# Test Report

Curtis-Straus LLC, *a wholly owned subsidiary of BV CPS*

| | |
|---|---|
| Report No | ES0817-1 |
| Client | Harman International Industries Inc. |
| Address | 30001 Cabot Dr.<br>Novi MI 48377 |
| Phone | 1-248-785-2513 |
| Items tested | NGRadio |
| FCC ID | 2AHPN-BE2842 |
| IC | 6434C-BE2842 |
| Equipment Type | Part 15 Spread Spectrum Transmitter |
| Equipment Code | DSS |
| FCC/IC Rule Parts | CFR Title 47 FCC Part 15.247, ISED Canada RSS-247 Issue 2 |
| Test Dates | 7-30-2018 to 11-29-2018 |
| Results | As detailed within this report |
| Prepared by | Christopher Hamel – Test Engineer |
| Authorized by | Yunus Faziloglu – Sr. Engineer |
| Issue Date | 12/13/2018 |
| Conditions of Issue | This Test Report is issued subject to the conditions stated in the '*Conditions of Testing*' section on page 19 of this report. |

## *Contents*



Report REV Sep-08-2017 - YF

## *Summary*

This test report supports an application for certification of a transmitter operating pursuant to: CFR Title 47 FCC Part 15.247, ISED Canada RSS-247 Issue 2

The product is the “NGRadio”. It is a frequency hopping spread spectrum transmitter that operates in the 2402 – 2480 MHz frequency range.

Antenna Type: Non-detachable PCB trace
Gain: -1.74dBi

We found that the product met the above requirements with the following modifications.
Ferrite “Laird model 28A2025-0A2” was added to display cable on head unit side.
Shielding added to display over certain components to block RF emissions from the switching power supply and the RGB data from the flex connector.

Antenna port conducted tests were completed before these modifications with the exception of 99% OBW.

Test samples were received in good condition.

| Issue No. | Reason for change | Date Issued |
|---|---|---|
| 1 | Original Release | December 13, 2018 |

## *Test Methodology*

All testing was performed according to the following rules/procedures/documents;
CFR Title 47 FCC Part 15.247, ISED Canada RSS-247 Issue 2, ISED Canada RSS-Gen Issue 5 and ANSI C63.10-2013.

Radiated emissions were maximized by rotating the device around 3 orthogonal planes (X, Y and Z) as well as varying the test antenna's height and polarity. EUT antenna is internal and cannot be maximized separately.

EUT operating voltage is 13.8V DC from a vehicle battery only, therefore AC line conducted emissions requirements are not applicable.

The following bandwidths were used during radiated spurious emissions testing.

| Frequency | RBW | VBW |
|---|---|---|
| 30-1000MHz | 120kHz | 1MHz |
| 1-25GHz | 1MHz | 3MHz |

## *Product Tested - Configuration Documentation*

| EUT Configuration | | | |
|---|---|---|---|
| **Work Order:** | S0817 | | |
| **Company:** | Harman International Inc. | | |
| **Company Address:** | 30001 Cabot Dr. | | |
| | Novi MI 48377 | | |
| | | | |
| **Contact:** | Mark Bowman | | |
| | | | |
| | **MN** | **PN** | **SN** |
| **EUT:** | NGRadio | | |
| **EUT Description:** | Automotive Infotainment Unit with Bluetooth | | |
| **EUT Max Frequency:** | 2480 MHz | | |
| **EUT Min Frequency:** | 2480 MHz | | |

| **EUT Components** | **MN** | **SN** |
|---|---|---|
| Head Unit | NGRadio (FCC radiated) | 01 |
| Head unit | NGRadio (FCC Conducted) | 02 |
| Head unit | NGRadio (EU radiated) | 03, 04 |
| Display | NGRadio | 05 |

| **Port Label** | **Port Type** | **# ports** | **# populated** | **cable type** | **shielded** | **ferrites** | **length (m)** | **in/out** | **under test** | **comment** |
|---|---|---|---|---|---|---|---|---|---|---|
| Power Harness | Power DC | 1 | 1 | Power DC | No | No | 1.5 | in | yes | |
| Backup cammera | other | 1 | 1 | other | No | No | 0.1 | in | yes | |
| Vehicle Harness | other | 1 | 1 | other | No | No | 2 | in | yes | |
| AM/FM | other | 1 | 1 | other | No | No | 0.1 | in | yes | |
| XM | other | 1 | 1 | other | No | No | 1 | in | yes | |
| USB | other | 2 | 1 | USB | No | No | 1.3 | in | yes | |
| Display | other | 1 | 1 | other | Yes | Yes | 0.3 | in | yes | Client added ferrite |

**Software Operating Mode Description:**

EUT placed in required Bluetooth test modes via R&S CMW communication tester.

