# RF TEST REPORT

**For**

## ShenZhen RiShengHua Technology Co., Ltd.
## Product Name: Smart Water Leak Detector
## Test Model(s).: RSH-WL08

| | | |
|---|---|---|
| **Report Reference No.** | : | **POCE240313002RL001** |
| **FCC ID** | : | **2A9K2-RSH-WL08** |
| **Applicant's Name** | : | ShenZhen RiShengHua Technology Co., Ltd. |
| **Address** | : | Floor 2, building E1, qiangrong East Industrial Zone, No. 723, Zhoushi Road, Jiuwei community, Hangcheng street, Bao'an District, Shenzhen |
| **Testing Laboratory** | : | Shenzhen POCE Technology Co., Ltd. |
| **Address** | : | 101-102 Building H5 & 1/F., Building H, Hongfa Science & Technology Park, Tangtou, Shiyan, Bao'an District, Shenzhen, Guangdong, China |
| **Test Specification Standard** | : | **47 CFR Part 15.247** |
| **Date of Receipt** | : | March 13, 2024 |
| **Date of Test** | : | March 13, 2024 to March 21, 2024 |
| **Data of Issue** | : | March 21, 2024 |
| **Result** | : | **Pass** |

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# Revision History Of Report

| Version | Description | REPORT No. | Issue Date |
|---|---|---|---|
| V1.0 | Original | POCE240313002RL001 | March 21, 2024 |
| | | | |
| | | | |
| | | | |
| | | | |

**NOTE1:**

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards.

| Compiled by: | Supervised by: | Approved by: |
|---|---|---|
| Ben Tang | Tom Chen | Machael Mo |
| Ben Tang /Test Engineer | Tom Chen / Project Engineer | Machael Mo / Manager |

# CONTENTS

# 1 TEST SUMMARY

## 1.1 Test Standards

The tests were performed according to following standards:

**47 CFR Part 15.247:** Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

## 1.2 Summary of Test Result

| Item | Standard | Method | Requirement | Result |
|---|---|---|---|---|
| Antenna requirement | 47 CFR Part 15.247 | | 47 CFR 15.203 | Pass |
| Occupied Bandwidth | 47 CFR Part 15.247 | ANSI C63.10-2013, section 11.8<br>KDB 558074 D01 15.247 Meas Guidance v05r02 | 47 CFR 15.247(a)(2) | Pass |
| Maximum Conducted Output Power | 47 CFR Part 15.247 | ANSI C63.10-2013, section 11.9.1<br>KDB 558074 D01 15.247 Meas Guidance v05r02 | 47 CFR 15.247(b)(3) | Pass |
| Power Spectral Density | 47 CFR Part 15.247 | ANSI C63.10-2013, section 11.10<br>KDB 558074 D01 15.247 Meas Guidance v05r02 | 47 CFR 15.247(e) | Pass |
| Emissions in non-restricted frequency bands | 47 CFR Part 15.247 | ANSI C63.10-2013 section 11.11<br>KDB 558074 D01 15.247 Meas Guidance v05r02 | 47 CFR 15.247(d), 15.209, 15.205 | Pass |
| Band edge emissions (Radiated) | 47 CFR Part 15.247 | ANSI C63.10-2013 section 6.10<br>KDB 558074 D01 15.247 Meas Guidance v05r02 | 47 CFR 15.247(d), 15.209, 15.205 | Pass |
| Emissions in frequency bands (below 1GHz) | 47 CFR Part 15.247 | ANSI C63.10-2013 section 6.6.4<br>KDB 558074 D01 15.247 Meas Guidance v05r02 | 47 CFR 15.247(d), 15.209, 15.205 | Pass |
| Emissions in frequency bands (above 1GHz) | 47 CFR Part 15.247 | ANSI C63.10-2013 section 6.6.4<br>KDB 558074 D01 15.247 Meas Guidance v05r02 | 47 CFR 15.247(d), 15.209, 15.205 | Pass |

# 2 GENERAL INFORMATION

## 2.1 Client Information

| | | |
|---|---|---|
| **Applicant's Name** | : | ShenZhen RiShengHua Technology Co., Ltd. |
| **Address** | : | Floor 2, building E1, qiangrong East Industrial Zone, No. 723, Zhoushi Road, Jiuwei community, Hangcheng street, Bao'an District, Shenzhen |
| **Manufacturer** | : | ShenZhen RiShengHua Technology Co., Ltd. |
| **Address** | : | Floor 2, building E1, qiangrong East Industrial Zone, No. 723, Zhoushi Road, Jiuwei community, Hangcheng street, Bao'an District, Shenzhen |

## 2.2 Description of Device (EUT)

| | |
|---|---|
| Product Name: | Smart Water Leak Detector |
| Model/Type reference: | RSH-WL08 |
| Series Model: | N/A |
| Trade Mark: | RSH |
| Power Supply: | DC:3.0V |
| Operation Frequency: | 2405MHz to 2480MHz |
| Number of Channels: | 16 |
| Modulation Type: | O-QPSK |
| Antenna Type: | PCB |
| Antenna Gain: | 1.08dBi |
| Hardware Version: | V1.0 |
| Software Version: | V1.0 |

(Remark:The Antenna Gain is supplied by the customer.POCE is not responsible for This data and the related calculations associated with it)

| **Operation Frequency each of channel** | | | |
|---|---|---|---|
| Channel | Frequency | Channel | Frequency |
| 1 | 2405 MHz | 9 | 2445 MHz |
| 2 | 2410 MHz | 10 | 2450 MHz |
| 3 | 2415 MHz | 11 | 2455 MHz |
| 4 | 2420 MHz | 12 | 2460 MHz |
| 5 | 2425 MHz | 13 | 2465 MHz |
| 6 | 2430 MHz | 14 | 2470 MHz |
| 7 | 2435 MHz | 15 | 2475 MHz |
| 8 | 2440 MHz | 16 | 2480 MHz |

Note:
In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

| Test channel | Frequency (MHz) |
|---|---|
| | |
| Lowest channel | 2405MHz |
| Middle channel | 2440MHz |
| Highest channel | 2480MHz |

## 2.3 Description of Test Modes

| No | Title | Description |
|---|---|---|
| TM1 | Lowest channel | Keep the EUT connect to AC power line and works in continuously transmitting mode with GFSK modulation. |
| TM2 | Middle channel | Keep the EUT connect to AC power line and works in continuously transmitting mode with GFSK modulation. |
| TM3 | Highest channel | Keep the EUT connect to AC power line and works in continuously transmitting mode with GFSK modulation. |
| Remark:Only the data of the worst mode would be recorded in this report. | | |

## 2.4 Description of Support Units

The EUT was tested as an independent device.

## 2.5 Equipments Used During The Test

**Power Spectral Density**
**Emissions in non-restricted frequency bands**
**Occupied Bandwidth**
**Maximum Conducted Output Power**

| Equipment | Manufacturer | Model No | Inventory No | Cal Date | Cal Due Date |
|---|---|---|---|---|---|
| RF Test Software | TACHOY | RTS-01 | V2.0.0.0 | 2023-05-11 | 2026-05-10 |
| High Pass filter | ZHINAN | OQHPF1-M1.5-18G-224 | 6210075 | 2023-05-11 | 2026-05-10 |
| Power divider | MIDEWEST | PWD-2533 | SMA-79 | 2023-05-11 | 2026-05-10 |
| DC power | HP | 66311B | 38444359 | 2023-05-11 | 2026-05-10 |
| Power Meter | Keysight | E4416A | MY5303506 | 2023-12-10 | 2024-12-09 |
| RF Sensor Unit | Tachoy Information Technology(shenzhen) Co.,Ltd. | TR1029-2 | 000001 | 2023-05-11 | 2026-05-10 |
| Wideband radio communication tester | R&S | CMW500 | 113410 | 2023-06-13 | 2024-06-12 |
| Vector signal generator | Keysight | N5181A | MY48180415 | 2023-11-09 | 2024-11-08 |
| Signal generator | Keysight | N5182A | MY50143455 | 2023-11-09 | 2024-11-08 |
| Spectrum Analyzer | Keysight | N9020A | MY53420323 | 2023-12-12 | 2024-12-11 |

| Band edge emissions (Radiated)<br>Emissions in frequency bands (below 1GHz)<br>Emissions in frequency bands (above 1GHz) | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No** | **Inventory No** | **Cal Date** | **Cal Due Date** |
| EMI Test software | Farad | EZ -EMC | V1.1.42 | 2023-05-11 | 2026-05-10 |
| Positioning Controller | / | MF-7802 | / | 2023-05-11 | 2026-05-10 |
| High Pass filter | ZHINAN | OQHPF1-M1.5-18G-224 | 6210075 | 2023-05-11 | 2026-05-10 |
| Amplifier(18-40G) | COM-POWER | AH-1840 | 10100008-1 | 2022-04-05 | 2025-04-04 |
| Horn antenna | COM-POWER | AH-1840 (18-40G) | 10100008 | 2023-04-05 | 2025-04-04 |
| Loop antenna | ZHINAN | ZN30900C | ZN30900C | 2021-07-05 | 2024-07-04 |
| Cable(LF)#2 | Schwarzbeck | / | / | 2024-02-19 | 2025-02-18 |
| Cable(LF)#1 | Schwarzbeck | / | / | 2024-02-19 | 2025-02-18 |
| Cable(HF)#2 | Schwarzbeck | AK9515E | 96250 | 2024-02-19 | 2025-02-18 |
| Cable(HF)#1 | Schwarzbeck | SYV-50-3-1 | / | 2024-02-19 | 2025-02-18 |
| Power amplifier(LF) | Schwarzbeck | BBV9743 | 9743-151 | 2023-06-13 | 2024-06-12 |
| Power amplifier(HF) | Schwarzbeck | BBV9718 | 9718-282 | 2023-06-13 | 2024-06-12 |
| Wideband radio communication tester | R&S | CMW500 | 113410 | 2023-06-13 | 2024-06-12 |
| Spectrum Analyzer | R&S | FSP30 | 1321.3008K40-101729-jR | 2023-06-14 | 2024-06-13 |
| Horn Antenna | Sunol Sciences | DRH-118 | A091114 | 2023-05-13 | 2025-05-12 |
| Broadband Antenna | Sunol Sciences | JB6 Antenna | A090414 | 2023-05-21 | 2025-05-20 |
| Test Receiver | R&S | ESCI | 102109 | 2023-06-13 | 2024-06-12 |

## 2.6 Statement Of The Measurement Uncertainty

| Test Item | Measurement Uncertainty |
|---|---|
| Occupied Bandwidth | ±3.63% |
| RF conducted power | ±0.733dB |
| RF power density | ±0.234% |
| Conducted Spurious emissions | ±1.98dB |
| Radiated Emission (Above 1GHz) | ±5.46dB |
| Radiated Emission (Below 1GHz) | ±5.79dB |
| Note: (1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2. | |

## 2.7 Identification of Testing Laboratory

| | |
|---|---|
| Company Name: | Shenzhen POCE Technology Co., Ltd. |
| Address: | 101-102 Building H5 & 1/F., Building H, Hongfa Science & Technology Park, Tangtou, Shiyan, Bao'an District, Shenzhen, Guangdong, China |
| Phone Number: | +86-13267178997 |
| Fax Number: | 86-755-29113252 |

Identification of the Responsible Testing Location

| | |
|---|---|
| Company Name: | Shenzhen POCE Technology Co., Ltd. |
| Address: | 101-102 Building H5 & 1/F., Building H, Hongfa Science & Technology Park, Tangtou, Shiyan, Bao'an District, Shenzhen, Guangdong, China |
| Phone Number: | +86-13267178997 |
| Fax Number: | 86-755-29113252 |
| FCC Registration Number: | 0032847402 |
| Designation Number: | CN1342 |
| Test Firm Registration Number: | 778666 |
| A2LA Certificate Number: | 6270.01 |

## 2.8 Announcement

(1) The test report reference to the report template version v1.

(2) The test report is invalid if not marked with the signatures of the persons responsible for preparing, reviewing and approving the test report.

(3) The test report is invalid if there is any evidence and/or falsification.

(4) This document may not be altered or revised in any way unless done so by POCE 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.

