

FCC Test Report

Applicant : **Audio-Technica Corporation**

Address : **2-46-1 Nishi-naruse, Machida, Tokyo**
194-8666, Japan

Product Name : **Wireless Headphones**

Report Date : **Nov. 02, 2023**

Shenzhen Anbotek Compliance Laboratory Limited



Shenzhen Anbotek Compliance Laboratory Limited

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TEST REPORT

Applicant : Audio-Technica Corporation
Manufacturer : Audio-Technica Corporation
Product Name : Wireless Headphones
Test Model No. : ATH-TWX9
Reference Model No. : N/A
Trade Mark : audio-technica
Rating(s) : Input: 5V \pm 1A (with DC 3.85V, 500mAh battery inside)
Output: 5V \pm 0.1*2A
Charging Case: with DC 3.85V, 500mAh battery inside
Headphones: with DC 3.85V, 70mAh battery inside
Test Standard(s) : FCC Part15 Subpart C, Section 15.247
Test Method(s) : ANSI C63.10: 2020, KDB 558074 D01 15.247 Meas Guidance v05r02

The device described above is tested by Shenzhen Anbotek Compliance Laboratory Limited to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and Shenzhen Anbotek Compliance Laboratory Limited is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the FCC Part 15 Subpart C requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of Shenzhen Anbotek Compliance Laboratory Limited.

Date of Receipt

Jul. 24, 2023

Date of Test

Jul. 26~Apr. 15, 2023

Prepared By



(Ella Liang)

Approved & Authorized Signer



(Edward Pan)



Revision History

| Report Version | Description | Issued Date |
|----------------|-----------------|---------------|
| R00 | Original Issue. | Nov. 02, 2023 |
| | | |
| | | |



1. General Information

1.1. Client Information

| | | |
|--------------|---|---|
| Applicant | : | Audio-Technica Corporation |
| Address | : | 2-46-1 Nishi-naruse, Machida, Tokyo 194-8666, Japan |
| Manufacturer | : | Audio-Technica Corporation |
| Address | : | 2-46-1 Nishi-naruse, Machida, Tokyo 194-8666, Japan |

1.2. Description of Device (EUT)

| | | |
|---------------------|---|---|
| Product Name | : | Wireless Headphones |
| Test Model No. | : | ATH-TWX9 |
| Reference Model No. | : | N/A |
| Trade Mark | : | audio-technica |
| Test Power Supply | : | DC 3.85V battery inside |
| Test Sample No. | : | 1-2-1(Normal Sample), 1-2-2(Engineering Sample) |
| Adapter | : | N/A |

RF Specification

| | | |
|---------------------|---|---|
| Operation Mode | : | <input checked="" type="checkbox"/> BT BLE |
| Support Rate | : | <input checked="" type="checkbox"/> 1Mbps <input checked="" type="checkbox"/> 2Mbps |
| Operation Frequency | : | 2402~2480MHz |
| Number of Channel | : | 40 Channels |
| Modulation Type | : | GFSK |
| Antenna Type | : | LDS Antenna |
| Antenna Gain(Peak) | : | -5.8dBi |

Remark: 1) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.



1.3. Auxiliary Equipment Used During Test

| Description | Rating(s) |
|-------------|-----------|
| | |

1.4. Description of Test Configuration

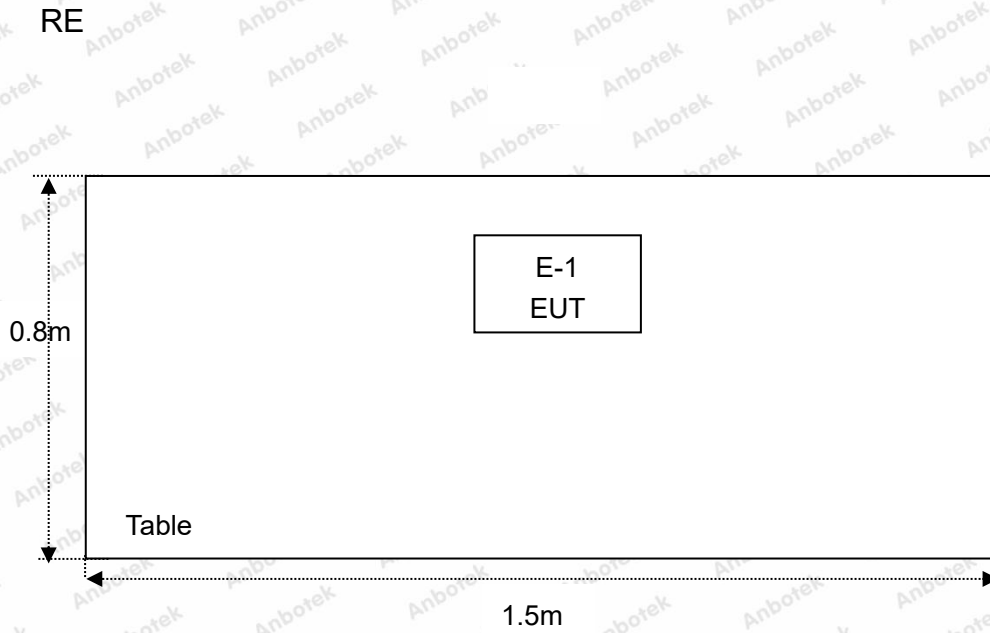
| Channel | Freq. (MHz) | Channel | Freq. (MHz) | Channel | Freq. (MHz) | Channel | Freq. (MHz) | Channel | Freq. (MHz) |
|---------|-------------|---------|-------------|---------|-------------|---------|-------------|---------|-------------|
| 00 | 2402 | 09 | 2420 | 18 | 2438 | 27 | 2456 | 36 | 2474 |
| 01 | 2404 | 10 | 2422 | 19 | 2440 | 28 | 2458 | 37 | 2476 |
| 02 | 2406 | 11 | 2424 | 20 | 2442 | 29 | 2460 | 38 | 2478 |
| 03 | 2408 | 12 | 2426 | 21 | 2444 | 30 | 2462 | 39 | 2480 |
| 04 | 2410 | 13 | 2428 | 22 | 2446 | 31 | 2464 | | |
| 05 | 2412 | 14 | 2430 | 23 | 2448 | 32 | 2466 | | |
| 06 | 2414 | 15 | 2432 | 24 | 2450 | 33 | 2468 | | |
| 07 | 2416 | 16 | 2434 | 25 | 2452 | 34 | 2470 | | |
| 08 | 2418 | 17 | 2436 | 26 | 2454 | 35 | 2472 | | |

Note:

1. The engineering test program was provided and the EUT was programmed to be in continuously transmitting mode.
2. EUT was tested with channel 0, 19 and 39.



