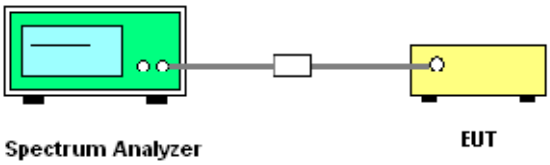
## 4.6. Conducted Band Edge and Spurious Emission Measurement

### Test Specification

| | |
|---|---|
| **Test Requirement:** | FCC Part15 C Section 15.247 (d) |
| **Test Method:** | KDB 558074 D01 15.247 Meas Guidance v05r02 |
| **Limit:** | In any 100 kHz bandwidth outside of the authorized frequency band, the emissions which fall in the non-restricted bands shall be attenuated at least 20 dB / 30dB relative to the maximum PSD level in 100 kHz by RF conducted measurement and radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a). |
| **Test Setup:** |  |
| **Test Mode:** | Transmitting mode with modulation |
| **Test Procedure:** | 1. The testing follows FCC KDB Publication 558074 D01 15.247 Meas Guidance v05r02.<br>2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.<br>3. Set to the maximum power setting and enable the EUT transmit continuously.<br>4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).<br>5. Measure and record the results in the test report.<br>6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band. |
| **Test Result:** | PASS |

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## Test Instruments

| RF Test Room | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Date** | **Calibration Due** |
| Spectrum analyzer | Agilent | N9020A | HKE-048 | Feb. 17, 2023 | Feb. 16, 2024 |
| High pass filter unit | Tonscend | JS0806-F | HKE-055 | Feb. 17, 2023 | Feb. 16, 2024 |
| RF Cable (9KHz-26.5GHz) | Tonscend | 170660 | N/A | Feb. 17, 2023 | Feb. 16, 2024 |
| RF automatic control unit | Tonscend | JS0806-2 | HKE-060 | Feb. 17, 2023 | Feb. 16, 2024 |
| RF test software | Tonscend | JS1120-B Version 2.6 | HKE-083 | N/A | N/A |

***Note:*** *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

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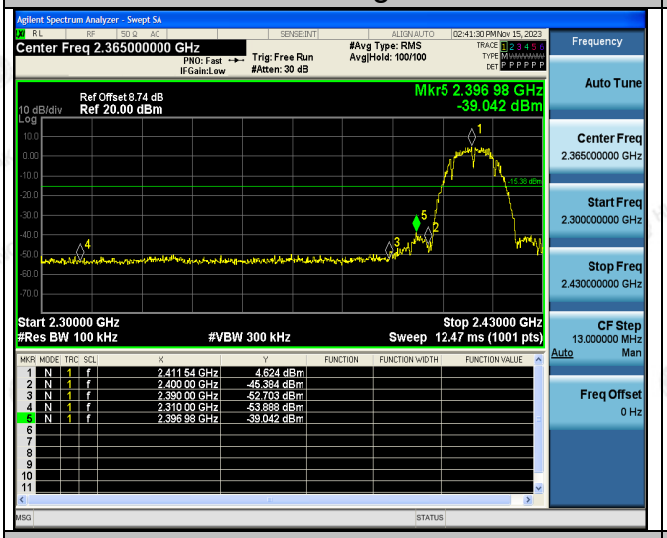
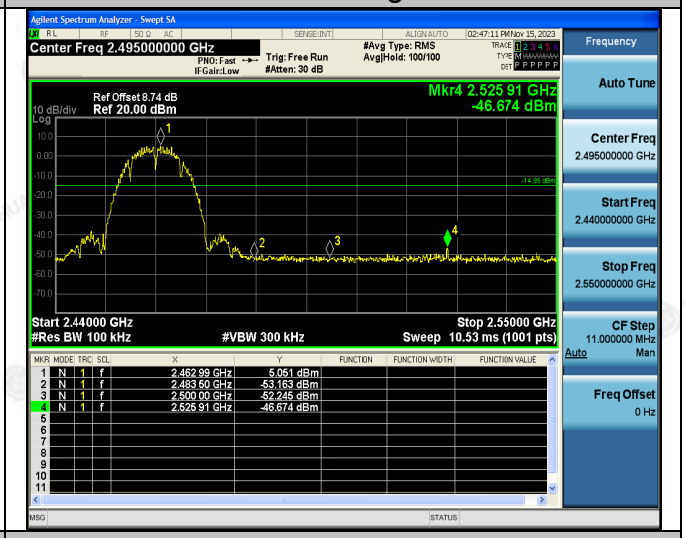
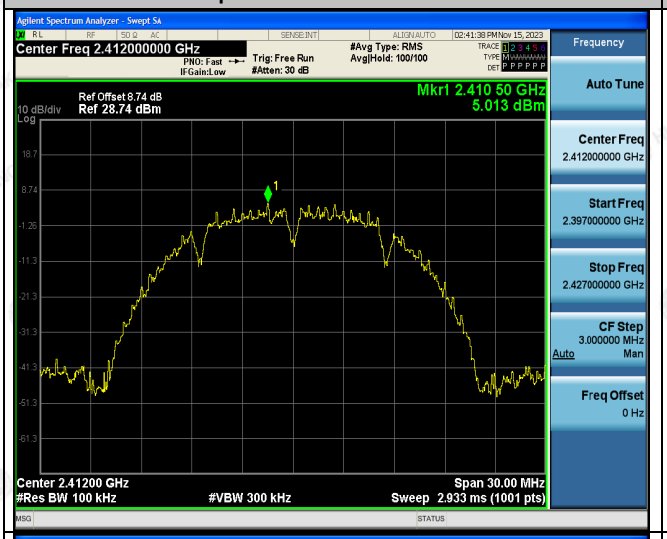
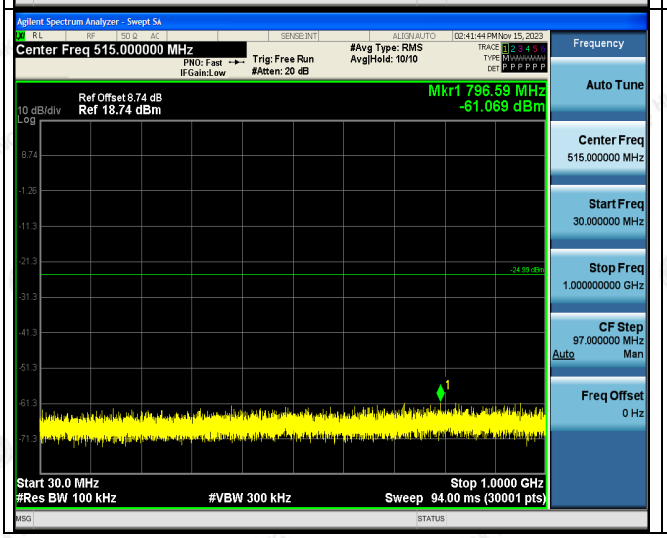
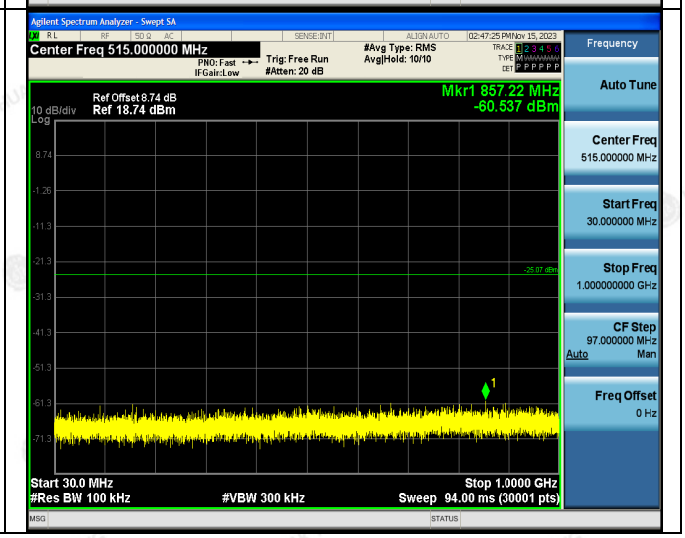
## Test Data

### 802.11b Modulation

| Lowest Channel | Highest Channel |
|---|---|
| Band Edge | Band Edge |
|  |  |
| Spurious Emission | Spurious Emission |
|  | |
|  |  |

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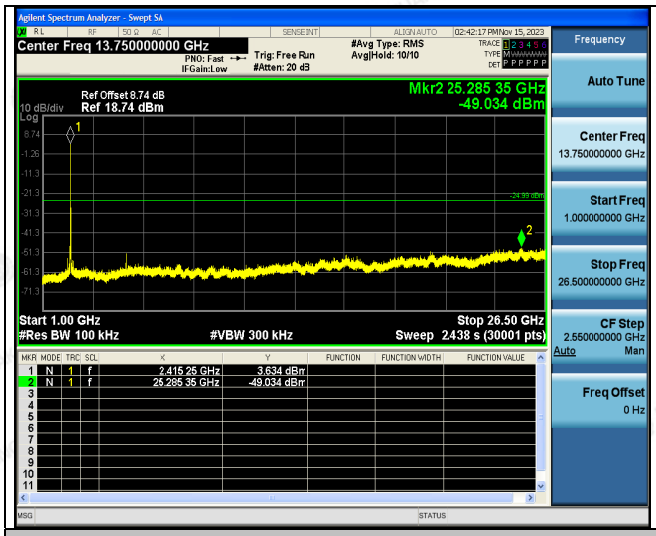
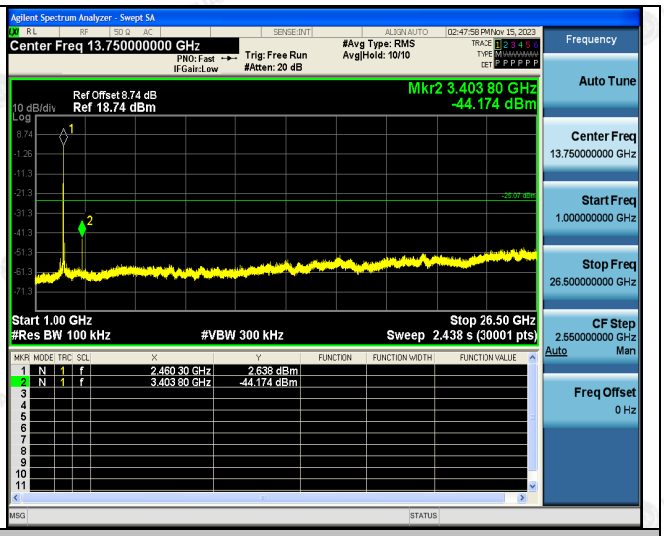
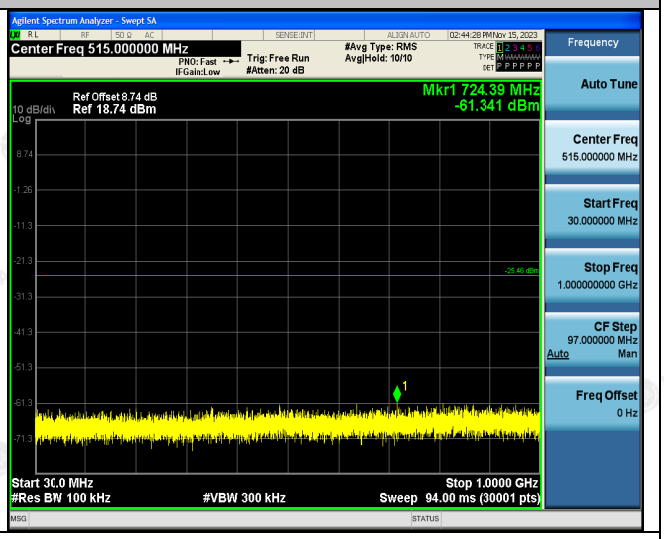
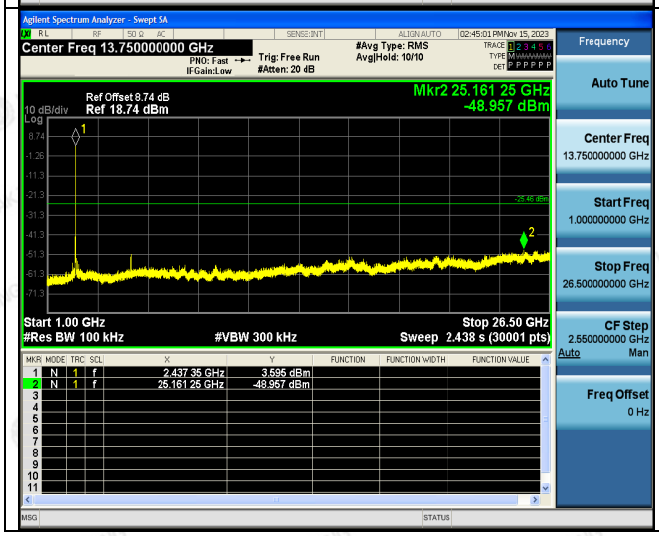



