Certificate No.: 3745.01

# FCC - TEST REPORT

| | | | | |
|---|---|---|---|---|
| Report Number | : | **709502310219-00B** | Date of Issue: | March 7, 2024 |

| | | |
|---|---|---|
| Model | : | SC162-WCD3 |
| Product Type | : | Smart Battery Doorbell |
| Applicant | : | Zhejiang Lingzhu Technology Co., Ltd |
| Address | : | Room 302,No 1 Building Huace Center,Xihu District, Hangzhou City, Zhejiang Province,China |
| Manufacturer | : | Zhejiang Lingzhu Technology Co., Ltd |
| Address | : | Room 302,No 1 Building Huace Center,Xihu District, Hangzhou City, Zhejiang Province,China |

| | | |
|---|---|---|
| Test Result | : | ■ **Positive** ☐ **Negative** |
| Total pages including Appendices | : | 65 |

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# 1 Table of Contents




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## 2 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

| Issue | Description of Change | Date of Issue |
|---|---|---|
| -00B | First Issue | 03/07/2024 |

## 3 Details about the Test Laboratory

Test Site 1

| | |
|---|---|
| Company name: | TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch<br>No.16 Lane, 1951 Du Hui Road,<br>Shanghai 201108,<br>P.R. China |
| Telephone: | +86 21 6141 0123 |
| Fax: | +86 21 6140 8600 |
| FCC Registration No.: | 820234 |
| FCC Designation Number: | CN1183 |
| ISED CAB identifier | CN0101 |
| IC Registration No.: | 31668 |

# 4 Description of the Equipment under Test

| | |
|---|---|
| Product: | Smart Battery Doorbell |
| Model no.: | SC162-WCD3 |
| FCC ID: | 2BEWXSC162 |
| Options and accessories: | NA |
| Rating: | 5V DC by lithium-ion battery, AC 8-24V or 5V Input (type C) |
| RF Transmission Frequency: | 802.11b/g/n-HT20: 2412~2462 MHz (Wi-Fi)<br>802.11n-HT40: 2422~2452 MHz (Wi-Fi)<br>2402~2480 MHz (BLE5.0)<br>433.92MHz (SRD) |

No. of Operated Channel:

| 802.11b/g/n(HT20) | | | | | 802.11n(HT40) | | |
|---|---|---|---|---|---|---|---|
| Ch | Fre(MHz) | Ch | Fre(MHz) | Ch | Fre(MHz) | Ch | Fre(MHz) |
| 1 | 2412 | 7 | 2442 | 3 | 2422 | 8 | 2447MHz |
| 2 | 2417 | 8 | 2447 | 4 | 2427 | 9 | 2452MHz |
| 3 | 2422 | 9 | 2452 | 5 | 2432 | | |
| 4 | 2427 | 10 | 2457 | 6 | 2437 | | |
| 5 | 2432 | 11 | 2462 | 7 | 2442 | | |
| 6 | 2437 | | | | | | |

| Bluetooth Low Energy | | | | | | | |
|---|---|---|---|---|---|---|---|
| Ch | Fre(MHz) | Ch | Fre(MHz) | Ch | Fre(MHz) | Ch | Fre(MHz) |
| 0 | 2402 | 10 | 2422 | 20 | 2442 | 30 | 2462 |
| 1 | 2404 | 11 | 2424 | 21 | 2444 | 31 | 2464 |
| 2 | 2406 | 12 | 2426 | 22 | 2446 | 32 | 2466 |
| 3 | 2408 | 13 | 2428 | 23 | 2448 | 33 | 2468 |
| 4 | 2410 | 14 | 2430 | 24 | 2450 | 34 | 2470 |
| 5 | 2412 | 15 | 2432 | 25 | 2452 | 35 | 2472 |
| 6 | 2414 | 16 | 2434 | 26 | 2454 | 36 | 2474 |
| 7 | 2416 | 17 | 2436 | 27 | 2456 | 37 | 2476 |
| 8 | 2418 | 18 | 2438 | 28 | 2458 | 38 | 2478 |
| 9 | 2420 | 19 | 2440 | 29 | 2460 | 39 | 2480 |


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| | |
|---|---|
| Modulation: | Direct Sequence Spread Spectrum (DSSS) for 802.11b<br>Orthogonal Frequency Division Multiplexing (OFDM) for 802.11g/n;<br>2.4GHz BLE: GFSK (1Mbps and 2Mbps)<br>433.92MHz: ASK |
| Hardware Version: | V1.0.2 |
| Software Version: | V2 |
| Antenna Type: | FPC Antenna for 2.4GHz<br>Spring antenna for 433.92MHz |
| Antenna Gain: | 0.45dBi for 2.4GHz; -2.01dBi for 433.92MHz |
| Description of the EUT: | The EUT was a Smart Battery Doorbell which has Wi-Fi and BLE function, it also can transmit at 433.92MHz. We tested it and listed the worst data in this report. This report is only for Wi-Fi. |
| Test sample no.: | SHA-781837-2 (RF Radiated and Conducted) |

The sample's mentioned in this report is/are submitted/ supplied/ manufactured by client. The laboratory therefore assumes no responsibility for accuracy of information on the brand name, model number, origin of manufacture, consignment, antenna gain or any information supplied.


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# 5 Summary of Test Standards

| Test Standards | |
|---|---|
| FCC Part 15 Subpart C<br>10-1-2023 Edition | PART 15 - RADIO FREQUENCY DEVICES<br>Subpart C - Intentional Radiators |

All the test methods were according to KDB 558074 D01 15.247 Meas Guidance v05r02 Measurement Guidance and ANSI C63.10-2013.


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# 6 Summary of Test Results

| Technical Requirements | | | | | | |
|---|---|---|---|---|---|---|
| **FCC Part 15 Subpart C** | | | | | | |
| Test Condition | | Pages | Test Site | Test Result | | |
| | | | | Pass | Fail | N/A |
| §15.207 | Conducted emission AC power port | 13-17 | Site 1 | ☒ | ☐ | ☐ |
| §15.247 (b) (3) | Conducted peak output power | 18-19 | Site 1 | ☒ | ☐ | ☐ |
| §15.247(a)(1) | 20dB bandwidth and 99% Occupied Bandwidth | --- | --- | ☐ | ☐ | ☒ |
| §15.247(a)(1) | Carrier frequency separation | --- | --- | ☐ | ☐ | ☒ |
| §15.247(a)(1)(iii) | Number of hopping frequencies | --- | --- | ☐ | ☐ | ☒ |
| §15.247(a)(1)(iii) | Dwell Time - Average Time of Occupancy | --- | --- | ☐ | ☐ | ☒ |
| §15.247(a)(2) | 6dB bandwidth | 20-24 | Site 1 | ☒ | ☐ | ☐ |
| §15.247(e) | Power spectral density | 25-29 | Site 1 | ☒ | ☐ | ☐ |
| §15.247(e) | Spurious RF conducted emissions | 30-42 | Site 1 | ☒ | ☐ | ☐ |
| §15.247(d) | Band edge | 43-51 | Site 1 | ☒ | ☐ | ☐ |
| §15.247(d) & §15.209 & §15.205 | Spurious radiated emissions for transmitter | 52-61 | Site 1 | ☒ | ☐ | ☐ |
| §15.203 | Antenna requirement | See note 1 | | ☒ | ☐ | ☐ |

Remark 1: N/A – Not Applicable.
Note 1: The EUT uses a FPC antenna, gain is 0.45dBi for 2.4GHz and spring antenna, gain is -2.01dBi for 433.92MHz. In accordance to §15.203, It is considered sufficiently to comply with the provisions of this section.


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# 7 General Remarks

**Remarks**

This submittal(s) (test report) is intended for FCC ID: 2BEWXSC162 complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C rules.

This report in only for 2.4GHz Wi-Fi.

**SUMMARY:**

All tests according to the regulations cited on page 5 were

■ - Performed

☐ - **Not** Performed

The Equipment under Test

■ - **Fulfills** the general approval requirements.

☐ - **Does not** fulfill the general approval requirements.

| | |
|---|---|
| Sample Received Date: | January 5, 2024 |
| Testing Start Date: | January 8, 2024 |
| Testing End Date: | January 30, 2024 |

-TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch

| Reviewed by: | Prepared by: | Tested by: |
|---|---|---|
| Hui TONG | Jiaxi XU | Cheng Huali |
| Review Engineer | Project Engineer | Test Engineer |



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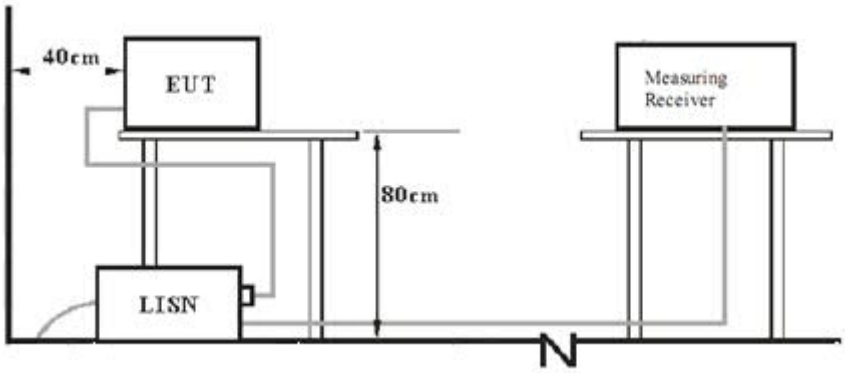
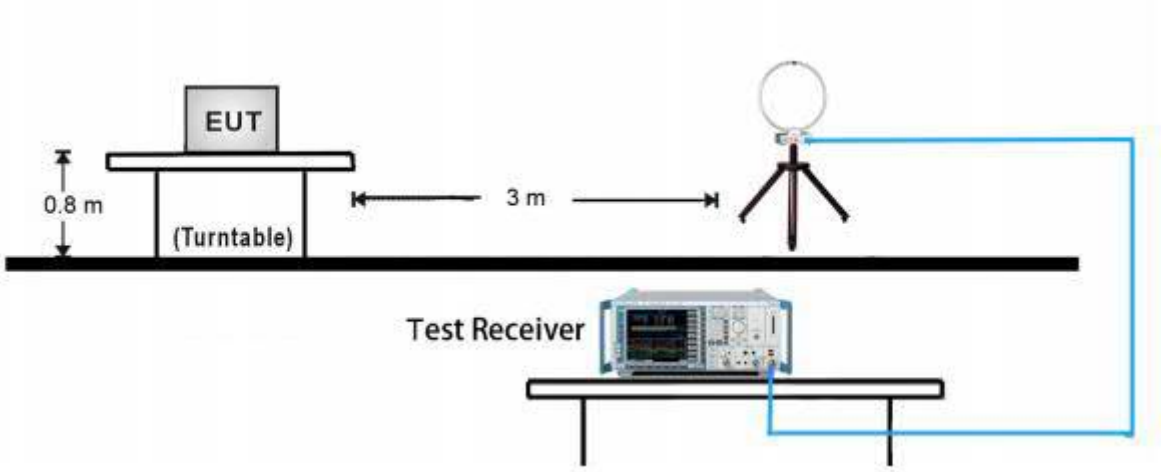
# 8 Test Setups

## 7.1 AC Power Line Conducted Emission test setups




## 7.2 Radiated test setups

9kHz ~ 30MHz Test Setup:





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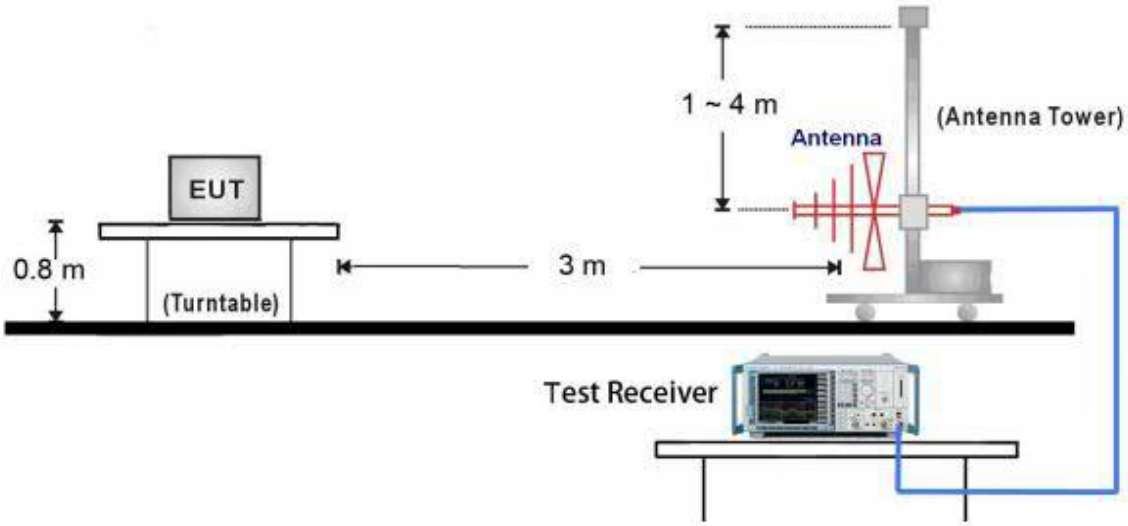
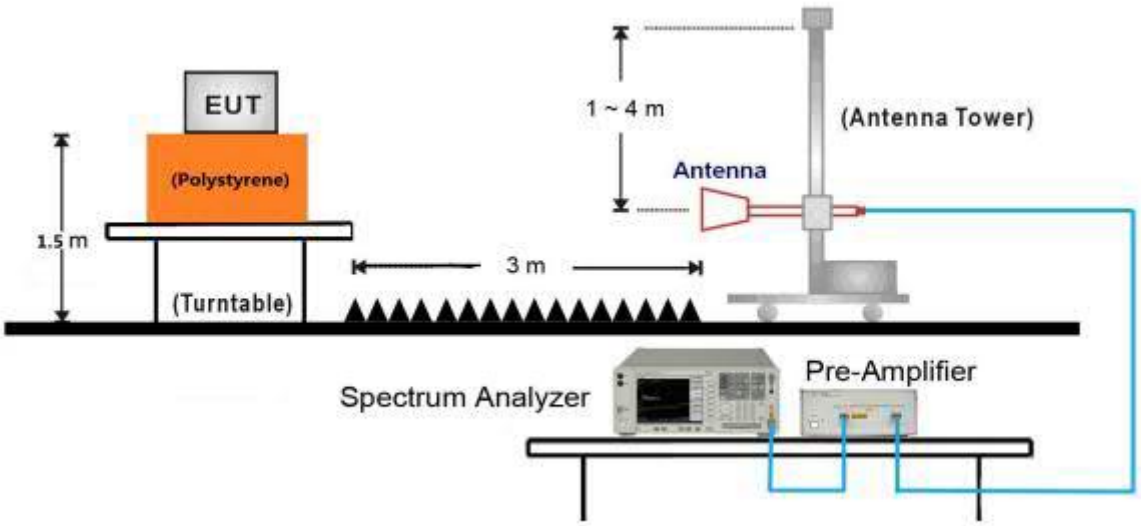
30MHz ~ 1GHz Test Setup:




1GHz ~ 18GHz Test Setup:





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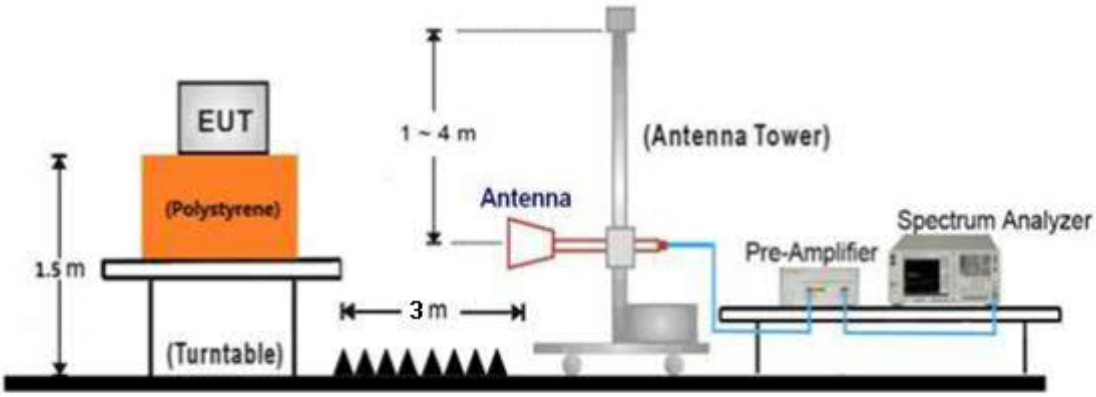
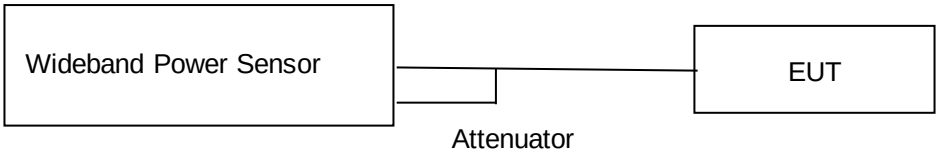
18GHz ~ 25GHz Test Setup:

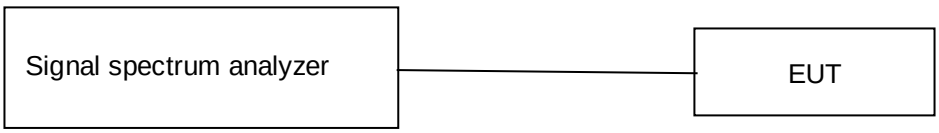



## 7.3 Conducted RF test setups

For Conducted peak output power




For other test items





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# 9 Systems test configuration

Auxiliary Equipment Used during Test:

| DESCRIPTION | MANUFACTURER | MODEL NO.(SHIELD) | S/N(LENGTH) |
|---|---|---|---|
| Notebook | Lenovo | E470 | PF-OU5TS7 17/09 |
| AC/DC adapter | MLF | MLF-A260502000UU | -- |
| AC/AC adapter | Mu Tang | MT48-0025 | -- |

Test software: AmebaD_mptool_2V1, which used to control the EUT in continues transmitting mode

The system was configured to channel 1(2412MHz), 6(2437MHz), and 11(2462MHz) for 802.11 b/g/n HT20 test and channel 3(2422MHz), 6(2437MHz), 9(2452MHz) for 802.11n (HT40).

Test Mode Applicability and Tested Channel Detail:

| Mode | Tested Channel | Data Rate (Mbps) | Modulation | Index Value (Power level setting) |
|---|---|---|---|---|
| 802.11b | 1 | 1 | CCK | 105 |
| | 6 | 1 | CCK | 105 |
| | 11 | 1 | CCK | 105 |
| 802.11g | 1 | 6 | OFDM | 96 |
| | 6 | 6 | OFDM | 96 |
| | 11 | 6 | OFDM | 96 |
| 802.11n HT20 | 1 | MCS0 | OFDM | 92 |
| | 6 | MCS0 | OFDM | 92 |
| | 11 | MCS0 | OFDM | 92 |
| 802.11n HT40 | 1 | MCS0 | OFDM | 92 |
| | 6 | MCS0 | OFDM | 92 |
| | 11 | MCS0 | OFDM | 92 |

Non-hopping mode: The system was configured to operate at a signal channel transmitting. The test software allows the configuration and operation at the worst-case duty and the highest transmit power.


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# 10 Technical Requirement

## 10.1 Conducted Emission

**Test Method**

1. The EUT was placed on a table, which is 0.8m above ground plane
2. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.).
3. Maximum procedure was performed to ensure EUT compliance
4. A EMI test receiver is used to test the emissions from both sides of AC line

**Limit**

According to §15.207, conducted emissions limit as below:

| Frequency MHz | QP Limit dBµV | AV Limit dBµV |
|---|---|---|
| 0.150-0.500 | 66-56* | 56-46* |
| 0.500-5 | 56 | 46 |
| 5-30 | 60 | 50 |

Decreasing linearly with logarithm of the frequency


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# 150k-30MHz Conducted Emission Test

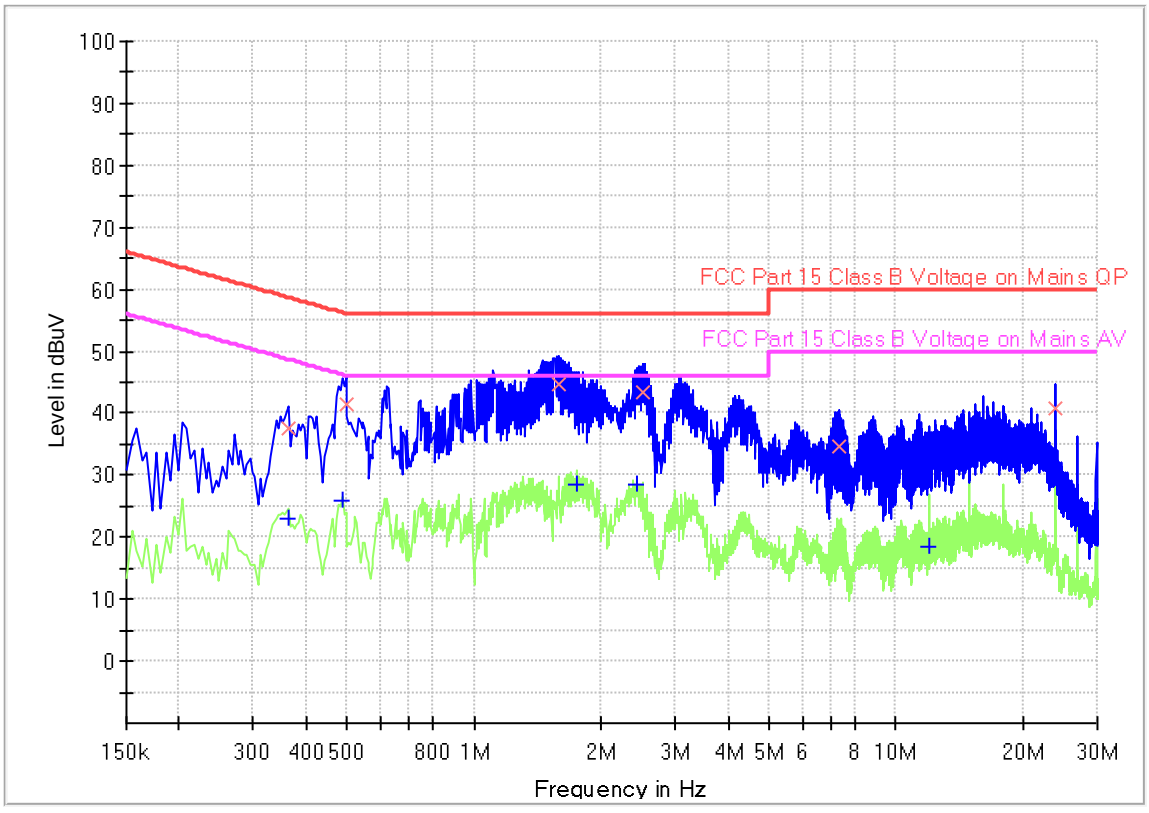
## EUT Information

| | |
|---|---|
| EUT Name: | Smart Battery Doorbell |
| Model | SC162-WCD3 |
| Client: | Zhejiang Lingzhu Technology Co., Ltd |
| Op Cond | Power on and charging, TX_2412MHz at g mode, AC 120V/60Hz, T21.5, H32.6%, P103.2kPa |
| Operator: | Huali CHENG |
| Standard | FCC Part 15.207(a) |
| Comment: | Phase L |
| Sample No.: | SHA-781837-2 |