1.5. Description Of Test Setup



1.6. Test Equipment List

| Item | Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Cal. Interval |
|------|---|-----------------|-------------------|--------------|---------------|---------------|
| 1. | L.I.S.N. Artificial Mains Network | Rohde & Schwarz | ENV216 | 100055 | Oct. 12, 2023 | 1 Year |
| 2. | Three Phase V-type Artificial Power Network | CYBERTEK | EM5040DT | E215040DT001 | Jul. 05, 2023 | 1 Year |
| 3. | EMI Test Receiver | Rohde & Schwarz | ESCI | 100627 | Oct. 12, 2023 | 1 Year |
| 4. | EMI Test Receiver | Rohde & Schwarz | ESR26 | 101481 | Oct. 12, 2023 | 1 Year |
| 5. | MXA Spectrum Analysis | Agilent | N9020A | MY51170037 | Oct. 12, 2023 | 1 Year |
| 6. | EMI Preamplifier | SKET Electronic | LNPA-0118G -45 | SKET-PA-002 | Oct. 12, 2023 | 1 Year |
| 7. | Double Ridged Horn Antenna | SCHWARZBECK | BBHA 9120D | 02555 | Oct. 16, 2022 | 3 Year |
| 8. | Bilog Broadband Antenna | Schwarzbeck | VULB9163 | 345 | Oct. 23, 2022 | 3 Year |
| 9. | Loop Antenna | Schwarzbeck | FMZB1519B | 00053 | Oct. 12, 2023 | 1 Year |
| 10. | Horn Antenna | A-INFO | LB-180400- KF | J211060628 | Oct. 12, 2023 | 1 Year |
| 11. | Pre-amplifier | SONOMA | 310N | 186860 | Oct. 12, 2023 | 1 Year |
| 12. | EMI Test Software EZ-EMC | SHURPLE | N/A | N/A | N/A | N/A |
| 13. | MXA Spectrum Analysis | KEYSIGHT | N9020A | MY53280032 | Oct. 12, 2023 | 1 Year |
| 14. | MXG RF Vector Signal Generator | Agilent | N5182A | MY48180656 | Oct. 12, 2023 | 1 Year |
| 15. | Signal Generator | Agilent | E4421B | MY41000743 | Oct. 12, 2023 | 1 Year |
| 16. | DC Power Supply | IVYTECH | IV3605 | 1804D360510 | Oct. 20, 2023 | 1 Year |
| 17. | Constant Temperature Humidity Chamber | ZHONGJIAN | ZJ-KHWS80 B | N/A | Oct. 16, 2023 | 1 Year |
| 18. | Power Meter | Agilent | N1914A | MY50001102 | Oct. 20, 2023 | 1 Year |
| 19. | Spectrum Analyzer | Rohde & Schwarz | FSV40-N | 101792 | May. 26, 2023 | 1 Year |



1.7. Measurement Uncertainty

| Parameter | Uncertainty |
|---|---|
| Conducted emissions (AMN 150kHz~30MHz) | 3.8dB |
| Occupied Bandwidth | 925Hz |
| Conducted Output Power | 0.76dB |
| Conducted Spurious Emission | 1.24dB |
| Radiated spurious emissions (Below 30MHz) | 3.53dB |
| Radiated spurious emissions (30MHz~1GHz) | Horizontal: 3.92dB; Vertical: 4.52dB |
| Radiated spurious emissions (above 1GHz) | 1G-6GHz: 4.78dB; 6G-18GHz: 4.88dB 18G-40GHz: 5.68dB |
| The measurement uncertainty and decision risk evaluated according to AB/WI-RF-F-032. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2. | |

1.8. Description of Test Facility

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

FCC-Registration No.: 184111

Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No. 184111.

ISED-Registration No.: 8058A

Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registered and fully described in a report filed with the (ISED) Innovation, Science and Economic Development Canada. The acceptance letter from the ISED is maintained in our files. Registration 8058A.

Test Location

Shenzhen Anbotek Compliance Laboratory Limited.

1/F, Building D, Sogood Science and Technology Park, Sanwei community, Hangcheng Street, Bao'an District, Shenzhen, Guangdong, China.



1.9. Disclaimer

1. The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.
2. The test report is invalid if there is any evidence and/or falsification.
3. The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein.
4. This document may not be altered or revised in any way unless done so by Anbotek and all revisions are duly noted in the revisions section.
5. Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.
6. The authenticity of the information provided by the customer is the responsibility of the customer and the laboratory is not responsible for its authenticity.

The laboratory is only responsible for the data released by the laboratory, except for the part provided by the applicant.



2. Summary of Test Results

| Standard Section | Test Item | Result |
|---|-----------------------------|--------|
| 15.203/15.247(c) | Antenna Requirement | PASS |
| 15.207 | Conducted Emission | N/A |
| 15.205/15.209 | Spurious Emission | PASS |
| 15.247(b)(3) | Conducted Peak Output Power | PASS |
| 15.247(a)(2) | 6dB Emission Bandwidth | PASS |
| 15.247(e) | Power Spectral Density | PASS |
| 15.247(d) | Band Edge | PASS |
| Remark: "N/A" is an abbreviation for Not Applicable. | | |