## Middle Channel

## Spurious Emission

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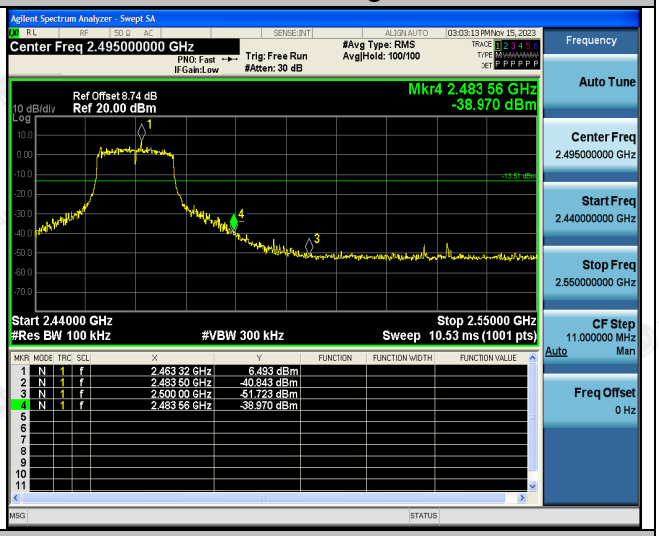
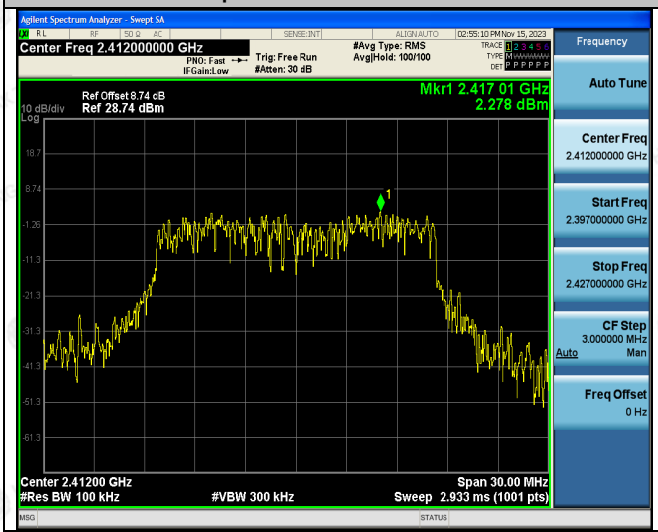
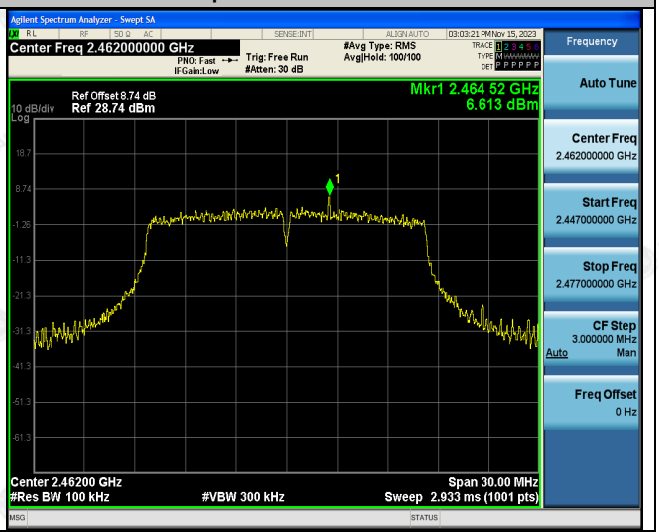
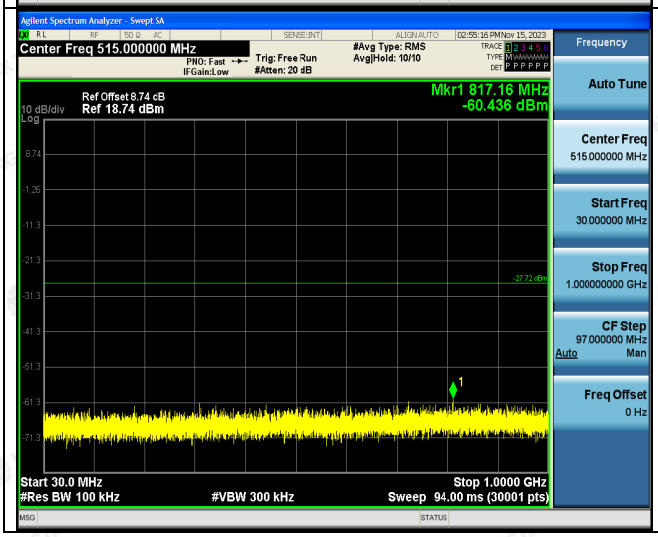
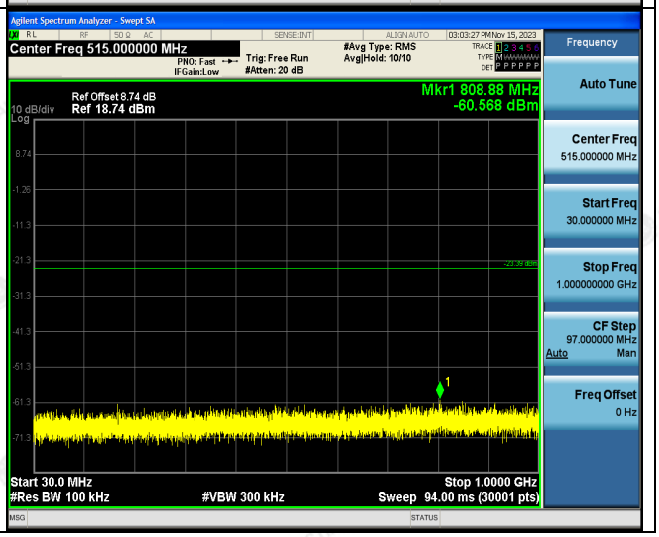
## 802.11g Modulation

| Lowest Channel | Highest Channel |
|---|---|
| Band Edge | Band Edge |
| |  |
| Spurious Emission | Spurious Emission |
|  |  |
|  |  |

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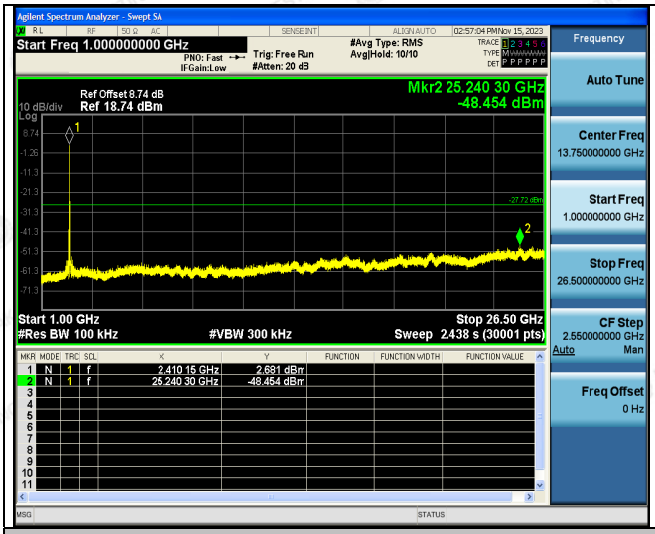
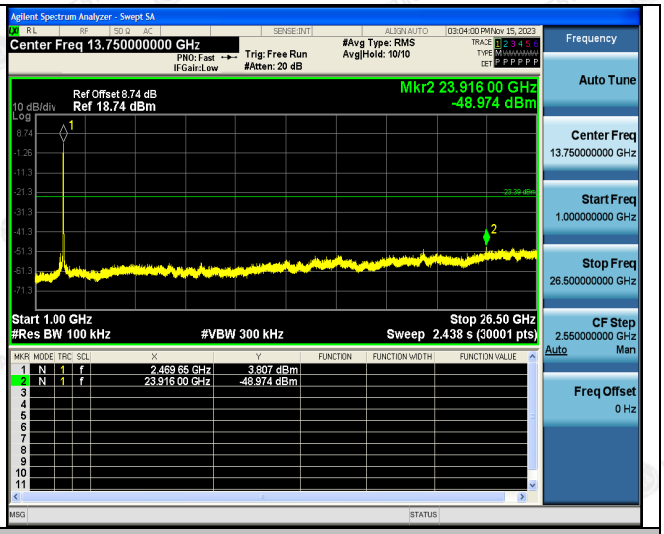
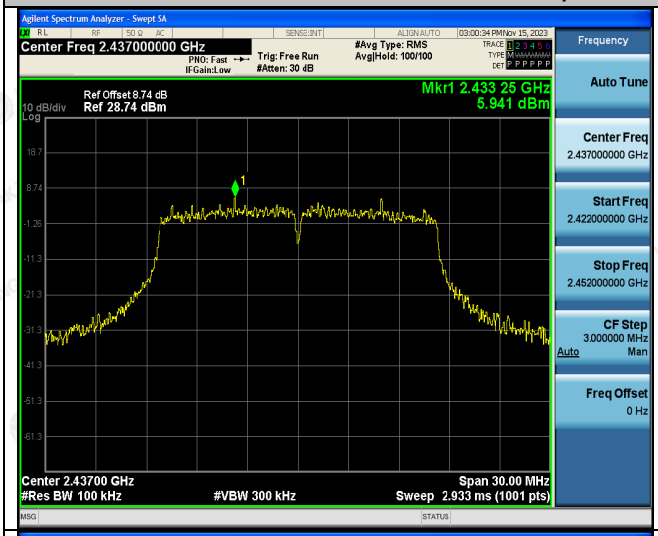
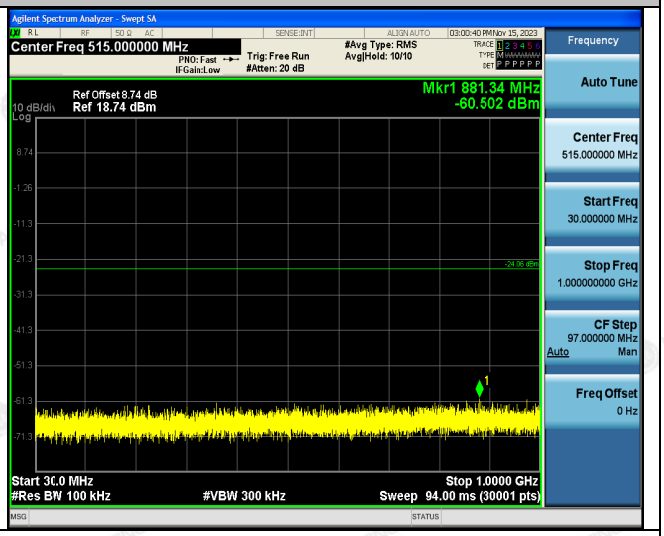