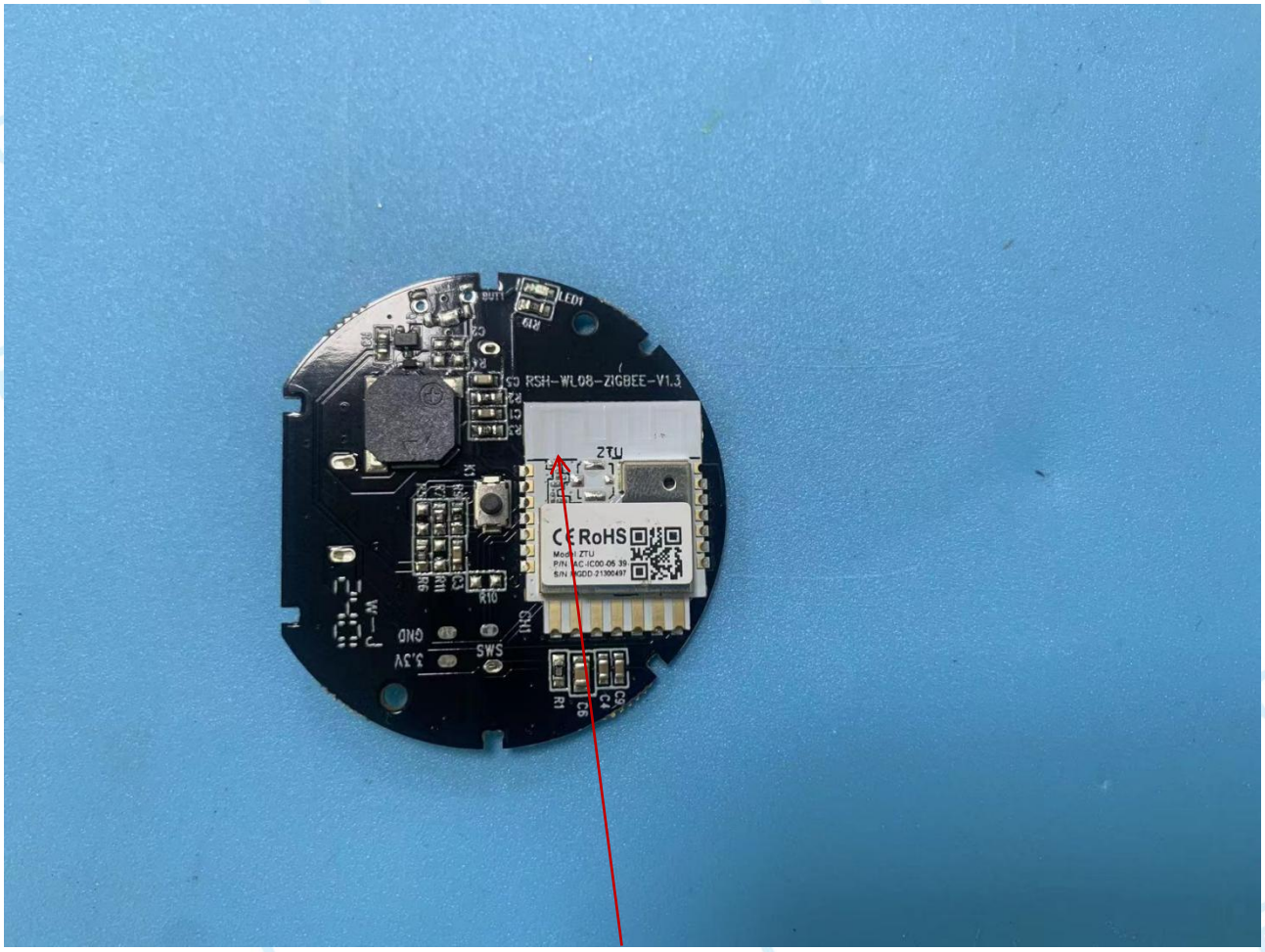
(6) The laboratory is only responsible for the data released by the laboratory, except for the part provided by the applicant.

# 3 Evaluation Results (Evaluation)

## 3.1 Antenna requirement

| | |
|---|---|
| Test Requirement: | Refer to 47 CFR Part 15.203, 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 shall be considered sufficient to comply with the provisions of this section. |

### 3.1.1 Conclusion:

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# 4 Radio Spectrum Matter Test Results (RF)

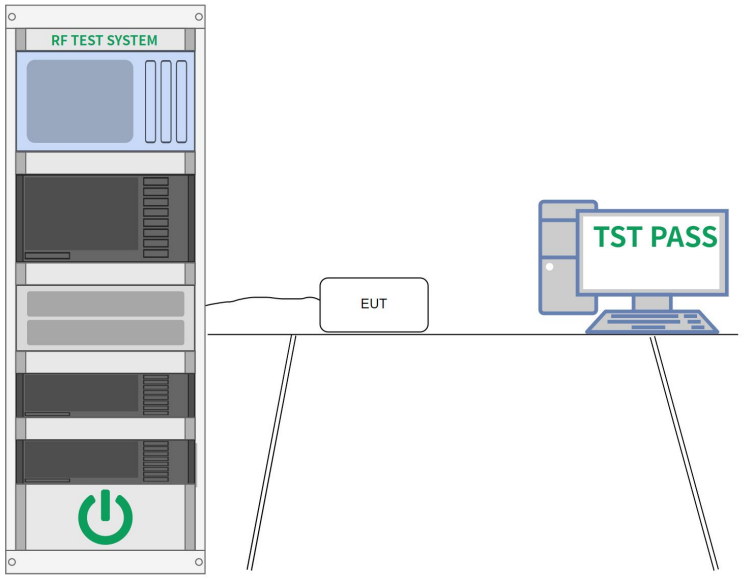
## 4.1 Occupied Bandwidth

| | |
|---|---|
| Test Requirement: | 47 CFR 15.247(a)(2) |
| Test Limit: | Refer to 47 CFR 15.247(a)(2), Systems using digital modulation techniques may operate in the 902-928 MHz, and 2400-2483.5 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz. |
| Test Method: | ANSI C63.10-2013, section 11.8<br>KDB 558074 D01 15.247 Meas Guidance v05r02 |
| Procedure: | a) Set RBW = 100 kHz.<br>b) Set the VBW >= [3 × RBW].<br>c) Detector = peak.<br>d) Trace mode = max hold.<br>e) Sweep = auto couple.<br>f) Allow the trace to stabilize.<br>g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission. |

### 4.1.1 E.U.T. Operation:

| Operating Environment: | | | | | |
|---|---|---|---|---|---|
| Temperature: | 23 °C | Humidity: | 52.3 % | Atmospheric Pressure: | 102 kPa |
| Pretest mode: | TM1 | | | | |
| Final test mode: | TM1 | | | | |

### 4.1.2 Test Setup Diagram:




### 4.1.3 Test Data:

Please Refer to Appendix for Details.

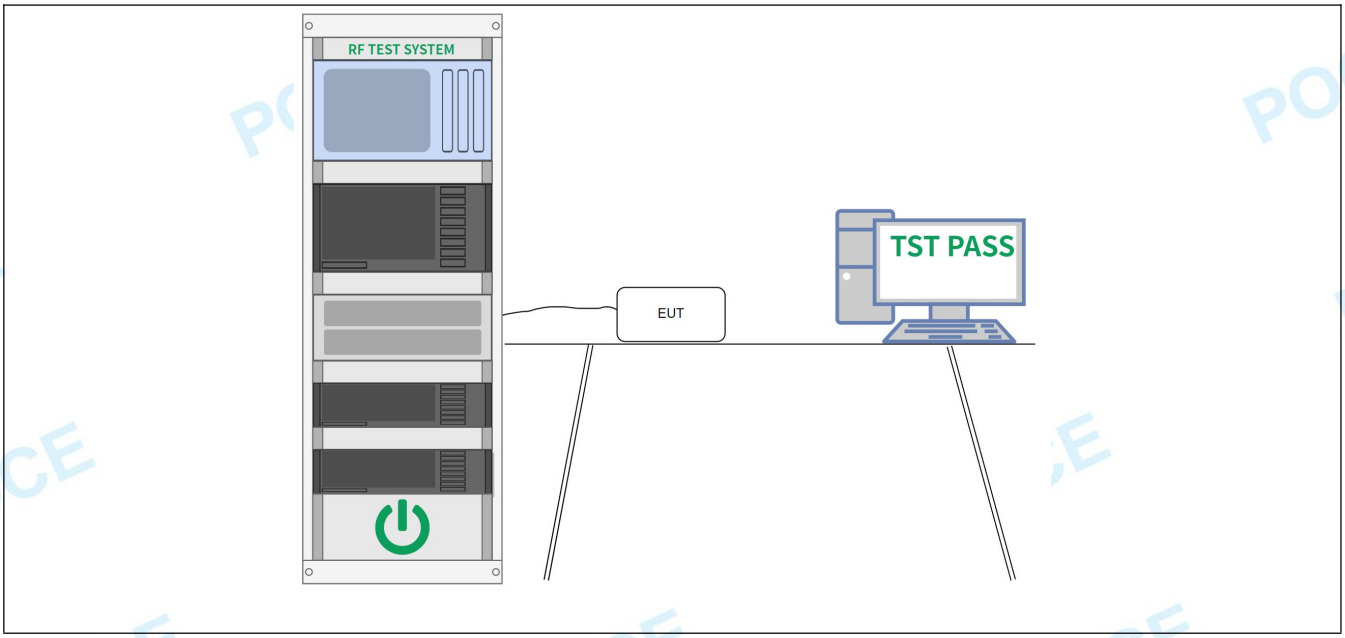
## 4.2 Maximum Conducted Output Power

| | |
|---|---|
| Test Requirement: | 47 CFR 15.247(b)(3) |
| Test Limit: | Refer to 47 CFR 15.247(b)(3), For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode. |
| Test Method: | ANSI C63.10-2013, section 11.9.1<br>KDB 558074 D01 15.247 Meas Guidance v05r02 |
| Procedure: | ANSI C63.10-2013, section 11.9.1 Maximum peak conducted output power<br>Note:<br>Per ANSI C63.10-2013, if there are two or more antnnas, the conducted powers at Core 0, Core 1,…, Core i were first measured separately, as shown in the section above(this product olny have one antenna). The measured values were then summed in linear power units then converted back to dBm.<br>Per ANSI C63.10-2013 Section 14.4.3.2.3, the directional gain is calculated using the following formula, where GN is the gain of the nth antenna and NANT, the total number of antennas used.<br>For correlated unequal antenna gain<br>Directional gain = 10*log[(10G1/20 + 10G2/20 + … + 10GN/20)2 / NANT] dBi<br>For completely uncorrelated unequal antenna gain<br>Directional gain = 10*log[(10G1/10 + 10G2/10 + … + 10GN/10)/ NANT] dBi<br>Sample Multiple antennas Calculation: Core 0 + Core 1 +…Core i. = MIMO/CDD (i is the number of antennas)<br>(#VALUE! mW + mW) = #VALUE! mW = dBm<br>Sample e.i.r.p. Calculation:<br>e.i.r.p. (dBm) = Conducted Power (dBm) + Ant gain (dBi) |

### 4.2.1 E.U.T. Operation:

| Operating Environment: | | | | | |
|---|---|---|---|---|---|
| Temperature: | 23 °C | Humidity: | 52.3 % | Atmospheric Pressure: | 102 kPa |
| Pretest mode: | TM1 | | | | |
| Final test mode: | TM1 | | | | |

### 4.2.2 Test Setup Diagram:




### 4.2.3 Test Data:

Please Refer to Appendix for Details.

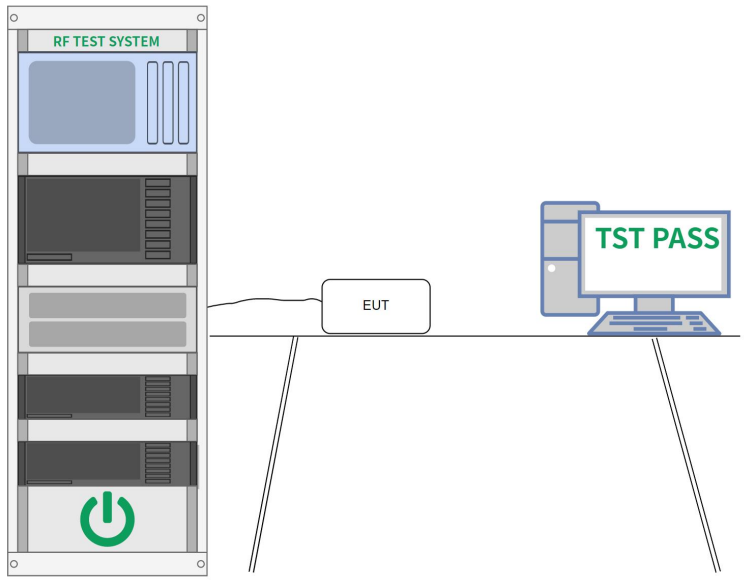
## 4.3 Power Spectral Density

| | |
|---|---|
| Test Requirement: | 47 CFR 15.247(e) |
| Test Limit: | Refer to 47 CFR 15.247(e), For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density. |
| Test Method: | ANSI C63.10-2013, section 11.10<br>KDB 558074 D01 15.247 Meas Guidance v05r02 |
| Procedure: | ANSI C63.10-2013, section 11.10, Maximum power spectral density level in the fundamental emission |

### 4.3.1 E.U.T. Operation:

| Operating Environment: | | | | | |
|---|---|---|---|---|---|
| Temperature: | 23 °C | Humidity: | 52.3 % | Atmospheric Pressure: | 102 kPa |
| Pretest mode: | TM1 | | | | |
| Final test mode: | TM1 | | | | |

### 4.3.2 Test Setup Diagram:




### 4.3.3 Test Data:

Please Refer to Appendix for Details.