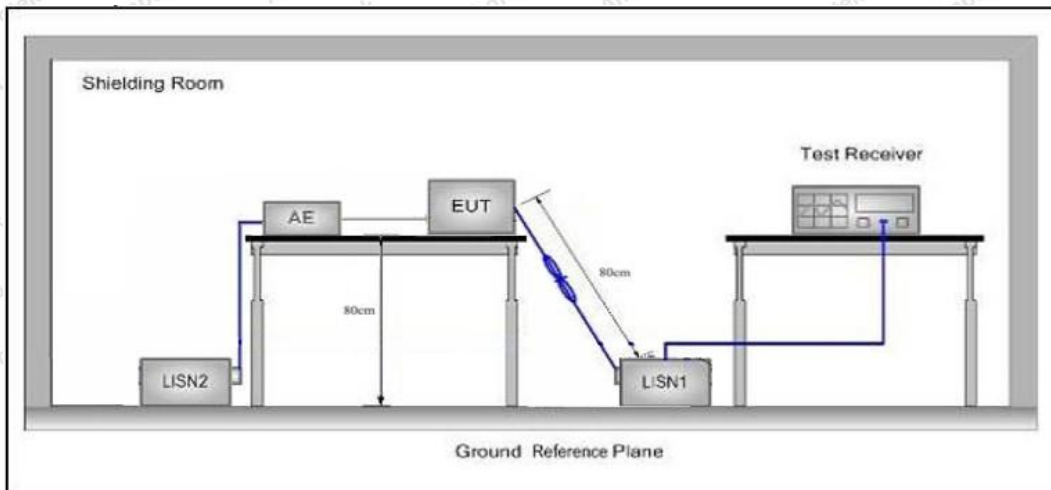
3. Conducted Emission Test

3.1. Test Standard and Limit

| Test Standard | FCC Part15 Section 15.207 | | |
|---------------|---------------------------|--------------------------------|---------------|
| Test Limit | Frequency | Maximum RF Line Voltage (dBuV) | |
| | | Quasi-peak Level | Average Level |
| | 150kHz~500kHz | 66 ~ 56 * | 56 ~ 46 * |
| | 500kHz~5MHz | 56 | 46 |
| 5MHz~30MHz | 60 | 50 | |

Remark:(1) *Decreasing linearly with logarithm of the frequency.
 (2) The lower limit shall apply at the transition frequency.

3.2. Test Setup



3.3. Test Procedure

The EUT system is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs. Both sides of AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to FCC ANSI C63.10: 2020 on Conducted Emission Measurement.

The bandwidth of test receiver (ESCI) set at 9kHz.

The frequency range from 150kHz to 30MHz is checked.

3.4. Test Data

Not applicable.



4. Radiation Spurious Emission and Band Edge

4.1. Test Standard and Limit

| Test Standard | FCC Part15 C Section 15.209 and 15.205 | | | | |
|---------------|--|----------------------------------|----------------|------------|--------------------------|
| Test Limit | Frequency (MHz) | Field strength (microvolt/meter) | Limit (dBuV/m) | Remark | Measurement distance (m) |
| | 0.009MHz~0.490MHz | 2400/F(kHz) | - | - | 300 |
| | 0.490MHz-1.705MHz | 24000/F(kHz) | - | - | 30 |
| | 1.705MHz-30MHz | 30 | - | - | 30 |
| | 30MHz~88MHz | 100 | 40.0 | Quasi-peak | 3 |
| | 88MHz~216MHz | 150 | 43.5 | Quasi-peak | 3 |
| | 216MHz~960MHz | 200 | 46.0 | Quasi-peak | 3 |
| | 960MHz~1000MHz | 500 | 54.0 | Quasi-peak | 3 |
| | Above 1000MHz | 500 | 54.0 | Average | 3 |
| - | | 74.0 | Peak | 3 | |

Remark:

(1)The lower limit shall apply at the transition frequency.