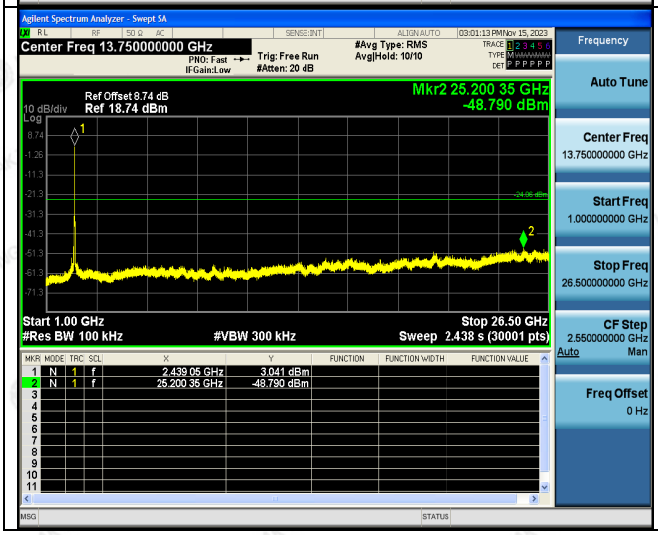




Middle Channel

Spurious Emission

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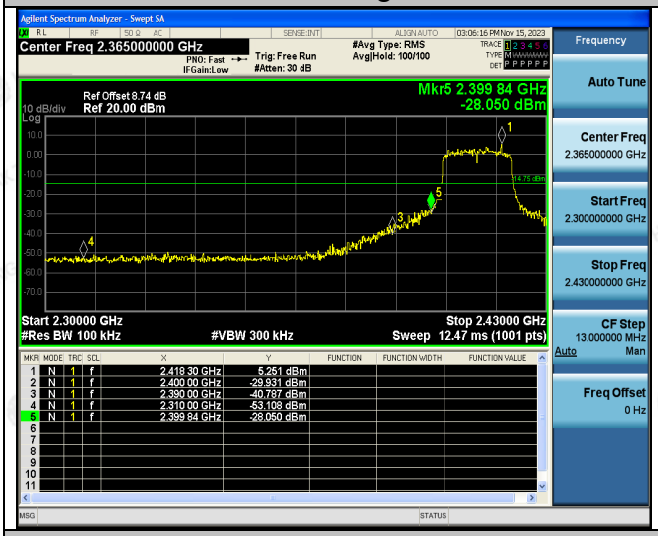
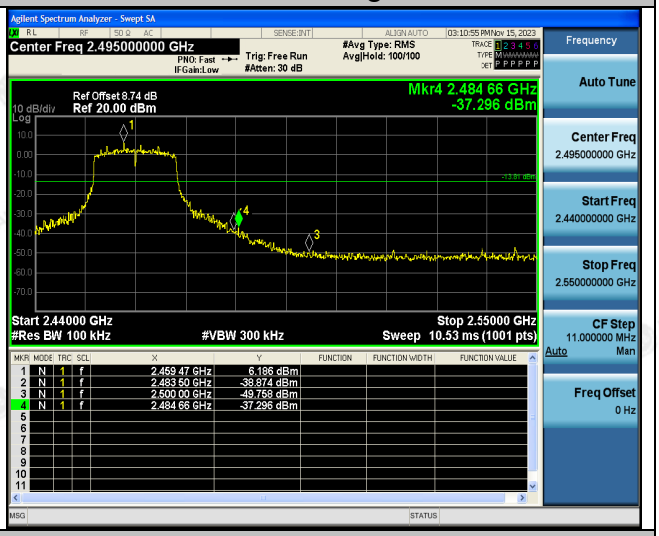
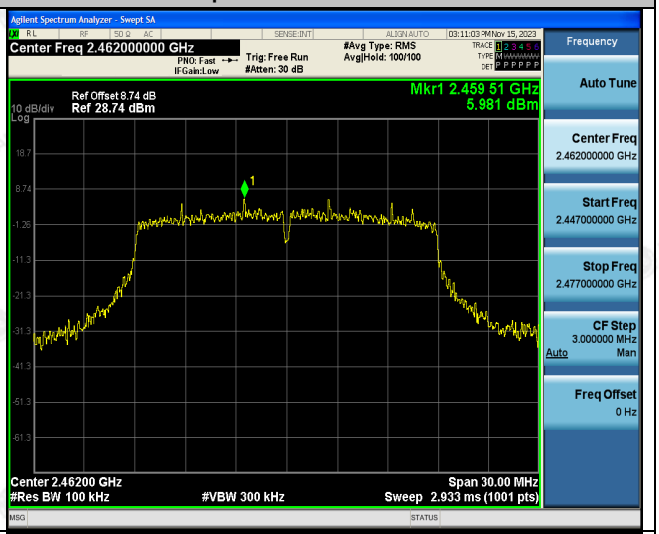
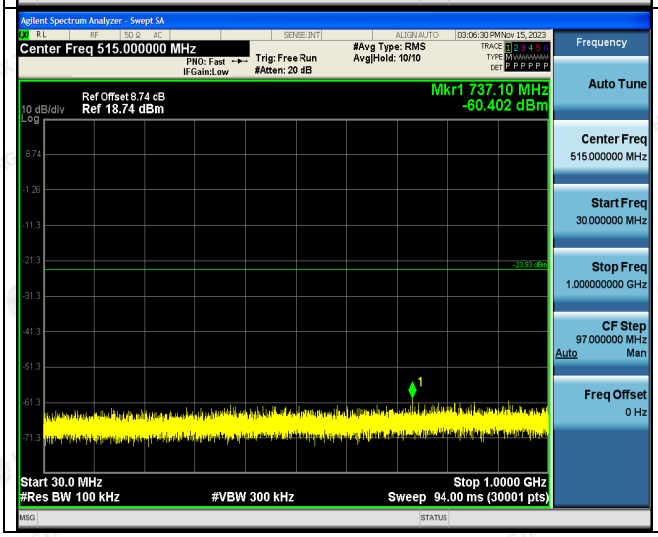
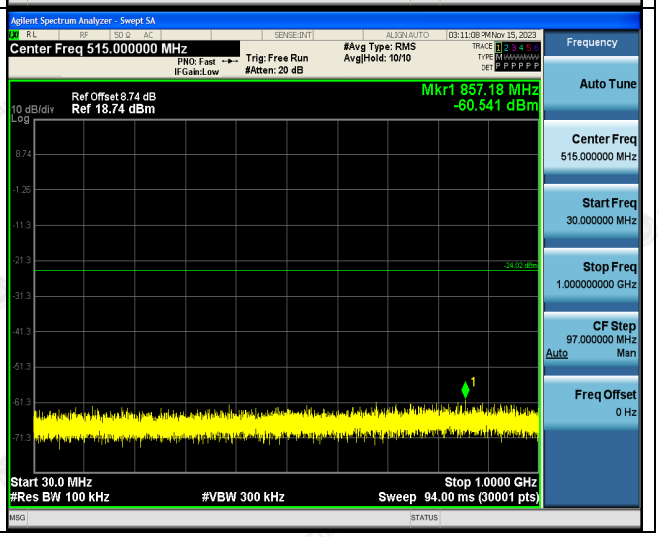
## 802.11n (HT20) Modulation

| Lowest Channel | Highest Channel |
|---|---|
| Band Edge | Band Edge |
|  |  |
| Spurious Emission | Spurious Emission |
| |  |
|  |  |

