

|                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                  |                                                                                     |                |                                |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------|--------------------------------|
| <b>Prüfbericht-Nr.:</b><br>Test report no.:                                                                                                                                                                                                                                                                                                                                                                                                                 | ULR-TC568820300000059F                                                                                                                                                                                           | <b>Auftrags-Nr.:</b><br>Order no.:                                                  | 166495275 0010 | Seite 1 von 47<br>Page 1 of 47 |
| <b>Kunden-Referenz-Nr.:</b><br>Client reference no.:                                                                                                                                                                                                                                                                                                                                                                                                        | NA                                                                                                                                                                                                               | <b>Auftragsdatum:</b><br>Order date:                                                | 2020-11-02     |                                |
| <b>Auftraggeber:</b><br>Client:                                                                                                                                                                                                                                                                                                                                                                                                                             | Bradford White Corporation<br>200 Lafayette St. Middleville, MI. 49333<br>Phone: 616-610-6432                                                                                                                    |                                                                                     |                |                                |
| <b>Prüfgegenstand:</b><br>Test item:                                                                                                                                                                                                                                                                                                                                                                                                                        | Bradford White Connect Adapter                                                                                                                                                                                   |                                                                                     |                |                                |
| <b>Bezeichnung:</b><br>Identification:                                                                                                                                                                                                                                                                                                                                                                                                                      | BWCADAPTER                                                                                                                                                                                                       |                                                                                     |                |                                |
| <b>Auftrags-Inhalt:</b><br>Order content:                                                                                                                                                                                                                                                                                                                                                                                                                   | Testing and Issue of FCC & ISED grant certificate                                                                                                                                                                |                                                                                     |                |                                |
| <b>Prüfgrundlage:</b><br>Test specification:                                                                                                                                                                                                                                                                                                                                                                                                                | FCC Part 15 Subpart C (15.247, 15.207)<br>RSS 247 Issue2 & RSS Gen Issue 5                                                                                                                                       |                                                                                     |                |                                |
| <b>Wareneingangsdatum:</b><br>Date of sample receipt:                                                                                                                                                                                                                                                                                                                                                                                                       | 2020-11-03                                                                                                                                                                                                       |  |                |                                |
| <b>Prüfmuster-Nr &amp; Serien-Nr.:</b><br>Test sample no & serial no.:                                                                                                                                                                                                                                                                                                                                                                                      | A002942060-002 &<br>A002942060-003 &<br>1610014323788                                                                                                                                                            |                                                                                     |                |                                |
| <b>Prüfzeitraum:</b><br>Testing period:                                                                                                                                                                                                                                                                                                                                                                                                                     | 2020-11-03 - 2020-11-09                                                                                                                                                                                          |                                                                                     |                |                                |
| <b>Ort der Prüfung:</b><br>Place of testing:                                                                                                                                                                                                                                                                                                                                                                                                                | Wireless laboratory, Bangalore                                                                                                                                                                                   |                                                                                     |                |                                |
| <b>Prüflaboratorium:</b><br>Testing laboratory:                                                                                                                                                                                                                                                                                                                                                                                                             | TÜV Rheinland (India) Pvt.Ltd.,<br>27/B, 2nd Cross, Electronic City<br>Phase1 Bangalore -560 100,<br>India<br><br>FCC Test site registration<br>number: 496599<br>ISED Test site registration<br>number: 3466E-1 |                                                                                     |                |                                |
| <b>Prüfergebnis*:</b><br>Test result*:                                                                                                                                                                                                                                                                                                                                                                                                                      | Pass                                                                                                                                                                                                             |                                                                                     |                |                                |
| <b>geprüft von:</b><br>tested by:                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>genehmigt von:</b><br>authorized by:                                                                                                                                                                          |                                                                                     |                |                                |
| <b>Datum:</b><br>Date: 2020-11-03                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Ausstellatum:</b><br>Issue date: 2020-12-30                                                                                                                                                                   |                                                                                     |                |                                |
| <b>Stellung / Position:</b><br>Srinivasa BR<br>Engineer                                                                                                                                                                                                                                                                                                                                                                                                     | <b>Stellung / Position:</b><br>Mahammadgouse Kaladagi<br>Assistant Manager                                                                                                                                       |                                                                                     |                |                                |
| <b>Sonstiges / Other:</b><br>FCC ID: 2AX6A - BWCADAPTER<br>IC:26687- BWCADAPTER                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                  |                                                                                     |                |                                |
| <b>Zustand des Prüfgegenstandes bei Anlieferung:</b><br>Condition of the test item at delivery:                                                                                                                                                                                                                                                                                                                                                             | <b>Prüfmuster vollständig und unbeschädigt</b><br>Test item complete and undamaged                                                                                                                               |                                                                                     |                |                                |
| <p>* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft<br/>P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht</p> <p>* Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor<br/>P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested</p>                     |                                                                                                                                                                                                                  |                                                                                     |                |                                |
| <p><b>Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.</b><br/>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</p> |                                                                                                                                                                                                                  |                                                                                     |                |                                |

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## TEST SUMMARY

| Test Item                                                     | Applicable Standard     |                                    | Result |
|---------------------------------------------------------------|-------------------------|------------------------------------|--------|
|                                                               | FCC                     | ISED                               |        |
| Maximum conducted (Peak & average) output power               | FCC 15.247(b)(3)        | RSS 247 Issue 2, Section 5.4 (d)   | Pass   |
| Maximum Power Spectral Density                                | FCC 15.247(e)           | RSS 247 Issue 2, Section 5.2 (b)   | *N/T   |
| DTS Bandwidth                                                 | FCC 15.247(a)(2)        | RSS 247 Issue 2, Section 5.2 (a)   | *N/T   |
| Emissions in non-restricted frequency bands                   | FCC 15.247(d)           | RSS 247 Issue 2, Section 5.5       | *N/T   |
| Spurious Radiated Emissions and Restricted Bands of Operation | FCC 15.209 / FCC 15.205 | RSS-Gen Issue 5, Section 8.9 /8.10 | Pass   |
| Conducted Emissions on a.c Power Lines                        | FCC 15.207              | RSS-Gen Issue 5, Section 8.8       | Pass   |
| Antenna requirement                                           | FCC 15.203              | -                                  | Pass   |

Product Category: Electronics Testing  
Test Discipline: EMC Test Facility

Note:

\*N/T-

- These test cases are not tested, the product uses certified RF module ESP-WROOM-32D from ESPRESSIF SYSTEMS (SHANGHAI) PTE LTD, having FCC ID: 2AC7Z-ESPWROOM32D & IC: 21098-ESPWROOM32D
- Conducted RF output power verification is performed and maximum average output power is within the module test results authorized under the FCCID: 2AC7Z-ESPWROOM32D, hence validity of the test results reported are verified and only Radiated spurious emission and band edge test are performed to confirm that the product **Bradford White Connect Adapter** meets all the applicable FCC & ISED spurious emission limits.

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## REVISION HISTORY OF THIS REPORT

| Report Number          | Version | Description               | Issue date |
|------------------------|---------|---------------------------|------------|
| ULR-TC568820300000059F | 01      | Initial issue of report   | 2020-11-26 |
| ULR-TC568820300000059F | 02      | Updated reviewer comments | 2020-12-09 |
| ULR-TC568820300000059F | 03      | Updated reviewer comments | 2020-12-30 |

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# 1 GENERAL REMARKS

## 1.1 Attachments

All attachments are part of this test report and are issued in separate document

1. TEST SETUP PHOTOS
2. EUT EXTERNAL PHOTOS
3. EUT INTERNAL PHOTOS
4. FCC LABEL AND LABEL LOCATION
5. BLOCK DIAGRAM
6. SPECIFICATION OF EUT
7. SCHEMATIC DIAGRAMS
8. BILL OF MATERIAL
9. USER MANUAL
10. MAXIMUM PERMISSIBLE EXPOSURE INFORMATION

## 2 TEST SITES

### 2.1 Testing Facilities

- |                                                                                                                            |                                                                                                                                                       |
|----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>1. TÜV Rheinland (India) Pvt.Ltd.,<br/>27/B, 2nd Cross,<br/>ElectronicCityPhase1<br/>Bangalore – 560 100,<br/>India</p> | <p>2. TUV Rheinland (India) Private Limited<br/>108 , Beside ISBR Business School,<br/>Electronic city Phase I<br/>Bangalore - 560 100.<br/>India</p> |
|----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|

### 2.2 List of Test and Measurement Instruments

Table 1: List of test and measurement instruments

| Equipment                | Manufacturer    | Model Name          | Serial Number  | Firmware Versions | Calibration Due Date | Periodicity | Test Facility                |
|--------------------------|-----------------|---------------------|----------------|-------------------|----------------------|-------------|------------------------------|
| EMI Receiver             | Rohde & Schwarz | ESU 40              | 100288         | 4.73 SP5          | 09.06.2021           | Yearly      | Radiated Spurious Emission   |
| Active loop antenna      | Schwarzbeck     | FMZB 1519 B         | 1519B-00111    | -                 | 31.01.2021           | Yearly      |                              |
| Biconical Antenna        | Schwarzbeck     | VHBB -9124/ BBA9106 | 01028          | -                 | 16.01.2021           | Yearly      |                              |
| Log - Periodical Antenna | Schwarzbeck     | VUSLP 9111B         | 9111B-111      | -                 | 17.01.2021           | Yearly      |                              |
| Horn Antenna             | Schwarzbeck     | BBHA 9170           | BBHA 9170-0904 | -                 | 29.01.2021           | Yearly      |                              |
| Horn Antenna             | Schwarzbeck     | BBHA 9120 D         | 9120D-1944     | -                 | 30.01.2021           | Yearly      |                              |
| Semi Anechoic Chamber    | Frankonia       | -                   | -              | -                 | -                    | -           |                              |
| Fully Anechoic Chamber   | Albatross       | -                   | -              | -                 | -                    | -           | Antenna-Port Conducted test  |
| USB Peak power sensor    | Boonton         | 55006               | 10231          | FW 3.2.4.0        | 09.01.2021           | Yearly      |                              |
| Spectrum Analyser        | Agilent         | E4407B              | US4119 2772    | -                 | 28.08.2021           | Yearly      |                              |
| Pulse Limiter            | Rohde & Schwarz | ESH3-Z2             | 100811         | -                 | 04.08.2021           | Yearly      | Conducted AC Power line Test |
| LISN                     | Rohde & Schwarz | ENV216              | 100022         | -                 | 04.09.2021           | Yearly      |                              |
| ESW44                    | Rohde & Schwarz | ESW44               | 101732         | -                 | 10.12.2020           | Yearly      |                              |

Table 2: Instrument application Software versions

| SL. No. | Test Type                                     | Application software | Version  |
|---------|-----------------------------------------------|----------------------|----------|
| 1       | Radiated spurious emission measurement in SAC | EMC 32               | 10.60.00 |
| 2       | Radiated spurious emission measurement in FAC | EMC 32               | 10.60.00 |

### 3 GENERAL PRODUCT INFORMATION

#### 3.1 Product Function and Intended Use

Bradford White Connect Adapter system is a smart home/commercial system that will enable residential and commercial water heaters and boilers to be smart, which mean the user can control the heater, monitor the energy consumption, and receive alerts whenever the heater runs into any flaw. The Bradford White Connect Adapter device is one of the critical components in the system which will allow controlling the smart water heaters using a mobile application.

#### 3.2 Ratings and System Details of Equipment under Test

Table 3: Ratings and System Details as declared by Client\*

|                                  |                                                                                           |                    |
|----------------------------------|-------------------------------------------------------------------------------------------|--------------------|
| Radio Protocol                   | Wi-Fi 2.4GHz                                                                              | BLE                |
| Operating Frequency Range        | 2412MHz to 2462MHz                                                                        | 2402MHz to 2480MHz |
| No. of Channels                  | 11 (Refer Table 5)                                                                        | 40 (Refer Table 6) |
| Channel Spacing                  | 5MHz                                                                                      | 2MHz               |
| Maximum Measured conducted power | 17.92 dBm                                                                                 | -11.47dBm          |
| Modulation                       | DSSS & OFDM                                                                               | GFSK               |
| Wi-Fi 2.4GHz operating modes     | 802.11b : DSSS<br>802.11g : OFDM<br>802.11n(20MHz): OFDM *                                | NA                 |
| Data rates                       | 802.11b : 1Mbps to 11Mbps<br>802.11g : 6Mbps to 54 Mbps<br>802.11n(20MHz): MCS0 to MCS7 * | 1Mbps              |
| Number of antennas               | One                                                                                       |                    |
| Antenna Gain                     | 3.7dBi                                                                                    |                    |
| Antenna Type                     | Inverted F - PCB Trace Antenna                                                            |                    |
| Supply Voltage to Product        | 5 VDC through adaptor ( Adaptor model: TRE06S050-A)                                       |                    |
| Environmental conditions         | Storage temp: -20°C to +80°C                                                              |                    |
|                                  | Operating temp: -20°C to +65°C                                                            |                    |
| EUT Dimension (L X W)            | (184.3 x 88) mm                                                                           |                    |

Note: The RF module support 802.11 n (40MHz bandwidth), which is disabled and not used in the product

**\*Disclaimer:** The information/data is supplied by the client and the same is considered to arrive at the final value. Any changes made apart from the specified specification, can directly impact on the tests results. Refer the products user manual for more details

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**Note:** Product Bradford White Connect Adapter has multiple protocols. All the supported wireless protocols and their respective test results are issued in separate test reports, refer clause 4.6 Report references

### 3.3 Measurement Uncertainty:

Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of  $k = 2$

**Table 4: Measurement Uncertainty**

| Parameter                         | Uncertainty                      |
|-----------------------------------|----------------------------------|
| Occupied Channel Bandwidth        | $\pm 5 \%$                       |
| RF output power, conducted        | $\pm 1.5 \text{ dB}$             |
| Power Spectral Density, conducted | $\pm 3 \text{ dB}$               |
| Unwanted Emissions, conducted     | $\pm 3 \text{ dB}$               |
| All emissions, radiated           | $\pm 6 \text{ dB}$               |
| Temperature                       | $\pm 3 \text{ }^{\circ}\text{C}$ |
| Supply Voltages                   | $\pm 3 \%$                       |
| Time                              | $\pm 5 \%$                       |

**Note:** The Listed Measurement Uncertainties are the worst-case uncertainty, for the respective test cases. Above Table is for reporting purpose only and not used in determining Final Pass/Fail verdict.

## 4 TEST SET-UP AND OPERATION MODE

### 4.1 Principle of Configuration Selection

Transmission was enabled with highest possible duty cycle transmission on low, mid and high channel.

### 4.2 Test Operation and Test Software

Hardware Version : Rev4.0  
Hardware Version Identification Number(s) (HVIN): BWCAHR4

Software Version : Rev2.0.0  
Software Version Identification Number(s) (FVIN): BWCASR2

### 4.3 Special Accessories and Auxiliary Equipment

- Test laptop, UART cable, Ethernet cable & Bradford White Water Heater

### 4.4 Countermeasures to achieve EMC Compliance

- None

### 4.5 List of frequencies

| Frequency Band (MHz) | Channel No. | Channel Frequency (MHz) |
|----------------------|-------------|-------------------------|
| 2412 – 2462          | <b>1</b>    | <b>2412</b>             |
|                      | 2           | 2417                    |
|                      | <b>3</b>    | <b>2422</b>             |
|                      | 4           | 2427                    |
|                      | 5           | 2432                    |
|                      | <b>6</b>    | <b>2437</b>             |
|                      | 7           | 2442                    |
|                      | 8           | 2447                    |
|                      | <b>9</b>    | <b>2452</b>             |
|                      | 10          | 2457                    |
|                      | <b>11</b>   | <b>2462</b>             |

Table 5: List of Wi-Fi 2.4GHz center Frequencies

#### Channel used for Wi-Fi testing

Channel Bandwidth 20MHz

Channel low : 2412MHz

Channel mid : 2437MHz

Channel high : 2462MHz

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| Frequency Band<br>(GHz)     | Channel<br>No. | Frequency<br>(MHz) |
|-----------------------------|----------------|--------------------|
| <b>BLE<br/>(2.4-2.4835)</b> | <b>0</b>       | <b>2402</b>        |
|                             | 1              | 2404               |
|                             | 2              | 2406               |
|                             | 3              | 2408               |
|                             | :              | :                  |
|                             | :              | :                  |
|                             | 18             | 2438               |
|                             | <b>19</b>      | <b>2440</b>        |
|                             | 20             | 2437               |
|                             | :              | :                  |
|                             | :              | :                  |
|                             | 36             | 2474               |
|                             | 37             | 2476               |
|                             | 38             | 2478               |
|                             | <b>39</b>      | <b>2480</b>        |

Table 6: List of BLE Center frequencies

#### Channel used for BLE testing

Channel low : 2402MHz

Channel mid : 2440MHz

Channel High : 2480MHz

#### Note:

TUV Sample Identification number : A002942060-003 –Radiated test Sample  
A002942060-002 – Conducted test Sample

## 4.6 Report references

**Note:** Product **Bradford White Connect Adapter** has multiple protocols. All the supported wireless protocols and their respective test results are issued in separate test reports, following table lists the report numbers.