(2) 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

4.2. Test Setup

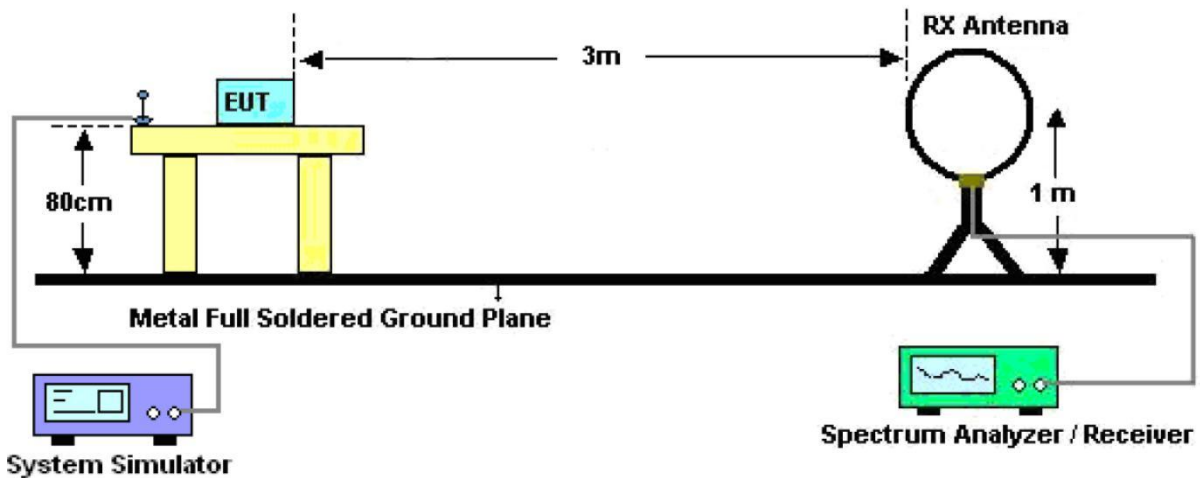


Figure 1. Below 30MHz



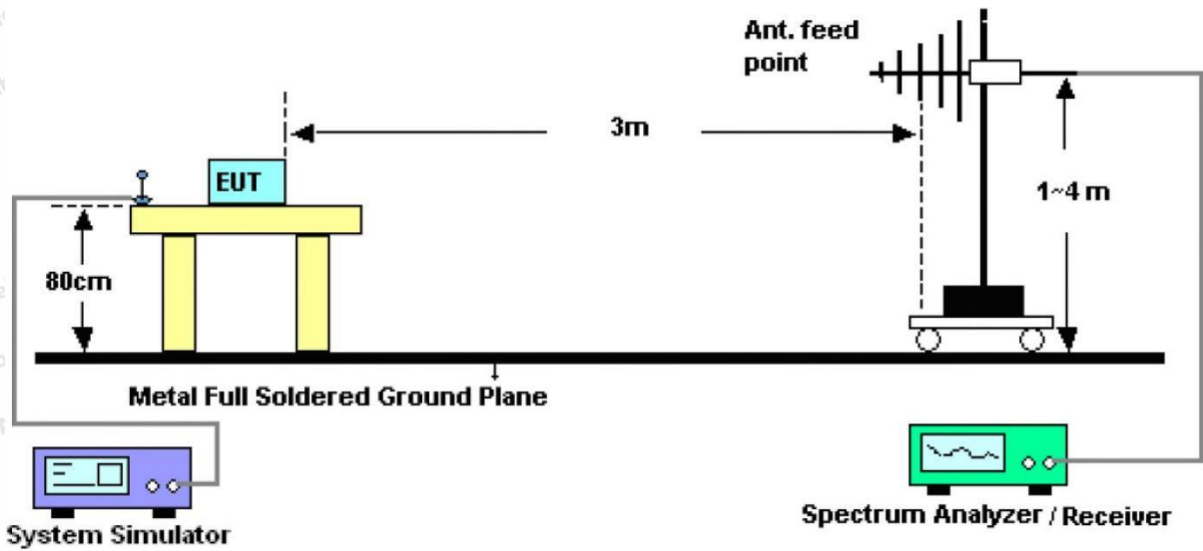


Figure 2. 30MHz to 1GHz

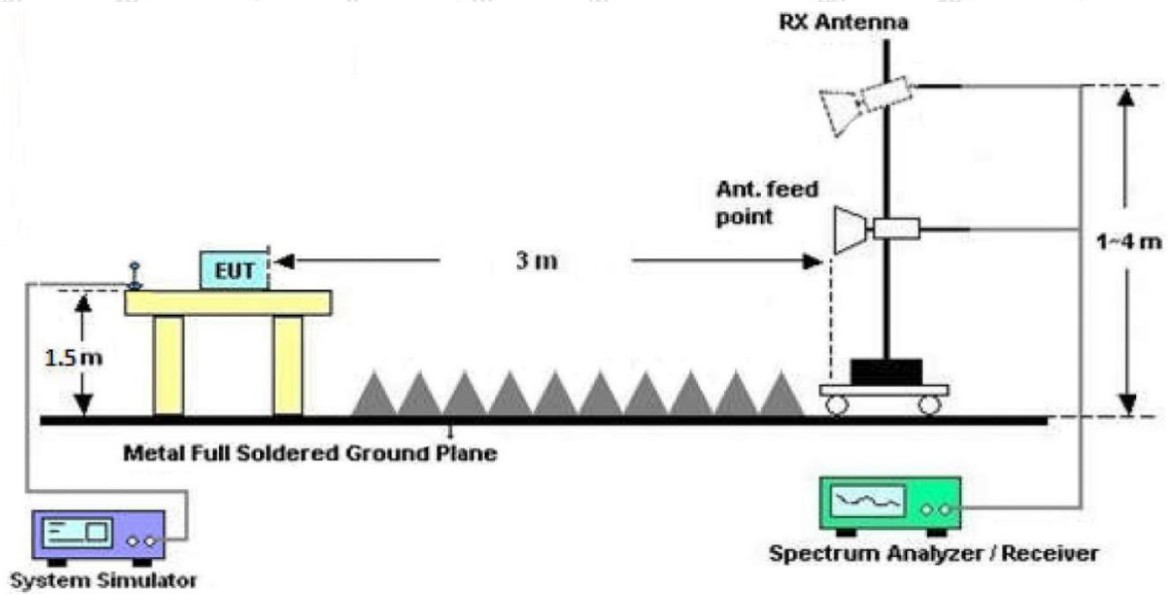


Figure 3. Above 1 GHz

4.3. Test Procedure

For below 1GHz: The EUT is placed on a turntable, which is 0.8m above the ground plane.

For above 1GHz: The EUT is placed on a turntable, which is 1.5m above the ground plane.

The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT is set 3 meters away from the receiving antenna which is mounted on a antenna tower. The antenna can be moved up and down from 1 to 4 meters to find out the maximum emission level. Rotated the EUT through three orthogonal axes to determine the maximum emissions, both horizontal and vertical polarization of the antenna are set on test. The EUT is tested in 9*6*6 Chamber. The device is evaluated in xyz orientation.



For the radiated emission test above 1GHz:

Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

For 9kHz to 150kHz, Set the spectrum analyzer as:

RBW = 200Hz, VBW = 1kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For 150kHz to 30MHz, Set the spectrum analyzer as:

RBW = 9KHz, VBW = 30kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For 30MHz to 1000MHz, Set the spectrum analyzer as:

RBW = 100kHz, VBW = 300kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For above 1GHz, Set the spectrum analyzer as:

RBW = 1MHz, VBW = 3MHz, Detector= Peak, Trace mode= Max hold, Sweep- auto couple.

For average measurement:

–VBW=3*RBW, Detector= RMS, When duty cycle is no less than 98 percent

–VBW=3*RBW, Detector= RMS, When duty cycle is less than 98 percent and duty cycle is constant, average=peak level+correction factor($20\log(\text{duty cycle})$).

–VBW $\geq 1/T$, when duty cycle is less than 98 percent and duty cycle is not constant, where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation, so refer to this clause 5.4 duty cycle.

4.4. Test Data

PASS

During the test, Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the X-axis is the worst case.