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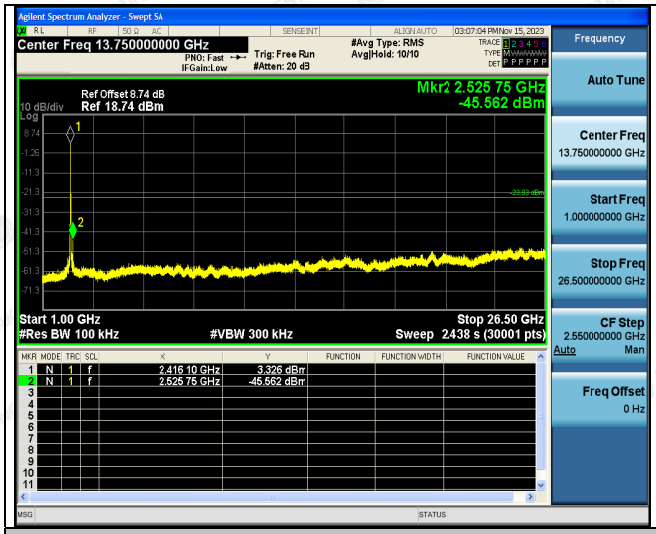
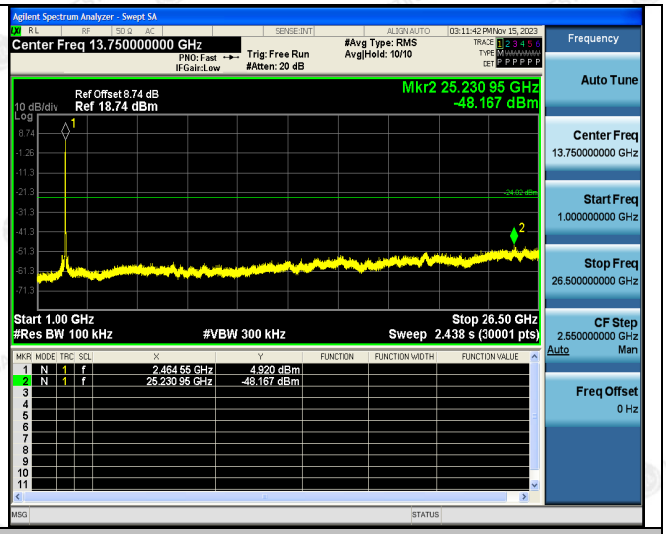
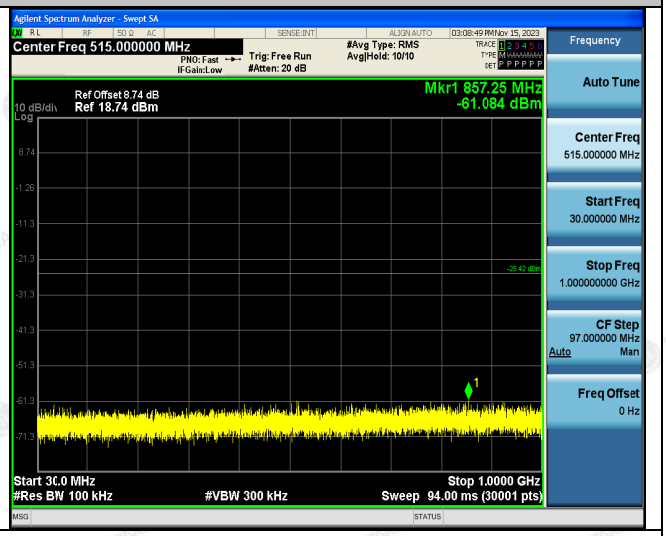
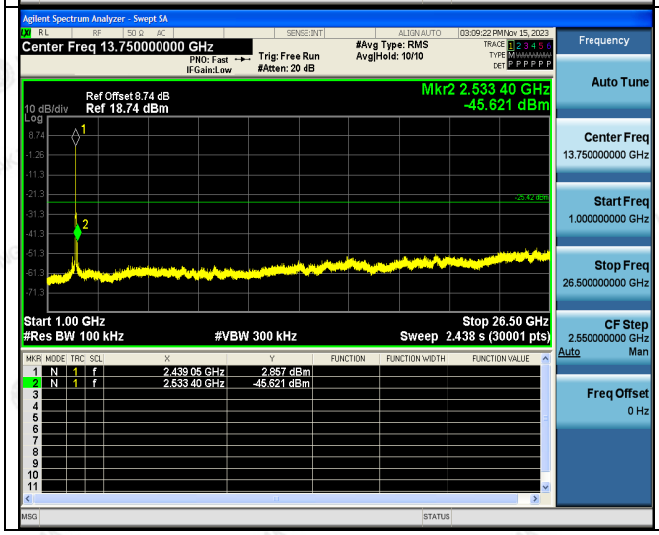



## Middle Channel

## Spurious Emission

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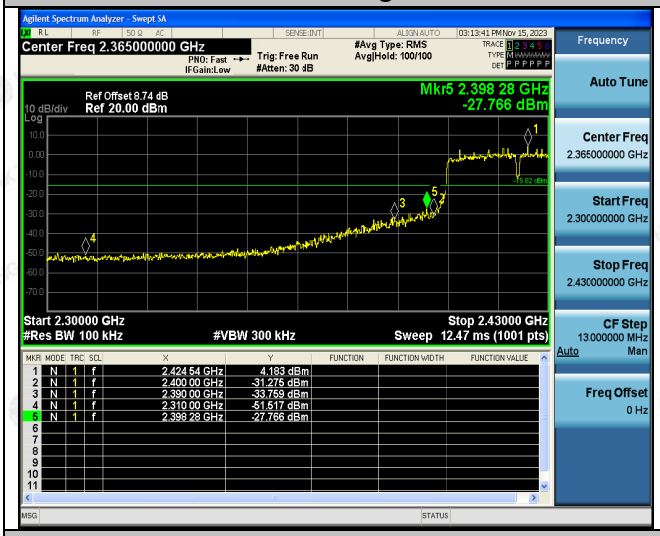
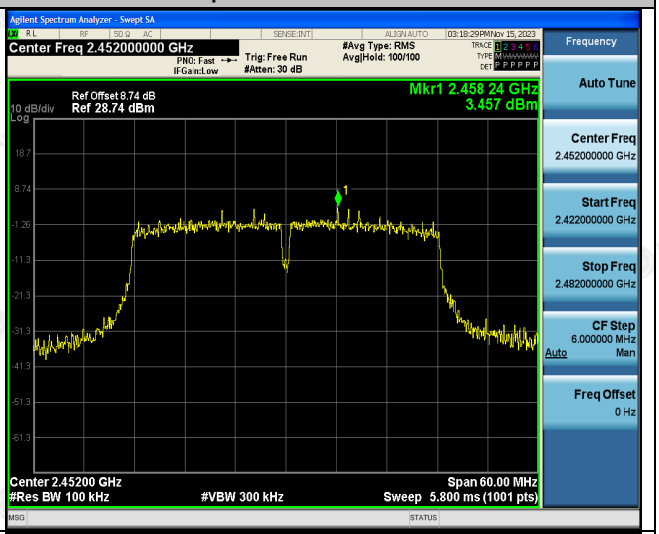
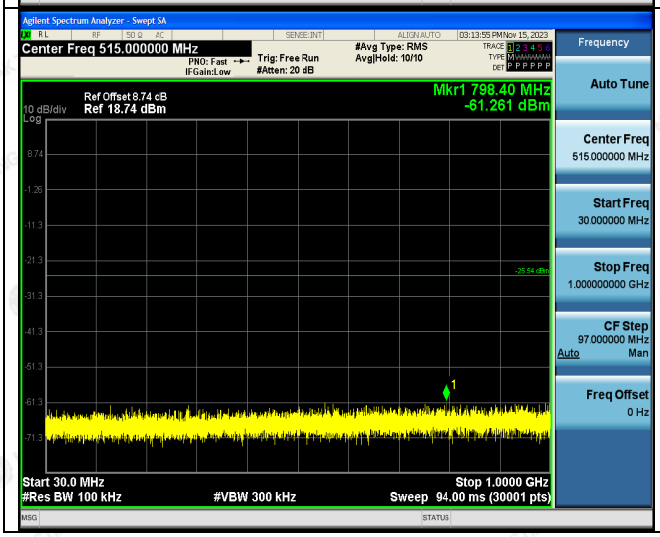
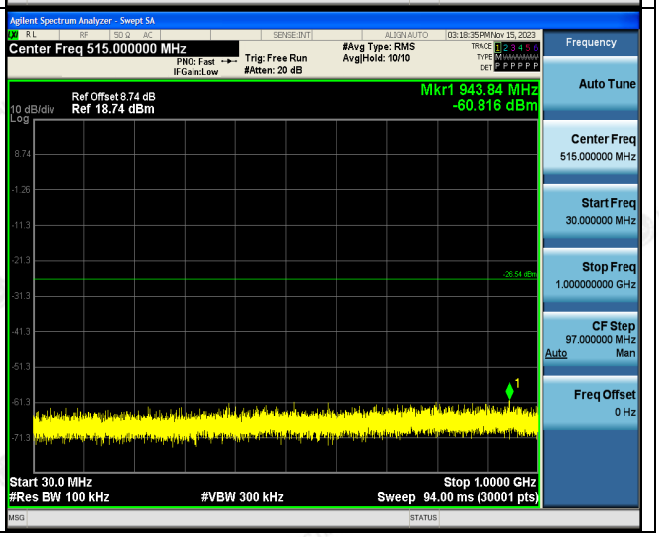
## 802.11n (HT40) Modulation

| Lowest Channel | Highest Channel |
|---|---|
| Band Edge | Band Edge |
|  | |
| Spurious Emission | Spurious Emission |
| |  |
|  |  |

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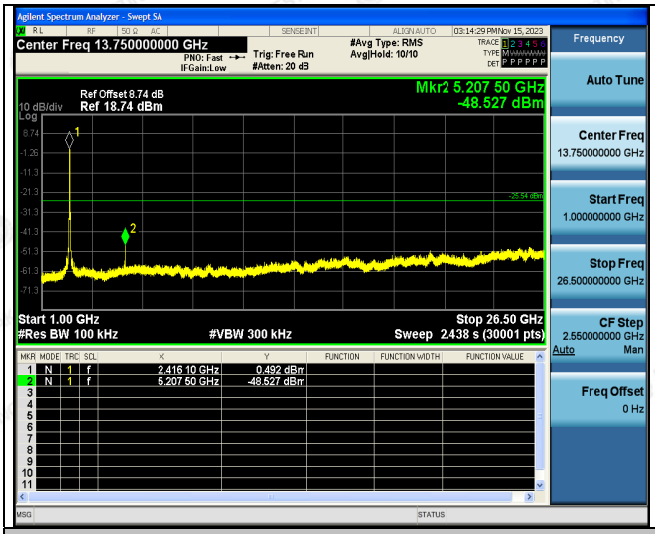
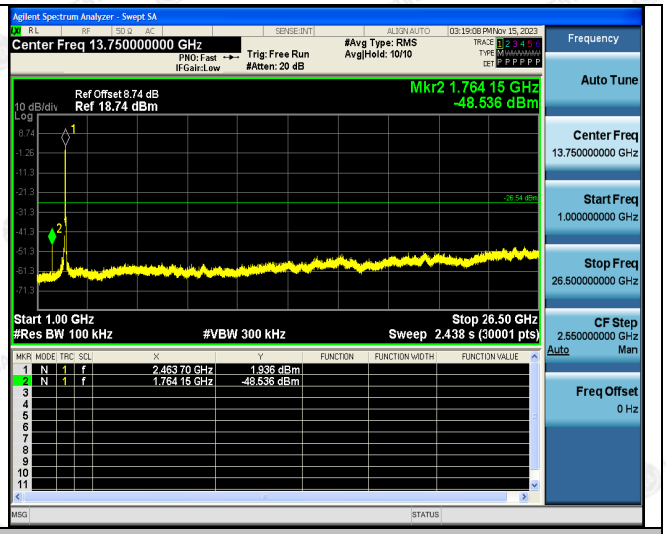
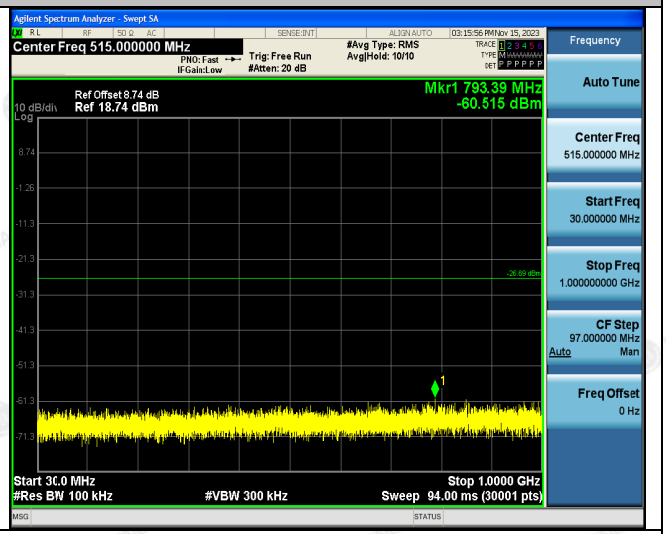
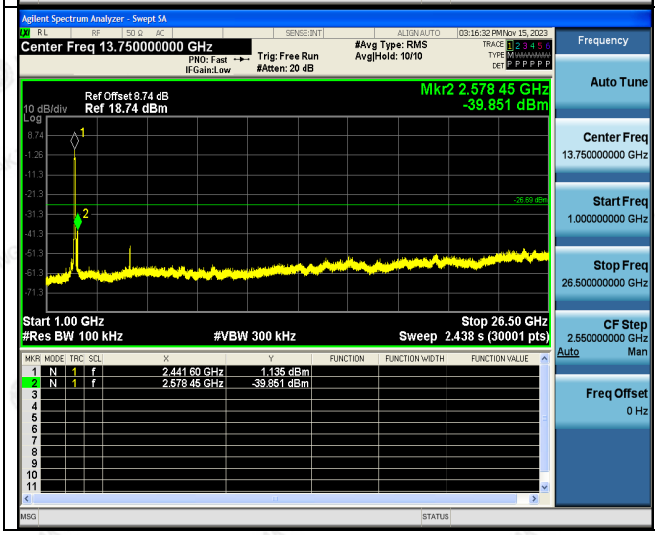