## Scan Setup: Voltage with 2-Line-LISN pre [EMI conducted]

| | |
|---|---|
| Hardware Setup: | Voltage with 2-Line-LISN |
| Receiver: | [ESR 3] |
| Level Unit: | dBuV |

| Subrange | Step Size | Detectors | IF BW | Meas. Time | Preamp |
|---|---|---|---|---|---|
| 9 kHz - 150 kHz | 100 Hz | PK+ | 200 Hz | 0.02 s | 0 dB |
| 150 kHz - 30 MHz | 4.5 kHz | PK+; AVG | 9 kHz | 0.01 s | 0 dB |



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## Final_Result

| Frequency (MHz) | QuasiPeak (dBuV) | CAverage (dBuV) | Limit (dBuV) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Line | Corr. (dB) |
|---|---|---|---|---|---|---|---|---|
| 0.361500 | --- | 22.85 | 48.69 | 25.84 | 1000.0 | 9.000 | L1 | 19.5 |
| 0.361500 | 37.68 | --- | 58.69 | 21.01 | 1000.0 | 9.000 | L1 | 19.5 |
| 0.487500 | --- | 25.84 | 46.21 | 20.37 | 1000.0 | 9.000 | L1 | 19.4 |
| 0.496500 | 41.40 | --- | 56.06 | 14.66 | 1000.0 | 9.000 | L1 | 19.4 |
| 1.585500 | 44.69 | --- | 56.00 | 11.31 | 1000.0 | 9.000 | L1 | 19.5 |
| 1.752000 | --- | 28.64 | 46.00 | 17.36 | 1000.0 | 9.000 | L1 | 19.5 |
| 2.431500 | --- | 28.44 | 46.00 | 17.56 | 1000.0 | 9.000 | L1 | 19.5 |
| 2.526000 | 43.33 | --- | 56.00 | 12.67 | 1000.0 | 9.000 | L1 | 19.5 |
| 7.291500 | 34.70 | --- | 60.00 | 25.30 | 1000.0 | 9.000 | L1 | 19.7 |
| 11.931000 | --- | 18.47 | 50.00 | 31.53 | 1000.0 | 9.000 | L1 | 19.9 |
| 23.941500 | --- | 30.40 | 50.00 | 19.60 | 1000.0 | 9.000 | L1 | 20.9 |
| 23.941500 | 40.85 | --- | 60.00 | 19.15 | 1000.0 | 9.000 | L1 | 20.9 |


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# 150k-30MHz Conducted Emission Test

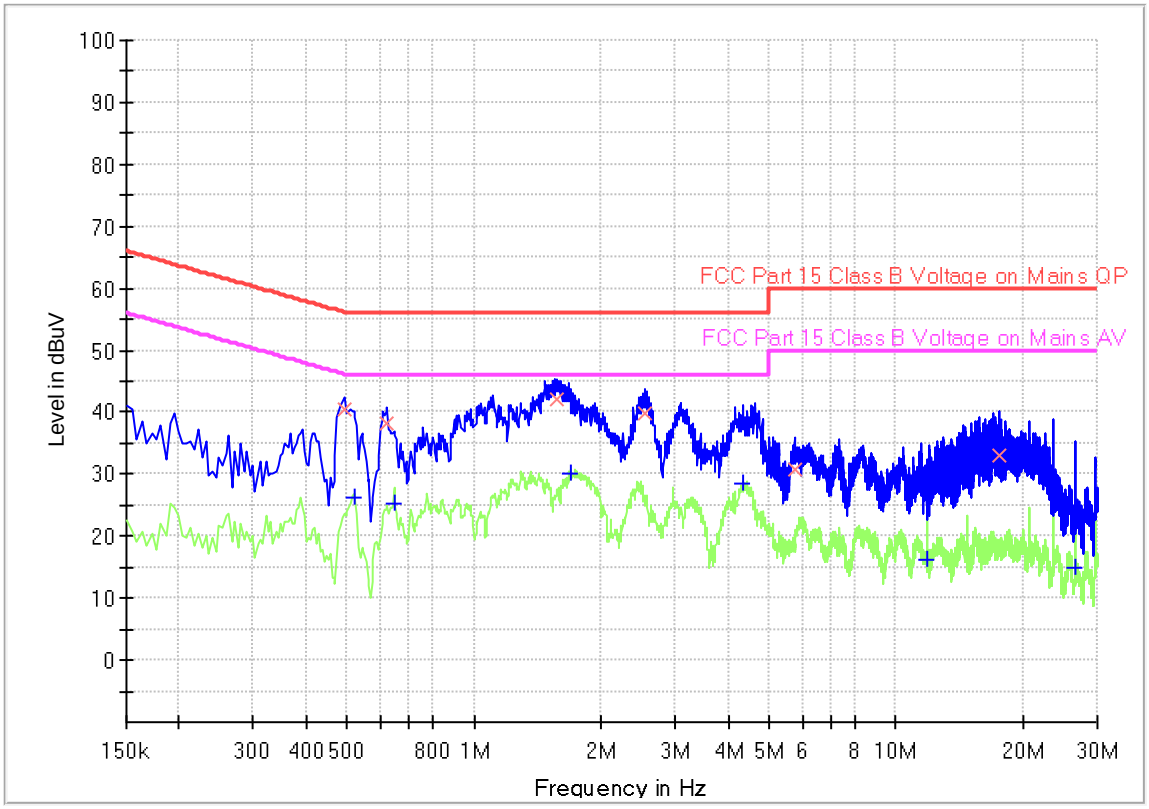
## EUT Information

| | |
|---|---|
| EUT Name: | Smart Battery Doorbell |
| Model | SC162-WCD3 |
| Client: | Zhejiang Lingzhu Technology Co., Ltd |
| Op Cond | Power on and charging, TX_2412MHz at g mode, AC 120V/60Hz, T21.5, H32.6%, P103.2kPa |
| Operator: | Huali CHENG |
| Standard | FCC Part 15.207(a) |
| Comment: | Phase N |
| Sample No.: | SHA-781837-2 |

## Scan Setup: Voltage with 2-Line-LISN pre [EMI conducted]

| | |
|---|---|
| Hardware Setup: | Voltage with 2-Line-LISN |
| Receiver: | [ESR 3] |
| Level Unit: | dBuV |

| Subrange | Step Size | Detectors | IF BW | Meas. Time | Preamp |
|---|---|---|---|---|---|
| 9 kHz - 150 kHz | 100 Hz | PK+ | 200 Hz | 0.02 s | 0 dB |
| 150 kHz - 30 MHz | 4.5 kHz | PK+; AVG | 9 kHz | 0.01 s | 0 dB |



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## Final_Result

| Frequency (MHz) | QuasiPeak (dBuV) | CAverage (dBuV) | Limit (dBuV) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Line | Corr. (dB) |
|---|---|---|---|---|---|---|---|---|
| 0.492000 | 40.37 | --- | 56.13 | 15.76 | 1000.0 | 9.000 | N | 19.5 |
| 0.519000 | --- | 26.23 | 46.00 | 19.77 | 1000.0 | 9.000 | N | 19.5 |
| 0.622500 | 38.36 | --- | 56.00 | 17.64 | 1000.0 | 9.000 | N | 19.4 |
| 0.645000 | --- | 25.26 | 46.00 | 20.74 | 1000.0 | 9.000 | N | 19.4 |
| 1.563000 | 42.03 | --- | 56.00 | 13.97 | 1000.0 | 9.000 | N | 19.5 |
| 1.698000 | --- | 30.12 | 46.00 | 15.88 | 1000.0 | 9.000 | N | 19.5 |
| 2.535000 | 39.98 | --- | 56.00 | 16.02 | 1000.0 | 9.000 | N | 19.5 |
| 4.357500 | --- | 28.65 | 46.00 | 17.35 | 1000.0 | 9.000 | N | 19.6 |
| 5.734500 | 30.62 | --- | 60.00 | 29.38 | 1000.0 | 9.000 | N | 19.6 |
| 11.836500 | --- | 16.15 | 50.00 | 33.85 | 1000.0 | 9.000 | N | 19.8 |
| 17.655000 | 32.91 | --- | 60.00 | 27.09 | 1000.0 | 9.000 | N | 20.0 |
| 26.650500 | --- | 14.88 | 50.00 | 35.12 | 1000.0 | 9.000 | N | 20.6 |

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)
Factor (dB) = Cable Loss (dB) + LISN Factor (dB) + 10dB Attenuator

Note 2: This test mode (USB input 5V) is worse than AC power on mode, therefore no data about AC power on mode appeared in the report.


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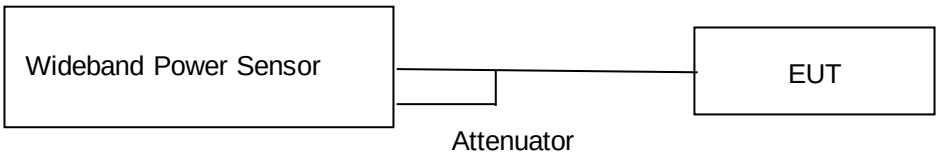
## 10.2 Conducted peak output power

**Test Method**

1) The EUT is configured to transmit continuously, or to transmit with a constant duty cycle.
2) At all times when the EUT is transmitting, it shall be transmitting at its maximum power control level.
3) The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.

4) Measure the peak power of the transmitter. This measurement is a peak over both the ON and OFF periods of the transmitter.




**Wideband Power Sensor conducted test setup**

**Limits**

According to §15.247 (b) (1), conducted peak output power limit as below:

| | Frequency Range | Limit | Limit |
|---|---|---|---|
| | MHz | W | dBm |
| **Conducted peak output power** | 2400-2483.5 | ≤1 | ≤30 |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## Test result

802.11b

| Frequency (MHz) | Conducted Peak Output Power(dBm) | Result |
|---|---|---|
| Low channel 2412MHz | 21.36 | Pass |
| Middle channel 2437MHz | 21.65 | Pass |
| High channel 2462MHz | 21.72 | Pass |

802.11g

| Frequency (MHz) | Conducted Peak Output Power(dBm) | Result |
|---|---|---|
| Low channel 2412MHz | 25.69 | Pass |
| Middle channel 2437MHz | 25.52 | Pass |
| High channel 2462MHz | 25.63 | Pass |

802.11n(HT20)

| Frequency (MHz) | Conducted Peak Output Power(dBm) | Result |
|---|---|---|
| Low channel 2412MHz | 24.88 | Pass |
| Middle channel 2437MHz | 24.62 | Pass |
| High channel 2462MHz | 25.15 | Pass |

802.11n(HT40)

| Frequency (MHz) | Conducted Peak Output Power(dBm) | Result |
|---|---|---|
| Low channel 2422MHz | 24.36 | Pass |
| Middle channel 2437MHz | 24.10 | Pass |
| High channel 2452MHz | 24.53 | Pass |


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## 10.3 6dB bandwidth

**Test Method for 6 dB Bandwidth**

1. The RF output of EUT was connected to the spectrum analyzer. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings:
   RBW=100KHz, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Use the automatic bandwidth measurement capability of an instrument, use the X dB bandwidth mode with X set to 6 dB.
5. Allow the trace to stabilize, record the 6 dB Bandwidth value.

**Limit**

| 6dB bandwidth Limit [kHz] |
|---|
| ≥500 |

Test result

| Test Mode | Frequency MHz | 6dB bandwidth (MHz) | | Result |
|---|---|---|---|---|
| | | result | limit | verdict |
| 802.11b | 2412 | 10.047 | ≥0.5 | Pass |
| | 2437 | 9.579 | ≥0.5 | Pass |
| | 2462 | 10.032 | ≥0.5 | Pass |
| 802.11g | 2412 | 16.505 | ≥0.5 | Pass |
| | 2437 | 16.503 | ≥0.5 | Pass |
| | 2462 | 16.475 | ≥0.5 | Pass |
| 802.11n(HT20) | 2412 | 17.618 | ≥0.5 | Pass |
| | 2437 | 17.633 | ≥0.5 | Pass |
| | 2462 | 17.747 | ≥0.5 | Pass |
| 802.11n(HT40) | 2422 | 36.349 | ≥0.5 | Pass |
| | 2437 | 36.339 | ≥0.5 | Pass |
| | 2452 | 36.326 | ≥0.5 | Pass |


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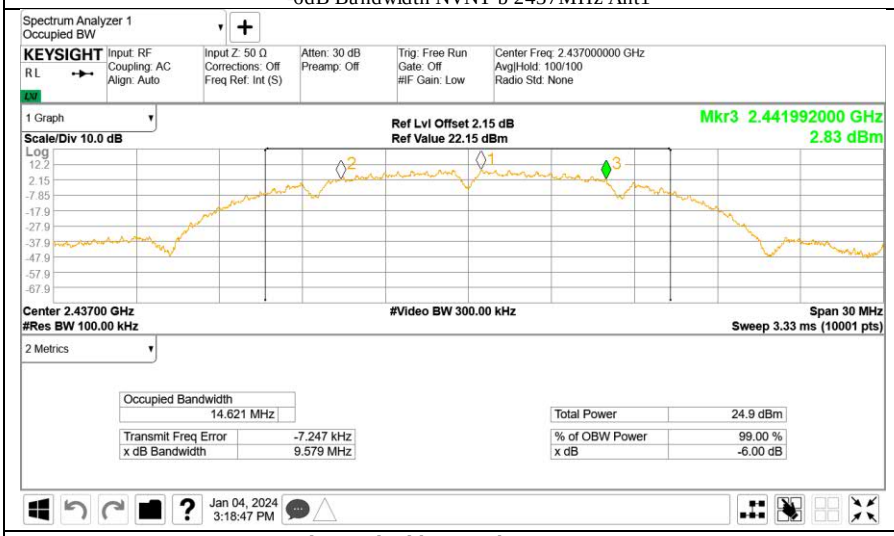
## 6 dB Bandwidth

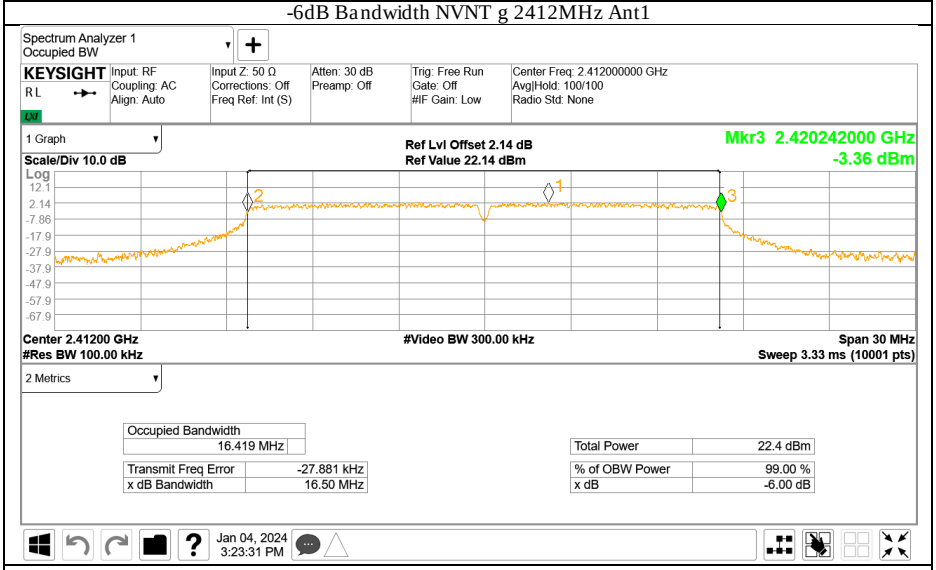
| Test Graphs |
|---|
| -6dB Bandwidth NVNT b 2412MHz Ant1 |


| -6dB Bandwidth NVNT b 2437MHz Ant1 |
|---|

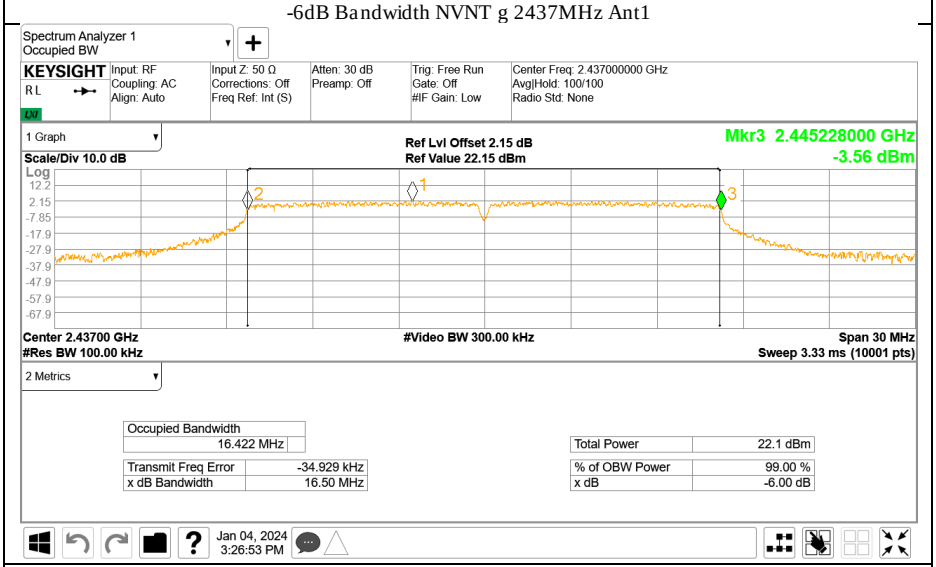



| -6dB Bandwidth NVNT b 2462MHz Ant1 |
|---|

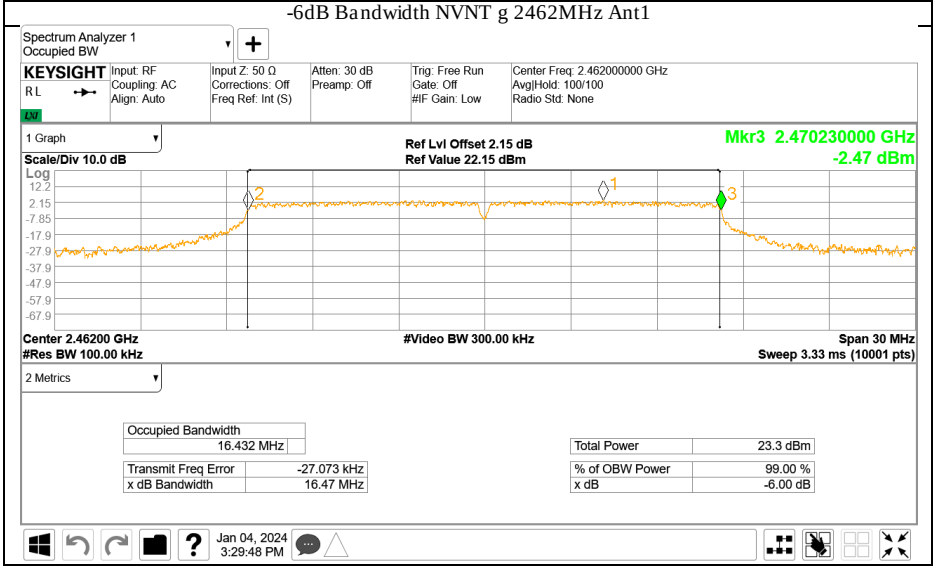
-6dB Bandwidth NVNT g 2412MHz Ant1




-6dB Bandwidth NVNT g 2437MHz Ant1




-6dB Bandwidth NVNT g 2462MHz Ant1



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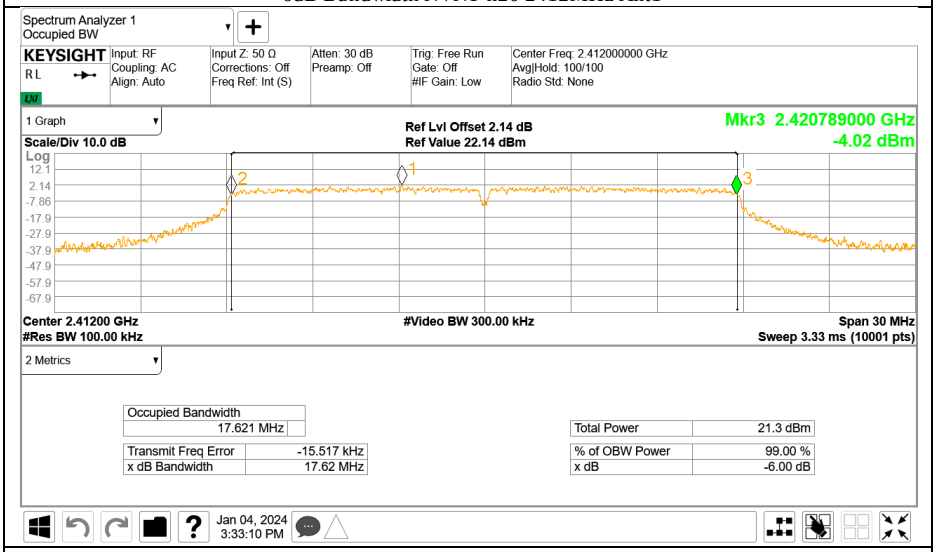
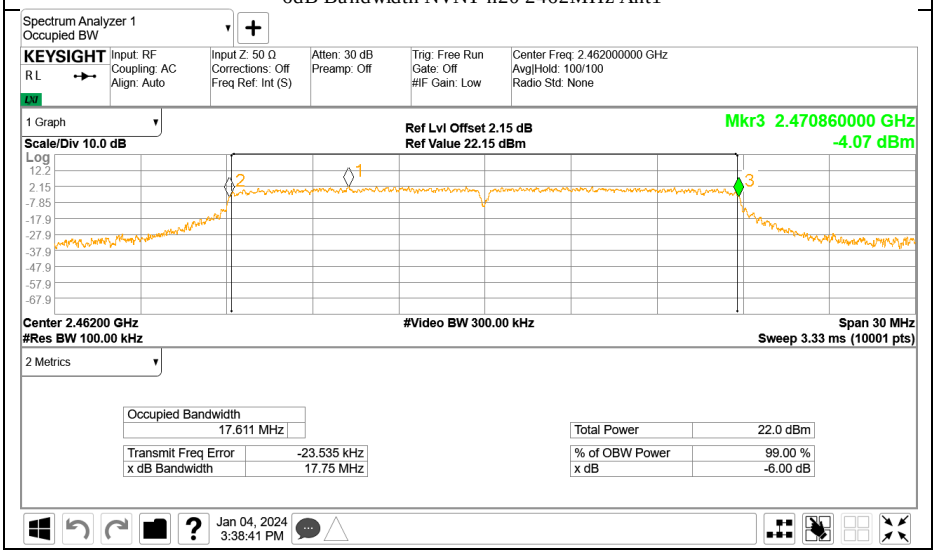
-6dB Bandwidth NVNT n20 2412MHz Ant1




