Certificate No.: 3745.01

China

# FCC - TEST REPORT

| | | | | |
|---|---|---|---|---|
| Report Number | : | **709502204647-00A** | Date of Issue: | July 04,2022 |

| | | |
|---|---|---|
| Model | : | WT3 |
| Product Type | : | Wi-Fi and Bluetooth Module |
| Applicant | : | Hangzhou Tuya Information Technology Co.,Ltd |
| Address | : | Room701,Building3,More Center,No.87 GuDun Road,Hangzhou,Zhejiang China |
| Manufacturer | : | Hangzhou Tuya Information Technology Co.,Ltd |
| Address | : | Room701,Building3,More Center,No.87 GuDun Road,Hangzhou,Zhejiang China |
| Test Result | : | ■ **Positive** ☐ **Negative** |
| Total pages including Appendices | : | 52 |

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# 1 Table of Contents





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## 2 Details about the Test Laboratory

**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 |
| Test Firm FCC Registration Number: | 820234 |
| Designation number: | CN1183 |
| IC Company Number: | 25988 |
| CAB identifier: | CN0101 |
| Telephone: | +86 21 6141 0123 |
| Fax: | +86 21 6140 8600 |

# 3 Description of the Equipment under Test

| | |
|---|---|
| Product: | Wi-Fi and Bluetooth Module |
| Model no.: | WT3 |
| FCC ID: | 2ANDL-WT3 |
| Options and accessories: | NA |
| Rating: | 3.0V-3.6V DC |
| RF Transmission Frequency: | For 802.11b/g/n(HT20): 2412~2462 MHz (Wi-Fi)<br>For 802.15.1:2402~2480 MHz |
| No. of Operated Channel: | 2.4GHz WIFI: 11 for 802.11b/g/n(HT20)<br>2.4GHz BLE: 40 |
| Modulation: | Direct Sequence Spread Spectrum (DSSS) for 802.11b<br>Orthogonal Frequency Division Multiplexing (OFDM) for 802.11g/n; 2.4GHz BLE: GFSK |

Channel list:

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

Antenna Type: onboard PCB antenna

| | |
|---|---|
| Antenna Gain: | 1.3dBi |
| Description of the EUT: | The Equipment Under Test (EUT) is a Wi-Fi and Bluetooth module which support 2.4GHz Wi-Fi and BLE 5.1(only support 1Mbps data rate). We tested it and listed the worst data in this report. |
| Test sample no.: | SHA-658297-1 |

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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# 4 Summary of Test Standards

| Test Standards | |
|---|---|
| FCC Part 15 Subpart C | 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 and ANSI C63.10 (2013).

# 5 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 | 13-15 | Site 1 | ☒ | ☐ | ☐ |
| §15.247 (b) (1) | Conducted peak output power | 16 | Site 1 | ☒ | ☐ | ☐ |
| §15.247(a)(1) | 20dB bandwidth | --- | --- | ☐ | ☐ | ☒ |
| §15.247(a)(1) | Carrier frequency separation | --- | --- | ☐ | ☐ | ☒ |
| §15.247(a)(1)(iii) | Number of hopping frequencies | --- | --- | ☐ | ☐ | ☒ |
| §15.247(a)(1)(iii) | Dwell Time | --- | --- | ☐ | ☐ | ☒ |
| §15.247(a)(2) | 6dB bandwidth | 17-20 | Site 1 | ☒ | ☐ | ☐ |
| §15.247(e) | Power spectral density | 21-24 | Site 1 | ☒ | ☐ | ☐ |
| §15.247(d) | Spurious RF conducted emissions | 25-34 | Site 1 | ☒ | ☐ | ☐ |
| §15.247(d) | Band edge | 35-41 | Site 1 | ☒ | ☐ | ☐ |
| §15.247(d) & §15.209 | Spurious radiated emissions for transmitter | 42-45 | Site 1 | ☒ | ☐ | ☐ |
| §15.203 | Antenna requirement | See note 1 | | ☒ | ☐ | ☐ |

Remark 1: N/A – Not Applicable.
Note 1: The EUT uses an onboard PCB antenna, which gain is 1.3dBi. In accordance to §15.203, It is considered sufficiently to comply with the provisions of this section.

China

# 6 General Remarks

**Remarks**

This submittal(s) (test report) is intended for FCC ID: 2ANDL-WT3, complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C Rules.

This report is only for the 2.4GHz Wi-Fi test report, for the 2.4GHz BLE test report please refer to 709502204647-00B.

**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: | June 24, 2022 |
| Testing Start Date: | June 27, 2022 |
| Testing End Date: | July 2, 2022 |

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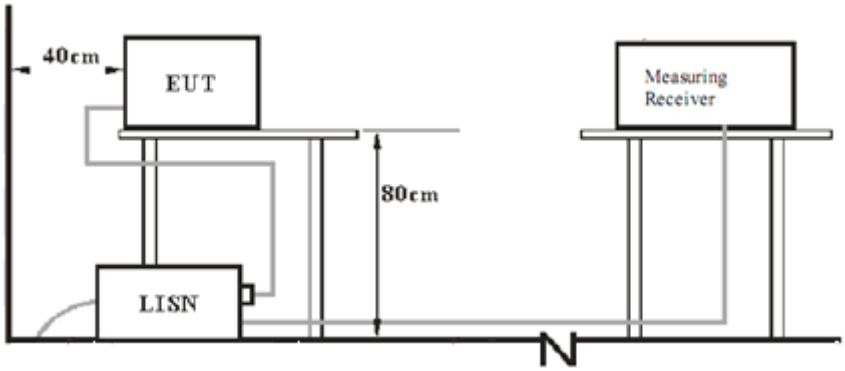
| Reviewed by: | Prepared by: | Tested by: |
|---|---|---|
| Hui TONG | Jiaxi XU | Wang Yiquan |
| Review Engineer | Project Engineer | Test Engineer |

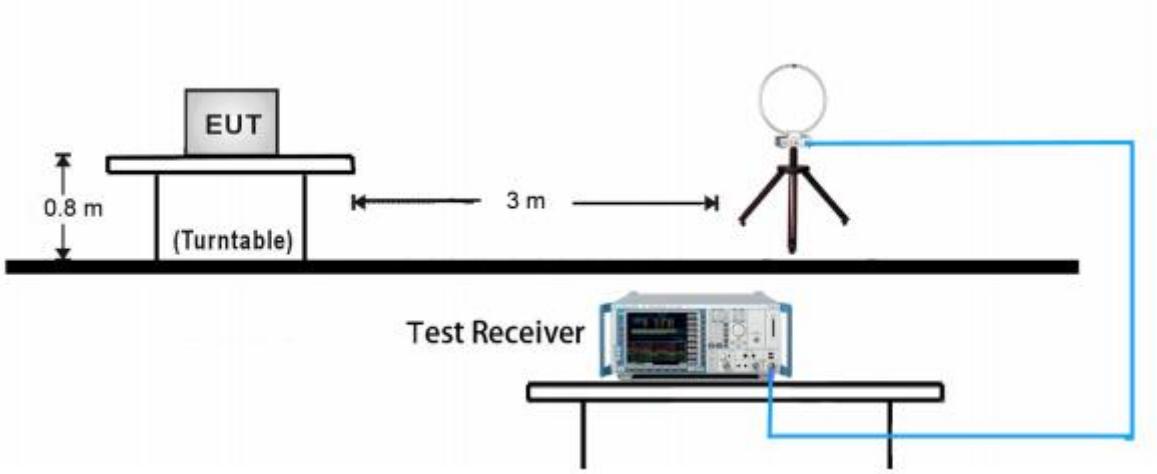
# 7 Test Setups

## 7.1 AC Power Line Conducted Emission test setups

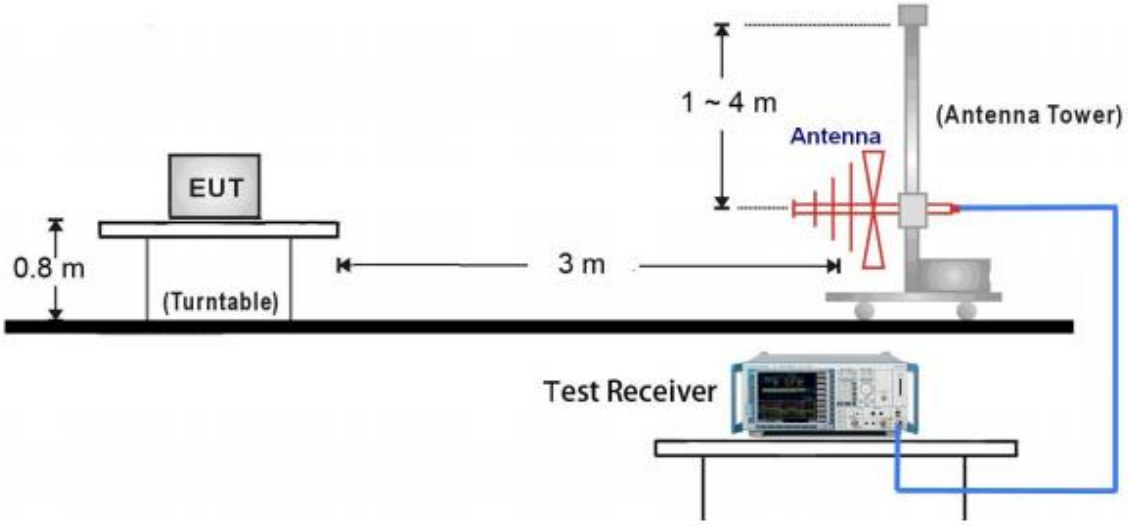



## 7.2 Radiated test setups

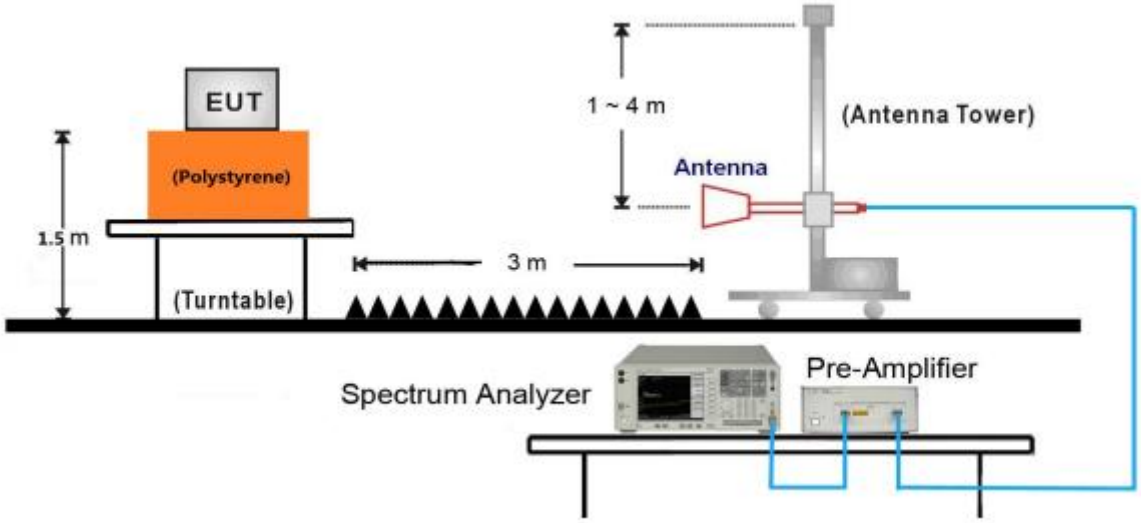
9kHz ~ 30MHz Test Setup:



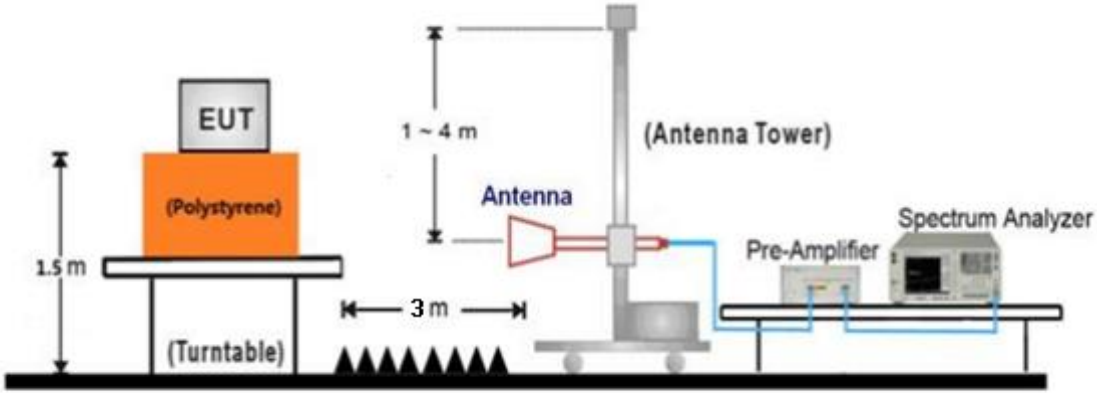
30MHz ~ 1GHz Test Setup:



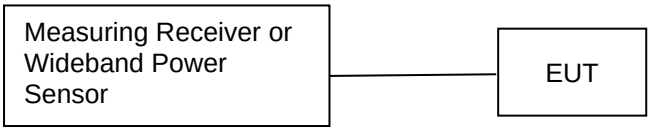

1GHz ~ 18GHz Test Setup:



18GHz ~ 25GHz Test Setup:




7.3 Conducted RF test setups



# 8 Systems test configuration

Auxiliary Equipment Used during Test:

| DESCRIPTION | MANUFACTURER | MODEL NO.(SHIELD) | S/N(LENGTH) |
|---|---|---|---|
| Notebook | Lenovo | E470 | PF-OU5TS7 17/09 |

Test software: Wifi Test Tool v1.6.0 release.

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

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.

# 9 Technical Requirement

## 9.1 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**

| 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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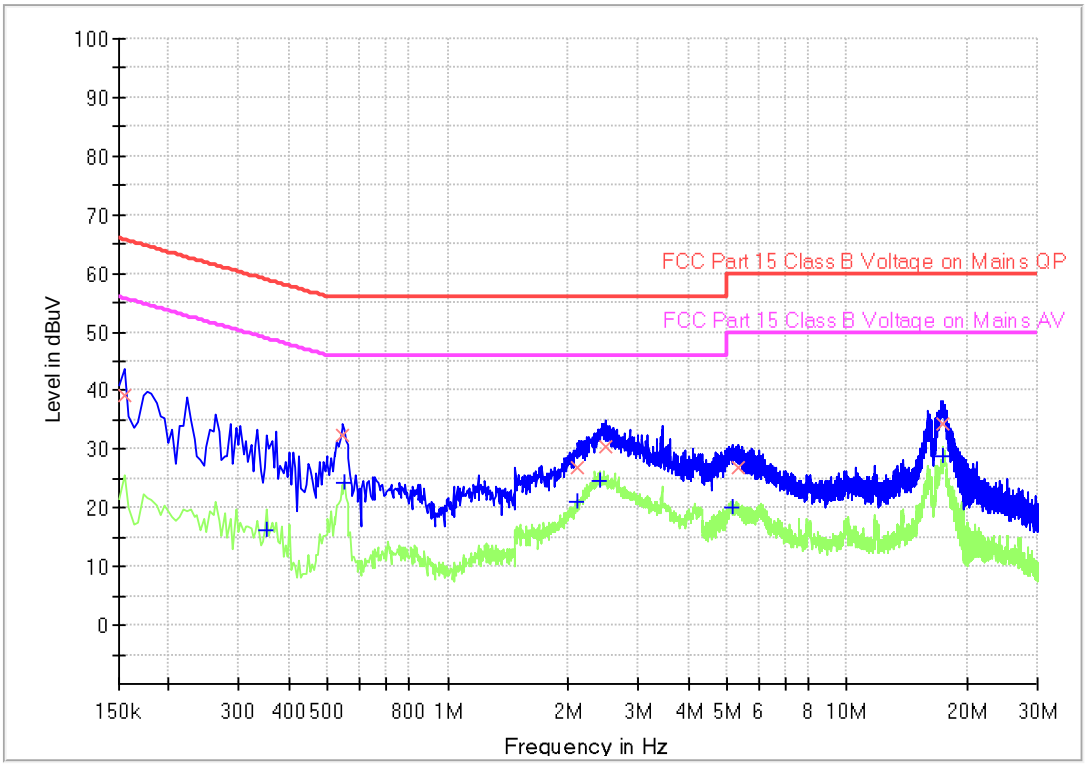
## Conducted Emission

| | | |
|---|---|---|
| Product Type | : | Wi-Fi and Bluetooth module |
| M/N | : | WT3 |
| Operating Condition | : | Mode 1: Tx_2462MHz for 802.11g |
| Test Specification | : | L-line |
| Comment | : | AC 120V/60Hz (powered by notebook) |