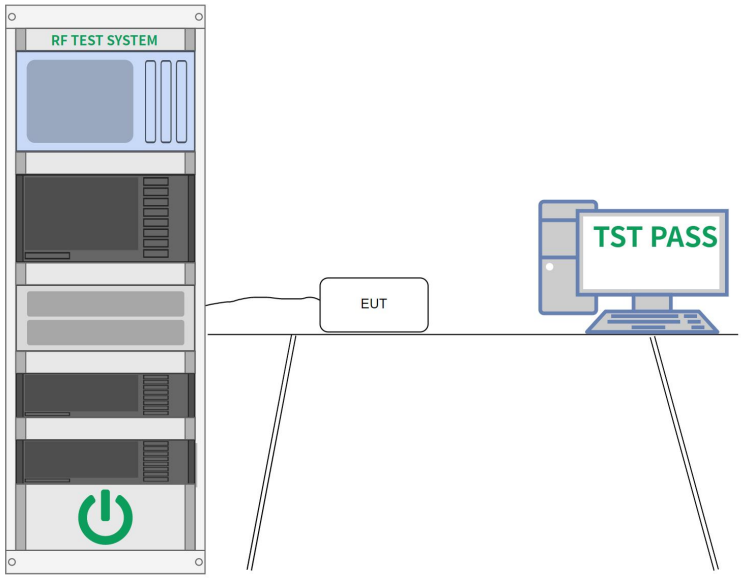
## 4.4 Emissions in non-restricted frequency bands

| | |
|---|---|
| Test Requirement: | 47 CFR 15.247(d), 15.209, 15.205 |
| Test Limit: | Refer to 47 CFR 15.247(d), 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. |
| Test Method: | ANSI C63.10-2013 section 11.11<br>KDB 558074 D01 15.247 Meas Guidance v05r02 |
| Procedure: | ANSI C63.10-2013<br>Section 11.11.1, Section 11.11.2, Section 11.11.3 |

### 4.4.1 E.U.T. Operation:

| Operating Environment: | | | | | |
|---|---|---|---|---|---|
| Temperature: | 23 °C | Humidity: | 52.3 % | Atmospheric Pressure: | 102 kPa |
| Pretest mode: | TM1 | | | | |
| Final test mode: | TM1 | | | | |

### 4.4.2 Test Setup Diagram:




### 4.4.3 Test Data:

Please Refer to Appendix for Details.

## 4.5 Band edge emissions (Radiated)

| | |
|---|---|
| Test Requirement: | Refer to 47 CFR 15.247(d), 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)).` |
| Test 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 |

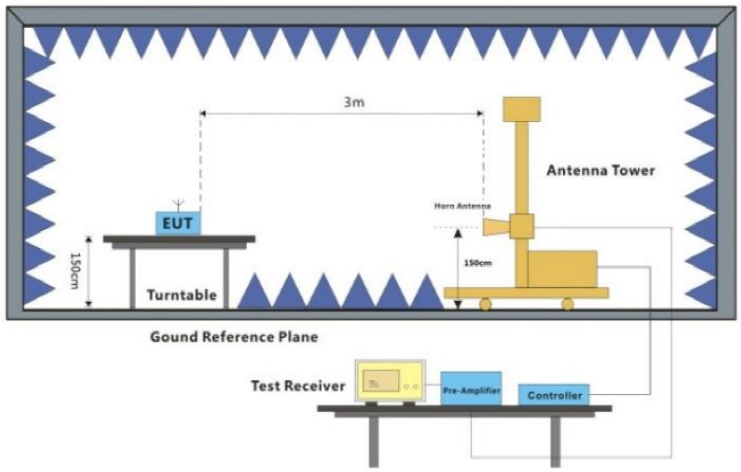
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.
In the emission table above, the tighter limit applies at the band edges.
The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

| | |
|---|---|
| Test Method: | ANSI C63.10-2013 section 6.10<br>KDB 558074 D01 15.247 Meas Guidance v05r02 |
| Procedure: | ANSI C63.10-2013 section 6.10.5.2 |

### 4.5.1 E.U.T. Operation:

| Operating Environment: | | | | | |
|---|---|---|---|---|---|
| Temperature: | 23 °C | Humidity: | 52.3 % | Atmospheric Pressure: | 102 kPa |
| Pretest mode: | TM1 | | | | |
| Final test mode: | TM1 | | | | |

### 4.5.2 Test Setup Diagram:



### 4.5.3 Test Data:

| Zigbee--Low Channel:2405MHz | | | | | | | |
|---|---|---|---|---|---|---|---|
| Frequency | Meter Reading | Factor | Emission Level | Limits | Over | Detector Type | Ant. Pol. |
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | | H/V |
| 2310 | 39.16 | -0.93 | 38.23 | 74 | -35.77 | peak | H |
| 2310 | 27.26 | -0.93 | 26.33 | 54 | -27.67 | AVG | H |
| 2390 | 38.10 | -0.73 | 37.37 | 74 | -36.63 | peak | H |
| 2390 | 27.00 | -0.73 | 26.27 | 54 | -27.73 | AVG | H |
| 2310 | 39.14 | -2.23 | 36.91 | 74 | -37.09 | peak | V |
| 2310 | 27.41 | -2.23 | 25.18 | 54 | -28.82 | AVG | V |
| 2390 | 39.02 | -1.92 | 37.1 | 74 | -36.9 | peak | V |
| 2390 | 27.44 | -1.92 | 25.52 | 54 | -28.48 | AVG | V |

Zigbee--High Channel:2480MHz

| Frequency | Meter Reading | Factor | Emission Level | Limits | Over | Detector Type | Ant. Pol. |
|---|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | | H/V |
| 2483.5 | 58.00 | -0.49 | 57.51 | 74 | -16.49 | peak | H |
| 2483.5 | 52.82 | -0.49 | 52.33 | 54 | -1.67 | AVG | H |
| 2500 | 38.80 | -0.45 | 38.35 | 74 | -35.65 | peak | H |
| 2500 | 27.38 | -0.45 | 26.93 | 54 | -27.07 | AVG | H |
| 2483.5 | 53.61 | -1.56 | 52.05 | 74 | -21.95 | peak | V |
| 2483.5 | 48.71 | -1.56 | 47.15 | 54 | -6.85 | AVG | V |
| 2500 | 38.24 | -1.50 | 36.74 | 74 | -37.26 | peak | V |
| 2500 | 27.52 | -1.50 | 26.02 | 54 | -27.98 | AVG | V |

Remark:

1.Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.

2.Mesurement Level = Reading level + Correct Factor, Margin= Mesurement Level - Limit

Correction Factor= Antenna Factor + Cable loss – Pre-amplifier

## 4.6 Emissions in frequency bands (below 1GHz)

<table>
<tr><td>Test Requirement:</td><td>Refer to 47 CFR 15.247(d), 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)).`</td></tr>
<tr><td>Test Limit:</td><td>
<table>
<tr><th>Frequency (MHz)</th><th>Field strength (microvolts/meter)</th><th>Measurement distance (meters)</th></tr>
<tr><td>0.009-0.490</td><td>2400/F(kHz)</td><td>300</td></tr>
<tr><td>0.490-1.705</td><td>24000/F(kHz)</td><td>30</td></tr>
<tr><td>1.705-30.0</td><td>30</td><td>30</td></tr>
<tr><td>30-88</td><td>100 **</td><td>3</td></tr>
<tr><td>88-216</td><td>150 **</td><td>3</td></tr>
<tr><td>216-960</td><td>200 **</td><td>3</td></tr>
<tr><td>Above 960</td><td>500</td><td>3</td></tr>
</table>
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.<br>In the emission table above, the tighter limit applies at the band edges.<br>The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.
</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10-2013 section 6.6.4<br>KDB 558074 D01 15.247 Meas Guidance v05r02</td></tr>
<tr><td>Procedure:</td><td>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.<br>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.<br>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.<br>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.<br>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.<br>f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.<br>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.<br>h. Test the EUT in the lowest channel, the middle channel, the Highest channel.<br>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.<br>j. Repeat above procedures until all frequencies measured was complete.<br>Remark:<br>1) For emission below 1GHz, through pre-scan found the worst case is the lowest</td></tr>
</table>

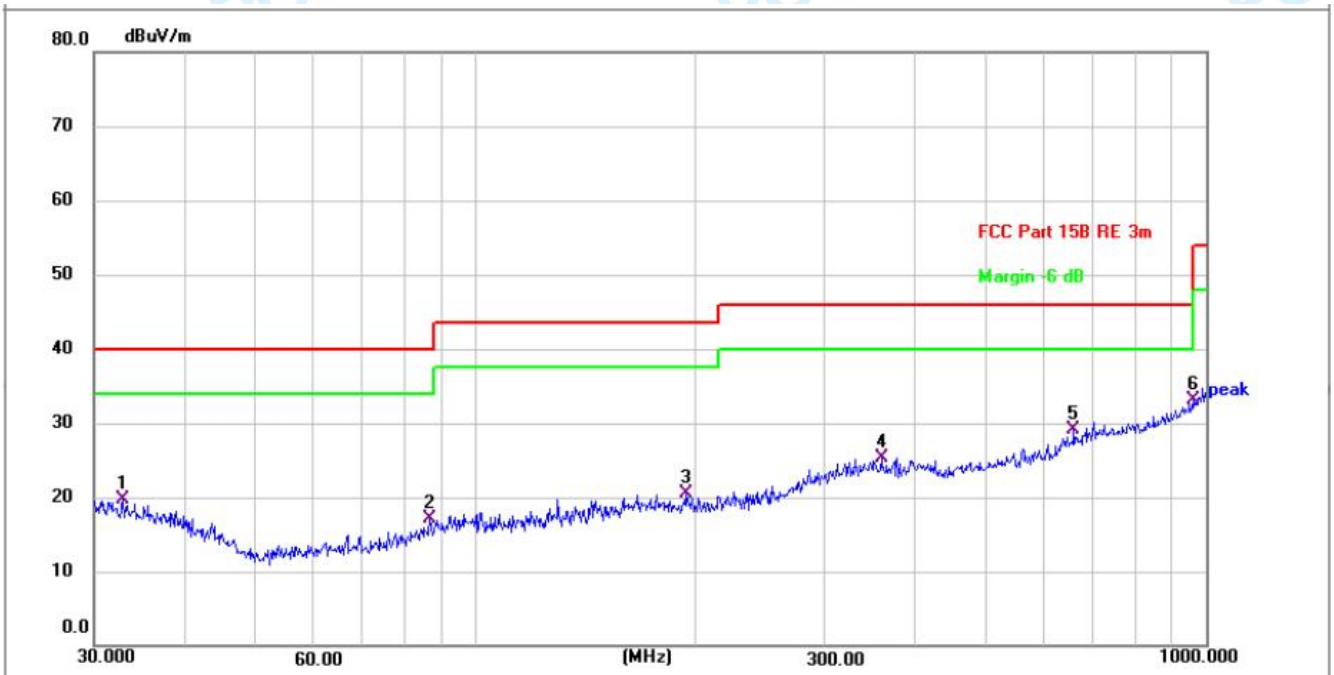
| | |
|---|---|
| | channel. Only the worst case is recorded in the report.<br>2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:<br>Final Test Level =Receiver Reading + Antenna Factor + Cable Factor ¨C Preamplifier Factor<br>3) Scan from 9kHz to 25GHz, the disturbance above 12.75GHz and below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported. Fundamental frequency is blocked by filter, and only spurious emission is shown. |

**4.6.1 E.U.T. Operation:**

| Operating Environment: | | | | | |
|---|---|---|---|---|---|
| Temperature: | 23 °C | Humidity: | 52.3 % | Atmospheric Pressure: | 102 kPa |
| Pretest mode: | TM1 | | | | |
| Final test mode: | TM1 | | | | |

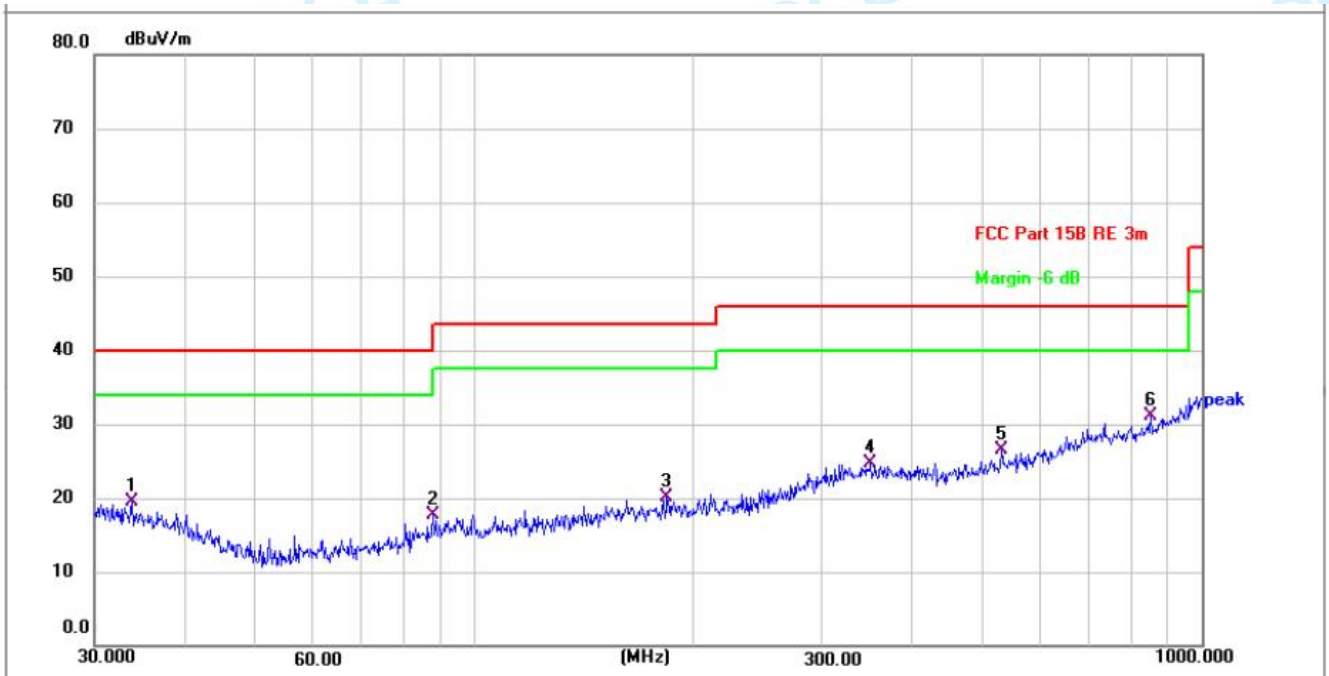
### 4.6.2 Test Data:

TM1 / Polarization: Horizontal / Band: 2400-2483.5 MHz / BW: 5 / CH: L




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Height (cm) | Azimuth (deg.) | P/F | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 32.8636 | 23.25 | -3.63 | 19.62 | 40.00 | -20.38 | QP | | | P | |
| 2 | 86.5027 | 23.69 | -6.57 | 17.12 | 40.00 | -22.88 | QP | | | P | |
| 3 | 193.7727 | 23.50 | -2.99 | 20.51 | 43.50 | -22.99 | QP | | | P | |
| 4 | 359.1860 | 23.68 | 1.69 | 25.37 | 46.00 | -20.63 | QP | | | P | |
| 5 | 658.8361 | 24.47 | 4.58 | 29.05 | 46.00 | -16.95 | QP | | | P | |
| 6 * | 958.7943 | 23.77 | 9.34 | 33.11 | 46.00 | -12.89 | QP | | | P | |

TM1 / Polarization: Vertical / Band: 2400-2483.5 MHz / BW: 5 / CH: L




| No. | Frequency (MHz) | Reading (dBuV) | Factor (dB/m) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Height (cm) | Azimuth (deg.) | P/F | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 33.7986 | 23.48 | -3.89 | 19.59 | 40.00 | -20.41 | QP | 100 | | P | |
| 2 | 87.7248 | 24.13 | -6.36 | 17.77 | 40.00 | -22.23 | QP | 100 | | P | |
| 3 | 183.8440 | 23.24 | -3.08 | 20.16 | 43.50 | -23.34 | QP | 100 | | P | |
| 4 | 350.4768 | 23.93 | 0.77 | 24.70 | 46.00 | -21.30 | QP | 100 | | P | |
| 5 | 530.1014 | 24.13 | 2.32 | 26.45 | 46.00 | -19.55 | QP | 100 | | P | |
| 6 * | 851.0353 | 24.79 | 6.27 | 31.06 | 46.00 | -14.94 | QP | 100 | | P | |

Remark: Margin= Mesurement Level- Limit
Measurement Level=Test receiver reading + correction factor
Correction Factor= Antenna Factor + Cable loss – Pre-amplifier

## 4.7 Emissions in frequency bands (above 1GHz)

<table>
<tr><td>Test Requirement:</td><td>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)).`</td></tr>
<tr><td>Test Limit:</td><td>
<table>
<tr><th>Frequency (MHz)</th><th>Field strength (microvolts/meter)</th><th>Measurement distance (meters)</th></tr>
<tr><td>0.009-0.490</td><td>2400/F(kHz)</td><td>300</td></tr>
<tr><td>0.490-1.705</td><td>24000/F(kHz)</td><td>30</td></tr>
<tr><td>1.705-30.0</td><td>30</td><td>30</td></tr>
<tr><td>30-88</td><td>100 **</td><td>3</td></tr>
<tr><td>88-216</td><td>150 **</td><td>3</td></tr>
<tr><td>216-960</td><td>200 **</td><td>3</td></tr>
<tr><td>Above 960</td><td>500</td><td>3</td></tr>
</table>
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.<br>
In the emission table above, the tighter limit applies at the band edges.<br>
The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.
</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10-2013 section 6.6.4<br>KDB 558074 D01 15.247 Meas Guidance v05r02</td></tr>
<tr><td>Procedure:</td><td>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.<br>
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.<br>
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.<br>
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.<br>
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.<br>
f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.<br>
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.<br>
h. Test the EUT in the lowest channel, the middle channel, the Highest channel.<br>
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.<br>
j. Repeat above procedures until all frequencies measured was complete.<br>
Remark:<br>
1) For emission below 1GHz, through pre-scan found the worst case is the lowest</td></tr>
</table>

| | |
|---|---|
| | channel. Only the worst case is recorded in the report.<br>2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:<br>Final Test Level =Receiver Reading + Antenna Factor + Cable Factor ¨C Preamplifier Factor<br>3) Scan from 9kHz to 25GHz, the disturbance above 12.75GHz and below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported. Fundamental frequency is blocked by filter, and only spurious emission is shown. |

**4.7.1 E.U.T. Operation:**

| Operating Environment: | | | | | |
|---|---|---|---|---|---|
| Temperature: | 23 °C | Humidity: | 52.3 % | Atmospheric Pressure: | 102 kPa |
| Pretest mode: | TM1 | | | | |
| Final test mode: | TM1 | | | | |

**4.7.2 Test Data:**

Zigbee--Low Channel:2405MHz

| Frequency | Meter Reading | Factor | Emission Level | Limits | Over | Detector Type | Ant. Pol. |
|---|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | | H/V |
| 4810 | 53.07 | -0.9 | 52.17 | 74 | -21.83 | peak | H |
| 4810 | 39.32 | -0.9 | 38.42 | 54 | -15.58 | AVG | H |
| 7215 | 53.38 | 4.13 | 57.51 | 74 | -16.49 | peak | H |
| 7215 | 40.23 | 4.13 | 44.36 | 54 | -9.64 | AVG | H |
| 9620 | 55.48 | 8.09 | 63.57 | 74 | -10.43 | peak | H |
| 9620 | 42.04 | 8.09 | 50.13 | 54 | -3.87 | AVG | H |
| 4810 | 51.04 | -0.9 | 50.14 | 74 | -23.86 | peak | V |
| 4810 | 39.04 | -0.9 | 38.14 | 54 | -15.86 | AVG | V |
| 7215 | 55.54 | 4.13 | 59.67 | 74 | -14.33 | peak | V |
| 7215 | 40.92 | 4.13 | 45.05 | 54 | -8.95 | AVG | V |
| 9620 | 54.54 | 8.09 | 62.63 | 74 | -11.37 | peak | V |
| 9620 | 41.69 | 8.09 | 49.78 | 54 | -4.22 | AVG | V |

Zigbee--Middle Channel:2440MHz

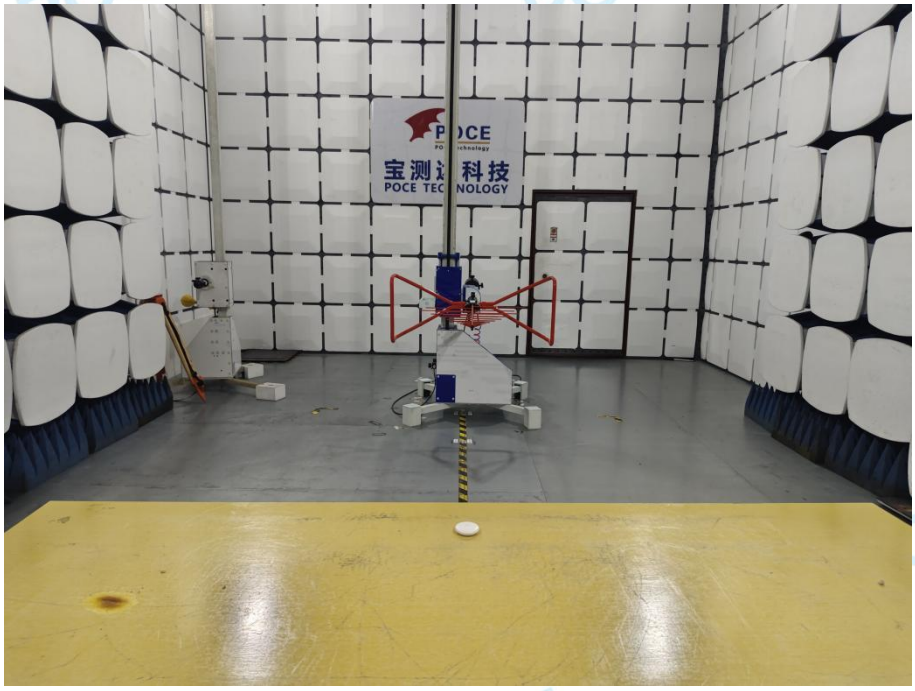
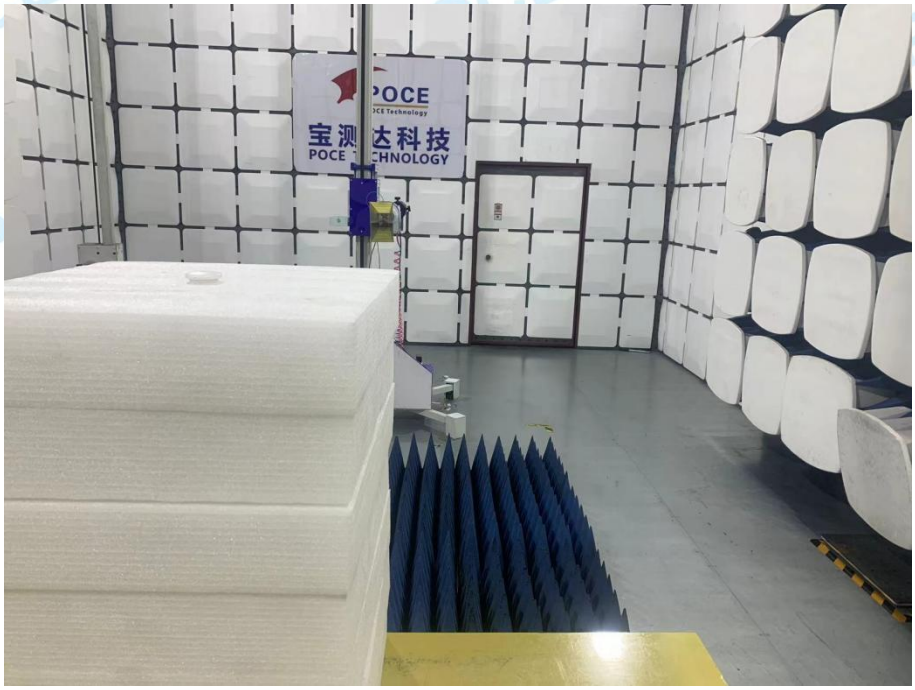
| Frequency | Meter Reading | Factor | Emission Level | Limits | Over | Detector Type | Ant. Pol. |
|---|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | | H/V |
| 4880 | 52.97 | -0.64 | 52.33 | 74 | -21.67 | peak | H |
| 4880 | 39.09 | -0.64 | 38.45 | 54 | -15.55 | AVG | H |
| 7320 | 55.16 | 4.31 | 59.47 | 74 | -14.53 | peak | H |
| 7320 | 39.65 | 4.31 | 43.96 | 54 | -10.04 | AVG | H |
| 9760 | 56.58 | 8.09 | 64.67 | 74 | -9.33 | peak | H |
| 9760 | 40.44 | 8.09 | 48.53 | 54 | -5.47 | AVG | H |
| 4880 | 53.40 | -0.64 | 52.76 | 74 | -21.24 | peak | V |
| 4880 | 38.76 | -0.64 | 38.12 | 54 | -15.88 | AVG | V |
| 7320 | 55.20 | 4.31 | 59.51 | 74 | -14.49 | peak | V |
| 7320 | 40.86 | 4.31 | 45.17 | 54 | -8.83 | AVG | V |
| 9760 | 54.85 | 8.09 | 62.94 | 74 | -11.06 | peak | V |
| 9760 | 40.39 | 8.09 | 48.48 | 54 | -5.52 | AVG | V |