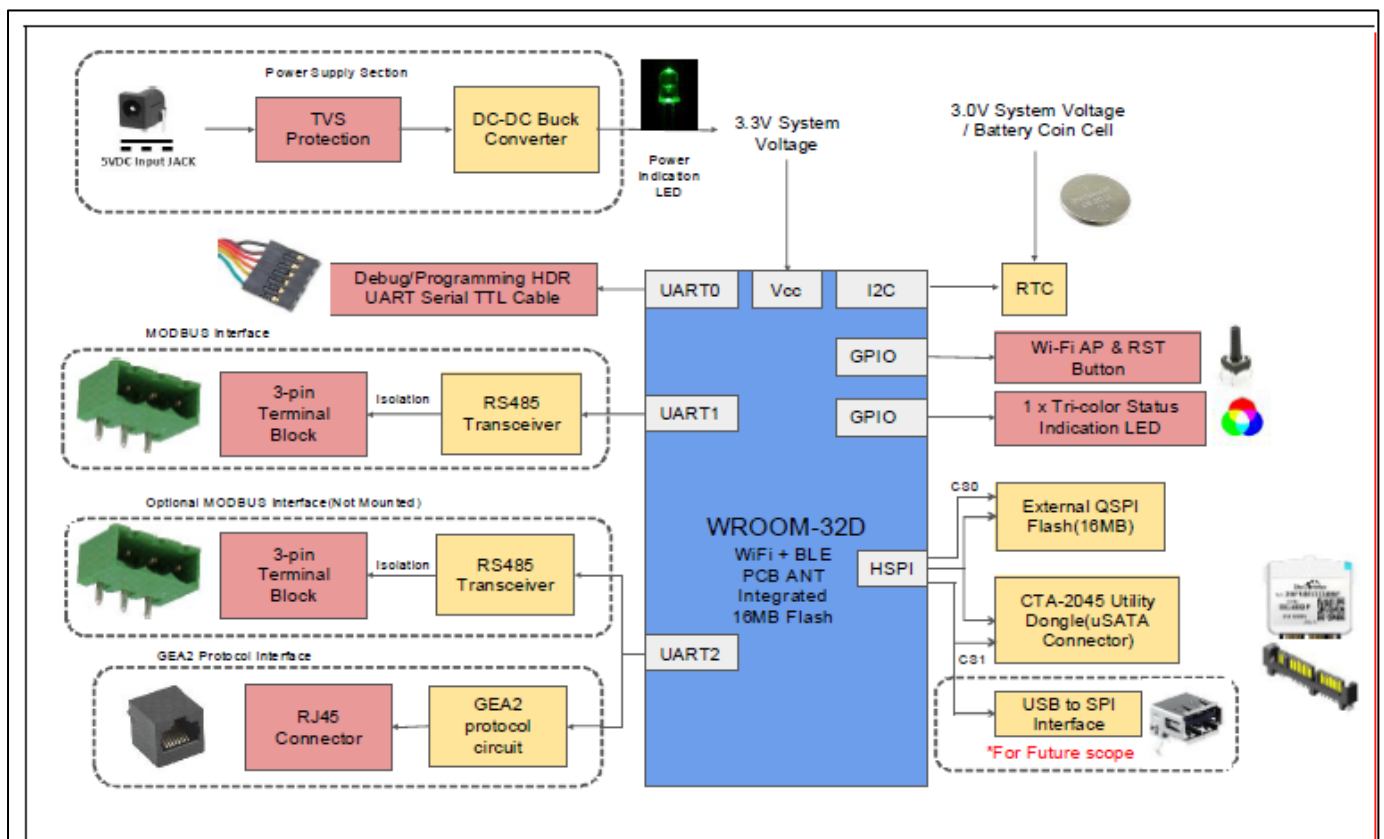
| Radio Protocol                                                   | Report Number          |
|------------------------------------------------------------------|------------------------|
| RF test report for Wi-Fi (2.4GHz) & BLE (2.4GHz) – (This report) | ULR-TC568820300000059F |
| RF test report for BT (2.4GHz)                                   | ULR-TC568820300000060F |

## 5 Operational Description

"Bradford White Connect Adapter system is a smart home/commercial system that will enable residential and commercial water heaters and boilers to be smart, which mean the user can control the heater, monitor the energy consumption, and receive alerts whenever the heater runs into any flaw.

The Bradford White Connect Adapter device is one of the critical components in the system which will allow controlling the smart water heaters using a mobile application."

## 6 Block Diagram



## 7 TEST METHODOLOGY

### 7.1 Radiated Emission Test

The radiated emission measurement was performed according to the procedures in ANSI C63.10-2013. The equipment under test (EUT) was placed at the middle of the 80 cm high turntable for below 1 GHz & 1.5 m height for above 1 GHz measurement, and the EUT is 3 meters far from the measuring antenna. The turntable was rotated 360° for obtaining the maximum emission. The height of the measuring antennas was scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Repeat the measurement steps until the maximum emissions were obtained. The measurement above 1000 MHz was performed by horn antenna, The measurement below 30 MHz was performed by loop antenna, Measurement from 30 MHz to 200 MHz was performed by Baloon and Biconical Antenna, and measurement from 200 MHz to 1 GHz was performed by Log-Periodic Antenna.

The EUT was rotated around the X-, Y-, and Z-Axis and the results from worst case axis are recorded

#### 7.1.1 Test Setup Configuration

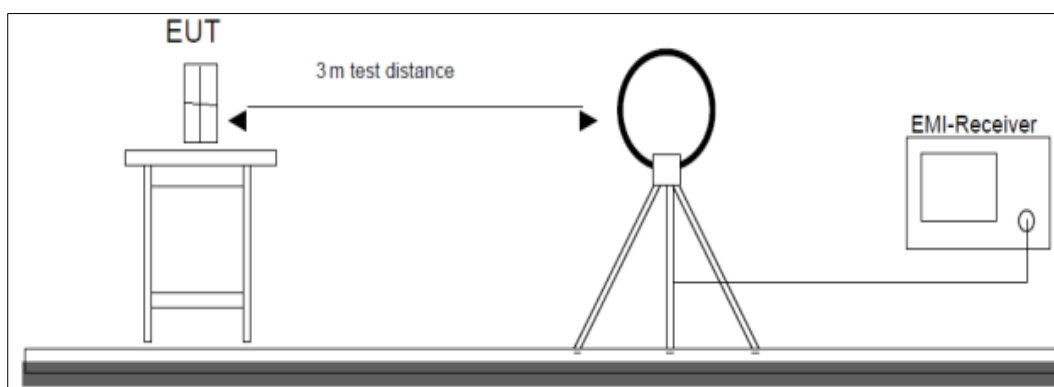


Figure 1: Frequency Range 9 kHz- 30 MHz

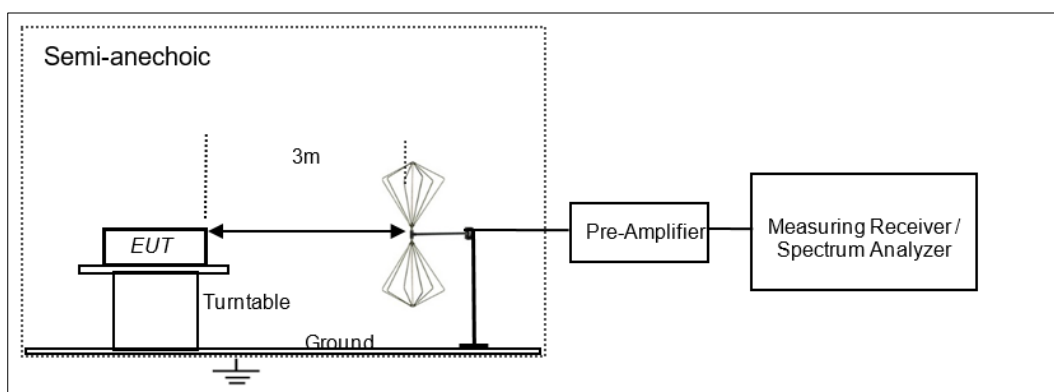
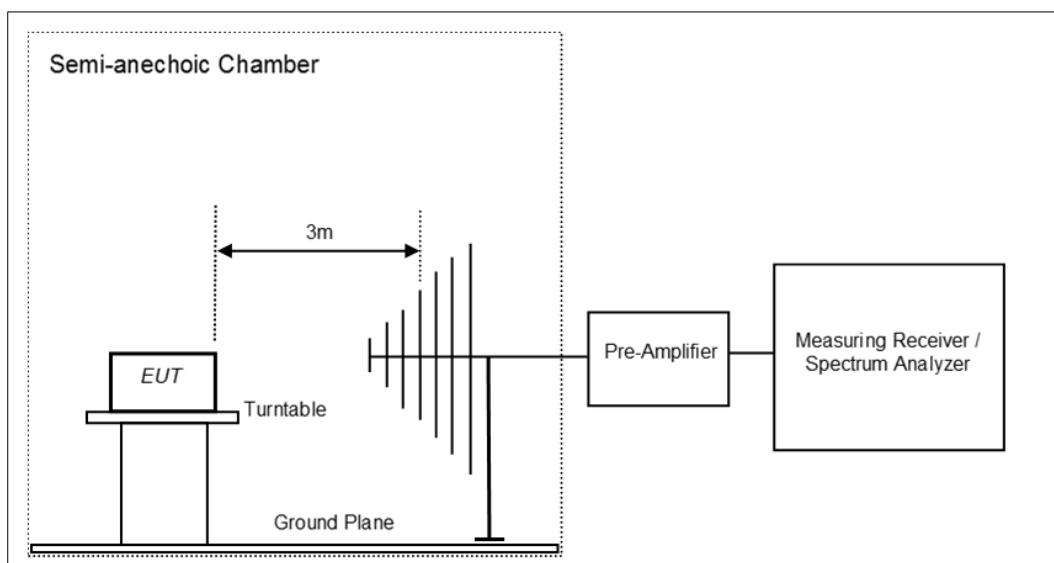
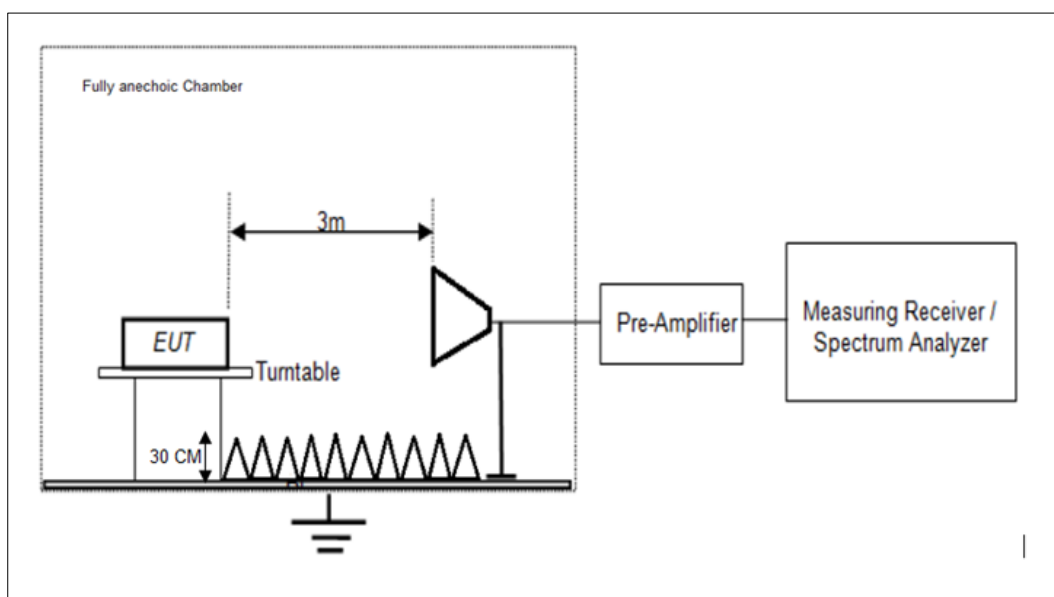


Figure 2: Frequency Range 30 MHz – 200 MHz



**Figure 3: Frequency Range 200 MHz - 1GHz**



**Figure 4: Frequency Range above 1 GHz**

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## 8 TEST RESULTS FOR Wi-Fi

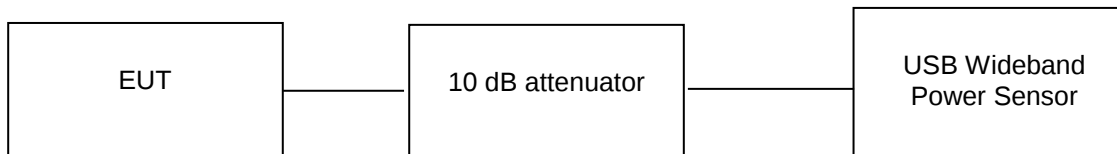
### 8.1 Maximum conducted (average) output power

**Result**

**Pass**

|                    |                                                                        |
|--------------------|------------------------------------------------------------------------|
| Test Specification | FCC part 15 Subpart C 15.247 (b)(3) / RSS 247 Issue 2, Section 5.4 (d) |
| Test Method        | Subclause 11.9.2.3 of ANSI C63.10                                      |
| Detector           | Average                                                                |
| Port of testing    | Antenna port                                                           |
| Requirement        | Power $\leq 1$ W (30 dBm) & e.i.r.p $\leq 4$ W (36 dBm)                |

#### Test Method



#### Test Condition

##### Environmental and Test conditions:

Normal Temperature = +23.8 °C      Voltage (V norm) = 5VDC through Adapter      Relative Humidity = 64 %

##### KDB Guidelines applied:

Measurements were made as per section 8.3.2.3 in KDB 558074 D01 15.247 Measurement Guidance v05r02.

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**Test results:**

**Note:**

1. All the losses are included during measurement and final values are mentioned in the test report
2. Total Average Output power (dBm) = Measured Average power (dBm) + Attenuator factor (10dB) + Cable loss (0.6dB) + Duty cycle correction factor (dB)
3. This product do not support additional beamforming gain / directional gain, it uses signal antenna and hence directional gain of the single antenna is 3.7 dBi
4. Maximum (e.i.r.p) = Maximum Average output power (dBm) + antenna gain (3.7 dBi)

**Modulation: 802.11b**

**Transmitted power level: + 18 dBm**

| Mode     | Data rate (Mbps) | Frequency (MHz) | Measured Average power (dBm) | Duty cycle (%) | Duty Factor | Final Measured Average power (dBm) | Limit (dBm) | Maximum e.i.r.p (dBm) | e.i.r.p Limit (dBm) |
|----------|------------------|-----------------|------------------------------|----------------|-------------|------------------------------------|-------------|-----------------------|---------------------|
| <b>b</b> | <b>1</b>         | 2412            | 17.33                        | 100            | 0           | 17.33                              | 30          | 21.03                 | 36                  |
|          |                  | 2437            | 17.18                        | 100            | 0           | 17.18                              | 30          | 20.88                 | 36                  |
|          |                  | 2462            | 17.07                        | 100            | 0           | 17.07                              | 30          | 20.77                 | 36                  |
|          | <b>11</b>        | <b>2412</b>     | <b>17.92</b>                 | <b>100</b>     | <b>0</b>    | <b>17.92</b>                       | <b>30</b>   | <b>21.62</b>          | <b>36</b>           |
|          |                  | <b>2437</b>     | <b>17.39</b>                 | <b>100</b>     | <b>0</b>    | <b>17.39</b>                       | <b>30</b>   | <b>21.09</b>          | <b>36</b>           |
|          |                  | <b>2462</b>     | <b>17.38</b>                 | <b>100</b>     | <b>0</b>    | <b>17.38</b>                       | <b>30</b>   | <b>21.08</b>          | <b>36</b>           |

**Modulation: 802.11g**

**Transmitted power level: + 18 dBm**

| Mode     | Data rate | Frequency (MHz) | Measured Average power (dBm) | Duty cycle (%) | Duty Factor | Final Measured Average power (dBm) | Limit (dBm) | Maximum e.i.r.p (dBm) | e.i.r.p limit (dBm) |
|----------|-----------|-----------------|------------------------------|----------------|-------------|------------------------------------|-------------|-----------------------|---------------------|
| <b>g</b> | <b>6</b>  | <b>2412</b>     | <b>16.26</b>                 | <b>100</b>     | <b>0</b>    | <b>16.26</b>                       | <b>30</b>   | <b>19.96</b>          | <b>36</b>           |
|          |           | <b>2437</b>     | <b>16.08</b>                 | <b>100</b>     | <b>0</b>    | <b>16.08</b>                       | <b>30</b>   | <b>19.78</b>          | <b>36</b>           |
|          |           | <b>2462</b>     | <b>16.02</b>                 | <b>100</b>     | <b>0</b>    | <b>16.02</b>                       | <b>30</b>   | <b>19.72</b>          | <b>36</b>           |
|          | <b>24</b> | 2412            | 14.33                        | 100            | 0           | 14.33                              | 30          | 18.03                 | 36                  |
|          |           | 2437            | 14.13                        | 100            | 0           | 14.13                              | 30          | 17.83                 | 36                  |
|          |           | 2462            | 14.25                        | 100            | 0           | 14.25                              | 30          | 17.95                 | 36                  |
|          | <b>54</b> | 2412            | 12.2                         | 100            | 0           | 12.20                              | 30          | 15.90                 | 36                  |
|          |           | 2437            | 12.2                         | 100            | 0           | 12.20                              | 30          | 15.90                 | 36                  |
|          |           | 2462            | 12                           | 100            | 0           | 12.00                              | 30          | 15.70                 | 36                  |

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**Modulation: 802.11n-20MHz**

**Transmitted power level: + 18 dBm**

| Mode            | Data rate   | Frequency (MHz) | Measured Average power (dBm) | Duty cycle (%) | Duty Factor | Final Measured Average power (dBm) | Limit (dBm) | Maximum e.i.r.p (dBm) | e.i.r.p limit (dBm) |
|-----------------|-------------|-----------------|------------------------------|----------------|-------------|------------------------------------|-------------|-----------------------|---------------------|
| <b>n-20 MHz</b> | <b>MCS0</b> | <b>2412</b>     | <b>16.12</b>                 | <b>100</b>     | <b>0</b>    | <b>16.12</b>                       | <b>30</b>   | <b>19.82</b>          | <b>36</b>           |
|                 |             | <b>2437</b>     | <b>16.09</b>                 | <b>100</b>     | <b>0</b>    | <b>16.09</b>                       | <b>30</b>   | <b>19.79</b>          | <b>36</b>           |
|                 |             | <b>2462</b>     | <b>15.92</b>                 | <b>100</b>     | <b>0</b>    | <b>15.92</b>                       | <b>30</b>   | <b>19.62</b>          | <b>36</b>           |
|                 | <b>MCS4</b> | 2412            | 14.5                         | 100            | 0           | 14.50                              | 30          | 18.2                  | 36                  |
|                 |             | 2437            | 14.26                        | 100            | 0           | 14.26                              | 30          | 17.96                 | 36                  |
|                 |             | 2462            | 14.24                        | 100            | 0           | 14.24                              | 30          | 17.94                 | 36                  |
|                 | <b>MCS7</b> | 2412            | 11.31                        | 100            | 0           | 11.31                              | 30          | 15.01                 | 36                  |
|                 |             | 2437            | 11.05                        | 100            | 0           | 11.05                              | 30          | 14.75                 | 36                  |
|                 |             | 2462            | 11.15                        | 100            | 0           | 11.15                              | 30          | 14.85                 | 36                  |

## 8.2 Spurious Radiated Emissions & Restricted Bands of Operation

### Result

### Pass

|                       |                                                                                            |
|-----------------------|--------------------------------------------------------------------------------------------|
| Test Specification    | FCC part 15 Subpart C 15.247 (d) / (15.209 & 15.205) /<br>IC RSS-GEN, Section 8.9 and 8.10 |
| Test Method           | ANSI C63.10                                                                                |
| Measurement Location  | Semi Anechoic Chamber 30MHz - 1 GHz<br>Fully Anechoic Chamber 1 GHz - 40GHz                |
| Measurement Bandwidth | 100 kHz for frequency range < 1GHz<br>1 MHz for Frequency range >1GHz                      |
| Detector              | Refer remarks below                                                                        |
| Measuring Distance    | 3 m                                                                                        |
| Requirement           | As per the limits mentioned in the below table                                             |
| Test setup            | Refer 7 TEST METHODOLOGY                                                                   |

**Table 7: Transmitter limits for Radiated emission**

| Frequency (MHz) | Field strength (μV/m) | Field strength (dBμV/m) | Distance of Measurement (m) |
|-----------------|-----------------------|-------------------------|-----------------------------|
| 0.009 – 0.490   | 2400/F(kHz)           | 48.50 – 13.80           | 300*                        |
| 0.490 – 1.705   | 24000/F(kHz)          | 33.80 – 23.00           | 30*                         |
| 1.705 -30       | 30                    | 29.54                   | 30*                         |
| 30-88           | 100                   | 40.0                    | 3                           |
| 88-216          | 150                   | 43.5                    | 3                           |
| 216-960         | 200                   | 46.0                    | 3                           |
| Above 960       | 500                   | 54.0                    | 3                           |

Remark: \* The limit shows in the table above of frequency range 0.009 – 0.490, 0.490 – 1.705 MHz and 1.705-30MHz is at 300 meter, 30 meter and 30 meter range respectively, which corresponds to 128.51 – 93.80, 73.80 – 62.96 and 69.54 dBμV/m at 3m range by extrapolation calculation and the measurement of loop antenna.