-6dB Bandwidth NVNT n20 2437MHz Ant1


-6dB Bandwidth NVNT n20 2462MHz Ant1



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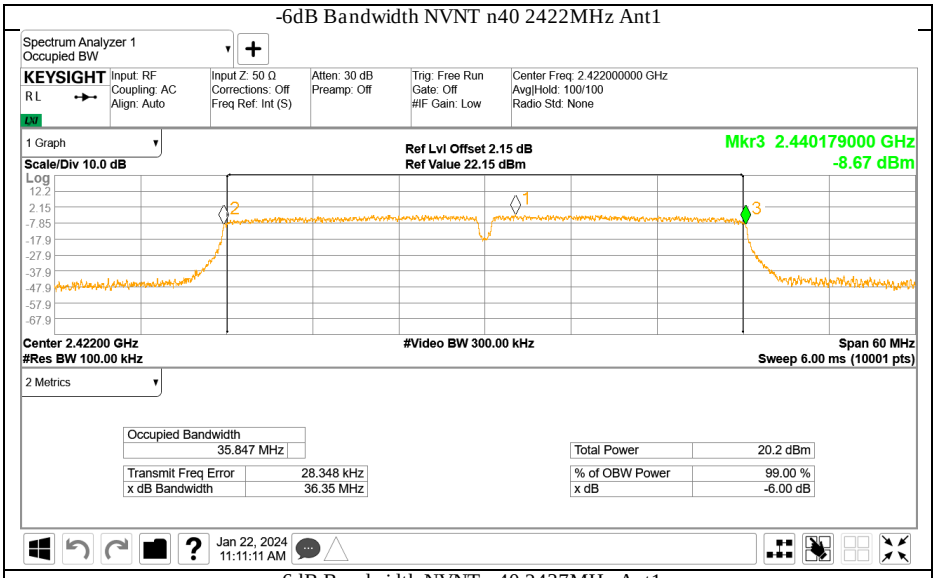
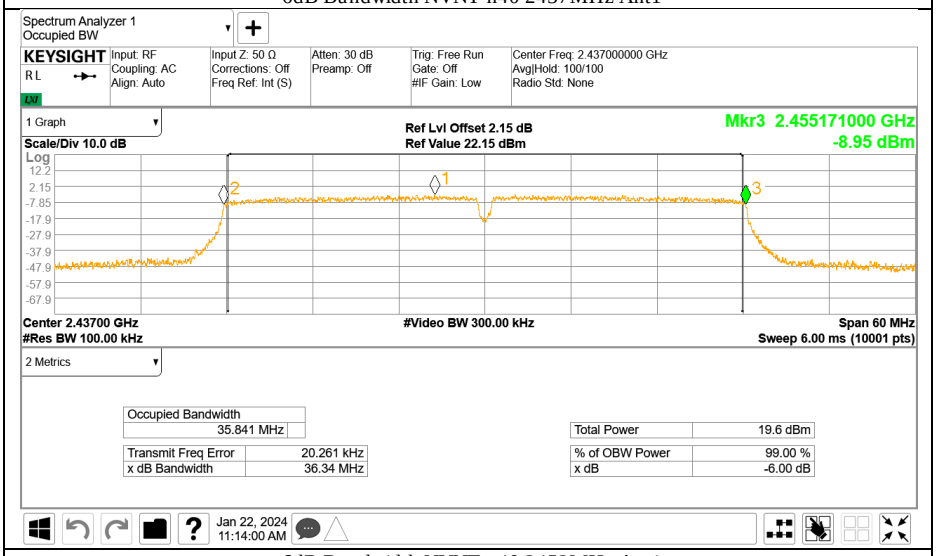
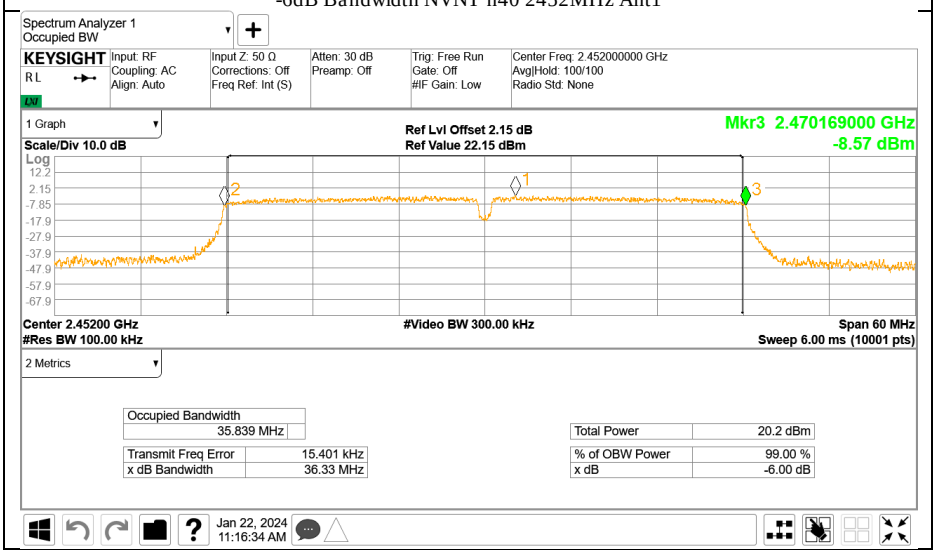
-6dB Bandwidth NVNT n40 2422MHz Ant1




-6dB Bandwidth NVNT n40 2437MHz Ant1




-6dB Bandwidth NVNT n40 2452MHz Ant1



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## 10.4 Power spectral density

**Test Method**

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance:

1. The RF output of EUT was connected to the spectrum analyzer. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings:
4. Set analyzer center frequency to DTS channel center frequency. RBW=3kHz, VBW≥3RBW, Span=1.5 times DTS bandwidth, Detector=Peak, Sweep=auto, Trace= max hold.
5. Allow trace to fully stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.
6. Repeat above procedures until other frequencies measured were completed.

**Limit**

| Limit [dBm/3KHz] |
|---|
| ≤8 |

**Test result**

802.11 B

| Frequency MHz | Power spectral density dBm/3kHz | Result |
|---|---|---|
| Low channel 2412MHz | -11.26 | Pass |
| Middle channel 2437MHz | -11.2 | Pass |
| High channel 2462MHz | -10.98 | Pass |

802.11 G

| Frequency MHz | Power spectral density dBm/3kHz | Result |
|---|---|---|
| Low channel 2412MHz | -11.42 | Pass |
| Middle channel 2437MHz | -11.72 | Pass |
| High channel 2462MHz | -10.51 | Pass |

802.11 N20

| Frequency MHz | Power spectral density dBm/3kHz | Result |
|---|---|---|
| Low channel 2412MHz | -12.31 | Pass |
| Middle channel 2437MHz | -12.47 | Pass |
| High channel 2462MHz | -11.61 | Pass |

802.11 N40

| Frequency MHz | Power spectral density dBm/3kHz | Result |
|---|---|---|
| Low channel 2422MHz | -13.26 | Pass |
| Middle channel 2437MHz | -13.69 | Pass |
| High channel 2452MHz | -13.44 | Pass |


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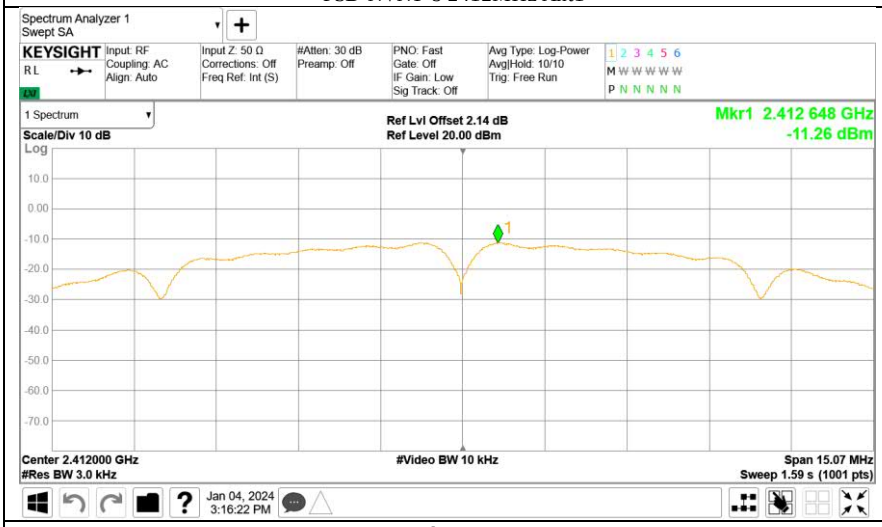
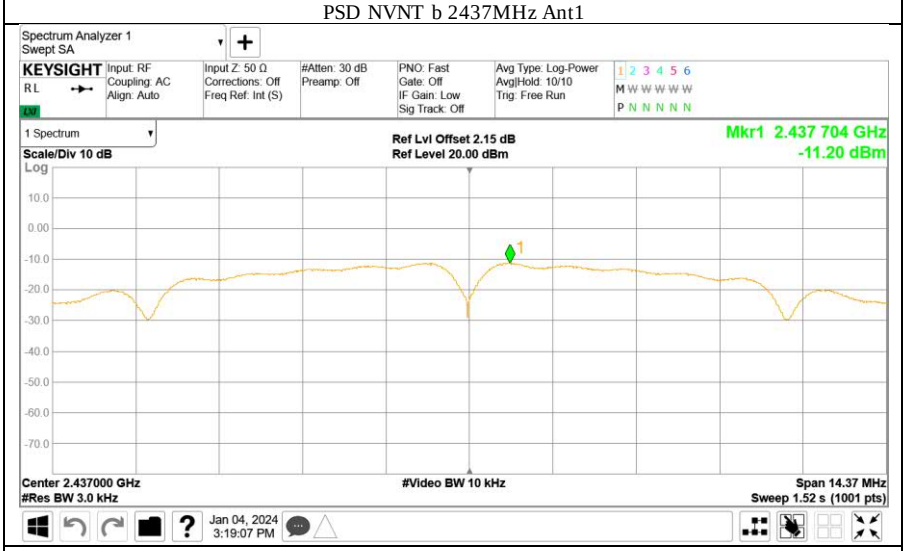
## Power Spectral Density Level

Test Graphs

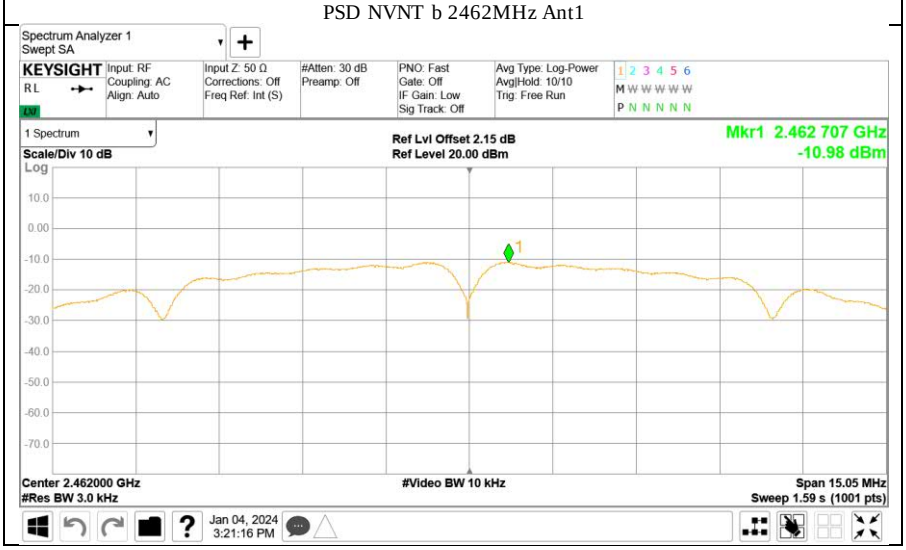
PSD NVNT b 2412MHz Ant1




PSD NVNT b 2437MHz Ant1




PSD NVNT b 2462MHz Ant1



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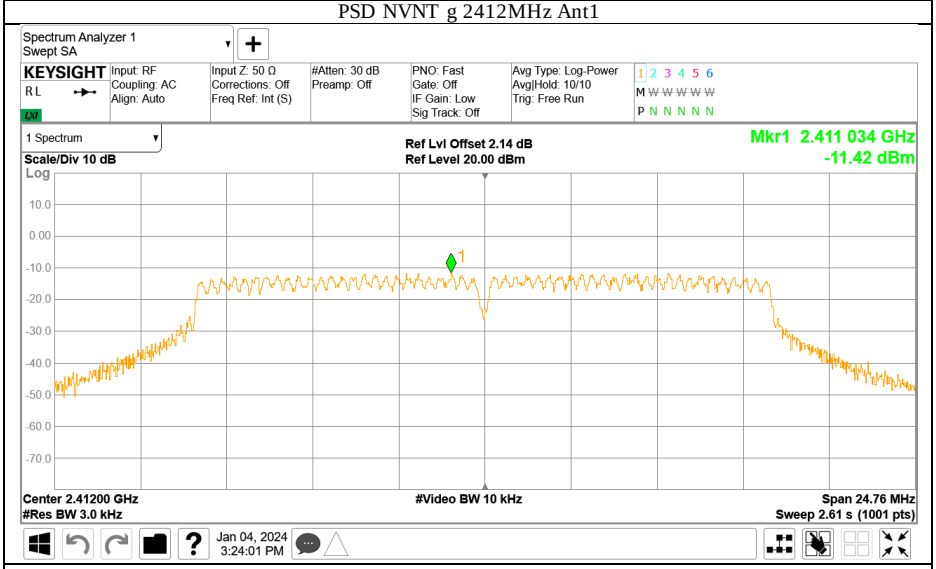
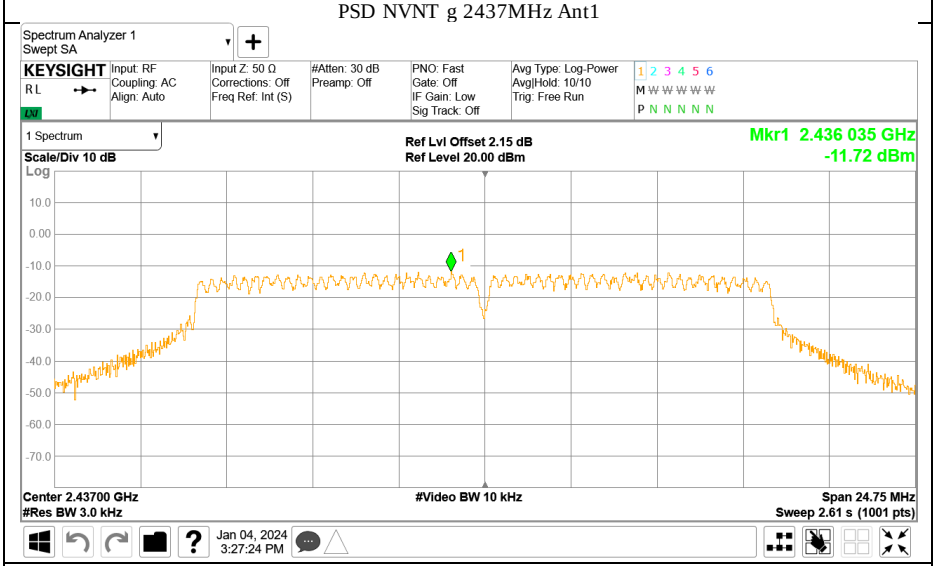
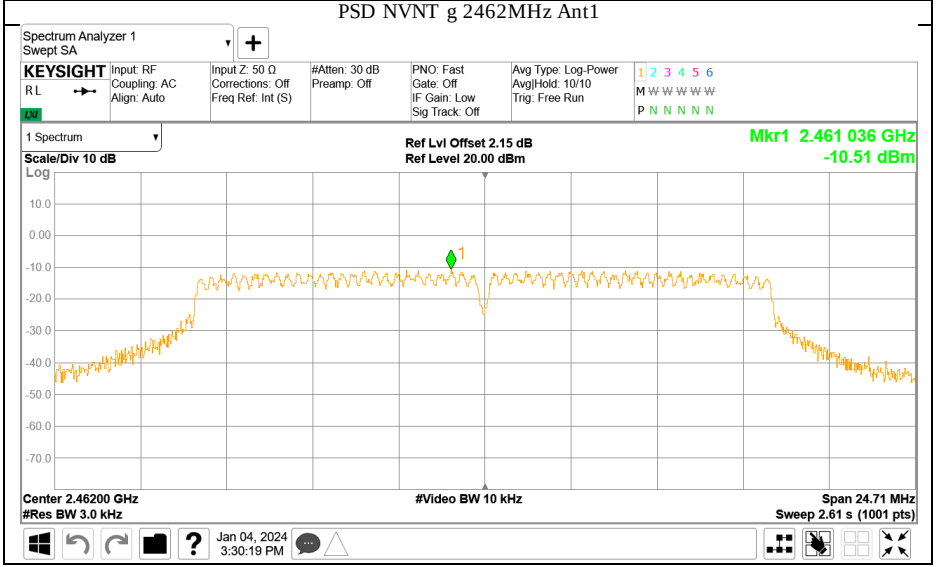
PSD NVNT g 2412MHz Ant1




PSD NVNT g 2437MHz Ant1




PSD NVNT g 2462MHz Ant1



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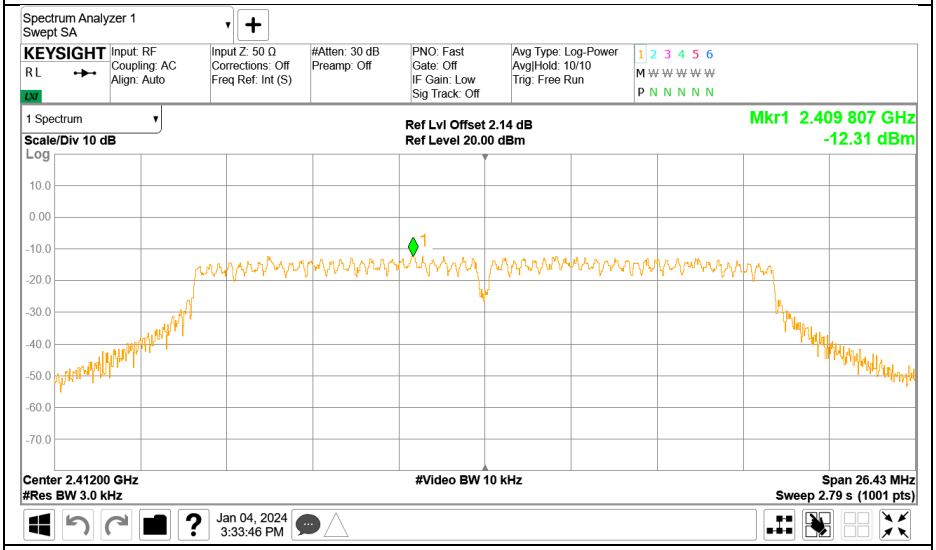
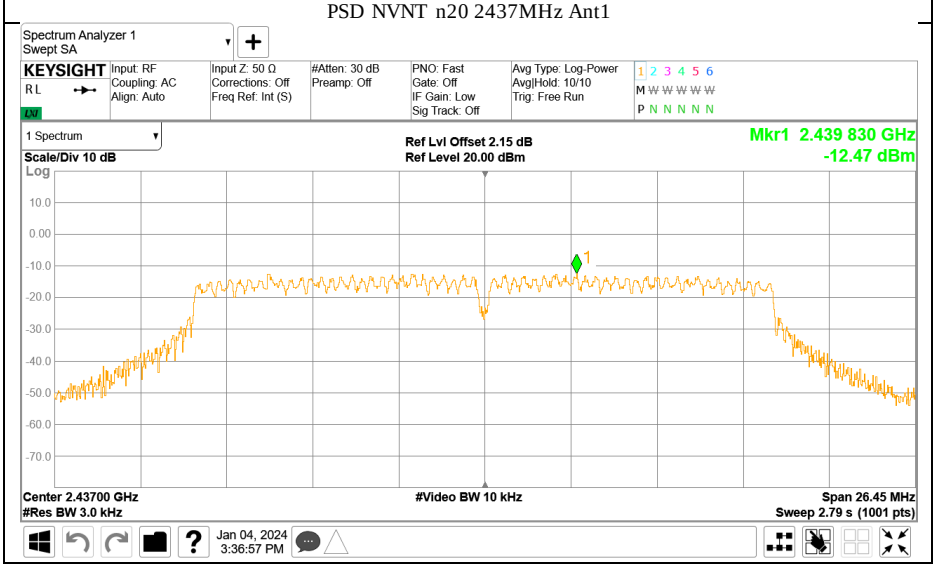
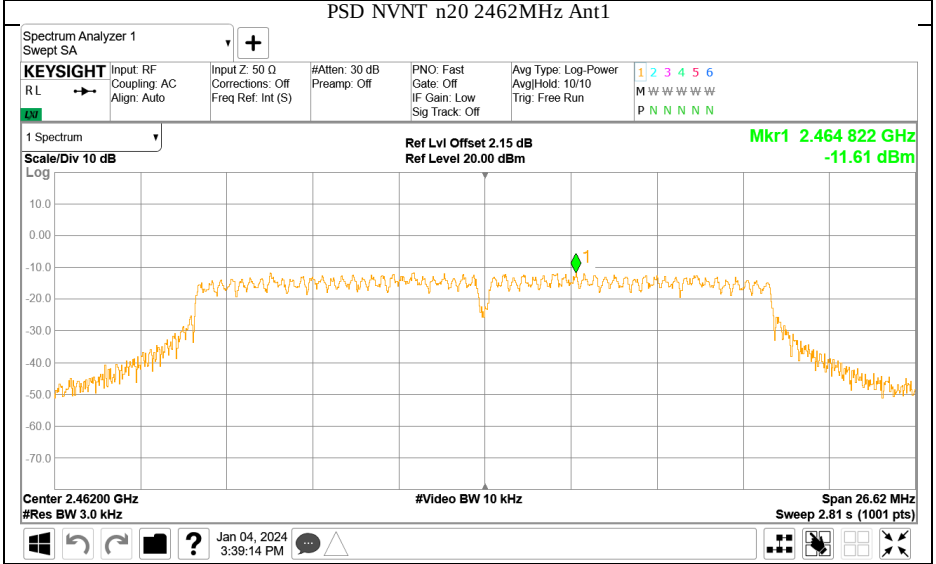
PSD NVNT n20 2412MHz Ant1