Zigbee--High Channel:2480MHz

| Frequency | Meter Reading | Factor | Emission Level | Limits | Over | Detector Type | Ant. Pol. |
|---|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | | H/V |
| 4960 | 51.88 | -0.37 | 51.51 | 74 | -22.49 | peak | H |
| 4960 | 38.94 | -0.37 | 38.57 | 54 | -15.43 | AVG | H |
| 7440 | 54.45 | 4.49 | 58.94 | 74 | -15.06 | peak | H |
| 7440 | 39.92 | 4.49 | 44.41 | 54 | -9.59 | AVG | H |
| 9920 | 53.28 | 8.08 | 61.36 | 74 | -12.64 | peak | H |
| 9920 | 42.17 | 8.08 | 50.25 | 54 | -3.75 | AVG | H |
| 4960 | 52.04 | -0.37 | 51.67 | 74 | -22.33 | peak | V |
| 4960 | 38.65 | -0.37 | 38.28 | 54 | -15.72 | AVG | V |
| 7440 | 52.86 | 4.49 | 57.35 | 74 | -16.65 | peak | V |
| 7440 | 39.04 | 4.49 | 43.53 | 54 | -10.47 | AVG | V |
| 9920 | 54.04 | 8.08 | 62.12 | 74 | -11.88 | peak | V |
| 9920 | 40.70 | 8.08 | 48.78 | 54 | -5.22 | AVG | V |

Remark: Margin= Mesurement Level- Limit
Measurement Level=Test receiver reading + correction factor
Correction Factor= Antenna Factor + Cable loss – Pre-amplifier

# 5 TEST SETUP PHOTOS

| Emissions in frequency bands (below 1GHz) |
| --- |
|  |
| **Emissions in frequency bands (above 1GHz)** |
|  |