Middle Channel

Spurious Emission

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## 4.7. Radiated Spurious Emission Measurement

### Test Specification

| | |
|---|---|
| **Test Requirement:** | FCC Part15 C Section 15.209 |
| **Test Method:** | ANSI C63.10: 2013 |
| **Frequency Range:** | 9 kHz to 25 GHz |
| **Measurement Distance:** | 3 m |
| **Antenna Polarization:** | Horizontal & Vertical |
| **Operation mode:** | Transmitting mode with modulation |

**Receiver Setup:**

| Frequency | Detector | RBW | VBW | Remark |
|---|---|---|---|---|
| 9kHz- 150kHz | Quasi-peak | 200Hz | 1kHz | Quasi-peak Value |
| 150kHz-30MHz | Quasi-peak | 9kHz | 30kHz | Quasi-peak Value |
| 30MHz-1GHz | Quasi-peak | 120KHz | 300KHz | Quasi-peak Value |
| Above 1GHz | Peak | 1MHz | 3MHz | Peak Value |
| | Peak | 1MHz | 10Hz | Average Value |

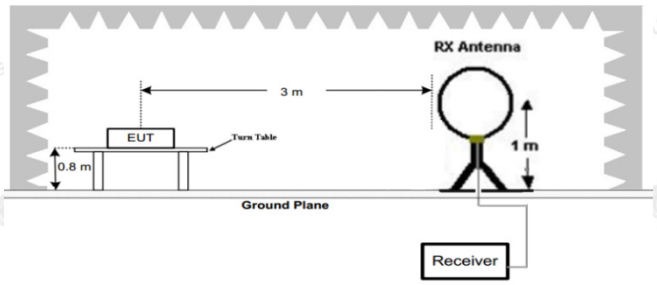
**Limit:**

| Frequency | Field Strength (microvolts/meter) | Measurement Distance (meters) |
|---|---|---|
| 0.009-0.490 | 2400/F(KHz) | 300 |
| 0.490-1.705 | 24000/F(KHz) | 30 |
| 1.705-30 | 30 | 30 |
| 30-88 | 100 | 3 |
| 88-216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |

| Frequency | Field Strength (microvolts/meter) | Measurement Distance (meters) | Detector |
|---|---|---|---|
| Above 1GHz | 500 | 3 | Average |
| | 5000 | 3 | Peak |

**Test setup:**

For radiated emissions below 30MHz




30MHz to 1GHz

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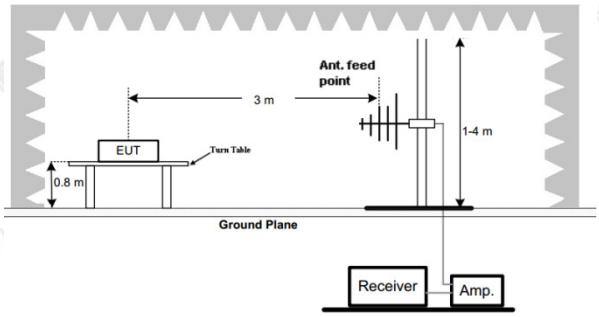
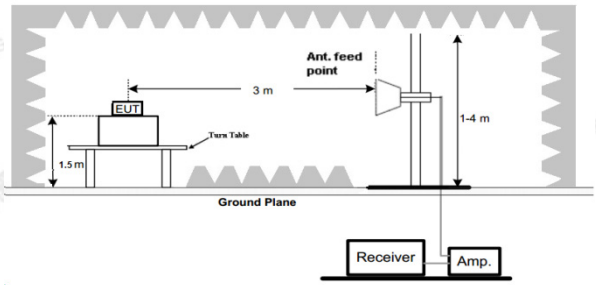
| | |
|---|---|
| |  <br>Above 1GHz<br>  |
| **Test Procedure:** | 1. For the radiated emission test below 1GHz:<br>The EUT was placed on a turntable with 0.8 meter above ground. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high PASS filter are used for the test in order to get better signal level.<br>2. For the radiated emission test above 1GHz:<br>Place the measurement antenna on a turntable with 1.5 meter above ground, which is away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. |

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| | |
|---|---|
| | The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.<br>3. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level<br>4. For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.<br>5. Use the following spectrum analyzer settings:<br>(1) Span shall wide enough to fully capture the emission being measured;<br>(2) Set RBW=120 kHz for f < 1 GHz; VBW ≥RBW; Sweep = auto; Detector function = peak; Trace = max hold;<br>(3) Set RBW = 1 MHz, VBW= 3MHz for f 1 GHz for peak measurement.<br>6.For average measurement: VBW = 10 Hz, when duty cycle is no less than 98 percent.VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation. |
| **Test results:** | PASS |

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**Test Instruments**

| Radiated Emission Test Site (966) | | | | | |
|---|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Date** | **Calibration Due** |
| Receiver | R&S | ESR-7 | HKE-010 | Feb. 17, 2023 | Feb. 16, 2024 |
| Spectrum analyzer | Agilent | N9020A | HKE-048 | Feb. 17, 2023 | Feb. 16, 2024 |
| Spectrum analyzer | R&S | FSP40 | HKE-025 | Feb. 17, 2023 | Feb. 16, 2024 |
| High gain antenna | Schwarzbeck | LB-180400KF | HKE-054 | Feb. 17, 2023 | Feb. 16, 2024 |
| Preamplifier | Schwarzbeck | BBV 9743 | HKE-006 | Feb. 17, 2023 | Feb. 16, 2024 |
| Preamplifier | EMCI | EMC051845SE | HKE-015 | Feb. 17, 2023 | Feb. 16, 2024 |
| Preamplifier | Agilent | 83051A | HKE-016 | Feb. 17, 2023 | Feb. 16, 2024 |
| Loop antenna | Schwarzbeck | FMZB 1519 B | HKE-014 | Feb. 17, 2023 | Feb. 16, 2024 |
| Broadband antenna | Schwarzbeck | VULB 9163 | HKE-012 | Feb. 17, 2023 | Feb. 16, 2024 |
| Horn antenna | Schwarzbeck | 9120D | HKE-013 | Feb. 17, 2023 | Feb. 16, 2024 |
| High pass filter unit | Tonscend | JS0806-F | HKE-055 | Feb. 17, 2023 | Feb. 16, 2024 |
| Antenna Mast | Keleto | CC-A-4M | N/A | N/A | N/A |
| Position controller | Taiwan MF | MF7802 | HKE-011 | Feb. 17, 2023 | Feb. 16, 2024 |
| Radiated test software | Tonscend | TS+ Rev 2.5.0.0 | HKE-082 | N/A | N/A |
| RF cable | Times | 9kHz-1GHz | HKE-117 | Feb. 17, 2023 | Feb. 16, 2024 |
| RF cable | Times | 1-40G | HKE-034 | Feb. 17, 2023 | Feb. 16, 2024 |
| Horn Antenna | Schewarzbeck | BBHA 9170 | HKE-017 | Feb. 17, 2023 | Feb. 16, 2024 |

***Note:*** *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

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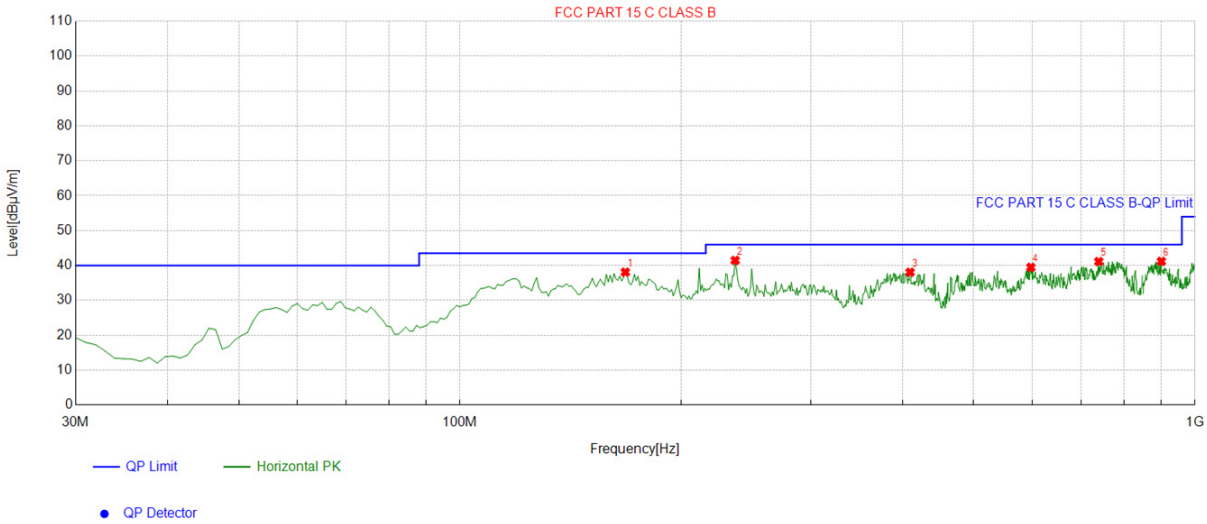
## Test Data