PSD NVNT n20 2437MHz Ant1




PSD NVNT n20 2462MHz Ant1



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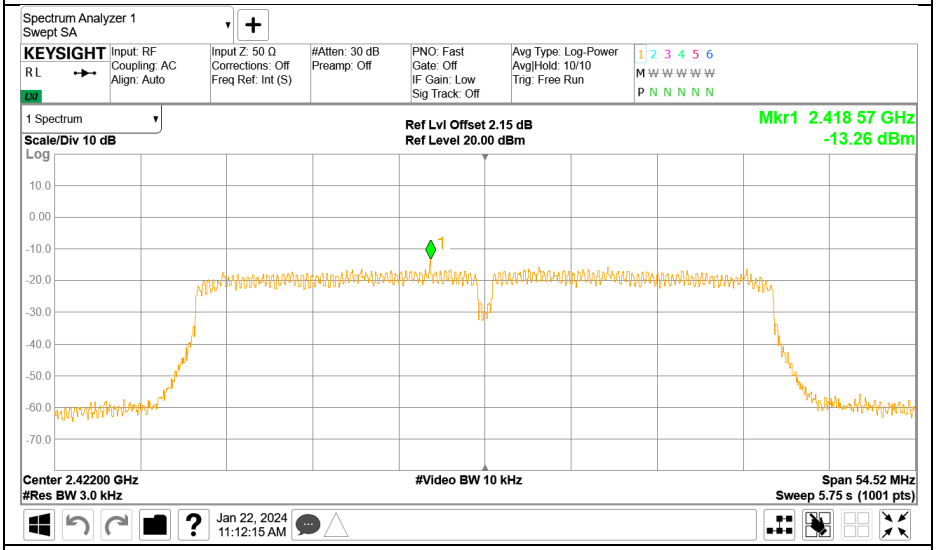
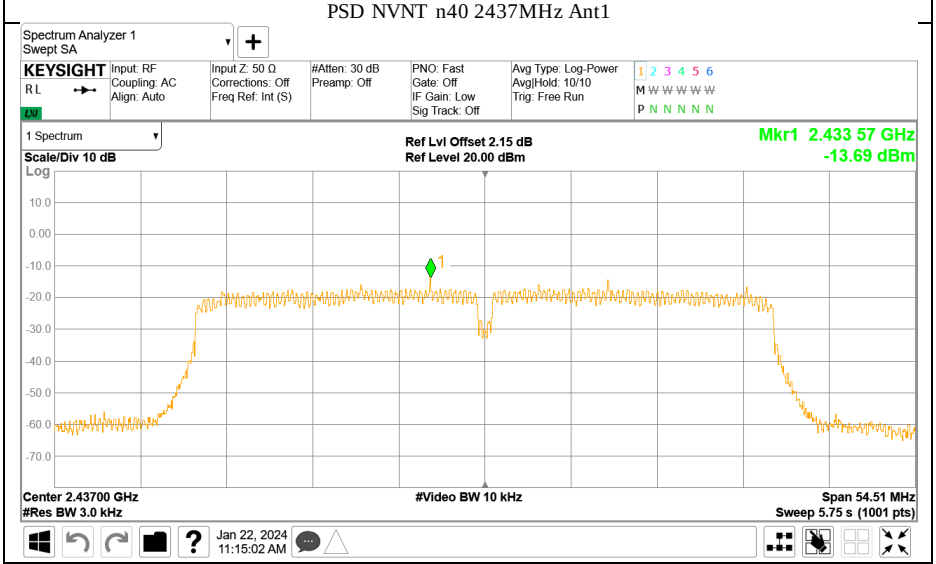
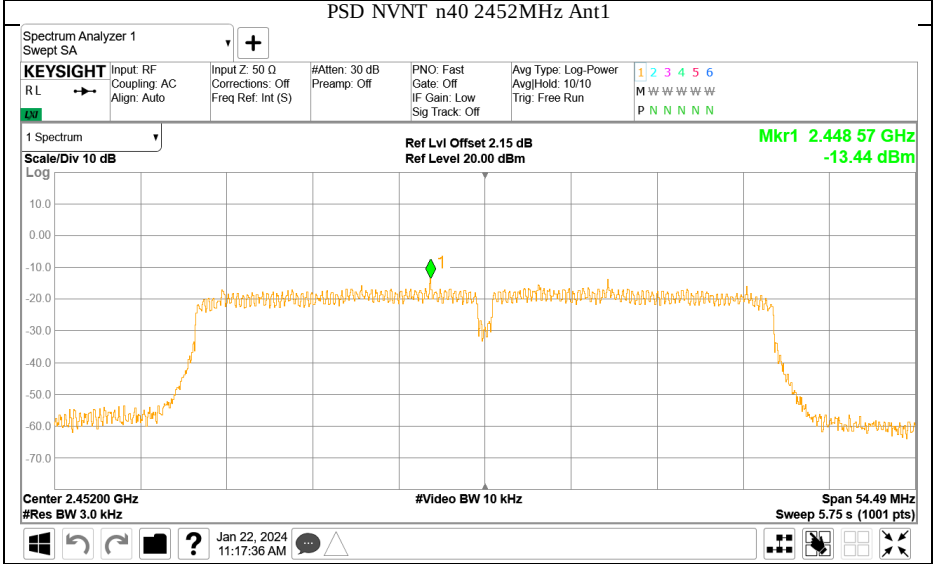
PSD NVNT n40 2422MHz Ant1




PSD NVNT n40 2437MHz Ant1




PSD NVNT n40 2452MHz Ant1



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## 10.5 Spurious RF conducted emissions

**Test Method**

1. The RF output of EUT was connected to the spectrum analyzer by RF cable. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10$^{th}$ harmonic. Typically, several plots are required to cover this entire span.
   RBW = 100 kHz, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
5. The level displayed must comply with the limit specified in this Section. Submit these plots.
6. Repeat above procedures until all frequencies measured were complete.

**Limit**

| Frequency Range MHz | Limit (dBc) |
|---|---|
| 30-25000 | -20 |


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## Spurious RF conducted emissions

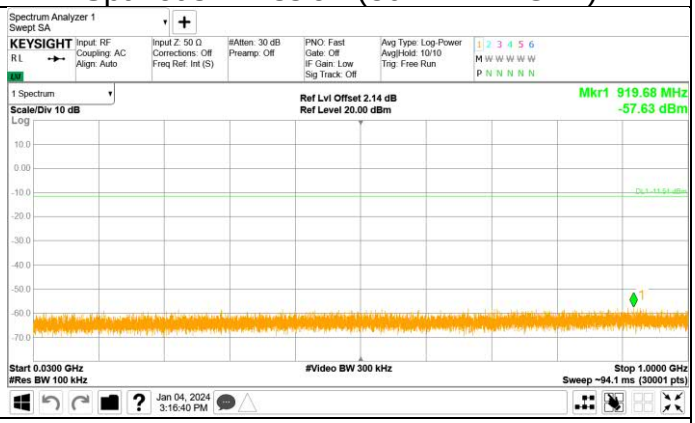
802.11 B

Out-of-Band Emissions

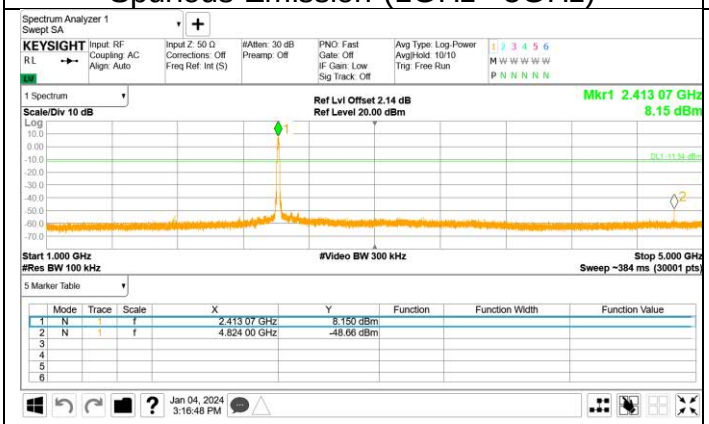
Channel 1 (2412MHz)

Reference point

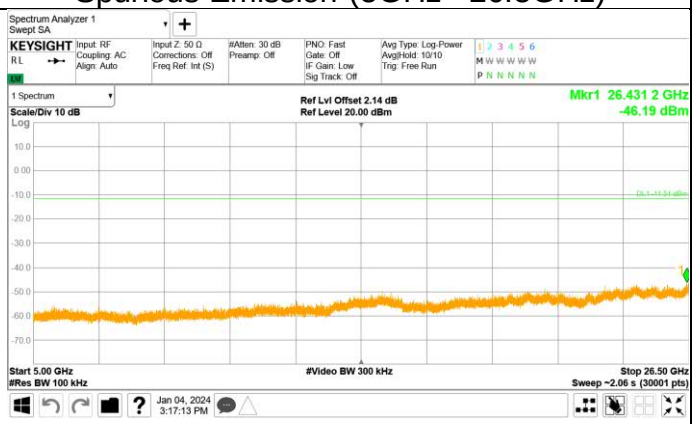

Spurious Emission (30MHz – 1GHz)




Spurious Emission (1GHz –5GHz)




Spurious Emission (5GHz –26.5GHz)



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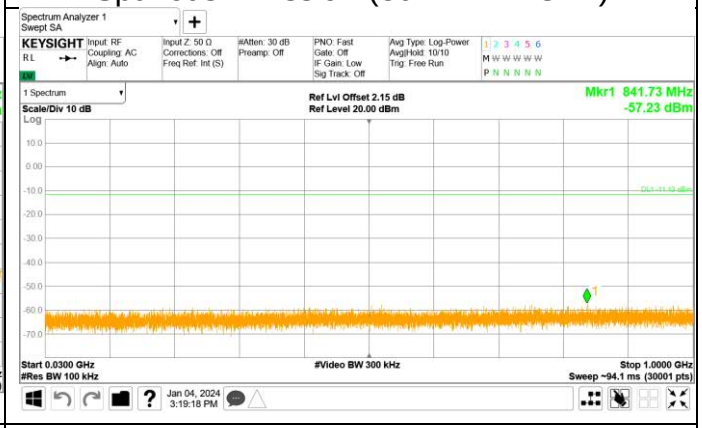
## Out-of-Band Emissions

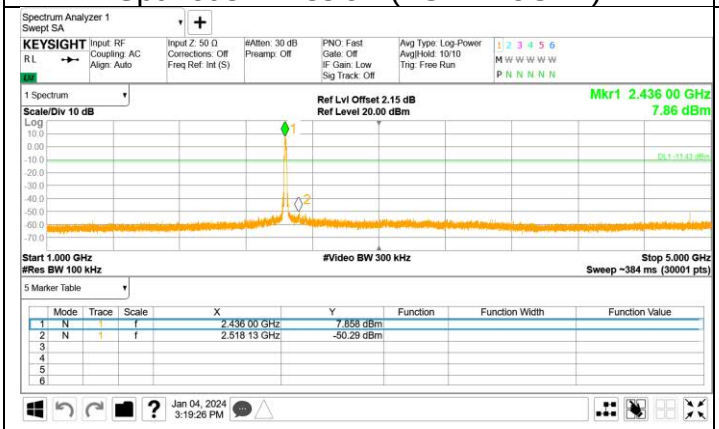
### Channel 6 (2437MHz)

#### Reference point

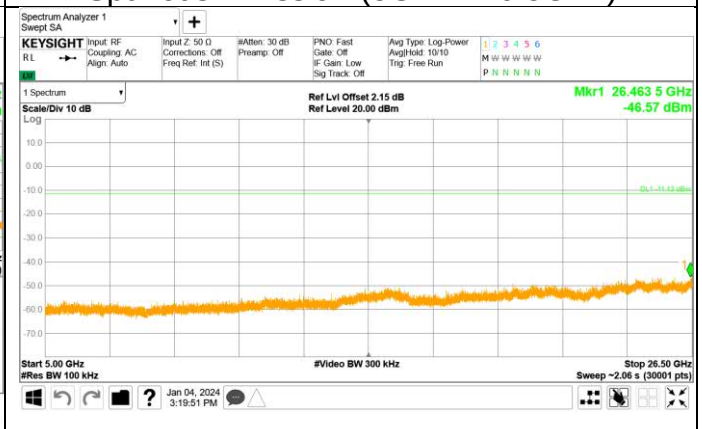

#### Spurious Emission (30MHz – 1GHz)




#### Spurious Emission (1GHz –5GHz)




#### Spurious Emission (5GHz –26.5GHz)



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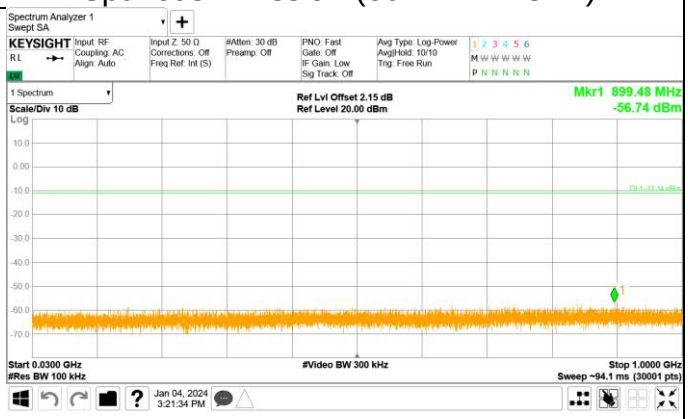
## Out-of-Band Emissions

### Channel 11 (2462MHz)

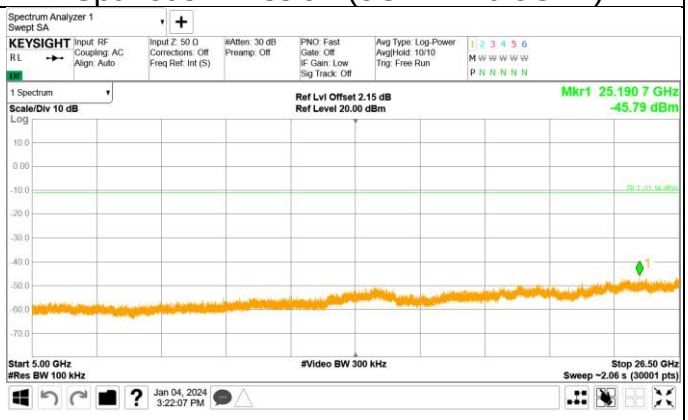
#### Reference point


#### Spurious Emission (30MHz – 1GHz)




#### Spurious Emission (1GHz –5GHz)


#### Spurious Emission (5GHz –26.5GHz)



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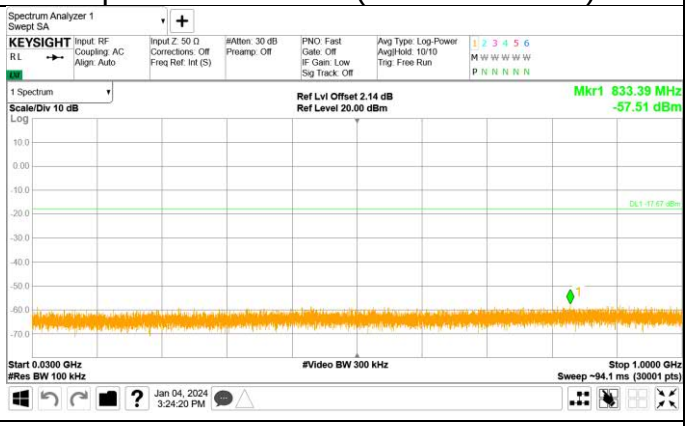
802.11 G

## Out-of-Band Emissions

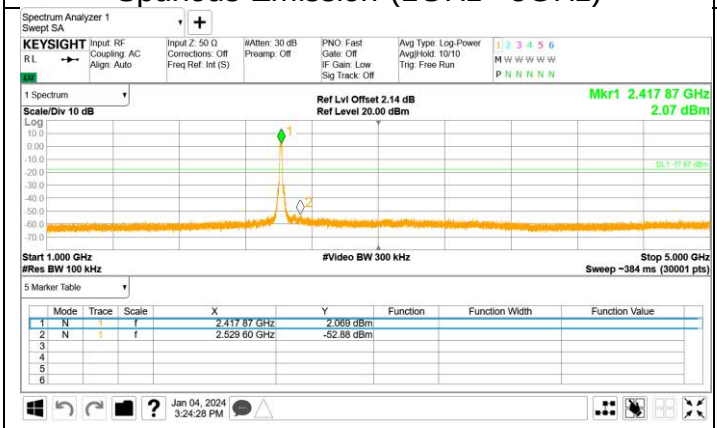
### Channel 1 (2412MHz)

#### Reference point

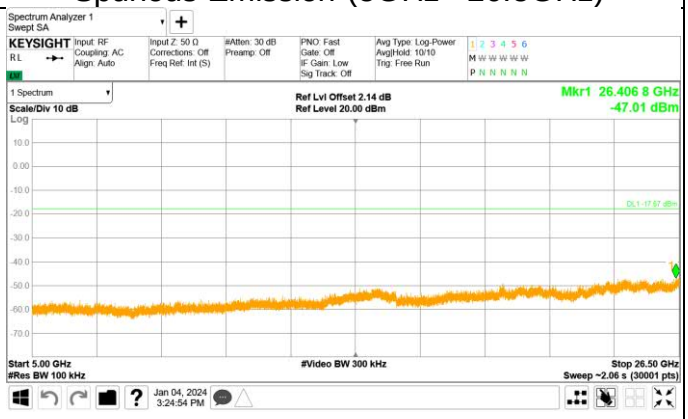

#### Spurious Emission (30MHz – 1GHz)




#### Spurious Emission (1GHz –5GHz)




#### Spurious Emission (5GHz –26.5GHz)



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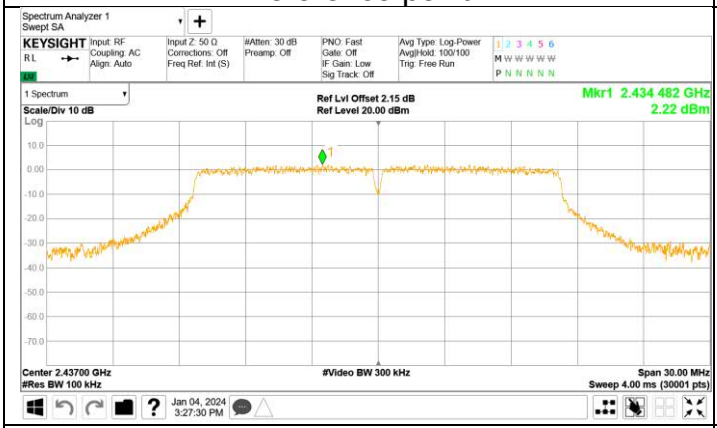
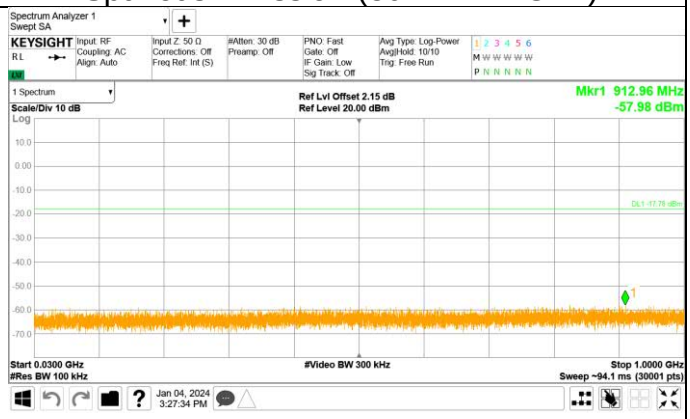
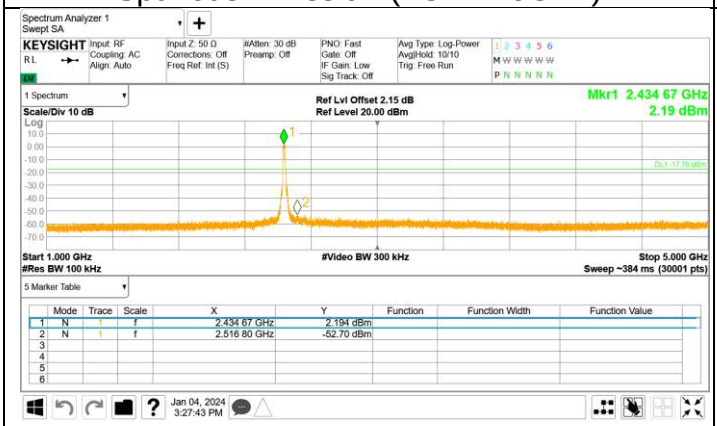
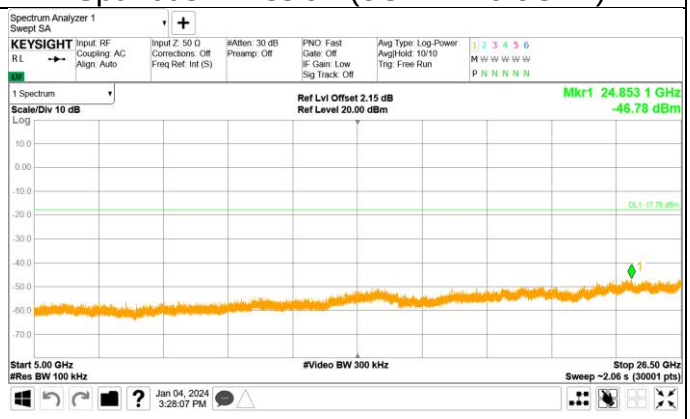
| Out-of-Band Emissions | |
|---|---|
| Channel 6 (2437MHz) | |
| Reference point | Spurious Emission (30MHz – 1GHz) |
|  |  |
| Spurious Emission (1GHz –5GHz) | Spurious Emission (5GHz –26.5GHz) |
|  |  |



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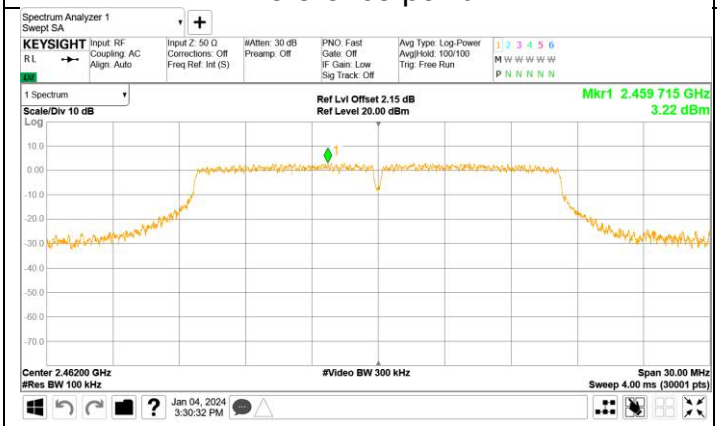
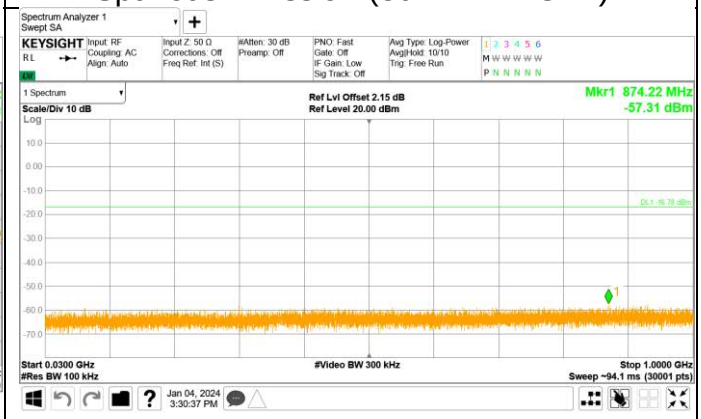
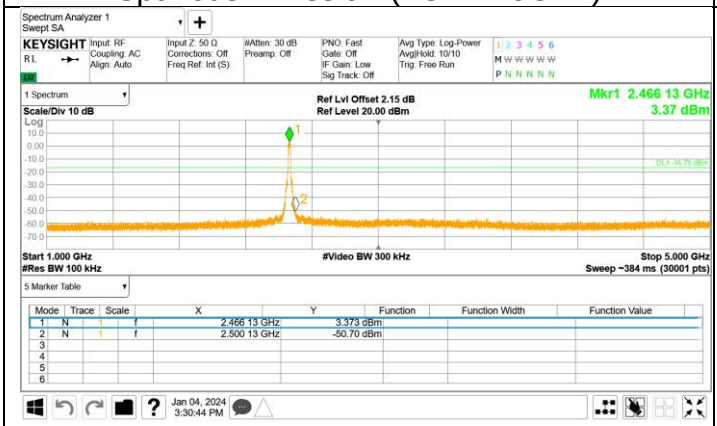
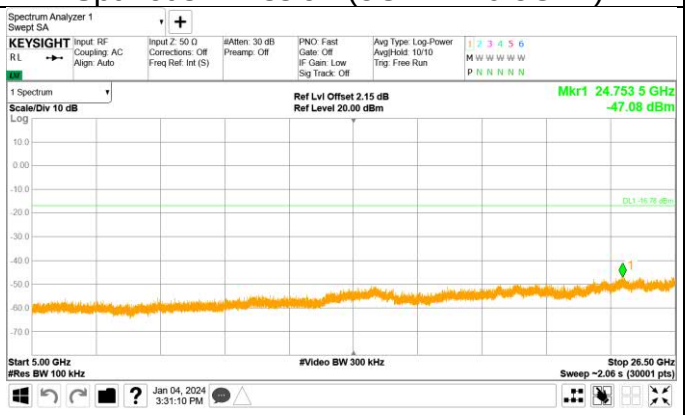
| Out-of-Band Emissions | |
|---|---|
| Channel 11 (2462MHz) | |
| Reference point | Spurious Emission (30MHz – 1GHz) |
|  |  |
| Spurious Emission (1GHz –5GHz) | Spurious Emission (5GHz –26.5GHz) |
|  |  |



