

# TEST REPORT

**Application No.:** SHCR2209002011HS  
**FCC ID:** 2AT72-LUNA4PLUS  
**IC:** 25565-LUNA4PLUS  
**Applicant:** VIS (Shanghai) Technology Limited  
**Address of Applicant:** No.58 Linsheng Road,Tinglin Town,Jinshan District, Shanghai, China  
**Manufacturer:** FOREO AB  
**Address of Manufacturer:** KARLAVAGEN 41, 114 31 STOCKHOLM, SWEDEN  
**Factory:** VIS (Shanghai) Technology Limited  
**Address of Factory:** No.58 Linsheng Road,Tinglin Town,Jinshan District, Shanghai, China  
**Equipment Under Test (EUT):**  
**EUT Name:** Personal handheld facial massager  
**Model No.:** LUNA™ 4 plus  
**Trade Mark:** FOREO  
**Standard(s) :** 47 CFR Part 15, Subpart C 15.247  
 RSS-247 Issue 2, February 2017  
 RSS-Gen Issue 5 April 2018 Amendment 2  
**Date of Receipt:** 2022-09-14  
**Date of Test:** 2022-09-15 to 2022-09-21  
**Date of Issue:** 2022-09-23

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

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

*Parlam Zhan*

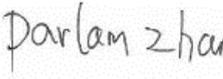
Parlam Zhan  
Laboratory Manager



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| Revision Record |             |            |        |
|-----------------|-------------|------------|--------|
| Version         | Description | Date       | Remark |
| 00              | Original    | 2022-09-23 | /      |
|                 |             |            |        |
|                 |             |            |        |

|                                 |  |  |  |
|---------------------------------|--|--|--|
| <b>Authorized for issue by:</b> |  |  |  |
|                                 |  |   |  |
|                                 |  | <hr/> <b>Bill Wu/Project Engineer</b>  |  |
|                                 |  |  |  |
|                                 |  | <hr/> <b>Parlam Zhan/Reviewer</b>  |  |



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## 2 Test Summary

| Radio Spectrum Technical Requirement |  |                    |        |                      |
|--------------------------------------|--|--------------------|--------|----------------------|
| Item                                 | FCC Requirement                                    | IC Requirement     | Method | Result               |
| Antenna Requirement                  | 47 CFR Part 15,<br>Subpart C 15.203 &<br>15.247(c) | RSS-Gen Clause 6.8 | N/A    | Customer Declaration |

N/A: Not applicable

| Radio Spectrum Matter Part                            |  |  |  |        |
|---|--|--|--|--------|
| Item  | FCC Requirement                                    | IC Requirement                               | Method                                 | Result |
| Conducted Emissions at AC Power Line (150kHz-30MHz)   | 47 CFR Part 15,<br>Subpart C 15.207                | RSS-Gen Clause 8.8                           | ANSI C63.10 (2013) Section 6.2         | Pass   |
| Minimum 6dB Bandwidth                                 | 47 CFR Part 15,<br>Subpart C 15.247a(2)            | RSS-247 Clause 5.2(a)                        | ANSI C63.10 (2013) Section 11.8.1      | Pass   |
| Conducted Peak Output Power                           | 47 CFR Part 15,<br>Subpart C 15.247(b)(3)          | RSS-247 Clause 5.4(d)                        | ANSI C63.10 (2013) Section 11.9.1      | Pass   |
| Power Spectrum Density                                | 47 CFR Part 15,<br>Subpart C 15.247(e)             | RSS-247 Clause 5.2(b)                        | ANSI C63.10 (2013) Section 11.10.2     | Pass   |
| Conducted Band Edges Measurement                      | 47 CFR Part 15,<br>Subpart C 15.247(d)             | RSS-247 Clause 5.5                           | ANSI C63.10 (2013) Section 11.13.3.2   | Pass   |
| Conducted Spurious Emissions                          | 47 CFR Part 15,<br>Subpart C 15.247(d)             | RSS-247 Clause 5.5                           | ANSI C63.10 (2013) Section 11.11       | Pass   |
| Radiated Emissions which fall in the restricted bands | 47 CFR Part 15,<br>Subpart C 15.209 &<br>15.247(d) | RSS-247 Section 3.3 &<br>RSS-Gen Section 8.9 | ANSI C63.10 (2013) Section 6.10.5      | Pass   |
| Radiated Spurious Emissions                           | 47 CFR Part 15,<br>Subpart C 15.209 &<br>15.247(d) | RSS-247 Section 3.3 &<br>RSS-Gen Section 8.9 | ANSI C63.10 (2013) Section 6.4,6.5,6.6 | Pass   |
| 99% Bandwidth   | -  | RSS-Gen Section 6.7                          | ANSI C63.10 Section 6.9.3              | Pass   |



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## 4 General Information

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

|                      |                                      |
|----------------------|--------------------------------------|
| Power supply:        | DC 3.7V 1000mAh Rechargeable battery |
| Operation Frequency: | 2402MHz to 2480MHz                   |
| Bluetooth Version:   | V5.0 LE                              |
| Data Rate:           | 1Mbps,2Mbps                          |
| Modulation Type:     | GFSK                                 |
| Number of Channels:  | 40                                   |
| Channel Spacing:     | 2MHz                                 |
| Antenna Type:        | PCB Antenna                          |
| Antenna Gain:        | 0dBi (Provided by manufacturer)      |
| S/N:                 | F1245JA26Zqdu3                       |
| Firmware Version:    | LUNA4PLUS F.REV.A                    |

### 4.2 Description of Support Units

| Description               | Manufacturer | Model No.    | Serial No. |
|---------------------------|--------------|--------------|------------|
| Laptop                    | LENOVO       | L460         | -          |
| Serial port adapter plate | -            | Test Plate 3 | -          |

### 4.3 Power level setting using in test:

| Channel | Level |
|---------|-------|
| 2402    | 7     |
| 2440    | 7     |
| 2480    | 7     |



#### 4.4 Measurement Uncertainty & Decision Rule

| No. | Item                            | Measurement Uncertainty |
|-----|---------------------------------|-------------------------|
| 1   | Radio Frequency                 | 8.4 x 10 <sup>-8</sup>  |
| 2   | Timeout                         | 2s                      |
| 3   | Duty cycle                      | 0.4%                    |
| 4   | Occupied Bandwidth              | 3%                      |
| 5   | RF conducted power              | 0.6dB                   |
| 6   | RF power density                | 2.9dB                   |
| 7   | Conducted Spurious emissions    | 0.75dB                  |
| 8   | RF Radiated power               | 5.2dB (Below 1GHz)      |
|     |                                 | 5.9dB (Above 1GHz)      |
| 9   | Radiated Spurious emission test | 4.2dB (Below 30MHz)     |
|     |                                 | 4.5dB (30MHz-1GHz)      |
|     |                                 | 5.1dB (1GHz-6GHz)       |
|     |                                 | 5.4dB (6GHz-18GHz)      |
| 10  | Temperature test                | 1°C                     |
| 11  | Humidity test                   | 3%                      |
| 12  | Supply voltages                 | 1.5%                    |
| 13  | Time                            | 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.

Note:

1. SGS is not responsible for wrong test results due to incorrect information (e.g. max. clock frequency, highest internal frequency, antenna gain, cable loss, etc ) is provided by the applicant. (if applicable).
2. SGS is not responsible for the authenticity, integrity and the validity of the conclusion based on results of the data provided by applicant. (if applicable).



#### 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 17025:2017 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.

- **A2LA (Certificate No. 6332.01)**

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. is accredited by the American Association for Laboratory Accreditation(A2LA).

- **FCC (Designation Number: CN1301)**

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- **ISED (CAB Identifier: CN0020)**

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. EMC Laboratory has been recognized by Innovation, Science and Economic Development Canada (ISED) as an accredited testing laboratory. Company Number: 8617A

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

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#### 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>RF Conducted Test</b>  |              |                               |                       |            |              |
| Spectrum Analyzer         | R&S          | FSP-30                        | SHEM002-1             | 2021-12-20 | 2022-12-19   |
| Spectrum Analyzer         | Keysight     | N9020B                        | SHEM241-1             | 2021-12-20 | 2022-12-19   |
| Spectrum Analyzer         | Agilent      | N9020A                        | SHEM181-1             | 2022-08-02 | 2023-08-01   |
| Signal Generator          | R&S          | SMR20                         | SHEM006-1             | 2022-08-02 | 2023-08-01   |
| Signal Generator          | Agilent      | N5182A                        | SHEM182-1             | 2022-08-02 | 2023-08-01   |
| Communication Tester      | R&S          | CMW270                        | SHEM183-1             | 2022-07-25 | 2023-07-24   |
| Communication Tester      | R&S          | CMW500                        | SHEM268-1             | 2022-07-25 | 2023-07-24   |
| Power Sensor              | Keysight     | U2021XA * 4                   | SHEM184-1             | 2022-08-02 | 2023-08-01   |
| Splitter                  | Anritsu      | MA1612A                       | SHEM185-1             | /          | /            |
| Coupler                   | e-meca       | 803-S-1                       | SHEM186-1             | /          | /            |
| High-low Temp Cabinet     | Suzhou Zhihe | TL-40                         | SHEM087-1             | 2020-04-15 | 2023-04-14   |
| AC Power Stabilizer       | APC          | KDF-31020T-V0-F0              | SHEM216-1             | 2021-12-20 | 2022-12-19   |
| DC Power Supply           | MCH          | MCH-303A                      | SHEM210-1             | 2021-12-20 | 2022-12-19   |
| Conducted test Cable      | /            | RF01~RF04                     | /                     | 2021-12-20 | 2022-12-19   |
| Switcher                  | Tonscend     | JS0806                        | SHEM184-1             | 2022-08-02 | 2023-08-01   |
| Test software             | Tonscend     | JS Tonscend<br>BT/WIFI System | Version: 2.6          | /          | /            |
| Coaxial Cable             | TST          |                               | SHEM263-1             | 2022-08-02 | 2023-08-01   |
| Test software             | TST          | TST PASS                      | Version: 2.0          | /          | /            |
| <b>RF Radiated Test</b>   |              |                               |                       |            |              |
| EMI test Receiver         | R&S          | ESU40                         | SHEM051-1             | 2021-12-20 | 2022-12-19   |
| Spectrum Analyzer         | R&S          | FSP-30                        | SHEM002-1             | 2021-12-20 | 2022-12-19   |
| Communication Tester      | R&S          | CMW500                        | SHEM268-1             | 2022-07-25 | 2023-07-24   |
| Loop Antenna (9kHz-30MHz) | Schwarzbeck  | FMZB1519                      | SHEM135-1             | 2021-12-20 | 2022-12-19   |
| Antenna (25MHz-2GHz)      | Schwarzbeck  | VULB9168                      | SHEM048-1             | 2021-09-11 | 2023-09-10   |
| Antenna (25MHz-2GHz)      | Schwarzbeck  | VULB9168                      | SHEM202-1             | 2021-05-07 | 2023-05-06   |
| Horn Antenna (1-18GHz)    | Schwarzbeck  | HF906                         | SHEM009-1             | 2022/8/11  | 2024-08-10   |
| Horn Antenna (1-18GHz)    | Schwarzbeck  | BBHA9120D                     | SHEM050-1             | 2021-09-18 | 2023-09-17   |
| Horn Antenna (14-40GHz)   | Schwarzbeck  | BBHA 9170                     | SHEM049-1             | 2021-09-18 | 2023-09-17   |
| Pre-Amplifier             | HP           | 8447D                         | SHEM236-1             | 2022-08-02 | 2023-08-01   |
| High-amplifier (14-40GHz) | Schwarzbeck  | 10001                         | SHEM049-2             | 2021-12-20 | 2022-12-19   |
| 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             | 2020-05-25 | 2023-05-24   |
| RE test Cable             | /            | RE01, RE02, RE06              | /                     | 2022-01-07 | 2023-01-06   |
| Test software             | ESE          | E3                            | Version:<br>6.111221a | /          | /            |



## 6 Radio Spectrum Technical Requirement

### 6.1 Antenna Requirement

#### 6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)

#### 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 PCB antenna and no consideration of replacement. The best case gain of the antenna is 0 dBi.

Antenna location: Refer to internal photo.



## 7 Radio Spectrum Matter Test Results

### 7.1 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:

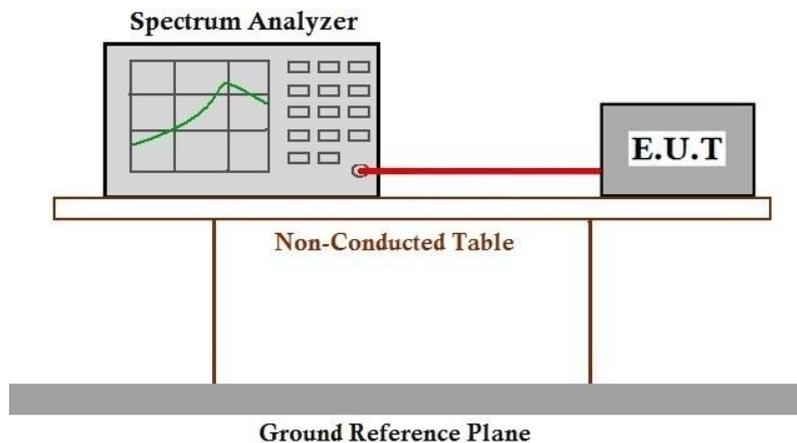
| Frequency range(MHz) | Output power of the intentional radiator(watt)         |
|----------------------|--|
| 902-928              | 1 for $\geq 50$ hopping channels                       |
|                      | 0.25 for $25 \leq$ hopping channels $< 50$             |
|                      | 1 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 |

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

Operating Environment:

Temperature: 24.7 °C      Humidity: 57.6 % RH      Atmospheric Pressure: 1010 mbar

#### 7.1.2 Test Setup Diagram



#### 7.1.3 Measurement Procedure and Data

Note: Since the verify power the same operating range bandwidth and smaller power can be covered by the higher power.

Please Refer to Appendix for Details



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## 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

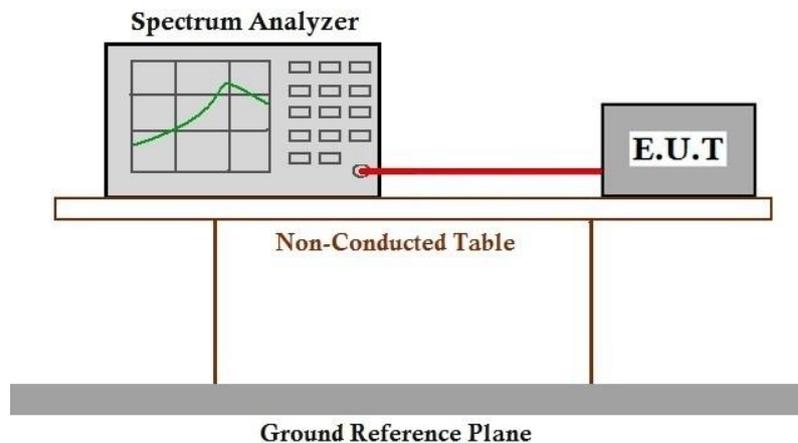
### 7.2.1 E.U.T. Operation

Operating Environment:  
 Temperature: 24.7 °C Humidity: 57.5 % RH Atmospheric Pressure: 1010 mbar

### 7.2.2 Test Mode Description

| Pre-scan / Final test | Mode Code | Description   |
|-----------------------|-----------|---|
| Final test            | 00        | TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation. |
| Final test            | 01        | TX mode(2Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation. |

### 7.2.3 Test Setup Diagram



### 7.2.4 Measurement Procedure and Data

Please Refer to Appendix for Details



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### 7.3 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:

≤8dBm in any 3 kHz band during any time interval of continuous transmission

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

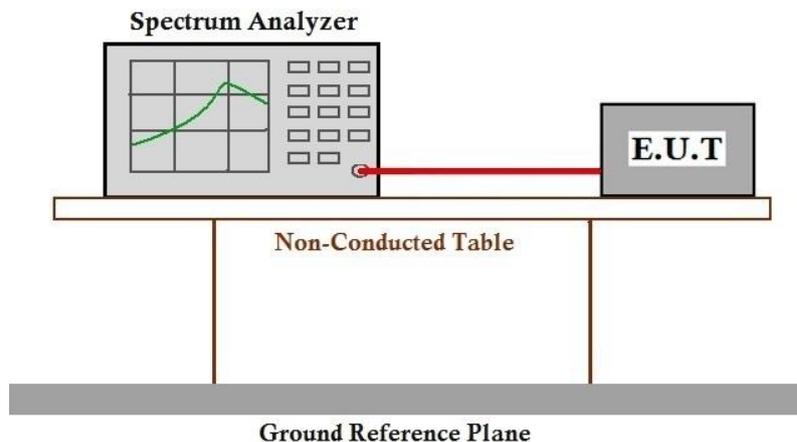
Operating Environment:

Temperature: 24.7 °C Humidity: 57.4 % RH Atmospheric Pressure: 1010 mbar

#### 7.3.2 Test Mode Description

| Pre-scan / Final test | Mode Code | Description   |
|-----------------------|-----------|---|
| Final test            | 00        | TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation. |
| Final test            | 01        | TX mode(2Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation. |

#### 7.3.3 Test Setup Diagram



#### 7.3.4 Measurement Procedure and Data

Please Refer to Appendix for Details



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## 7.4 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)).

### 7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 24.7 °C Humidity: 57.2 % RH Atmospheric Pressure: 1010 mbar

### 7.4.2 Test Mode Description

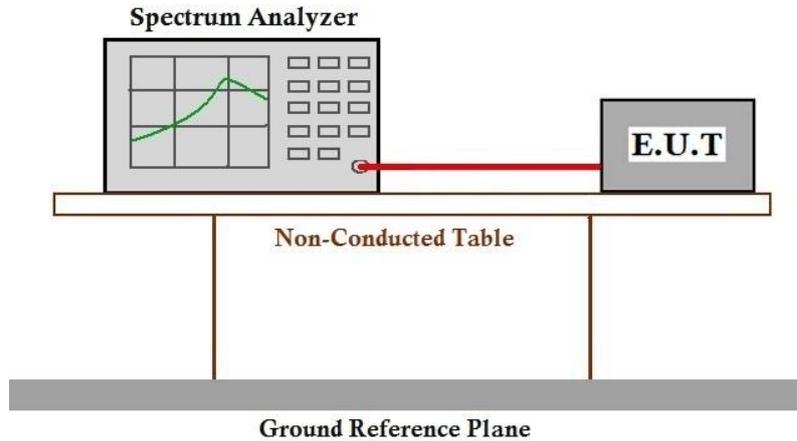
| Pre-scan /<br>Final test | Mode<br>Code | Description   |
|--------------------------|--------------|---|
| Final test               | 00           | TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation. |
| Final test               | 01           | TX mode(2Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation. |



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### 7.4.3 Test Setup Diagram



### 7.4.4 Measurement Procedure and Data

Please Refer to Appendix for Details



## 7.5 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)).

### 7.5.1 E.U.T. Operation

Operating Environment:

Temperature: 24.7 °C Humidity: 57.3 % RH Atmospheric Pressure: 1010 mbar

### 7.5.2 Test Mode Description

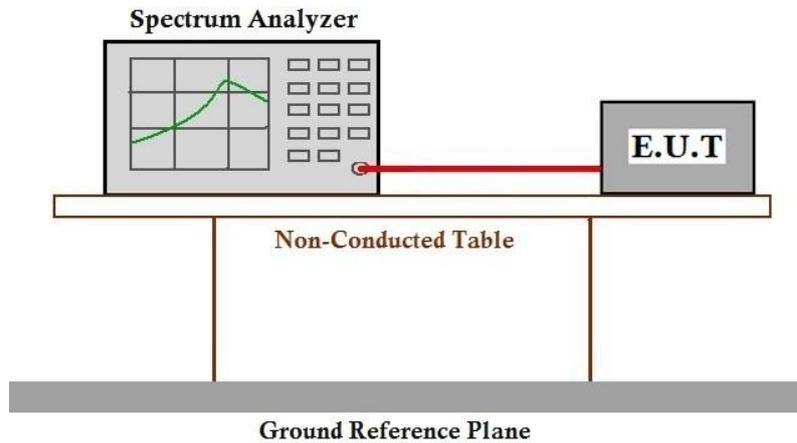
| Pre-scan /<br>Final test | Mode<br>Code | Description   |
|--------------------------|--------------|---|
| Final test               | 00           | TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation. |
| Final test               | 01           | TX mode(2Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation. |



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### 7.5.3 Test Setup Diagram



### 7.5.4 Measurement Procedure and Data

Please Refer to Appendix for Details



**7.6 Radiated Emissions which fall in the restricted bands**

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209

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.