## *Statement of Conformity*

| RSS-GEN | RSP-100 | RSS 247 | Part 15 | Comments |
|---|---|---|---|---|
| 6.4 | | | 15.15(b) | There are no controls accessible to the user that varies the output power to operate in violation of the regulatory requirements. |
| | 3.1 | | 15.19 | The label is shown in the label exhibit. |
| | 3.2 | | 15.21 | Information to the user is shown in the instruction manual exhibit. |
| | | | 15.27 | See modifications section on Page 3. |
| 3.2 | | | 15.31 | The EUT was tested in accordance with the measurement standards in this section. |
| 6.13.2 | | | 15.33 | Frequency range was investigated according to this section, unless noted in specific rule section under which the equipment operates. |
| 6.13.1 | | | 15.35 | The EUT emissions were measured using the measurement detector and bandwidth specified in this section, unless noted in specific rule section under which the equipment operates. |
| 6.8 | | | 15.203 | EUT employs a non-detachable internal PCB trace antenna with -1.74dBi gain. |
| 8.10 | | | 15.205<br>15.209 | The fundamental is not in a Restricted band and the spurious and harmonic emissions in the Restricted bands comply with the general emission limits of 15.209 or RSS-Gen as applicable |
| 8.8 | | | 15.207 | N/A. EUT is vehicle battery powered only. |

Refer to Appendix A of this report for antenna port conducted measurements.

# *Test Results*

## Radiated Spurious Emissions

### LIMITS

*Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).*
[15.247(d)]

Radiated emissions were maximized by rotating the device around 3 orthogonal planes (X, Y and Z) and worst case emissions observed in X "installed" orientation. All the results below are for the worst case orientation only.

### MEASUREMENTS / RESULTS

Worst case packet type was found to be DH1

3 Channels were tested: Low (0), Mid (39) and High (78)

| | |
|---|---|
| Curtis Straus - a Bureau Veritas Company | Work Order - S0817 |
| Radiated Emissions Electric Field 3m Distance | EUT Power Input - 13.8V DC |
| Top Peaks Horizontal 30-1000MHz | Test Site - CH1 |
| Operator: CCH | Conditions - 21.4°C; 35%RH; 1008mBar |
| | Witnessed by - N/A |
| Notes: | EUT Maximum Frequency - 2480MHz |
| New Display 0.3m cable Client supplied ferrite BT Low channel TX DH1 | |
| Data Taken at 11/15/2018 | |

| Frequency (MHz) | Peak Reading (dBµV) | Correction Factor (dB/m) | Adjusted Peak Amplitude (dBµV/m) | Lim2: FCC_pt15_209 (dBµV/m) | Lim2 Margin (dB) | Lim2 Test Results (Pass/Fail) | Worst Margin Lim2 (dB) |
|---|---|---|---|---|---|---|---|
| 289.548 | 49.6 | -15.3 | 34.3 | 46 | -11.7 | PASS | |
| 301.042 | 50.3 | -15.1 | 35.2 | 46 | -10.8 | PASS | |
| 313.701 | 45.6 | -14.7 | 30.9 | 46 | -15.1 | PASS | |
| 415.623 | 43.1 | -12 | 31.2 | 46 | -14.8 | PASS | |
| 424.232 | 42.8 | -11.5 | 31.3 | 46 | -14.7 | PASS | |
| 594.031 | 46 | -8.4 | 37.7 | 46 | -8.3 | PASS | -8.3 |

Curtis Straus - a Bureau Veritas Company
Radiated Emissions Electric Field 3m Distance
Top Peaks Vertical 30-1000MHz
Operator: CCH

Work Order - S0817
EUT Power Input - 13.8V DC
Test Site - CH1
Conditions - 21.4°C; 35%RH; 1008mBar
Witnessed by - N/A
EUT Maximum Frequency - 2480MHz