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz Radiated emission limits in these three bands are based on measurements employing an average detector.

### Test Conditions:

Temperature (Norm) = + 23.5 °C      Voltage = 110 VAC, 60 Hz supply to adaptor      Relative humidity = 62 %

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**Test results:**

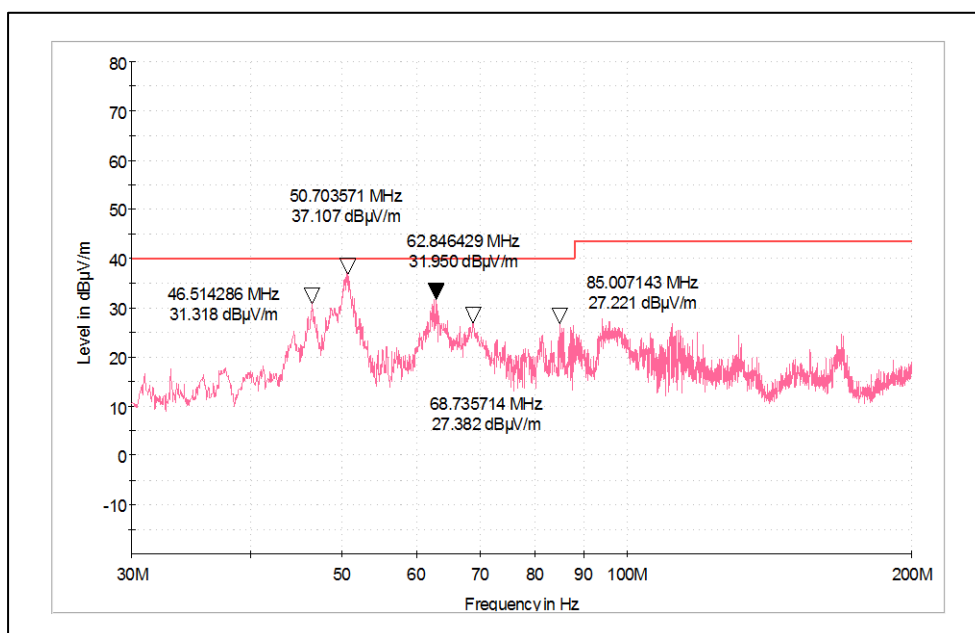
Note: All the losses are included during measurement and final values are mentioned in the test report. Refer 7 TEST METHODOLOGY for more details

**Test results for frequency range 9kHz – 30MHz**

No emissions found in frequency range 9 kHz to 30 MHz, and measured levels are below 20dB from the limit line, hence not reported

**Test results for frequency range 30MHz – 200MHz**

| Antenna Polarization | Measured Frequency (MHz) | Measured Spurious Emission level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
|----------------------|--------------------------|-------------------------------------------------|----------------------|-------------|
| Vertical             | 46.51                    | 31.31(Pk)                                       | 40.00                | -8.69       |
|                      | 50.59                    | 37.24(Qp)                                       | 40.00                | -2.76       |
|                      | 62.84                    | 31.95(Pk)                                       | 40.00                | -8.05       |
|                      | 68.73                    | 27.38(Pk)                                       | 40.00                | -12.62      |
|                      | 85.00                    | 27.22(Pk)                                       | 40.00                | -12.78      |
| Horizontal           | 50.21                    | 13.99(Pk)                                       | 40.00                | -26.01      |
|                      | 68.06                    | 11.31(Pk)                                       | 40.00                | -28.69      |
|                      | 99.15                    | 11.99(Pk)                                       | 43.50                | -31.51      |
|                      | 170.79                   | 19.33(Pk)                                       | 43.50                | -24.17      |



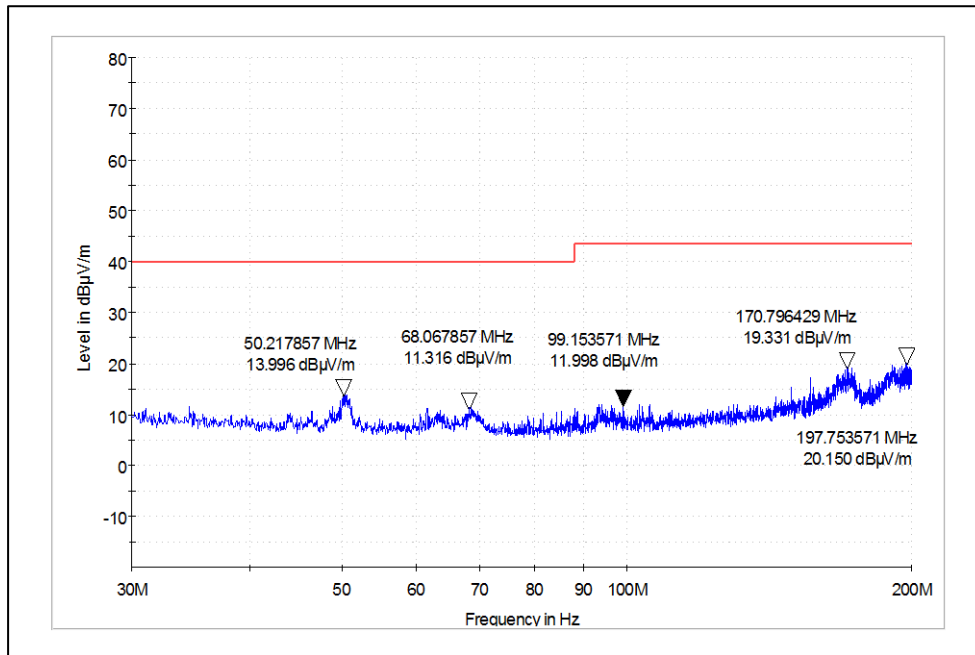
Channel Frequency 30MHz – 200MHz

Polarization Vertical

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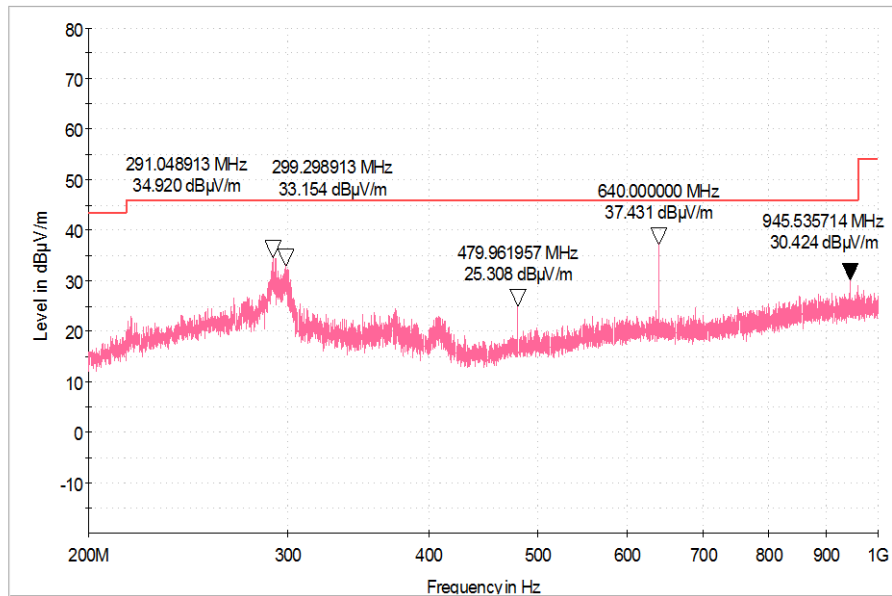
Channel Frequency 30MHz – 200MHz

Polarization Horizontal

Test results for frequency range 200MHz – 1GHz

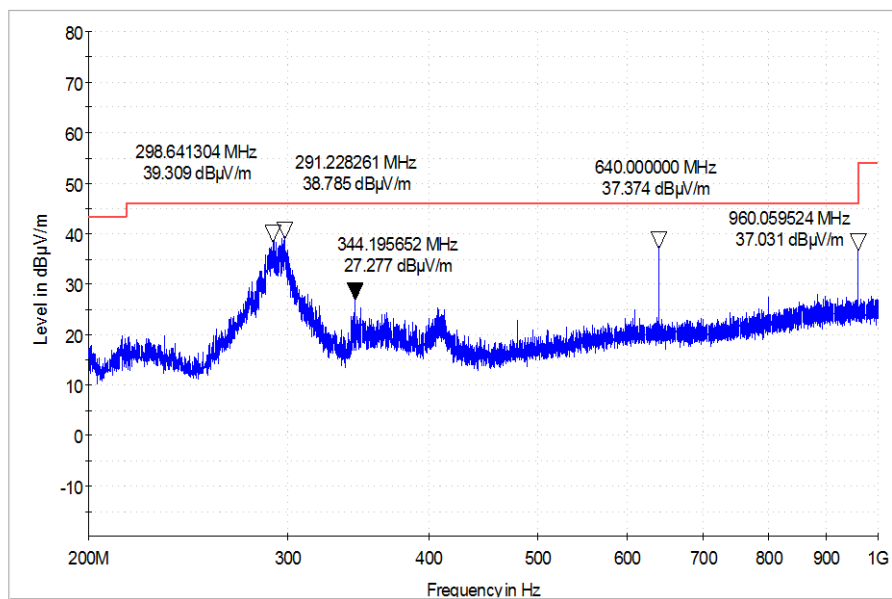
| Antenna Polarization | Measured Frequency (MHz) | Measured Spurious Emission level (dBµV/m) | Limit (dBµV/m) | Margin (dB) |
|----------------------|--------------------------|-------------------------------------------|----------------|-------------|
| Vertical             | 291.04                   | 34.92(Pk)                                 | 46.50          | -11.58      |
|                      | 299.29                   | 33.15(Pk)                                 | 46.50          | -13.35      |
|                      | 479.96                   | 25.30(Pk)                                 | 46.50          | -21.2       |
|                      | 640.00                   | 37.43(Pk)                                 | 46.50          | -9.07       |
|                      | 945.53                   | 30.42(Pk)                                 | 46.50          | -16.08      |
| Horizontal           | 298.64                   | 39.30(Pk)                                 | 46.50          | -7.2        |
|                      | 291.22                   | 38.78(Pk)                                 | 46.50          | -7.72       |
|                      | 344.19                   | 27.27(Pk)                                 | 46.50          | -19.23      |
|                      | 640.00                   | 37.37(Pk)                                 | 46.50          | -9.13       |
|                      | 960.05                   | 37.03(Pk)                                 | 46.50          | -9.47       |

**Note:** (Pk)- Peak detector  
(Qp)- Quasi peak detector



Channel Frequency 200MHz – 1GHz

Polarization Vertical



Channel Frequency 200MHz – 1GHz

Polarization Horizontal

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**Test results for the frequencies in the range 1 GHz to 26.5 GHz**

**Modulation: 802.11b**

**Data Rate: 1Mbps**

| Mode | Data rate (Mbps) | Channel | Polarization | Frequency (MHz) | Emission level (dBµV/m) | Limit (dBµV/m) | Margin (dB) |
|------|------------------|---------|--------------|-----------------|-------------------------|----------------|-------------|
| b    | 1                | Low     | Vertical     | 2390(pk)        | 40.01                   | 74*            | -33.99      |
|      |                  |         |              | 2390(Av)        | 28.19                   | 54*            | -25.81      |
|      |                  |         |              | 2412(pk)        | 98.18                   | -              | -           |
|      |                  |         |              | 2412(Av)        | 88.88                   | -              | -           |
|      |                  |         |              | 4824(pk)        | 53.52                   | 74             | 53.52       |
|      |                  |         |              | 4824(Av)        | 44.56                   | 54             | 44.56       |
|      |                  |         |              | 7236(Pk)        | No Harmonics found      |                |             |
|      |                  |         |              | 7236(av)        |                         |                |             |
|      |                  |         | Horizontal   | 2390(pk)        | 47.42                   | 74*            | -26.58      |
|      |                  |         |              | 2390(Av)        | 34.62                   | 54*            | -19.38      |
|      |                  |         |              | 2412(pk)        | 107.13                  | -              | -           |
|      |                  |         |              | 2412(Av)        | 97.83                   | -              | -           |
|      |                  |         |              | 4824(pk)        | 48.50                   | 74             | -25.50      |
|      |                  |         |              | 4824(Av)        | 38.31                   | 54             | -15.69      |
|      |                  |         |              | 7236(Pk)        | No Harmonics found      |                |             |
|      |                  |         |              | 7236(av)        |                         |                |             |
|      |                  | Mid     | Vertical     | 2437(Av)        | 100.2                   | -              | -           |
|      |                  |         |              | 2437(Av)        | 90.7                    | -              | -           |
|      |                  |         |              | 4874(Pk)        | 54.67                   | 74             | -19.33      |
|      |                  |         |              | 4874(Av)        | 45.47                   | 54             | -8.53       |
|      |                  |         |              | 7311(pk)        | No Harmonics found      |                |             |
|      |                  |         |              | 7311(Av)        |                         |                |             |
|      |                  |         | Horizontal   | 2437(Pk)        | 52.06                   | -              | -           |
|      |                  |         |              | 2437(Av)        | 42.03                   | -              | -           |
|      |                  |         |              | 4874(Pk)        | 52.06                   | 74             | -21.94      |
|      |                  |         |              | 4874(Av)        | 42.03                   | 54             | -11.97      |
|      |                  |         |              | 7311(pk)        | No Harmonics found      |                |             |
|      |                  |         |              | 7311(Av)        |                         |                |             |
|      |                  | High    | Vertical     | 2462(Pk)        | 102.1                   | -              | -           |
|      |                  |         |              | 2462(Av)        | 92.8                    | -              | -           |
|      |                  |         |              | 2483.5(Pk)      | 49.16                   | 74*            | -24.84      |
|      |                  |         |              | 2483.5(Av)      | 36.31                   | 54*            | -17.69      |
|      |                  |         |              | 4924(Pk)        | 51.38                   | 74             | -22.62      |
|      |                  |         |              | 4924(Av)        | 42.13                   | 54             | -11.87      |
|      |                  |         |              | 7386(Pk)        | No Harmonics found      |                |             |
|      |                  |         |              | 7386(Av)        |                         |                |             |
|      |                  |         | Horizontal   | 2462(Pk)        | 107.13                  | -              | -           |
|      |                  |         |              | 2462(Av)        | 97.81                   | -              | -           |
|      |                  |         |              | 2483.5(Pk)      | 54.24                   | 74*            | -19.76      |
|      |                  |         |              | 2483.5(Av)      | 40.54                   | 54*            | -13.46      |
|      |                  |         |              | 4924(Pk)        | 50.66                   | 74             | -23.34      |
|      |                  |         |              | 4924(Av)        | 40.87                   | 54             | -13.13      |
|      |                  |         |              | 7386(Pk)        | No Harmonics found      |                |             |
|      |                  |         |              | 7386(Av)        |                         |                |             |

\* : Indicate restricted band of operation §15.205  
Pk: Peak Detector; Av: Average Detector