**7.6.1 E.U.T. Operation**

Operating Environment:

Temperature: 24.8 °C Humidity: 57.4 % RH Atmospheric Pressure: 1010 mbar

**7.6.2 Test Mode Description**

| Pre-scan / Final test | Mode Code | Description   |
|-----------------------|-----------|---|
| Final test            | 00        | TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation. |
| Final test            | 01        | TX mode(2Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation. |



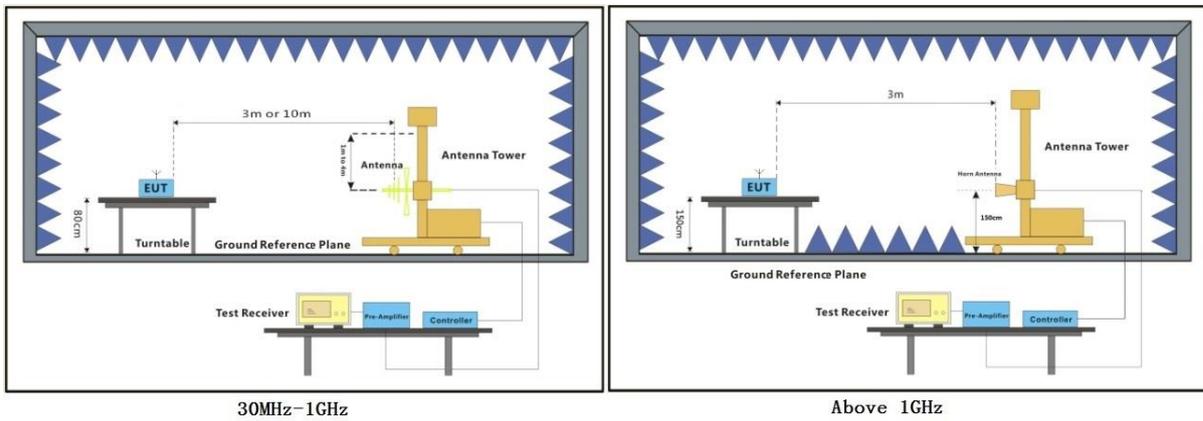
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### 7.6.3 Test Setup Diagram



30MHz-1GHz

Above 1GHz



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**7.6.4 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: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

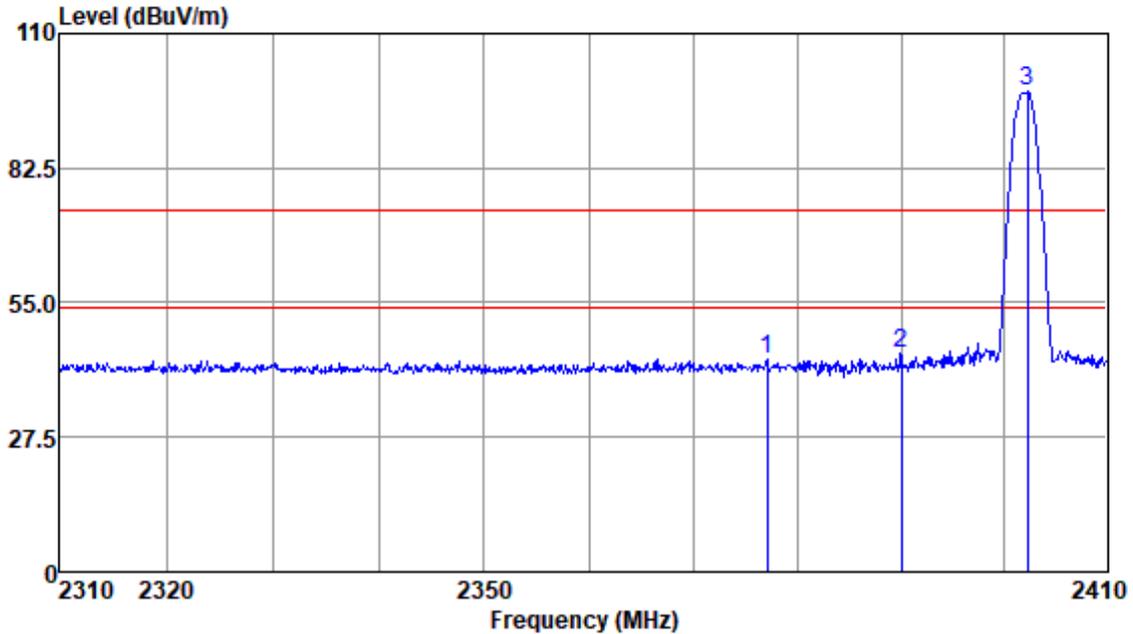
Remark 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level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



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Test Mode: 00; Polarity: Horizontal; Modulation:GFSK; Channel:Low



Antenna Polarity :HORIZONTAL

| Read Freq | 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         |        |
| 2377.03   | 45.25 | 28.76          | 4.59       | 35.17         | 43.43          | 74.00      | -30.57     | Peak   |
| 2390.00   | 46.53 | 28.80          | 4.60       | 35.18         | 44.75          | 74.00      | -29.25     | Peak   |
| 2402.25   | 99.75 | 28.85          | 4.62       | 35.19         | 98.03          | 74.00      | 24.03      | Peak   |

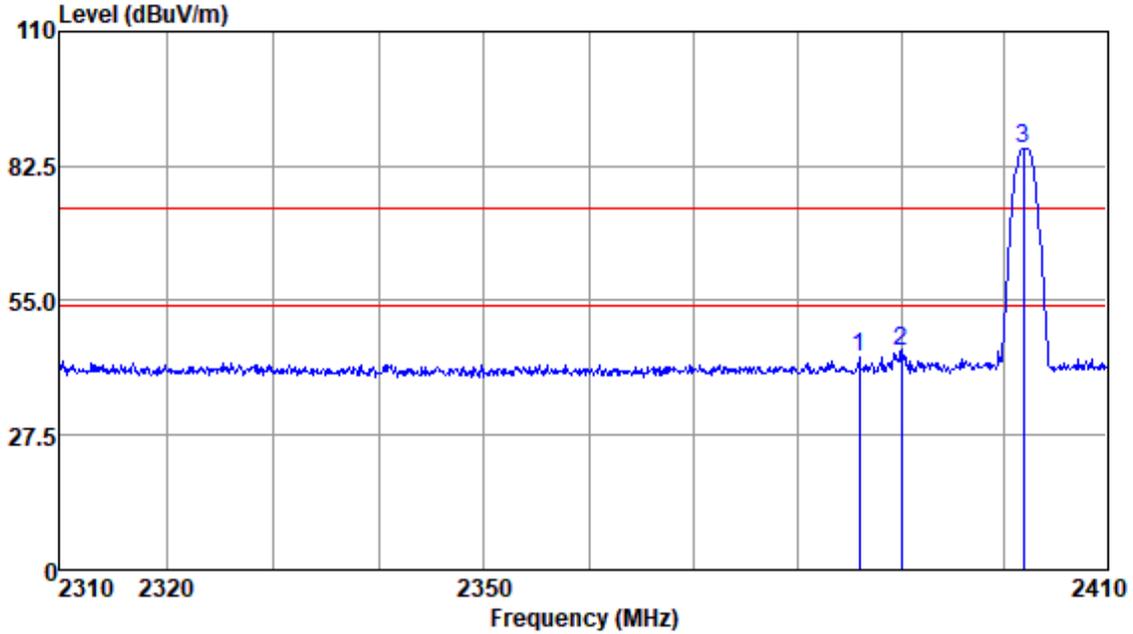
Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



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Test Mode: 00; Polarity: Vertical; Modulation:GFSK; Channel:Low



Antenna Polarity :VERTICAL

| Read Freq | 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         |        |
| 2385.92   | 45.32 | 28.80          | 4.60       | 35.18         | 43.54          | 74.00      | -30.46     | Peak   |
| 2390.00   | 46.57 | 28.80          | 4.60       | 35.18         | 44.79          | 74.00      | -29.21     | Peak   |
| 2401.84   | 87.96 | 28.85          | 4.62       | 35.19         | 86.24          | 74.00      | 12.24      | Peak   |

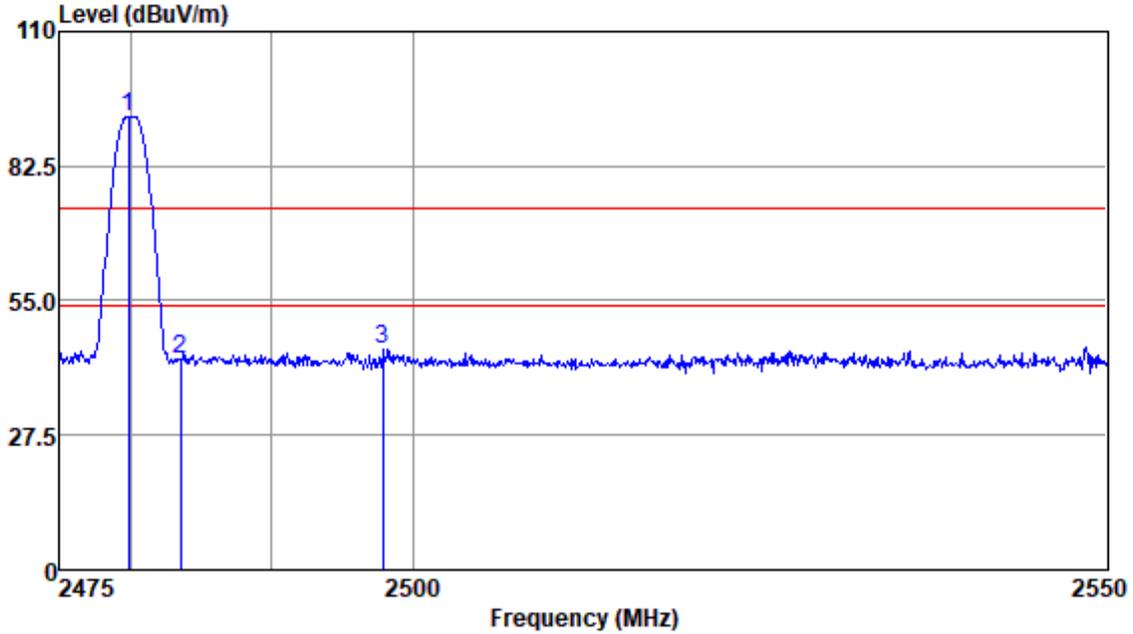
Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



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Test Mode: 00; Polarity: Horizontal; Modulation:GFSK; Channel:High



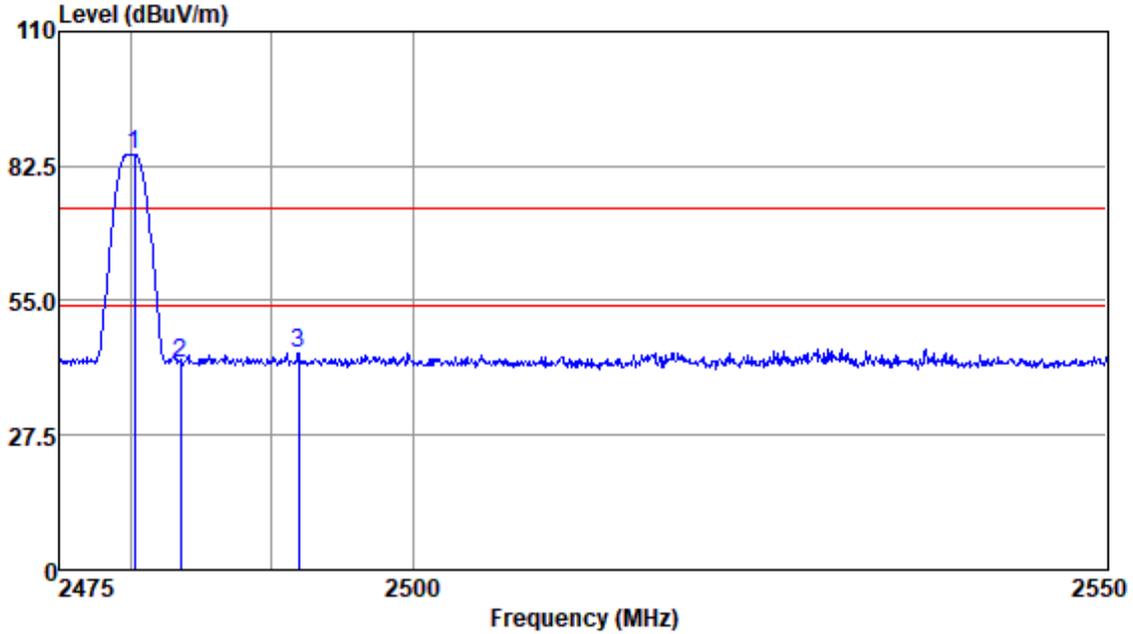
Antenna Polarity :HORIZONTAL

| 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         |        |
| 2479.81 | 93.93      | 29.08          | 4.76       | 35.25         | 92.52          | 74.00      | 18.52      | Peak   |
| 2483.50 | 44.38      | 29.09          | 4.78       | 35.26         | 42.99          | 74.00      | -31.01     | Peak   |
| 2497.86 | 46.57      | 29.12          | 4.80       | 35.27         | 45.22          | 74.00      | -28.78     | Peak   |

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



Test Mode: 00; Polarity: Vertical; Modulation:GFSK; Channel:High



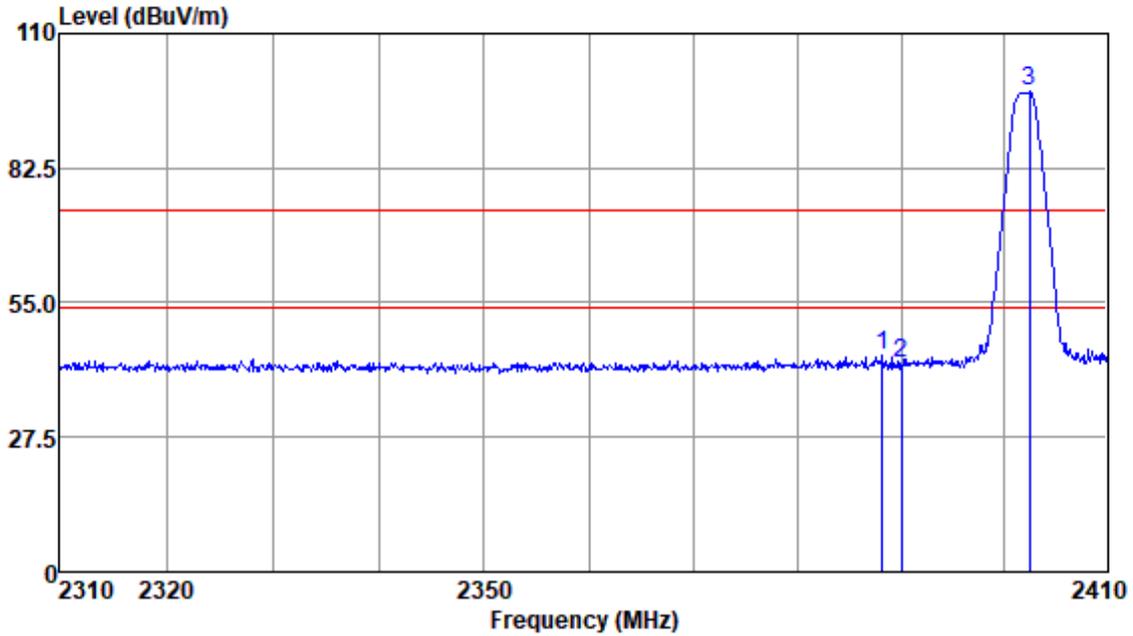
Antenna Polarity :VERTICAL

| 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         |        |
| 2480.25 | 86.26      | 29.08          | 4.76       | 35.25         | 84.85          | 74.00      | 10.85      | Peak   |
| 2483.50 | 43.51      | 29.09          | 4.78       | 35.26         | 42.12          | 74.00      | -31.88     | Peak   |
| 2491.90 | 45.56      | 29.10          | 4.79       | 35.26         | 44.19          | 74.00      | -29.81     | Peak   |

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



Test Mode: 01; Polarity: Horizontal; Modulation:GFSK; Channel:Low



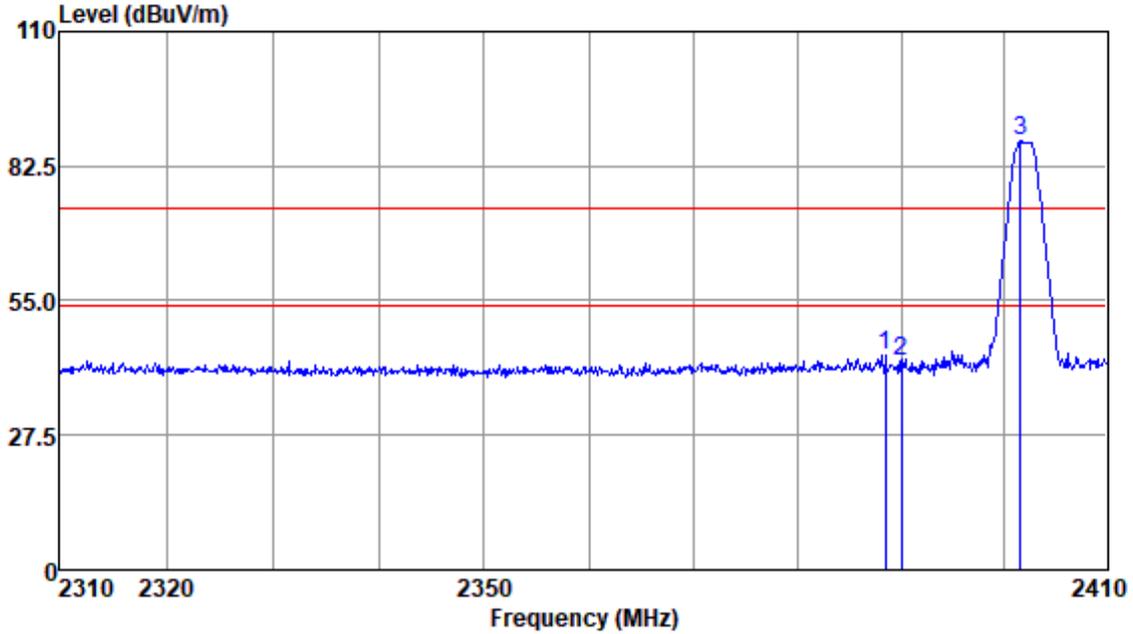
Antenna Polarity :HORIZONTAL

| Read Freq | 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         |        |
| 2388.14   | 45.92 | 28.80          | 4.60       | 35.18         | 44.14          | 74.00      | -29.86     | Peak   |
| 2390.00   | 44.44 | 28.80          | 4.60       | 35.18         | 42.66          | 74.00      | -31.34     | Peak   |
| 2402.45   | 99.75 | 28.85          | 4.62       | 35.19         | 98.03          | 74.00      | 24.03      | Peak   |