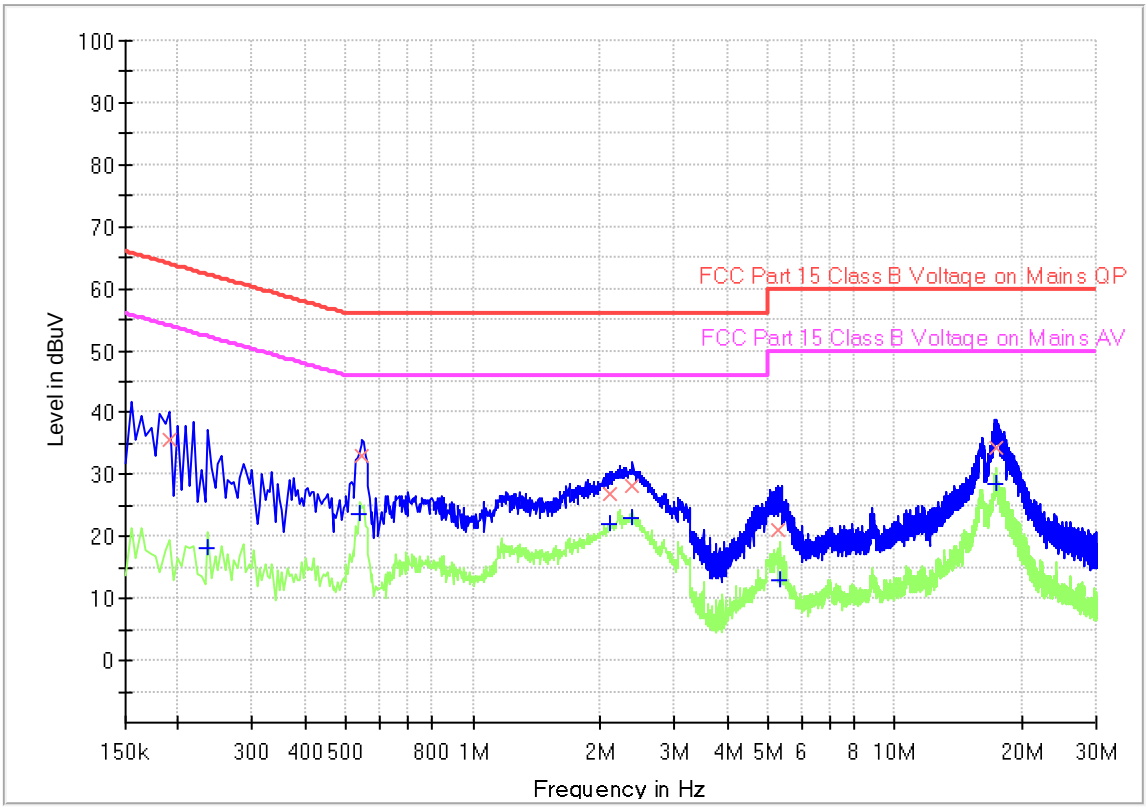



## Final_Result

| Frequency (MHz) | QuasiPeak (dBuV) | CAverage (dBuV) | Limit (dBuV) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Line | Corr. (dB) |
|---|---|---|---|---|---|---|---|---|
| 0.154500 | 39.07 | --- | 65.75 | 26.68 | 1000.0 | 9.000 | L1 | 19.5 |
| 0.352500 | --- | 16.13 | 48.90 | 32.77 | 1000.0 | 9.000 | L1 | 19.5 |
| 0.546000 | 32.42 | --- | 56.00 | 23.58 | 1000.0 | 9.000 | L1 | 19.5 |
| 0.550500 | --- | 24.20 | 46.00 | 21.80 | 1000.0 | 9.000 | L1 | 19.5 |
| 2.121000 | 26.96 | --- | 56.00 | 29.04 | 1000.0 | 9.000 | L1 | 19.5 |
| 2.121000 | --- | 20.92 | 46.00 | 25.08 | 1000.0 | 9.000 | L1 | 19.5 |
| 2.404500 | --- | 24.72 | 46.00 | 21.28 | 1000.0 | 9.000 | L1 | 19.5 |
| 2.472000 | 30.45 | --- | 56.00 | 25.55 | 1000.0 | 9.000 | L1 | 19.5 |
| 5.158500 | --- | 20.07 | 50.00 | 29.93 | 1000.0 | 9.000 | L1 | 19.6 |
| 5.356500 | 26.81 | --- | 60.00 | 33.19 | 1000.0 | 9.000 | L1 | 19.6 |
| 17.443500 | --- | 28.83 | 50.00 | 21.17 | 1000.0 | 9.000 | L1 | 19.8 |
| 17.452500 | 34.33 | --- | 60.00 | 25.67 | 1000.0 | 9.000 | L1 | 19.8 |

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

| | | |
|---|---|---|
| Product Type | : | Wi-Fi and Bluetooth module |
| M/N | : | WT3 |
| Operating Condition | : | Mode 1: Tx_2462MHz for 802.11g |
| Test Specification | : | N-line |
| Comment | : | AC 120V/60Hz (powered by notebook) |




## Final_Result

| Frequency (MHz) | QuasiPeak (dBuV) | CAverage (dBuV) | Limit (dBuV) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Line | Corr. (dB) |
|---|---|---|---|---|---|---|---|---|
| 0.190500 | 35.52 | --- | 64.01 | 28.49 | 1000.0 | 9.000 | N | 19.5 |
| 0.235500 | --- | 18.19 | 52.25 | 34.06 | 1000.0 | 9.000 | N | 19.5 |
| 0.537000 | --- | 23.76 | 46.00 | 22.24 | 1000.0 | 9.000 | N | 19.5 |
| 0.546000 | 33.10 | --- | 56.00 | 22.90 | 1000.0 | 9.000 | N | 19.5 |
| 2.116500 | 26.96 | --- | 56.00 | 29.04 | 1000.0 | 9.000 | N | 19.5 |
| 2.121000 | --- | 21.98 | 46.00 | 24.02 | 1000.0 | 9.000 | N | 19.5 |
| 2.386500 | --- | 22.98 | 46.00 | 23.02 | 1000.0 | 9.000 | N | 19.5 |
| 2.391000 | 28.07 | --- | 56.00 | 27.93 | 1000.0 | 9.000 | N | 19.5 |
| 5.284500 | 21.03 | --- | 60.00 | 38.97 | 1000.0 | 9.000 | N | 19.6 |
| 5.352000 | --- | 12.88 | 50.00 | 37.12 | 1000.0 | 9.000 | N | 19.6 |
| 17.295000 | --- | 28.52 | 50.00 | 21.48 | 1000.0 | 9.000 | N | 19.8 |
| 17.443500 | 34.31 | --- | 60.00 | 25.69 | 1000.0 | 9.000 | N | 19.8 |

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

## 9.2 Conducted peak output power

### Test Method

1. Use the following spectrum analyzer settings:
   RBW > the 6dB bandwidth of the emission being measured, VBW≥3RBW, Span≥3RBW
   Sweep = auto, Detector function = peak, Trace = max hold.
2. Add a correction factor to the display.
3. Use a power meter to measure the conducted peak output power.

### Limits

| Frequency Range MHz | Limit W | Limit dBm |
|---|---|---|
| 2400-2483.5 | ≤1 | ≤30 |

### Test result

802.11b

| Frequency (MHz) | Conducted Peak Output Power(dBm) | Result |
|---|---|---|
| Low channel 2412MHz | 18.03 | Pass |
| Middle channel 2437MHz | 17.85 | Pass |
| High channel 2462MHz | 18.64 | Pass |

802.11g

| Frequency (MHz) | Conducted Peak Output Power(dBm) | Result |
|---|---|---|
| Low channel 2412MHz | 21.79 | Pass |
| Middle channel 2437MHz | 21.76 | Pass |
| High channel 2462MHz | 22.23 | Pass |

802.11n(HT20)

| Frequency (MHz) | Conducted Peak Output Power(dBm) | Result |
|---|---|---|
| Low channel 2412MHz | 21.33 | Pass |
| Middle channel 2437MHz | 21.22 | Pass |
| High channel 2462MHz | 21.67 | Pass |

## 9.3 6dB bandwidth

### Test Method

1. Use the following spectrum analyzer settings:
   RBW=100K, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold
2. Use the automatic bandwidth measurement capability of an instrument, may be employed using the X dB bandwidth mode with X set to 6 dB, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.
3. Allow the trace to stabilize, record the X dB Bandwidth value.

### Limit

| Limit [kHz] |
|---|
| ≥500 |

### Test result

802.11b

| Frequency | 6dB bandwidth | Result |
|---|---|---|
| MHz | MHz | |
| Top channel 2412MHz | 12.552 | Pass |
| Middle channel 2437MHz | 12.552 | Pass |
| Bottom channel 2462MHz | 12.555 | Pass |

802.11g

| Frequency | 6dB bandwidth | Result |
|---|---|---|
| MHz | MHz | |
| Top channel 2412MHz | 16.038 | Pass |
| Middle channel 2437MHz | 16.014 | Pass |
| Bottom channel 2462MHz | 16.293 | Pass |

802.11n(HT20)

| Frequency | 6dB bandwidth | Result |
|---|---|---|
| MHz | MHz | |
| Top channel 2412MHz | 15.771 | Pass |
| Middle channel 2437MHz | 17.538 | Pass |
| Bottom channel 2462MHz | 16.014 | Pass |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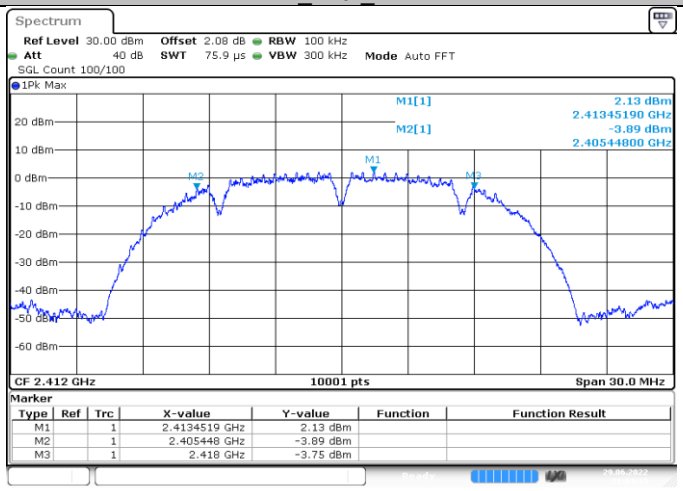
## 6 dB Bandwidth

802.11b

11B_Ant1_2412

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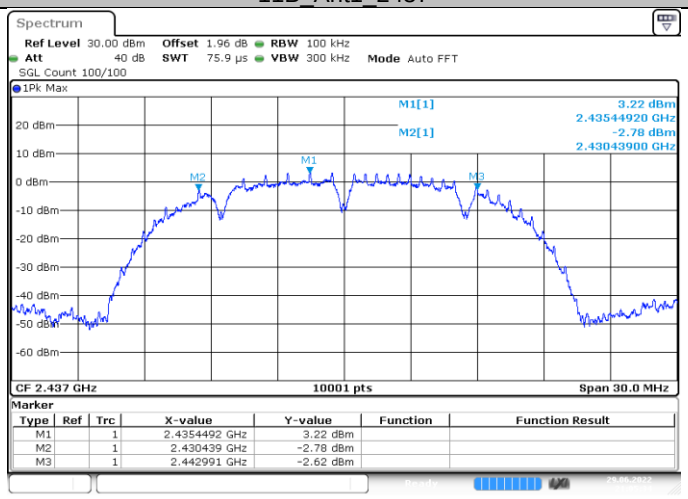
11B_Ant1_2437

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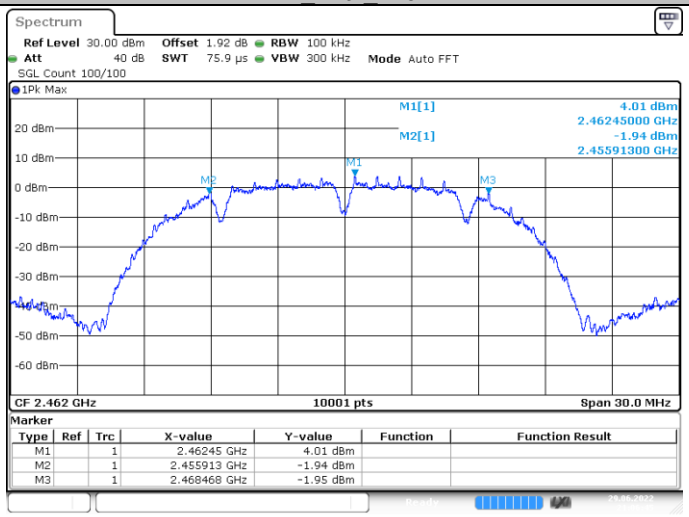


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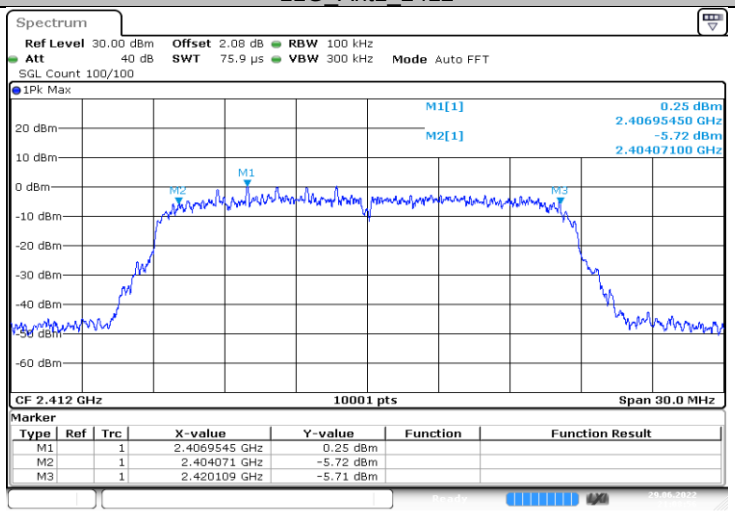
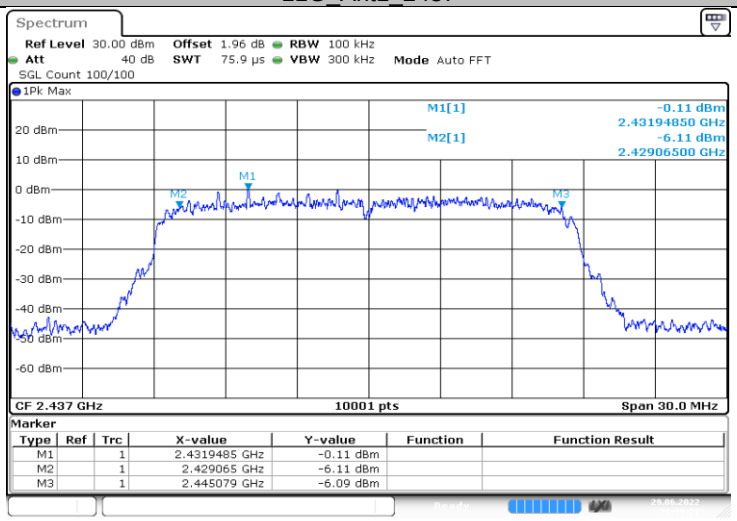
802.11g

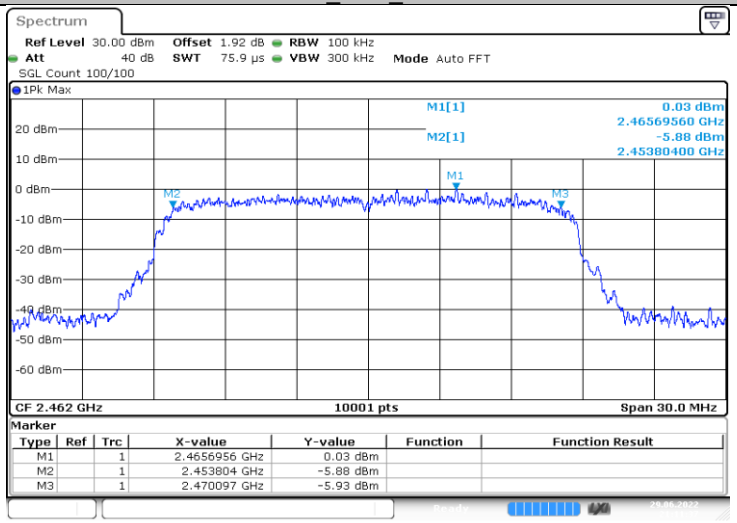
11G_Ant1_2412




11G_Ant1_2437

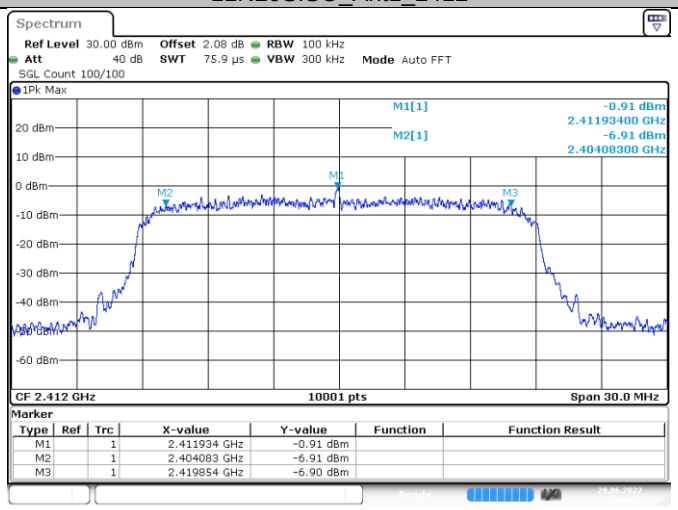



11G_Ant1_2462



## 802.11n(HT20)

### 11N20SISO_Ant1_2412

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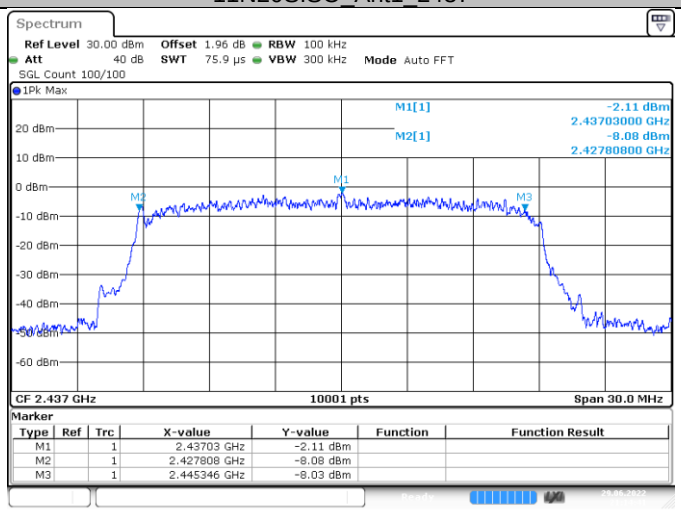


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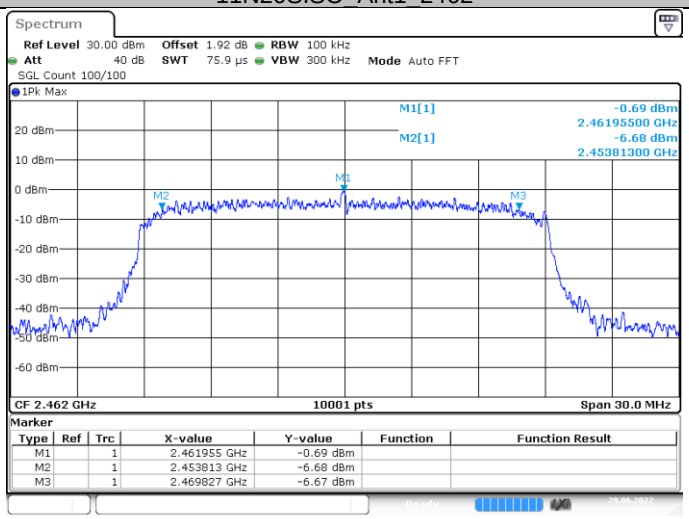



Date: 29.JUN.2022 21:16:05

## 9.4 Power spectral density

**Test Method**

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

1. 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.
2. Allow trace to fully stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.
3. Repeat above procedures until other frequencies measured were completed.