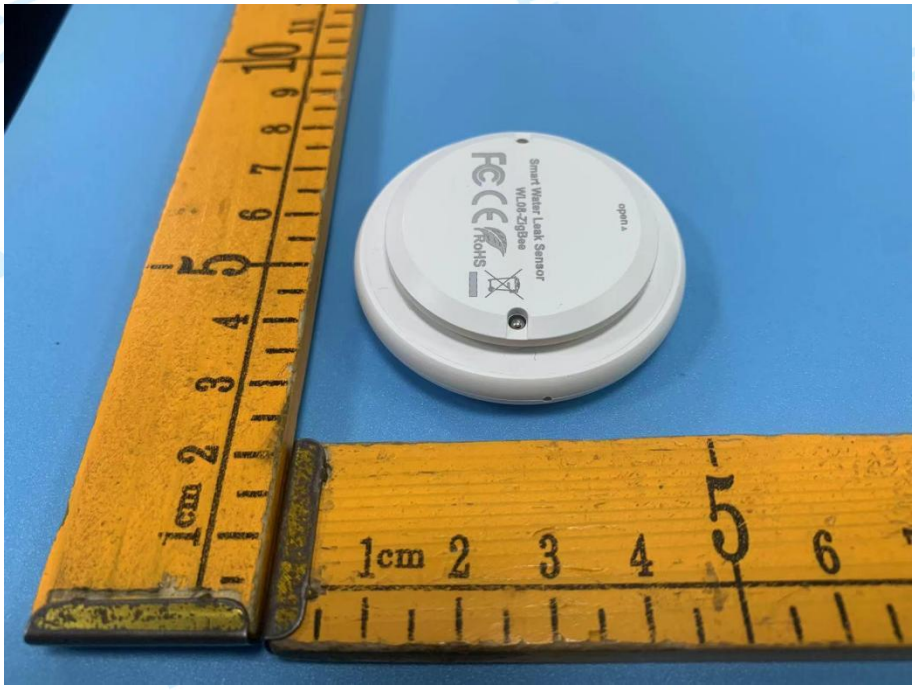
# 6 PHOTOS OF THE EUT

| External |
| --- |
|  |

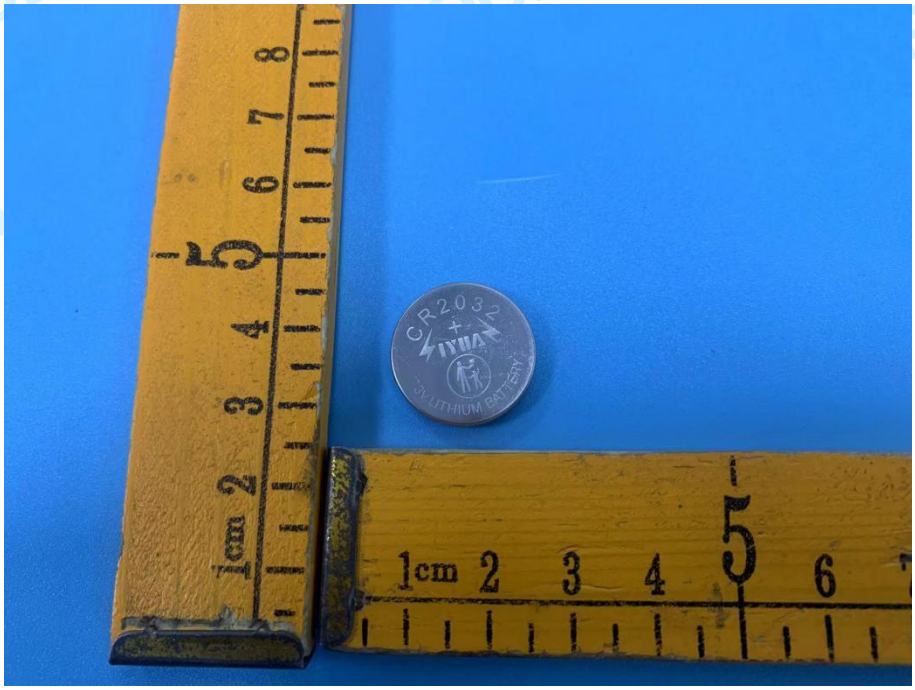

Smart Water Leak Sensor
WL08-ZigBee
FC CE RoHS
1cm 2 3 4 5 6 7

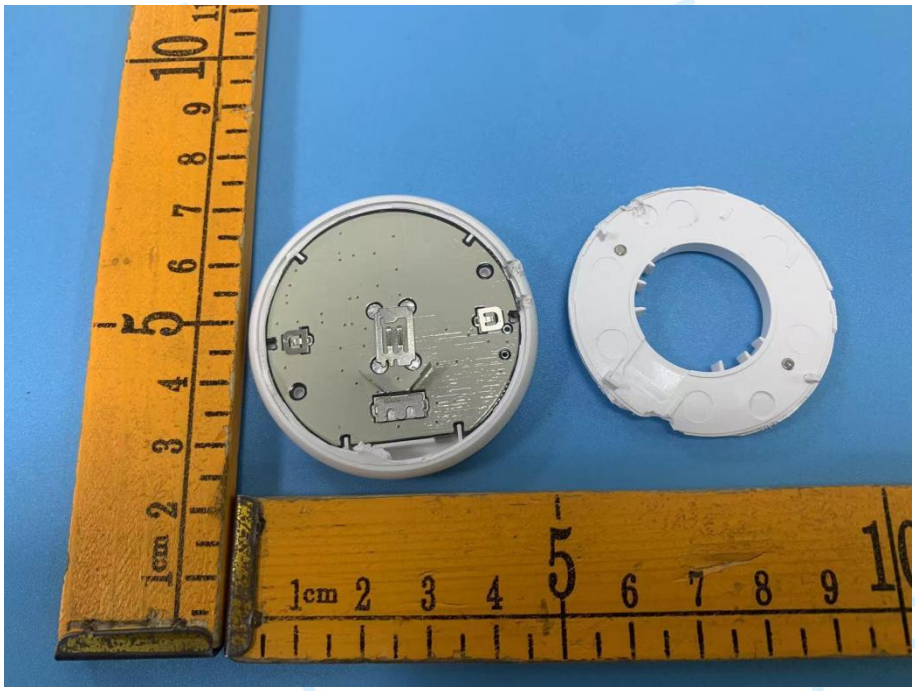

Smart Water Leak Sensor
WL08-ZigBee
FC CE RoHS
1cm 2 3 4 5 6 7

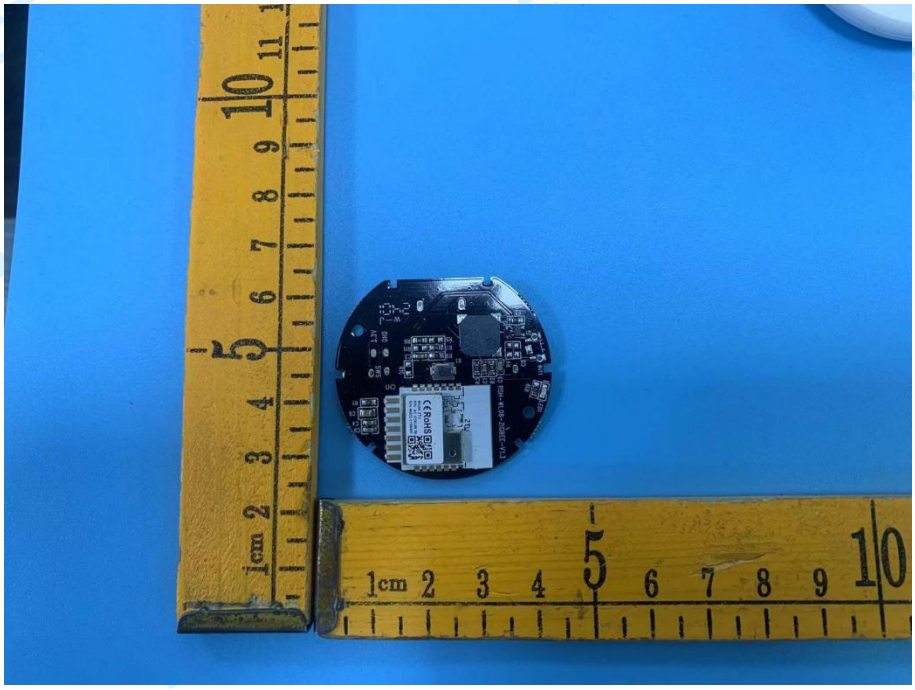

Smart Water Leak Sensor
WL08-ZigBee
open

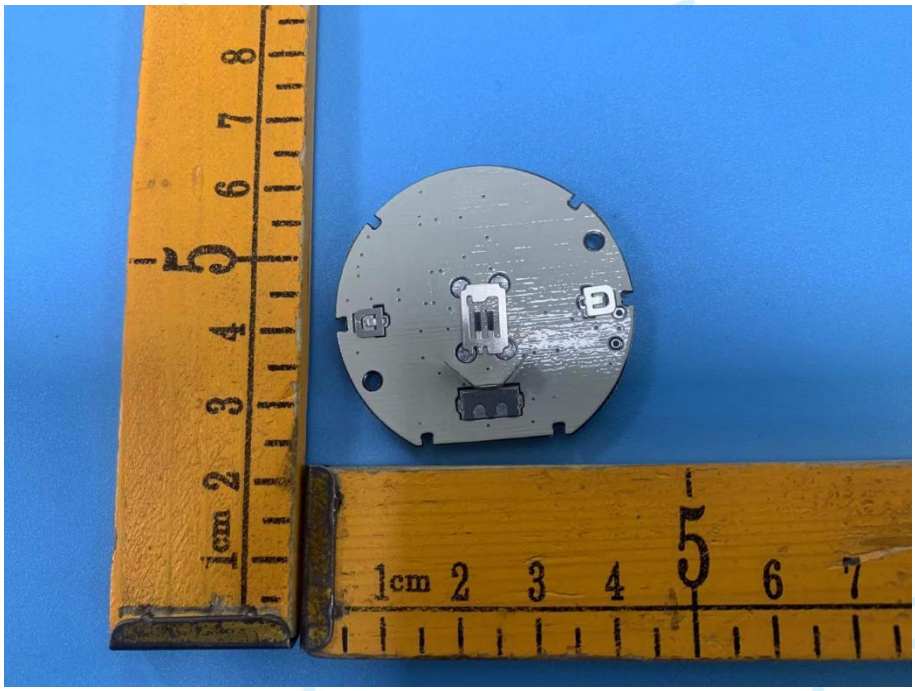

Smart Water Leak Sensor
WL08-ZigBee
open

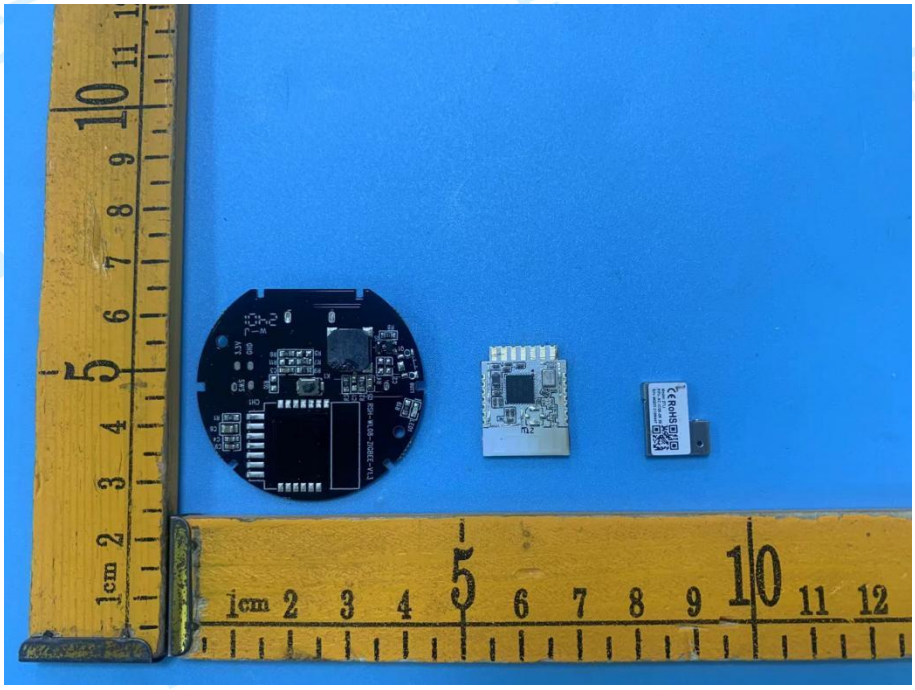
| Internal |
| --- |
|  |

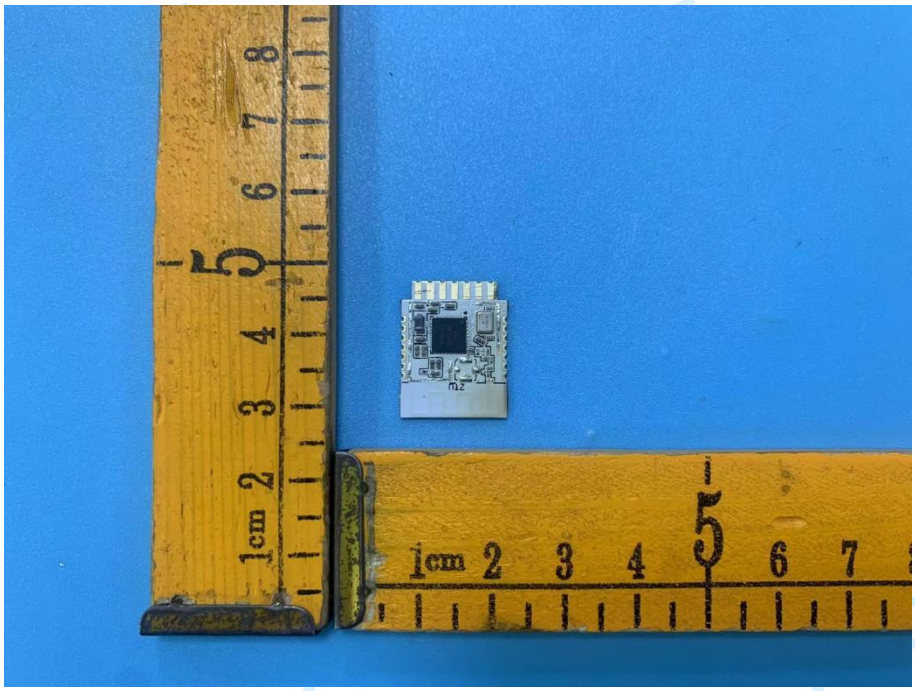
| |
| --- |
|  |

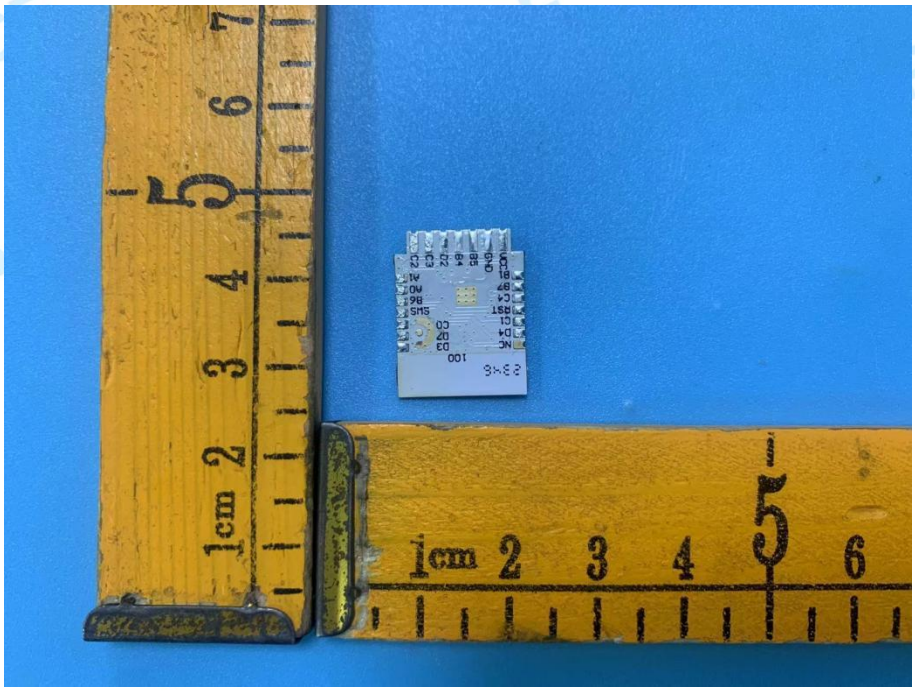












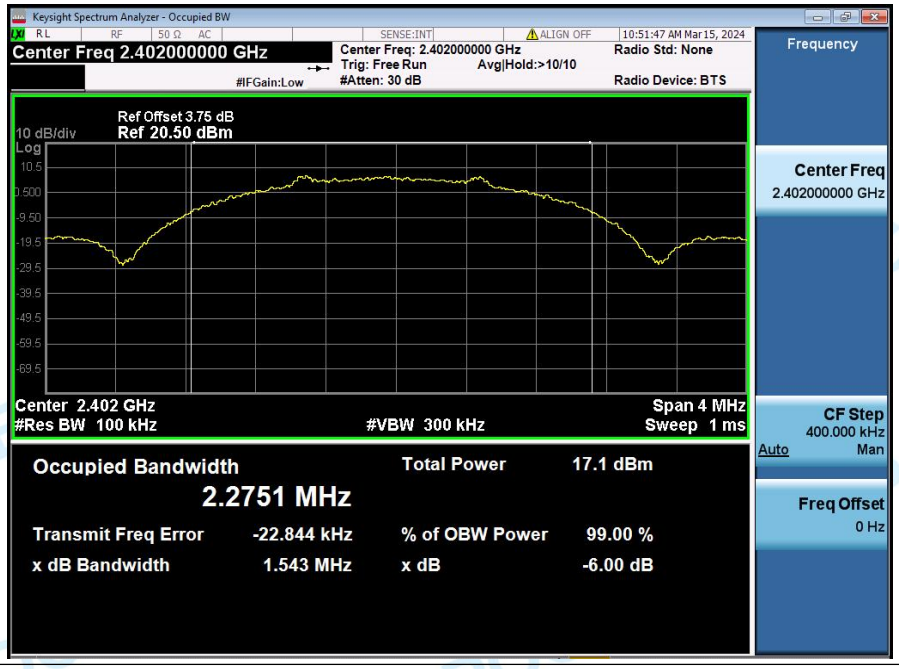
# Appendix

# Smart Water Leak Detector--RSH-WL08--FCC
# FCC_BLE (Part15.247) Test Data

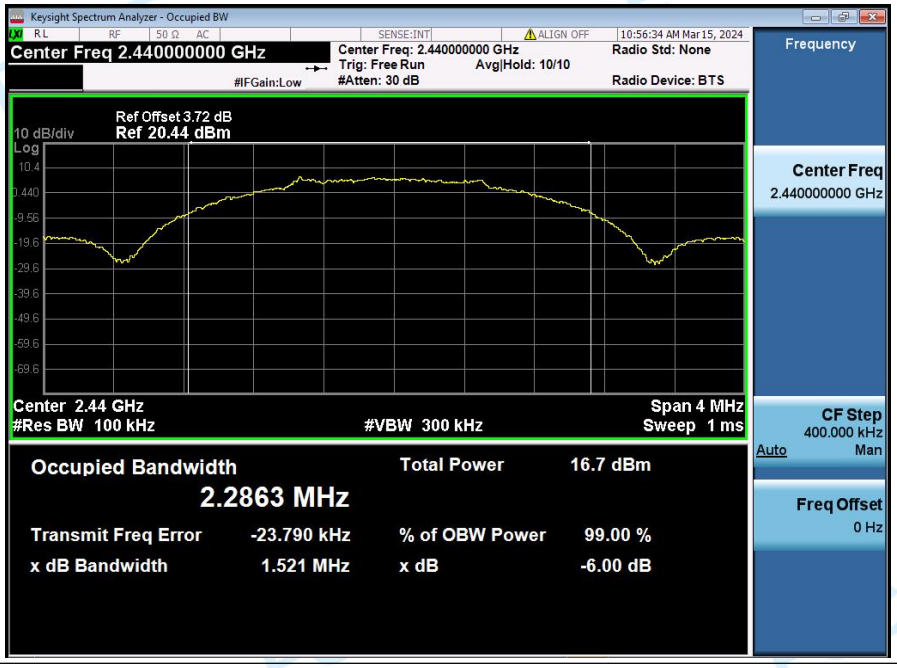
## 1. -6dB Bandwidth

| Condition | Antenna | Rate | Frequency (MHz) | -6dB BW(kHz) | limit(kHz) | Result |
|---|---|---|---|---|---|---|
| NVNT | ANT1 | 2Mbps | 2402.00 | 1542.94 | 500 | Pass |
| NVNT | ANT1 | 2Mbps | 2440.00 | 1521.47 | 500 | Pass |
| NVNT | ANT1 | 2Mbps | 2480.00 | 1346.03 | 500 | Pass |

**-6dB_Bandwidth_NVNT_ANT1_2Mbps_2402**



-6dB_Bandwidth_NVNT_ANT1_2Mbps_2440

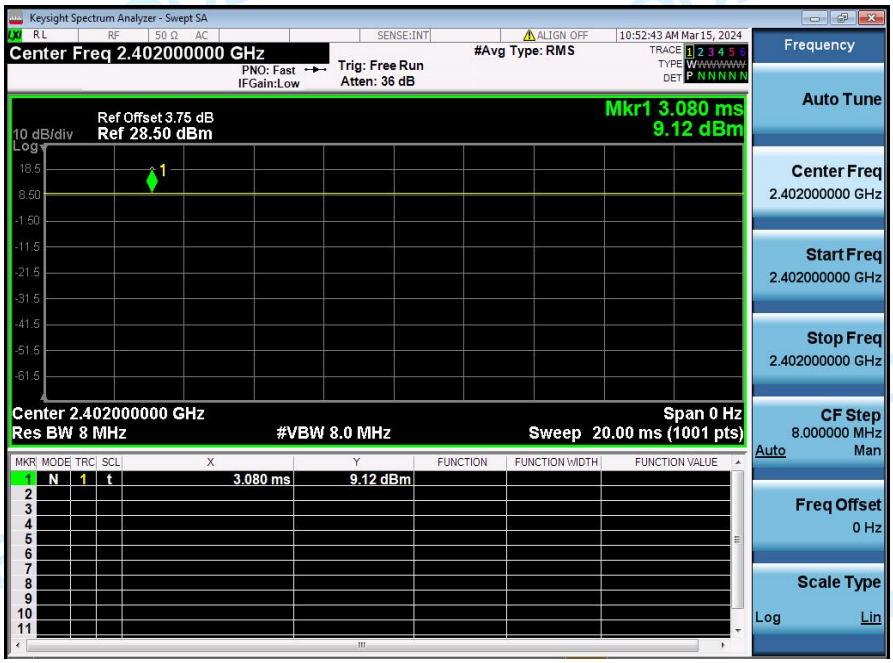



-6dB_Bandwidth_NVNT_ANT1_2Mbps_2480

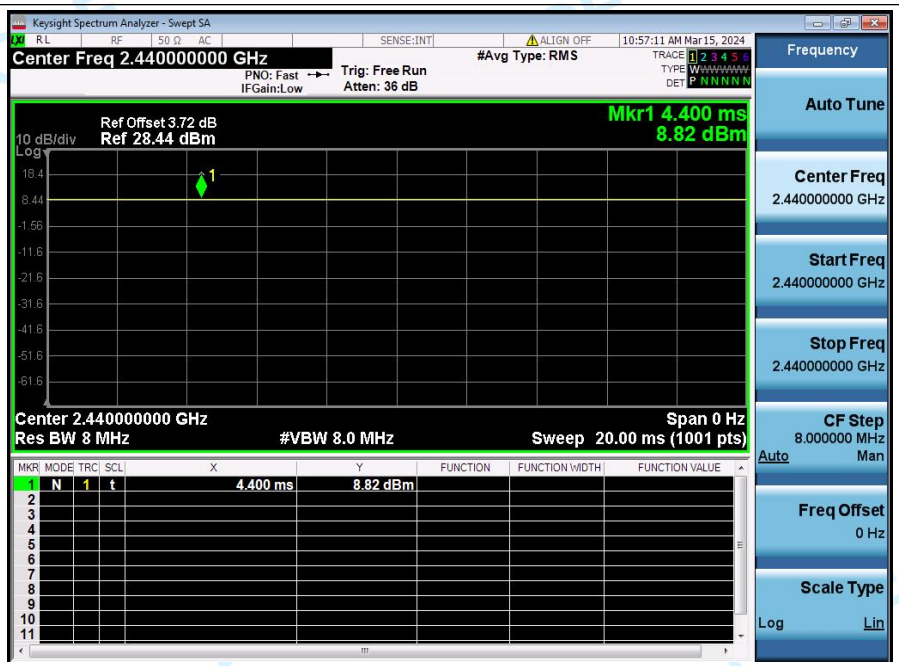
## 2. Duty Cycle

| Condition | Antenna | Rate | Frequency (MHz) | Dutycycle(%) | Duty_factor |
|---|---|---|---|---|---|
| NVNT | ANT1 | 2Mbps | 2402.00 | 100 | 0.00 |
| NVNT | ANT1 | 2Mbps | 2440 | 100 | 0.00 |
| NVNT | ANT1 | 2Mbps | 2480 | 100 | 0.00 |