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



Test Mode: 01; Polarity: Vertical; Modulation:GFSK; Channel:Low



Antenna Polarity :VERTICAL

| Read Freq | Antenna Level | Cable Factor | Preamp Loss | Emission Factor | Limit Level | Over Line | Remark      |
|-----------|---------------|--------------|-------------|-----------------|-------------|-----------|-------------|
| MHz       | dBuv          | dB/m         | dB          | dB              | dBuv/m      | dB        |             |
| 2388.45   | 45.80         | 28.80        | 4.60        | 35.18           | 44.02       | 74.00     | -29.98 Peak |
| 2390.00   | 44.48         | 28.80        | 4.60        | 35.18           | 42.70       | 74.00     | -31.30 Peak |
| 2401.54   | 89.30         | 28.85        | 4.62        | 35.19           | 87.58       | 74.00     | 13.58 Peak  |

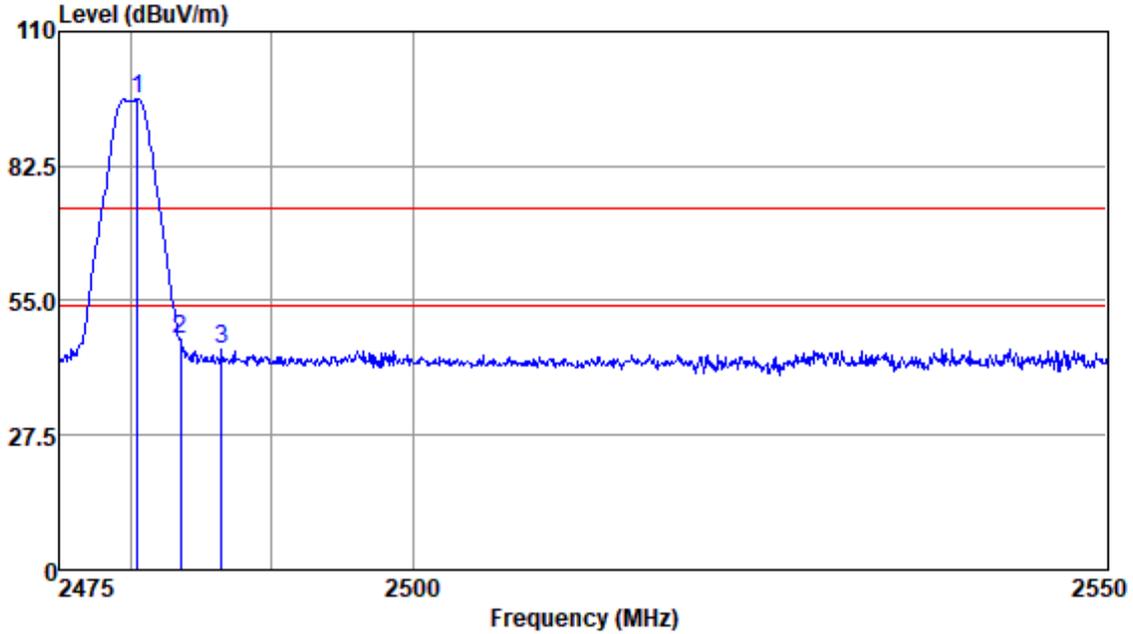
Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



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Test Mode: 01; Polarity: Horizontal; Modulation:GFSK; Channel:High



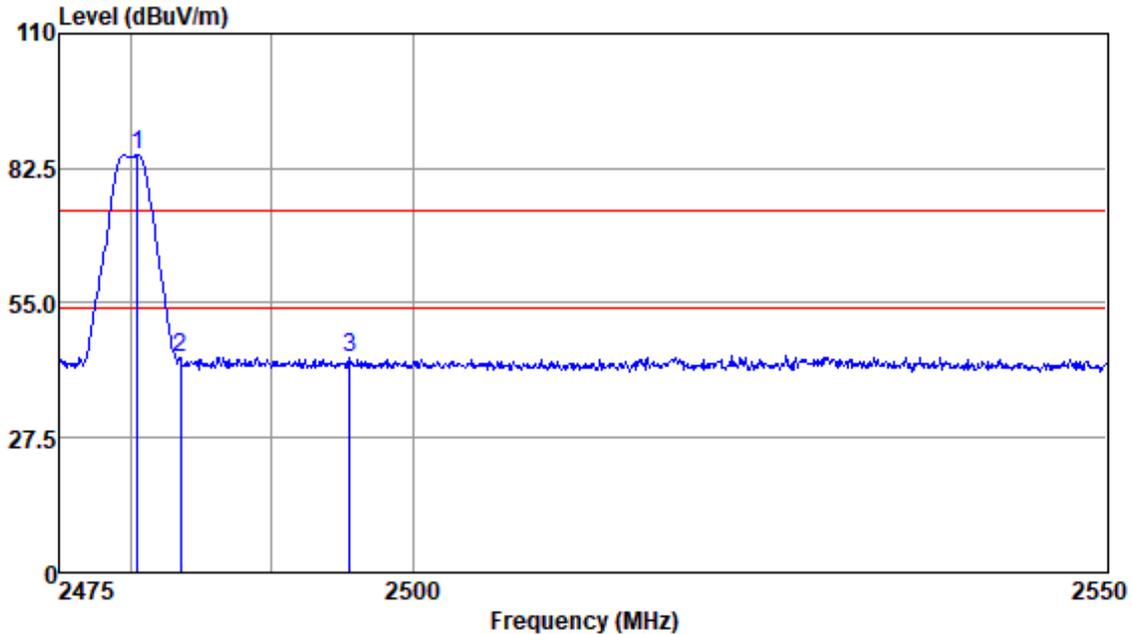
Antenna Polarity :HORIZONTAL

| 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         |        |
| 2480.47 | 97.66      | 29.08          | 4.76       | 35.25         | 96.25          | 74.00      | 22.25      | Peak   |
| 2483.50 | 48.65      | 29.09          | 4.78       | 35.26         | 47.26          | 74.00      | -26.74     | Peak   |
| 2486.41 | 46.64      | 29.09          | 4.78       | 35.26         | 45.25          | 74.00      | -28.75     | Peak   |

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



Test Mode: 01; Polarity: Vertical; Modulation:GFSK; 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         |        |
| 2480.47 | 86.68      | 29.08          | 4.76       | 35.25         | 85.27          | 74.00      | 11.27      | Peak   |
| 2483.50 | 45.20      | 29.09          | 4.78       | 35.26         | 43.81          | 74.00      | -30.19     | Peak   |
| 2495.55 | 45.36      | 29.10          | 4.79       | 35.26         | 43.99          | 74.00      | -30.01     | Peak   |

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



### 7.7 Radiated Spurious Emissions Below 1GHz

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209

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

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                            |
| 960-1000       | 500                              | 3                            |

#### 7.7.1 E.U.T. Operation

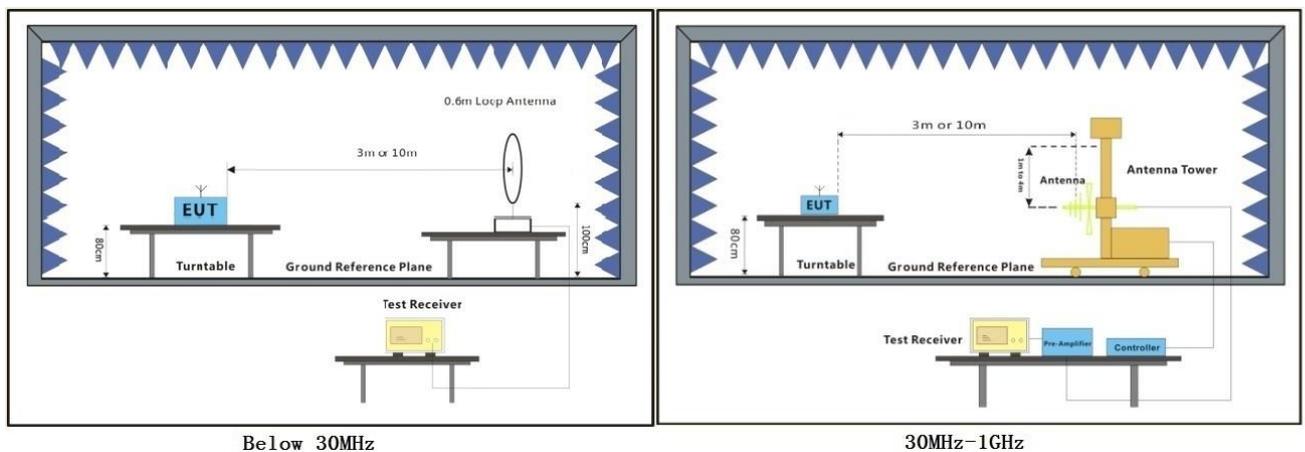
Operating Environment:

Temperature: 24.8 °C Humidity: 57.4 % RH Atmospheric Pressure: 1010 mbar

#### 7.7.2 Test Mode Description

| Pre-scan / Final test | Mode Code | Description   |
|-----------------------|-----------|---|
| Final test            | 00        | TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation. |
| Final test            | 01        | TX mode(2Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation. |

#### 7.7.3 Test Setup Diagram



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EEC EMC Lab

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 NO.588 West Jindu Road, Songjiang District, Shanghai China 201612 t (86-21) 61915666 f (86-21) 61915678 www.sgs.com.cn  
 中国·上海·松江区金都西路588号 邮编: 201612 t (86-21) 61915666 f (86-21) 61915678 sgs.china@sgs.com

**7.7.4 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. 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.
- 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 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 quasi-peak method as specified and then reported in a data sheet.
- g. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- h. 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.
- i. Repeat above procedures until all frequencies measured was complete.

Remark:

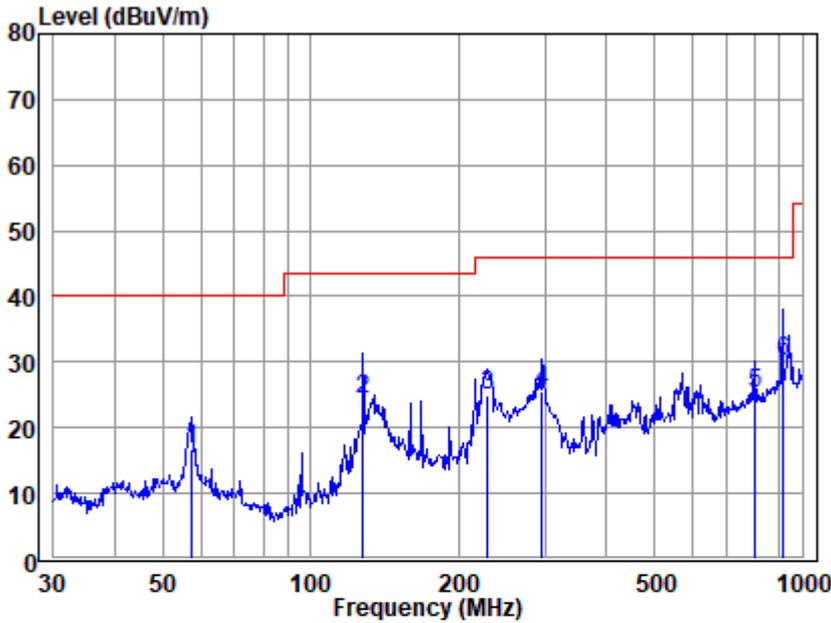
- 1. Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor
- 2. Scan from 9kHz to 30MHz, the disturbance below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.
- 3. The disturbance below 1GHz was very low and the harmonics were the highest point could be found when testing, so only the above harmonics had been displayed.



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Test Mode: 00; Polarity: Horizontal



Antenna Polarity :Horizontal  
EUT/Project :2011HS  
Test mode :00

|   | 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         |        |
| 1 | 57.20  | 33.61      | 13.34          | 1.76       | 32.00         | 16.71          | 40.00      | -23.29     | QP     |
| 2 | 127.68 | 41.99      | 11.74          | 2.59       | 31.90         | 24.42          | 43.50      | -19.08     | QP     |
| 3 | 227.90 | 43.23      | 10.41          | 3.74       | 32.49         | 24.89          | 46.00      | -21.11     | QP     |
| 4 | 295.33 | 40.32      | 13.42          | 4.40       | 32.63         | 25.51          | 46.00      | -20.49     | QP     |
| 5 | 799.63 | 25.80      | 22.42          | 7.03       | 30.06         | 25.19          | 46.00      | -20.81     | QP     |
| 6 | 912.58 | 28.59      | 23.76          | 7.55       | 29.80         | 30.10          | 46.00      | -15.90     | QP     |

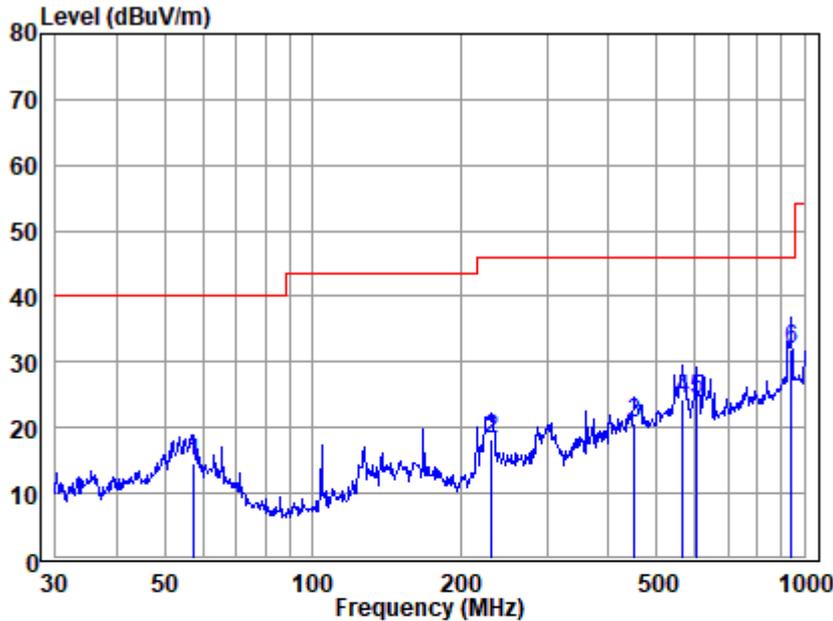
Note: Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



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Test Mode: 00; Polarity: Vertical



Antenna Polarity :Vertical  
EUT/Project :2011HS  
Test mode :00

|   | 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         |        |
| 1 | 57.20  | 31.65      | 13.34          | 1.76       | 32.00         | 14.75          | 40.00      | -25.25     | QP     |
| 2 | 231.40 | 36.17      | 10.65          | 3.76       | 32.43         | 18.15          | 46.00      | -27.85     | QP     |
| 3 | 450.29 | 31.94      | 17.12          | 5.27       | 33.74         | 20.59          | 46.00      | -25.41     | QP     |
| 4 | 563.12 | 32.64      | 18.97          | 6.01       | 33.22         | 24.40          | 46.00      | -21.60     | QP     |
| 5 | 601.58 | 31.10      | 19.91          | 6.21       | 32.91         | 24.31          | 46.00      | -21.69     | QP     |
| 6 | 940.84 | 30.14      | 23.75          | 7.69       | 29.74         | 31.84          | 46.00      | -14.16     | QP     |

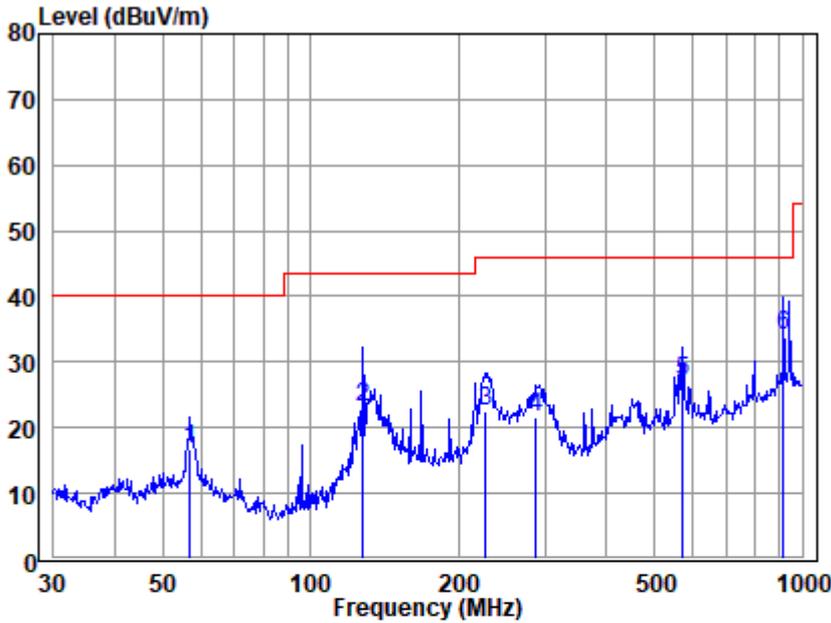
Note: Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



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Test Mode: 01; Polarity: Horizontal



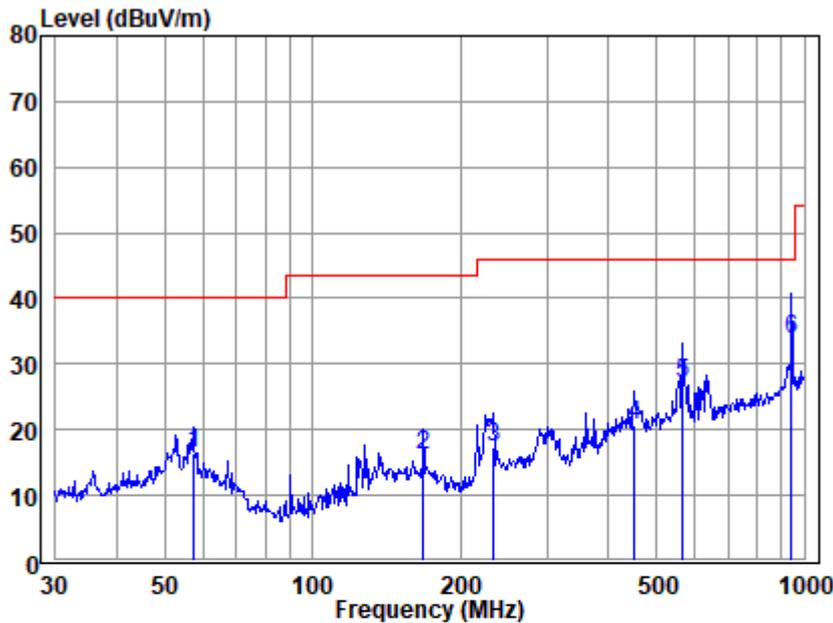
Antenna Polarity :Horizontal  
EUT/Project :2011HS  
Test mode :01

|   | 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         |        |
| 1 | 56.91  | 33.52      | 13.37          | 1.76       | 32.00         | 16.65          | 40.00      | -23.35     | QP     |
| 2 | 127.68 | 40.77      | 11.74          | 2.59       | 31.90         | 23.20          | 43.50      | -20.30     | QP     |
| 3 | 225.59 | 40.94      | 10.29          | 3.73       | 32.53         | 22.43          | 46.00      | -23.57     | QP     |
| 4 | 287.92 | 36.69      | 13.30          | 4.27       | 32.73         | 21.53          | 46.00      | -24.47     | QP     |
| 5 | 571.77 | 35.39      | 19.07          | 6.02       | 33.28         | 27.20          | 46.00      | -18.80     | QP     |
| 6 | 917.23 | 32.45      | 23.75          | 7.57       | 29.79         | 33.98          | 46.00      | -12.02     | QP     |