**Limit**

| Limit [dBm/3KHz] |
|---|
| ≤8 |

**Test result**

802.11b

| Frequency (MHz) | Power spectral density(dBm/3KHz) | Result |
|---|---|---|
| Low channel 2412MHz | -10.81 | Pass |
| Middle channel 2437MHz | -11.17 | Pass |
| High channel 2462MHz | -10.08 | Pass |

802.11g

| Frequency (MHz) | Power spectral density(dBm/3KHz) | Result |
|---|---|---|
| Low channel 2412MHz | -12.97 | Pass |
| Middle channel 2437MHz | -12.91 | Pass |
| High channel 2462MHz | -12.49 | Pass |

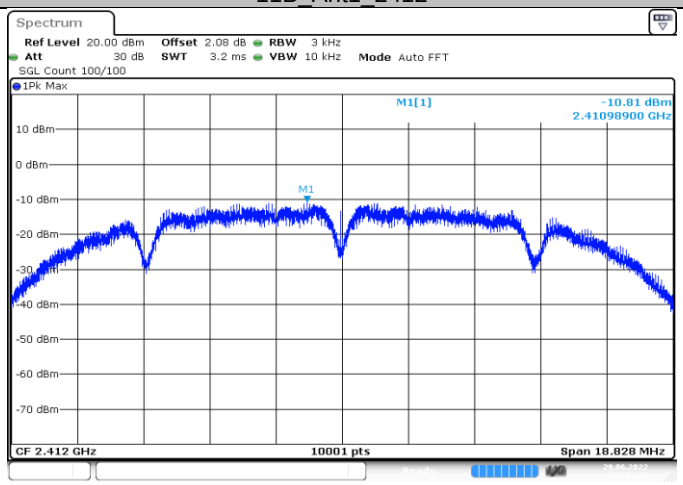
802.11 n(HT20)

| Frequency (MHz) | Power spectral density(dBm/3KHz) | Result |
|---|---|---|
| Low channel 2412MHz | -13.43 | Pass |
| Middle channel 2437MHz | -13.52 | Pass |
| High channel 2462MHz | -13.05 | Pass |

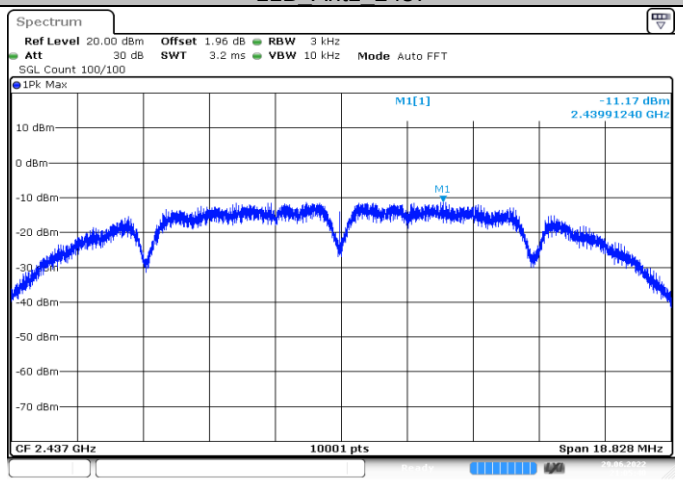
## Power spectral density

802.11b

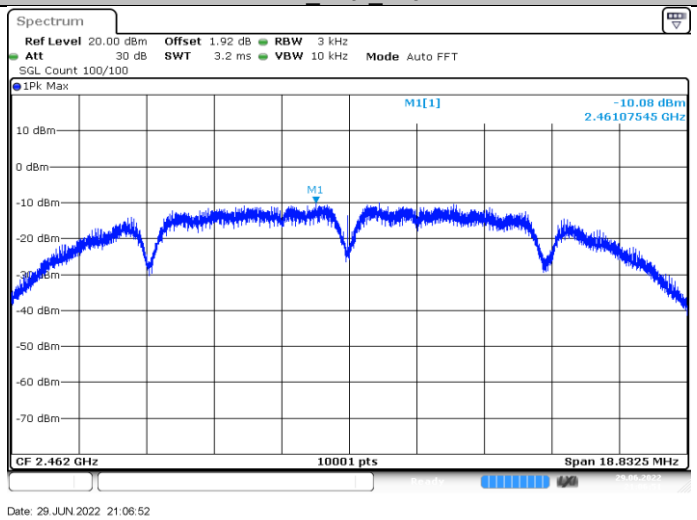
11B_Ant1_2412




11B_Ant1_2437

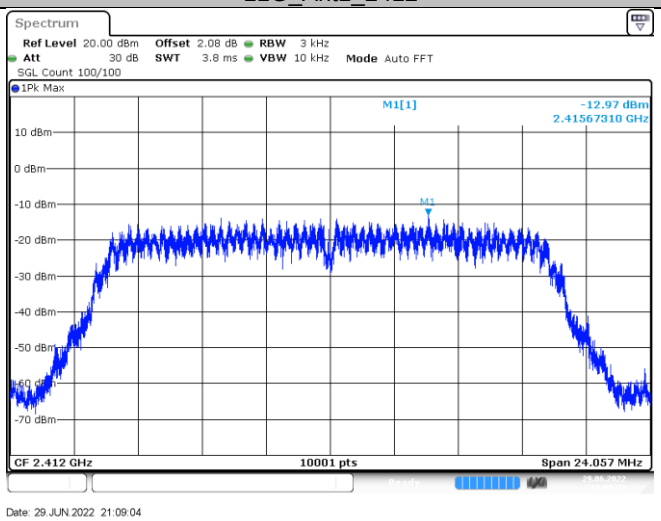



11B_Ant1_2462



802.11g

11G_Ant1_2412

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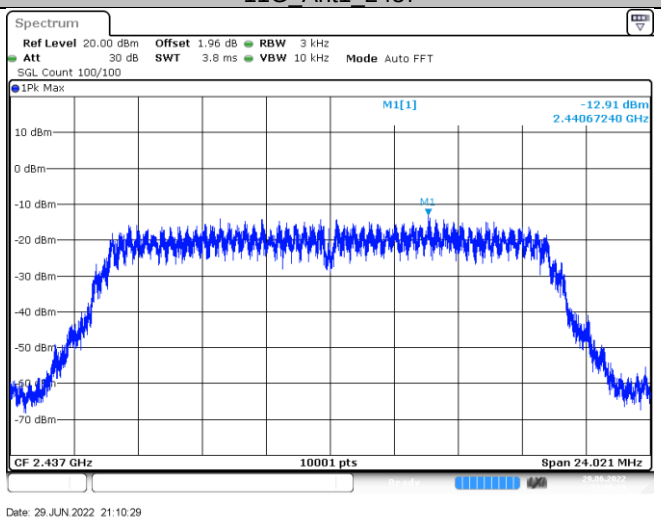
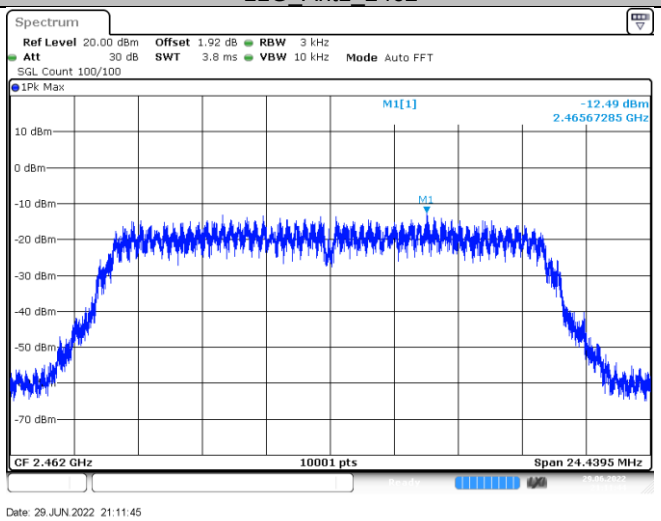
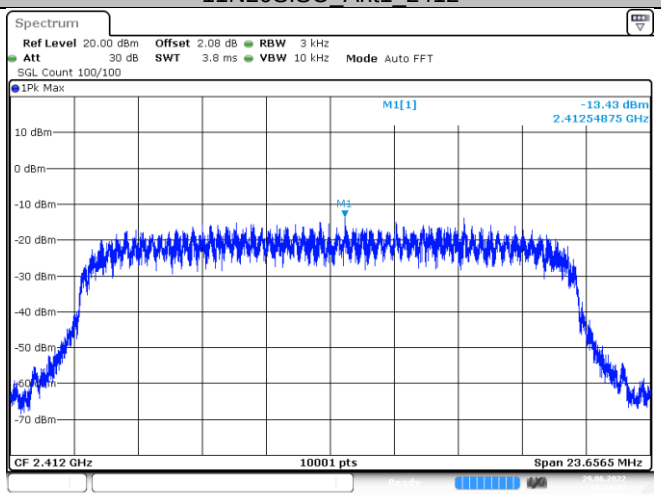



11G_Ant1_2462

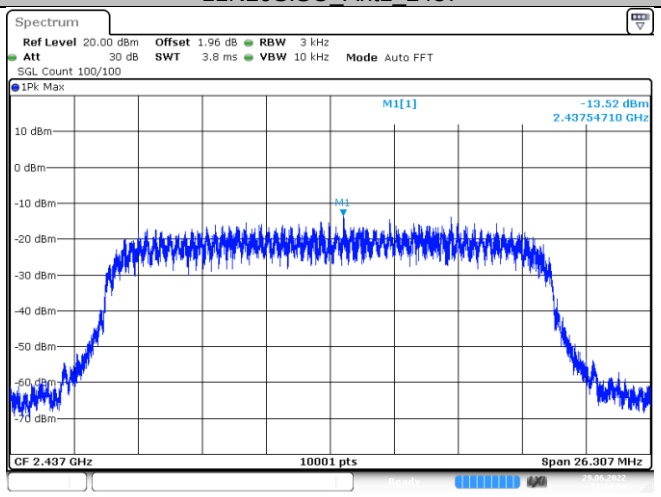


## 802.11n (HT20)

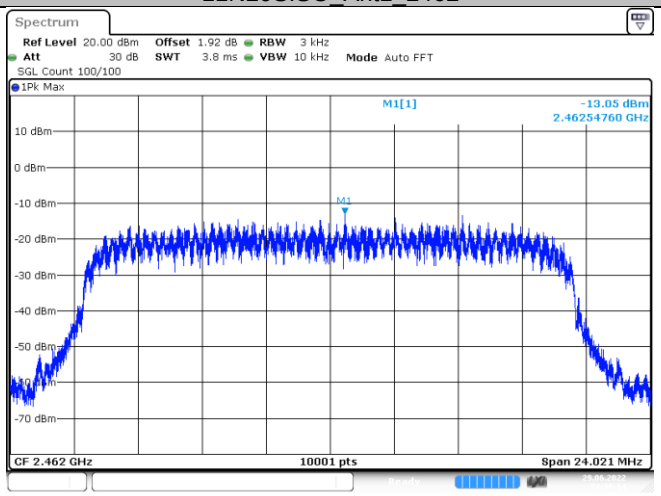
### 11N20SISO_Ant1_2412




### 11N20SISO_Ant1_2437




### 11N20SISO_Ant1_2462



## 9.5 Spurious RF conducted emissions

**Test Method**

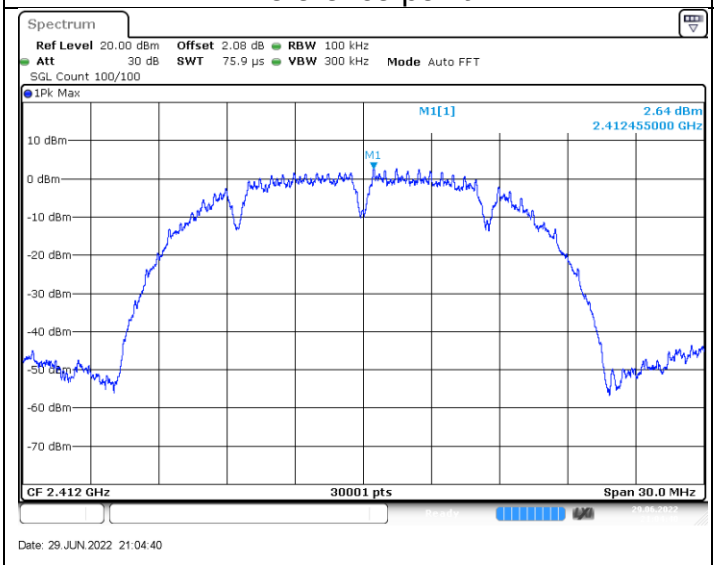
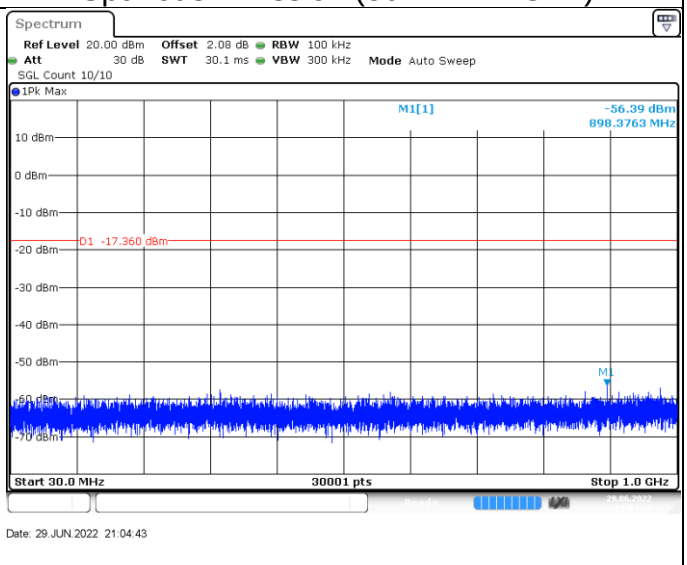
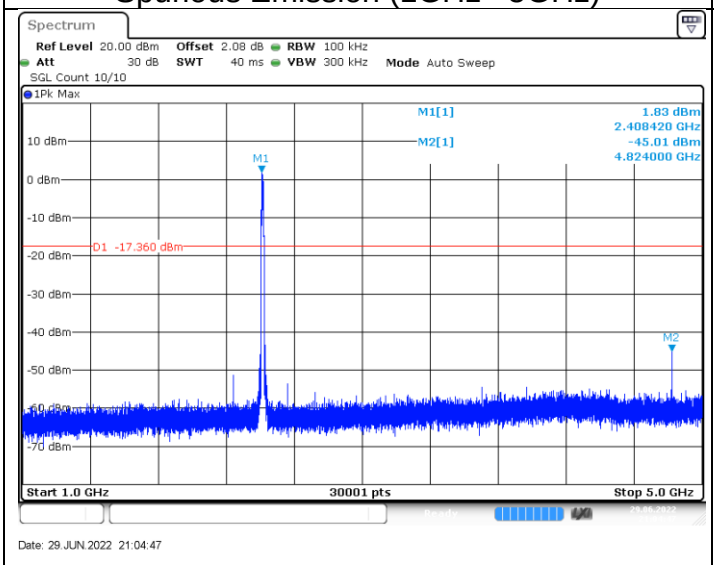
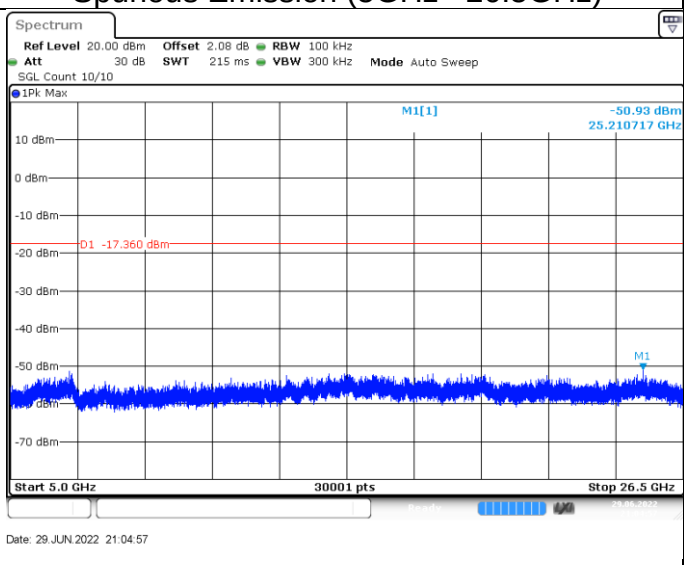
1. Establish a reference level by using the following procedure:
   a. Set RBW=100 kHz. VBW≥3RBW. Detector =peak, Sweep time = auto couple, Trace mode = max hold.
   b. Allow trace to fully stabilize, use the peak marker function to determine the maximum PSD level.
2. Use the maximum PSD level to establish the reference level.
   a. Set the center frequency and span to encompass frequency range to be measured.
   b. Use the peak marker function to determine the maximum amplitude level. Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements, report the three highest emissions relative to the limit.
3. Repeat above procedures until other frequencies measured were completed.