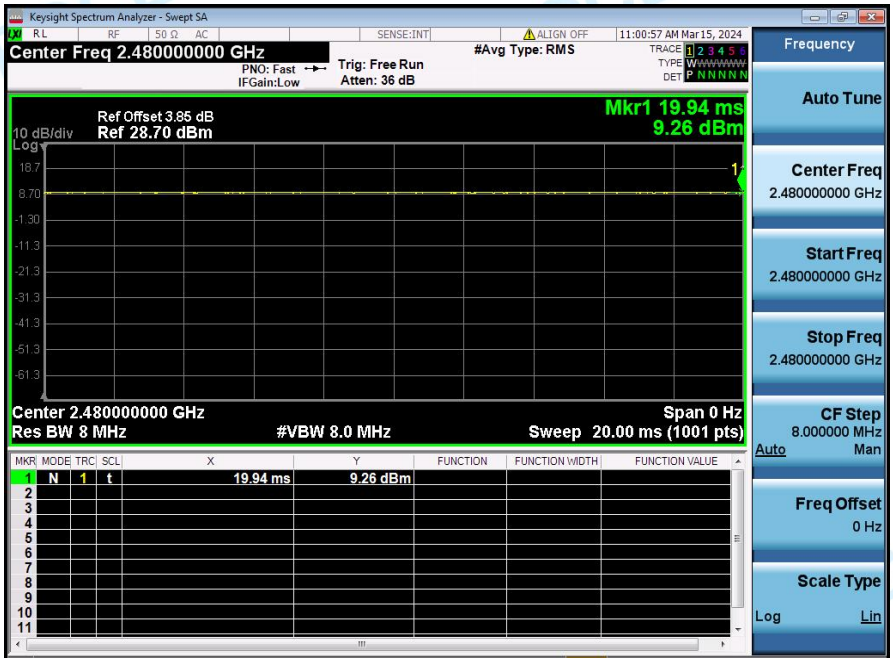
**Duty_Cycle_NVNT_ANT1_2Mbps_2402**




**Duty_Cycle_NVNT_ANT1_2Mbps_2440**



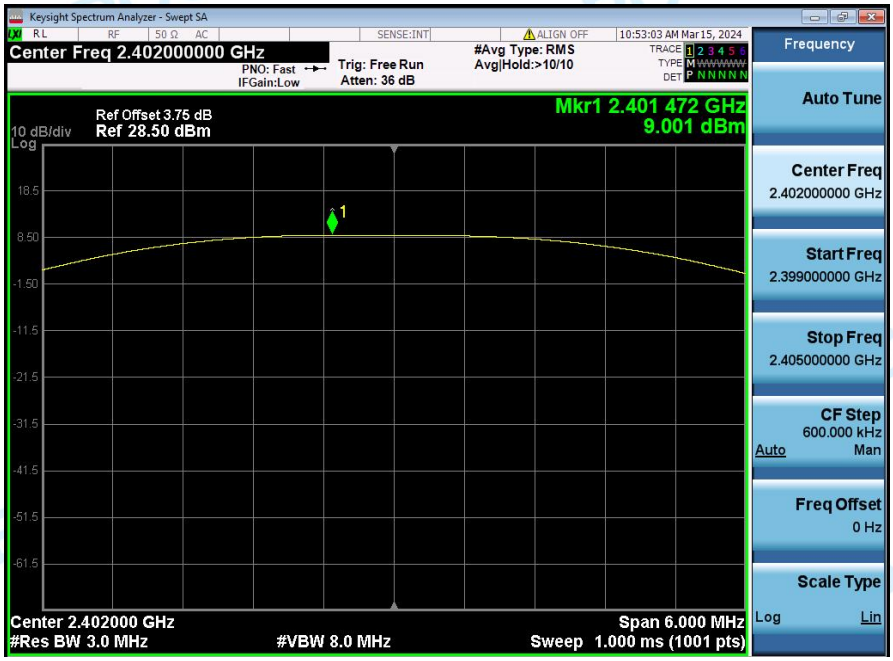
**Duty_Cycle_NVNT_ANT1_2Mbps_2480**



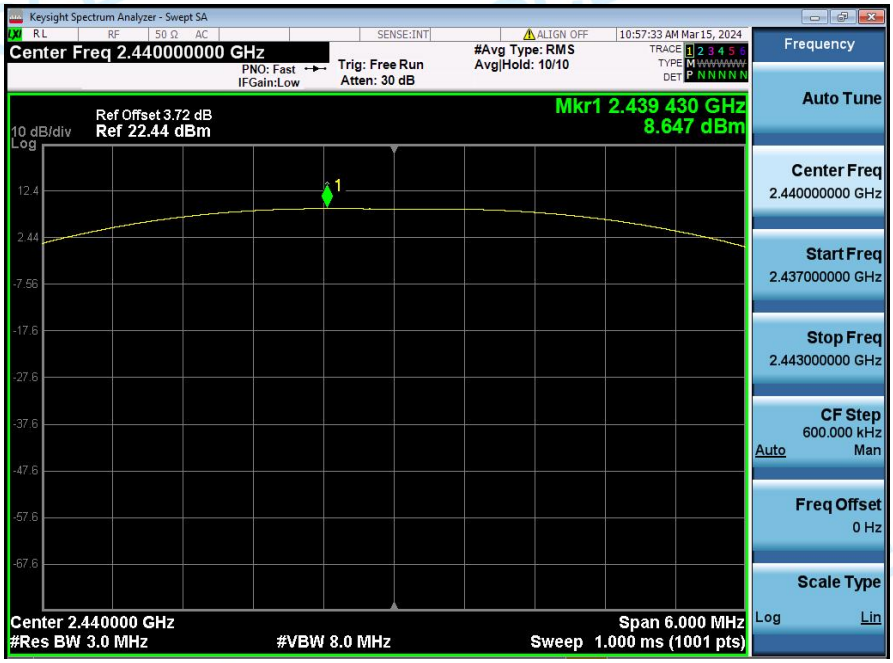
## 3. Peak Output Power

| Condition | Antenna | Rate | Frequency (MHz) | Max. Conducted Power(dBm) | Max. Conducted Power(mW) | Limit(mW) | Result |
|---|---|---|---|---|---|---|---|
| NVNT | ANT1 | 2Mbps | 2402.00 | 9.00 | 7.95 | 1000 | Pass |
| NVNT | ANT1 | 2Mbps | 2440 | 8.65 | 7.32 | 1000 | Pass |
| NVNT | ANT1 | 2Mbps | 2480 | 9.18 | 8.29 | 1000 | Pass |

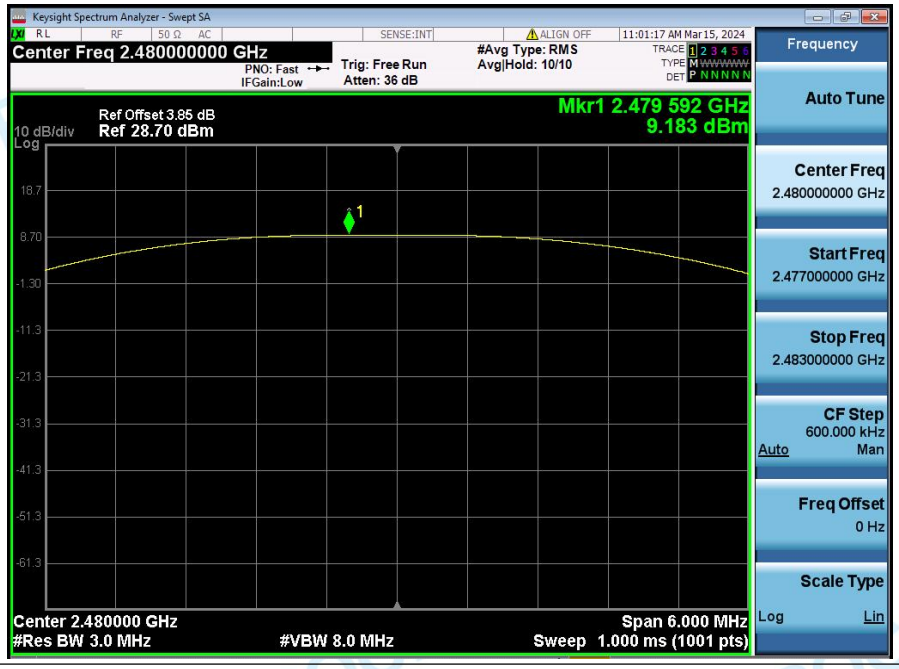
**Peak_Output_Power_NVNT_ANT1_2Mbps_2402**




**Peak_Output_Power_NVNT_ANT1_2Mbps_2440**




**Peak_Output_Power_NVNT_ANT1_2Mbps_2480**

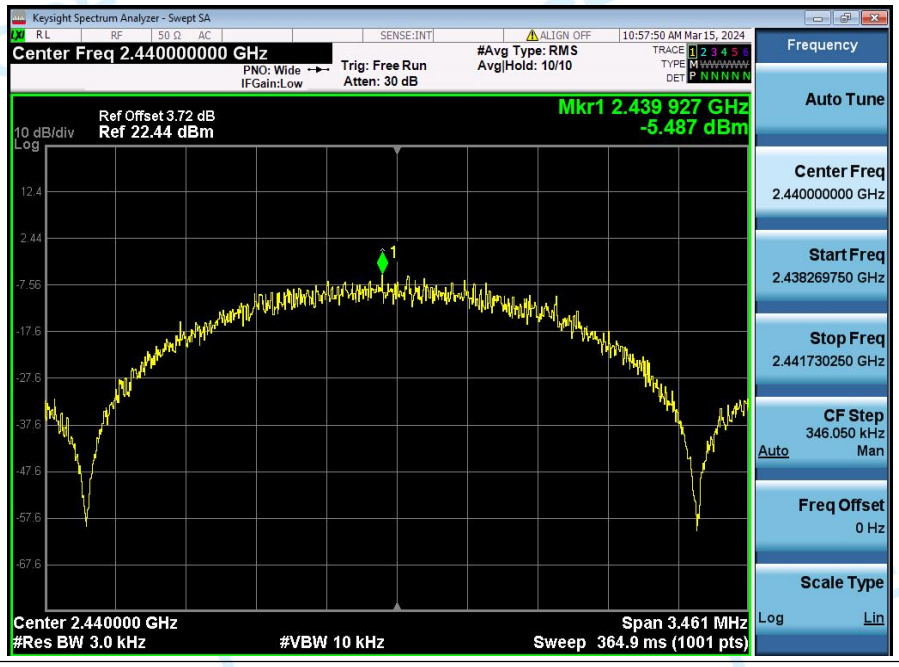

Keysight Spectrum Analyzer - Swept SA
RL
RF
50 Ω AC
SENSE:INT
ALIGN OFF
11:01:17 AM Mar 15, 2024
Center Freq 2.480000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 36 dB
#Avg Type: RMS
Avg|Hold: 10/10
TRACE 1 2 3 4 5 6
TYPE M
DET P N N N N N
Ref Offset 3.85 dB
10 dB/div
Log
Ref 28.70 dBm
Mkr1 2.479 592 GHz
9.183 dBm
18.7
8.70
-1.30
-11.3
-21.3
-31.3
-41.3
-51.3
-61.3
Center 2.480000 GHz
#Res BW 3.0 MHz
#VBW 8.0 MHz
Span 6.000 MHz
Sweep 1.000 ms (1001 pts)
Frequency
Auto Tune
Center Freq
2.480000000 GHz
Start Freq
2.477000000 GHz
Stop Freq
2.483000000 GHz
CF Step
600.000 kHz
Auto
Man
Freq Offset
0 Hz
Scale Type
Log
Lin

## 4. Power Spectral Density

| Condition | Antenna | Rate | Frequency (MHz) | Power Spectral Density(dBm) | Limit(dBm/3kHz) | Result |
|---|---|---|---|---|---|---|
| NVNT | ANT1 | 2Mbps | 2402.00 | -4.80 | 8 | Pass |
| NVNT | ANT1 | 2Mbps | 2440 | -5.49 | 8 | Pass |
| NVNT | ANT1 | 2Mbps | 2480 | -2.17 | 8 | Pass |