**All the test modes completed for test. only the worst result of (802.11b at 2412MHz) was reported as below:**

**Below 1GHz**

### Horizontal




| Suspected List | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| NO. | Freq. [MHz] | Factor [dB] | Reading [dBµV/m] | Level [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity |
| 1 | 167.87787 | -16.99 | 55.08 | 38.09 | 43.50 | 5.41 | 100 | 297 | Horizontal |
| 2 | 236.81681 | -13.40 | 54.85 | 41.45 | 46.00 | 4.55 | 100 | 351 | Horizontal |
| 3 | 409.64965 | -9.22 | 47.27 | 38.05 | 46.00 | 7.95 | 100 | 11 | Horizontal |
| 4 | 598.01801 | -5.07 | 44.53 | 39.46 | 46.00 | 6.54 | 100 | 82 | Horizontal |
| 5 | 739.77978 | -3.00 | 44.12 | 41.12 | 46.00 | 4.88 | 100 | 33 | Horizontal |
| 6 | 899.98999 | -0.51 | 41.68 | 41.17 | 46.00 | 4.83 | 100 | 354 | Horizontal |

Remark: Factor = Cable loss + Antenna factor – Preamplifier; Level = Reading + Factor; Margin = Limit – Level

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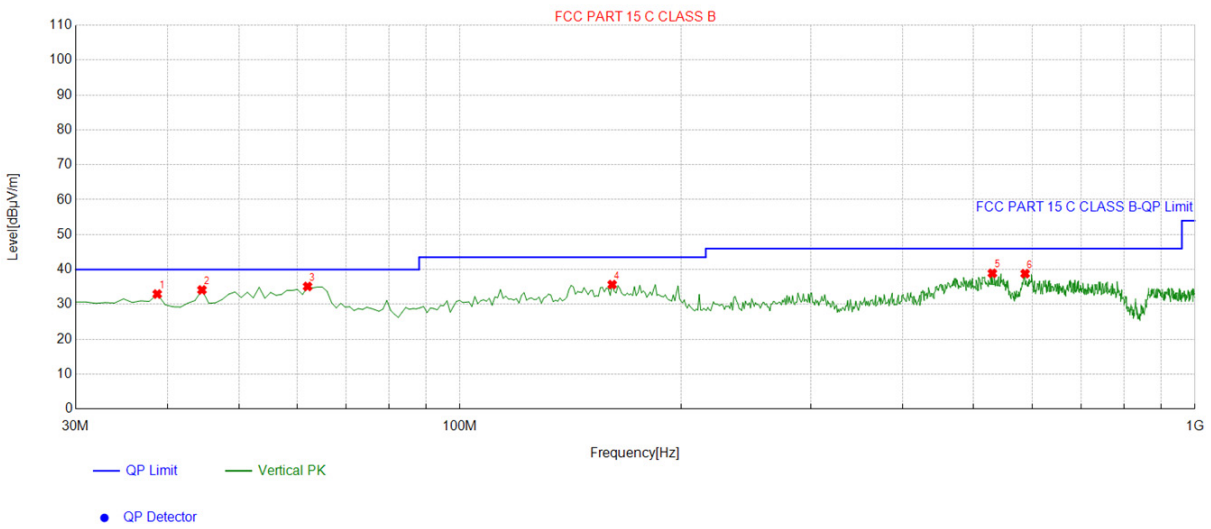
**Vertical**




| Suspected List | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| NO. | Freq. [MHz] | Factor [dB] | Reading [dBμV/m] | Level [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity |
| 1 | 38.738739 | -15.54 | 48.50 | 32.96 | 40.00 | 7.04 | 100 | 261 | Vertical |
| 2 | 44.564565 | -15.07 | 49.20 | 34.13 | 40.00 | 5.87 | 100 | 275 | Vertical |
| 3 | 62.042042 | -14.19 | 49.32 | 35.13 | 40.00 | 4.87 | 100 | 359 | Vertical |
| 4 | 161.08108 | -17.19 | 52.86 | 35.67 | 43.50 | 7.83 | 100 | 181 | Vertical |
| 5 | 530.05005 | -6.88 | 45.77 | 38.89 | 46.00 | 7.11 | 100 | 324 | Vertical |
| 6 | 587.33733 | -5.49 | 44.30 | 38.81 | 46.00 | 7.19 | 100 | 123 | Vertical |

Remark: Factor = Cable loss + Antenna factor – Preamplifier; Level = Reading + Factor; Margin = Limit – Level

## Harmonics and Spurious Emissions

### Frequency Range (9kHz-30MHz)

| Frequency (MHz) | Level@3m (dBμV/m) | Limit@3m (dBμV/m) |
|---|---|---|
| -- | -- | -- |
| -- | -- | -- |
| -- | -- | -- |
| -- | -- | -- |

***Note:*** *1. Emission Level=Reading+ Cable loss-Antenna factor-Amp factor.*

*2. The emission levels are 20 dB below the limit value, which are not reported. It is deemed to comply with the requirement.*

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## Above 1GHz

### Radiated Emission Test

LOW CH1 (802.11b Mode)/2412

Horizontal:

| Frequency (MHz) | Reading Result (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 4824 | 55.92 | -3.64 | 52.28 | 74 | -21.72 | peak |
| 4824 | 45.27 | -3.64 | 41.63 | 54 | -12.37 | AVG |
| 7236 | 53.31 | -0.95 | 52.36 | 74 | -21.64 | peak |
| 7236 | 42.35 | -0.95 | 41.4 | 54 | -12.6 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit | | | | | | |

Vertical:

| Frequency (MHz) | Reading Result (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 4824 | 55.73 | -3.64 | 52.09 | 74 | -21.91 | peak |
| 4824 | 42.69 | -3.64 | 39.05 | 54 | -14.95 | AVG |
| 7236 | 52.46 | -0.95 | 51.51 | 74 | -22.49 | peak |
| 7236 | 40.54 | -0.95 | 39.59 | 54 | -14.41 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit | | | | | | |

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MID CH6 (802.11b Mode)/2437

Horizontal:

| Frequency (MHz) | Reading Result (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 4874 | 57.05 | -3.51 | 53.54 | 74 | -20.46 | peak |
| 4874 | 45.08 | -3.51 | 41.57 | 54 | -12.43 | AVG |
| 7311 | 52.13 | -0.82 | 51.31 | 74 | -22.69 | peak |
| 7311 | 41.65 | -0.82 | 40.83 | 54 | -13.17 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit | | | | | | |

Vertical:

| Frequency (MHz) | Reading Result (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 4874 | 54.27 | -3.51 | 50.76 | 74 | -23.24 | peak |
| 4874 | 44.45 | -3.51 | 40.94 | 54 | -13.06 | AVG |
| 7311 | 53.94 | -0.82 | 53.12 | 74 | -20.88 | peak |
| 7311 | 42.41 | -0.82 | 41.59 | 54 | -12.41 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit | | | | | | |

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HIGH CH11 (802.11b Mode)/2462

Horizontal:

| Frequency (MHz) | Reading Result (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 4924 | 53.46 | -3.43 | 50.03 | 74 | -23.97 | peak |
| 4924 | 42.59 | -3.43 | 39.16 | 54 | -14.84 | AVG |
| 7386 | 51.83 | -0.75 | 51.08 | 74 | -22.92 | peak |
| 7386 | 40.46 | -0.75 | 39.71 | 54 | -14.29 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit | | | | | | |

Vertical:

| Frequency (MHz) | Reading Result (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 4924 | 54.76 | -3.43 | 51.33 | 74 | -22.67 | peak |
| 4924 | 43.81 | -3.43 | 40.38 | 54 | -13.62 | AVG |
| 7386 | 51.42 | -0.75 | 50.67 | 74 | -23.33 | peak |
| 7386 | 40.03 | -0.75 | 39.28 | 54 | -14.72 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit | | | | | | |

Remark：
(1) Measuring frequencies from 1 GHz to the 25 GHz.
(2) “F” denotes fundamental frequency; “H” denotes spurious frequency; “E” denotes band edge frequency.
(3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(4) The emissions are attenuated more than 20dB below the permissible limits are not recorded in the report.
(5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.
(6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54dBuV/m(AV Limit), the Average Detected not need to completed.

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LOW CH1 (802.11g Mode)/2412

Horizontal:

| Frequency (MHz) | Reading Result (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 4824 | 53.71 | -3.64 | 50.07 | 74 | -23.93 | peak |
| 4824 | 43.95 | -3.64 | 40.31 | 54 | -13.69 | AVG |
| 7236 | 50.18 | -0.95 | 49.23 | 74 | -24.77 | peak |
| 7236 | 41.26 | -0.95 | 40.31 | 54 | -13.69 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit | | | | | | |

Vertical:

| Frequency (MHz) | Reading Result (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 4824 | 55.28 | -3.64 | 51.64 | 74 | -22.36 | peak |
| 4824 | 43.38 | -3.64 | 39.74 | 54 | -14.26 | AVG |
| 7236 | 51.41 | -0.95 | 50.46 | 74 | -23.54 | peak |
| 7236 | 41.72 | -0.95 | 40.77 | 54 | -13.23 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit | | | | | | |

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MID CH6 (802.11g Mode)/2437

Horizontal:

| Frequency (MHz) | Reading Result (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 4874 | 54.09 | -3.51 | 50.58 | 74 | -23.42 | peak |
| 4874 | 42.76 | -3.51 | 39.25 | 54 | -14.75 | AVG |
| 7311 | 50.14 | -0.82 | 49.32 | 74 | -24.68 | peak |
| 7311 | 40.96 | -0.82 | 40.14 | 54 | -13.86 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit | | | | | | |

Vertical:

| Frequency (MHz) | Reading Result (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 4874 | 52.66 | -3.51 | 49.15 | 74 | -24.85 | peak |
| 4874 | 44.16 | -3.51 | 40.65 | 54 | -13.35 | AVG |
| 7311 | 50.36 | -0.82 | 49.54 | 74 | -24.46 | peak |
| 7311 | 39.75 | -0.82 | 38.93 | 54 | -15.07 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit | | | | | | |

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HIGH CH11 (802.11g Mode)/2462

Horizontal:

| Frequency (MHz) | Reading Result (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 4924 | 55.35 | -3.43 | 51.92 | 74 | -22.08 | peak |
| 4924 | 47.45 | -3.43 | 44.02 | 54 | -9.98 | AVG |
| 7386 | 52.25 | -0.75 | 51.5 | 74 | -22.5 | peak |
| 7386 | 42.26 | -0.75 | 41.51 | 54 | -12.49 | AVG |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit

Vertical:

| Frequency (MHz) | Reading Result (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 4924 | 53.99 | -3.43 | 50.56 | 74 | -23.44 | peak |
| 4924 | 44.25 | -3.43 | 40.82 | 54 | -13.18 | AVG |
| 7386 | 52.62 | -0.75 | 51.87 | 74 | -22.13 | peak |
| 7386 | 40.76 | -0.75 | 40.01 | 54 | -13.99 | AVG |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit

Remark：
(1) Measuring frequencies from 1 GHz to the 25 GHz.
(2) “F” denotes fundamental frequency; “H” denotes spurious frequency; “E” denotes band edge frequency.
(3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(4) The emissions are attenuated more than 20dB below the permissible limits are not recorded in the report.
(5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.
(6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54dBuV/m(AV Limit), the Average Detected not need to completed.