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**Modulation: 802.11g**

**Data Rate: 6Mbps**

| Mode | Data rate(Mbps) | Channel | Polarization | Frequency (MHz) | Emission level (dBµV/m) | Limit (dBµV/m) | Margin (dB) |
|------|-----------------|---------|--------------|-----------------|-------------------------|----------------|-------------|
| g    | 6               | Low     | Vertical     | 2390(pk)        | 50.41                   | 74*            | -18.69      |
|      |                 |         |              | 2390(Av)        | 37.08                   | 54*            | -11.47      |
|      |                 |         |              | 2412(pk)        | 95.12                   | -              | -           |
|      |                 |         |              | 2412(Av)        | 88.29                   | -              | -           |
|      |                 |         |              | 4824(pk)        | 53.94                   | 74             | -22.77      |
|      |                 |         |              | 4824(Av)        | 41.36                   | 54             | -15.47      |
|      |                 |         |              | 7236(Pk)        | No Harmonics found      |                |             |
|      |                 |         |              | 7236(av)        |                         |                |             |
|      |                 |         | Horizontal   | 2390(pk)        | 55.31                   | 74*            | -18.69      |
|      |                 |         |              | 2390(Av)        | 42.53                   | 54*            | -11.47      |
|      |                 |         |              | 2412(pk)        | 101.05                  | -              | -           |
|      |                 |         |              | 2412(Av)        | 92.55                   | -              | -           |
|      |                 |         |              | 4824(pk)        | 51.23                   | 74             | -22.77      |
|      |                 |         |              | 4824(Av)        | 38.53                   | 54             | -15.47      |
|      |                 |         |              | 7236(Pk)        | No Harmonics found      |                |             |
|      |                 |         |              | 7236(Av)        |                         |                |             |
|      |                 | Mid     | Vertical     | 2437(Av)        | 95.63                   | -              | -           |
|      |                 |         |              | 2437(Av)        | 86.64                   | -              | -           |
|      |                 |         |              | 4874(Pk)        | 51.94                   | 74             | -22.06      |
|      |                 |         |              | 4874(Av)        | 39.73                   | 54             | -14.27      |
|      |                 |         |              | 7311(pk)        | No Harmonics found      |                |             |
|      |                 |         |              | 7311(Av)        |                         |                |             |
|      |                 |         | Horizontal   | 2437(Pk)        | 100.24                  | -              | -           |
|      |                 |         |              | 2437(Av)        | 92.54                   | -              | -           |
|      |                 |         |              | 4874(Pk)        | 49.57                   | 74             | -24.43      |
|      |                 |         |              | 4874(Av)        | 36.13                   | 54             | -17.87      |
|      |                 |         |              | 7311(pk)        | No Harmonics found      |                |             |
|      |                 |         |              | 7311(Av)        |                         |                |             |
|      |                 | High    | Vertical     | 2462(Pk)        | 96.87                   | -              | -           |
|      |                 |         |              | 2462(Av)        | 88.58                   | -              | -           |
|      |                 |         |              | 2483.5(Pk)      | 57.35                   | 74*            | -16.65      |
|      |                 |         |              | 2483.5(Av)      | 44.79                   | 54*            | -9.21       |
|      |                 |         |              | 4924(Pk)        | 49.57                   | 74             | -24.43      |
|      |                 |         |              | 4924(Av)        | 36.13                   | 54             | -17.87      |
|      |                 |         |              | 7386(Pk)        | No Harmonics found      |                |             |
|      |                 |         |              | 7386(Av)        |                         |                |             |
|      |                 |         | Horizontal   | 2462(Pk)        | 100.87                  | -              | -           |
|      |                 |         |              | 2462(Av)        | 93.2                    | -              | -           |
|      |                 |         |              | 2483.5(Pk)      | 61.66                   | 74*            | -12.34      |
|      |                 |         |              | 2483.5(Av)      | 49.16                   | 54*            | -4.84       |
|      |                 |         |              | 4924(Pk)        | 49.49                   | 74             | -24.51      |
|      |                 |         |              | 4924(Av)        | 37.2                    | 54             | -16.80      |
|      |                 |         |              | 7386(Pk)        | No Harmonics found      |                |             |
|      |                 |         |              | 7386(Av)        |                         |                |             |

\* : Indicate restricted band of operation §15.205  
Pk: Peak Detector; Av: Average Detector

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**Modulation: 802.11n\_20MHz**  
**Data Rate: MCS0**

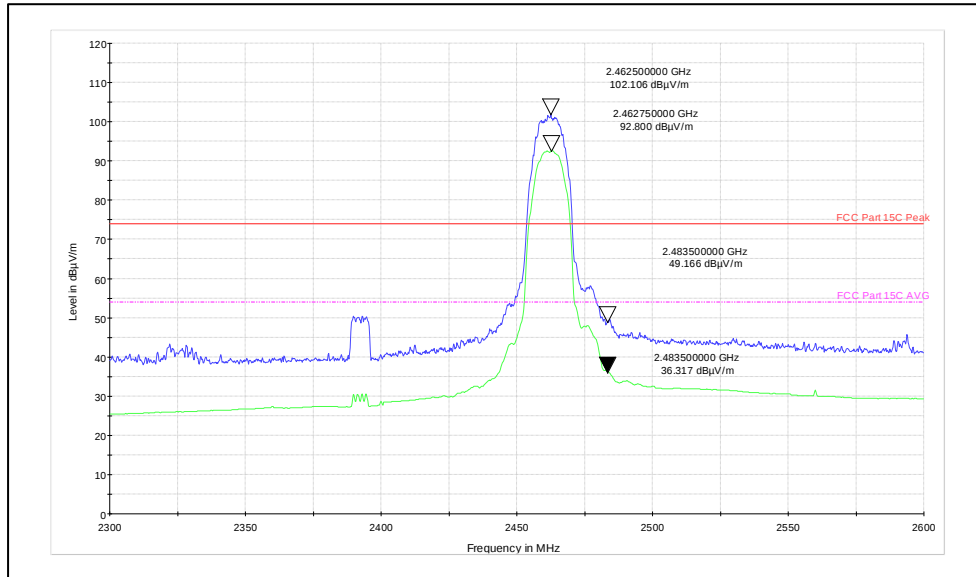
| Mode  | Data rate (Mbps) | Channel | Polarization | Frequency (MHz) | Emission level (dBµV/m) | Limit (dBµV/m) | Margin (dB) |
|-------|------------------|---------|--------------|-----------------|-------------------------|----------------|-------------|
| n(20) | MCS0             | Low     | Vertical     | 2390(pk)        | 51.57                   | 74*            | -18.46      |
|       |                  |         |              | 2390(Av)        | 37.94                   | 54*            | -11.52      |
|       |                  |         |              | 2412(pk)        | 98.09                   | -              | -           |
|       |                  |         |              | 2412(Av)        | 88.53                   | -              | -           |
|       |                  |         |              | 4824(pk)        | 53.45                   | 74             | -22.36      |
|       |                  |         |              | 4824(Av)        | 39.81                   | 54             | -16.36      |
|       |                  |         |              | 7236(Pk)        | No Harmonics found      |                |             |
|       |                  |         |              | 7236(av)        |                         |                |             |
|       |                  |         | Horizontal   | 2390(pk)        | 55.54                   | 74*            | -23.96      |
|       |                  |         |              | 2390(Av)        | 42.48                   | 54*            | -34.79      |
|       |                  |         |              | 2412(pk)        | 100.52                  | -              | -           |
|       |                  |         |              | 2412(Av)        | 91.79                   | -              | -           |
|       |                  |         |              | 4824(pk)        | 51.64                   | 74             | -22.36      |
|       |                  |         |              | 4824(Av)        | 37.64                   | 54             | -16.36      |
|       |                  |         |              | 7236(Pk)        | No Harmonics found      |                |             |
|       |                  |         |              | 7236(av)        |                         |                |             |
|       |                  | Mid     | Vertical     | 2437(Av)        | 97.96                   | -              | -           |
|       |                  |         |              | 2437(Av)        | 88.79                   | -              | -           |
|       |                  |         |              | 4874(Pk)        | 51.85                   | 74             | -22.15      |
|       |                  |         |              | 4874(Av)        | 38.22                   | 54             | -15.78      |
|       |                  |         |              | 7311(pk)        | No Harmonics found      |                |             |
|       |                  |         |              | 7311(Av)        |                         |                |             |
|       |                  |         | Horizontal   | 2437(Pk)        | 102.04                  | -              | -           |
|       |                  |         |              | 2437(Av)        | 92.39                   | -              | -           |
|       |                  |         |              | 4874(Pk)        | 49.74                   | 74             | -24.26      |
|       |                  |         |              | 4874(Av)        | 36.80                   | 54             | -17.20      |
|       |                  |         |              | 7311(pk)        | No Harmonics found      |                |             |
|       |                  |         |              | 7311(Av)        |                         |                |             |
|       |                  | High    | Vertical     | 2462(Pk)        | 98.42                   | -              | -           |
|       |                  |         |              | 2462(Av)        | 88.73                   | -              | -           |
|       |                  |         |              | 2483.5(Pk)      | 57.92                   | 74*            | -16.08      |
|       |                  |         |              | 2483.5(Av)      | 44.11                   | 54*            | -9.89       |
|       |                  |         |              | 4924(Pk)        | 48.35                   | 74             | -25.65      |
|       |                  |         |              | 4924(Av)        | 35.34                   | 54             | -18.66      |
|       |                  |         |              | 7386(Pk)        | No Harmonics found      |                |             |
|       |                  |         |              | 7386(Av)        |                         |                |             |
|       |                  |         | Horizontal   | 2462(Pk)        | 103.86                  | -              | -           |
|       |                  |         |              | 2462(Av)        | 94.32                   | -              | -           |
|       |                  |         |              | 2483.5(Pk)      | 63.38                   | 74*            | -10.62      |
|       |                  |         |              | 2483.5(Av)      | 49.42                   | 54*            | -4.58       |
|       |                  |         |              | 4924(Pk)        | 48.18                   | 74             | -25.82      |
|       |                  |         |              | 4924(Av)        | 34.44                   | 54             | -19.56      |
|       |                  |         |              | 7386(Pk)        | No Harmonics found      |                |             |
|       |                  |         |              | 7386(Av)        |                         |                |             |

\* : Indicate restricted band of operation §15.205  
Pk: Peak Detector; Av: Average Detector