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



Test Mode: 01; Polarity: Vertical



Antenna Polarity :Vertical  
EUT/Project :2011HS  
Test mode :01

| 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         |        |
| 1 57.20  | 33.32      | 13.34          | 1.76       | 32.00         | 16.42          | 40.00      | -23.58     | QP     |
| 2 168.00 | 32.38      | 12.84          | 3.20       | 32.27         | 16.15          | 43.50      | -27.35     | QP     |
| 3 232.58 | 35.27      | 10.77          | 3.77       | 32.40         | 17.41          | 46.00      | -28.59     | QP     |
| 4 452.58 | 32.03      | 17.13          | 5.30       | 33.69         | 20.77          | 46.00      | -25.23     | QP     |
| 5 563.12 | 35.34      | 18.97          | 6.01       | 33.22         | 27.10          | 46.00      | -18.90     | QP     |
| 6 940.84 | 31.92      | 23.75          | 7.69       | 29.74         | 33.62          | 46.00      | -12.38     | QP     |

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



### 7.8 Radiated Spurious Emissions Above 1GHz

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209

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

Limit:

| Frequency(MHz) | Field strength(microvolts/meter) | Measurement distance(meters) |
|----------------|----------------------------------|------------------------------|
| Above 1000     | 500                              | 3                            |

#### 7.8.1 E.U.T. Operation

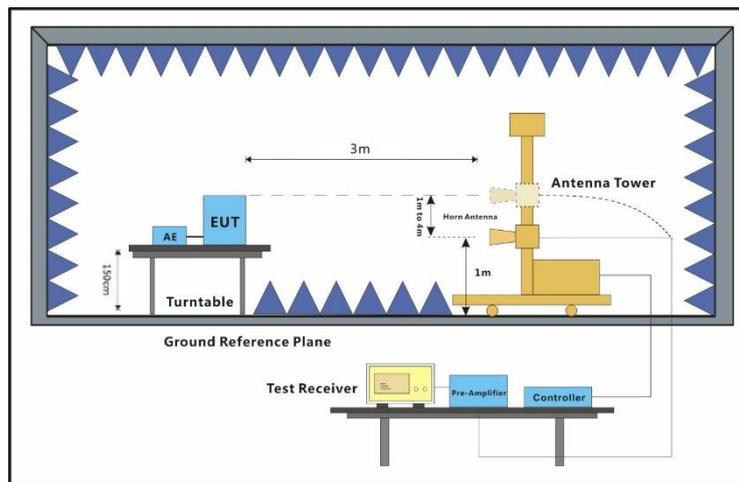
Operating Environment:

Temperature: 24.8 °C Humidity: 57.4 % RH Atmospheric Pressure: 1010 mbar

#### 7.8.2 Test Mode Description

| Pre-scan / Final test | Mode Code | Description   |
|-----------------------|-----------|---|
| Final test            | 00        | TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation. |
| Final test            | 01        | TX mode(2Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation. |

#### 7.8.3 Test Setup Diagram



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**7.8.4 Measurement Procedure and Data**

- a. 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.
- 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 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 or average method as specified and then reported in a data sheet.
- g. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- h. 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.
- i. Repeat above procedures until all frequencies measured was complete.

Remark:

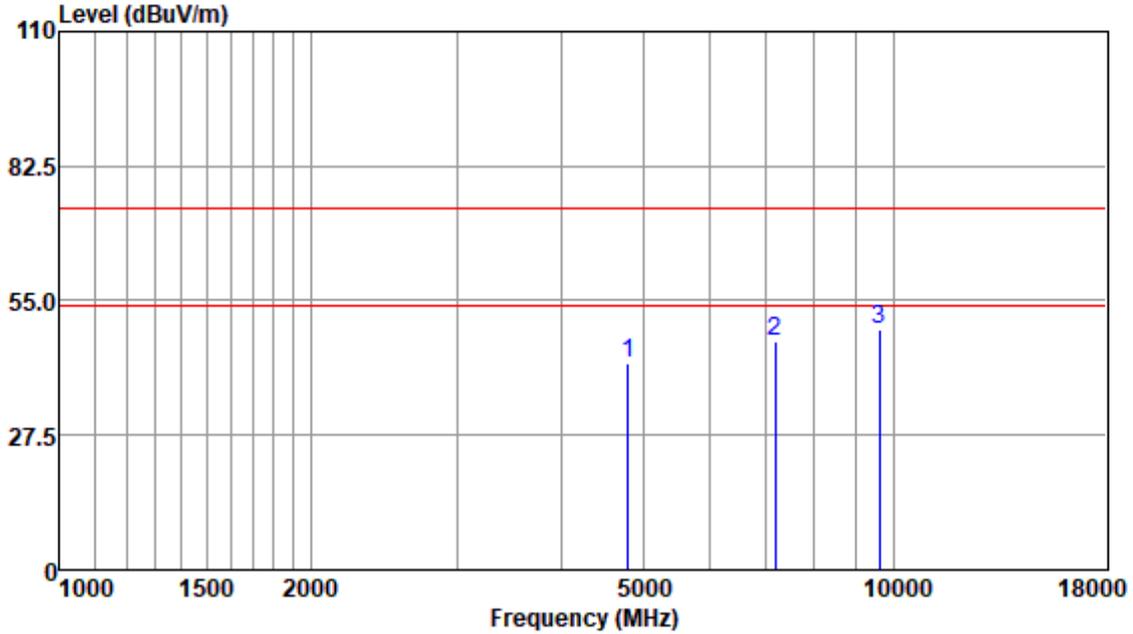
1. Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor
2. Scan from 1GHz to 25GHz, the disturbance above 18GHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.
3. As shown in this section, 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.



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Test Mode: 00; Polarity: Horizontal; Modulation:GFSK; Channel:Low



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         |        |
| 4804.00 | 42.11      | 33.72          | 5.09       | 38.71         | 42.21          | 74.00      | -31.79     | Peak   |
| 7206.00 | 41.78      | 36.28          | 5.75       | 37.18         | 46.63          | 74.00      | -27.37     | Peak   |
| 9608.00 | 38.90      | 37.70          | 6.78       | 34.18         | 49.20          | 74.00      | -24.80     | Peak   |

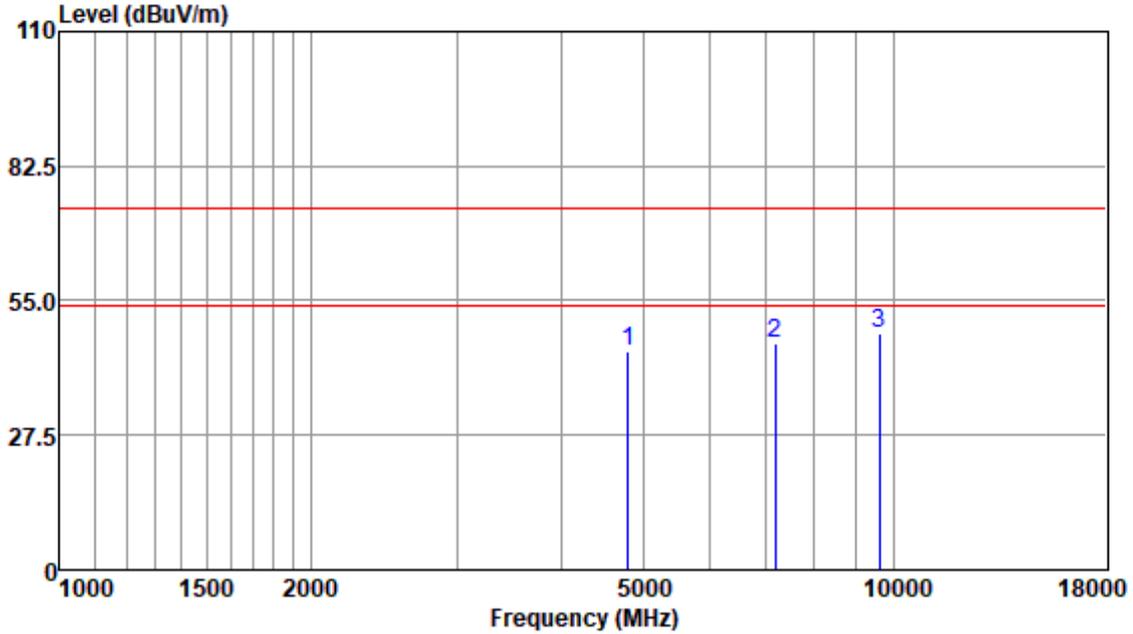
Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



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Test Mode: 00; Polarity: Vertical; Modulation:GFSK; Channel:Low



Antenna Polarity :VERTICAL

| Read Freq | 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         |        |
| 4804.00   | 44.41 | 33.72          | 5.09       | 38.71         | 44.51          | 74.00      | -29.49     | Peak   |
| 7206.00   | 41.33 | 36.28          | 5.75       | 37.18         | 46.18          | 74.00      | -27.82     | Peak   |
| 9608.00   | 37.94 | 37.70          | 6.78       | 34.18         | 48.24          | 74.00      | -25.76     | Peak   |

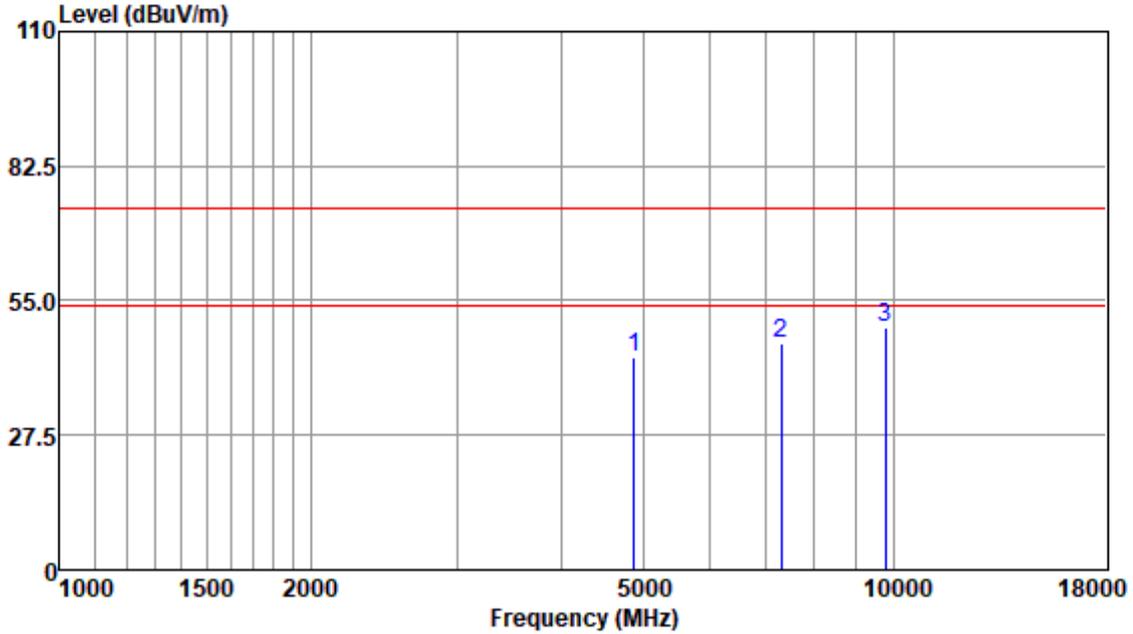
Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



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Test Mode: 00; Polarity: Horizontal; Modulation:GFSK; Channel:middle



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         |        |
| 4884.00 | 43.90      | 33.95          | 4.48       | 38.78         | 43.55          | 74.00      | -30.45     | Peak   |
| 7326.00 | 40.93      | 36.47          | 5.98       | 37.10         | 46.28          | 74.00      | -27.72     | Peak   |
| 9768.00 | 39.70      | 37.61          | 6.48       | 34.14         | 49.65          | 74.00      | -24.35     | Peak   |

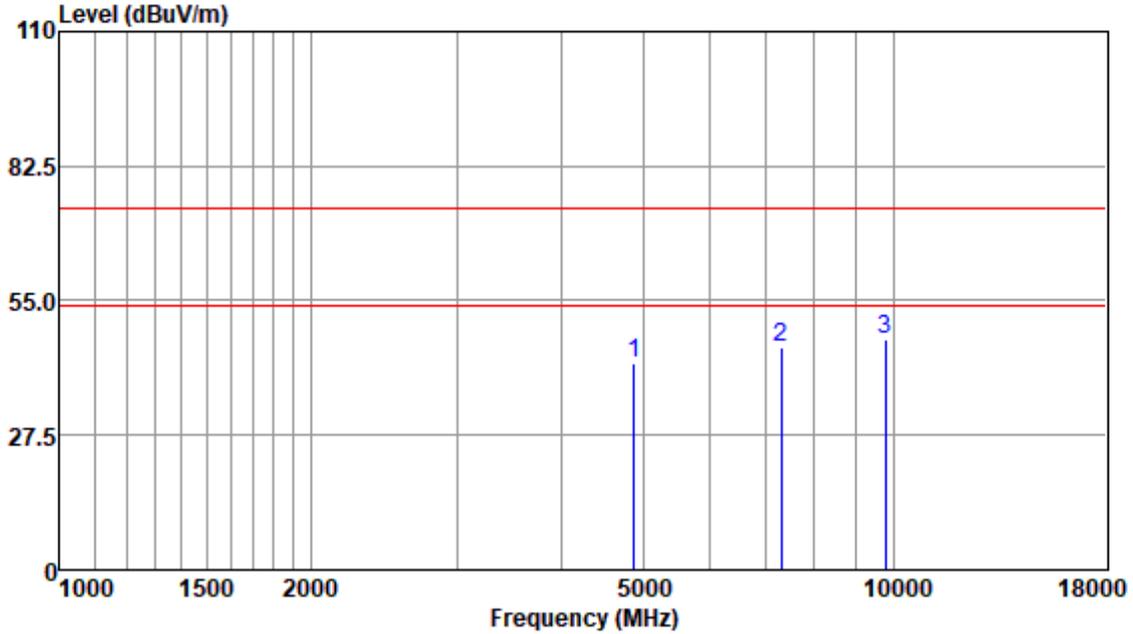
Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



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Test Mode: 00; Polarity: Vertical; Modulation:GFSK; Channel:middle



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         |        |
| 4884.00 | 42.54      | 33.95          | 4.48       | 38.78         | 42.19          | 74.00      | -31.81     | Peak   |
| 7326.00 | 39.94      | 36.47          | 5.98       | 37.10         | 45.29          | 74.00      | -28.71     | Peak   |
| 9768.00 | 37.30      | 37.61          | 6.48       | 34.14         | 47.25          | 74.00      | -26.75     | Peak   |

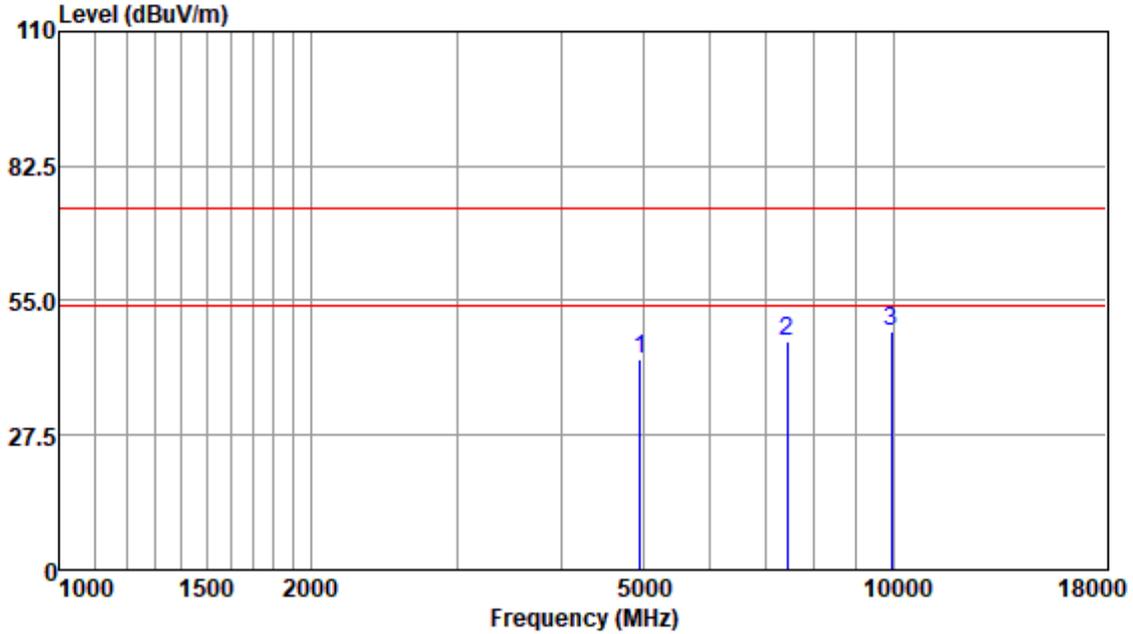
Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



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Test Mode: 00; Polarity: Horizontal; Modulation:GFSK; Channel:High



Antenna Polarity :HORIZONTAL

| Read Freq | 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         |        |
| 4960.00   | 43.00 | 33.98          | 5.04       | 38.87         | 43.15          | 74.00      | -30.85     | Peak   |
| 7440.00   | 41.06 | 36.40          | 6.09       | 37.03         | 46.52          | 74.00      | -27.48     | Peak   |
| 9920.00   | 38.28 | 37.81          | 6.53       | 34.11         | 48.51          | 74.00      | -25.49     | Peak   |

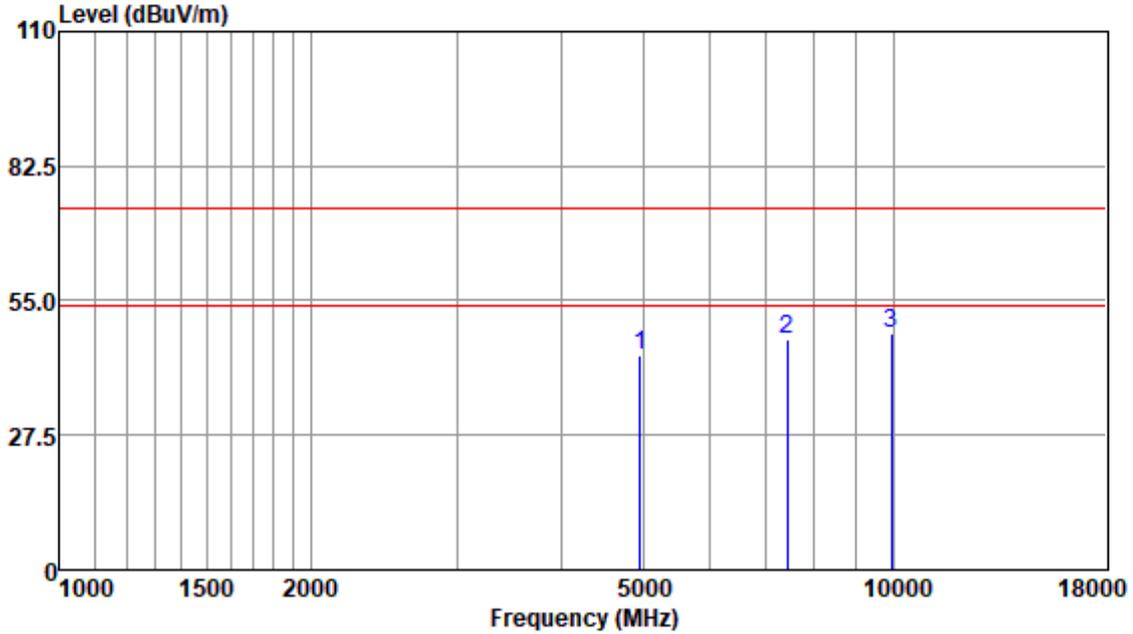
Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