**Limit**

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

## Spurious RF conducted emissions

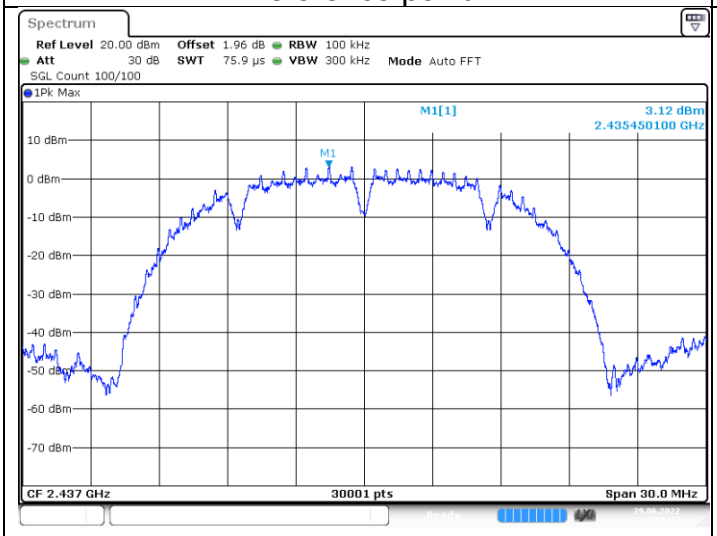
802.11b

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

## Out-of-Band Emissions

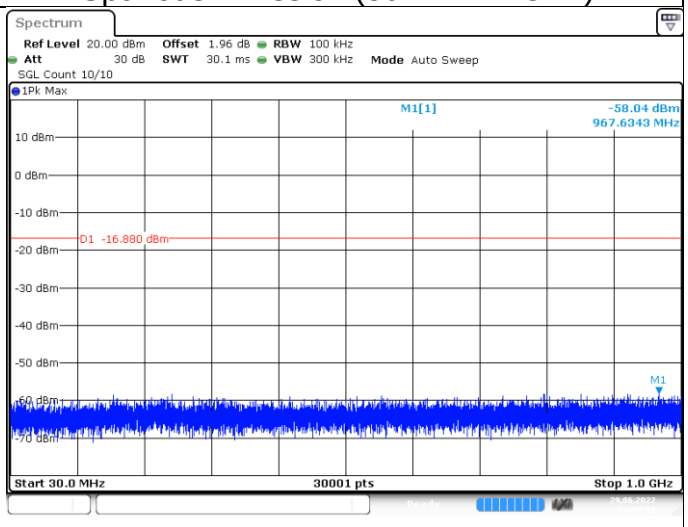
### Channel 6 (2437MHz)

#### Reference point



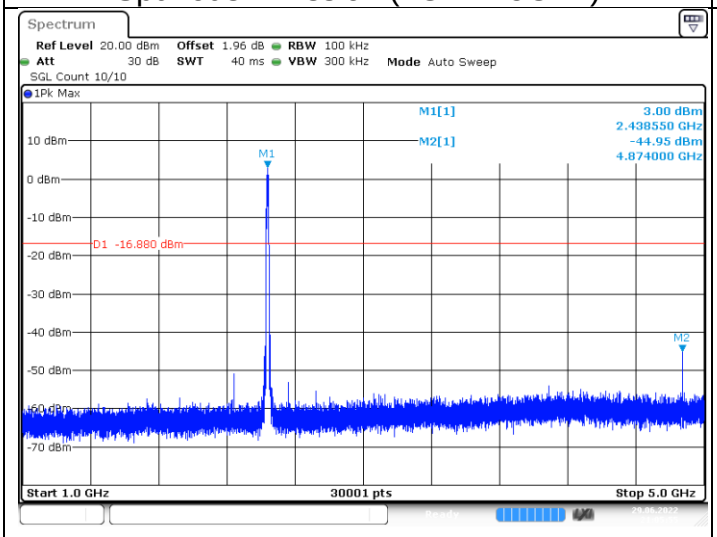

Date: 29.JUN.2022 21:05:48

#### Spurious Emission (30MHz – 1GHz)



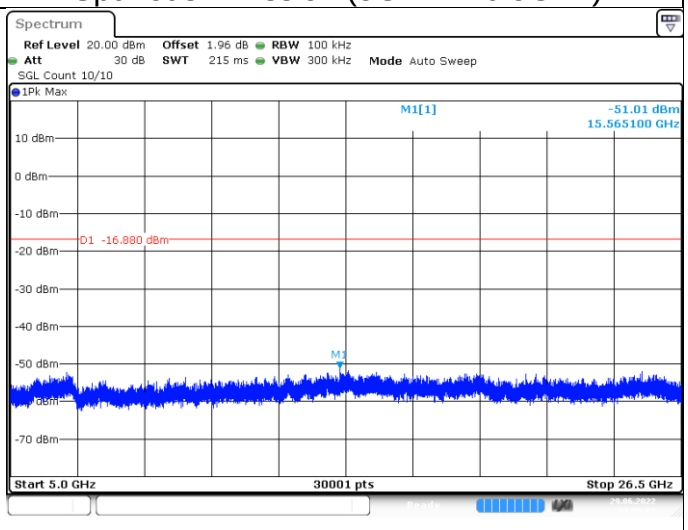

Date: 29.JUN.2022 21:05:51

#### Spurious Emission (1GHz –5GHz)

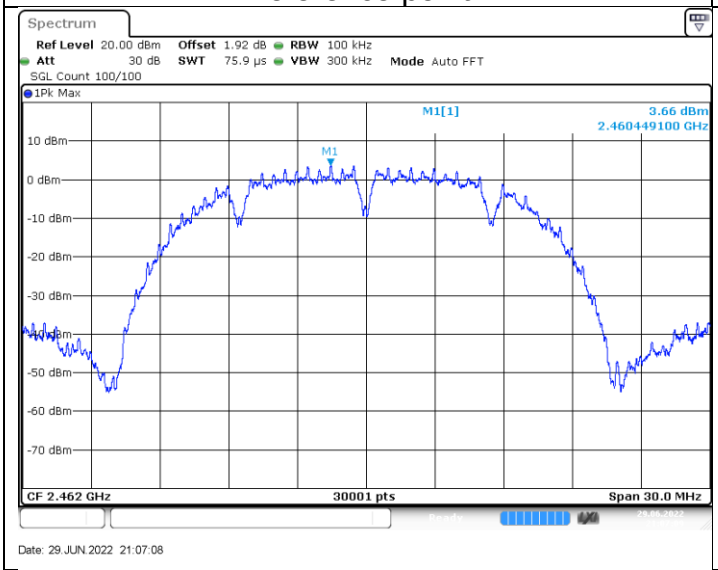
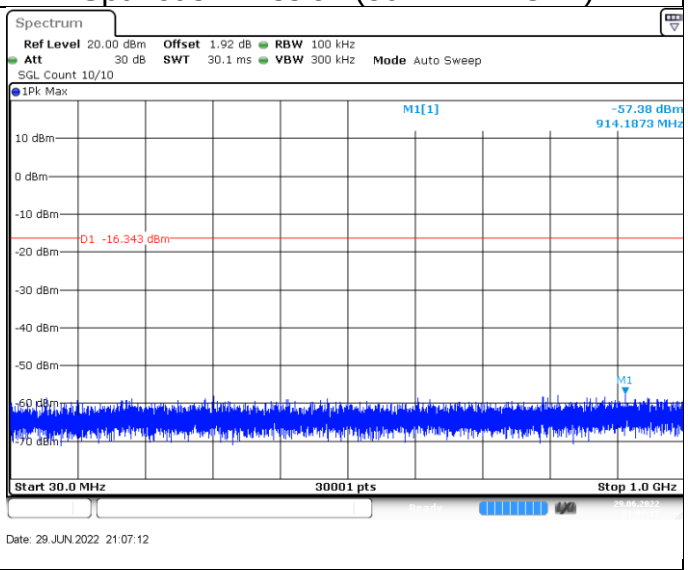
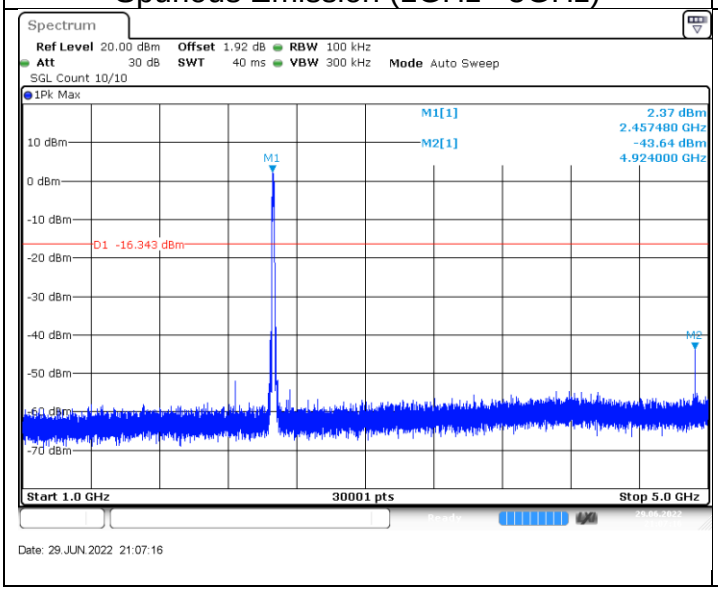
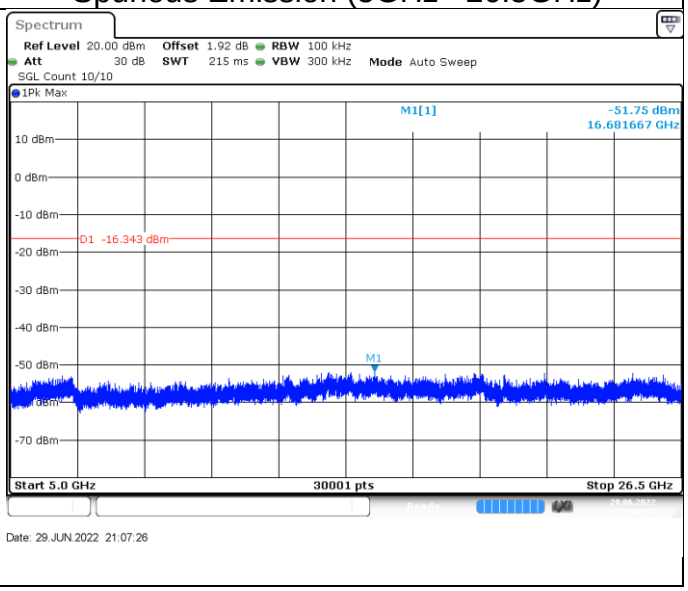



Date: 29.JUN.2022 21:05:55

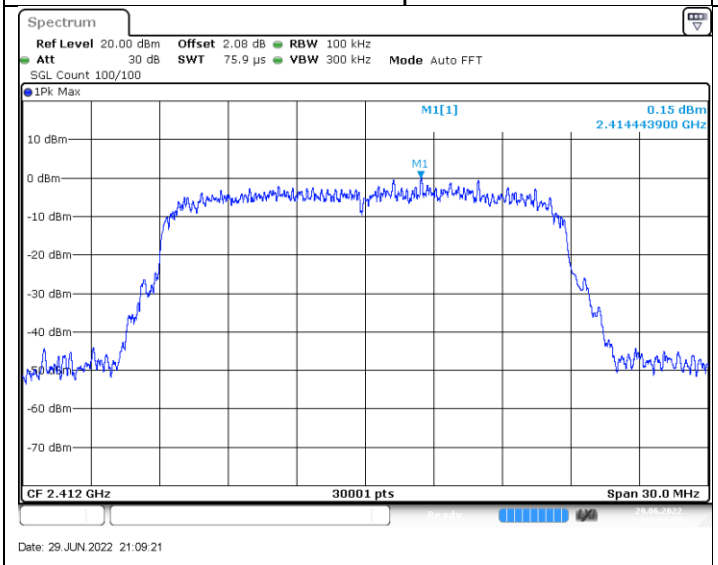
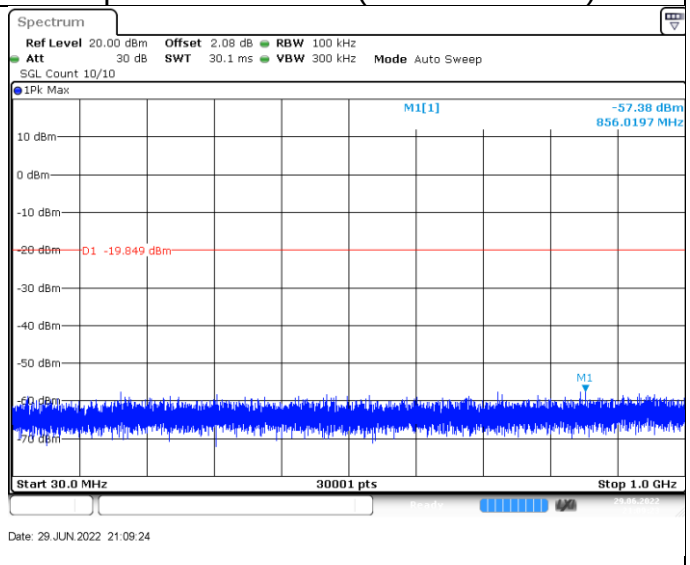
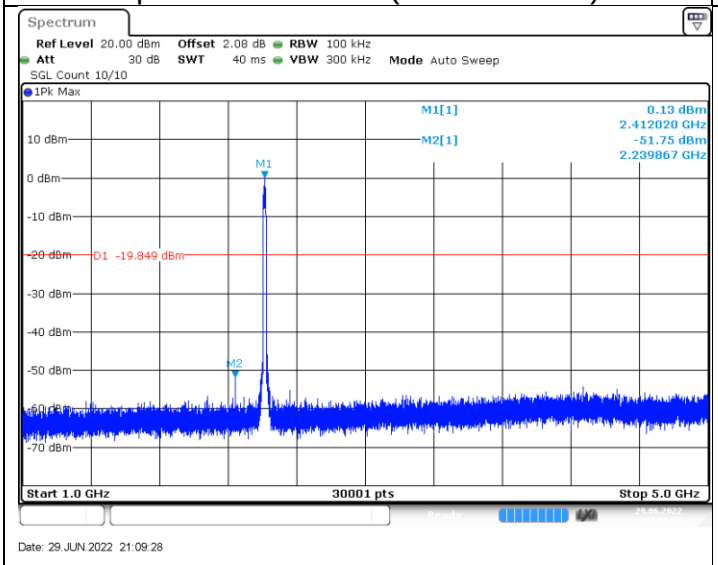
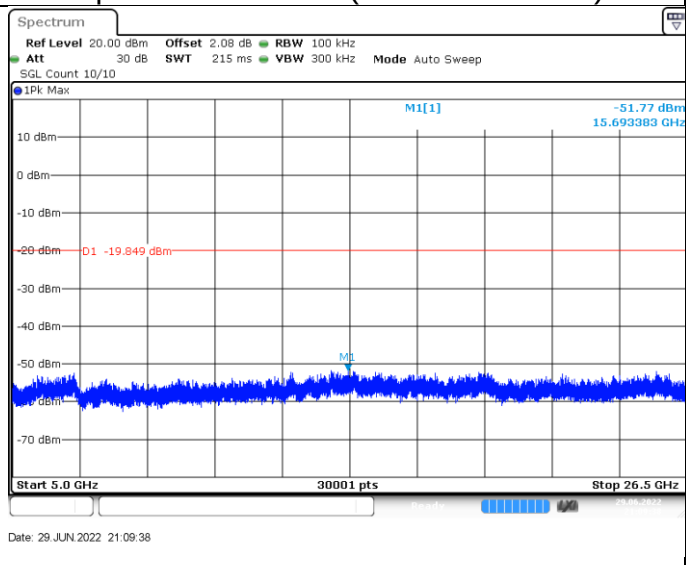
#### Spurious Emission (5GHz –26.5GHz)