**Worst case Plots**

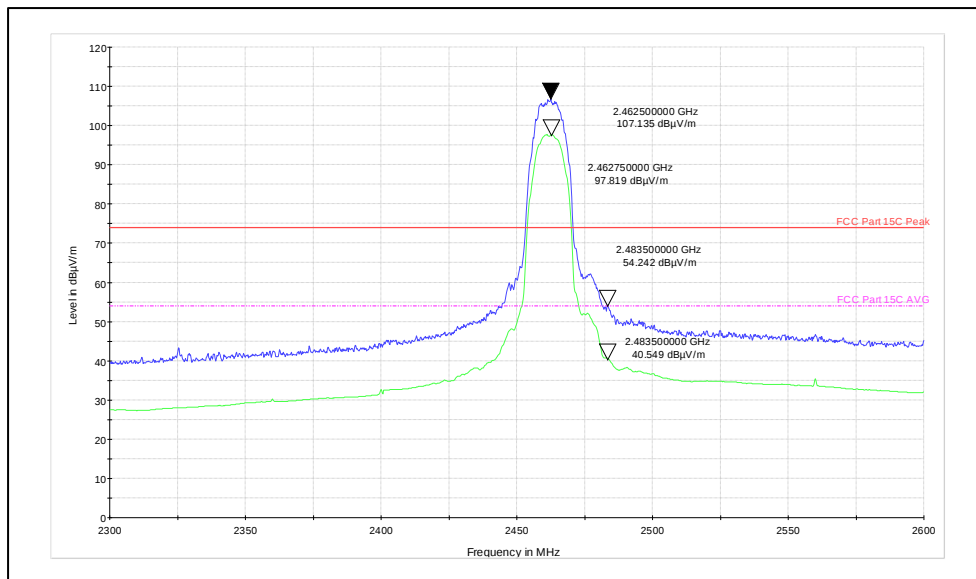
**Data Rate: 1Mbps**

**Channel Frequency 2462MHz**



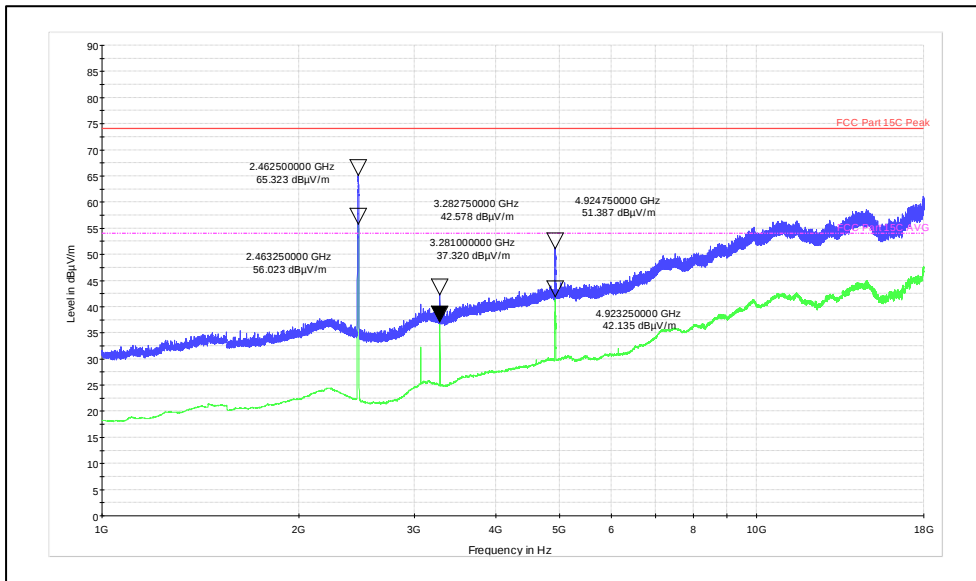
Channel Frequency: 2462MHz

Polarization: Vertical



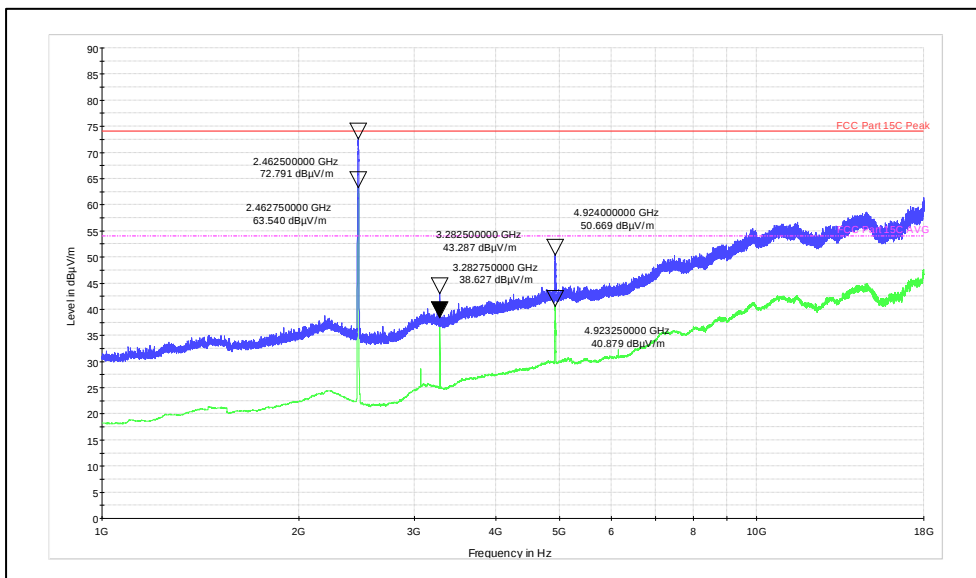
Channel Frequency: 2462MHz

Polarization: Horizontal



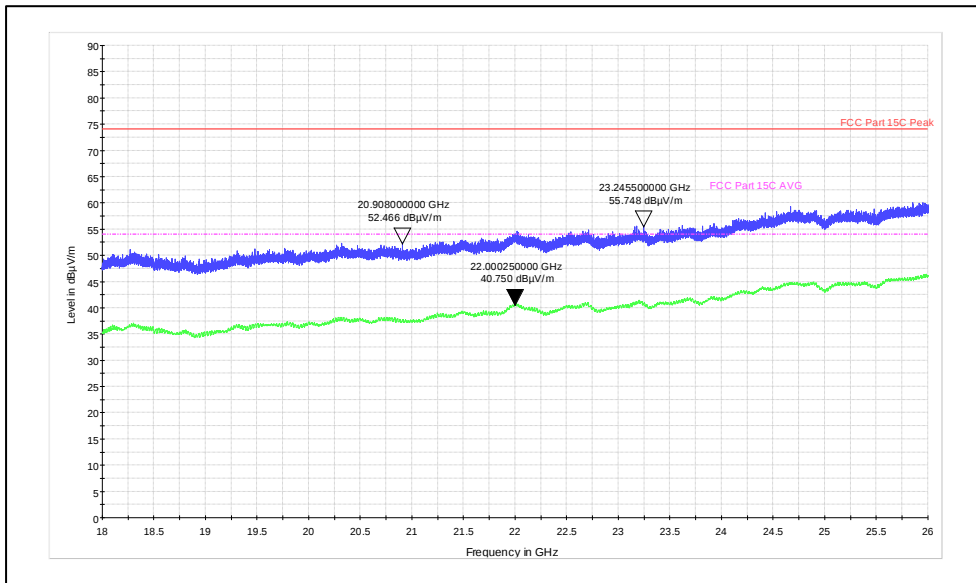
Channel Frequency: 1 - 18 GHz

Polarization: Vertical



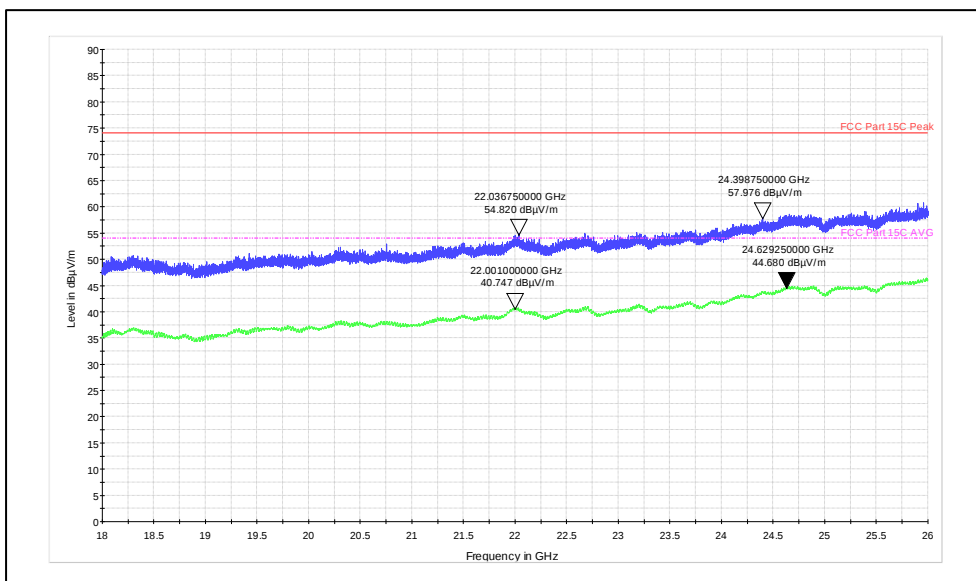
Channel Frequency: 1 - 18 GHz

Polarization: Horizontal



Channel Frequency: 18 - 26 GHz

Polarization: Vertical



Channel Frequency: 18 - 26 GHz

Polarization: Horizontal

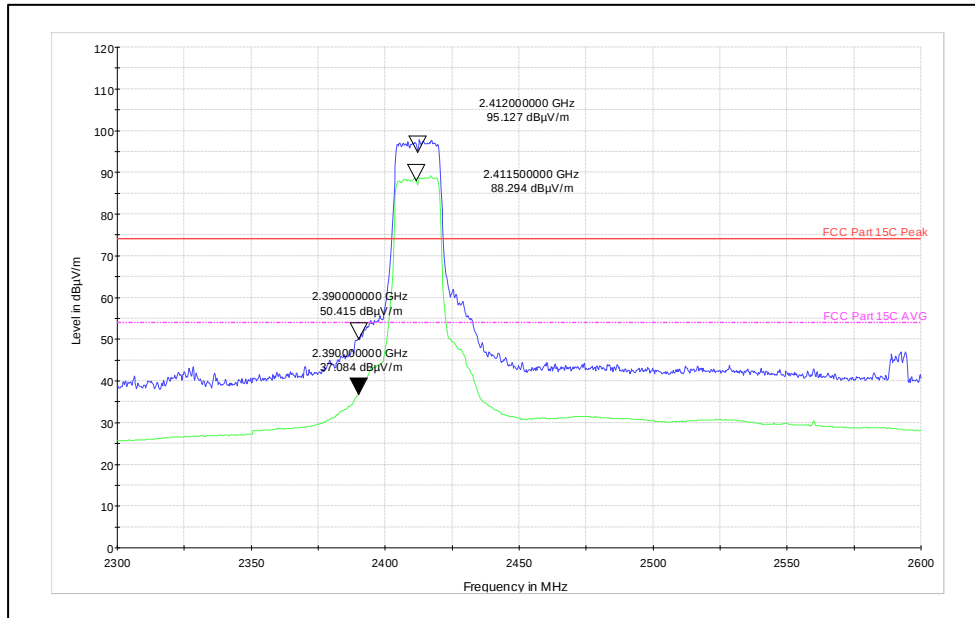
**Prüfbericht - Nr.:**  
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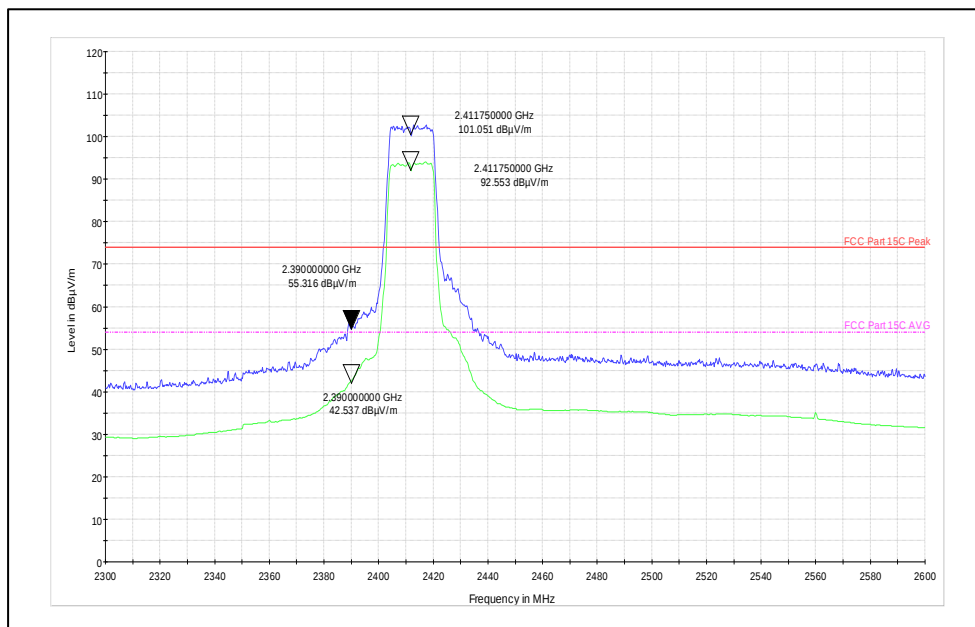
**Data Rate: 6Mbps**