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Test Mode: 00; Polarity: Vertical; Modulation:GFSK; Channel:High



Antenna Polarity :VERTICAL

| Read Freq | Antenna Level | Cable Factor | Preamp Loss | Emission Factor | Limit Level | Over Line | Remark      |
|-----------|---------------|--------------|-------------|-----------------|-------------|-----------|-------------|
| MHz       | dBuv          | dB/m         | dB          | dB              | dBuv/m      | dBuv/m    | dB          |
| 4960.00   | 43.50         | 33.98        | 5.04        | 38.87           | 43.65       | 74.00     | -30.35 Peak |
| 7440.00   | 41.78         | 36.40        | 6.09        | 37.03           | 47.24       | 74.00     | -26.76 Peak |
| 9920.00   | 37.93         | 37.81        | 6.53        | 34.11           | 48.16       | 74.00     | -25.84 Peak |

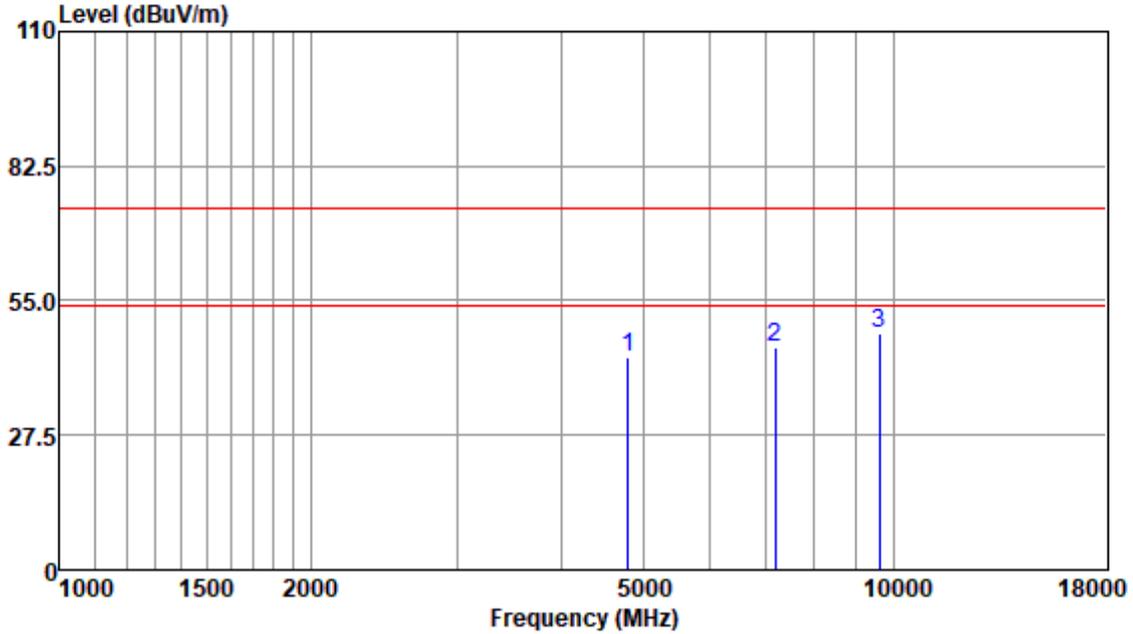
Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



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Test Mode: 01; Polarity: Horizontal; Modulation:GFSK; Channel:Low



Antenna Polarity :HORIZONTAL

| Read Freq | 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         |        |
| 4804.00   | 43.18 | 33.72          | 5.09       | 38.71         | 43.28          | 74.00      | -30.72     | Peak   |
| 7206.00   | 40.81 | 36.28          | 5.75       | 37.18         | 45.66          | 74.00      | -28.34     | Peak   |
| 9608.00   | 37.93 | 37.70          | 6.78       | 34.18         | 48.23          | 74.00      | -25.77     | Peak   |

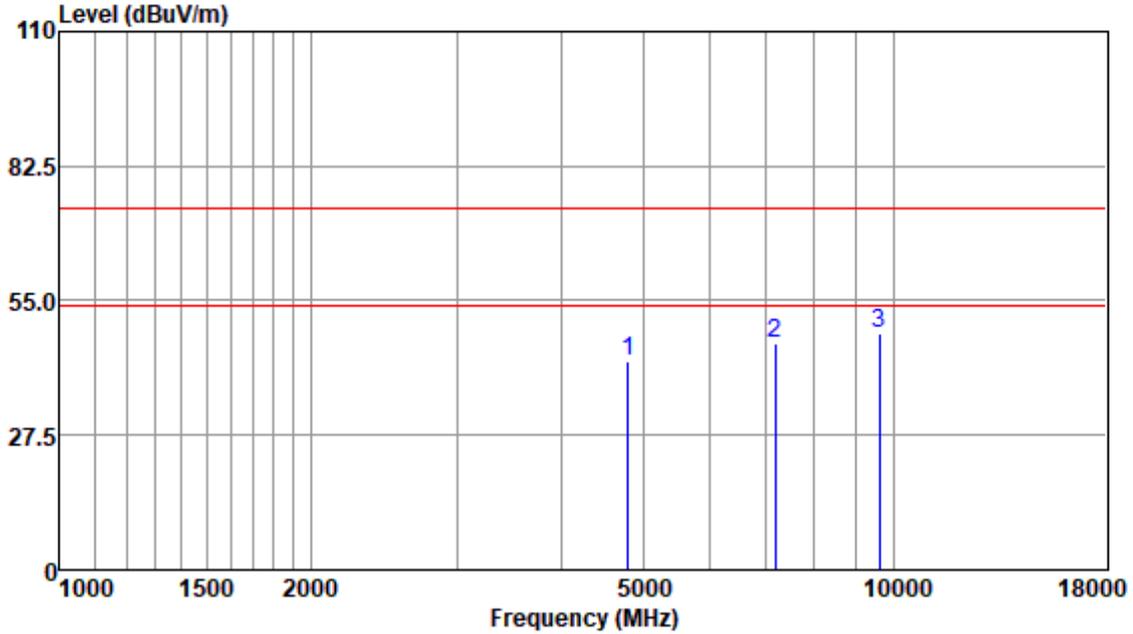
Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



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Test Mode: 01; Polarity: Vertical; Modulation:GFSK; Channel:Low



Antenna Polarity :VERTICAL

| Read 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         |        |
| 4804.00   | 42.47      | 33.72          | 5.09       | 38.71         | 42.57          | 74.00      | -31.43     | Peak   |
| 7206.00   | 41.32      | 36.28          | 5.75       | 37.18         | 46.17          | 74.00      | -27.83     | Peak   |
| 9608.00   | 37.96      | 37.70          | 6.78       | 34.18         | 48.26          | 74.00      | -25.74     | Peak   |

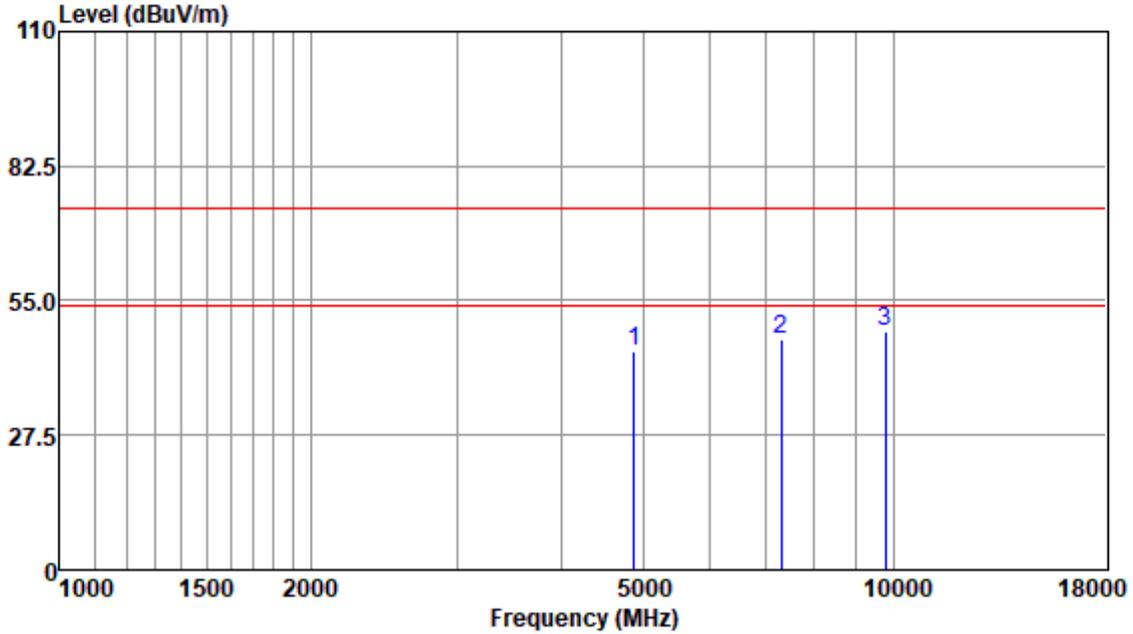
Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



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Test Mode: 01; Polarity: Horizontal; Modulation:GFSK; Channel:middle



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         |        |
| 4884.00 | 44.93      | 33.95          | 4.48       | 38.78         | 44.58          | 74.00      | -29.42     | Peak   |
| 7326.00 | 41.89      | 36.47          | 5.98       | 37.10         | 47.24          | 74.00      | -26.76     | Peak   |
| 9768.00 | 38.74      | 37.61          | 6.48       | 34.14         | 48.69          | 74.00      | -25.31     | Peak   |

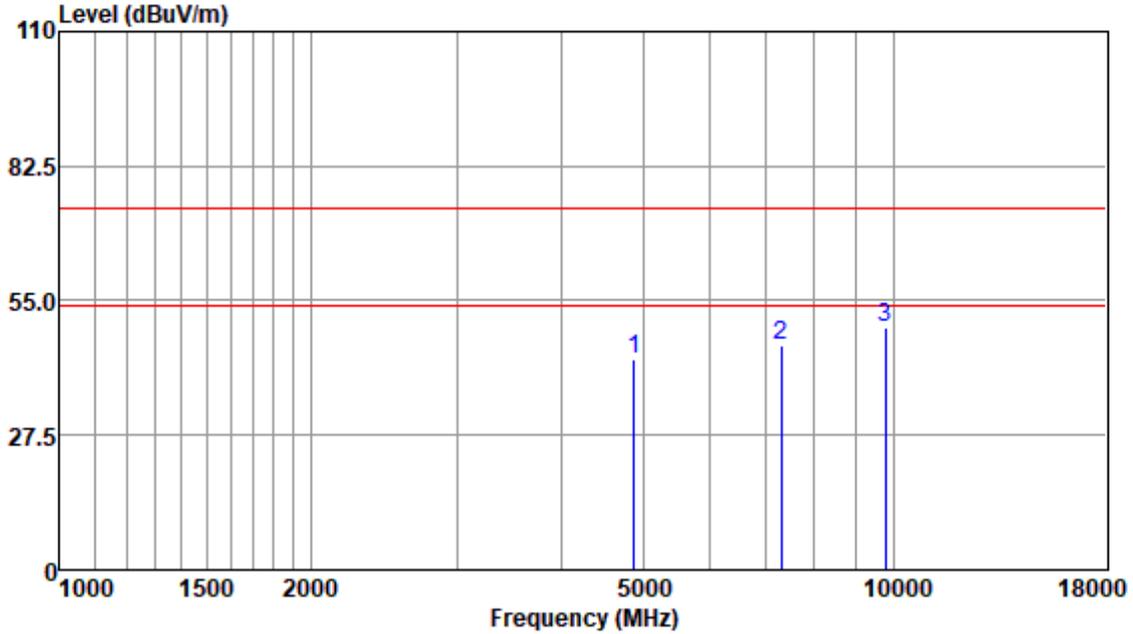
Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



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Test Mode: 01; Polarity: Vertical; Modulation:GFSK; Channel:middle



Antenna Polarity :VERTICAL

| Read Freq | 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         |        |
| 4884.00   | 43.53 | 33.95          | 4.48       | 38.78         | 43.18          | 74.00      | -30.82     | Peak   |
| 7326.00   | 40.33 | 36.47          | 5.98       | 37.10         | 45.68          | 74.00      | -28.32     | Peak   |
| 9768.00   | 39.70 | 37.61          | 6.48       | 34.14         | 49.65          | 74.00      | -24.35     | Peak   |

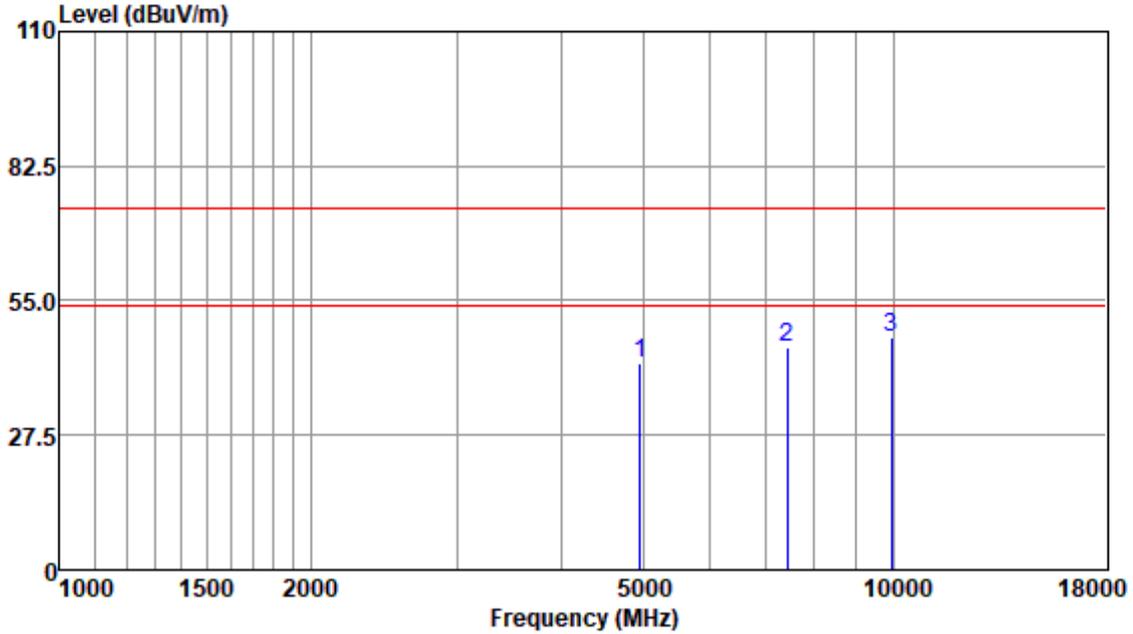
Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



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Test Mode: 01; Polarity: Horizontal; Modulation:GFSK; Channel:High



Antenna Polarity :HORIZONTAL

| Read Freq | Antenna Level | Cable Factor | Preamp Loss | Emission Factor | Limit Level | Over Line | Remark      |
|-----------|---------------|--------------|-------------|-----------------|-------------|-----------|-------------|
| MHz       | dBuv          | dB/m         | dB          | dB              | dBuv/m      | dB        |             |
| 4960.00   | 42.02         | 33.98        | 5.04        | 38.87           | 42.17       | 74.00     | -31.83 Peak |
| 7440.00   | 40.13         | 36.40        | 6.09        | 37.03           | 45.59       | 74.00     | -28.41 Peak |
| 9920.00   | 37.25         | 37.81        | 6.53        | 34.11           | 47.48       | 74.00     | -26.52 Peak |

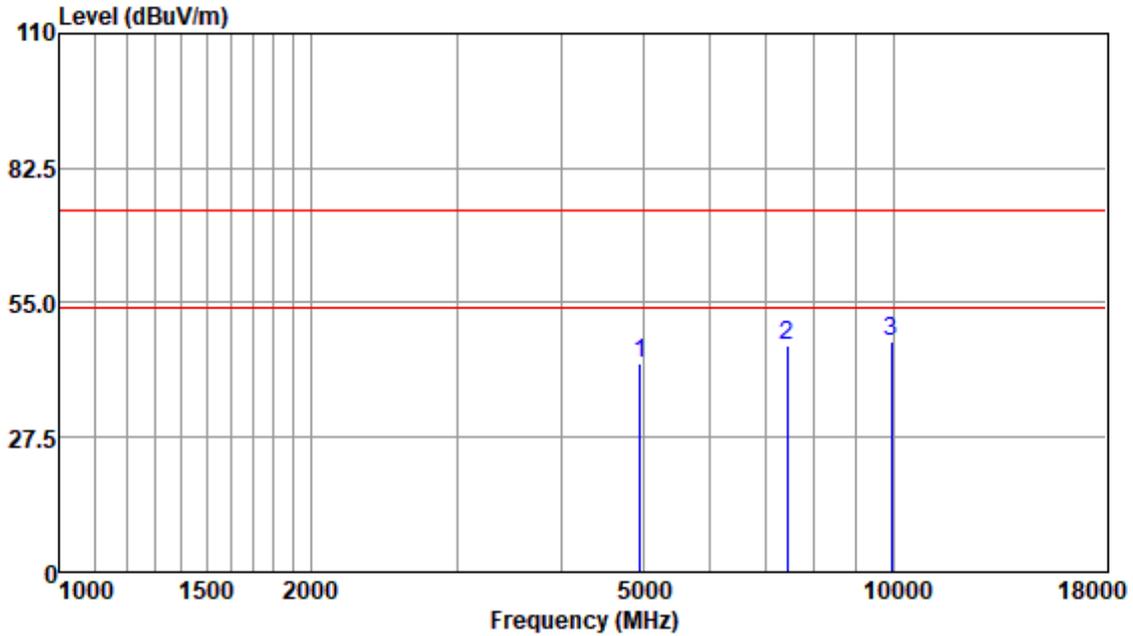
Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



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Test Mode: 01; Polarity: Vertical; Modulation:GFSK; Channel:High



Antenna Polarity :VERTICAL

| Read Freq | Antenna Factor | Cable Loss | Preamp Factor | Emission Level | Limit Line | Over Limit | Remark |
|-----------|----------------|------------|---------------|----------------|------------|------------|--------|
| MHz       | dB/m           | dB         | dB            | dBuV/m         | dBuV/m     | dB         |        |
| 4960.00   | 33.98          | 5.04       | 38.87         | 42.58          | 74.00      | -31.42     | Peak   |
| 7440.00   | 36.40          | 6.09       | 37.03         | 46.28          | 74.00      | -27.72     | Peak   |
| 9920.00   | 37.81          | 6.53       | 34.11         | 47.14          | 74.00      | -26.86     | Peak   |