Date: 29.JUN.2022 21:06:05

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

802.11g

| 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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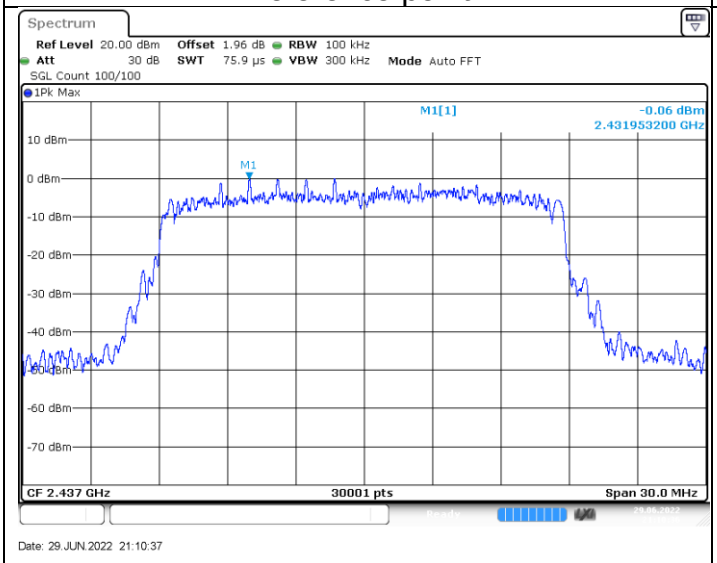
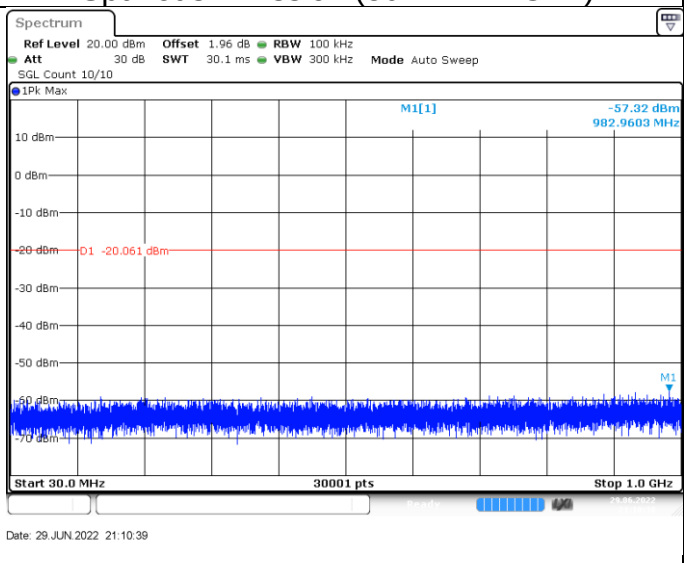
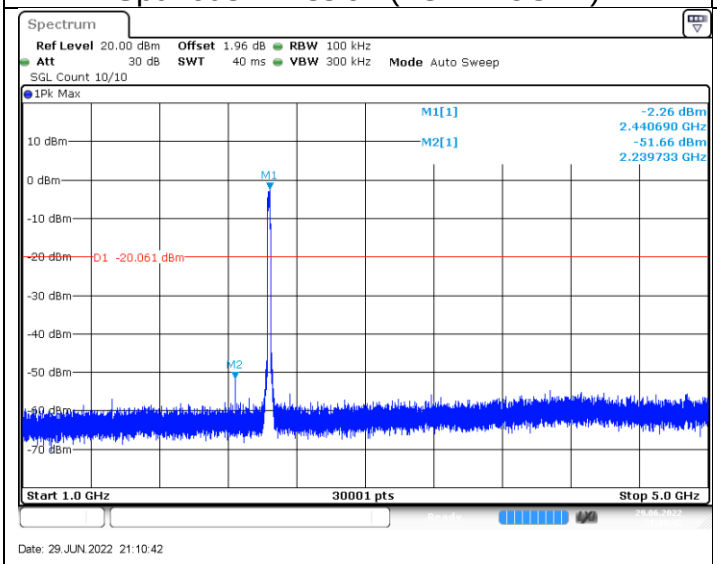
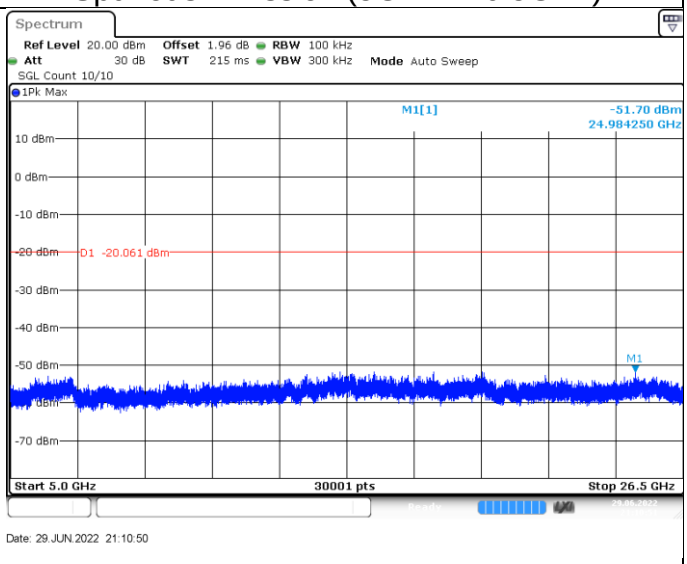
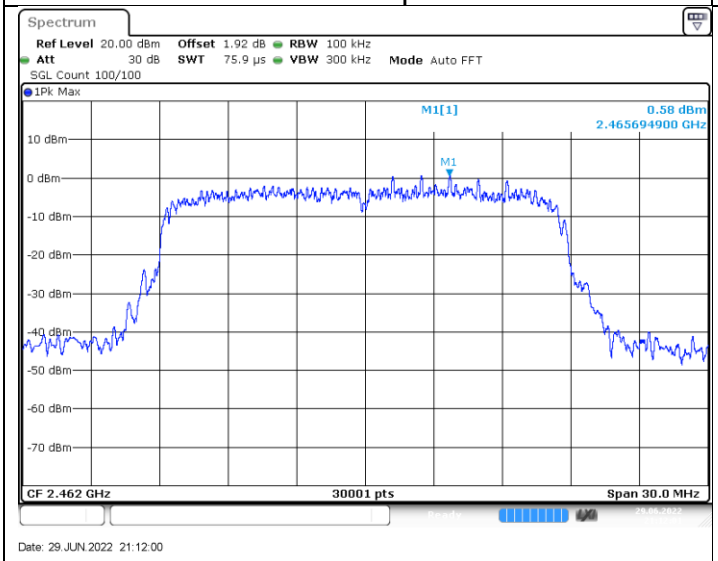
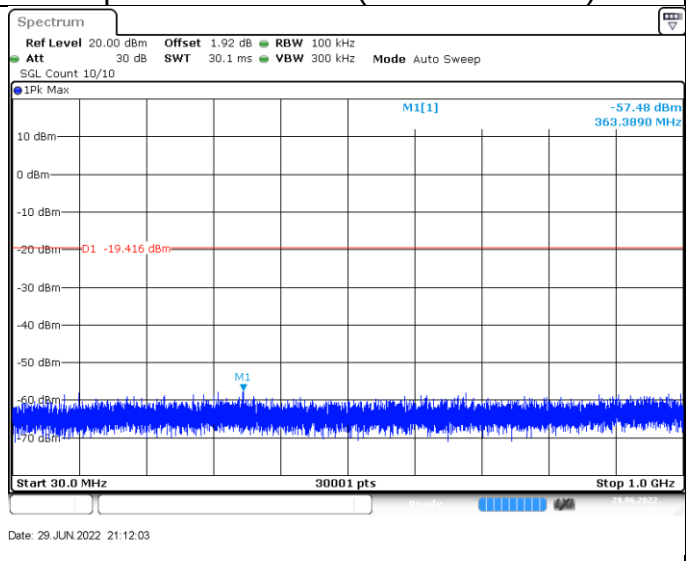
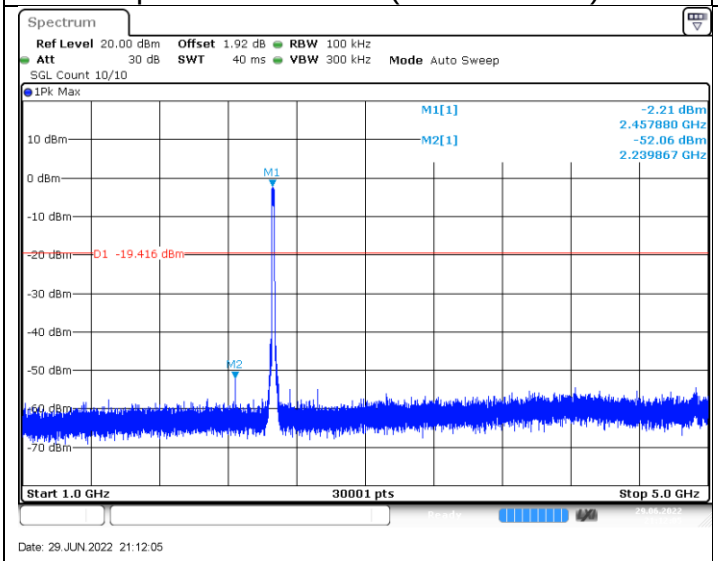
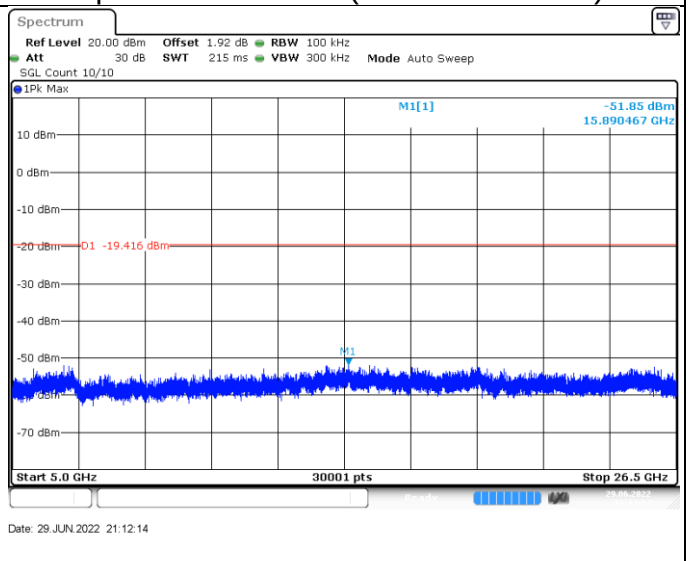
Phone: +86 21 61410123, Fax:+86 21 61408600

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

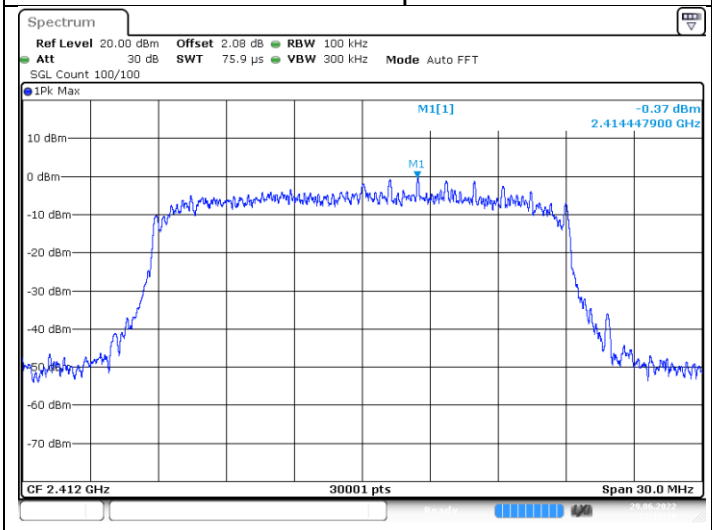
| Out-of-Band Emissions | |
|---|---|
| Channel 11 (2462MHz) | |
| Reference point | Spurious Emission (30MHz – 1GHz) |
|  |  |
| Spurious Emission (1GHz –5GHz) | Spurious Emission (5GHz –26.5GHz) |
|  |  |

802.11n(HT20)

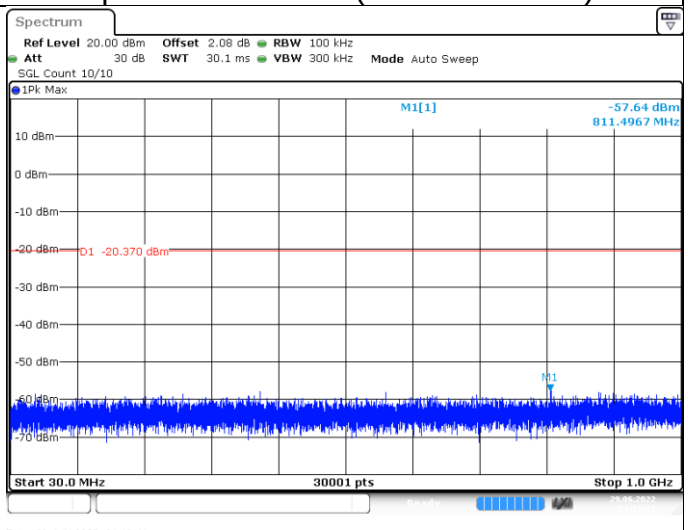
Out-of-Band Emissions

Channel 1 (2412MHz)

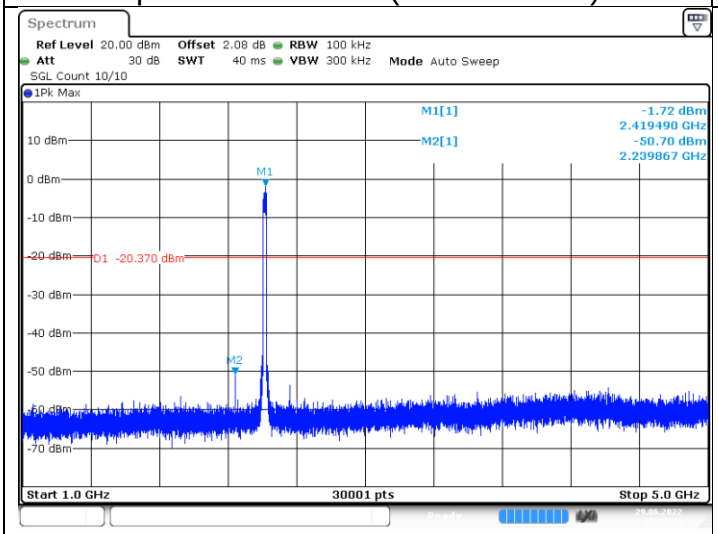
Reference point



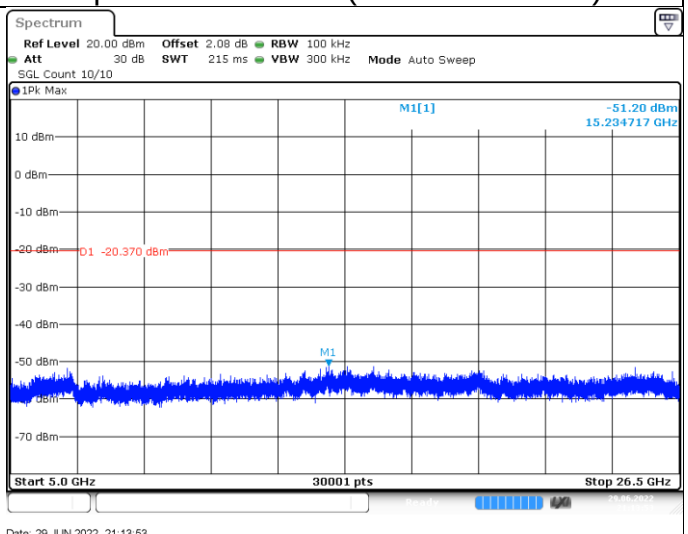

Spurious Emission (30MHz – 1GHz)

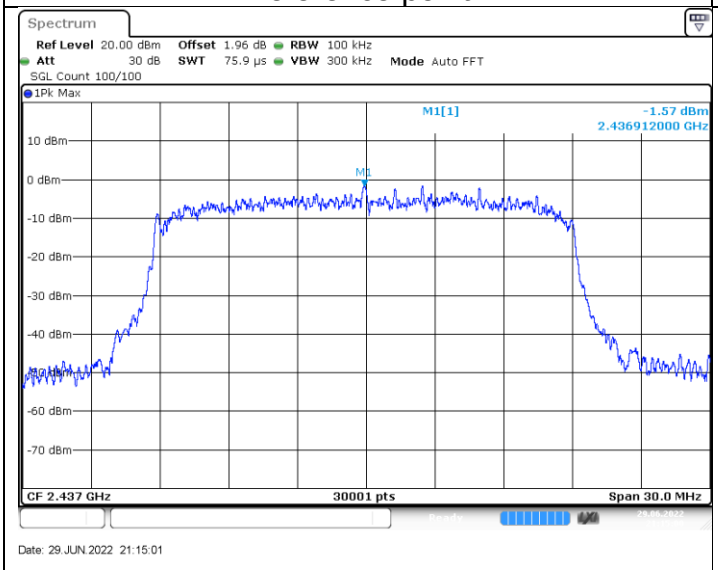
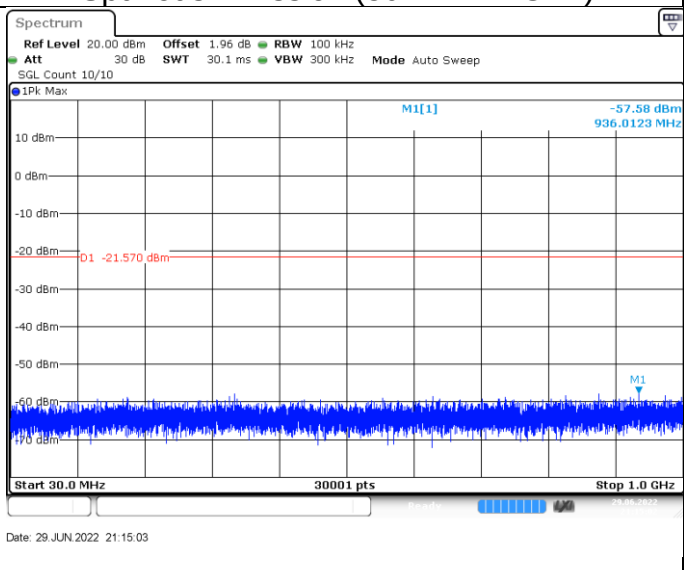
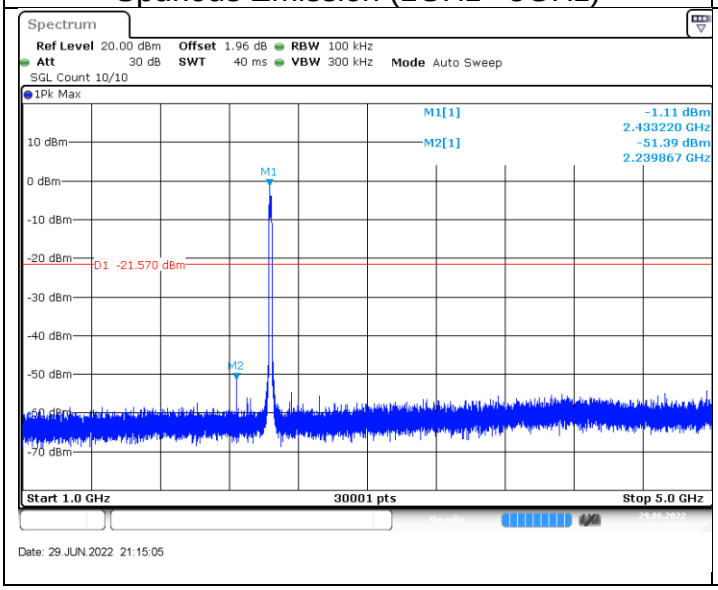
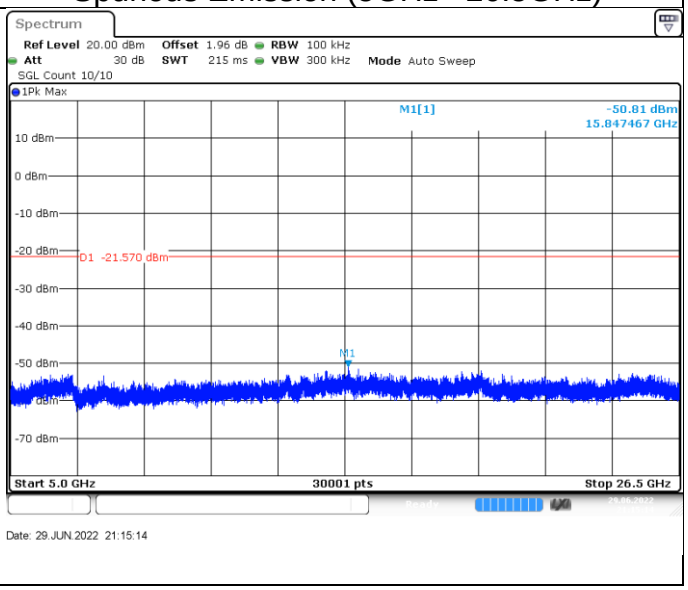