**Power_Spectral_Density_NVNT_ANT1_2Mbps_2402**


**Power_Spectral_Density_NVNT_ANT1_2Mbps_2440**



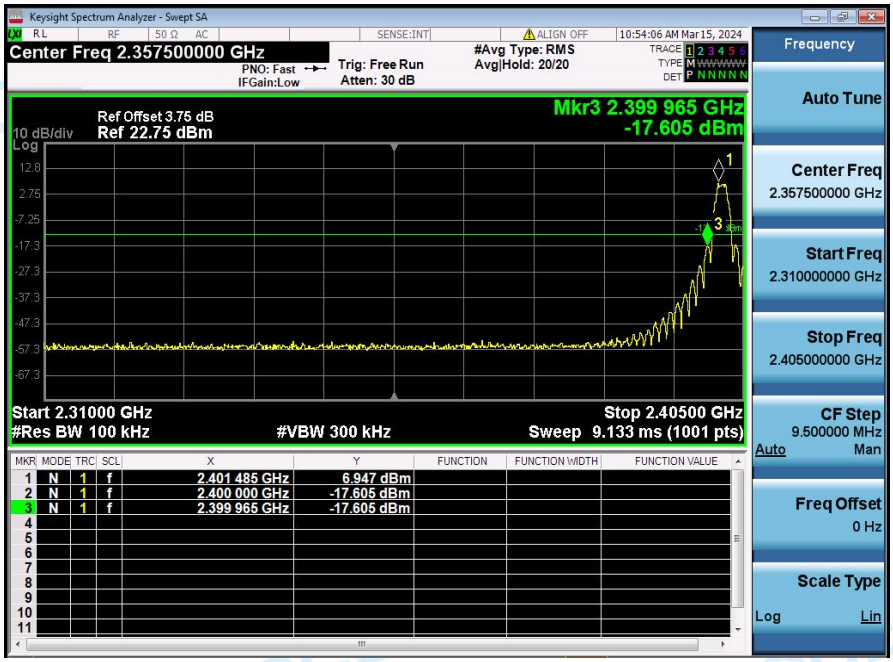
**Power_Spectral_Density_NVNT_ANT1_2Mbps_2480**

## 5. Bandedge

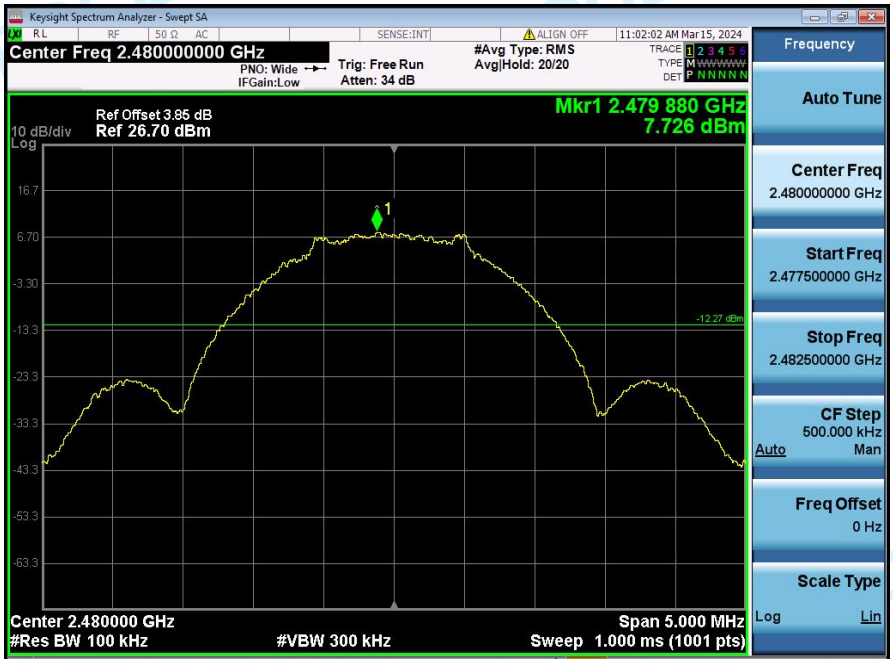
| Condition | Antenna | Rate | TX_Frequency (MHz) | Max. Mark Frequency (MHz) | Spurious level(dBm) | limit(dBm) | Result |
|---|---|---|---|---|---|---|---|
| NVNT | ANT1 | 2Mbps | 2402.00 | 2399.965 | -17.605 | -12.848 | Pass |
| NVNT | ANT1 | 2Mbps | 2480 | 2483.700 | -53.667 | -12.274 | Pass |

1_Reference_Level_NVNT_ANT1_2Mbps_2402

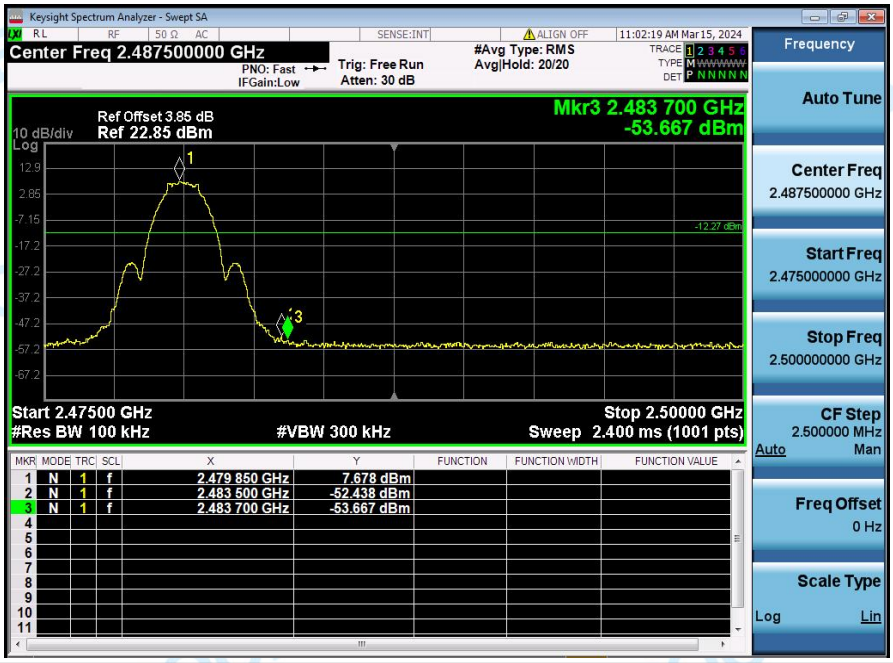

2_Bandedge_NVNT_ANT1_2Mbps_2402



1_Reference_Level_NVNT_ANT1_2Mbps_2480




2_Bandedge_NVNT_ANT1_2Mbps_2480

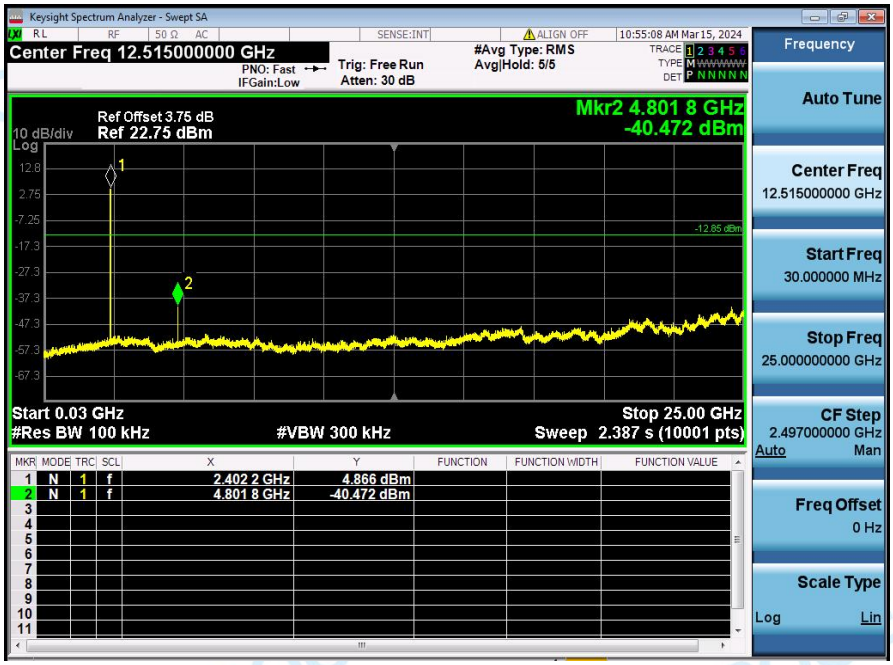


## 6. Spurious Emission

| Condition | Antenna | Rate | TX_Frequency(MHz) | Spurious MAX.Value(dBm) | Limit | Result |
|---|---|---|---|---|---|---|
| NVNT | ANT1 | 2Mbps | 2402.00 | -40.472 | -12.848 | Pass |
| NVNT | ANT1 | 2Mbps | 2440 | -39.409 | -13.207 | Pass |
| NVNT | ANT1 | 2Mbps | 2480 | -40.976 | -12.274 | Pass |

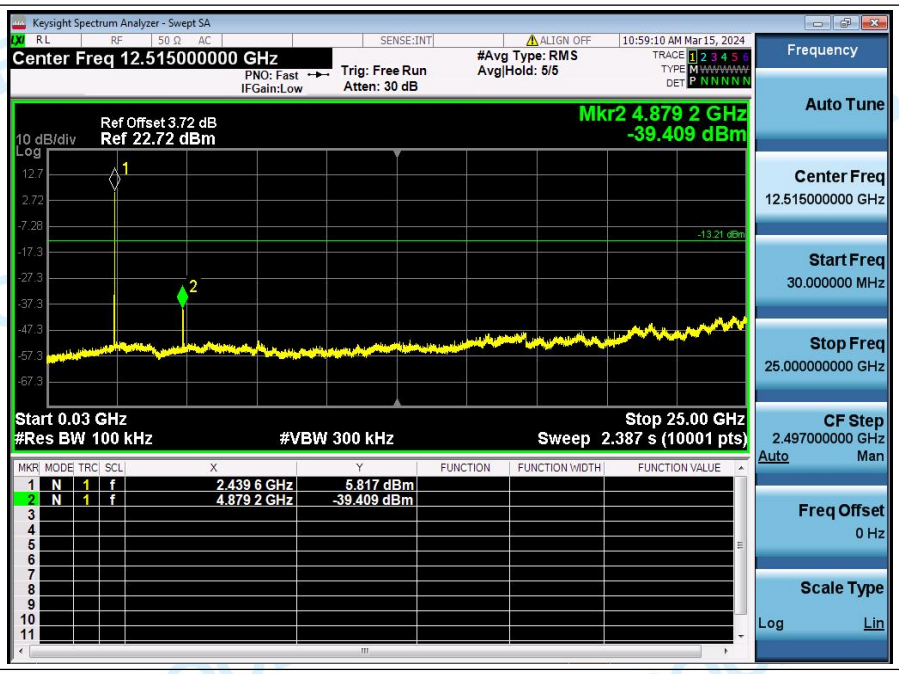
1_Reference_Level_NVNT_ANT1_2Mbps_2402


2_Spurious_Emission_NVNT_ANT1_2Mbps_2402



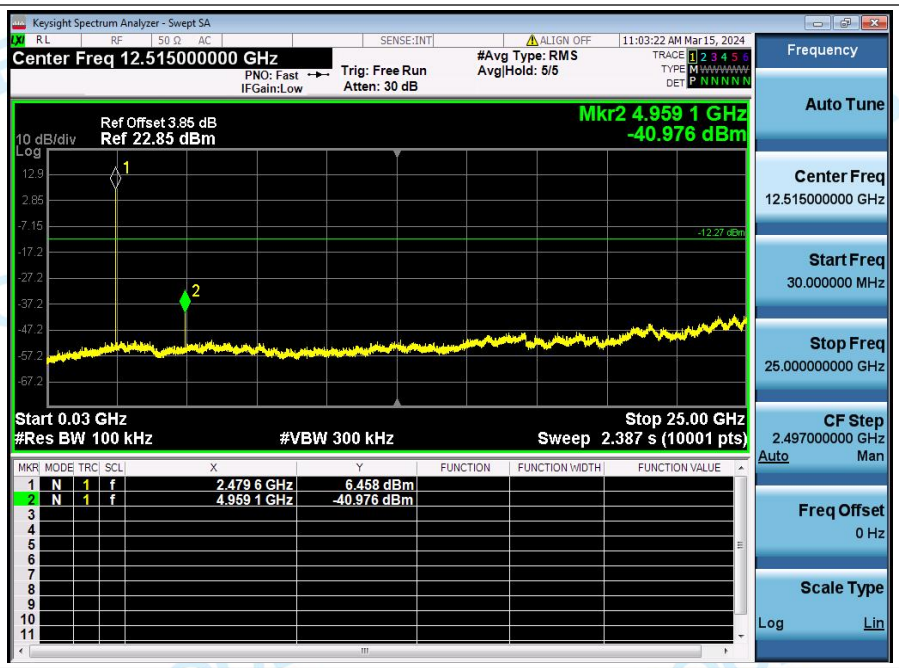
1_Reference_Level_NVNT_ANT1_2Mbps_2440


2_Spurious_Emission_NVNT_ANT1_2Mbps_2440



1_Reference_Level_NVNT_ANT1_2Mbps_2480


2_Spurious_Emission_NVNT_ANT1_2Mbps_2480




********** End of Report **********