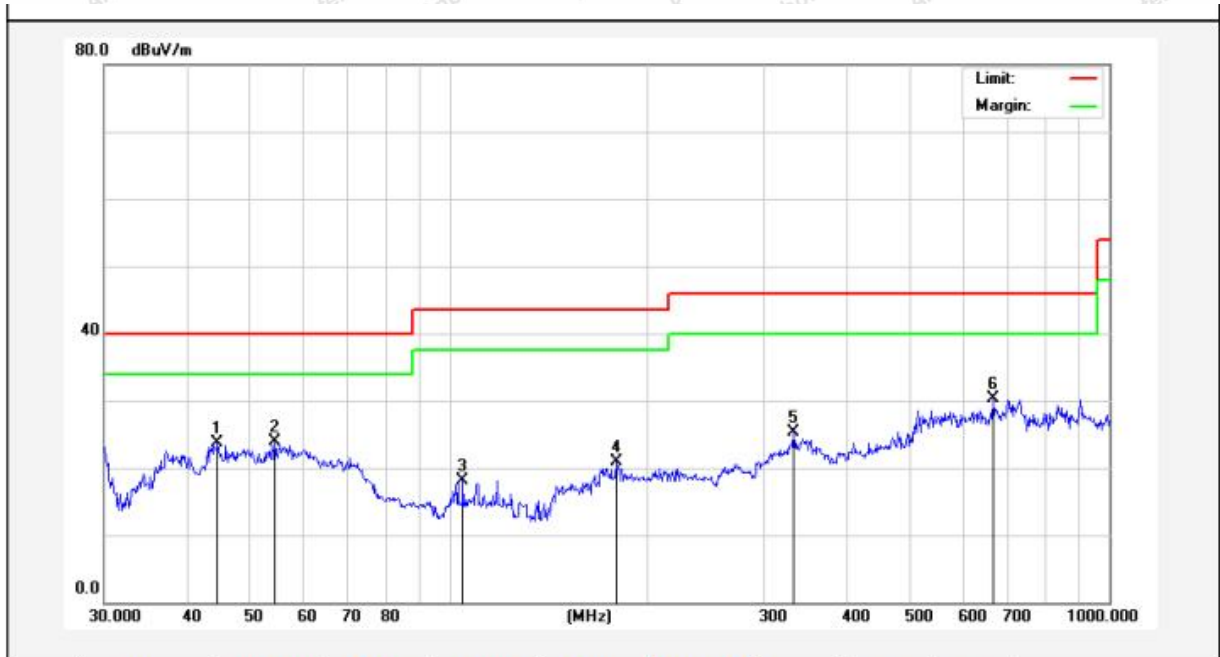
The test results of 9kHz-30MHz was attenuated more than 20dB below the permissible limits, so the results don't record in the report.

During the test, pre-scan all modes, only the worst case is recorded in the report.



Test Results (30~1000MHz)

Test Mode: BLE_2M (2480MHz)
 Power Source: DC 3.85V battery inside
 Polarization: Horizontal
 Temp.(°C)/Hum.(%RH): 23.5°C/49%RH

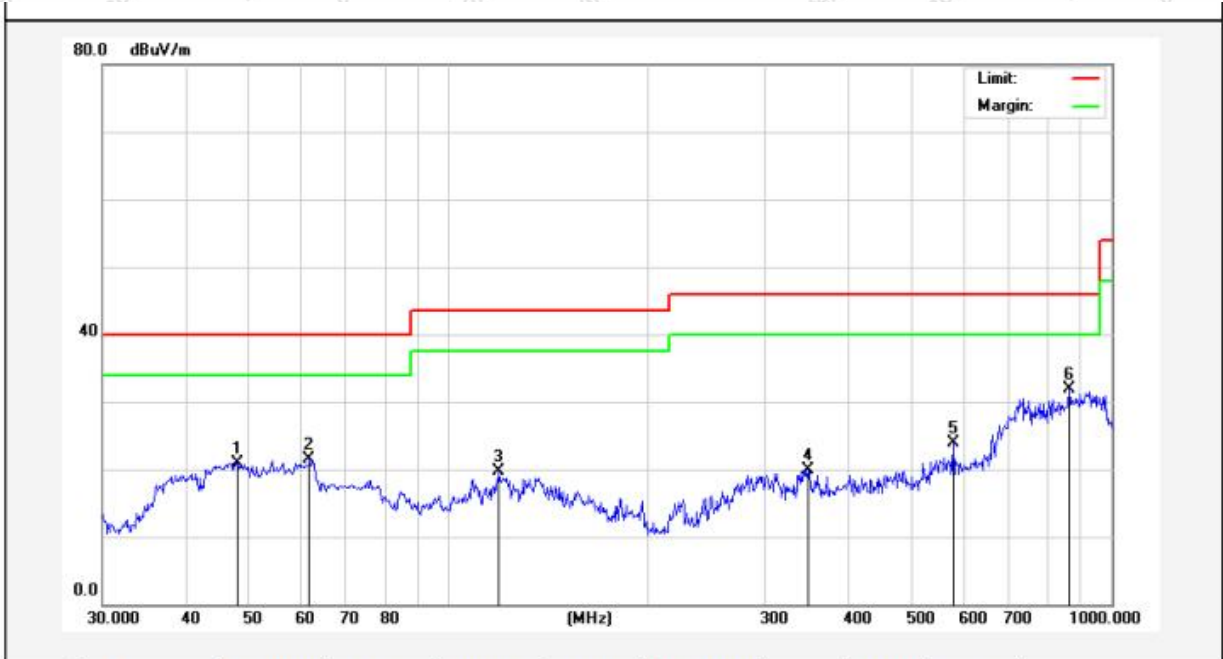


| No. | Freq. (MHz) | Reading (dBuV) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|-----|-------------|----------------|---------------|-----------------|----------------|-----------------|----------|-------------|--------------|--------|
| 1 | 44.5868 | 38.98 | -15.27 | 23.71 | 40.00 | -16.29 | QP | | | |
| 2 | 54.4516 | 41.26 | -17.42 | 23.84 | 40.00 | -16.16 | QP | | | |
| 3 | 104.9033 | 40.40 | -22.22 | 18.18 | 43.50 | -25.32 | QP | | | |
| 4 | 179.3863 | 44.14 | -23.20 | 20.94 | 43.50 | -22.56 | QP | | | |
| 5 | 332.5187 | 41.62 | -16.40 | 25.22 | 46.00 | -20.78 | QP | | | |
| 6 | 665.8035 | 40.80 | -10.42 | 30.38 | 46.00 | -15.62 | QP | | | |



Test Results (30~1000MHz)