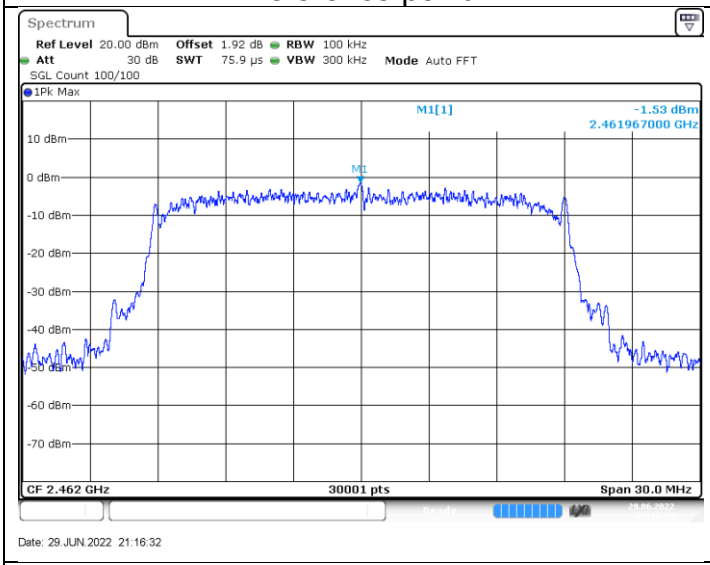
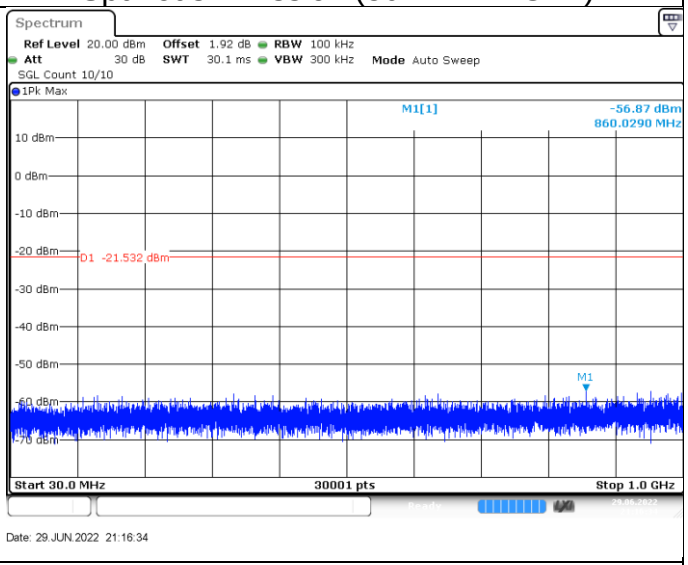
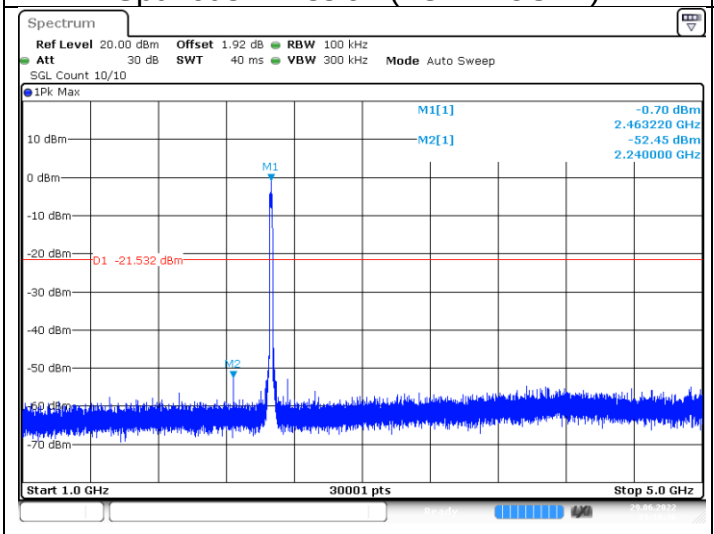
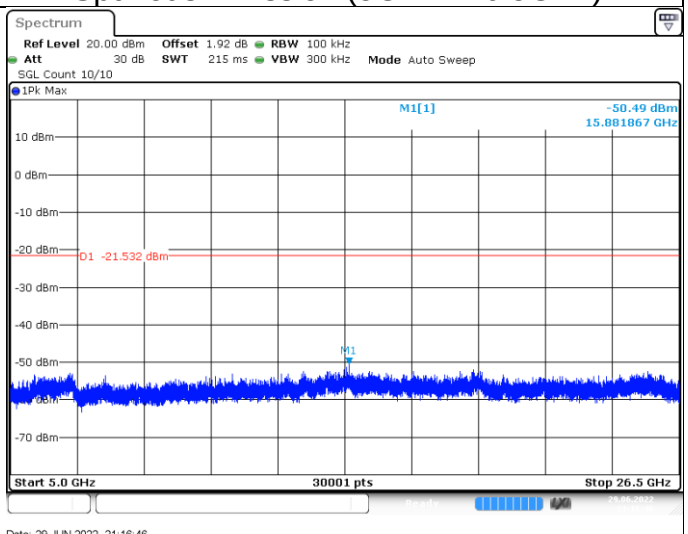

Spurious Emission (1GHz –5GHz)




Spurious Emission (5GHz –26.5GHz)



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

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

## 9.6 Band edge

**Test Method**

1 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≥RBW, Sweep = auto, Detector function = peak, Trace = max hold.
2 Allow the trace to stabilize, use the peak and delta measurement to record the result.
3 The level displayed must comply with the limit specified in this Section.

**Limit**

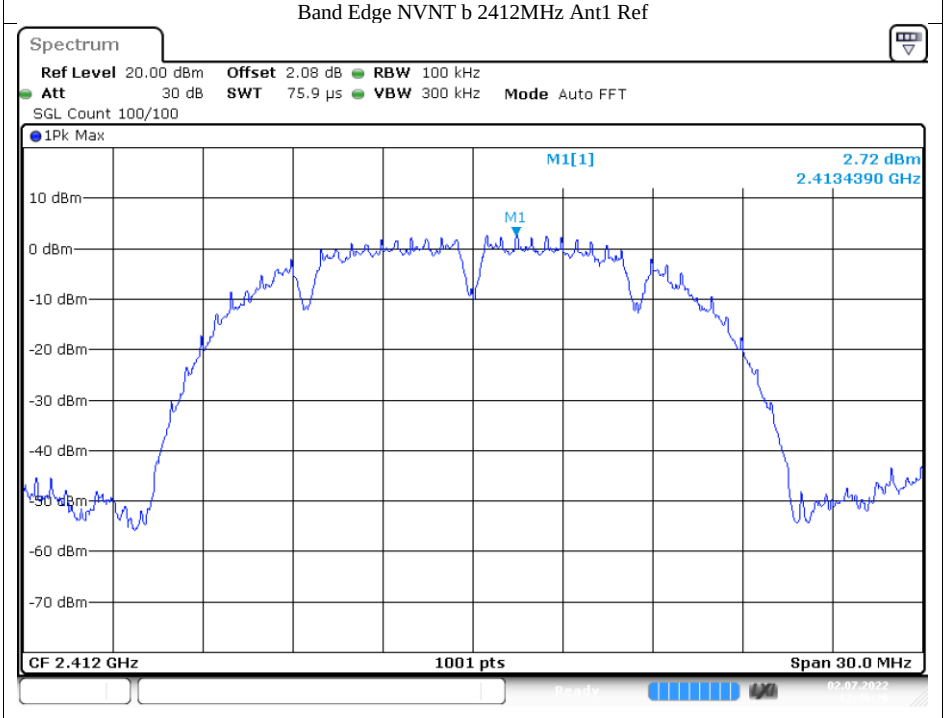
In any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a) and RSS-Gen8.10, must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)) and RSS-Gen.