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



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**7.9 99% Bandwidth**

Test Requirement RSS-Gen Section 6.7  
 Test Method: ANSI C63.10 Section 6.9.3

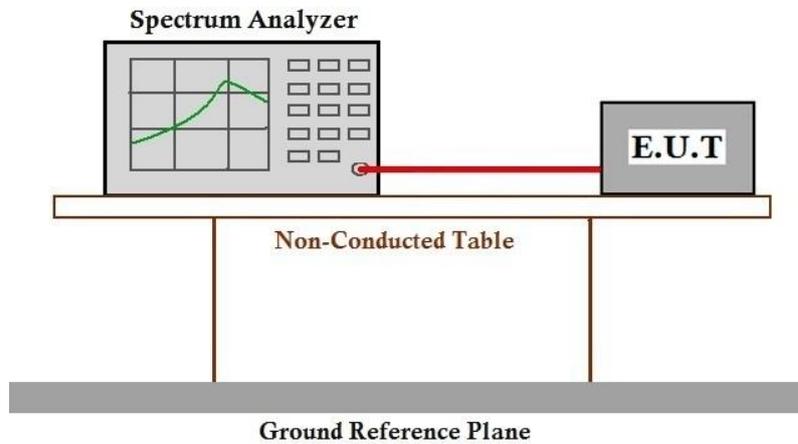
**7.9.1 E.U.T. Operation**

Operating Environment:  
 Temperature: 24.8 °C Humidity: 57.5 % RH Atmospheric Pressure: 1010 mbar

**7.9.2 Test Mode Description**

| Pre-scan / Final test | Mode Code | Description   |
|-----------------------|-----------|---|
| Final test            | 00        | TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation. |
| Final test            | 01        | TX mode(2Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation. |

**7.9.3 Test Setup Diagram**



**7.9.4 Measurement Procedure and Data**

Please Refer to Appendix for Details



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 中国·上海·松江区金都西路588号 邮编: 201612 t (86-21) 61915666 f (86-21) 61915678 sgs.china@sgs.com

## 8 Test Setup Photo

Refer to Appendix - Test Setup Photo for SHCR2209002011HS

## 9 EUT Constructional Details (EUT Photos)

Refer to Appendix - Photographs of EUT Constructional Details for SHCR2209002011HS

## 10 Appendix

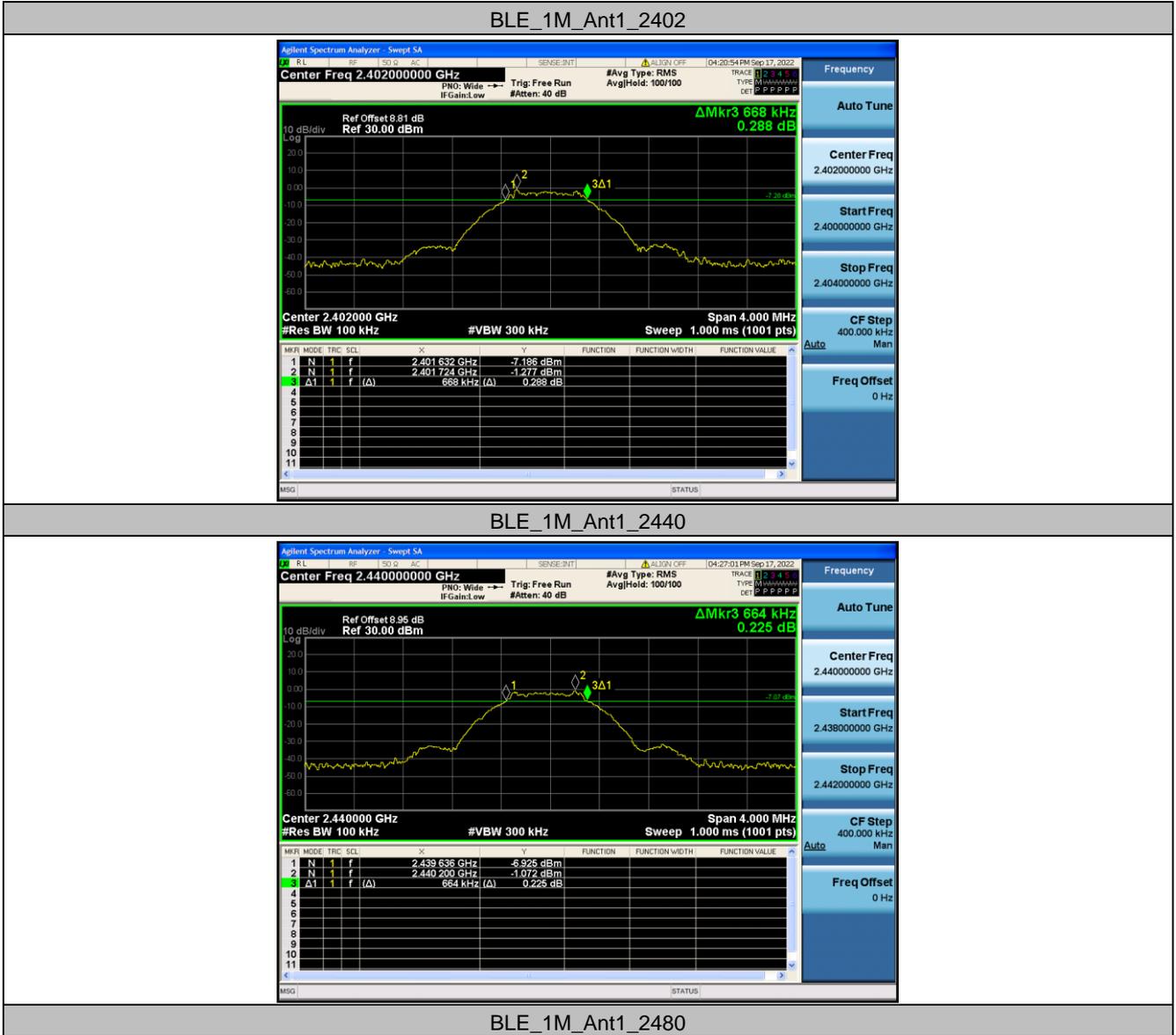
### 10.1 Appendix A: DTS Bandwidth

#### 10.1.1 Test Result

| TestMode | Antenna | Channel | DTS BW [MHz] | FL[MHz]  | FH[MHz]  | Limit[MHz] | Verdict |
|----------|---------|---------|--------------|----------|----------|------------|---------|
| BLE_1M   | Ant1    | 2402    | 0.668        | 2401.632 | 2402.300 | 0.5        | PASS    |
|          |         | 2440    | 0.664        | 2439.636 | 2440.300 | 0.5        | PASS    |
|          |         | 2480    | 0.708        | 2479.616 | 2480.324 | 0.5        | PASS    |
| BLE_2M   | Ant1    | 2402    | 1.324        | 2401.304 | 2402.628 | 0.5        | PASS    |
|          |         | 2440    | 1.252        | 2439.352 | 2440.604 | 0.5        | PASS    |
|          |         | 2480    | 1.352        | 2479.348 | 2480.700 | 0.5        | PASS    |



**10.1.2 Test Graphs**



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BLE\_2M\_Ant1\_2402



BLE\_2M\_Ant1\_2440



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BLE\_2M\_Ant1\_2480



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## 10.2 Appendix B: Occupied Channel Bandwidth

### 10.2.1 Test Result

| TestMode | Antenna | Channel | OCB [MHz] | FL[MHz]   | FH[MHz]   | Limit[MHz] | Verdict |
|----------|---------|---------|-----------|-----------|-----------|------------|---------|
| BLE_1M   | Ant1    | 2402    | 1.0303    | 2401.4549 | 2402.4852 | ---        | ---     |
|          |         | 2440    | 1.0346    | 2439.4527 | 2440.4873 | ---        | ---     |
|          |         | 2480    | 1.0291    | 2479.4522 | 2480.4813 | ---        | ---     |
| BLE_2M   | Ant1    | 2402    | 2.0672    | 2400.9393 | 2403.0065 | ---        | ---     |
|          |         | 2440    | 2.0626    | 2438.9278 | 2440.9904 | ---        | ---     |
|          |         | 2480    | 2.0645    | 2478.9315 | 2480.9960 | ---        | ---     |

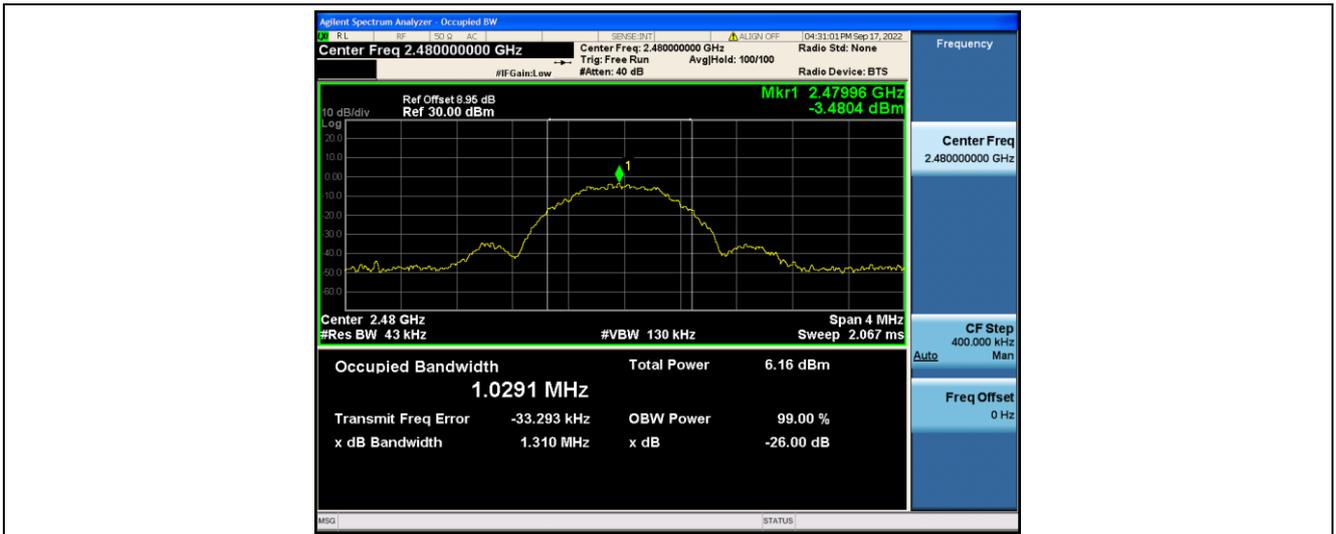


**10.2.2 Test Graphs**



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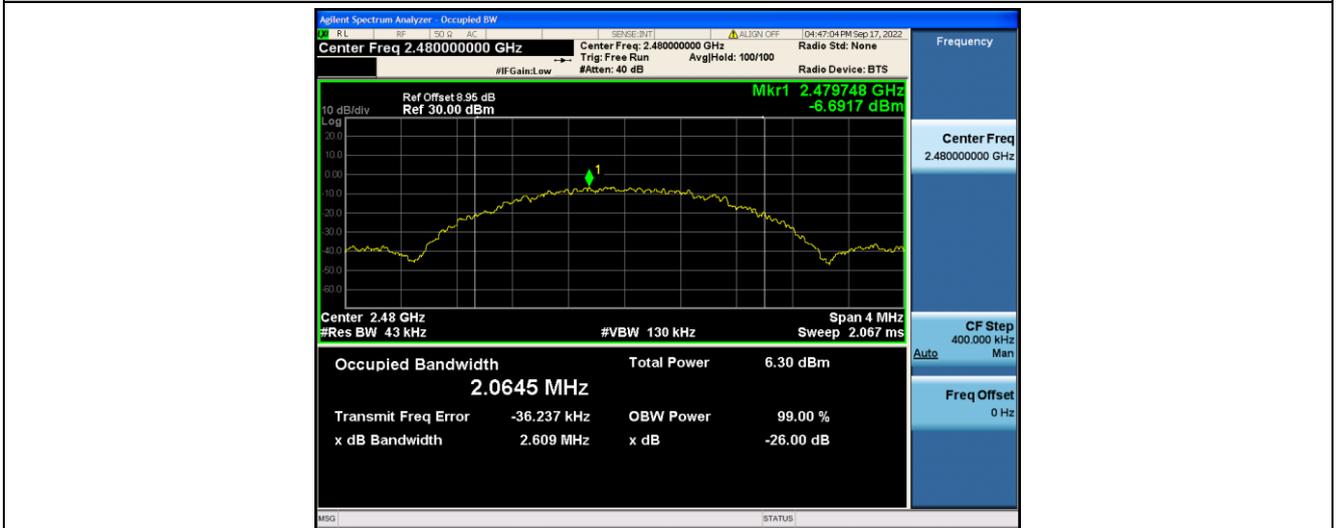
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### 10.3 Appendix C: Maximum conducted output power

#### 10.3.1 Test Result

| Test Mode | Antenna | Channel | Result[dBm] | Limit[dBm] | Verdict |
|-----------|---------|---------|-------------|------------|---------|
| BLE_1M    | Ant1    | 2402    | -0.8        | ≤30        | PASS    |
|           |         | 2440    | -0.29       | ≤30        | PASS    |
|           |         | 2480    | -0.82       | ≤30        | PASS    |
| BLE_2M    | Ant1    | 2402    | -0.88       | ≤30        | PASS    |
|           |         | 2440    | -0.33       | ≤30        | PASS    |
|           |         | 2480    | -0.85       | ≤30        | PASS    |



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**10.3.2 Test Graphs**



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BLE\_2M\_Ant1\_2440



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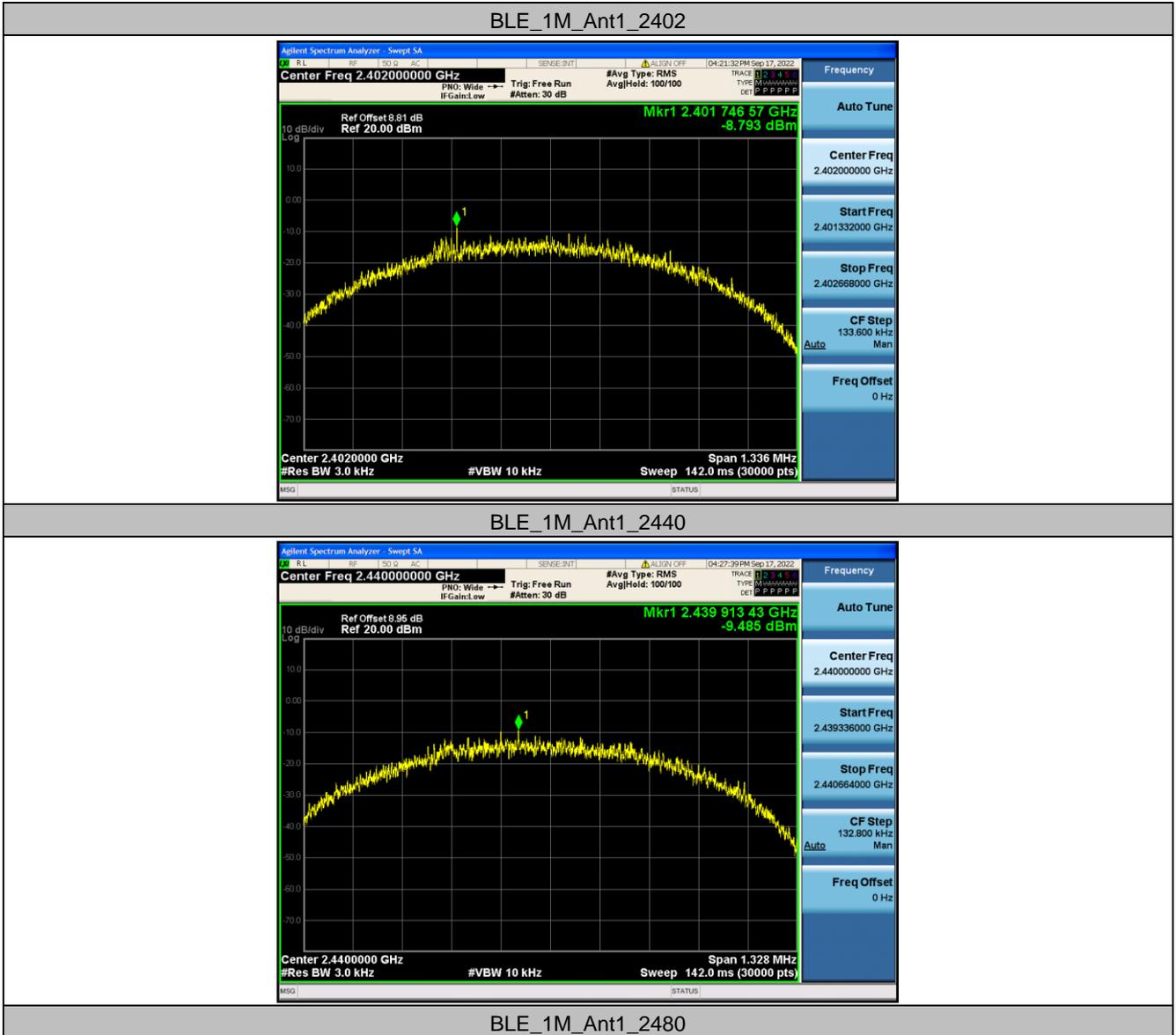
## 10.4 Appendix D: Maximum power spectral density

### 10.4.1 Test Result

| TestMode | Antenna | Channel | Result[dBm/3-100kHz] | Limit[dBm/3kHz] | Verdict |
|----------|---------|---------|----------------------|-----------------|---------|
| BLE_1M   | Ant1    | 2402    | -8.79                | ≤8.00           | PASS    |
|          |         | 2440    | -9.49                | ≤8.00           | PASS    |
|          |         | 2480    | -10.81               | ≤8.00           | PASS    |
| BLE_2M   | Ant1    | 2402    | -13.36               | ≤8.00           | PASS    |
|          |         | 2440    | -11.98               | ≤8.00           | PASS    |
|          |         | 2480    | -13.4                | ≤8.00           | PASS    |



**10.4.2 Test Graphs**

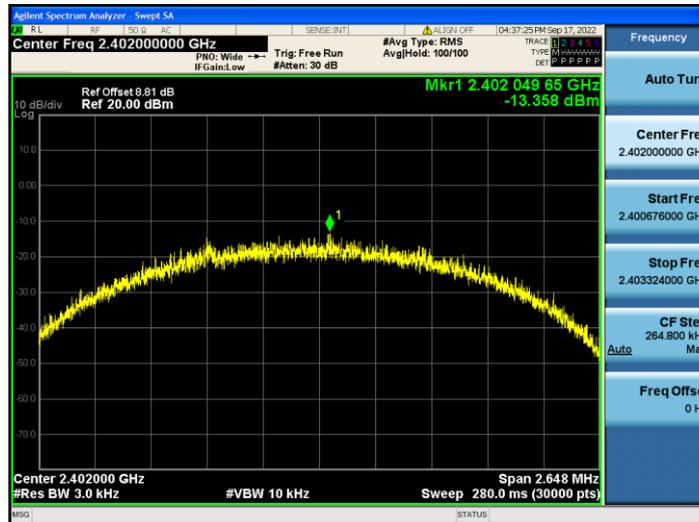


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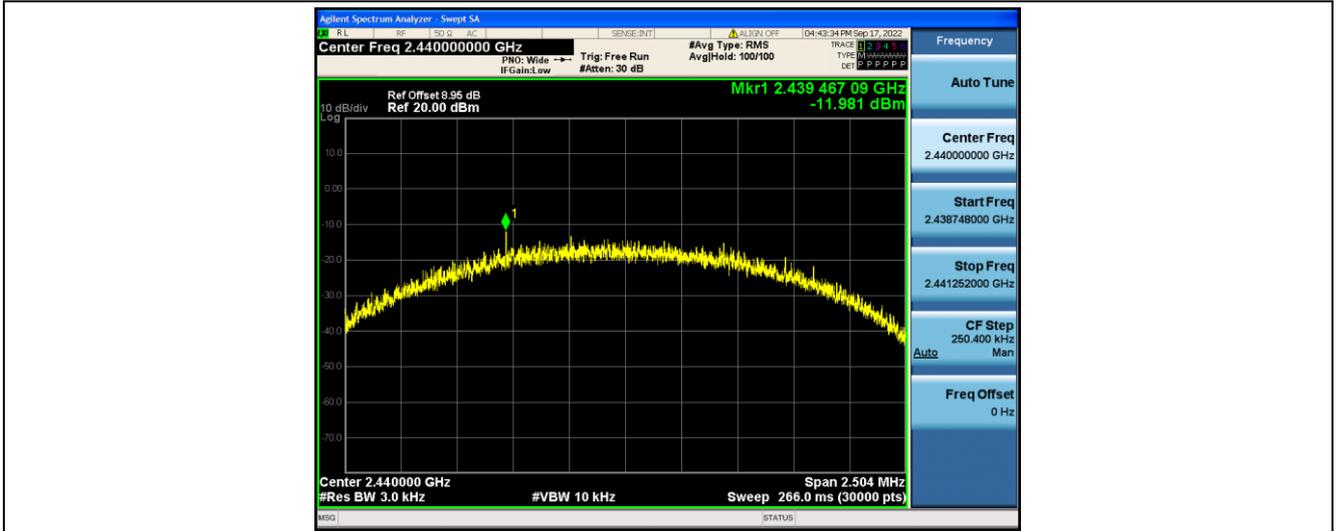