**Channel Frequency 2412MHz**



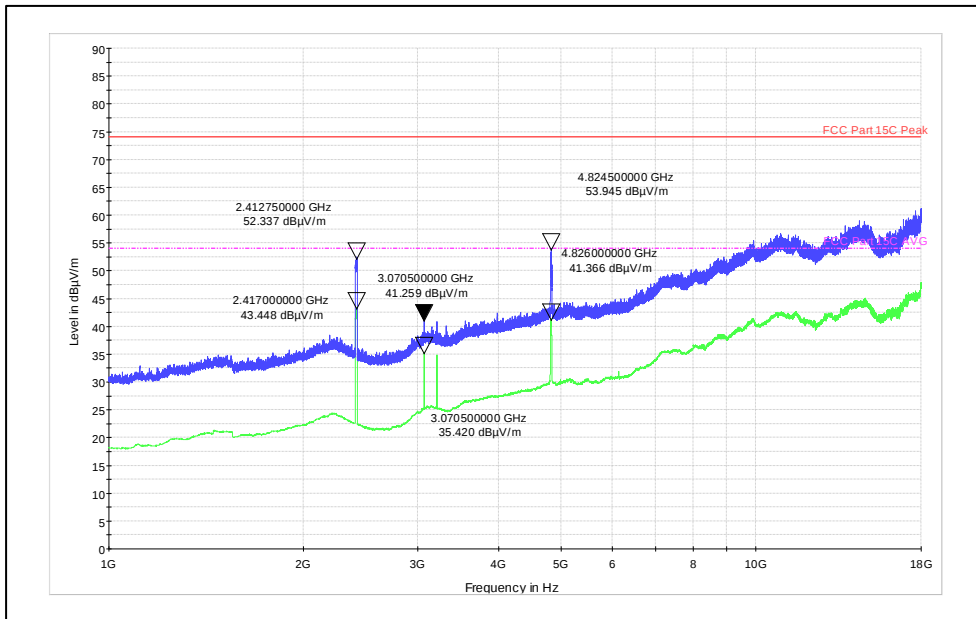
Channel Frequency: 2412MHz

Polarization: Vertical



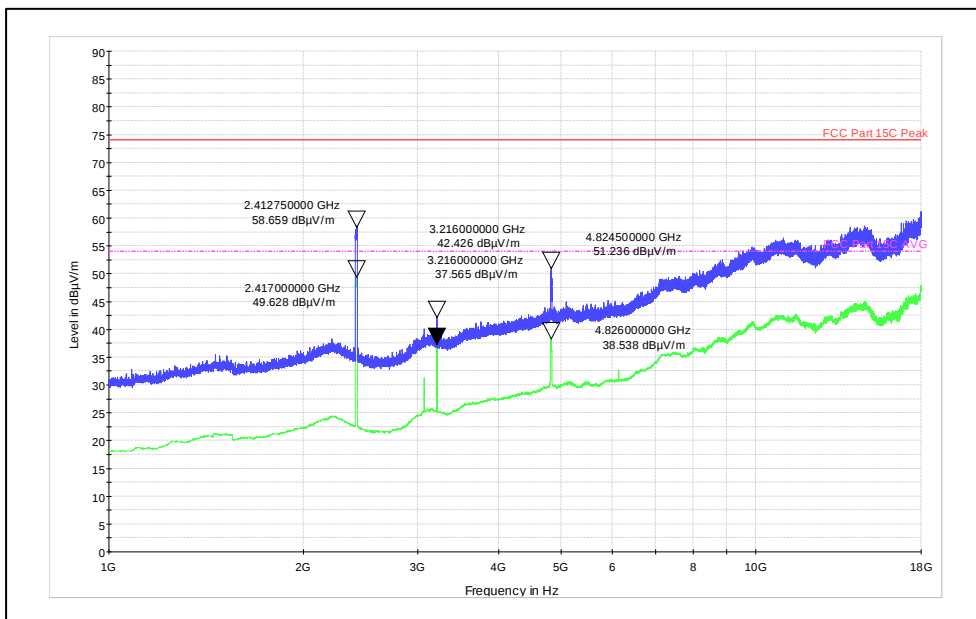
Channel Frequency: 2412MHz

Polarization: Horizontal



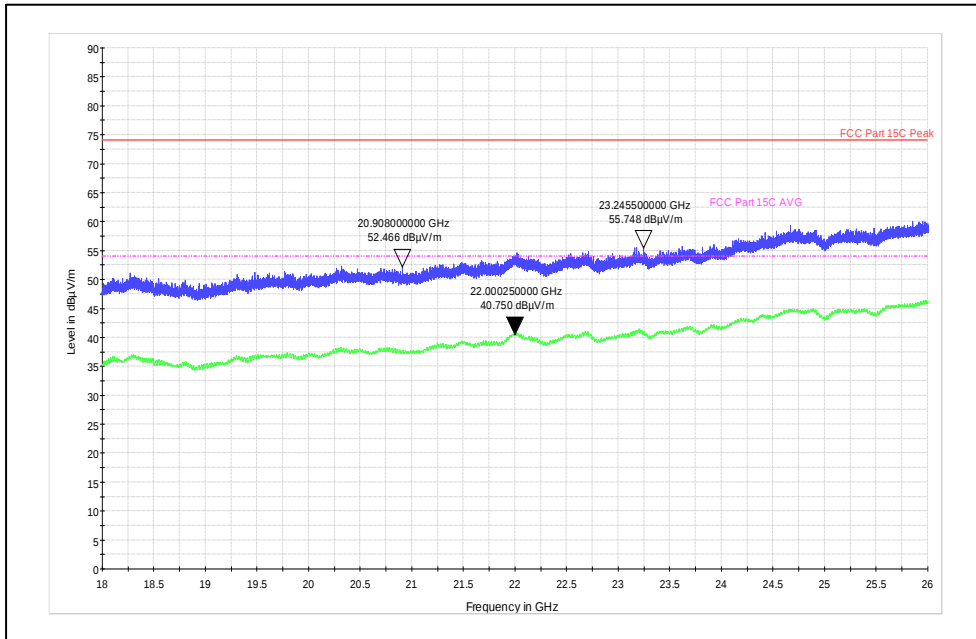
Channel Frequency: 1 - 18 GHz

Polarization: Vertical



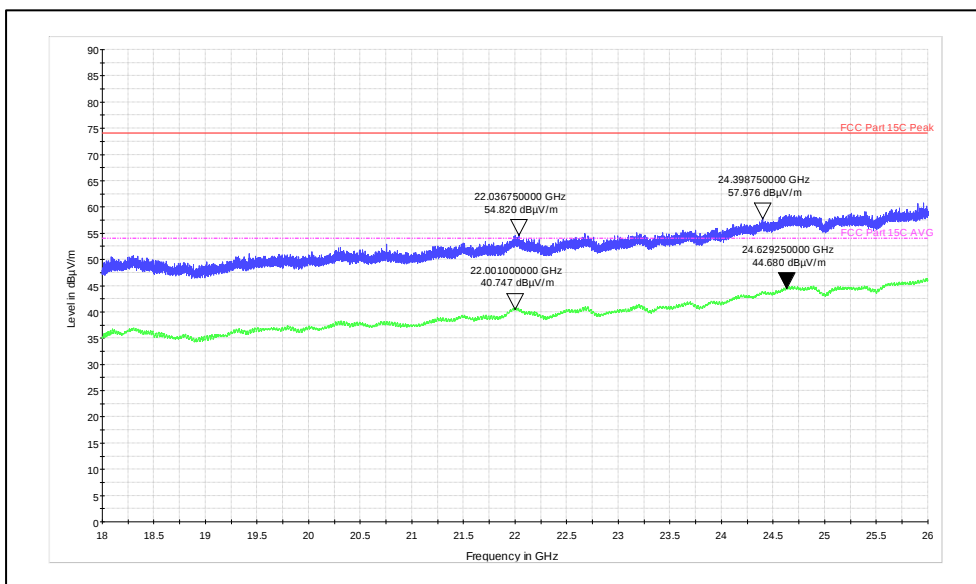
Channel Frequency: 1 - 18 GHz

Polarization: Horizontal



Channel Frequency: 18-26GHz

Polarization: Vertical

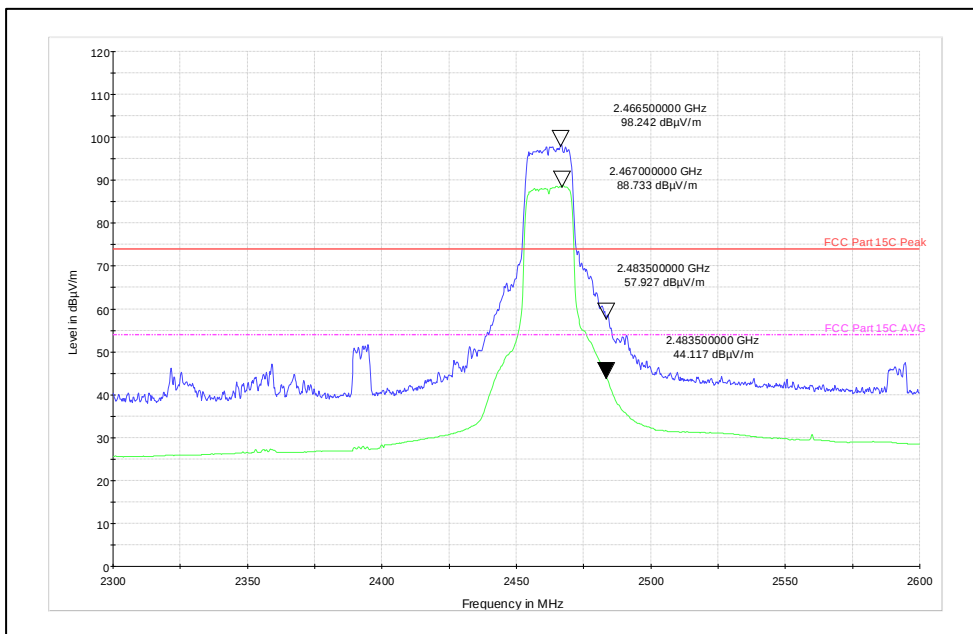


Channel Frequency: 18-26 GHz

Polarization: Horizontal

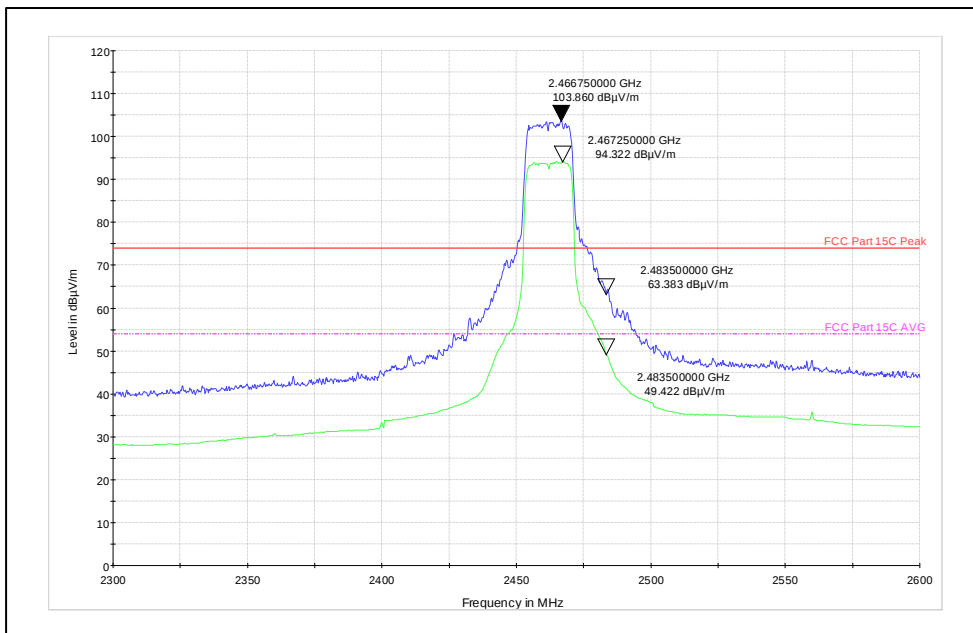
Data Rate: MCS0\_n Mode 20MHz

Channel Frequency 2462MHz



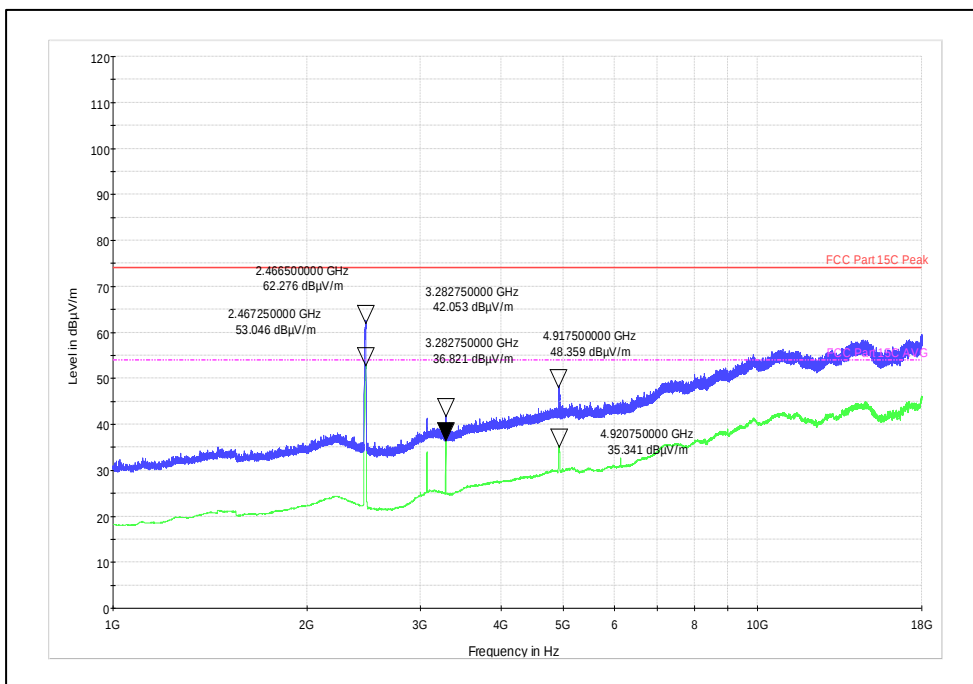
Channel Frequency: 2462MHz

Polarization: Vertical



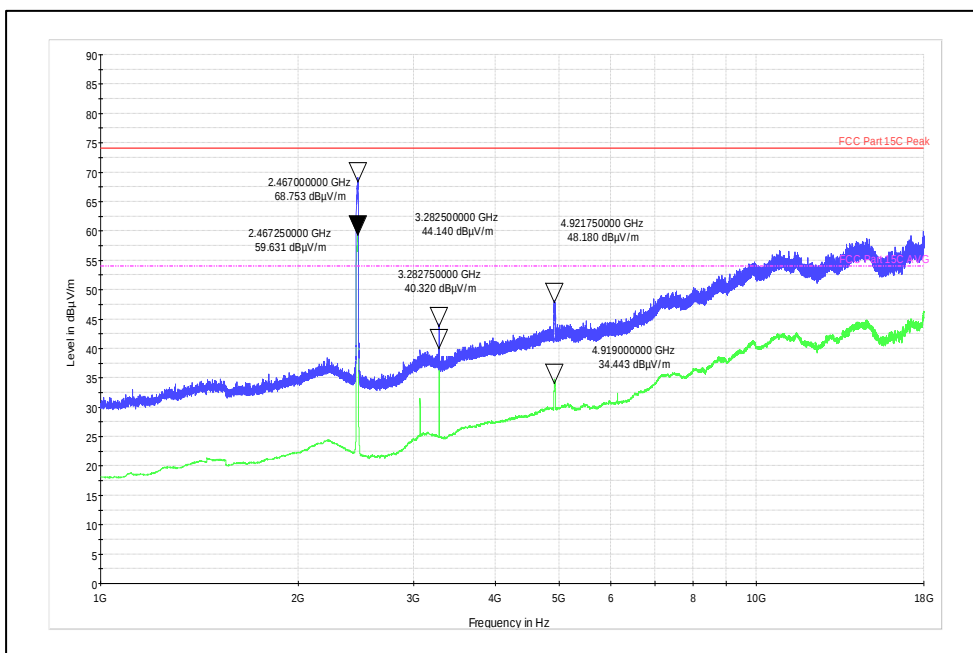
Channel Frequency: 2462MHz

Polarization: Horizontal



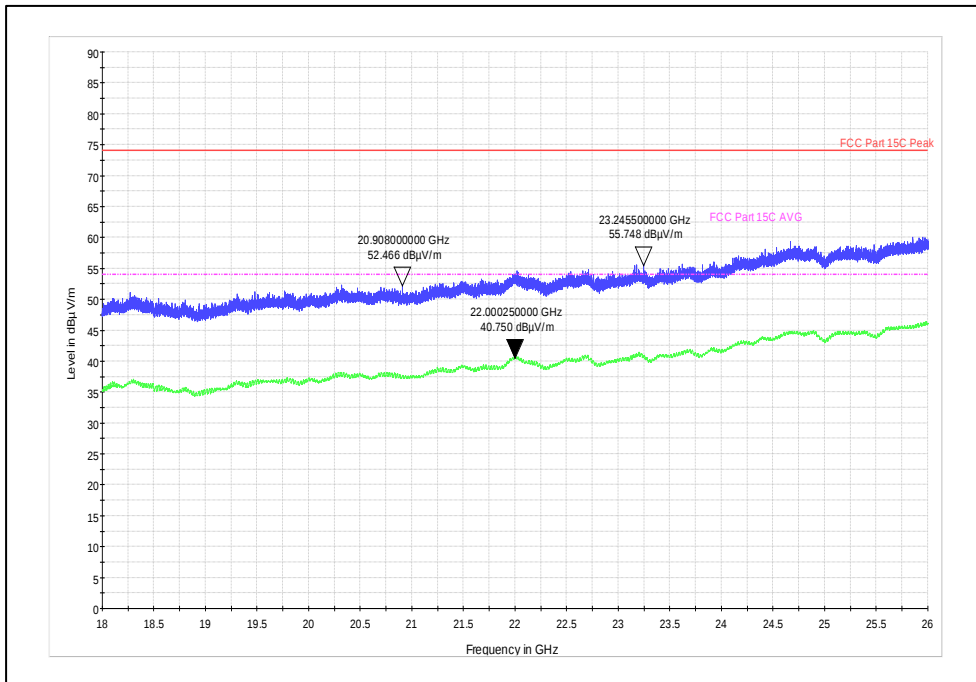
Channel Frequency: 1 - 18 GHz

Polarization: Vertical



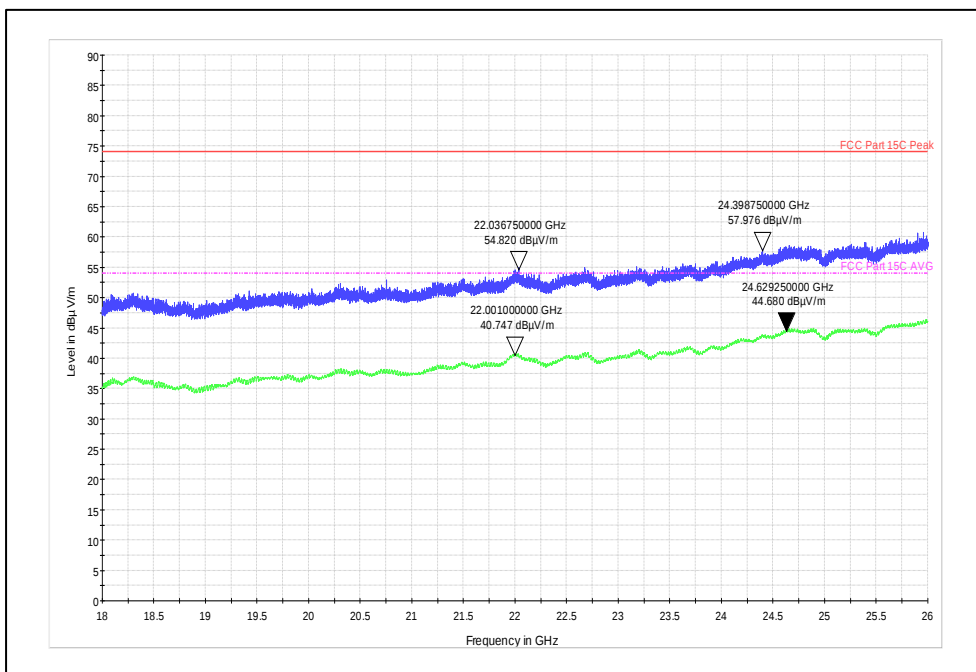
Channel Frequency: 1 - 18 GHz

Polarization: Horizontal



Channel Frequency: 18 -26GHz

Polarization: Vertical



Channel Frequency: 18-26GHz

Polarization: Horizontal

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## 9 TEST RESULTS FOR BLUETOOTH LOW ENERGY

### 9.1 Maximum conducted (Peak) output power

**Result**

**Pass**

Test Specification

FCC part 15 Subpart C 15.247 (b)(3) / RSS 247 Issue 2, Section 5.4 (d)

Test Method

Subclause 11.9.1.1 of ANSI C63.10

Detector

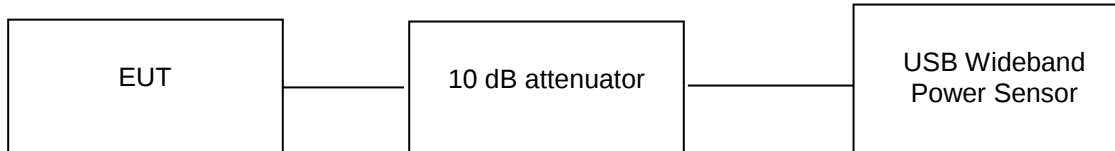
Peak

Port of testing

Antenna port

Requirement

Power  $\leq 1$  W (30 dBm) & e.i.r.p  $\leq 4$  W (36 dBm)



#### Test Condition

##### Normal Test Condition:

Temperature (Norm) = + 23.8 °C

Voltage = 5VDC through Adapter

Relative humidity: 64%

##### KDB Guidelines applied:

Measurements were made as per section 8.3.1.1 in KDB 558074 D01 15.247 Measurement Guidance v05r02.

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Test Report No.:

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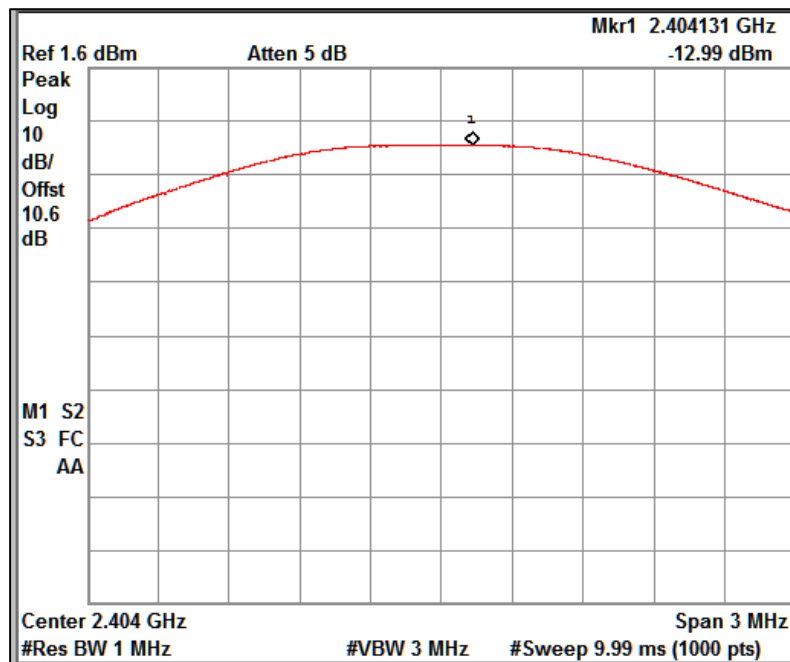
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**Test results:**

**Note:**

1. All the losses are included during measurement and final values are mentioned in the test report.
2. Total Average Output power (dBm) = Measured Average power (dBm) + Attenuator factor (10dB) + Cable loss (0.6dB) + Duty cycle correction factor (dB)
3. This product do not support additional beamforming gain / directional gain, it uses signal antenna and hence directional gain of the single antenna is 3.7dBi
4. Maximum (e.i.r.p) = Maximum Average output power (dBm) + antenna gain (3.7 dBi)

| Data Rate (Mbps) | Channel Frequency (MHz) | Maximum Peak Conducted Output Power (dBm) | Power Limit (dBm) | e.i.r.p (dBm) | e.i.r.p Limit (dBm) |
|------------------|-------------------------|-------------------------------------------|-------------------|---------------|---------------------|
| 1                | 2402                    | -12.99                                    | 30                | -9.29         | 36                  |
|                  | 2440                    | -12.37                                    | 30                | -8.67         | 36                  |
|                  | 2480                    | -11.47                                    | 30                | -7.77         | 36                  |



Channel Frequency: 2402MHz

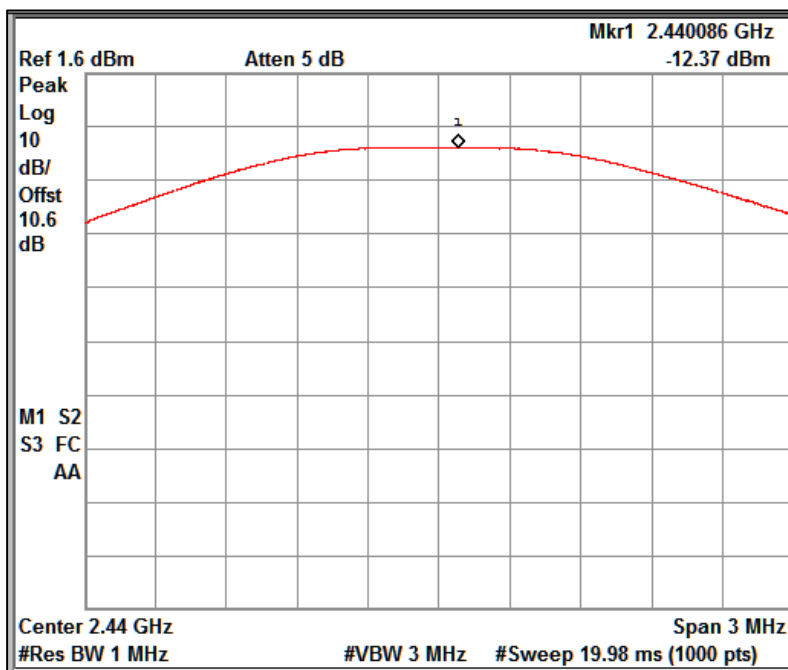
**Prüfbericht - Nr.:**

Test Report No.:

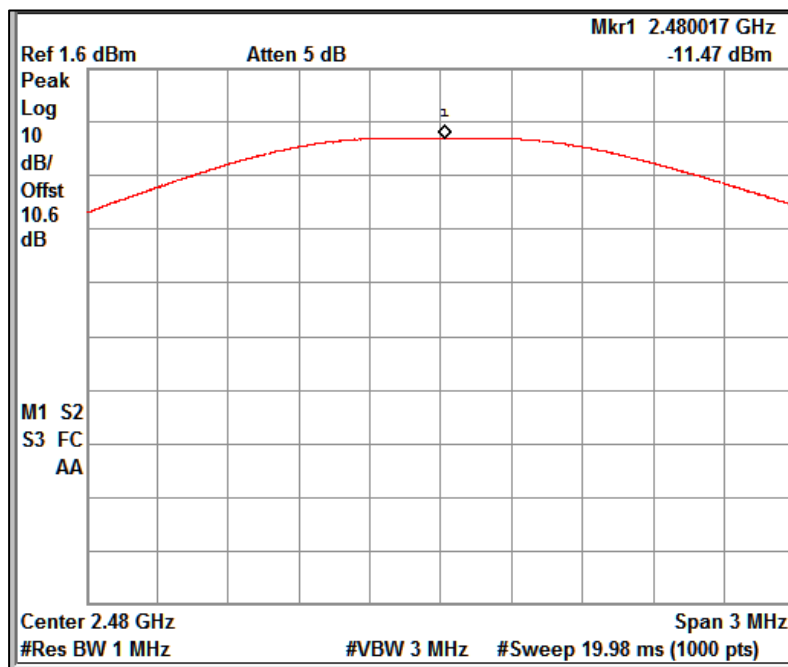
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Channel Frequency: 2440MHz



Channel Frequency: 2480MHz

## 9.2 Spurious Radiated Emissions & Restricted Bands of Operation

### Result

### Pass

|                       |                                                                                            |
|-----------------------|--------------------------------------------------------------------------------------------|
| Test Specification    | FCC part 15 Subpart C 15.247 (d) / (15.209 & 15.205) /<br>IC RSS-GEN, Section 8.9 and 8.10 |
| Test Method           | ANSI C63.10                                                                                |
| Measurement Location  | Semi Anechoic Chamber 30MHz - 1 GHz<br>Fully Anechoic Chamber 1 GHz - 40GHz                |
| Measurement Bandwidth | 100 kHz for frequency range < 1GHz<br>1 MHz for Frequency range >1GHz                      |
| Detector              | Refer remarks below                                                                        |
| Measuring Distance    | 3 m                                                                                        |
| Requirement           | As per the limits mentioned in the below table                                             |
| Test setup            | Refer TEST METHODOLOGY                                                                     |

**Table 8: Transmitter limits for Radiated emission**

| Frequency (MHz) | Field strength (μV/m) | Field strength (dBμV/m) | Distance of Measurement (m) |
|-----------------|-----------------------|-------------------------|-----------------------------|
| 0.009 – 0.490   | 2400/F(kHz)           | 48.50 – 13.80           | 300*                        |
| 0.490 – 1.705   | 24000/F(kHz)          | 33.80 – 23.00           | 30*                         |
| 1.705 -30       | 30                    | 29.54                   | 30*                         |
| 30-88           | 100                   | 40.0                    | 3                           |
| 88-216          | 150                   | 43.5                    | 3                           |
| 216-960         | 200                   | 46.0                    | 3                           |
| Above 960       | 500                   | 54.0                    | 3                           |

Remark: \* The limit shows in the table above of frequency range 0.009 – 0.490, 0.490 – 1.705 MHz and 1.705-30MHz is at 300 meter, 30 meter and 30 meter range respectively, which corresponds to 128.51 – 93.80, 73.80 – 62.96 and 69.54 dBμV/m at 3m range by extrapolation calculation and the measurement of loop antenna.

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz Radiated emission limits in these three bands are based on measurements employing an average detector.