## Test result

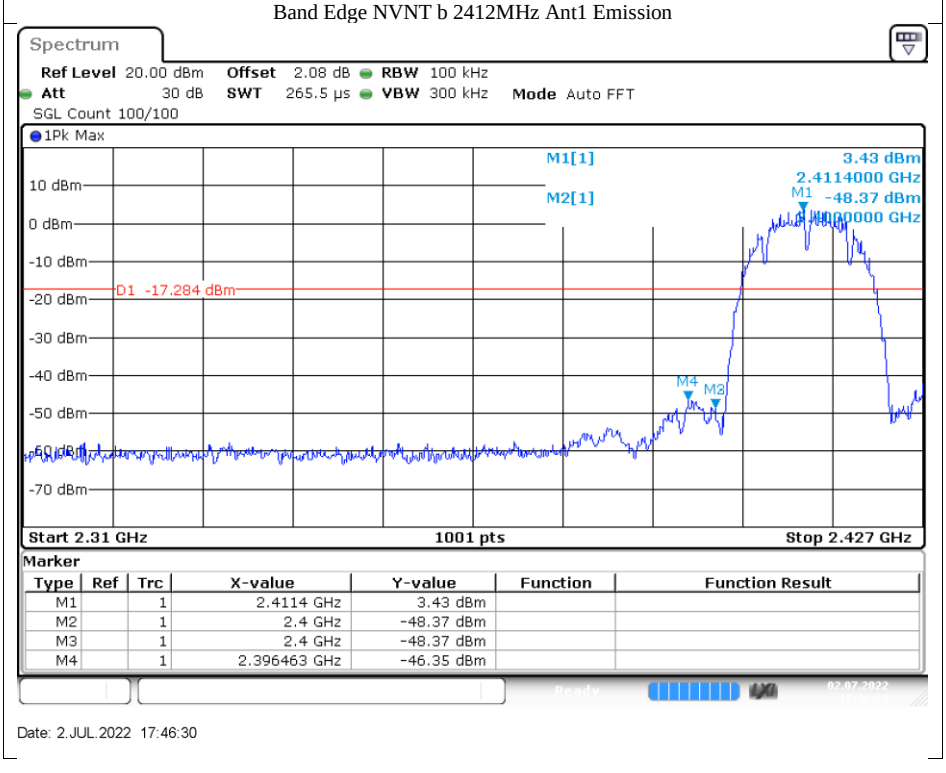
802.11b

Test Graphs

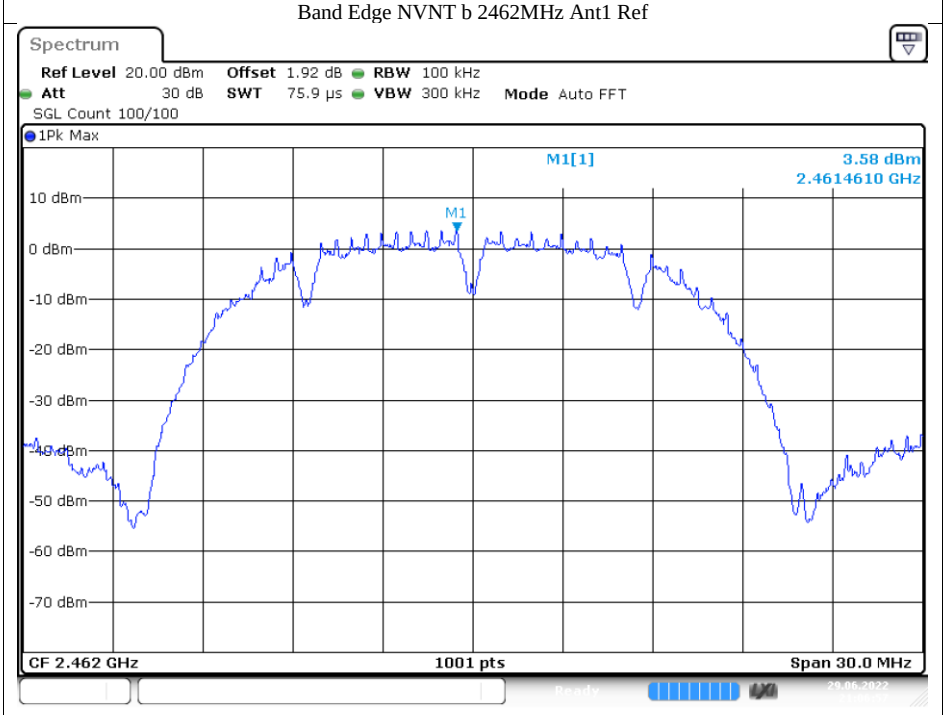
Band Edge NVNT b 2412MHz Ant1 Ref




Band Edge NVNT b 2412MHz Ant1 Emission

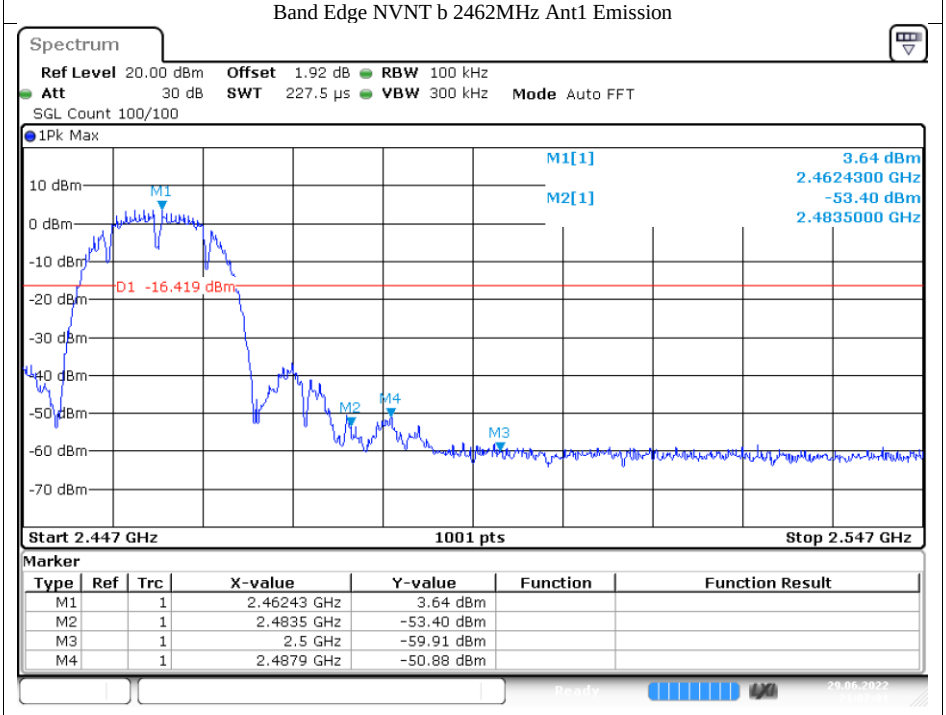


Band Edge NVNT b 2462MHz Ant1 Ref




Date: 29.JUN.2022 21:06:58

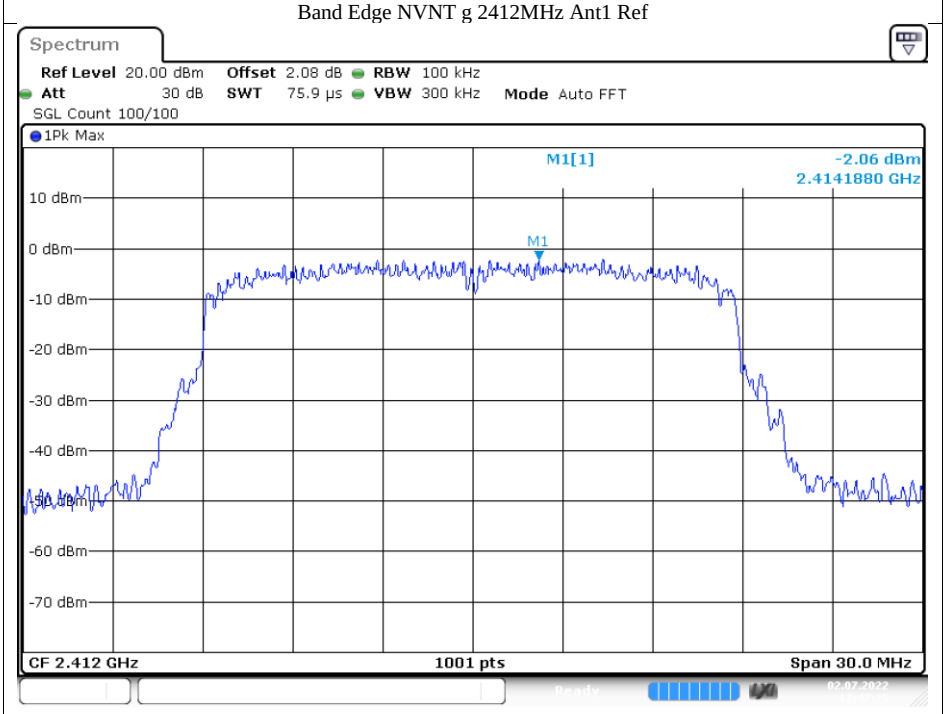
Band Edge NVNT b 2462MHz Ant1 Emission




Date: 29.JUN.2022 21:07:02

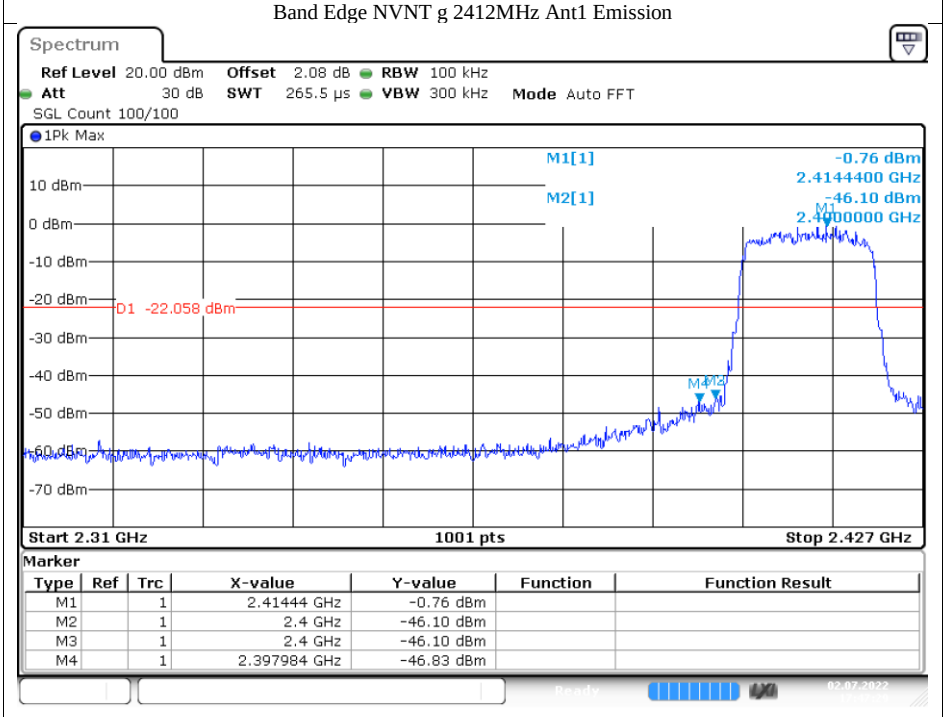
802.11g

Band Edge NVNT g 2412MHz Ant1 Ref




Date: 2.JUL.2022 17:47:26

Band Edge NVNT g 2412MHz Ant1 Emission




Date: 2.JUL.2022 17:47:29



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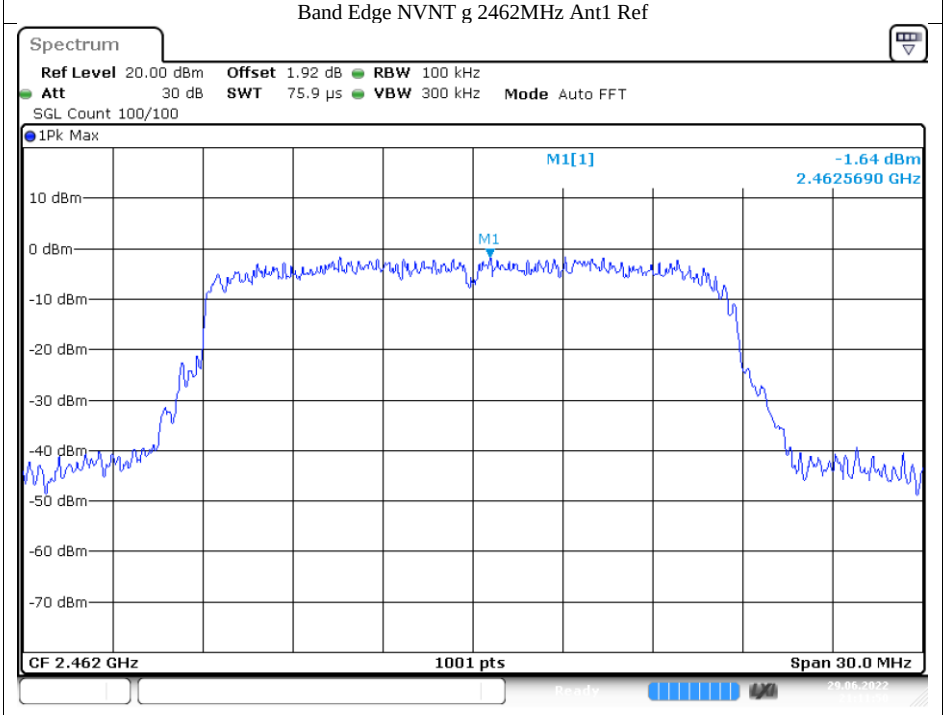
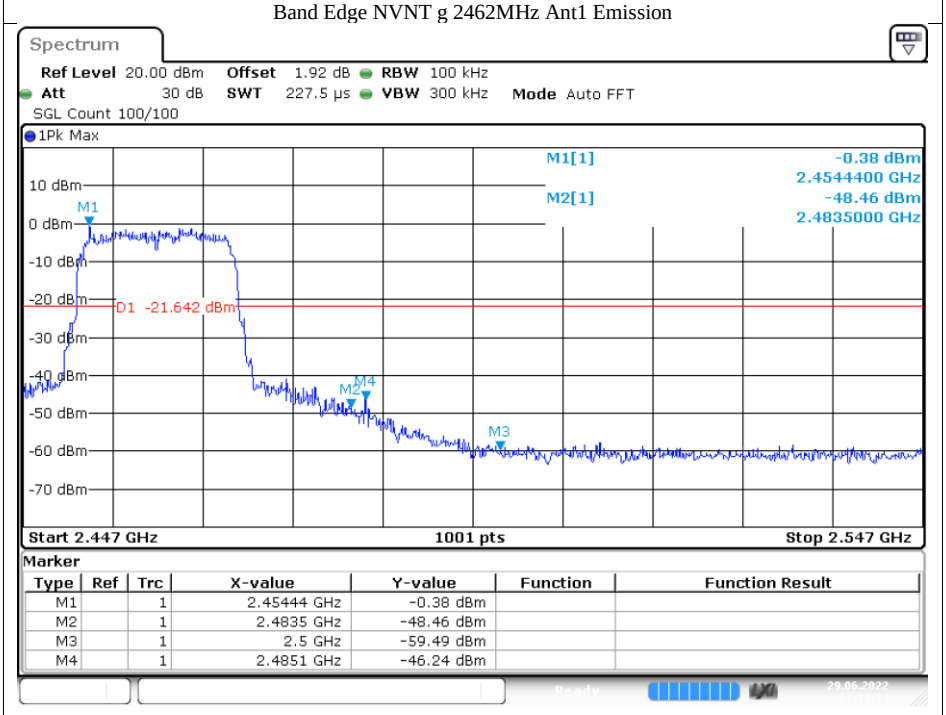
Band Edge NVNT g 2462MHz Ant1 Ref




Date: 29.JUN.2022 21:11:51

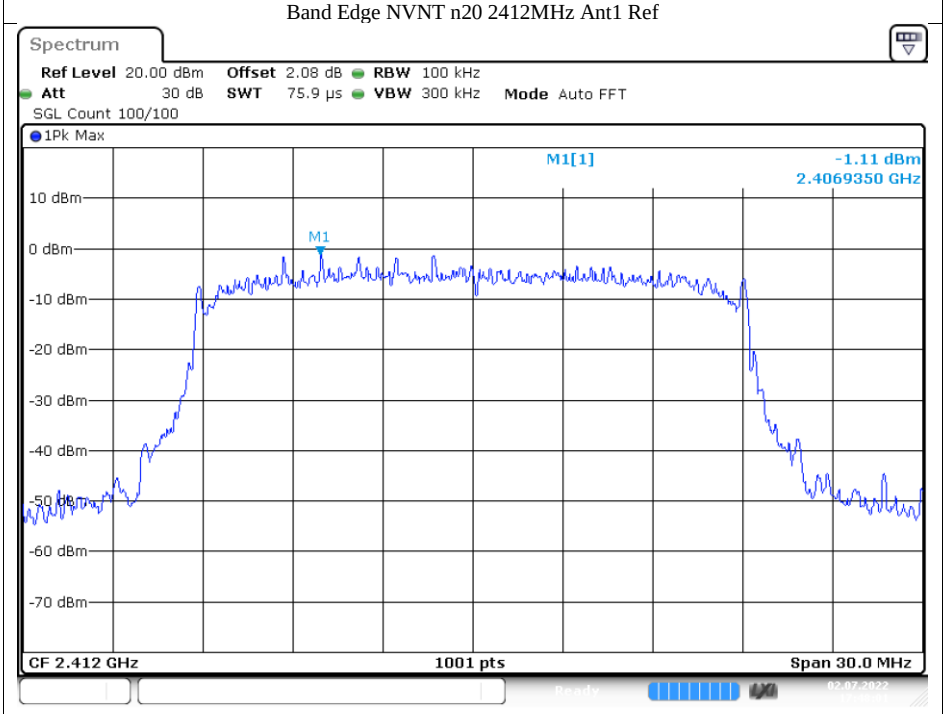
Band Edge NVNT g 2462MHz Ant1 Emission




Date: 29.JUN.2022 21:11:54

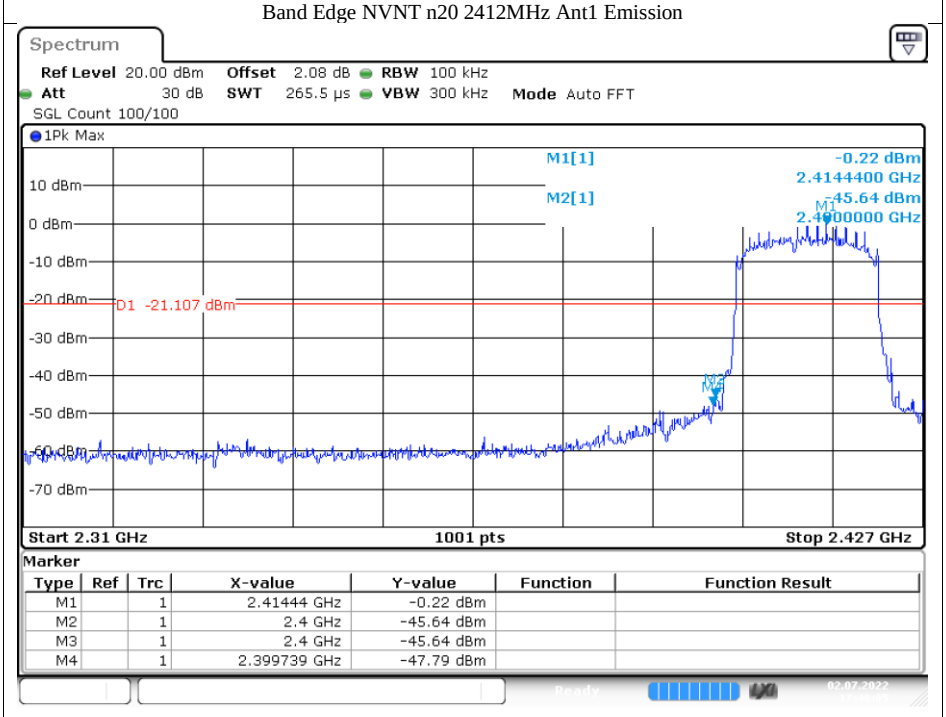
802.11n(HT20)

Band Edge NVNT n20 2412MHz Ant1 Ref



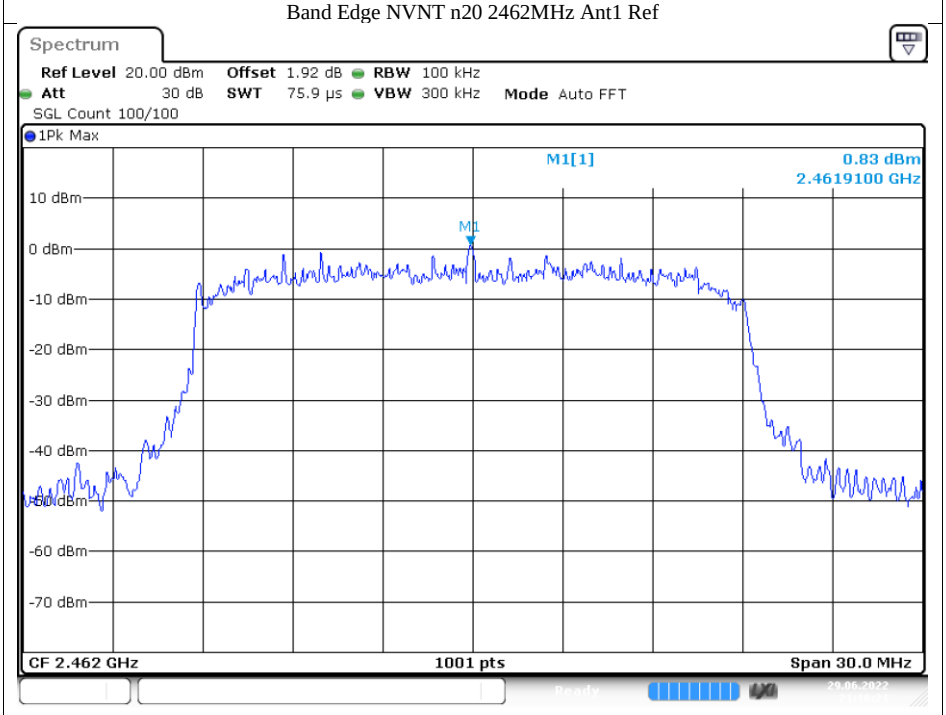

Date: 2.JUL.2022 17:48:01

Band Edge NVNT n20 2412MHz Ant1 Emission



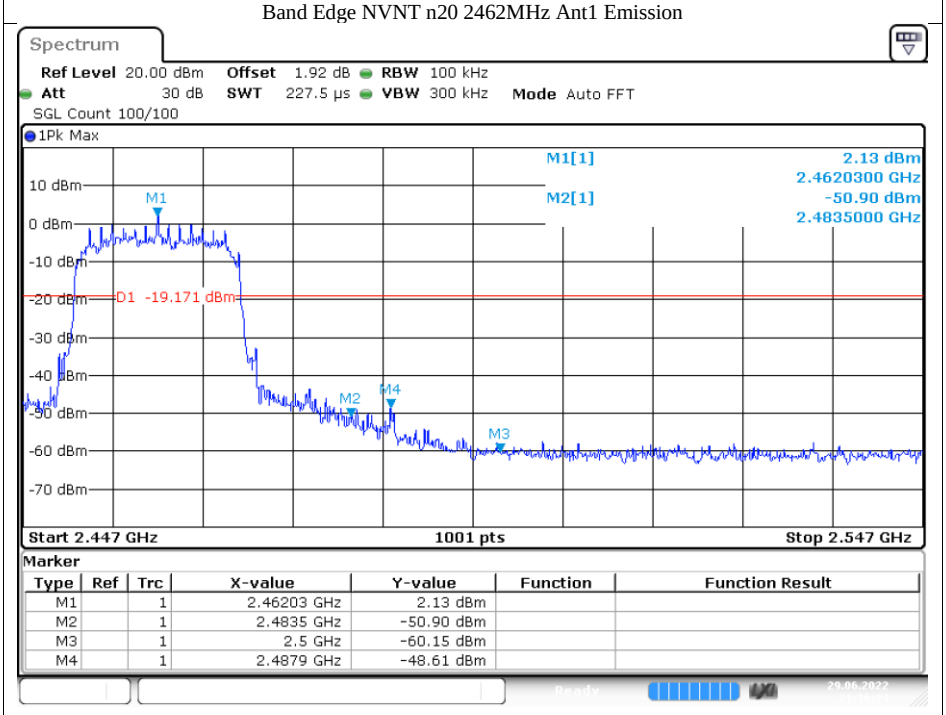

Date: 2.JUL.2022 17:48:05

Band Edge NVNT n20 2462MHz Ant1 Ref




Date: 29.JUN.2022 21:16:21

Band Edge NVNT n20 2462MHz Ant1 Emission




Date: 29.JUN.2022 21:16:25

## 9.7 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:

For Below 1GHz

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 to 120 kHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

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 1000 MHz

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.
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.