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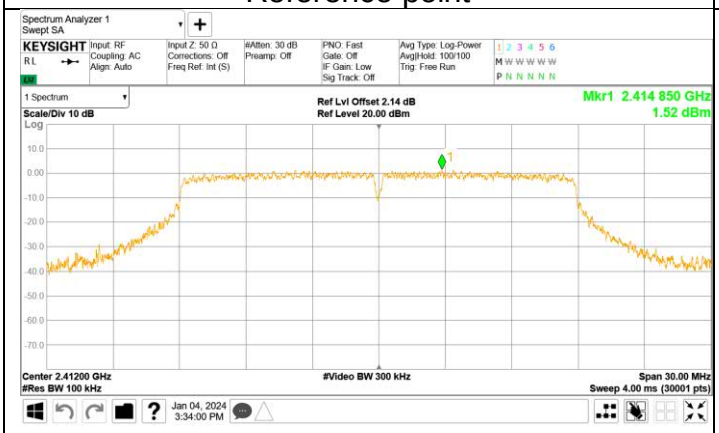
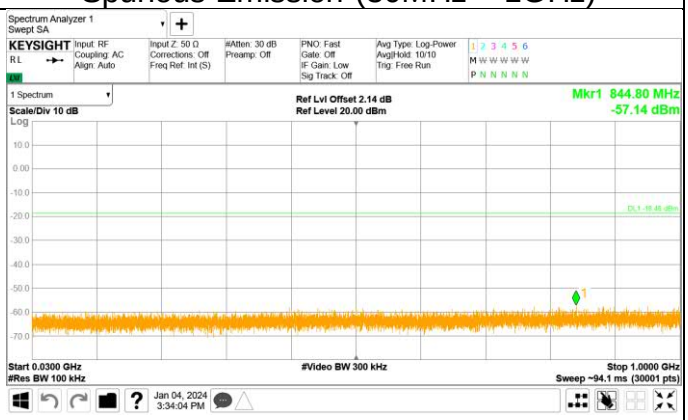
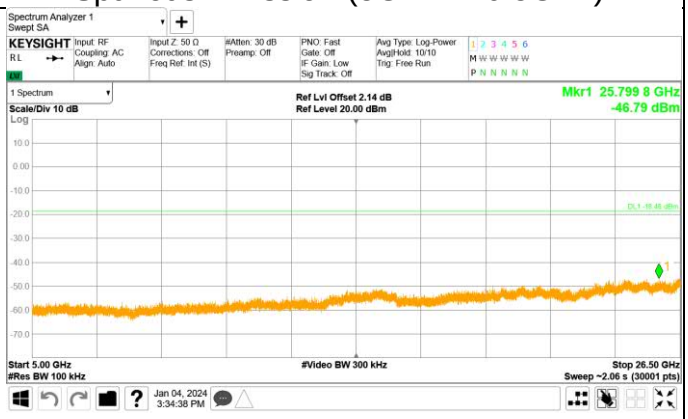
802.11 N HT20

| Out-of-Band Emissions | |
|---|---|
| Channel 1 (2412MHz) | |
| Reference point | Spurious Emission (30MHz – 1GHz) |
|  |  |
| Spurious Emission (1GHz –5GHz) | Spurious Emission (5GHz –26.5GHz) |
|  |  |



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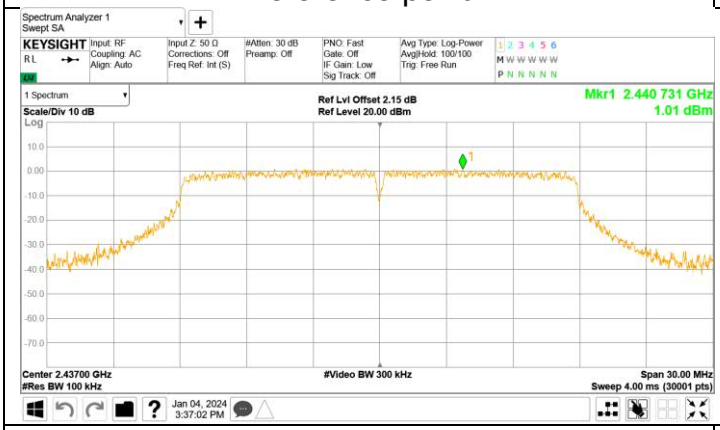
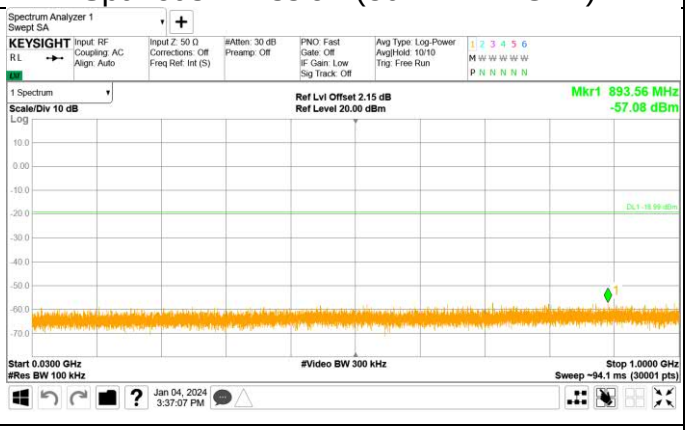
## Out-of-Band Emissions

### Channel 6 (2437MHz)

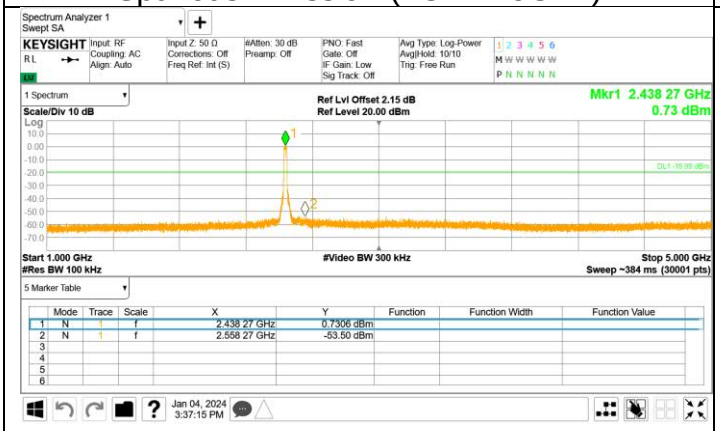
#### Reference point



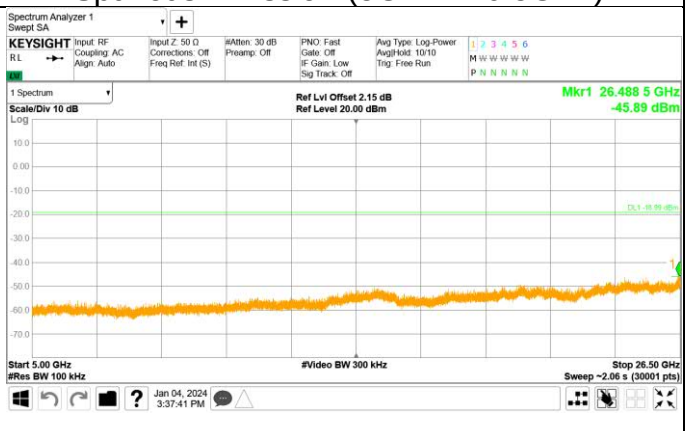

#### Spurious Emission (30MHz – 1GHz)




#### Spurious Emission (1GHz –5GHz)




#### Spurious Emission (5GHz –26.5GHz)



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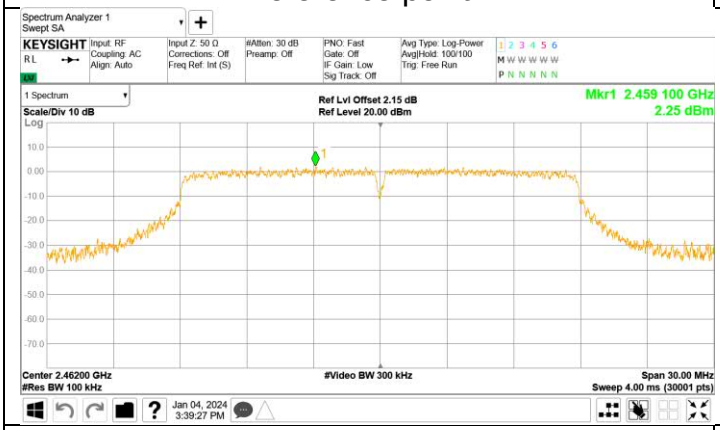
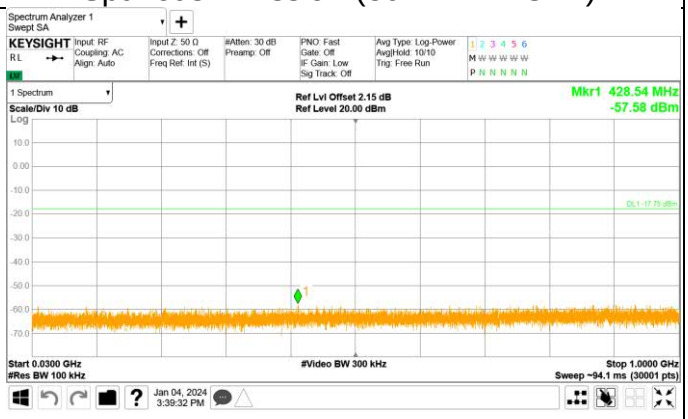
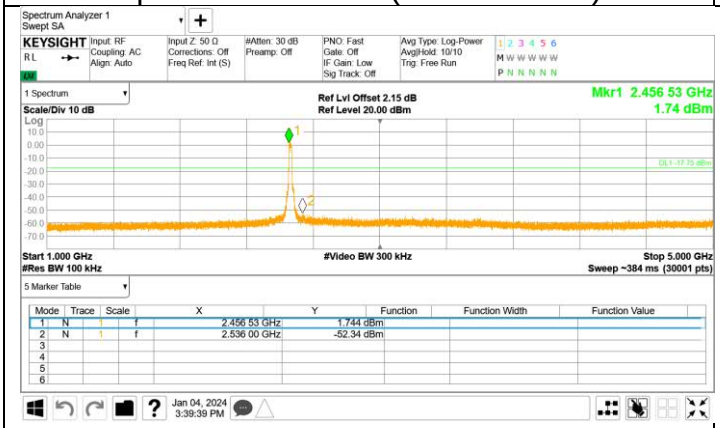
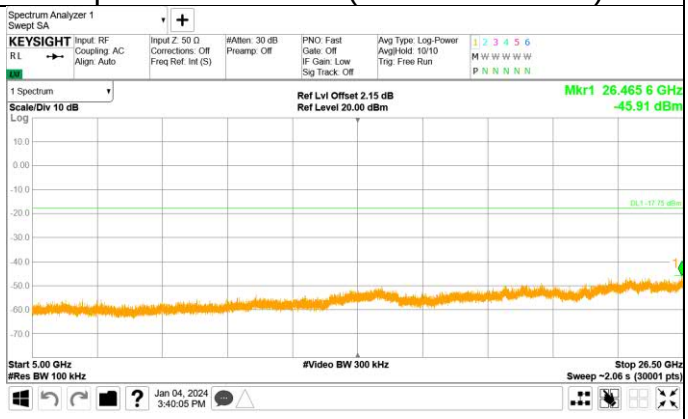
| Out-of-Band Emissions | |
|---|---|
| Channel 11 (2462MHz) | |
| Reference point | Spurious Emission (30MHz – 1GHz) |
|  |  |
| Spurious Emission (1GHz –5GHz) | Spurious Emission (5GHz –26.5GHz) |
|  |  |



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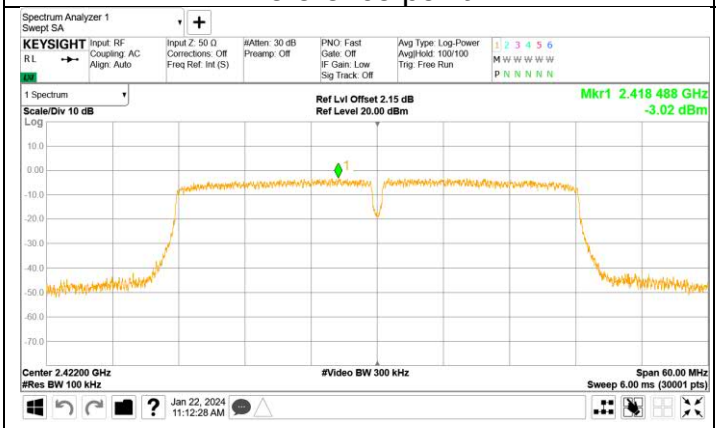
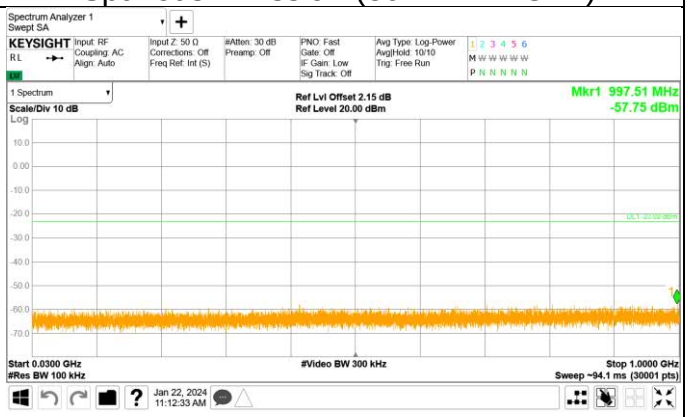
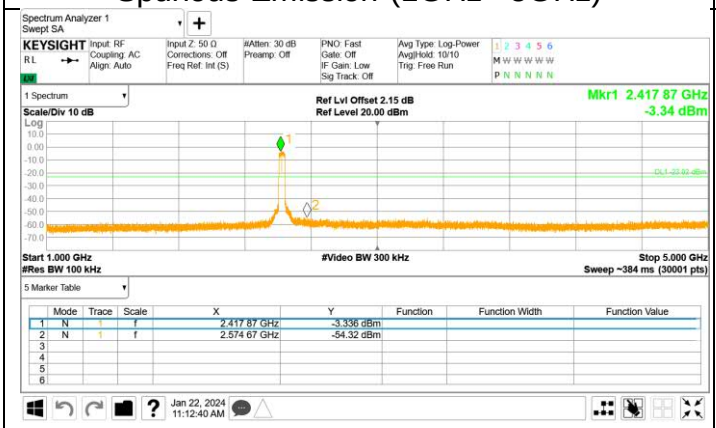
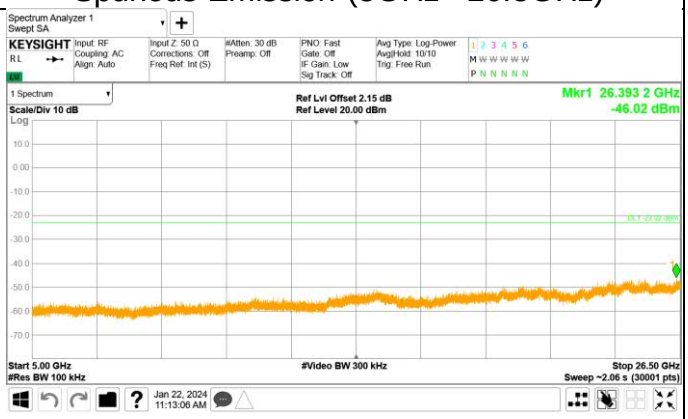
802.11 N HT40

| Out-of-Band Emissions | |
|---|---|
| Channel 3 (2422MHz) | |
| Reference point | Spurious Emission (30MHz – 1GHz) |
|  |  |
| Spurious Emission (1GHz –5GHz) | Spurious Emission (5GHz –26.5GHz) |
|  |  |



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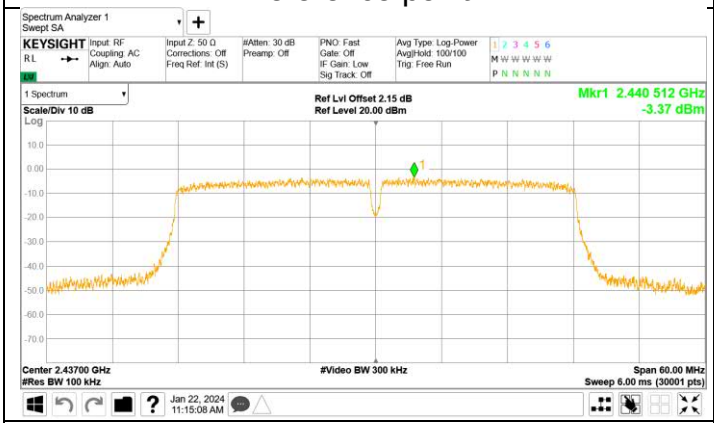
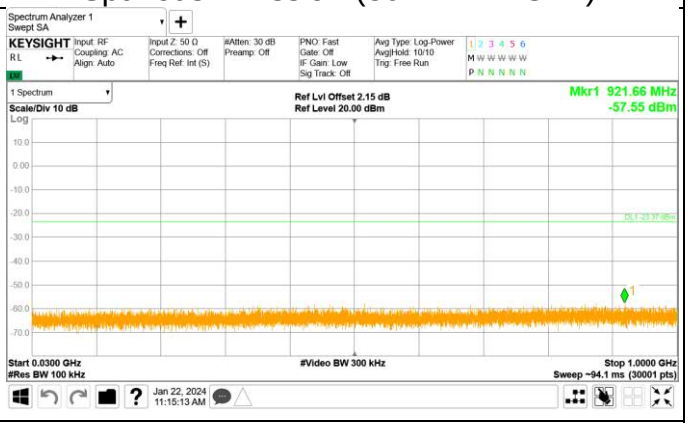
## Out-of-Band Emissions

### Channel 6 (2437MHz)

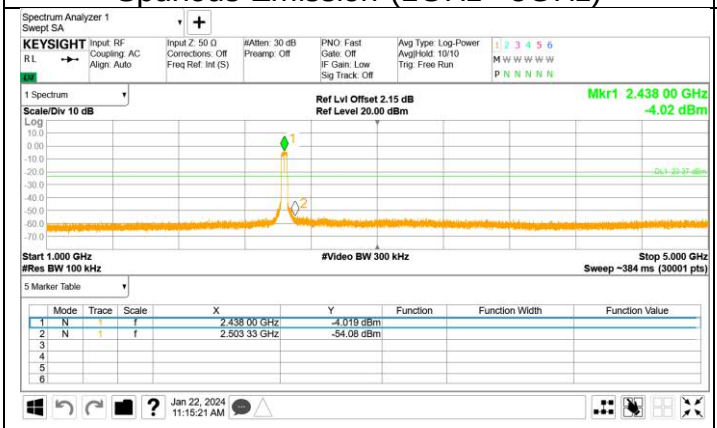
#### Reference point



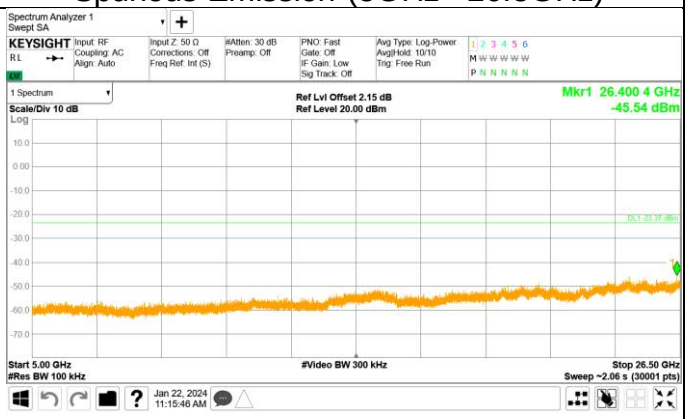

#### Spurious Emission (30MHz – 1GHz)




#### Spurious Emission (1GHz –5GHz)




#### Spurious Emission (5GHz –26.5GHz)



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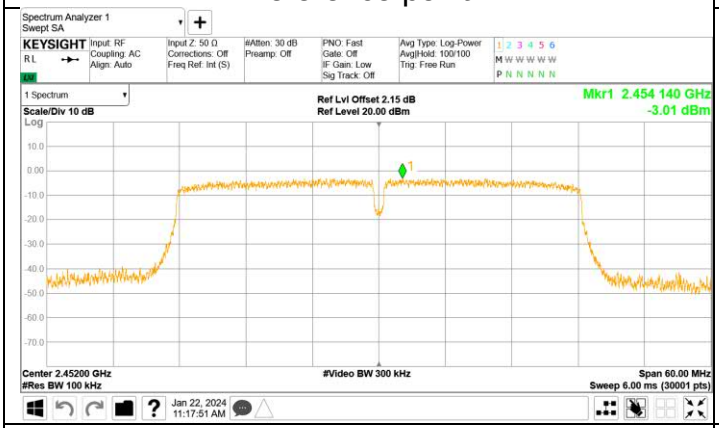
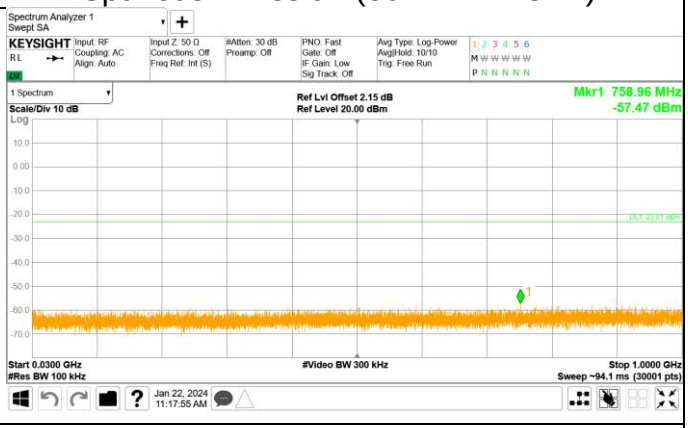
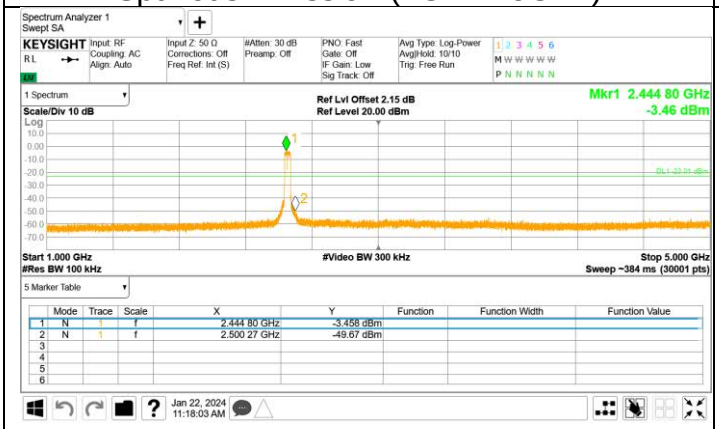
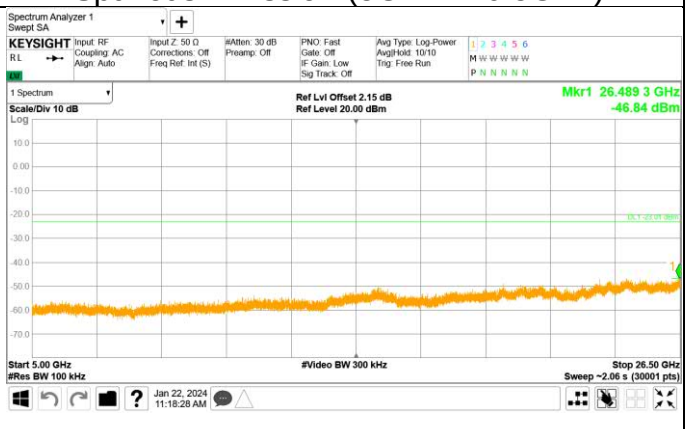
| Out-of-Band Emissions | |
|---|---|
| Channel 9 (2452MHz) | |
| Reference point | Spurious Emission (30MHz – 1GHz) |
|  |  |
| Spurious Emission (1GHz –5GHz) | Spurious Emission (5GHz –26.5GHz) |
|  |  |



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## 10.6 Band edge

**Test Method**

1. The RF output of EUT was connected to the spectrum analyzer by RF cable. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peak level of the in-band emission and all spurious
   RBW = 100 kHz, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Allow the trace to stabilize, use the peak and delta measurement to record the result.
5. The level displayed must comply with the limit specified in this Section.
6. Repeat above procedures until all frequencies measured were complete and submit all the plots.