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LOW CH1 (802.11n/H20 Mode)/2412

Horizontal:

| Frequency (MHz) | Reading Result (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 4824 | 53.39 | -3.64 | 49.75 | 74 | -24.25 | peak |
| 4824 | 45.18 | -3.64 | 41.54 | 54 | -12.46 | AVG |
| 7236 | 50.31 | -0.95 | 49.36 | 74 | -24.64 | peak |
| 7236 | 41.92 | -0.95 | 40.97 | 54 | -13.03 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit | | | | | | |

Vertical:

| Frequency (MHz) | Reading Result (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 4824 | 55.62 | -3.64 | 51.98 | 74 | -22.02 | peak |
| 4824 | 43.84 | -3.64 | 40.2 | 54 | -13.8 | AVG |
| 7236 | 52.43 | -0.95 | 51.48 | 74 | -22.52 | peak |
| 7236 | 40.31 | -0.95 | 39.36 | 54 | -14.64 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit | | | | | | |

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MID CH6 (802.11n/H20 Mode)/2437

Horizontal:

| Frequency (MHz) | Reading Result (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 4874 | 52.03 | -3.51 | 48.52 | 74.00 | -25.48 | peak |
| 4874 | 43.78 | -3.51 | 40.27 | 54.00 | -13.73 | AVG |
| 7311 | 51.12 | -0.82 | 50.30 | 74.00 | -23.70 | peak |
| 7311 | 40.83 | -0.82 | 40.01 | 54.00 | -13.99 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit | | | | | | |

Vertical:

| Frequency (MHz) | Reading Result (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 4874 | 54.59 | -3.51 | 51.08 | 74.00 | -22.92 | peak |
| 4874 | 41.39 | -3.51 | 37.88 | 54.00 | -16.12 | AVG |
| 7311 | 53.14 | -0.82 | 52.32 | 74.00 | -21.68 | peak |
| 7311 | 38.84 | -0.82 | 38.02 | 54.00 | -15.98 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit | | | | | | |

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HIGH CH11 (802.11n/H20 Mode)/2462

Horizontal:

| Frequency (MHz) | Reading Result (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 4924 | 53.72 | -3.43 | 50.29 | 74 | -23.71 | peak |
| 4924 | 43.36 | -3.43 | 39.93 | 54 | -14.07 | AVG |
| 7386 | 52.75 | -0.75 | 52 | 74 | -22 | peak |
| 7386 | 41.61 | -0.75 | 40.86 | 54 | -13.14 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

Vertical:

| Frequency (MHz) | Reading Result (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 4924 | 54.72 | -3.43 | 51.29 | 74 | -22.71 | peak |
| 4924 | 43.58 | -3.43 | 40.15 | 54 | -13.85 | AVG |
| 7386 | 51.15 | -0.75 | 50.4 | 74 | -23.6 | peak |
| 7386 | 39.79 | -0.75 | 39.04 | 54 | -14.96 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

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LOW CH3 (802.11n/H40 Mode)/2422

Horizontal:

| Frequency (MHz) | Meter Reading (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 4844 | 55.11 | -3.63 | 51.48 | 74 | -22.52 | peak |
| 4844 | 45.45 | -3.63 | 41.82 | 54 | -12.18 | AVG |
| 7266 | 53.19 | -0.94 | 52.25 | 74 | -21.75 | peak |
| 7266 | 41.01 | -0.94 | 40.07 | 54 | -13.93 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

Vertical:

| Frequency (MHz) | Meter Reading (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 4844 | 55.17 | -3.63 | 51.54 | 74 | -22.46 | peak |
| 4844 | 46.37 | -3.63 | 42.74 | 54 | -11.26 | AVG |
| 7266 | 52.18 | -0.94 | 51.24 | 74 | -22.76 | peak |
| 7266 | 42.87 | -0.94 | 41.93 | 54 | -12.07 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

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MID CH6 (802.11n/H40 Mode)/2437

Horizontal:

| Frequency (MHz) | Meter Reading (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 4874 | 52.81 | -3.51 | 49.3 | 74 | -24.7 | peak |
| 4874 | 41.73 | -3.51 | 38.22 | 54 | -15.78 | AVG |
| 7311 | 51.36 | -0.82 | 50.54 | 74 | -23.46 | peak |
| 7311 | 38.85 | -0.82 | 38.03 | 54 | -15.97 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

Vertical:

| Frequency (MHz) | Meter Reading (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 4874 | 51.42 | -3.51 | 47.91 | 74 | -26.09 | peak |
| 4874 | 42.79 | -3.51 | 39.28 | 54 | -14.72 | AVG |
| 7311 | 50.32 | -0.82 | 49.5 | 74 | -24.5 | peak |
| 7311 | 40.81 | -0.82 | 39.99 | 54 | -14.01 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

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HIGH CH9 (802.11n/H40 Mode)/2452

Horizontal:

| Frequency (MHz) | Meter Reading (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 4904 | 55.05 | -3.43 | 51.62 | 74 | -22.38 | peak |
| 4904 | 42.69 | -3.43 | 39.26 | 54 | -14.74 | AVG |
| 7356 | 53.23 | -0.75 | 52.48 | 74 | -21.52 | peak |
| 7356 | 41.78 | -0.75 | 41.03 | 54 | -12.97 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

Vertical:

| Frequency (MHz) | Meter Reading (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 4904 | 52.17 | -3.43 | 48.74 | 74 | -25.26 | peak |
| 4904 | 41.76 | -3.43 | 38.33 | 54 | -15.67 | AVG |
| 7356 | 50.25 | -0.75 | 49.5 | 74 | -24.5 | peak |
| 7356 | 40.85 | -0.75 | 40.1 | 54 | -13.9 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

Remark：
(1) Measuring frequencies from 1 GHz to the 25 GHz.
(2) “F” denotes fundamental frequency; “H” denotes spurious frequency; “E” denotes band edge frequency.
(3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(4) The emissions are attenuated more than 20dB below the permissible limits are not recorded in the report.
(5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.
(6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.

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**Test Result of Radiated Spurious at Band edges**

Operation Mode:

802.11b Mode TX CH Low (2412MHz)

Horizontal

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2310.00 | 53.91 | -5.81 | 48.1 | 74 | -25.9 | peak |
| 2310.00 | 41.59 | -5.81 | 35.78 | 54 | -18.22 | AVG |
| 2390.00 | 50.26 | -5.84 | 44.42 | 74 | -29.58 | peak |
| 2390.00 | 38.62 | -5.84 | 32.78 | 54 | -21.22 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2310.00 | 54.82 | -5.81 | 49.01 | 74 | -24.99 | peak |
| 2310.00 | 42.74 | -5.81 | 36.93 | 54 | -17.07 | AVG |
| 2390.00 | 51.93 | -5.84 | 46.09 | 74 | -27.91 | peak |
| 2390.00 | 41.44 | -5.84 | 35.6 | 54 | -18.4 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

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Operation Mode: TX CH High (2462MHz)

Horizontal

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2483.50 | 52.48 | -5.81 | 46.67 | 74 | -27.33 | peak |
| 2483.50 | 40.78 | -5.81 | 34.97 | 54 | -19.03 | AVG |
| 2500.00 | 51.51 | -6.06 | 45.45 | 74 | -28.55 | peak |
| 2500.00 | 39.91 | -6.06 | 33.85 | 54 | -20.15 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2483.50 | 56.07 | -5.81 | 50.26 | 74 | -23.74 | peak |
| 2483.50 | 43.82 | -5.81 | 38.01 | 54 | -15.99 | AVG |
| 2500.00 | 54.37 | -6.06 | 48.31 | 74 | -25.69 | peak |
| 2500.00 | 40.27 | -6.06 | 34.21 | 54 | -19.79 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |
| Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit. | | | | | | |

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Operation Mode: 802.11g Mode TX CH Low (2412MHz)

Horizontal

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2310.00 | 52.97 | -5.81 | 47.16 | 74 | -26.84 | peak |
| 2310.00 | 41.85 | -5.81 | 36.04 | 54 | -17.96 | AVG |
| 2390.00 | 51.52 | -5.84 | 45.68 | 74 | -28.32 | peak |
| 2390.00 | 38.31 | -5.84 | 32.47 | 54 | -21.53 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2310.00 | 54.69 | -5.81 | 48.88 | 74 | -25.12 | peak |
| 2310.00 | 42.21 | -5.81 | 36.4 | 54 | -17.6 | AVG |
| 2390.00 | 50.49 | -5.84 | 44.65 | 74 | -29.35 | peak |
| 2390.00 | 41.24 | -5.84 | 35.4 | 54 | -18.6 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

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Operation Mode: TX CH High (2462MHz)

Horizontal

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2483.50 | 53.01 | -5.65 | 47.36 | 74 | -26.64 | peak |
| 2483.50 | 44.16 | -5.65 | 38.51 | 54 | -15.49 | AVG |
| 2500.00 | 51.46 | -5.65 | 45.81 | 74 | -28.19 | peak |
| 2500.00 | 42.21 | -5.65 | 36.56 | 54 | -17.44 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2483.50 | 55.98 | -5.65 | 50.33 | 74 | -23.67 | peak |
| 2483.50 | 42.79 | -5.65 | 37.14 | 54 | -16.86 | AVG |
| 2500.00 | 52.49 | -5.65 | 46.84 | 74 | -27.16 | peak |
| 2500.00 | 41.01 | -5.65 | 35.36 | 54 | -18.64 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |
| Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit. | | | | | | |

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Operation Mode: 802.11n/H20 Mode TX CH Low (2412MHz)

Horizontal

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2310.00 | 54.54 | -5.81 | 48.73 | 74 | -25.27 | peak |
| 2310.00 | 43.08 | -5.81 | 37.27 | 54 | -16.73 | AVG |
| 2390.00 | 52.31 | -5.84 | 46.47 | 74 | -27.53 | peak |
| 2390.00 | 41.19 | -5.84 | 35.35 | 54 | -18.65 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2310.00 | 53.55 | -5.81 | 47.74 | 74 | -26.26 | peak |
| 2310.00 | 43.05 | -5.81 | 37.24 | 54 | -16.76 | AVG |
| 2390.00 | 51.86 | -5.84 | 46.02 | 74 | -27.98 | peak |
| 2390.00 | 40.55 | -5.84 | 34.71 | 54 | -19.29 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

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Operation Mode: TX CH High (2462MHz)