### Test Conditions:

Temperature (Norm) = + 23.5 °C      Voltage = 110VAC, 60Hz supply to adaptor      Relative humidity = 64 %

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## Test results:

Note: All the losses are included during measurement and final values are mentioned in the test report. Refer TEST METHODOLOGY for more details

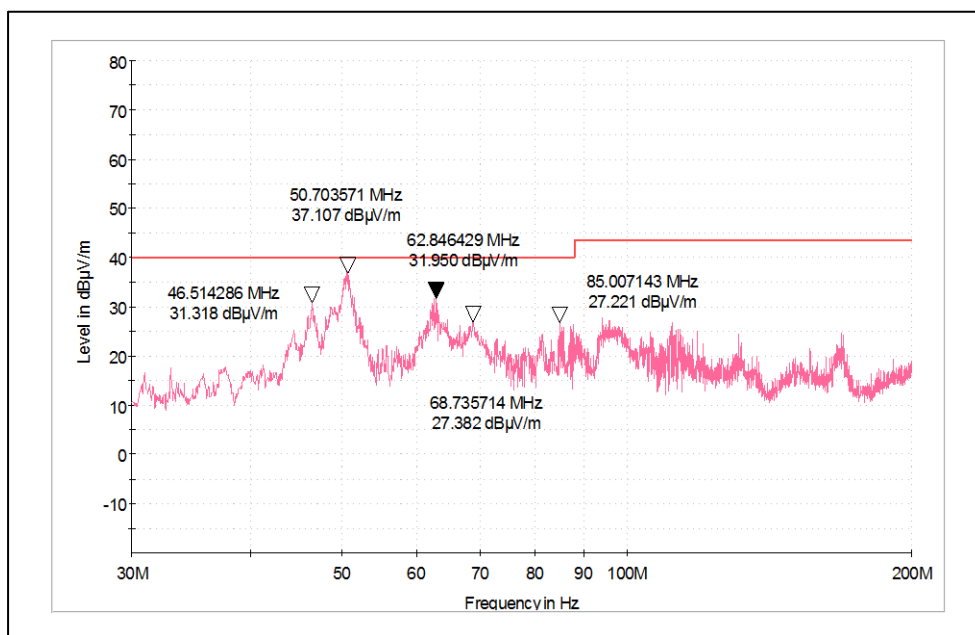
### Test results for frequency range 9kHz – 30MHz

No emissions found in frequency range 9 kHz to 30 MHz, and measured levels are below 20dB from the limit line, hence not reported

### Test results for frequency range 30MHz – 200MHz

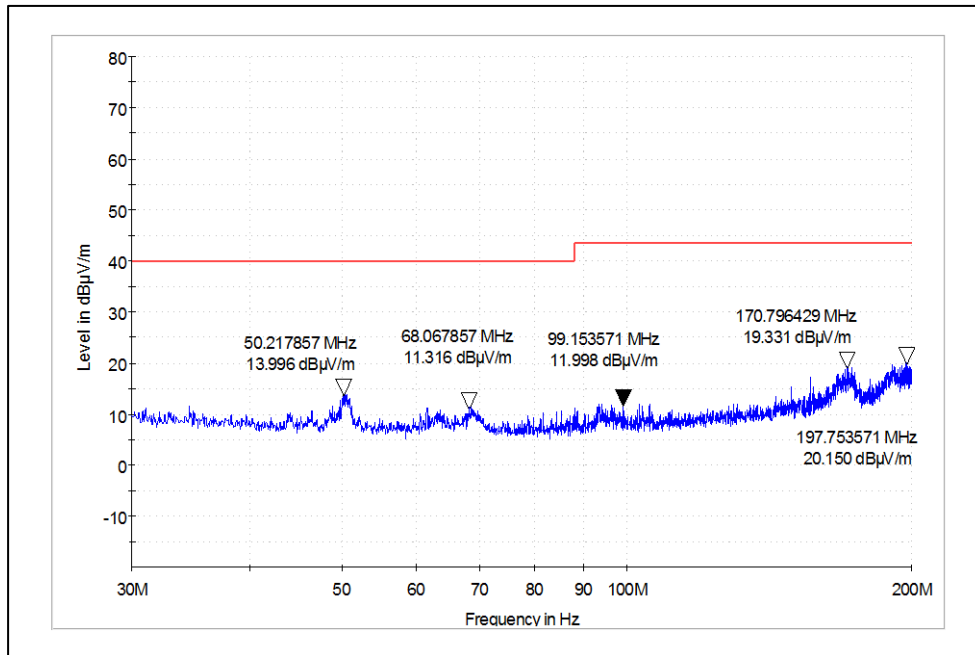
| Antenna Polarization | Measured Frequency (MHz) | Measured Spurious Emission level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
|----------------------|--------------------------|-------------------------------------------------|----------------------|-------------|
| Vertical             | 46.51                    | 31.31(Pk)                                       | 40.00                | -8.69       |
|                      | 50.59                    | 37.24(Qp)                                       | 40.00                | -2.76       |
|                      | 62.84                    | 31.95(Pk)                                       | 40.00                | -8.05       |
|                      | 68.73                    | 27.38(Pk)                                       | 40.00                | -12.62      |
|                      | 85.00                    | 27.22(Pk)                                       | 40.00                | -12.78      |
| Horizontal           | 50.21                    | 13.99(Pk)                                       | 40.00                | -26.01      |
|                      | 68.06                    | 11.31(Pk)                                       | 40.00                | -28.69      |
|                      | 99.15                    | 11.99(Pk)                                       | 43.50                | -31.51      |
|                      | 170.79                   | 19.33(Pk)                                       | 43.50                | -24.17      |

**Note:** (Pk)- Peak detector  
(Qp)- Quasi peak detector



Channel Frequency 30MHz – 200MHz

Polarization Vertical



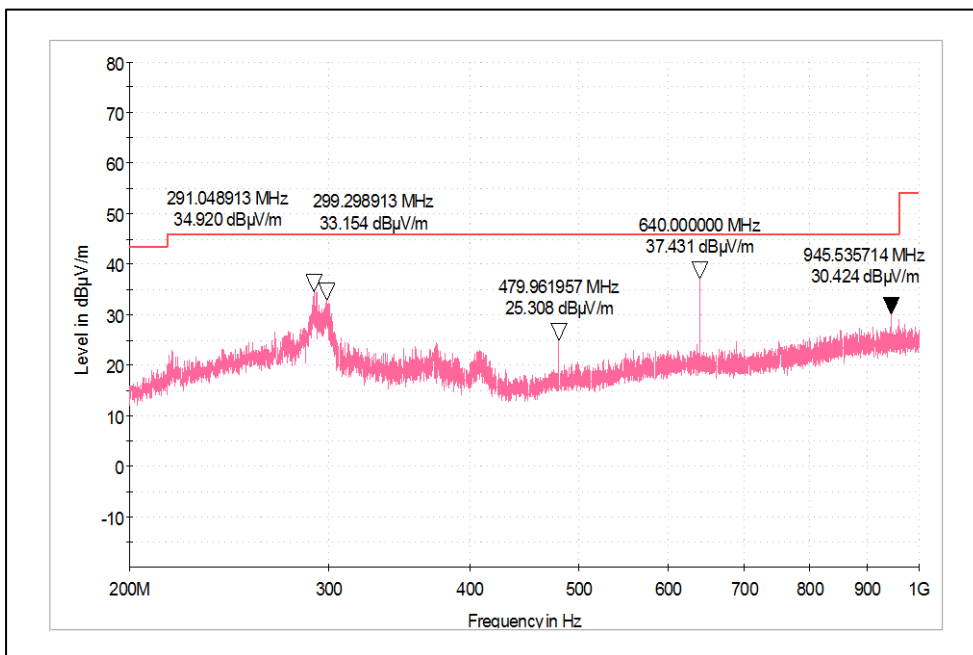
Channel Frequency 30MHz – 200MHz

Polarization Horizontal

**Test results for frequency range 200MHz – 1GHz**

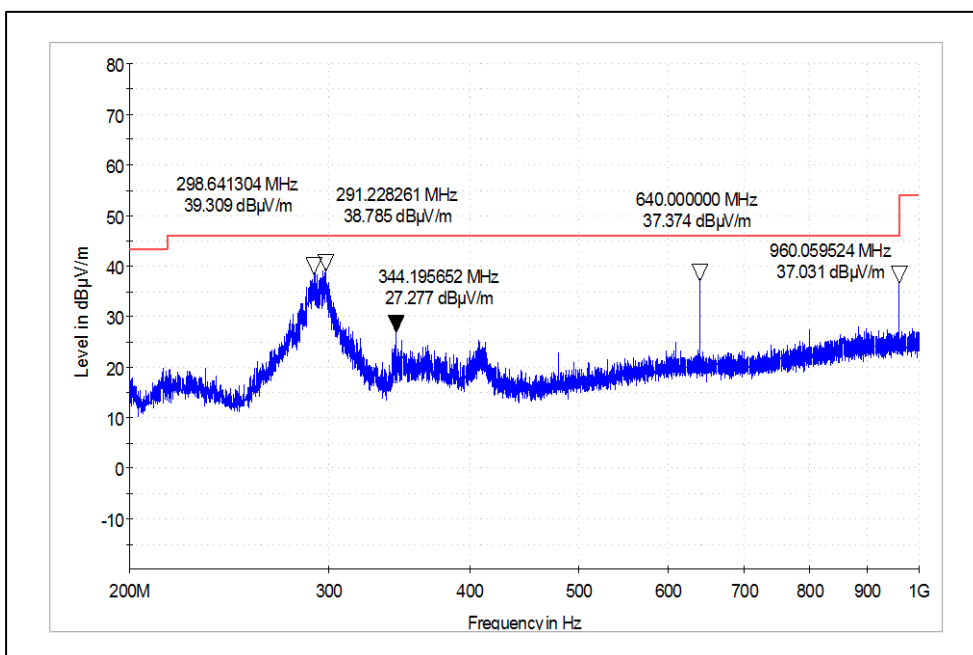
| Antenna Polarization | Measured Frequency (MHz) | Measured Spurious Emission level (dBµV/m) | Limit (dBµV/m) | Margin (dB) |
|----------------------|--------------------------|-------------------------------------------|----------------|-------------|
| Vertical             | 291.04                   | 34.92(Pk)                                 | 46.50          | -11.58      |
|                      | 299.29                   | 33.15(Pk)                                 | 46.50          | -13.35      |
|                      | 479.96                   | 25.30(Pk)                                 | 46.50          | -21.2       |
|                      | 640.00                   | 37.43(Pk)                                 | 46.50          | -9.07       |
|                      | 945.53                   | 30.42(Pk)                                 | 46.50          | -16.08      |
| Horizontal           | 298.64                   | 39.30(Pk)                                 | 46.50          | -7.2        |
|                      | 291.22                   | 38.78(Pk)                                 | 46.50          | -7.72       |
|                      | 344.19                   | 27.27(Pk)                                 | 46.50          | -19.23      |
|                      | 640.00                   | 37.37(Pk)                                 | 46.50          | -9.13       |
|                      | 960.05                   | 37.03(Pk)                                 | 46.50          | -9.47       |

**Note:** (Pk)- Peak detector  
(Qp)- Quasi peak detector



Channel Frequency 200MHz – 1GHz

Polarization Vertical



Channel Frequency 200MHz – 1GHz

Polarization Horizontal

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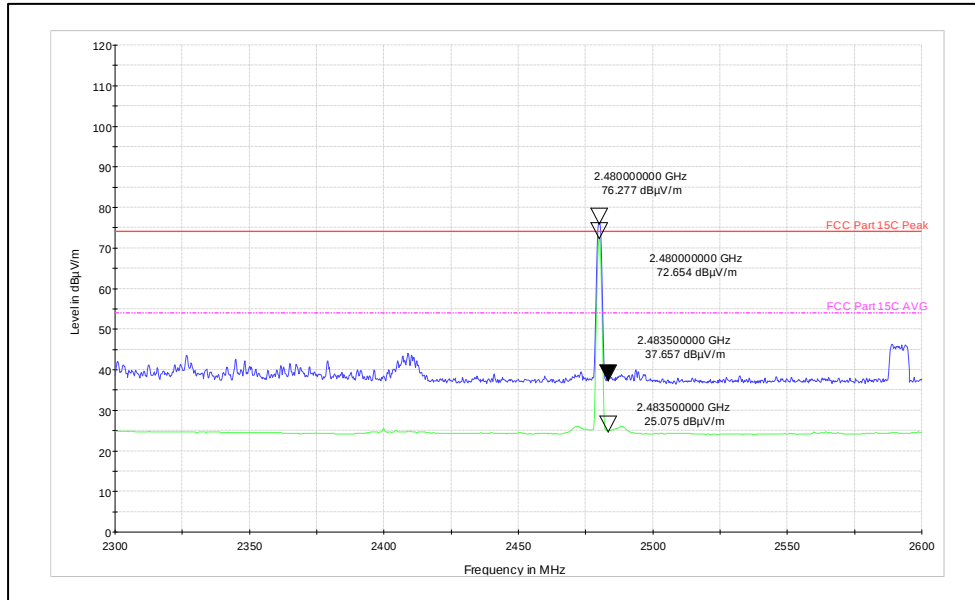
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**Test results for the frequencies above 1GHz**

| Data rate(Mbps) | Channel | Polarization | Frequency (MHz) | Emission level (dBµV/m) | Limit (dBµV/m) | Margin (dB) |
|-----------------|---------|--------------|-----------------|-------------------------|----------------|-------------|
| 1               | Low     | Vertical     | 2390(Pk)        | 38.59                   | 74*            | -35.41      |
|                 |         |              | 2390(Av)        | 24.69                   | 54*            | -29.31      |
|                 |         |              | 2404(Pk)        | 70.54                   | -              | -           |
|                 |         |              | 2404(Av)        | 66.92                   | -              | -           |
|                 |         |              | 4808(Pk)        | 42.03                   | 74             | -31.97      |
|                 |         |              | 4808(Av)        | 29.88                   | 54             | -24.12      |
|                 |         |              | 7212(Pk)        | No Harmonics found      |                |             |
|                 |         |              | 7212(Pk)        |                         |                |             |
|                 |         | Horizontal   | 2390(Pk)        | 36.95                   | 74*            | -37.05      |
|                 |         |              | 2390(Av)        | 24.27                   | 54*            | -29.73      |
|                 |         |              | 2404(Pk)        | 74.95                   | -              | -           |
|                 |         |              | 2404(Av)        | 71.65                   | -              | -           |
|                 |         |              | 4808(Pk)        | 42.16                   | 74             | -31.84      |
|                 |         |              | 4808(Av)        | 29.86                   | 54             | -24.14      |
|                 |         |              | 7212(Pk)        | No Harmonics found      |                |             |
|                 |         |              | 7212(Pk)        |                         |                |             |
|                 | Mid     | Vertical     | 2440(Pk)        | 72.54                   | -              | -           |
|                 |         |              | 2440(Av)        | 69.36                   | -              | -           |
|                 |         |              | 4880(Pk)        | 41.9                    | 74             | -32.1       |
|                 |         |              | 4880(Av)        | 29.8                    | 54             | -24.20      |
|                 |         |              | 7320(Pk)        | No Harmonics found      |                |             |
|                 |         |              | 7320(Pk)        |                         |                |             |
|                 |         | Horizontal   | 2440(Pk)        | 77.81                   | -              | -           |
|                 |         |              | 2440(Av)        | 74.42                   | -              | -           |
|                 |         |              | 4880(Pk)        | 42.33                   | 74             | -31.67      |
|                 |         |              | 4880(Av)        | 29.83                   | 54             | -24.17      |
|                 |         |              | 7320(Pk)        | No Harmonics found      |                |             |
|                 |         |              | 7320(Pk)        |                         |                |             |
|                 | High    | Vertical     | 2480(Pk)        | 76.27                   | -              | -           |
|                 |         |              | 2480(Av)        | 72.65                   | -              | -           |
|                 |         |              | 2483.5(Pk)      | 37.65                   | 74*            | -36.35      |
|                 |         |              | 2483.5(Av)      | 25.07                   | 54*            | -28.93      |
|                 |         |              | 4960(Pk)        | 49.69                   | 74             | -24.31      |
|                 |         |              | 4960(Av)        | 29.58                   | 54             | -24.42      |
|                 |         |              | 7440(Pk)        | No Harmonics found      |                |             |
|                 |         |              | 7440(Pk)        |                         |                |             |
|                 |         | Horizontal   | 2480(Pk)        | 80.58                   | -              | -           |
|                 |         |              | 2480(Av)        | 77.33                   | -              | -           |
|                 |         |              | 2483.5(Pk)      | 38.98                   | 74*            | -35.02      |
|                 |         |              | 2483.5(Av)      | 26.51                   | 54*            | -27.49      |
|                 |         |              | 4960(Pk)        | 41.64                   | 74             | -32.36      |
|                 |         |              | 4960(Av)        | 29.6                    | 54             | -24.40      |
|                 |         |              | 7440(Pk)        | No Harmonics found      |                |             |
|                 |         |              | 7440(Pk)        |                         |                |             |

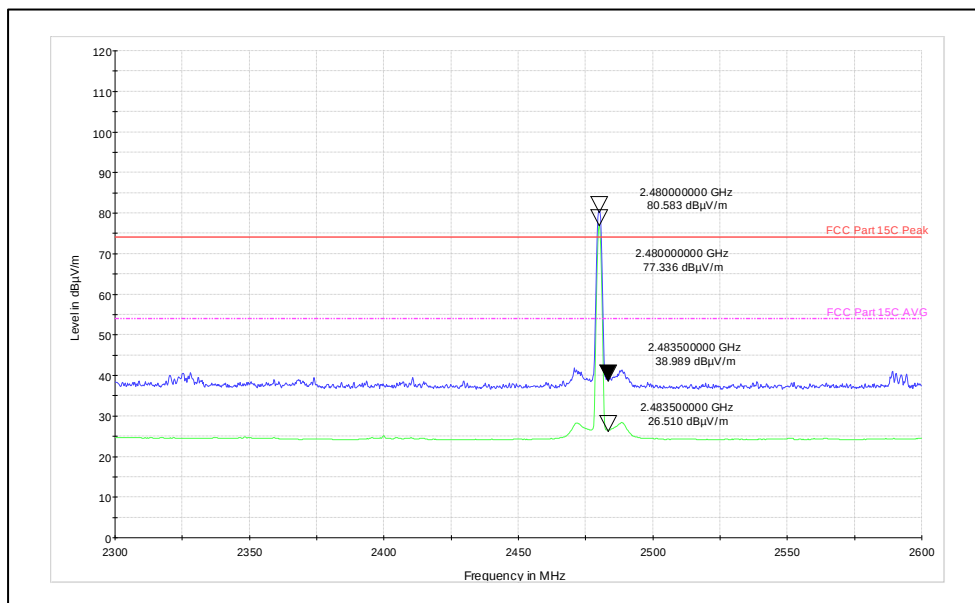
\* : Indicate restricted band of operation §15.205  
Pk: Peak Detector; Av: Average Detector