**Limit:**

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that 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 § 15.247(b)(3), the attenuation required shall be 30 dB instead of 20 dB.

| Frequency Range MHz | Limit (dBc) |
|---|---|
| 30-25000 | -20 |


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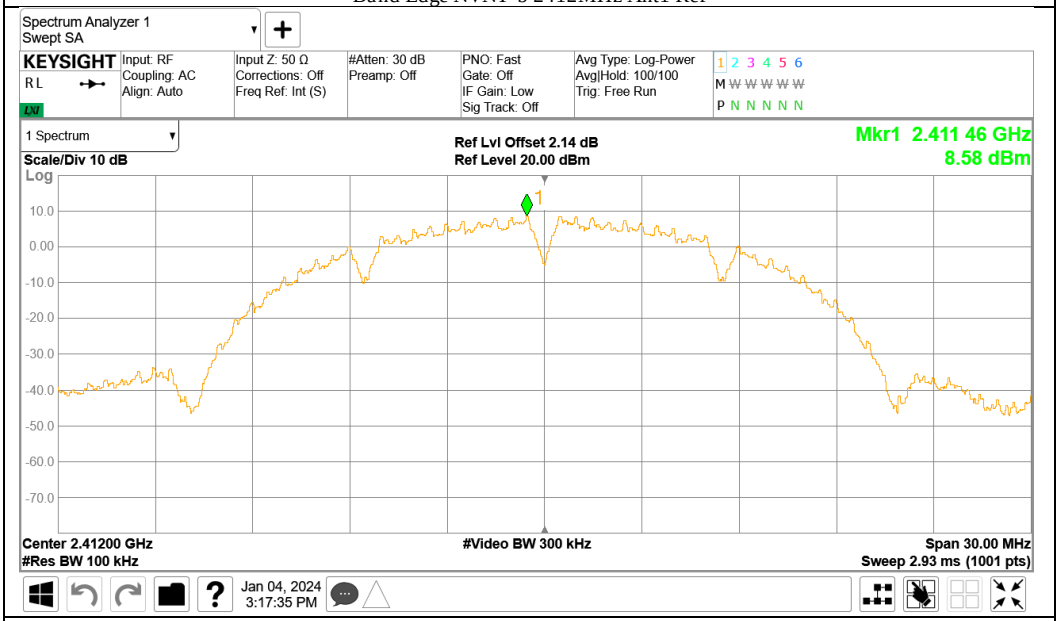
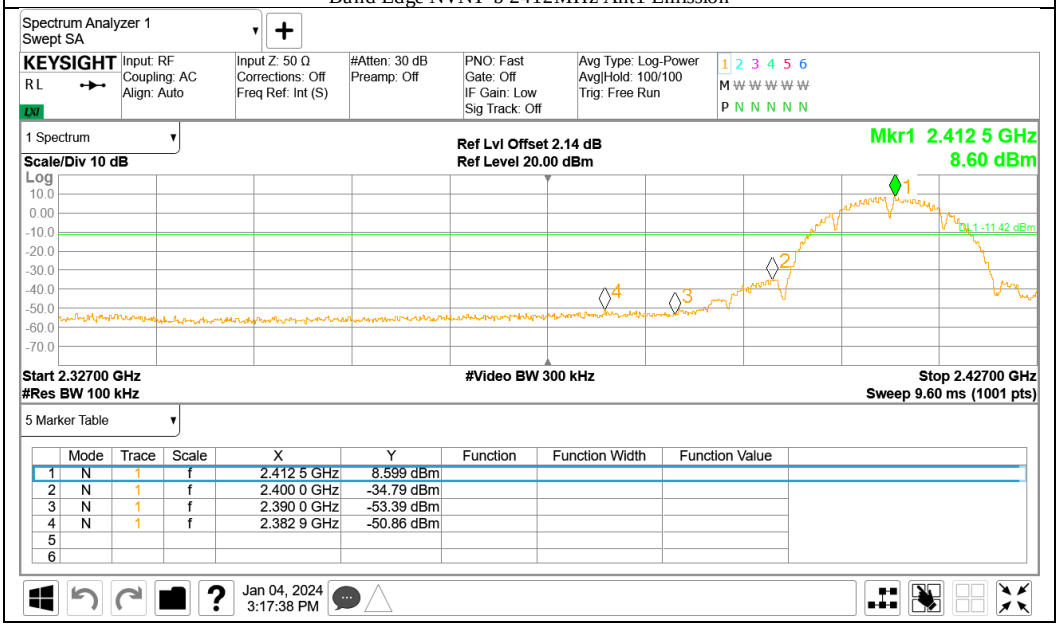
## Test result

Test Graphs

Band Edge NVNT b 2412MHz Ant1 Ref




Band Edge NVNT b 2412MHz Ant1 Emission




| | Mode | Trace | Scale | X | Y | Function | Function Width | Function Value |
|---|---|---|---|---|---|---|---|---|
| 1 | N | 1 | f | 2.412 5 GHz | 8.599 dBm | | | |
| 2 | N | 1 | f | 2.400 0 GHz | -34.79 dBm | | | |
| 3 | N | 1 | f | 2.390 0 GHz | -53.39 dBm | | | |
| 4 | N | 1 | f | 2.382 9 GHz | -50.86 dBm | | | |
| 5 | | | | | | | | |
| 6 | | | | | | | | |



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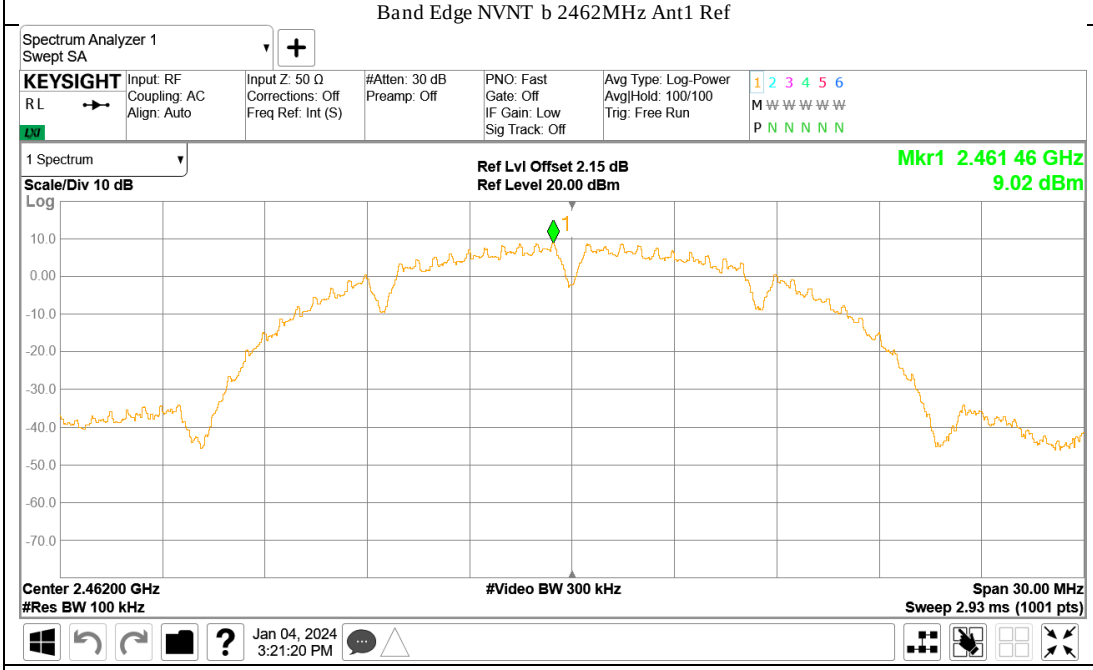
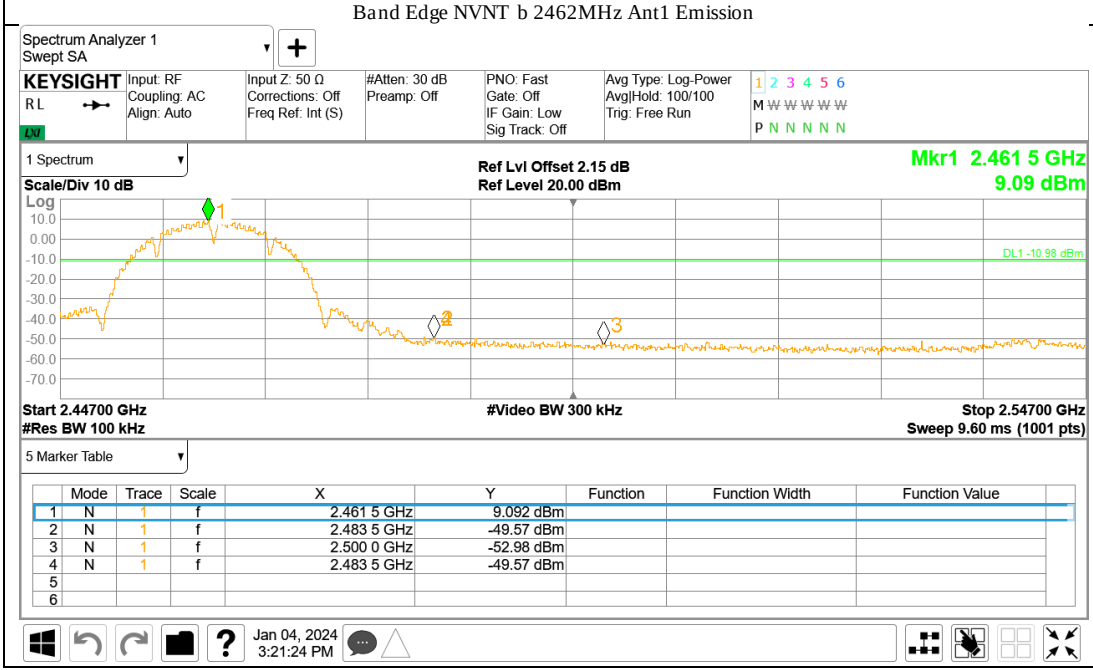
Band Edge NVNT b 2462MHz Ant1 Ref




Band Edge NVNT b 2462MHz Ant1 Emission



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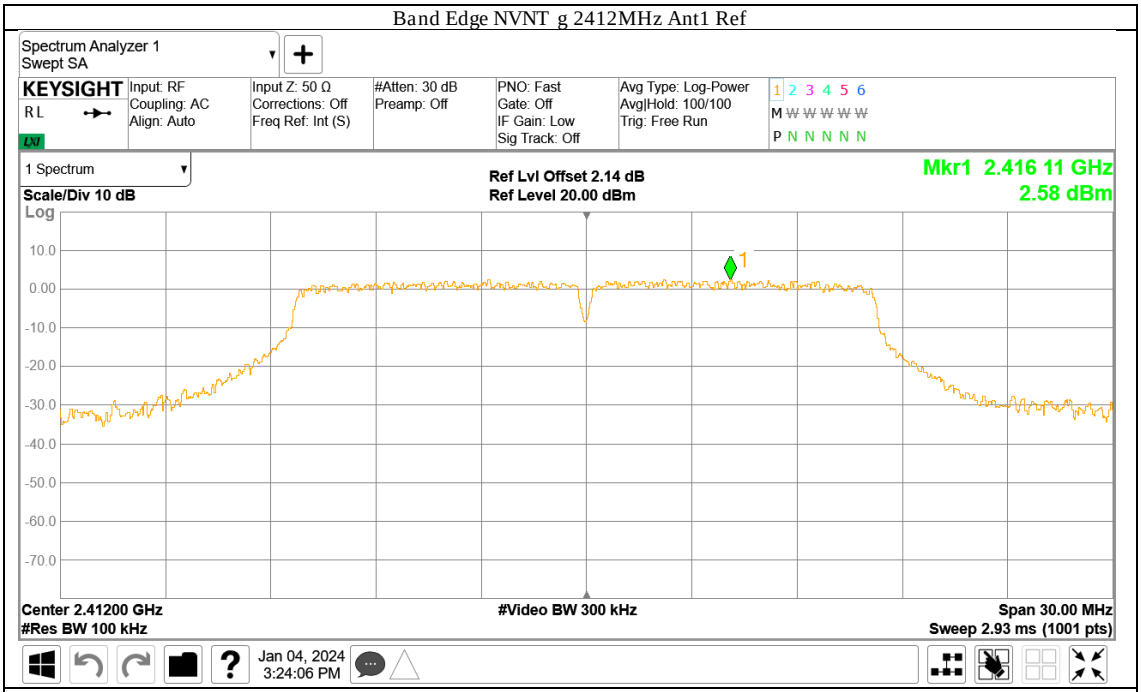
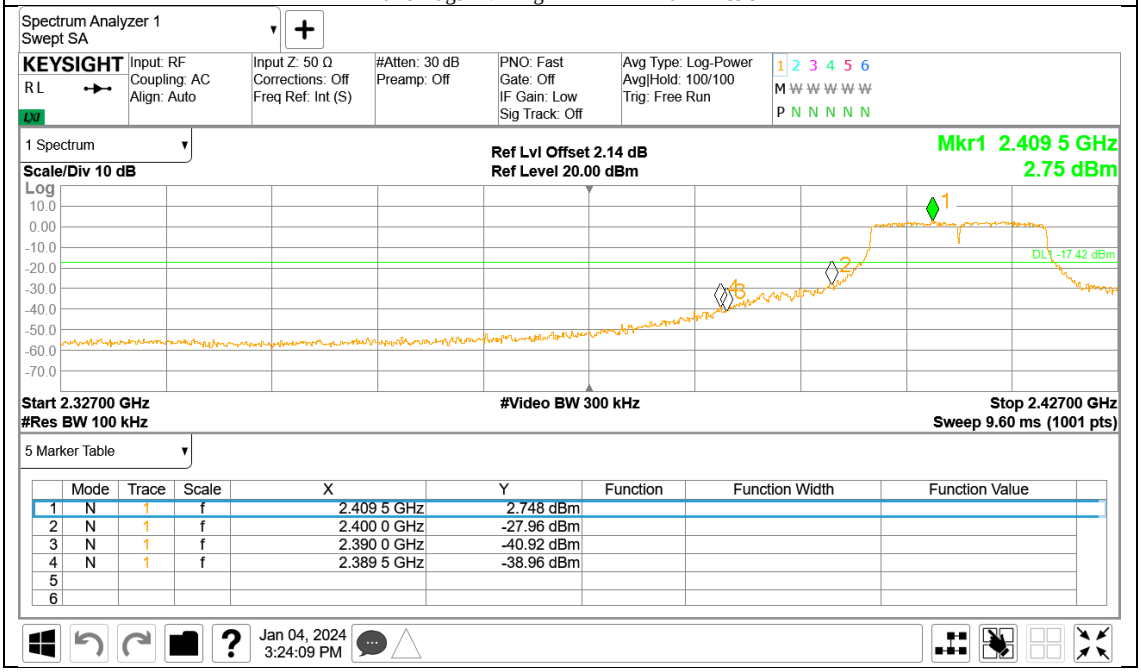
Band Edge NVNT g 2412MHz Ant1 Ref




Band Edge NVNT g 2412MHz Ant1 Emission




| | Mode | Trace | Scale | X | Y | Function | Function Width | Function Value |
|---|---|---|---|---|---|---|---|---|
| 1 | N | 1 | f | 2.409 5 GHz | 2.748 dBm | | | |
| 2 | N | 1 | f | 2.400 0 GHz | -27.96 dBm | | | |
| 3 | N | 1 | f | 2.390 0 GHz | -40.92 dBm | | | |
| 4 | N | 1 | f | 2.389 5 GHz | -38.96 dBm | | | |
| 5 | | | | | | | | |
| 6 | | | | | | | | |



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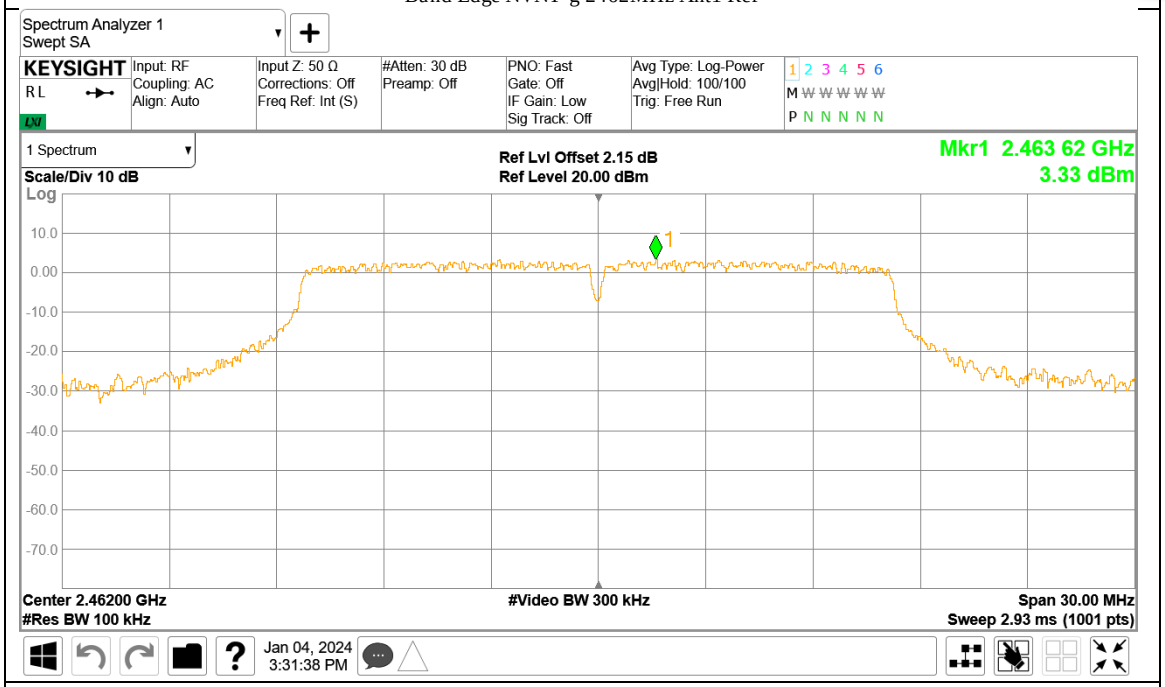
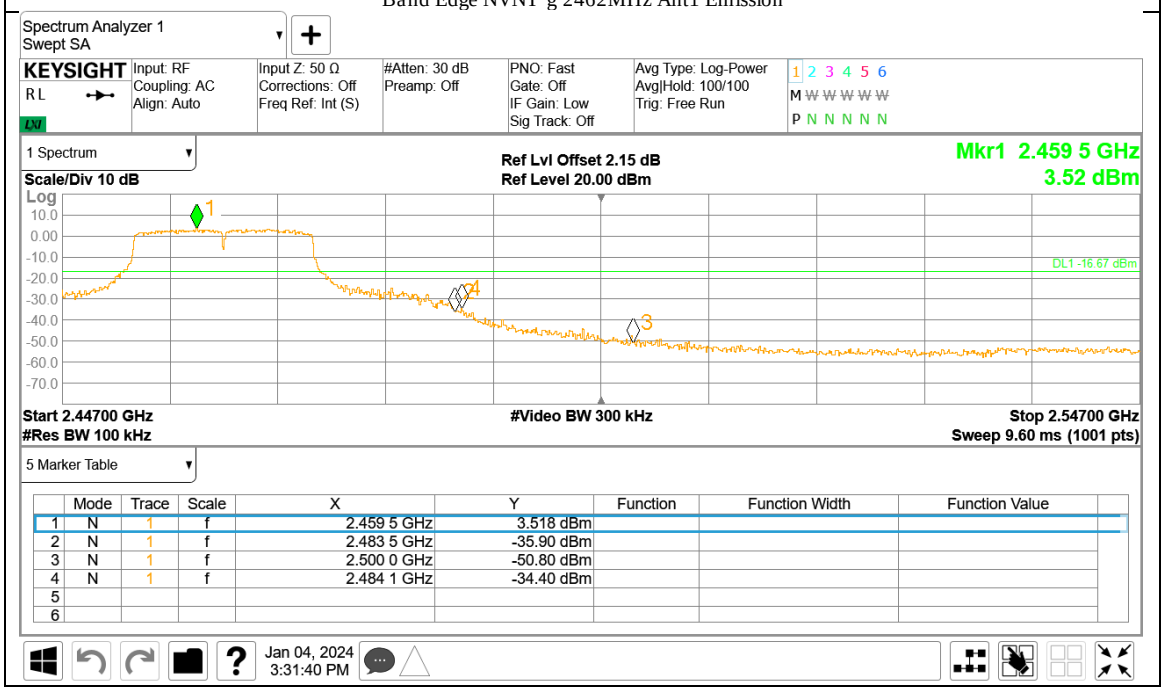
Band Edge NVNT g 2462MHz Ant1 Ref




Band Edge NVNT g 2462MHz Ant1 Emission




| | Mode | Trace | Scale | X | Y | Function | Function Width | Function Value |
|---|---|---|---|---|---|---|---|---|
| 1 | N | 1 | f | 2.459 5 GHz | 3.518 dBm | | | |
| 2 | N | 1 | f | 2.483 5 GHz | -35.90 dBm | | | |
| 3 | N | 1 | f | 2.500 0 GHz | -50.80 dBm | | | |
| 4 | N | 1 | f | 2.484 1 GHz | -34.40 dBm | | | |
| 5 | | | | | | | | |
| 6 | | | | | | | | |