BLE\_2M\_Ant1\_2440

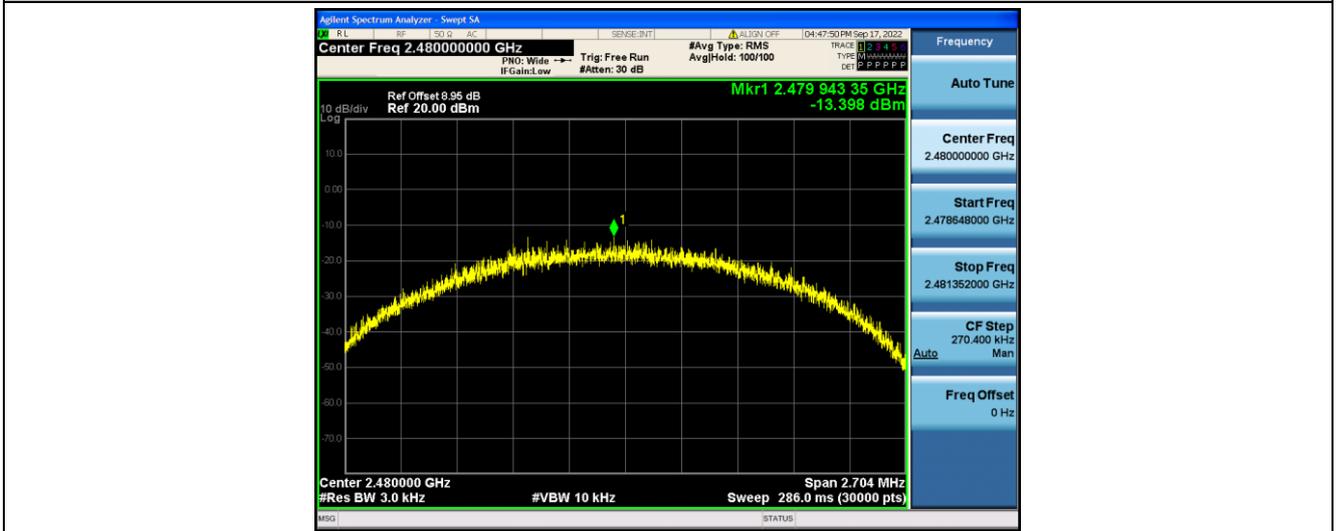


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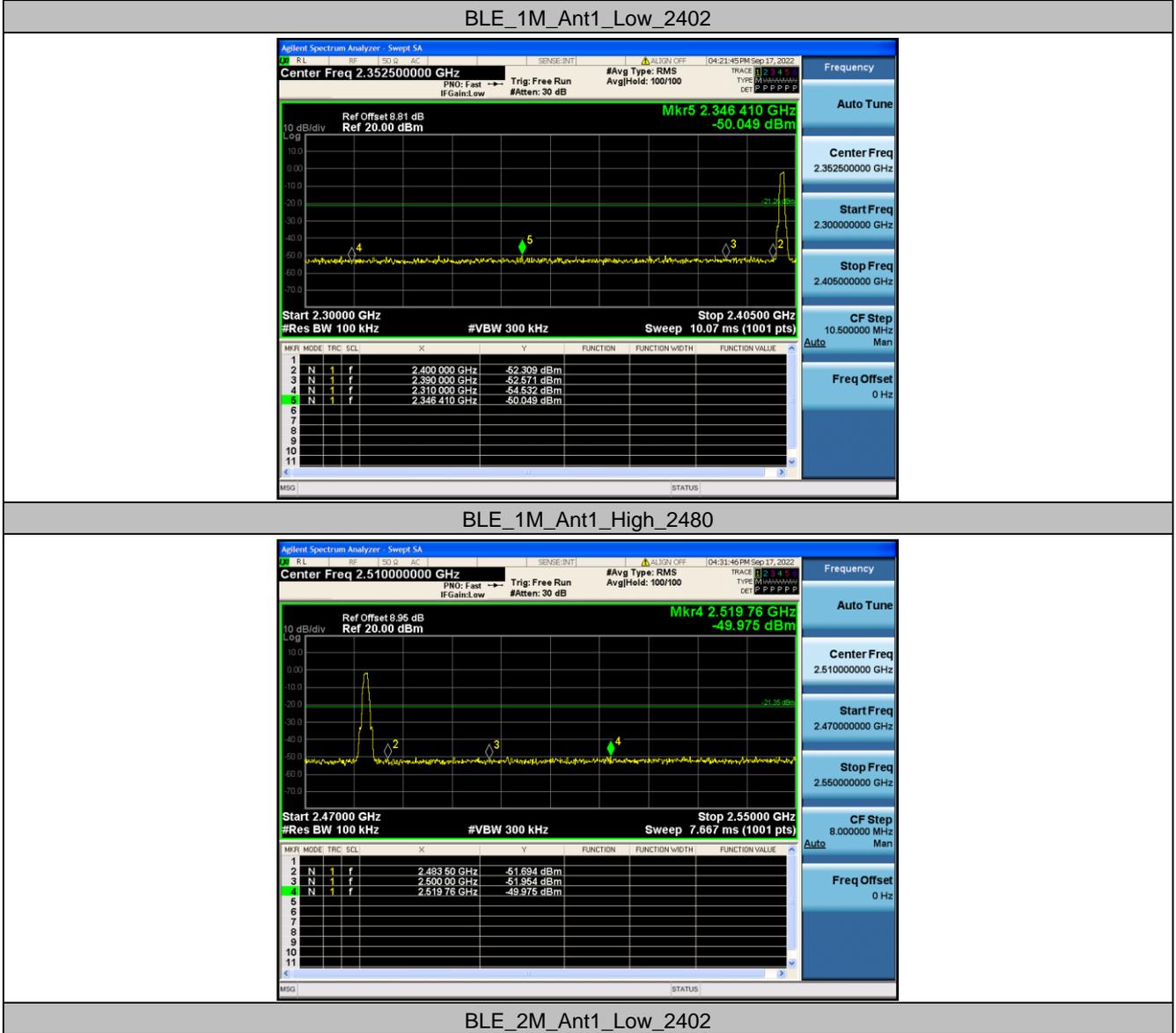
## 10.5 Appendix E: Band edge measurements

### 10.5.1 Test Result

| TestMode | Antenna | ChName | Channel | RefLevel[dBm] | Result[dBm] | Limit[dBm] | Verdict |
|----------|---------|--------|---------|---------------|-------------|------------|---------|
| BLE_1M   | Ant1    | Low    | 2402    | -1.26         | -50.05      | ≤-21.26    | PASS    |
|          |         | High   | 2480    | -1.35         | -49.98      | ≤-21.35    | PASS    |
| BLE_2M   | Ant1    | Low    | 2402    | -3.66         | -35.03      | ≤-23.66    | PASS    |
|          |         | High   | 2480    | -3.25         | -49.82      | ≤-23.25    | PASS    |



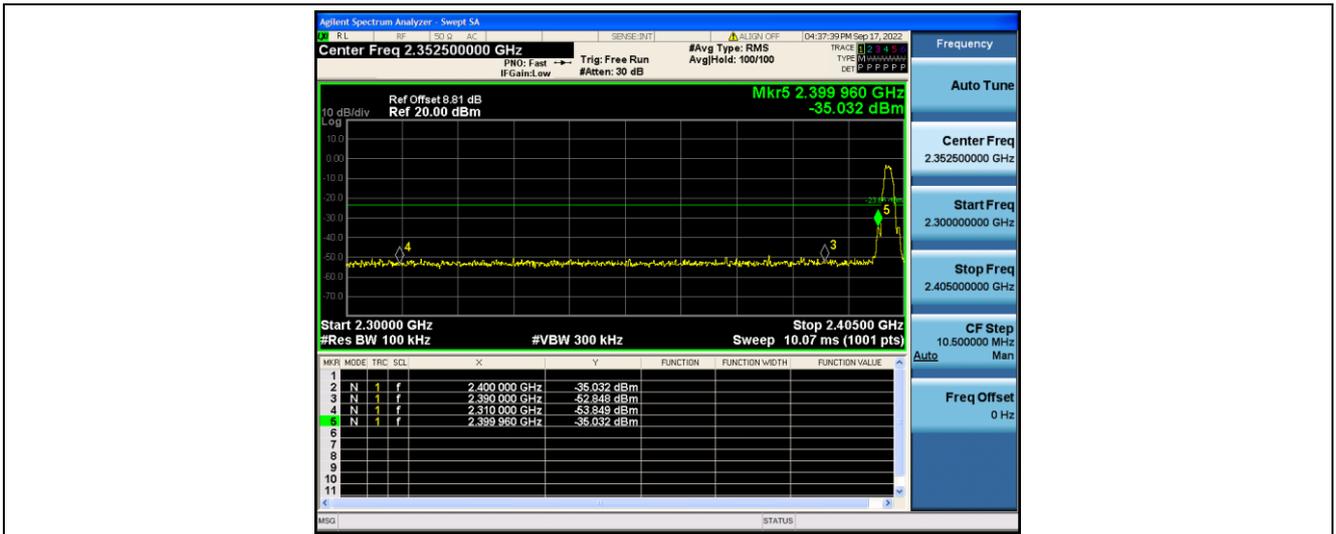
**10.5.2 Test Graphs**



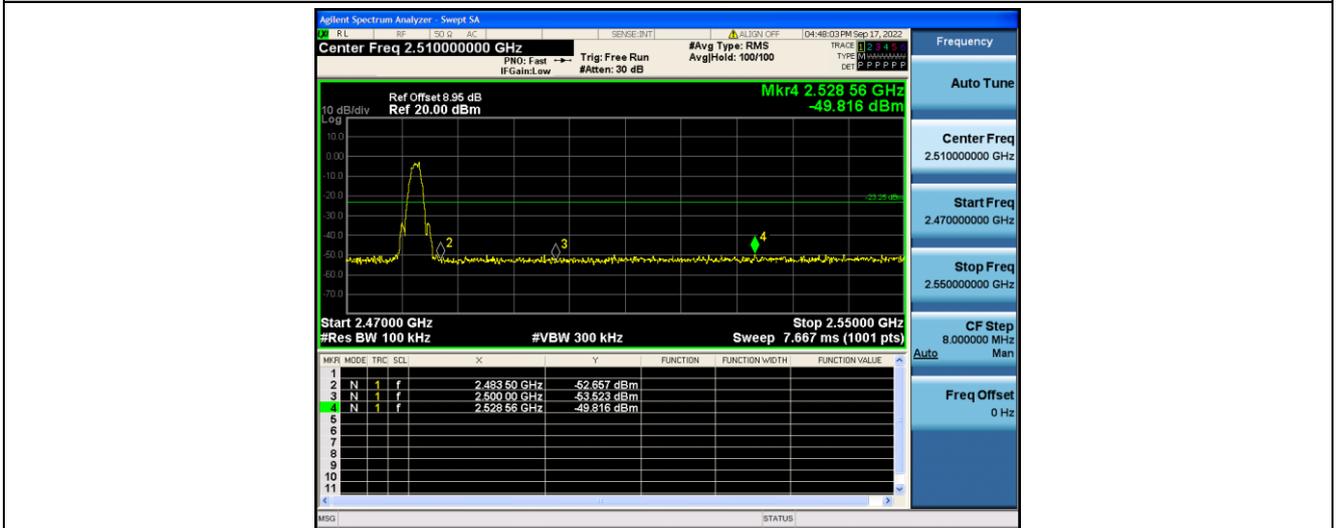
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## 10.6 Appendix F: Conducted Spurious Emission

### 10.6.1 Test Result

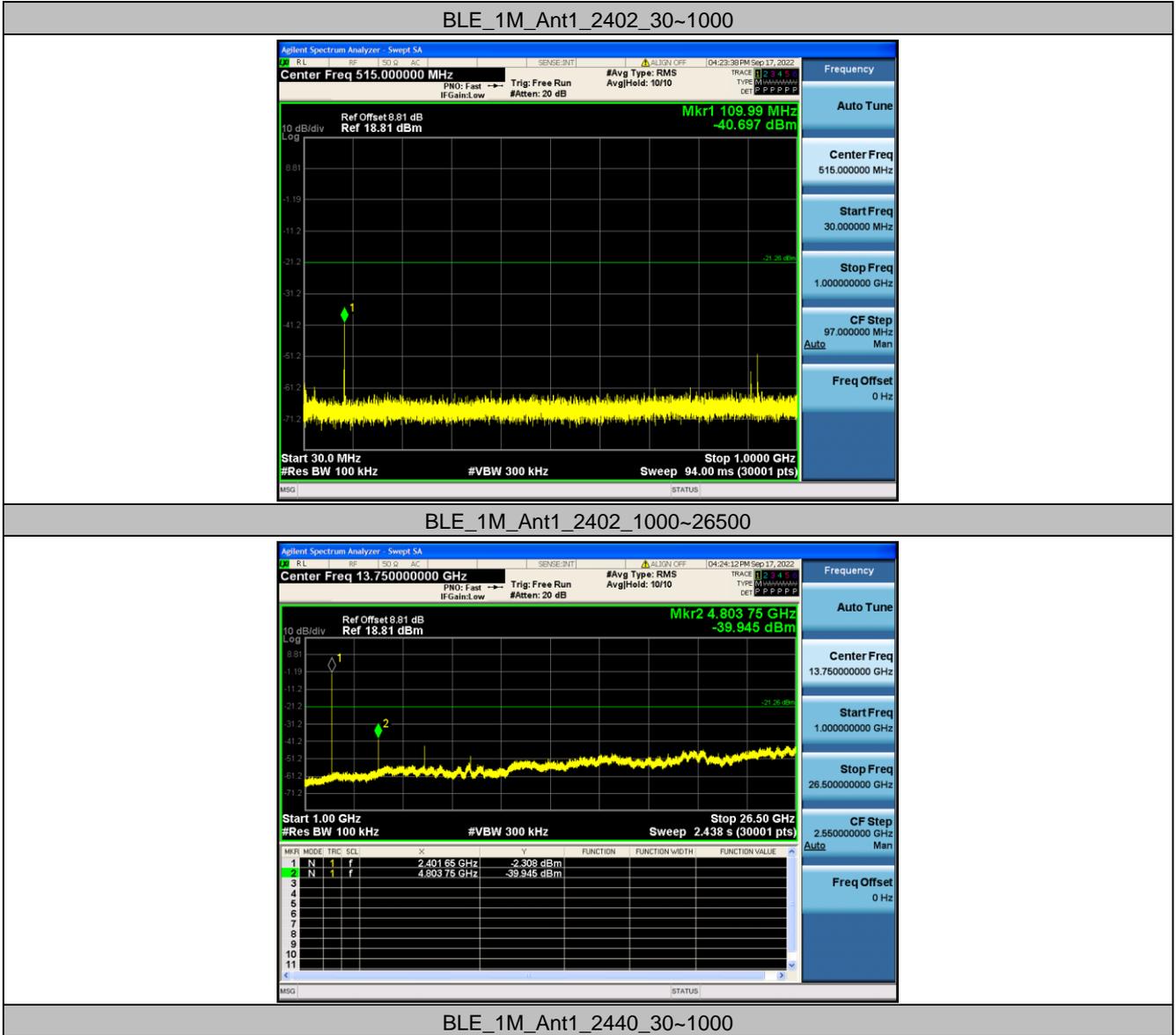
| TestMode | Antenna | Channel | FreqRange [MHz] | RefLevel [dBm] | Result[dBm] | Limit[dBm] | Verdict |
|----------|---------|---------|-----------------|----------------|-------------|------------|---------|
| BLE_1M   | Ant1    | 2402    | 30~1000         | -1.26          | -40.7       | ≤-21.26    | PASS    |
|          |         |         | 1000~26500      | -1.26          | -39.95      | ≤-21.26    | PASS    |
|          |         | 2440    | 30~1000         | -1.53          | -41.04      | ≤-21.53    | PASS    |
|          |         |         | 1000~26500      | -1.53          | -39.54      | ≤-21.53    | PASS    |
|          |         | 2480    | 30~1000         | -1.35          | -40.25      | ≤-21.35    | PASS    |
|          |         |         | 1000~26500      | -1.35          | -39.35      | ≤-21.35    | PASS    |
| BLE_2M   | Ant1    | 2402    | 30~1000         | -3.66          | -51.65      | ≤-23.66    | PASS    |
|          |         |         | 1000~26500      | -3.66          | -39.96      | ≤-23.66    | PASS    |
|          |         | 2440    | 30~1000         | -2.97          | -60.24      | ≤-22.97    | PASS    |
|          |         |         | 1000~26500      | -2.97          | -41.13      | ≤-22.97    | PASS    |
|          |         | 2480    | 30~1000         | -3.25          | -50.12      | ≤-23.25    | PASS    |
|          |         |         | 1000~26500      | -3.25          | -41.26      | ≤-23.25    | PASS    |



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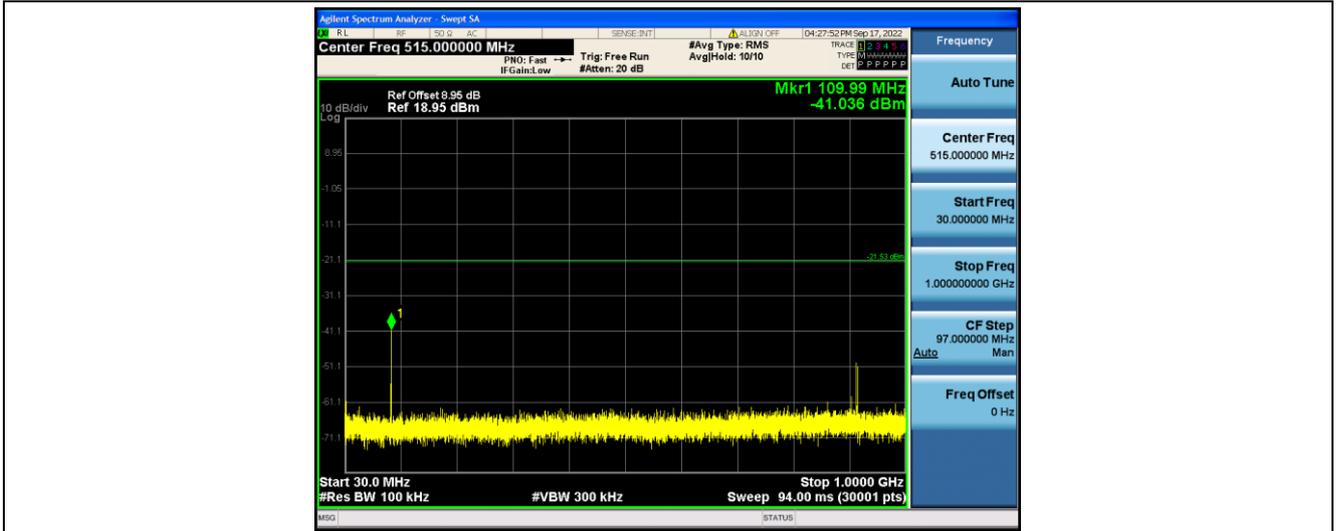
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**10.6.2 Test Graphs**