**Limit**

The radio emission outside the operating frequency band 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. Radiated emissions which fall in the restricted bands, as defined in section15.205 and RSS-GEN 8.10 must comply with the radiated emission limits specified in section 15.209.

| Frequency MHz | Field Strength uV/m | Measured Distance Meters |
|---|---|---|
| 0.009~0.490 | 2400/F (kHz) | 300 |
| 0.490~1.705 | 24000/F (kHz) | 30 |
| 1.705~30 | 30 | 30 |

| Frequency MHz | Field Strength uV/m | Field Strength dBµV/m | Detector |
|---|---|---|---|
| 30-88 | 100 | 40 | QP |
| 88-216 | 150 | 43.5 | QP |
| 216-960 | 200 | 46 | QP |
| 960-1000 | 500 | 54 | QP |
| Above 1000 | 500 | 54 | AV |
| Above 1000 | 5000 | 74 | PK |

## 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.

**Transmitting spurious emission test result as below:**

Pre-scan with three orthogonal axis and worst case as X axis listed below table

| Test mode:802.11B (2412MHz) | | | | | |
|---|---|---|---|---|---|
| **Frequency MHz** | **Measure Level (dBuV/m)** | **Limit (dBuV/M** | **Margin (dB)** | **Detector** | **Polarization** |
| 2385.60 | 46.86 | 74 | 27.14 | PK | Hoirznotal |
| 2386.13 | 45.12 | 74 | 28.88 | PK | Vertical |
| 4823.86 | 50.17 | 74 | 23.83 | PK | Hoirznotal |
| 4823.86 | 43.23 | 74 | 30.77 | PK | Vertical |

| Test mode:802.11B (2437MHz) | | | | | |
|---|---|---|---|---|---|
| **Frequency MHz** | **Measure Level (dBuV/m)** | **Limit (dBuV/M** | **Margin (dB)** | **Detector** | **Polarization** |
| 4873.73 | 49.41 | 74.00 | 24.59 | PK | Hoirznotal |
| 4873.73 | 43.77 | 74.00 | 30.23 | PK | Vertical |

| Test mode:802.11B (2462MHz) | | | | | |
|---|---|---|---|---|---|
| **Frequency MHz** | **Measure Level (dBuV/m)** | **Limit (dBuV/M** | **Margin (dB)** | **Detector** | **Polarization** |
| 2385.60 | 46.86 | 74.00 | 27.14 | PK | Hoirznotal |
| 2386.13 | 45.12 | 74.00 | 28.88 | PK | Vertical |
| 4923.60 | 51.33 | 74.00 | 22.67 | PK | Hoirznotal |
| 4923.60 | 45.35 | 74.00 | 28.65 | 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

| Test mode:802.11G (2412MHz) | | | | | |
|---|---|---|---|---|---|
| Frequency MHz | Measure Level (dBuV/m) | Limit (dBuV/M | Margin (dB) | Detector | Polarization |
| 2388.88 | 49.98 | 74 | 24.02 | PK | Horiznotal |
| 2385.13 | 43.36 | 74 | 30.64 | PK | Vertical |
| 4819.90 | 46.08 | 74 | 27.92 | PK | Horiznotal |
| 4819.90 | 43.23 | 74 | 30.77 | PK | Vertical |

| Test mode:802.11G (2437MHz) | | | | | |
|---|---|---|---|---|---|
| Frequency MHz | Measure Level (dBuV/m) | Limit (dBuV/M | Margin (dB) | Detector | Polarization |
| 4872.03 | 46.17 | 74.00 | 27.83 | PK | Horiznotal |
| 4872.03 | 43.21 | 74.00 | 30.79 | PK | Vertical |

| Test mode:802.11G (2462MHz) | | | | | |
|---|---|---|---|---|---|
| Frequency MHz | Measure Level (dBuV/m) | Limit (dBuV/M | Margin (dB) | Detector | Polarization |
| 2483.60 | 53.45 | 74.00 | 20.55 | PK | Horiznotal |
| 2483.60 | 42.20 | 54.00 | 11.80 | AV | Horiznotal |
| 2483.68 | 45.74 | 74.00 | 28.26 | PK | Vertical |
| 4923.03 | 47.01 | 74.00 | 26.99 | PK | Horiznotal |
| 4923.60 | 44.35 | 74.00 | 29.65 | 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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| Test mode:802.11N (2412MHz) | | | | | |
|---|---|---|---|---|---|
| **Frequency MHz** | **Measure Level (dBuV/m)** | **Limit (dBuV/M** | **Margin (dB)** | **Detector** | **Polarization** |
| 2385.86 | 49.28 | 74 | 24.72 | PK | Horiznotal |
| 2383.55 | 43.58 | 74 | 30.42 | PK | Vertical |
| 4823.86 | 45.14 | 74 | 28.86 | PK | Horiznotal |
| 4823.86 | 42.89 | 74 | 31.11 | PK | Vertical |

| Test mode:802.11N (2437MHz) | | | | | |
|---|---|---|---|---|---|
| **Frequency MHz** | **Measure Level (dBuV/m)** | **Limit (dBuV/M** | **Margin (dB)** | **Detector** | **Polarization** |
| 4875.43 | 46.02 | 74.00 | 27.98 | PK | Horiznotal |
| 4875.43 | 42.19 | 74.00 | 31.81 | PK | Vertical |

| Test mode:802.11N (2462MHz) | | | | | |
|---|---|---|---|---|---|
| **Frequency MHz** | **Measure Level (dBuV/m)** | **Limit (dBuV/M** | **Margin (dB)** | **Detector** | **Polarization** |
| 2483.70 | 52.58 | 74.00 | 21.42 | PK | Horiznotal |
| 2483.70 | 42.37 | 54.00 | 11.63 | AV | Horiznotal |
| 2483.70 | 44.81 | 74.00 | 29.19 | PK | Vertical |
| 4923.60 | 47.93 | 74.00 | 26.07 | PK | Horiznotal |
| 4923.60 | 42.61 | 74.00 | 31.39 | 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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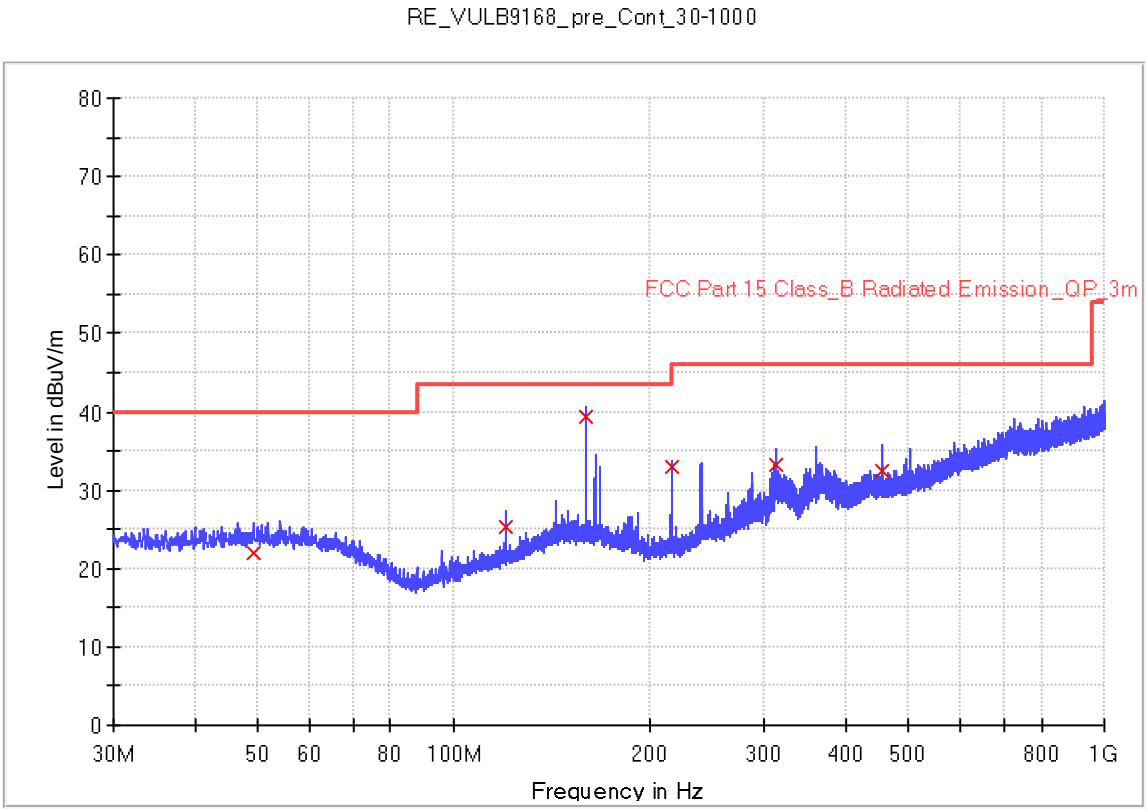
The worst case of Radiated Emission below 1GHz:

| | |
|---|---|
| Site: 3-meter chamber | Time: 2022/07/02 - 14:08 |
| Limit: FCC_Part15.109_RE(3m)_ClassB | Engineer: Wang Yiquan |
| Probe: VULB9168 | Polarity: Horizontal |
| EUT: Wi-Fi and Bluetooth module, Model no: WT3 | Power: DC 3.3V by debug board for EUT, AC 120V,60Hz for notebook |
| Note: Transmit by 802.11g at channel 2462MHz.<br>Note: Pre-scan with three orthogonal axis and worst case as X axis. | |




## Limit and Margin

| Frequency (MHz) | QuasiPeak (dBuV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) | Margin - QPK (dB) | Limit - QPK (dBuV/m) |
|---|---|---|---|---|---|---|---|---|---|
| 49.320000 | 21.9 | 1000.0 | 120.000 | 100.2 | H | 254.0 | 18.1 | 18.1 | 40.0 |
| 119.960000 | 25.2 | 1000.0 | 120.000 | 100.2 | H | 180.0 | 20.9 | 18.3 | 43.5 |
| 159.960000 | 39.3 | 1000.0 | 120.000 | 100.2 | H | 219.0 | 20.1 | 4.2 | 43.5 |
| 215.960000 | 33.0 | 1000.0 | 120.000 | 100.2 | H | 74.0 | 21.9 | 10.5 | 43.5 |
| 311.960000 | 33.3 | 1000.0 | 120.000 | 100.2 | H | 126.0 | 24.2 | 12.7 | 46.0 |
| 456.040000 | 32.6 | 1000.0 | 120.000 | 100.2 | H | 298.0 | 31.2 | 13.5 | 46.0 |

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)
Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)
Note 2: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 25GHz), therefore no data appear in the report.

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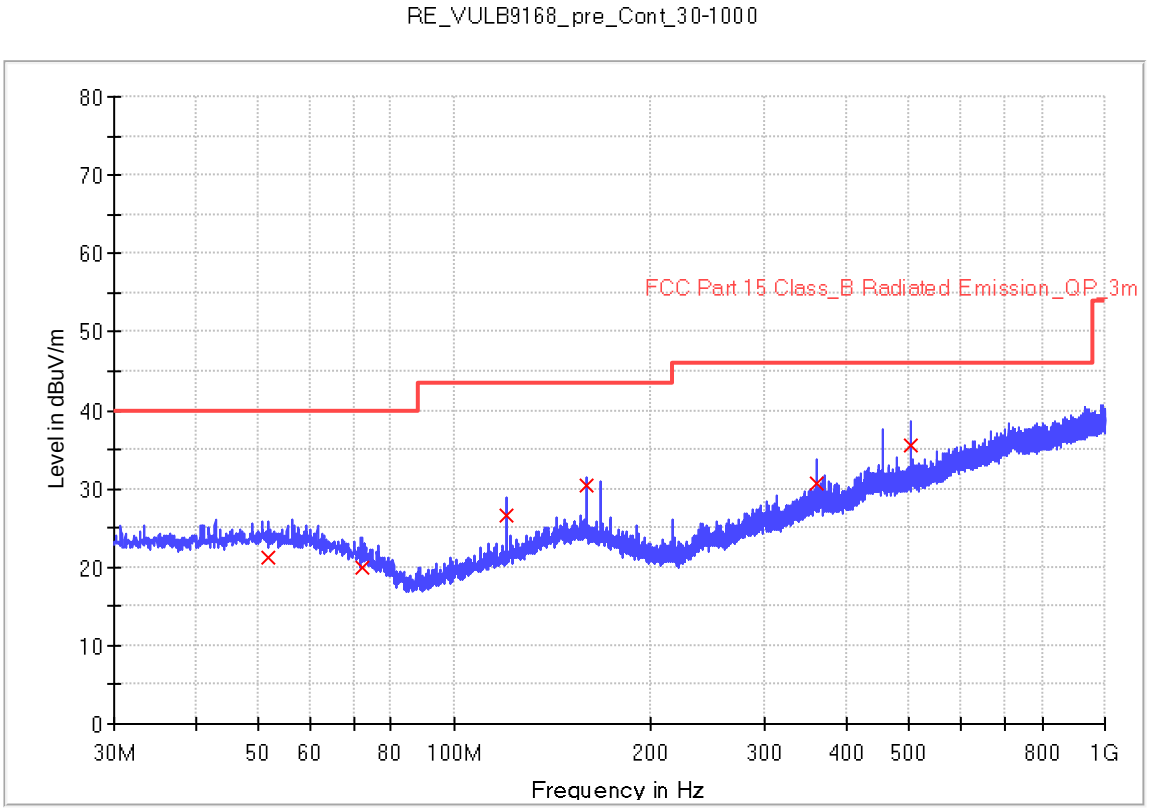
| | |
|---|---|
| Site: 3-meter chamber | Time: 2022/07/02 - 15:21 |
| Limit: FCC_Part15.109_RE(3m)_ClassB | Engineer: Wang Yiquan |
| Probe: VULB9168 | Polarity: Vertical |
| EUT: Wi-Fi and Bluetooth module, Model no: WT3 | Power: DC 3.3V by debug board for EUT,<br>AC 120V,60Hz for notebook |
| Note: Transmit by 802.11g at channel 2462MHz.<br>Note: Pre-scan with three orthogonal axis and worst case as X axis. | |




## Limit and Margin

| Frequency (MHz) | QuasiPeak (dBuV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) | Margin - QPK (dB) | Limit - QPK (dBuV/m) |
|---|---|---|---|---|---|---|---|---|---|
| 51.640000 | 21.2 | 1000.0 | 120.000 | 100.2 | V | 37.0 | 18.1 | 18.8 | 40.0 |
| 71.960000 | 19.9 | 1000.0 | 120.000 | 100.2 | V | 84.0 | 20.4 | 20.1 | 40.0 |
| 119.960000 | 26.6 | 1000.0 | 120.000 | 100.2 | V | 262.0 | 22.6 | 16.9 | 43.5 |
| 159.960000 | 30.4 | 1000.0 | 120.000 | 100.2 | V | 140.0 | 24.2 | 13.1 | 43.5 |
| 360.000000 | 30.8 | 1000.0 | 120.000 | 100.2 | V | 207.0 | 25.9 | 15.2 | 46.0 |
| 504.000000 | 35.6 | 1000.0 | 120.000 | 100.2 | V | 330.0 | 30.7 | 10.4 | 46.0 |

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)
Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)
Note 2: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 25GHz), therefore no data appear in the report.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# 10 Test Equipment List

List of Test Instruments
Test Site1

| | DESCRIPTION | MANUFACTURER | MODEL NO. | SERIAL NO. | CAL. DATE | CAL. DUE DATE |
|---|---|---|---|---|---|---|
| C | Signal Analyzer | Rohde & Schwarz | FSV40 | 101091 | 2021-8-2 | 2022-8-1 |
| | Wideband power sensor | Rohde & Schwarz | NRP-Z81 | 105903 | 2021-03-19 | 2022-3-18 |
| RE | EMI Test Receiver | Rohde & Schwarz | ESR3 | 101906 | 2021-8-2 | 2022-8-1 |
| | Signal Analyzer | Rohde & Schwarz | FSV40 | 101091 | 2021-8-2 | 2022-8-1 |
| | 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 | 2021-8-2 | 2022-8-1 |
| | Loop antenna | Rohde & Schwarz | HFH2-Z2E | 100933 | 2026-6-13 | 2023-6-12 |
| | DOUBLE-RIDGED WAVEGUIDE HORN WITH PRE-AMPLIFIER (18 GHZ - 40 GHZ) | ETS-Lindgren | 3116C-PA | 002222727 | 2020-9-23 | 2023-9-22 |
| | 3m Semi-anechoic chamber | TDK | 9X6X6 | ---- | 2021-5-8 | 2024-5-7 |
| CE | EMI Test Receiver | Rohde & Schwarz | ESR3 | 101907 | 2021-8-2 | 2022-8-1 |
| | LISN | Rohde & Schwarz | ENV216 | 101924 | 2021-8-2 | 2022-8-1 |

| Measurement Software Information | | | |
|---|---|---|---|
| Test Item | Software | Manufacturer | Version |
| C | Bluetooth and WiFi Test System | Shenzhen JS tonscend co.,ltd | 2.6.77.0518 |
| RE | EMC 32 | Rohde & Schwarz | V9.15.00 |
| 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

# 11 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 | 30MHz to 1GHz, ±5.03dB (Horizontal)<br>±5.12dB (Vertical)<br>1GHz to 18GHz, ±5.49dB<br>18GHz to 40GHz, ±5.63dB |
| Carrier power conducted measurement | 50MHz~18GHz, ±1.238dB |
| Spurious Emission Conducted Measurement | 9kHz ~40GHz, ± 1.224dB |

Measurement Uncertainty Decision Rule:

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2007, clause 4.4.3 and 4.5.1.

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## 12 Photographs of Test Set-ups

Refer to the < Test Setup photos >.



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# 13 Photographs of EUT

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

THE END



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