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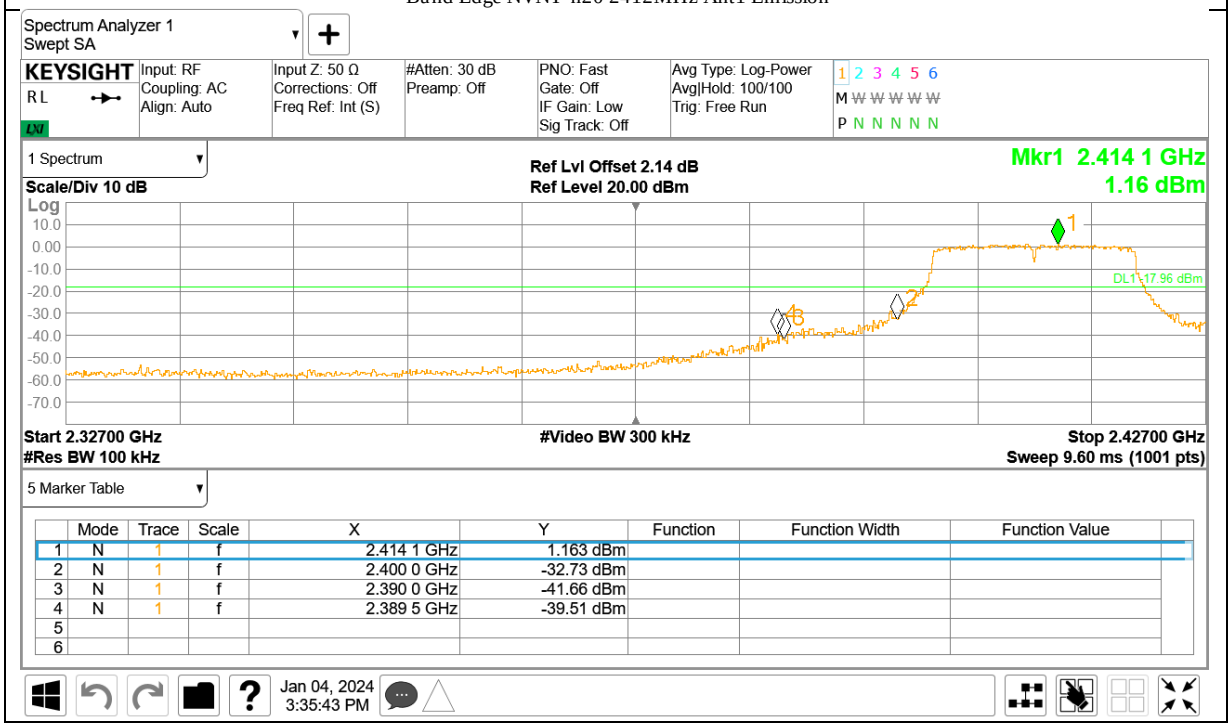
Band Edge NVNT n20 2412MHz Ant1 Ref


Band Edge NVNT n20 2412MHz Ant1 Emission




| | Mode | Trace | Scale | X | Y | Function | Function Width | Function Value |
|---|---|---|---|---|---|---|---|---|
| 1 | N | 1 | f | 2.414 1 GHz | 1.163 dBm | | | |
| 2 | N | 1 | f | 2.400 0 GHz | -32.73 dBm | | | |
| 3 | N | 1 | f | 2.390 0 GHz | -41.66 dBm | | | |
| 4 | N | 1 | f | 2.389 5 GHz | -39.51 dBm | | | |
| 5 | | | | | | | | |
| 6 | | | | | | | | |



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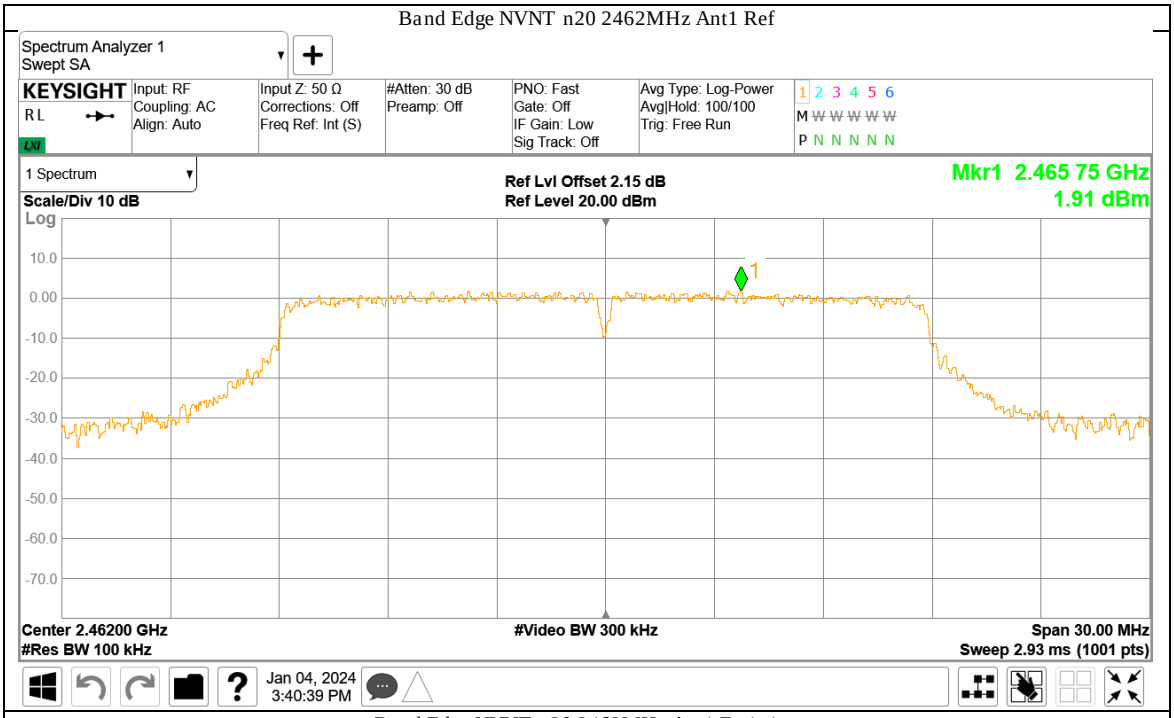
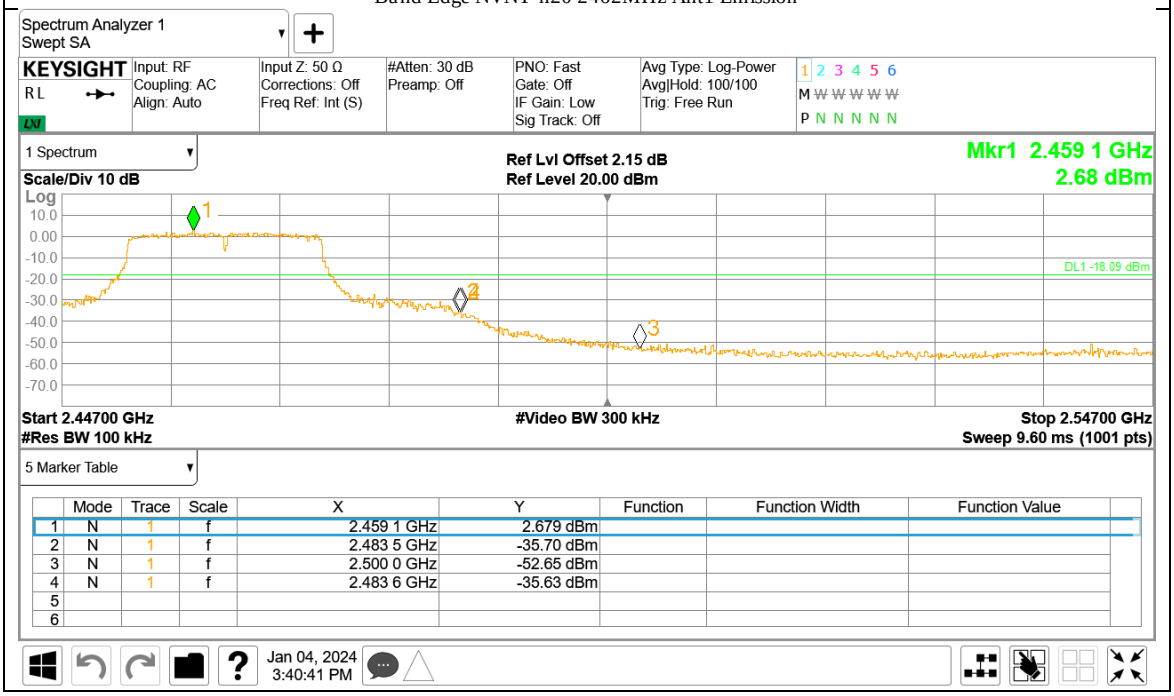
Band Edge NVNT n20 2462MHz Ant1 Ref




Band Edge NVNT n20 2462MHz Ant1 Emission




| | Mode | Trace | Scale | X | Y | Function | Function Width | Function Value |
|---|---|---|---|---|---|---|---|---|
| 1 | N | 1 | f | 2.459 1 GHz | 2.679 dBm | | | |
| 2 | N | 1 | f | 2.483 5 GHz | -35.70 dBm | | | |
| 3 | N | 1 | f | 2.500 0 GHz | -52.65 dBm | | | |
| 4 | N | 1 | f | 2.483 6 GHz | -35.63 dBm | | | |
| 5 | | | | | | | | |
| 6 | | | | | | | | |



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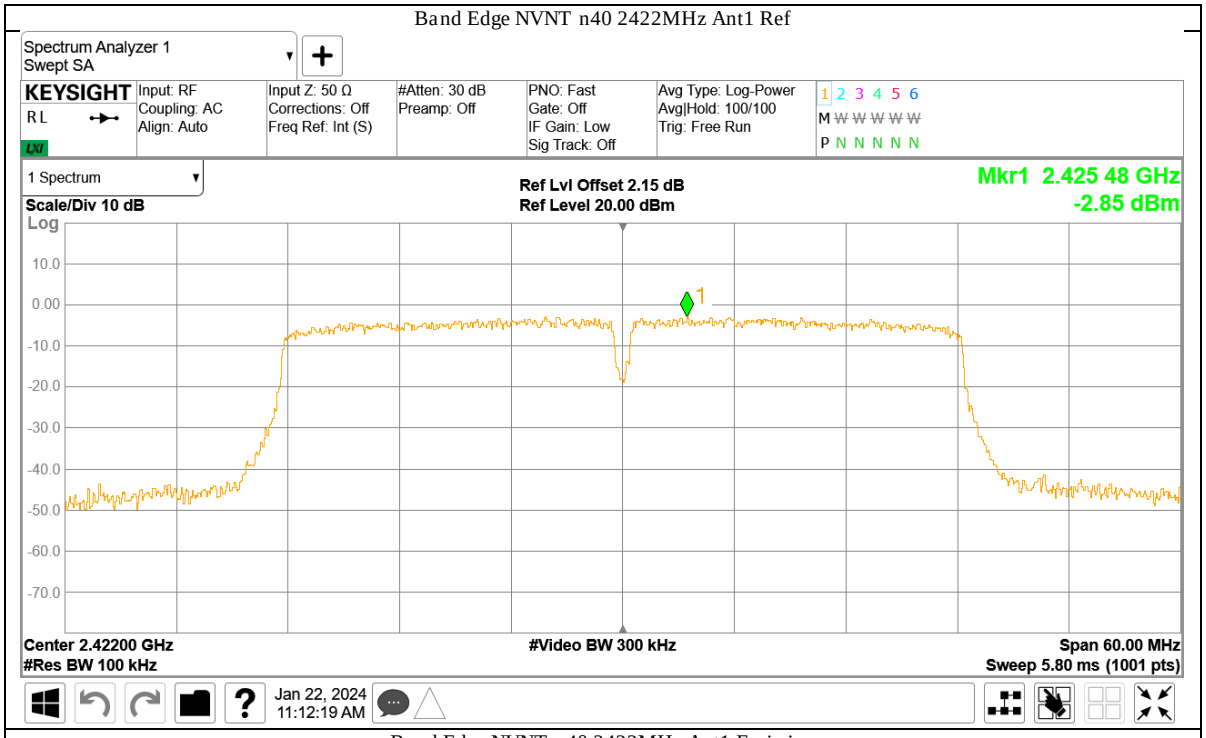
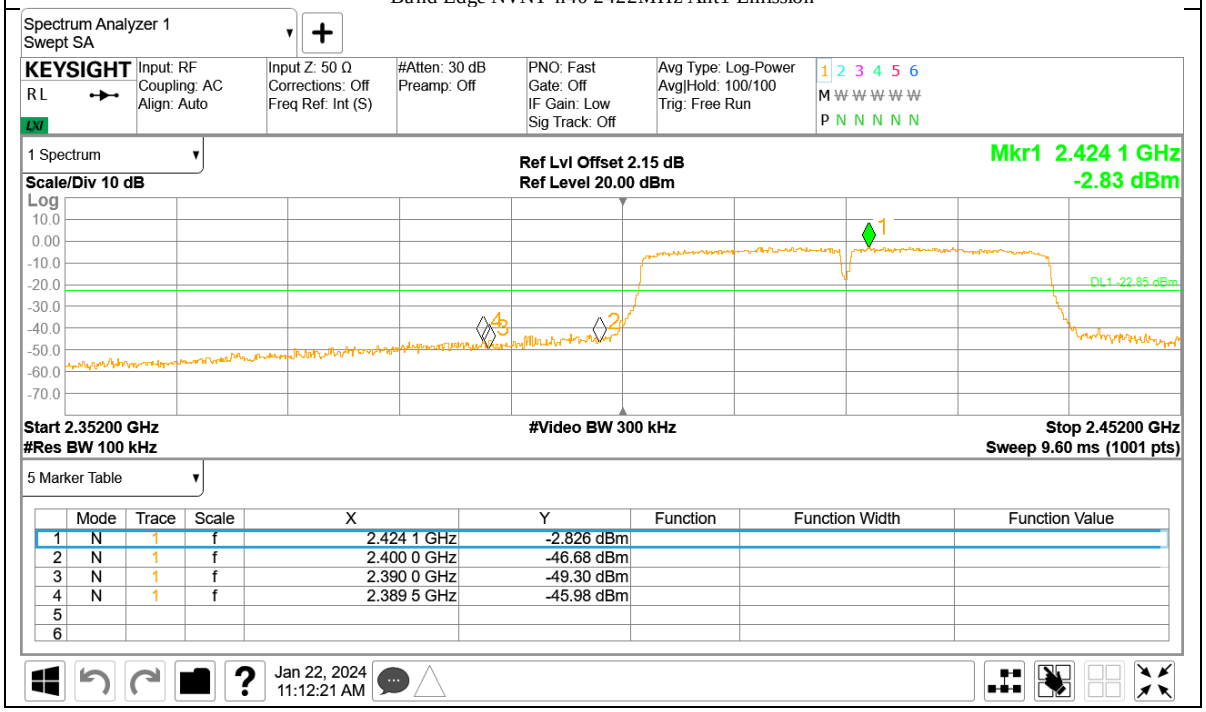
Band Edge NVNT n40 2422MHz Ant1 Ref




Band Edge NVNT n40 2422MHz Ant1 Emission




| | Mode | Trace | Scale | X | Y | Function | Function Width | Function Value |
|---|---|---|---|---|---|---|---|---|
| 1 | N | 1 | f | 2.424 1 GHz | -2.826 dBm | | | |
| 2 | N | 1 | f | 2.400 0 GHz | -46.68 dBm | | | |
| 3 | N | 1 | f | 2.390 0 GHz | -49.30 dBm | | | |
| 4 | N | 1 | f | 2.389 5 GHz | -45.98 dBm | | | |
| 5 | | | | | | | | |
| 6 | | | | | | | | |



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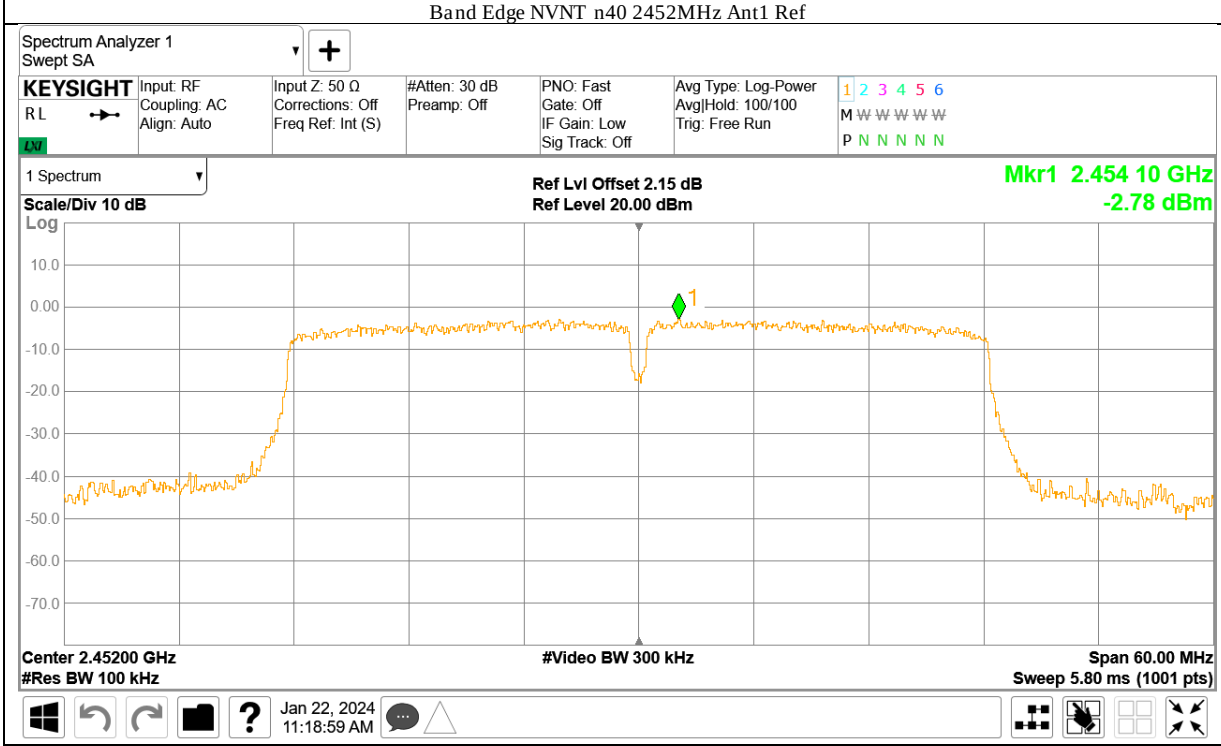
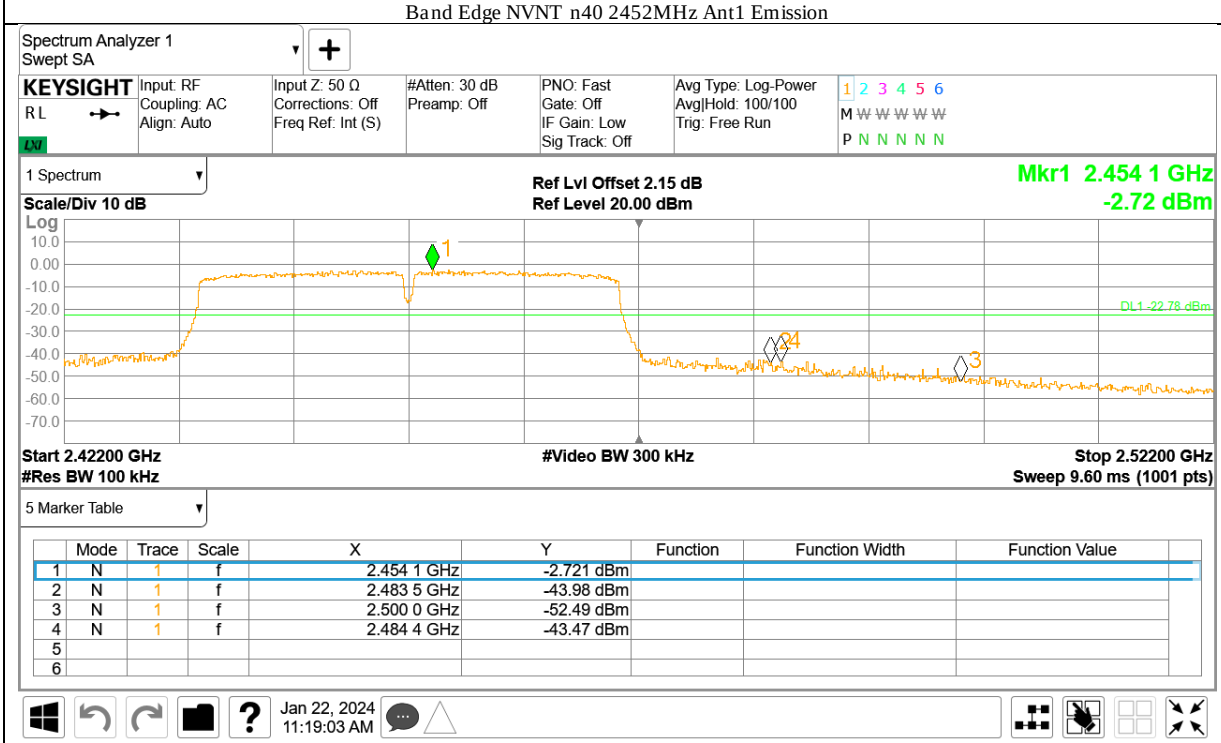
Band Edge NVNT n40 2452MHz Ant1 Ref




Band Edge NVNT n40 2452MHz Ant1 Emission




| | Mode | Trace | Scale | X | Y | Function | Function Width | Function Value |
|---|---|---|---|---|---|---|---|---|
| 1 | N | 1 | f | 2.454 1 GHz | -2.721 dBm | | | |
| 2 | N | 1 | f | 2.483 5 GHz | -43.98 dBm | | | |
| 3 | N | 1 | f | 2.500 0 GHz | -52.49 dBm | | | |
| 4 | N | 1 | f | 2.484 4 GHz | -43.47 dBm | | | |
| 5 | | | | | | | | |
| 6 | | | | | | | | |



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## 10.7 Spurious radiated emissions for transmitter

**Test Method**

1. The EUT was place on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
3. The height of antenna 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.
4. 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 and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. Use the following spectrum analyzer settings According to C63.10

   1) Procedure for Unwanted Emissions Measurements Below 1000 MHz

   Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 100 kHz to 120kHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

   2) For Peak unwanted emissions Above 1GHz:

   Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 1MHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

   Procedures for average unwanted emissions measurements above 1GHz

   a) RBW = 1MHz.

   b) VBW \ [3 × RBW].

   c) Detector = RMS (power averaging), if [span / (# of points in sweep)] \ RBW / 2. Satisfying this condition can require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, then the detector mode shall be set to peak.

   d) Averaging type = power (i.e., rms) (As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.)

   e) Sweep time = auto.

   f) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, then the number of traces shall be increased by a factor of 1 / D, where D is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 100 traces shall be averaged.)

   g) If tests are performed with the EUT transmitting at a duty cycle less than 98%, then a correction factor shall be added to the measurement results prior to comparing with the emission limit, to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:

   1) If power averaging (rms) mode was used in the preceding step e), then the correction factor is [10 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 3 dB shall be added to the measured emission levels.


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2) If linear voltage averaging mode was used in the preceding step e), then the correction factor is [20 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB shall be added to the measured emission levels.
3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission (AV) at frequency above 1GHz.