Test Mode: BLE_2M (2480MHz)
 Power Source: DC 3.85V battery inside
 Polarization: Horizontal
 Temp.(°C)/Hum.(%RH): 23.5°C/49%RH



| No. | Freq. (MHz) | Reading (dBUV) | Factor (dB/m) | Result (dBUV/m) | Limit (dBUV/m) | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|-----|-------------|----------------|---------------|-----------------|----------------|-----------------|----------|-------------|--------------|--------|
| 1 | 47.9940 | 36.48 | -15.48 | 21.00 | 40.00 | -19.00 | QP | | | |
| 2 | 61.5618 | 39.62 | -18.06 | 21.56 | 40.00 | -18.44 | QP | | | |
| 3 | 119.0180 | 39.40 | -19.76 | 19.64 | 43.50 | -23.86 | QP | | | |
| 4 | 348.0274 | 34.90 | -15.05 | 19.85 | 46.00 | -26.15 | QP | | | |
| 5 | 576.6443 | 35.06 | -11.10 | 23.96 | 46.00 | -22.04 | QP | | | |
| 6 | 863.0562 | 39.00 | -7.16 | 31.84 | 46.00 | -14.16 | QP | | | |



Test Results (1GHz-25GHz)

| Test Mode: CH00 | | | | Test channel: Lowest | | |
|-----------------|----------------|---------------|-----------------|----------------------|-----------------|--------------|
| Peak value: | | | | | | |
| Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Result (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | polarization |
| 4804.00 | 28.78 | 15.27 | 44.05 | 74.00 | -29.95 | Vertical |
| 7206.00 | 28.79 | 18.09 | 46.88 | 74.00 | -27.12 | Vertical |
| 9608.00 | 29.75 | 23.76 | 53.51 | 74.00 | -20.49 | Vertical |
| 12010.00 | * | | | 74.00 | | Vertical |
| 14412.00 | * | | | 74.00 | | Vertical |
| 4804.00 | 28.42 | 15.27 | 43.69 | 74.00 | -30.31 | Horizontal |
| 7206.00 | 29.43 | 18.09 | 47.52 | 74.00 | -26.48 | Horizontal |
| 9608.00 | 28.25 | 23.76 | 52.01 | 74.00 | -21.99 | Horizontal |
| 12010.00 | * | | | 74.00 | | Horizontal |
| 14412.00 | * | | | 74.00 | | Horizontal |
| Average value: | | | | | | |
| Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Over Limit (dB) | polarization |
| 4804.00 | 17.05 | 15.27 | 32.32 | 54.00 | -21.68 | Vertical |
| 7206.00 | 17.84 | 18.09 | 35.93 | 54.00 | -18.07 | Vertical |
| 9608.00 | 19.22 | 23.76 | 42.98 | 54.00 | -11.02 | Vertical |
| 12010.00 | * | | | 54.00 | | Vertical |
| 14412.00 | * | | | 54.00 | | Vertical |
| 4804.00 | 16.75 | 15.27 | 32.02 | 54.00 | -21.98 | Horizontal |
| 7206.00 | 18.46 | 18.09 | 36.55 | 54.00 | -17.45 | Horizontal |
| 9608.00 | 17.76 | 23.76 | 41.52 | 54.00 | -12.48 | Horizontal |
| 12010.00 | * | | | 54.00 | | Horizontal |
| 14412.00 | * | | | 54.00 | | Horizontal |



Test Results (1GHz-25GHz)

| Test Mode: CH19 | | | | Test channel: Middle | | |
|-----------------|----------------|---------------|-----------------|----------------------|-----------------|--------------|
| Peak value: | | | | | | |
| Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Result (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | polarization |
| 4880.00 | 28.33 | 15.42 | 43.75 | 74.00 | -30.25 | Vertical |
| 7320.00 | 28.76 | 18.02 | 46.78 | 74.00 | -27.22 | Vertical |
| 9760.00 | 29.25 | 23.80 | 53.05 | 74.00 | -20.95 | Vertical |
| 12200.00 | * | | | 74.00 | | Vertical |
| 14640.00 | * | | | 74.00 | | Vertical |
| 4880.00 | 28.23 | 15.42 | 43.65 | 74.00 | -30.35 | Horizontal |
| 7320.00 | 29.30 | 18.02 | 47.32 | 74.00 | -26.68 | Horizontal |
| 9760.00 | 27.97 | 23.80 | 51.77 | 74.00 | -22.23 | Horizontal |
| 12200.00 | * | | | 74.00 | | Horizontal |
| 14640.00 | * | | | 74.00 | | Horizontal |
| Average value: | | | | | | |
| Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Over Limit (dB) | polarization |
| 4880.00 | 17.14 | 15.42 | 32.56 | 54.00 | -21.44 | polarization |
| 7320.00 | 17.70 | 18.02 | 35.72 | 54.00 | -18.28 | Vertical |
| 9760.00 | 19.07 | 23.80 | 42.87 | 54.00 | -11.13 | Vertical |
| 12200.00 | * | | | 54.00 | | Vertical |
| 14640.00 | * | | | 54.00 | | Vertical |
| 4880.00 | 16.86 | 15.42 | 32.28 | 54.00 | -21.72 | Vertical |
| 7320.00 | 18.81 | 18.02 | 36.83 | 54.00 | -17.17 | Horizontal |
| 9760.00 | 18.06 | 23.80 | 41.86 | 54.00 | -12.14 | Horizontal |
| 12200.00 | * | | | 54.00 | | Horizontal |
| 14640.00 | * | | | 54.00 | | Horizontal |



Test Results (1GHz-25GHz)