**Worst case Plots**  
**Channel Frequency 2480MHz**



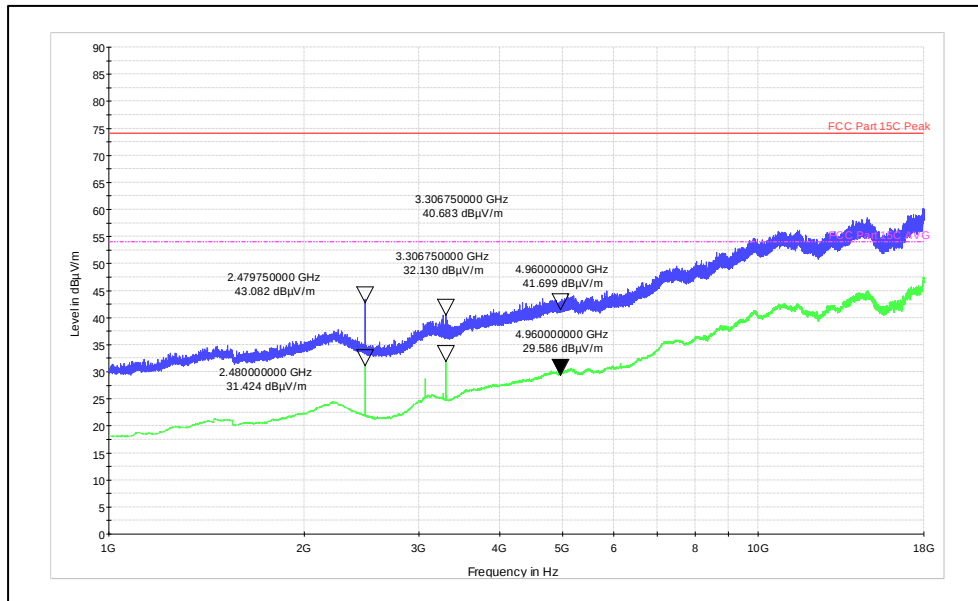
Channel Frequency: 2480MHz

Polarization: Vertical



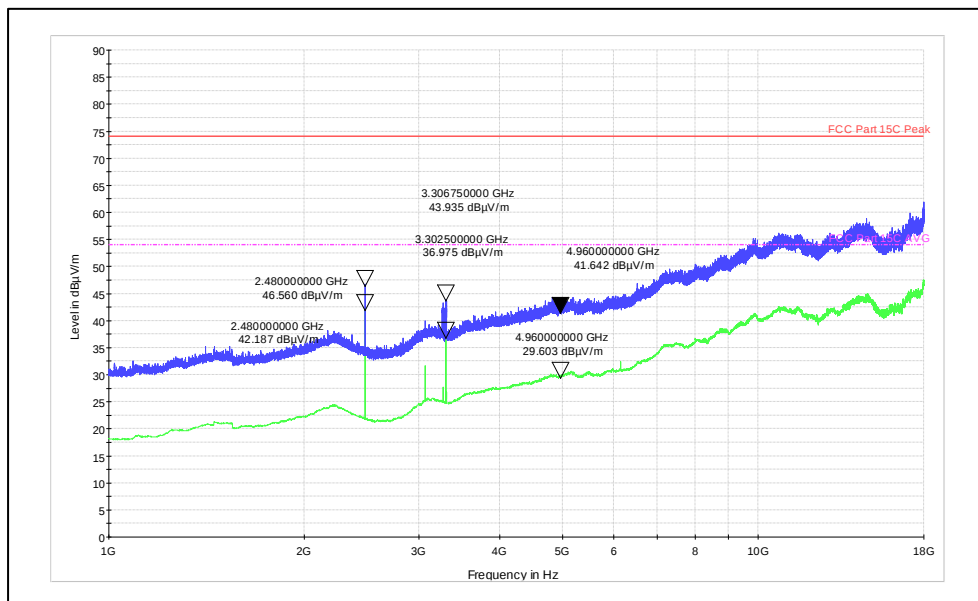
Channel Frequency: 2480MHz

Polarization: Horizontal



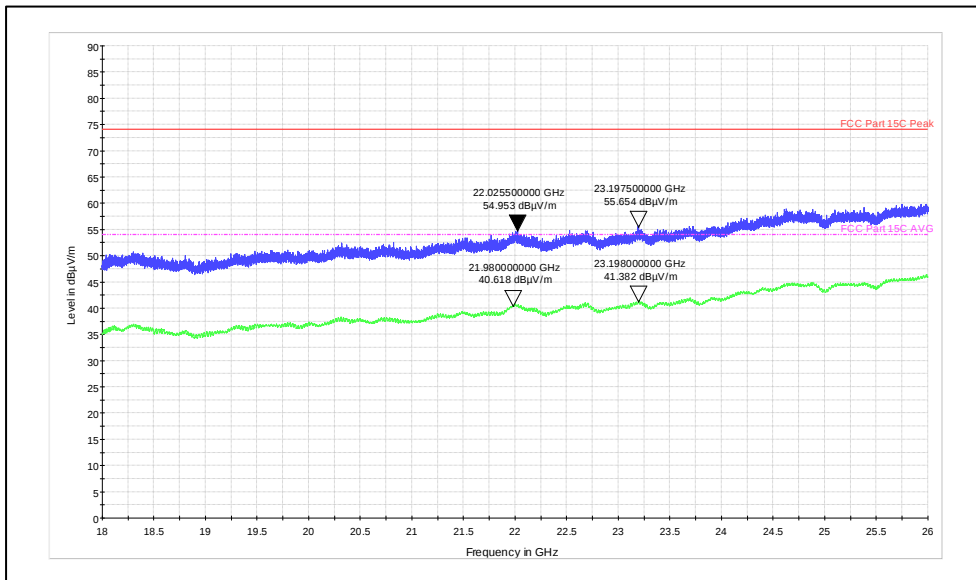
Channel Frequency: 1-18GHz

Polarization: Vertical



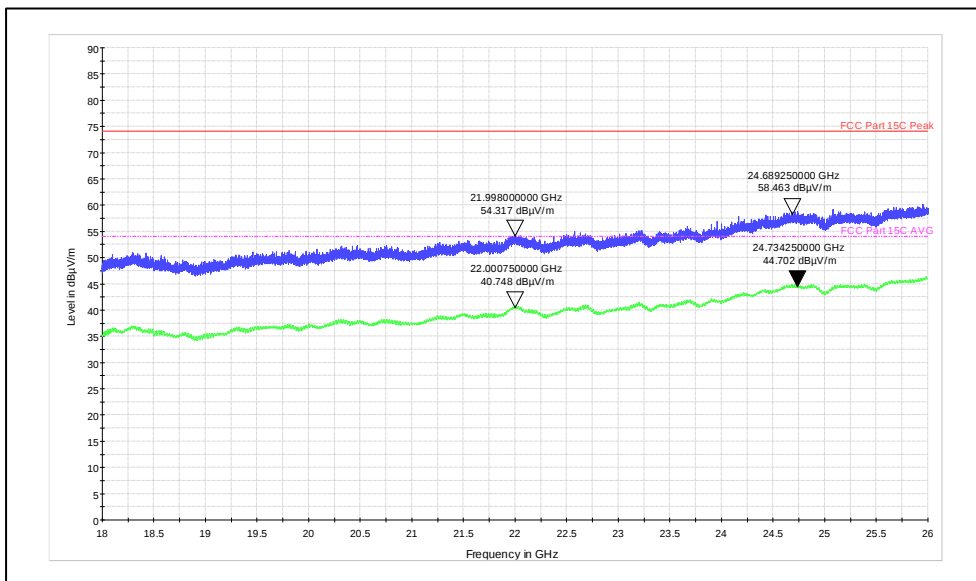
Channel Frequency: 1-18GHz

Polarization: Horizontal



Channel Frequency: 18GHz-26GHz

Polarization: Vertical



Channel Frequency: 18GHz-26GHz

Polarization: Horizontal

**Prüfbericht - Nr.:**  
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## 10 Conducted Spurious Emission Test on AC Power Line

### Result

**Pass**

Test Specification : FCC Part 15 Section 15.207 / RSS Gen Issue 5 Section 8.8  
Test Method : ANSI C 63.10-2013  
Testing Location : Screened room  
Measurement Bandwidth : 9kHz  
Frequency Range : 150kHz – 30MHz  
Supply Voltage : 110VAC,60Hz  
Test Method : Refer TEST METHODOLOGY

### Limits of section 15.207

| Frequency of emission<br>(MHz) | QP Limit<br>(dBμV) | AV Limit<br>(dBμV/m) |
|--------------------------------|--------------------|----------------------|
| 0.15 – 0.5                     | 66 – 56*           | 56 – 46*             |
| 0.5 – 5                        | 56                 | 46                   |
| 5 – 30                         | 60                 | 50                   |

\* Decreases with the logarithm of the frequency

### Test Conditions:

Normal Temperature = +24°C

Voltage (V norm) = 110V AC, 60Hz supply to adaptor

RH = 64 %

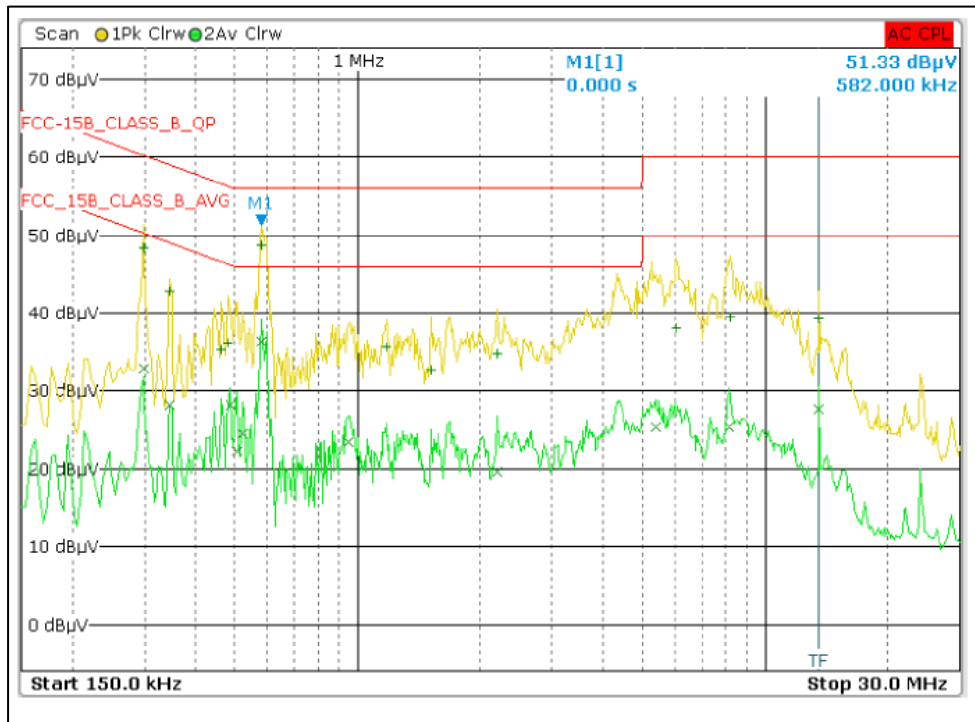
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**Test Results:**

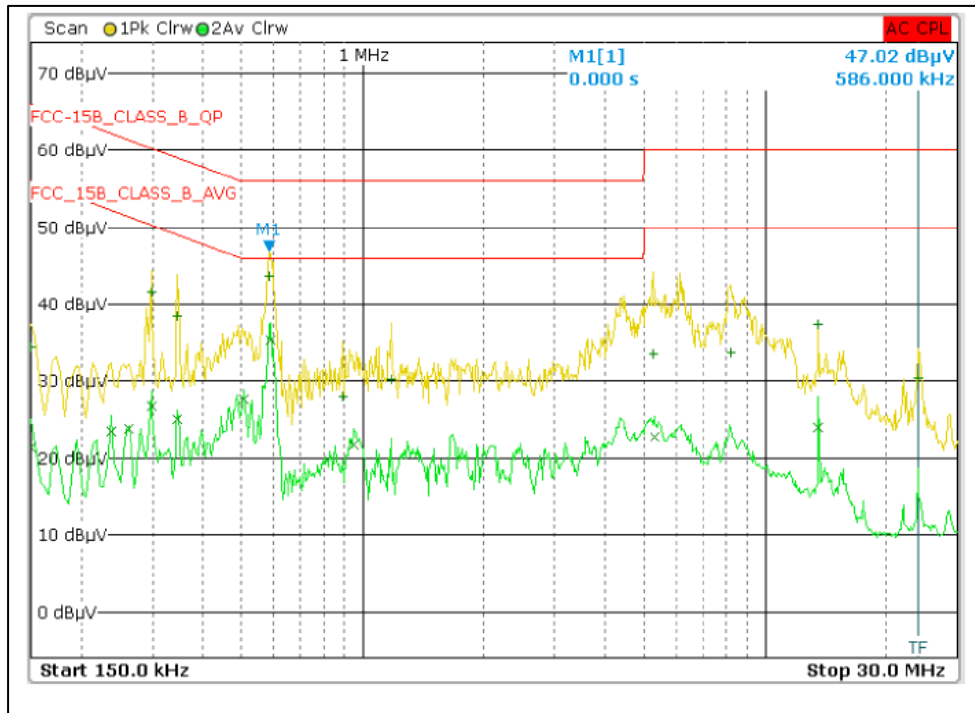
**Power: 110VAC\_60Hz-Line**



Graph:Line

| Trace | Frequency         | Level (dBμV) | Phase | Detector   | Delta Limit/dB |
|-------|-------------------|--------------|-------|------------|----------------|
| 1     | 582.000000000 kHz | 48.80        |       | Quasi Peak | -7.20          |
| 2     | 582.000000000 kHz | 36.37        |       | Average    | -9.63          |
| 1     | 298.000000000 kHz | 48.35        |       | Quasi Peak | -11.95         |
| 1     | 346.000000000 kHz | 42.86        |       | Quasi Peak | -16.20         |
| 2     | 298.000000000 kHz | 32.91        |       | Average    | -17.39         |
| 2     | 486.000000000 kHz | 28.09        |       | Average    | -18.15         |
| 1     | 482.000000000 kHz | 36.23        |       | Quasi Peak | -20.07         |
| 1     | 1.174000000 MHz   | 35.73        |       | Quasi Peak | -20.27         |
| 1     | 8.234000000 MHz   | 39.49        |       | Quasi Peak | -20.51         |
| 1     | 13.558000000 MHz  | 39.24        |       | Quasi Peak | -20.76         |
| 2     | 346.000000000 kHz | 28.19        |       | Average    | -20.87         |
| 1     | 2.206000000 MHz   | 34.70        |       | Quasi Peak | -21.30         |
| 1     | 462.000000000 kHz | 35.33        |       | Quasi Peak | -21.33         |
| 2     | 522.000000000 kHz | 24.47        |       | Average    | -21.53         |
| 1     | 6.054000000 MHz   | 38.10        |       | Quasi Peak | -21.90         |
| 2     | 13.562000000 MHz  | 27.71        |       | Average    | -22.29         |
| 2     | 946.000000000 kHz | 23.37        |       | Average    | -22.63         |
| 1     | 1.518000000 MHz   | 32.66        |       | Quasi Peak | -23.34         |
| 2     | 506.000000000 kHz | 22.23        |       | Average    | -23.77         |
| 2     | 8.174000000 MHz   | 25.43        |       | Average    | -24.57         |
| 2     | 5.378000000 MHz   | 25.29        |       | Average    | -24.71         |
| 2     | 2.206000000 MHz   | 19.61        |       | Average    | -26.39         |

**Power: 110VAC\_60Hz-Nuetral**



**Graph:Nuetral**

| Trace | Frequency         | Level (dBµV) | Phase | Detector   | Delta Limit/dB |
|-------|-------------------|--------------|-------|------------|----------------|
| 2     | 590.000000000 kHz | 35.39        |       | Average    | -10.61         |
| 1     | 586.000000000 kHz | 43.67        |       | Quasi Peak | -12.33         |
| 2     | 506.000000000 kHz | 27.67        |       | Average    | -18.33         |
| 1     | 298.000000000 kHz | 41.61        |       | Quasi Peak | -18.69         |
| 1     | 346.000000000 kHz | 38.37        |       | Quasi Peak | -20.69         |
| 1     | 13.562000000 MHz  | 37.47        |       | Quasi Peak | -22.53         |
| 2     | 298.000000000 kHz | 26.74        |       | Average    | -23.56         |
| 2     | 346.000000000 kHz | 24.95        |       | Average    | -24.11         |
| 2     | 946.000000000 kHz | 21.74        |       | Average    | -24.26         |
| 1     | 1.174000000 MHz   | 30.30        |       | Quasi Peak | -25.70         |
| 2     | 13.562000000 MHz  | 23.91        |       | Average    | -26.09         |
| 1     | 8.218000000 MHz   | 33.77        |       | Quasi Peak | -26.23         |
| 1     | 5.290000000 MHz   | 33.57        |       | Quasi Peak | -26.43         |
| 2     | 5.298000000 MHz   | 22.68        |       | Average    | -27.32         |
| 2     | 262.000000000 kHz | 23.83        |       | Average    | -27.54         |
| 1     | 894.000000000 kHz | 27.95        |       | Quasi Peak | -28.05         |
| 2     | 238.000000000 kHz | 23.52        |       | Average    | -28.65         |
| 1     | 24.038000000 MHz  | 30.45        |       | Quasi Peak | -29.55         |
| 1     | 150.000000000 kHz | 34.49        |       | Quasi Peak | -31.51         |
| 2     | 150.000000000 kHz | 21.41        |       | Average    | -34.59         |

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\*\*\*\*\*END OF TEST REPORT\*\*\*\*\*