**Limit**

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that 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 § 15.247(b)(3), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength 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).

| Frequency MHz | Field Strength µV/m | Field Strength dBµV/m | Detector | Measurement distance meters |
|---|---|---|---|---|
| 0.009-0.490 | 2400/F(kHz) | 48.5-13.8 | AV | 300 |
| 0.490-1.705 | 24000/F(kHz) | 33.8-23.0 | QP | 30 |
| 1.705-30 | 30 | 29.5 | QP | 30 |
| 30-88 | 100 | 40 | QP | 3 |
| 88-216 | 150 | 43.5 | QP | 3 |
| 216-960 | 200 | 46 | QP | 3 |
| 960-1000 | 500 | 54 | QP | 3 |
| Above 1000 | 500 | 54 | AV | 3 |
| Above 1000 | 5000 | 74 | PK | 3 |

Note 1: Limit 3m(dBµV/m)=Limit 300m(dBµV/m)+40Log(300m/3m) (Below 30MHz)
Note 2: Limit 3m(dBµV/m)=Limit 30m(dBµV/m)+40Log(30m/3m) (Below 30MHz)


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## Spurious Radiated Emissions for Transmitter

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.
Data of measurement within frequency range 9kHz-30MHz is the noise floor or attenuated more than 20dB below the permissible limits or the field strength is too small to be measured, so test data does not present in this report.

### Transmitting spurious emission test result as below:

| Test mode:802.11B (2412MHz) | | | | | |
|---|---|---|---|---|---|
| Frequency MHz | Measure Level (dBuV/m) | Limit (dBuV/M | Margin (dB) | Detector | Polarization |
| 2383.89 | 49.30 | 74.00 | 24.70 | PK | Hoirznotal |
| 4823.86 | 46.32 | 74.00 | 27.68 | PK | Hoirznotal |
| 2382.43 | 44.47 | 74.00 | 29.53 | PK | Vertical |
| 2655.80 | 45.62 | 74.00 | 28.38 | PK | Vertical |
| 4823.86 | 42.27 | 74.00 | 31.73 | PK | Vertical |

| Test mode:802.11B (2437MHz) | | | | | |
|---|---|---|---|---|---|
| Frequency MHz | Measure Level (dBuV/m) | Limit (dBuV/M | Margin (dB) | Detector | Polarization |
| 4873.73 | 46.93 | 74.00 | 27.07 | PK | Hoirznotal |
| 2660.33 | 46.89 | 73.00 | 26.11 | PK | Vertical |
| 4873.73 | 43.56 | 74.00 | 30.44 | PK | Vertical |

| Test mode:802.11B (2462MHz) | | | | | |
|---|---|---|---|---|---|
| Frequency MHz | Measure Level (dBuV/m) | Limit (dBuV/M | Margin (dB) | Detector | Polarization |
| 2483.56 | 51.73 | 74.00 | 22.27 | PK | Hoirznotal |
| 4924.16 | 47.11 | 74.00 | 26.89 | PK | Hoirznotal |
| 2483.55 | 48.71 | 74.00 | 25.29 | PK | Vertical |
| 2663.77 | 46.58 | 73.00 | 26.42 | PK | Vertical |
| 4924.16 | 44.32 | 74.00 | 29.68 | PK | Vertical |


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| Test mode:802.11g (2412MHz) | | | | | |
|---|---|---|---|---|---|
| Frequency MHz | Measure Level (dBuV/m) | Limit (dBuV/M | Margin (dB) | Detector | Polarization |
| 2387.26 | 60.51 | 74.00 | 13.49 | PK | Hoirznotal |
| 2387.26 | 49.40 | 54.00 | 4.60 | AV | Hoirznotal |
| 2389.64 | 61.25 | 74.00 | 12.75 | PK | Hoirznotal |
| 2389.64 | 51.70 | 54.00 | 2.30 | AV | Hoirznotal |
| 4819.90 | 43.39 | 74.00 | 30.61 | PK | Hoirznotal |
| 2389.84 | 54.87 | 74.00 | 19.13 | PK | Vertical |
| 2389.84 | 44.00 | 54.00 | 10.00 | AV | Vertical |
| 2654.10 | 46.19 | 74.00 | 27.81 | PK | Vertical |
| 4824.43 | 40.34 | 74.00 | 33.66 | PK | Vertical |
| Test mode:802.11g (2437MHz) | | | | | |
| Frequency MHz | Measure Level (dBuV/m) | Limit (dBuV/M | Margin (dB) | Detector | Polarization |
| 4874.86 | 40.85 | 74.00 | 33.15 | PK | Hoirznotal |
| 4873.73 | 41.22 | 74.00 | 32.78 | PK | Vertical |
| Test mode:802.11g (2462MHz) | | | | | |
| Frequency MHz | Measure Level (dBuV/m) | Limit (dBuV/M | Margin (dB) | Detector | Polarization |
| 2483.56 | 62.12 | 74.00 | 11.88 | PK | Hoirznotal |
| 2483.56 | 52.20 | 54.00 | 1.80 | AV | Hoirznotal |
| 2484.86 | 60.89 | 74.00 | 13.11 | PK | Hoirznotal |
| 2484.86 | 49.10 | 54.00 | 4.90 | AV | Hoirznotal |
| 4927.56 | 42.67 | 74.00 | 31.33 | PK | Hoirznotal |
| 2483.56 | 62.91 | 74.00 | 11.09 | PK | Vertical |
| 2483.56 | 51.90 | 54.00 | 2.10 | AV | Vertical |
| 2485.03 | 60.40 | 74.00 | 13.60 | PK | Vertical |
| 2485.03 | 49.00 | 54.00 | 5.00 | AV | Vertical |
| 4925.86 | 42.42 | 74.00 | 31.58 | PK | Vertical |


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| Test mode:802.11n20 (2412MHz) | | | | | |
|---|---|---|---|---|---|
| Frequency MHz | Measure Level (dBuV/m) | Limit (dBuV/M | Margin (dB) | Detector | Polarization |
| 2389.96 | 61.66 | 74.00 | 12.34 | PK | Hoirznotal |
| 2389.96 | 48.70 | 54.00 | 5.30 | AV | Hoirznotal |
| 4823.38 | 40.99 | 74.00 | 33.01 | PK | Hoirznotal |
| 2389.99 | 55.84 | 74.00 | 18.16 | PK | Vertical |
| 2389.99 | 40.20 | 54.00 | 13.80 | AV | Vertical |
| 4824.43 | 40.43 | 74.00 | 33.57 | PK | Vertical |

| Test mode:802.11n20 (2437MHz) | | | | | |
|---|---|---|---|---|---|
| Frequency MHz | Measure Level (dBuV/m) | Limit (dBuV/M | Margin (dB) | Detector | Polarization |
| 4877.70 | 41.35 | 74.00 | 32.65 | PK | Hoirznotal |
| 4872.03 | 41.10 | 74.00 | 32.90 | PK | Vertical |

| Test mode:802.11n20 (2462MHz) | | | | | |
|---|---|---|---|---|---|
| Frequency MHz | Measure Level (dBuV/m) | Limit (dBuV/M | Margin (dB) | Detector | Polarization |
| 2483.55 | 62.56 | 74.00 | 11.44 | PK | Hoirznotal |
| 2483.55 | 52.00 | 54.00 | 2.00 | AV | Hoirznotal |
| 2485.36 | 59.15 | 74.00 | 14.85 | PK | Hoirznotal |
| 2485.36 | 48.80 | 54.00 | 5.20 | AV | Hoirznotal |
| 4925.30 | 41.74 | 74.00 | 32.26 | PK | Hoirznotal |
| 2483.61 | 61.19 | 74.00 | 12.81 | PK | Vertical |
| 2483.61 | 47.90 | 54.00 | 6.10 | AV | Vertical |
| 4923.60 | 42.02 | 74.00 | 31.98 | PK | Vertical |


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| Test mode:802.11n40 (2422MHz) | | | | | |
|---|---|---|---|---|---|
| Frequency MHz | Measure Level (dBuV/m) | Limit (dBuV/M | Margin (dB) | Detector | Polarization |
| 2385.78 | 58.53 | 74.00 | 15.47 | PK | Hoirznotal |
| 2385.78 | 45.10 | 54.00 | 8.90 | AV | Hoirznotal |
| 2389.15 | 57.61 | 74.00 | 16.39 | PK | Hoirznotal |
| 2389.15 | 46.50 | 54.00 | 7.50 | AV | Hoirznotal |
| 4849.93 | 41.83 | 74.00 | 32.17 | PK | Hoirznotal |
| 2385.84 | 50.58 | 74.00 | 23.42 | PK | Vertical |
| 4839.16 | 40.92 | 74.00 | 33.08 | PK | Vertical |

| Test mode:802.11n20 (2437MHz) | | | | | |
|---|---|---|---|---|---|
| Frequency MHz | Measure Level (dBuV/m) | Limit (dBuV/M | Margin (dB) | Detector | Polarization |
| 4876.56 | 40.91 | 74.00 | 33.09 | PK | Hoirznotal |
| 4872.60 | 40.07 | 74.00 | 33.93 | PK | Vertical |

| Test mode:802.11n20 (2462MHz) | | | | | |
|---|---|---|---|---|---|
| Frequency MHz | Measure Level (dBuV/m) | Limit (dBuV/M | Margin (dB) | Detector | Polarization |
| 2483.54 | 58.19 | 74.00 | 15.81 | PK | Hoirznotal |
| 2483.54 | 47.40 | 54.00 | 6.60 | AV | Hoirznotal |
| 4913.96 | 40.83 | 74.00 | 33.17 | PK | Hoirznotal |
| 2483.50 | 55.80 | 74.00 | 18.20 | PK | Vertical |
| 2483.50 | 44.60 | 54.00 | 9.40 | AV | Vertical |
| 4910.00 | 40.87 | 74.00 | 33.13 | PK | Vertical |

Remark:

(1) Emission level= Original Receiver Reading + Correct Factor
(2) Correct Factor = Antenna Factor + Cable Loss -Amplifier gain
(3) Margin = limit – Corrected Reading


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**The worst case of Radiated Emission below 1GHz:**
Pre-scan all test modes and only the worst case listed as below.

# 30-1000MHz Radiated Emission

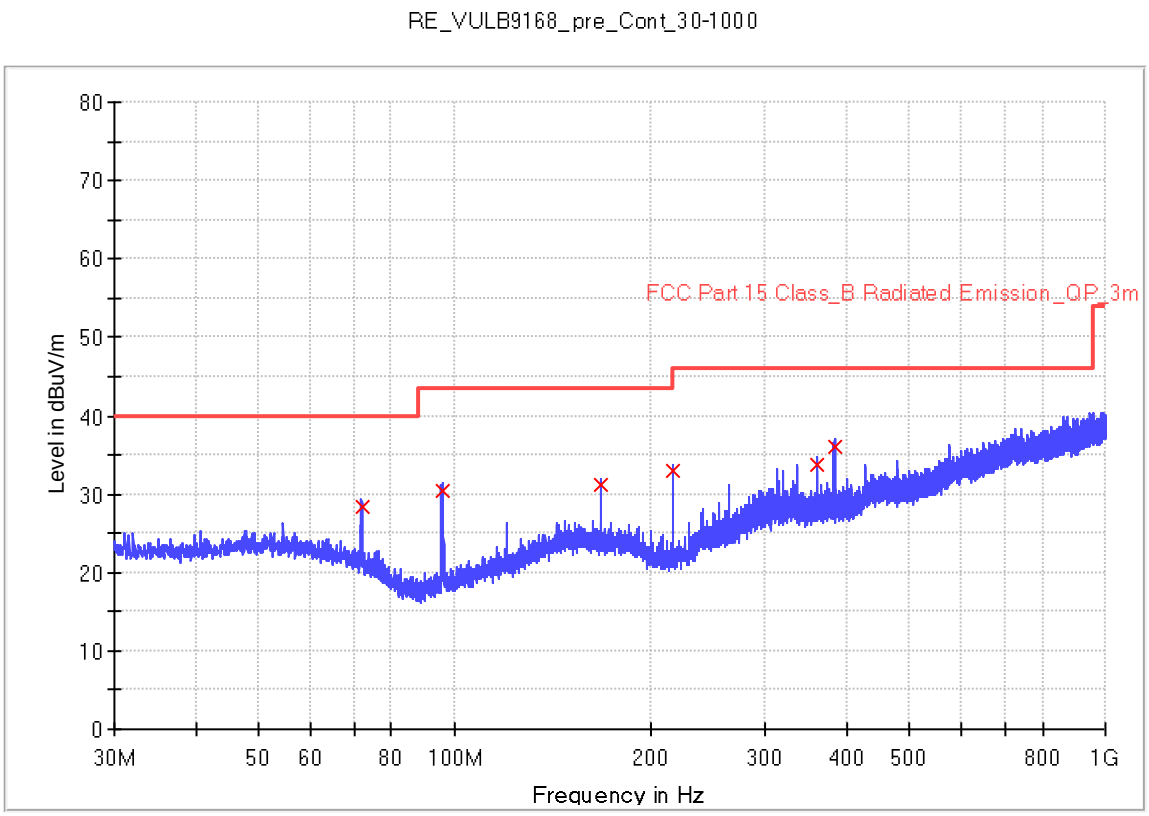
## EUT Information

| | |
|---|---|
| EUT Name: | Smart Battery Doorbell |
| Model: | SC162-WCD3 |
| Client: | Zhejiang Lingzhu Technology Co., Ltd |
| Op Cond: | Power on and charging, TX_2412MHz at g mode, AC 120V/60Hz, T20.2, 41.4%, P103.2kPa |
| Operator: | Huali CHENG |
| Test Spec: | FCC Part 15.209(a) |
| Comment: | Horizontal |
| Sample No: | SHA-781837-2 |

## Sweep Setup: RE_VULB9168_pre_Cont_30-1000 [EMI radiated]

| | |
|---|---|
| Hardware Setup: | RE_VULB9168 |
| Receiver: | [ESR 3] |
| Level Unit: | dBuV/m |

| Subrange | Step Size | Detectors | Bandwidth | Sweep Time | Preamp |
|---|---|---|---|---|---|
| 30 MHz - 1 GHz | 48.5 kHz | PK+ | 120 kHz | 0.2 s | 20 dB |





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## Limit and Margin

| Frequency (MHz) | QuasiPeak (dBuV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) | Margin - QPK (dB) | Limit - QPK (dBuV/m) |
|---|---|---|---|---|---|---|---|---|---|
| 71.960000 | 28.4 | 1000.0 | 120.000 | 169.0 | H | 325.0 | 18.2 | 11.6 | 40.0 |
| 95.720000 | 30.3 | 1000.0 | 120.000 | 159.0 | H | 69.0 | 15.6 | 13.2 | 43.5 |
| 168.000000 | 31.1 | 1000.0 | 120.000 | 201.0 | H | 198.0 | 20.4 | 12.4 | 43.5 |
| 216.000000 | 32.9 | 1000.0 | 120.000 | 185.0 | H | 206.0 | 17.5 | 13.1 | 46.0 |
| 360.000000 | 33.8 | 1000.0 | 120.000 | 156.0 | H | 85.0 | 23.0 | 12.2 | 46.0 |
| 383.000000 | 35.9 | 1000.0 | 120.000 | 174.0 | H | 174.0 | 23.8 | 10.1 | 46.0 |


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# 30-1000MHz Radiated Emission

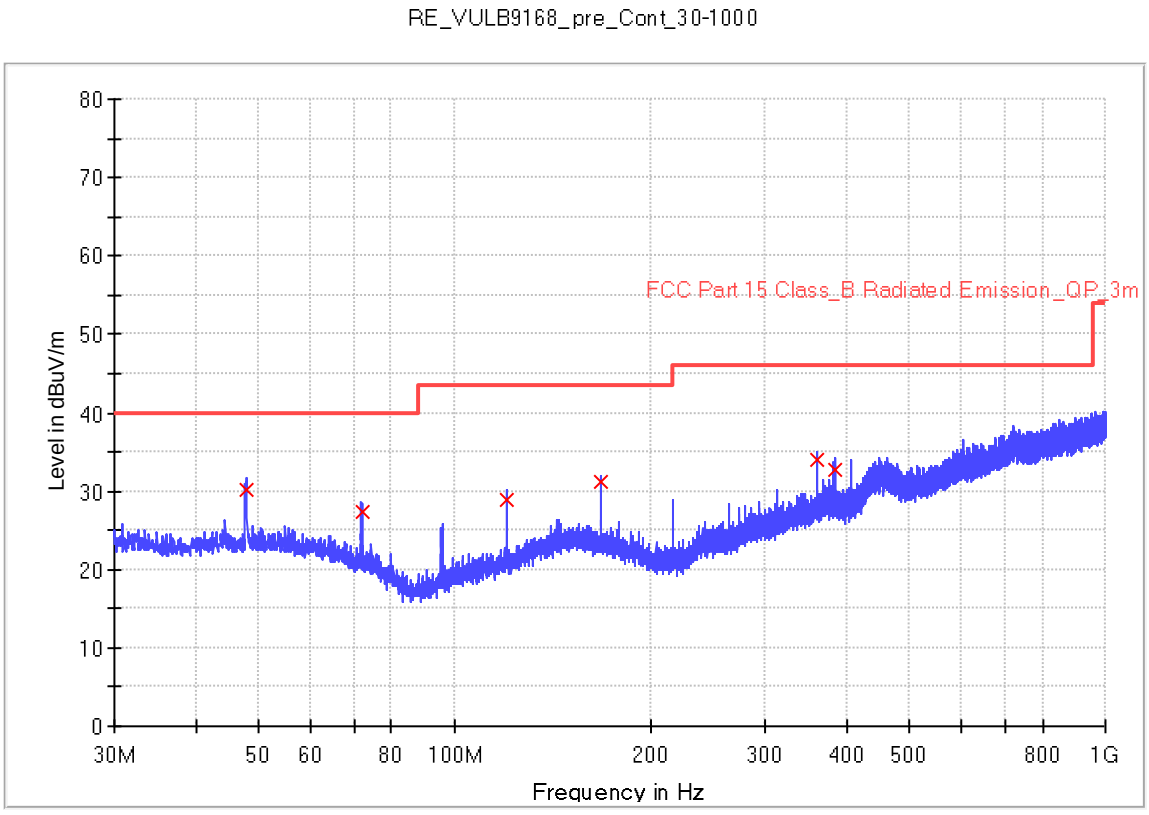
## EUT Information

| | |
|---|---|
| EUT Name: | Smart Battery Doorbell |
| Model: | SC162-WCD3 |
| Client: | Zhejiang Lingzhu Technology Co., Ltd |
| Op Cond: | Power on and charging, TX_2412MHz at g mode, AC 120V/60Hz, T20.2, 41.4%, P103.2kPa |
| Operator: | Huali CHENG |
| Test Spec: | FCC Part 15.209(a) |
| Comment: | Horizontal |
| Sample No: | SHA-781837-2 |

## Sweep Setup: RE_VULB9168_pre_Cont_30-1000 [EMI radiated]

| | |
|---|---|
| Hardware Setup: | RE_VULB9168 |
| Receiver: | [ESR 3] |
| Level Unit: | dBuV/m |

| Subrange | Step Size | Detectors | Bandwidth | Sweep Time | Preamp |
|---|---|---|---|---|---|
| 30 MHz - 1 GHz | 48.5 kHz | PK+ | 120 kHz | 0.2 s | 20 dB |



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## Limit and Margin

| Frequency (MHz) | QuasiPeak (dBuV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) | Margin - QPK (dB) | Limit - QPK (dBuV/m) |
|---|---|---|---|---|---|---|---|---|---|
| 47.760000 | 30.3 | 1000.0 | 120.000 | 112.0 | V | 69.0 | 20.5 | 9.7 | 40.0 |
| 71.960000 | 27.3 | 1000.0 | 120.000 | 103.0 | V | 125.0 | 18.2 | 12.7 | 40.0 |
| 119.960000 | 29.0 | 1000.0 | 120.000 | 106.0 | V | 329.0 | 18.1 | 14.5 | 43.5 |
| 168.000000 | 31.1 | 1000.0 | 120.000 | 100.0 | V | 74.0 | 20.4 | 12.4 | 43.5 |
| 360.000000 | 33.9 | 1000.0 | 120.000 | 126.0 | V | 209.0 | 23.0 | 12.1 | 46.0 |
| 383.800000 | 32.6 | 1000.0 | 120.000 | 110.0 | V | 115.0 | 23.8 | 13.4 | 46.0 |

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)
Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)


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# 11 Test Equipment List

List of Test Instruments
Test Site1

| | DESCRIPTION | MANUFACTURER | MODEL NO. | SERIAL NO. | CAL. DATE | CAL. DUE DATE |
|---|---|---|---|---|---|---|
| C | Signal spectrum analyzer | Agilent | N9020B | MY59050168 | 2023-2-10 | 2024-2-9 |
| | Wideband power sensor | Rohde & Schwarz | NRP-Z81 | 105903 | 2023-2-10 | 2024-2-9 |
| | 10dB Attenuator | Aeroflex Weinschel | CG-4689 | 93459 | 2023-2-10 | 2024-2-9 |
| RE | EMI Test Receiver | Rohde & Schwarz | ESR3 | 101906 | 2023-8-1 | 2024-7-31 |
| | Signal Analyzer | Rohde & Schwarz | FSV40 | 101091 | 2023-8-1 | 2024-7-31 |
| | Trilog Super Broadband Test Antenna | Schwarzbeck | VULB 9168 | 961 | 2021-9-23 | 2024-9-22 |
| | Double-ridged waveguide horn antenna | Rohde & Schwarz | HF907 | 102868 | 2021-3-15 | 2024-3-14 |
| | Pre-amplifier | Rohde & Schwarz | SCU-18D | 19006451 | 2023-8-1 | 2024-7-31 |
| | Loop antenna | Rohde & Schwarz | HFH2-Z2 | 100443 | 2023-6-15 | 2024-6-14 |
| | Double Ridged Horn Antenna | ETS-Lindgren | 3116C | 00246076 | 2023-7-7 | 2026-7-6 |
| | 3m Semi-anechoic chamber | TDK | 9X6X6 | ---- | 2021-5-8 | 2024-5-7 |
| CE | EMI Test Receiver | Rohde & Schwarz | ESR3 | 101907 | 2023-8-1 | 2024-7-31 |
| | LISN | Rohde & Schwarz | ENV216 | 101924 | 2023-8-1 | 2024-7-31 |

| Measurement Software Information | | | |
|---|---|---|---|
| Test Item | Software | Manufacturer | Version |
| C | MTS 8310 | MWRFtest | 3.0.0.0 |
| | Power Viewer | Rohde & Schwarz | V 11.0 |
| RE | EMC 32 | Rohde & Schwarz | V10.50.40 |
| CE | EMC 32 | Rohde & Schwarz | V9.15.03 |

C - Conducted RF tests

- Conducted peak output power
- 6dB bandwidth and 99% Occupied Bandwidth
- Power spectral density*
- Spurious RF conducted emissions
- Band edge


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# 12 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

| Items | Extended Uncertainty |
|---|---|
| Conducted Disturbance at Mains Terminals | 150kHz to 30MHz, LISN, 3.16dB |
| Radiated Disturbance | 9kHz to 30MHz, 3.52dB<br>30MHz to 1GHz, 5.03dB (Horizontal)<br>5.12dB (Vertical)<br>1GHz to 18GHz, 5.49dB<br>18GHz to 40GHz, 5.63dB |
| RF Conducted Measurement | Power related： 1.16dB<br>Frequency related： $6.00\times10^{-8}$ |

Measurement Uncertainty Decision Rule:

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2021, clause 4.4.3 and 4.5.1.


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# 13 Photographs of Test Set-ups

Refer to the < Test Setup photos >.


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# 14 Photographs of EUT

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

**----------End of Test Report----------**



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