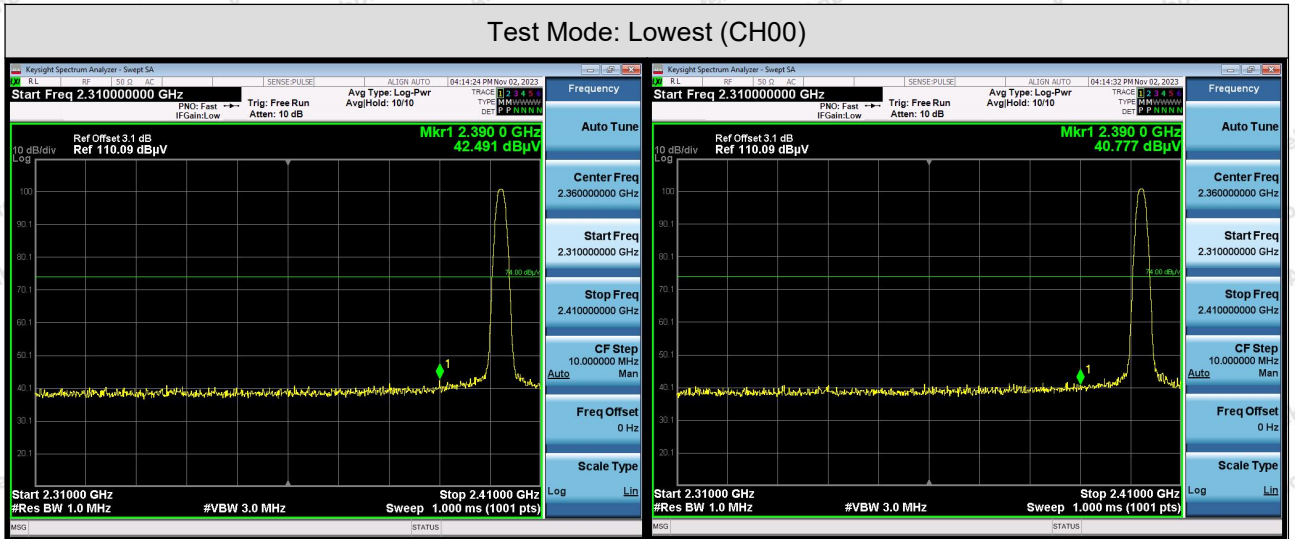
| Test Mode: CH39 | | | | Test channel: Highest | | |
|-----------------|----------------|---------------|-----------------|-----------------------|-----------------|--------------|
| Peak value: | | | | | | |
| Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Result (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | polarization |
| 4960.00 | 28.46 | 15.58 | 44.04 | 74.00 | -29.96 | Vertical |
| 7440.00 | 28.92 | 17.93 | 46.85 | 74.00 | -27.15 | Vertical |
| 9920.00 | 29.95 | 23.83 | 53.78 | 74.00 | -20.22 | Vertical |
| 12400.00 | * | | | 74.00 | | Vertical |
| 14880.00 | * | | | 74.00 | | Vertical |
| 4960.00 | 28.37 | 15.58 | 43.95 | 74.00 | -30.05 | Horizontal |
| 7440.00 | 29.51 | 17.93 | 47.44 | 74.00 | -26.56 | Horizontal |
| 9920.00 | 28.35 | 23.83 | 52.18 | 74.00 | -21.82 | Horizontal |
| 12400.00 | * | | | 74.00 | | Horizontal |
| 14880.00 | * | | | 74.00 | | Horizontal |
| Average value: | | | | | | |
| Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Over Limit (dB) | polarization |
| 4960.00 | 18.26 | 15.58 | 33.84 | 54.00 | -20.16 | Vertical |
| 7440.00 | 18.97 | 17.93 | 36.90 | 54.00 | -17.10 | Vertical |
| 9920.00 | 19.72 | 23.83 | 43.55 | 54.00 | -10.45 | Vertical |
| 12400.00 | * | | | 54.00 | | Vertical |
| 14880.00 | * | | | 54.00 | | Vertical |
| 4960.00 | 18.04 | 15.58 | 33.62 | 54.00 | -20.38 | Horizontal |
| 7440.00 | 19.61 | 17.93 | 37.54 | 54.00 | -16.46 | Horizontal |
| 9920.00 | 18.21 | 23.83 | 42.04 | 54.00 | -11.96 | Horizontal |
| 12400.00 | * | | | 54.00 | | Horizontal |
| 14880.00 | * | | | 54.00 | | Horizontal |

Remark:

- 1.Result =Reading + Factor
2. "*" means the test results were attenuated more than 20dB below the permissible limits, so the results don't record in the report.
3. During the test, pre-scan the BLE_1M&BLE_2M, and found the BLE_2M is worse case, the report only record this mode.

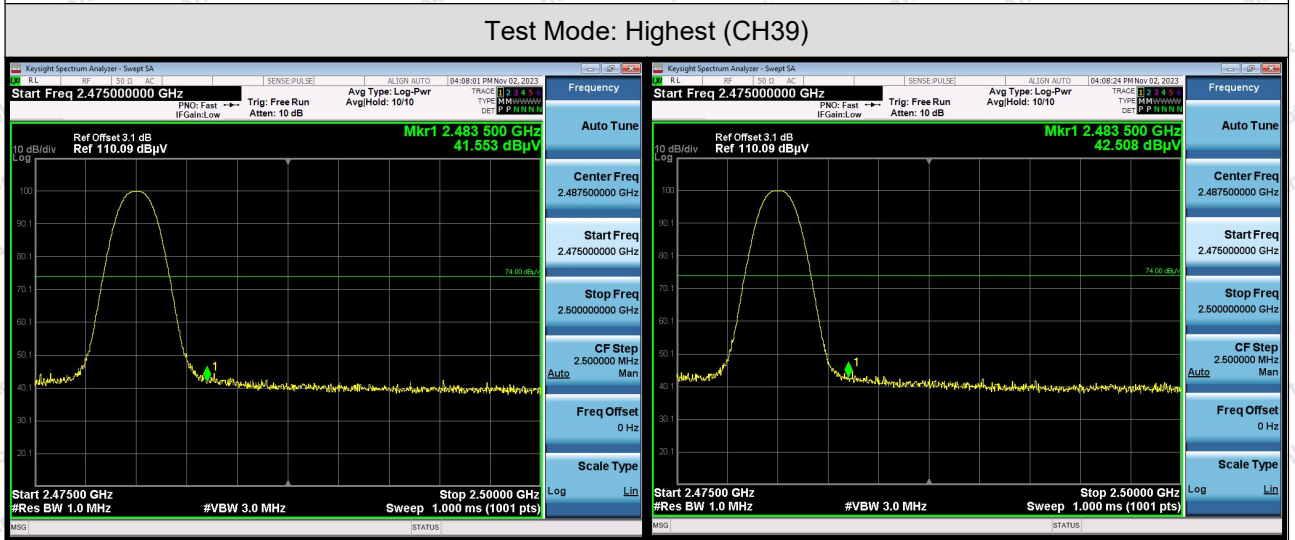


Radiated Band Edge:



Peak Value(Vertical)

Peak Value(Horizontal)



Peak Value(Vertical)

Peak Value(Horizontal)



Average:

| Test Channel | Peak Value (dBuV/m) | Correction factor | Average Value (dBuV/m) | Limit (dBuV/m) | Polarization | Verdict |
|--------------|---------------------|-------------------|------------------------|----------------|--------------|---------|
| CH00 | 42.491 | -9.14 | 33.352 | 54.00 | Vertical | Pass |
| | 40.777 | -9.14 | 31.638 | 54.00 | Horizontal | Pass |
| CH39 | 41.553 | -8.75 | 32.801 | 54.00 | Vertical | Pass |
| | 42.508 | -8.75 | 33.756 | 54.00 | Horizontal | Pass |

Remark:

1. During the test, pre-scan the BLE_1M and BLE_2M and found the BLE_2M modulation is worse case, the report only record this mode.
2. Correction factor= $20\log(\text{Duty Cycle})$
3. Average Value=Peak Value+Correction factor

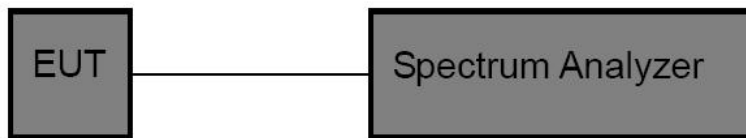


5. Maximum Peak Output Power Test

5.1. Test Standard and Limit

| | |
|---------------|------------------------------------|
| Test Standard | FCC Part15 C Section 15.247 (b)(3) |
| Test Limit | 1W (30dBm) |

5.2. Test Setup



5.3. Test Procedure

This procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the DTS bandwidth.

1. Set the RBW \geq DTS bandwidth.
2. Set the VBW $\geq 3 \times$ RBW.
3. Set the span $\geq 3 \times$ RBW.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use peak marker function to determine the peak amplitude level.

5.4. Test Data

Pass

Please refer to the Appendix Test Data.

Additional test for duty cycle.

Please refer to the Appendix Test Data.

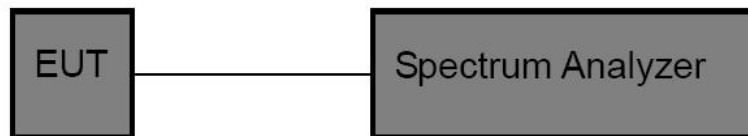


6. 6dB Emission Bandwidth Test

6.1. Test Standard and Limit

| | |
|---------------|------------------------------------|
| Test Standard | FCC Part15 C Section 15.247 (a)(2) |
| Test Limit | ≥500kHz |

6.2. Test Setup



6.3. Test Procedure

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as:
 - RBW = 100kHz, VBW≥3*RBW
 - Detector= Peak
 - Trace mode= Max hold.
 - Sweep- auto couple.
4. Mark the peak frequency and -6dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

6.4. Test Data

Pass

Please refer to the Appendix Test Data.

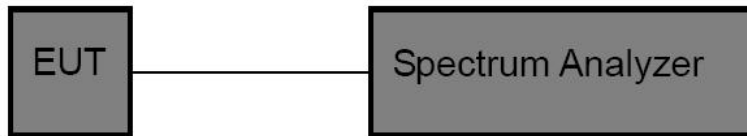


7. Power Spectral Density Test

7.1. Test Standard and Limit

| | |
|---------------|---------------------------------|
| Test Standard | FCC Part15 C Section 15.247 (e) |
| Test Limit | 8dBm/3KHz |

7.2. Test Setup



7.3. Test Procedure

1. Place the EUT on the table and set it in transmitting mode. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set the spectrum analyzer as RBW = 3kHz, VBW $\geq 3 \times$ RBW, Span = 1.5x DTS BW
3. Record the max. reading.
4. Repeat the above procedure until the measurements for all frequencies are completed.

7.4. Test Data

Pass

Please refer to the Appendix Test Data.

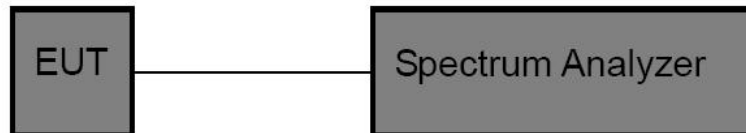


8. 100kHz Bandwidth of Frequency Band Edge Requirement

8.1. Test Standard and Limit

| | |
|---------------|--|
| Test Standard | FCC Part15 C Section 15.247 (d) |
| Test Limit | In any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, 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). |

8.2. Test Setup



8.3. Test Procedure

Using the following spectrum analyzer setting:

1. Set the RBW = 100KHz.
2. Set the VBW = 300KHz.
3. Sweep time = auto couple.
4. Detector function = peak.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.

8.4. Test Data

Pass

Please refer to the Appendix Test Data.



9. Antenna Requirement

9.1. Test Standard and Requirement

| Test Standard | FCC Part15 Section 15.203 /247(c) |
|---------------|---|
| Requirement | <p>1) 15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.</p> <p>2) 15.247(c) (1)(i) requirement: Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.</p> |

9.2. Antenna Connected Construction

The antenna is **LDS Antenna** which permanently attached, and the best case gain of the antenna is -5.8dBi. It complies with the standard requirement.



APPENDIX I -- TEST SETUP PHOTOGRAPH

Please refer to separated files Appendix I -- Test Setup Photograph

APPENDIX II -- EXTERNAL PHOTOGRAPH

Please refer to separated files Appendix II -- External Photograph

APPENDIX III -- INTERNAL PHOTOGRAPH

Please refer to separated files Appendix III -- Internal Photograph

----- End of Report -----