Horizontal

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2483.50 | 53.25 | -5.65 | 47.6 | 74 | -26.4 | peak |
| 2483.50 | 42.63 | -5.65 | 36.98 | 54 | -17.02 | AVG |
| 2500.00 | 51.13 | -5.65 | 45.48 | 74 | -28.52 | peak |
| 2500.00 | 41.06 | -5.65 | 35.41 | 54 | -18.59 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2483.50 | 53.43 | -5.65 | 47.78 | 74 | -26.22 | peak |
| 2483.50 | 42.06 | -5.65 | 36.41 | 54 | -17.59 | AVG |
| 2500.00 | 52.82 | -5.65 | 47.17 | 74 | -26.83 | peak |
| 2500.00 | 40.14 | -5.65 | 34.49 | 54 | -19.51 | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |
| Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit. | | | | | | |

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Operation Mode: 802.11n/H40 Mode TX CH Low (2422MHz)

Horizontal

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2310.00 | 56.23 | -5.81 | 50.42 | 74 | -23.58 | peak |
| 2310.00 | / | -5.81 | / | 54 | / | AVG |
| 2390.00 | 54.15 | -5.84 | 48.31 | 74 | -25.69 | peak |
| 2390.00 | / | -5.84 | / | 54 | / | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2310.00 | 55.17 | -5.81 | 49.36 | 74 | -24.64 | peak |
| 2310.00 | / | -5.81 | / | 54 | / | AVG |
| 2390.00 | 53.69 | -5.84 | 47.85 | 74 | -26.15 | peak |
| 2390.00 | / | -5.84 | / | 54 | / | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

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Operation Mode: TX CH High (2452MHz)

Horizontal

| Frequency (MHz) | Reading Result (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 2483.50 | 55.69 | -5.65 | 50.04 | 74 | -23.96 | peak |
| 2483.50 | / | -5.65 | / | 54 | / | AVG |
| 2500.00 | 53.14 | -5.65 | 47.49 | 74 | -26.51 | peak |
| 2500.00 | / | -5.65 | / | 54 | / | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |

Vertical:

| Frequency (MHz) | Reading Result (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 2483.50 | 53.24 | -5.65 | 47.59 | 74 | -26.41 | peak |
| 2483.50 | / | -5.65 | / | 54 | / | AVG |
| 2500.00 | 51.96 | -5.65 | 46.31 | 74 | -27.69 | peak |
| 2500.00 | / | -5.65 | / | 54 | / | AVG |
| Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level-Limit. | | | | | | |
| Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit. | | | | | | |

Remark:
1. If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.
2. In restricted bands of operation, the spurious emissions below the permissible value more than 20dB.
3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

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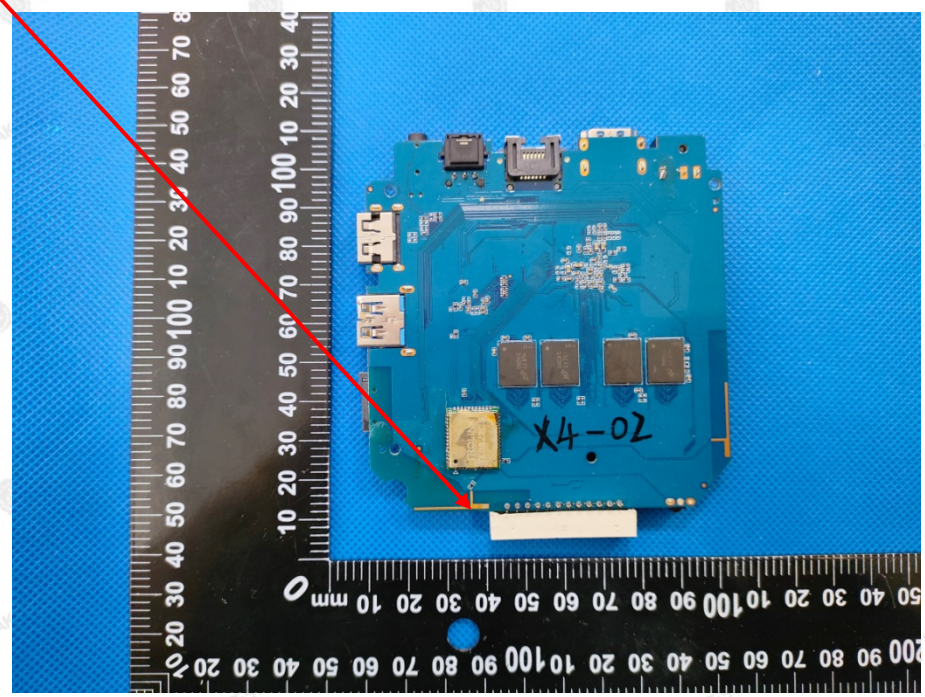
## 4.8. Antenna Requirement

**Standard Applicable**
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247, if transmitting antennas of directional gain greater than6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

**Refer to statement below for compliance.**
The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

**Antenna Connected Construction**
The antenna used in this product is PCB Antenna, which permanently attached. It conforms to the standard requirements. The directional gains of antenna used for transmitting is 1dBi.

Antenna

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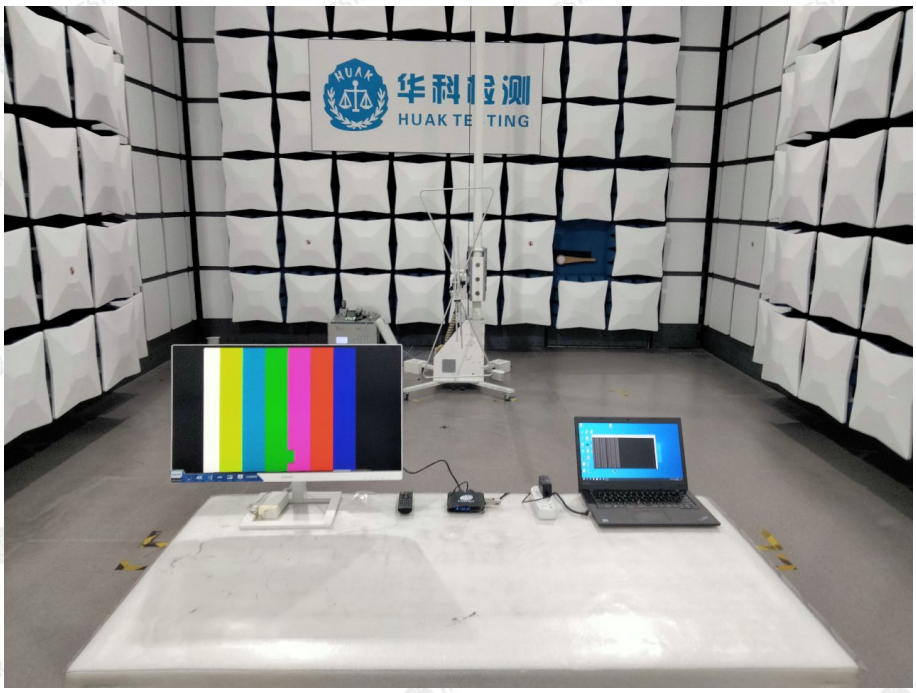
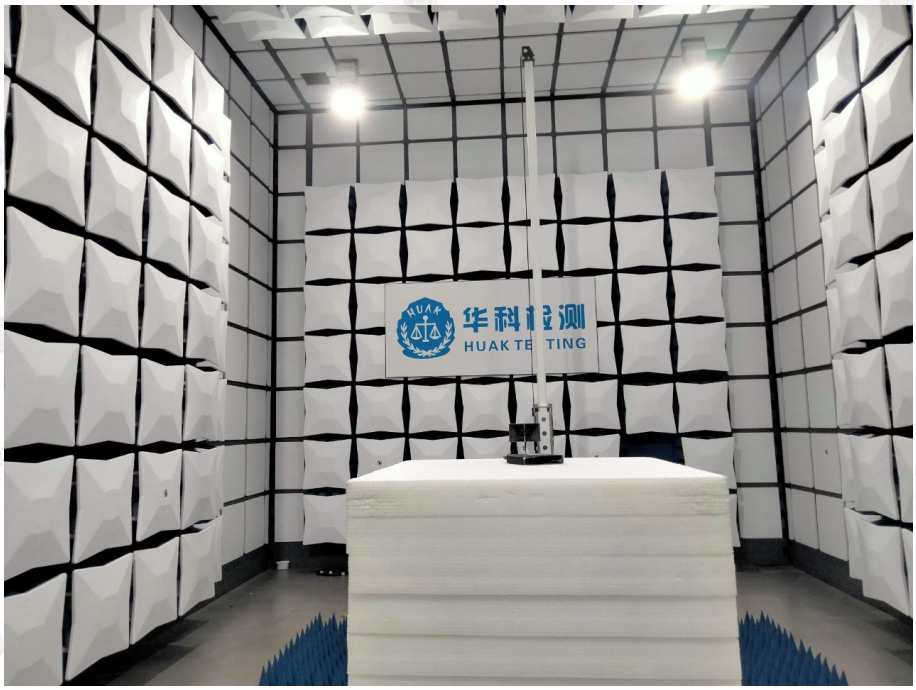
# 5. Photograph of Test

Radiated Emissions

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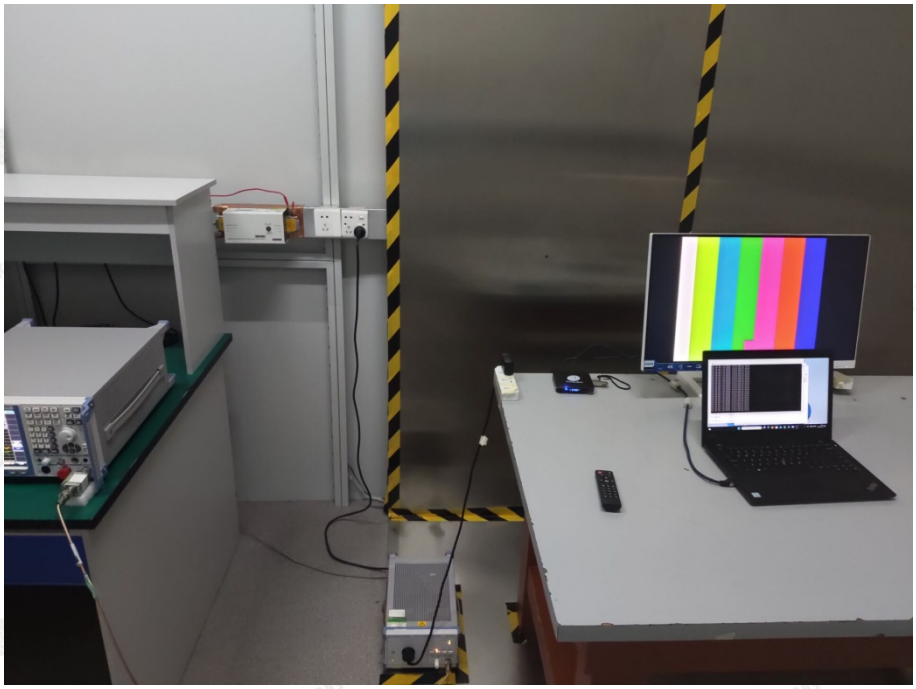
Conducted Emission



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# 6. Photos of the EUT

Reference to the report: ANNEX A of external photos and ANNEX B of internal photos.

---------End of test report---------

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