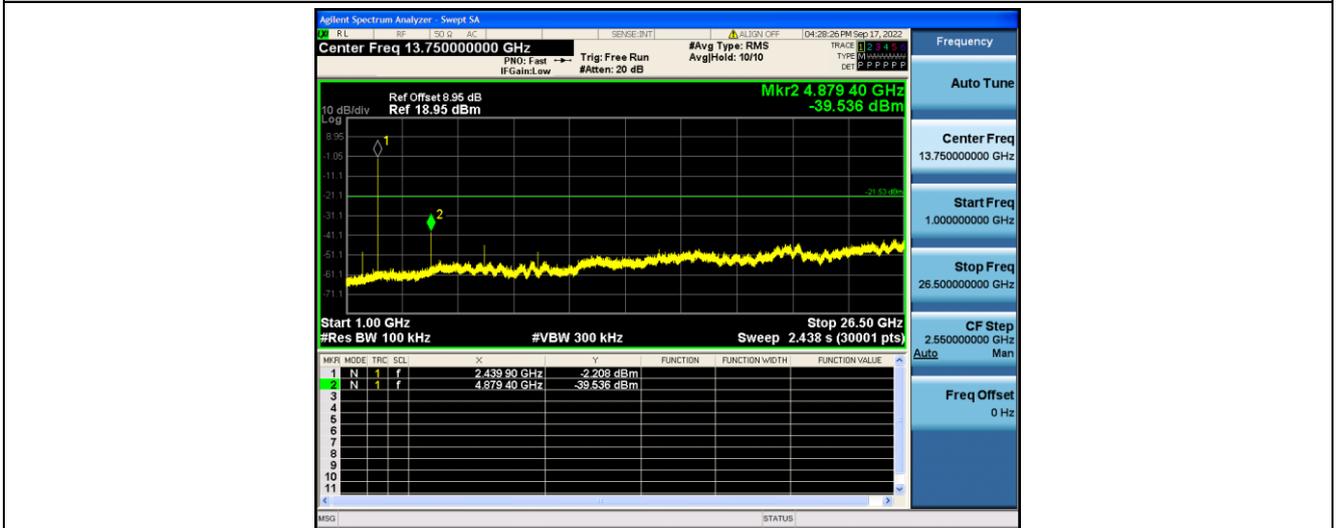


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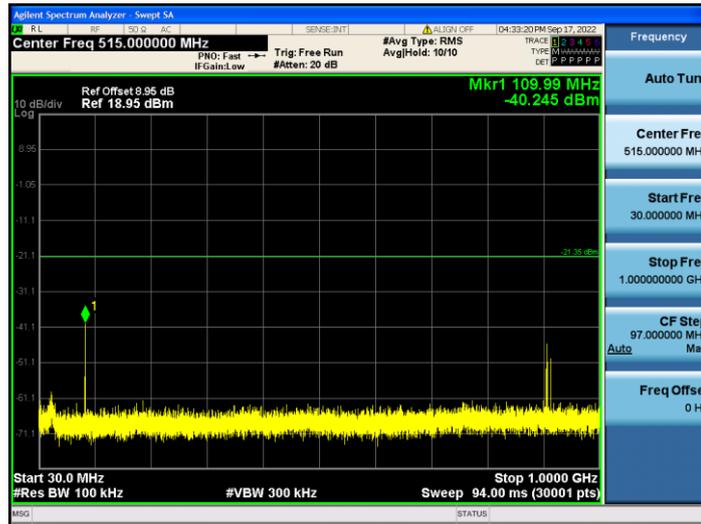


BLE\_1M\_Ant1\_2440\_1000~26500

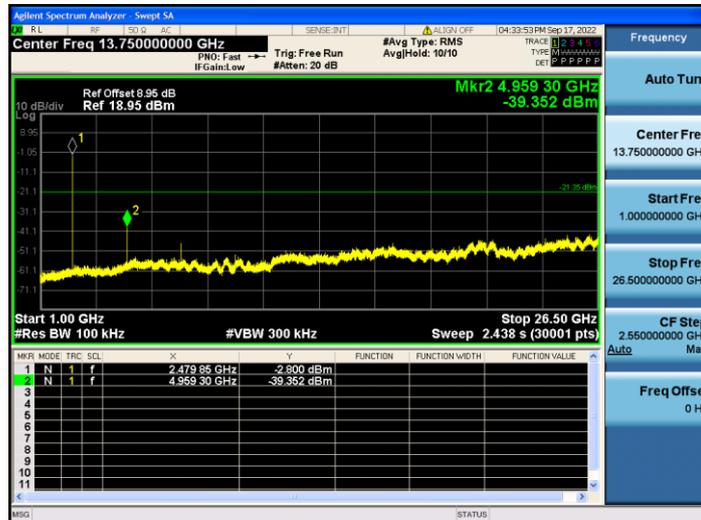


BLE\_1M\_Ant1\_2480\_30~1000



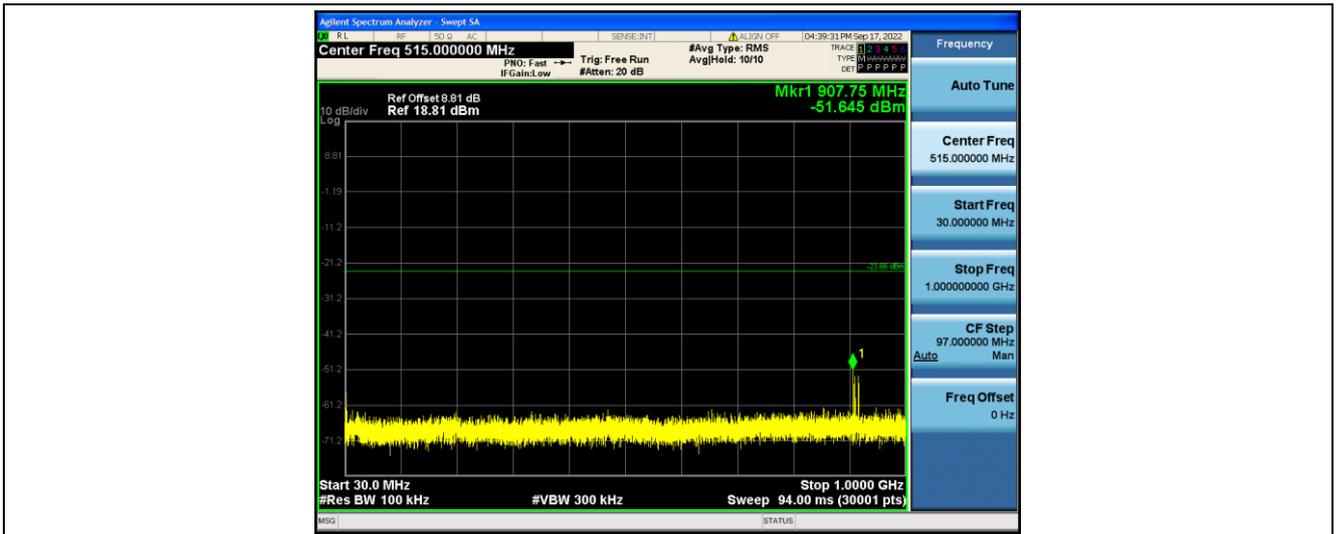


BLE\_1M\_Ant1\_2480\_1000~26500

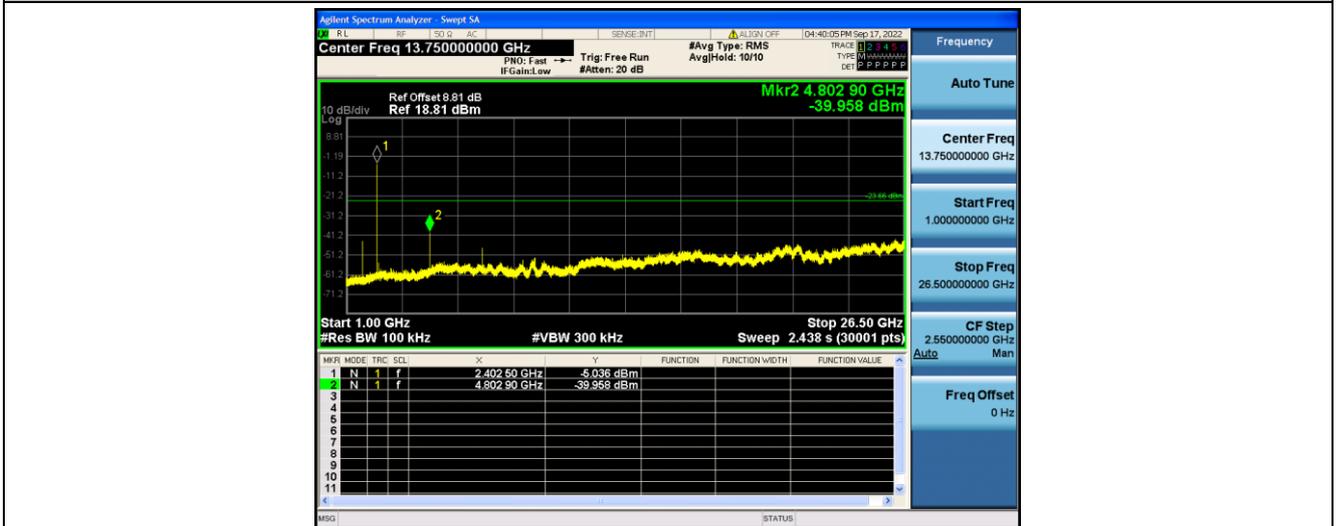


BLE\_2M\_Ant1\_2402\_30~1000



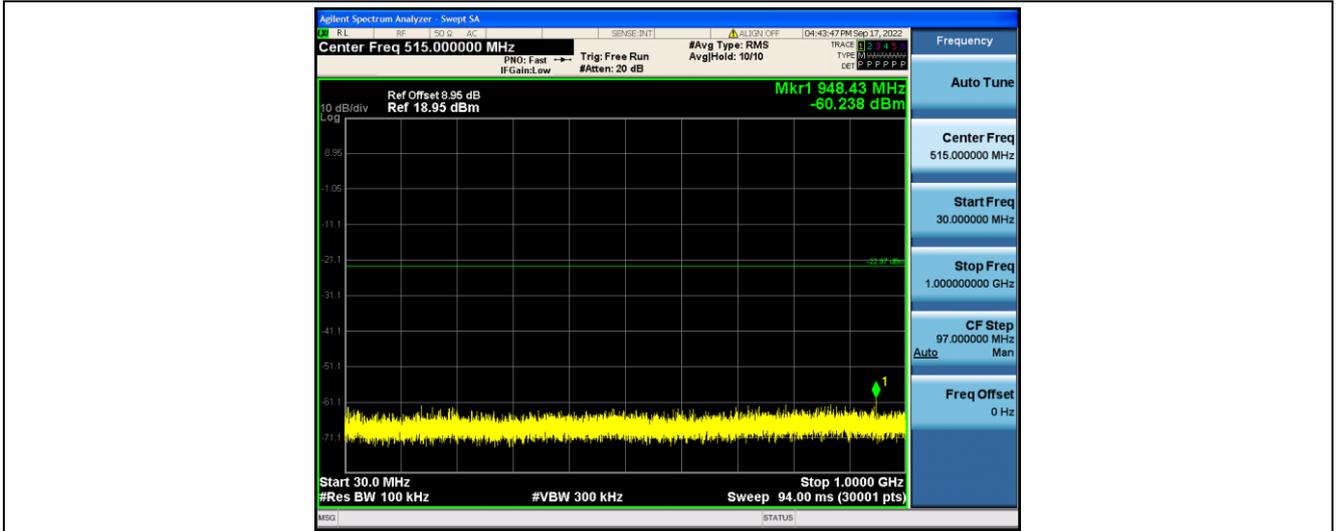


BLE\_2M\_Ant1\_2402\_1000~26500

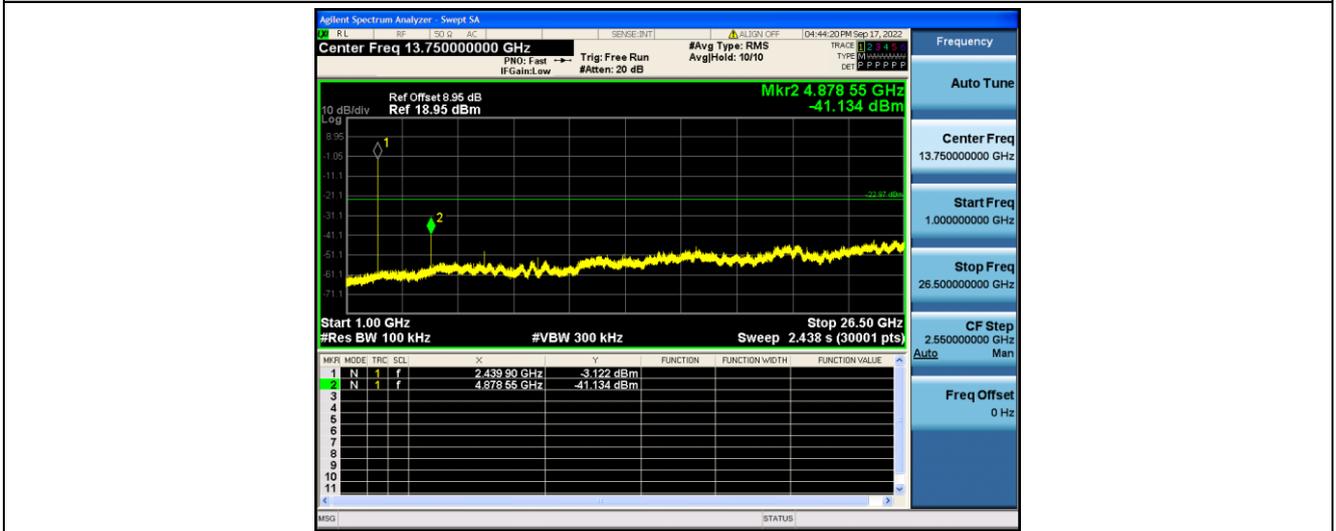


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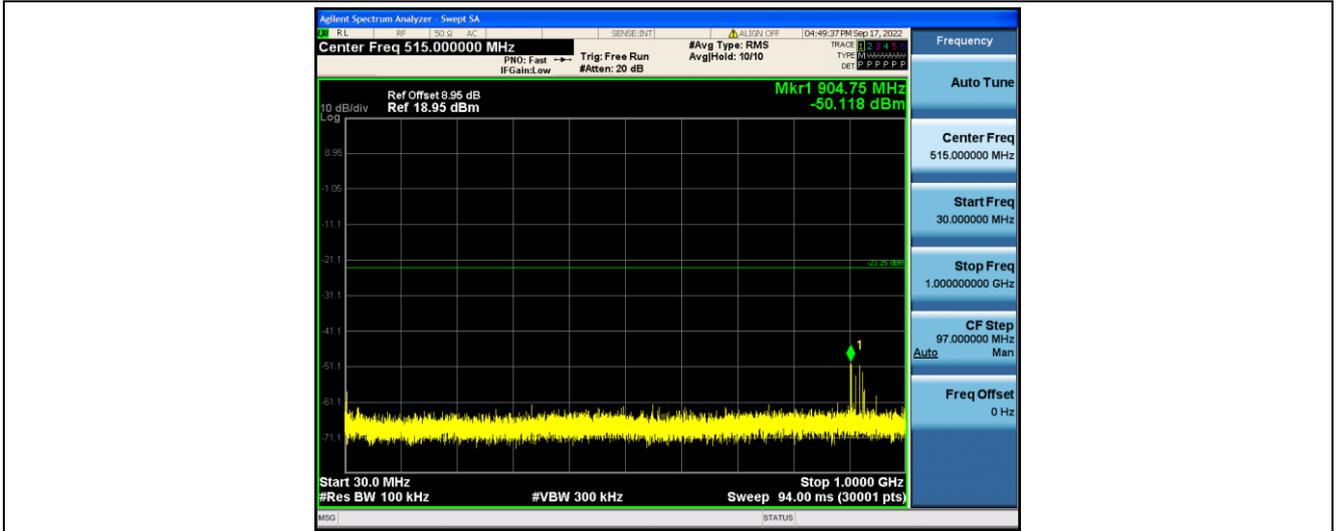


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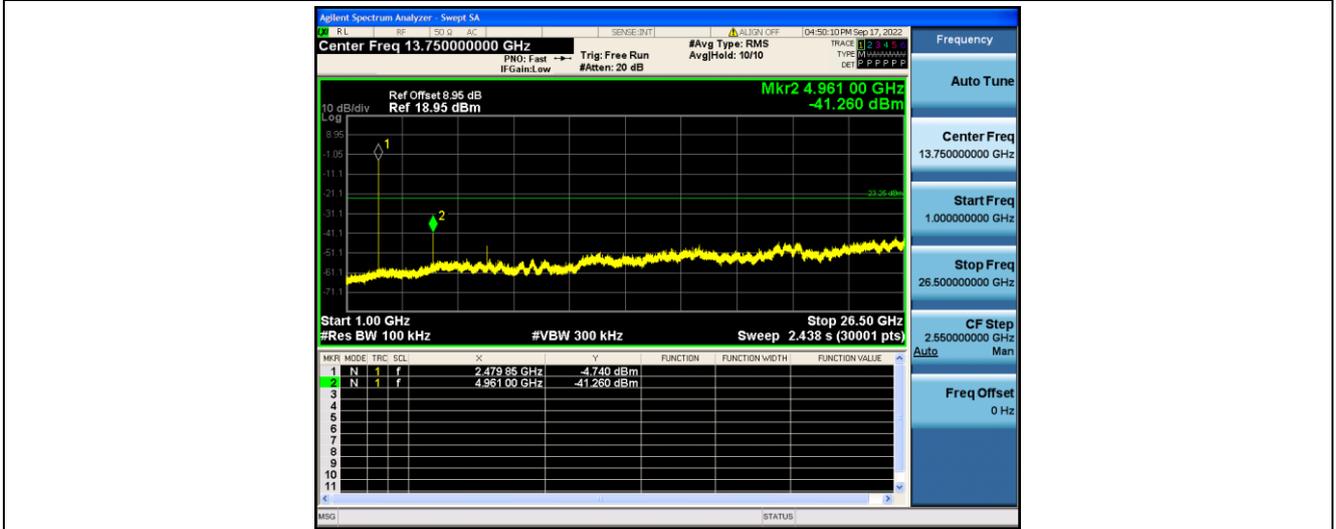


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BLE\_2M\_Ant1\_2480\_1000~26500



-- End of the Report --