Notes:
New Display 0.3m cable Client supplied ferrite BT Low channel TX DH1

Data Taken at 11/15/2018

| Frequency (MHz) | Peak Reading (dBµV) | Correction Factor (dB/m) | Adjusted Peak Amplitude (dBµV/m) | Lim2: FCC_pt15_209 (dBµV/m) | Lim2 Margin (dB) | Lim2 Test Results (Pass/Fail) | Worst Margin Lim2 (dB) |
|---|---|---|---|---|---|---|---|
| 30.121 | 36.1 | -7.9 | 28.2 | 40 | -11.8 | PASS | |
| 36.79 | 39.9 | -13.1 | 26.7 | 40 | -13.3 | PASS | |
| 38.487 | 42 | -15.2 | 26.8 | 40 | -13.2 | PASS | |
| 415.575 | 47.2 | -12 | 35.2 | 46 | -10.8 | PASS | -10.8 |
| 424.159 | 45.6 | -11.5 | 34 | 46 | -12 | PASS | |
| 593.934 | 42.3 | -8.4 | 34 | 46 | -12 | PASS | |

30-1000MHz CH0

Curtis Straus - a Bureau Veritas Company
Radiated Emissions Electric Field 3m Distance
Top Peaks Horizontal 30-1000MHz
Operator: CCH

Work Order - S0817
EUT Power Input - 13.8V DC
Test Site - CH1
Conditions - 21.4°C; 35%RH; 1008mBar
Witnessed by - N/A
EUT Maximum Frequency - 2480MHz

Notes:
New Display 0.3m cable Client supplied ferrite BT mid channel TX DH1

Data Taken at 11/15/2018

| Frequency (MHz) | Peak Reading (dBµV) | Correction Factor (dB/m) | Adjusted Peak Amplitude (dBµV/m) | Lim2: FCC_pt15_209 (dBµV/m) | Lim2 Margin (dB) | Lim2 Test Results (Pass/Fail) | Worst Margin Lim2 (dB) |
|---|---|---|---|---|---|---|---|
| 262.291 | 49 | -16.1 | 32.9 | 46 | -13.1 | PASS | |
| 304.971 | 51.8 | -14.9 | 36.9 | 46 | -9.1 | PASS | |
| 416.036 | 42.1 | -11.9 | 30.2 | 46 | -15.8 | PASS | |
| 422.971 | 41.5 | -11.6 | 29.9 | 46 | -16.1 | PASS | |
| 424.135 | 42.4 | -11.5 | 30.8 | 46 | -15.2 | PASS | |
| 594.006 | 45.5 | -8.4 | 37.1 | 46 | -8.9 | PASS | -8.9 |

Curtis Straus - a Bureau Veritas Company
Radiated Emissions Electric Field 3m Distance
Top Peaks Vertical 30-1000MHz
Operator: CCH

Work Order - S0817
EUT Power Input - 13.8V DC
Test Site - CH1
Conditions - 21.4°C; 35%RH; 1008mBar
Witnessed by - N/A
EUT Maximum Frequency - 2480MHz

Notes:
New Display 0.3m cable Client supplied ferrite BT mid channel TX DH1

Data Taken at 11/15/2018

| Frequency (MHz) | Peak Reading (dBµV) | Correction Factor (dB/m) | Adjusted Peak Amplitude (dBµV/m) | Lim2: FCC_pt15_209 (dBµV/m) | Lim2 Margin (dB) | Lim2 Test Results (Pass/Fail) | Worst Margin Lim2 (dB) |
|---|---|---|---|---|---|---|---|
| 32.134 | 37 | -10.2 | 26.8 | 40 | -13.2 | PASS | |
| 37.032 | 42.3 | -13.1 | 29.2 | 40 | -10.8 | PASS | -10.8 |
| 141.308 | 45.3 | -15.8 | 29.5 | 43.5 | -14 | PASS | |
| 415.526 | 47.1 | -12 | 35.2 | 46 | -10.8 | PASS | |
| 424.184 | 45.6 | -11.5 | 34 | 46 | -12 | PASS | |
| 593.982 | 42.5 | -8.4 | 34.2 | 46 | -11.8 | PASS | |

30-1000MHz CH39

Curtis Straus - a Bureau Veritas Company
Radiated Emissions Electric Field 3m Distance
Top Peaks Horizontal 30-1000MHz
Operator: CCH

Work Order - S0817
EUT Power Input - 13.8V DC
Test Site - CH1
Conditions - 21.4°C; 35%RH; 1008mBar
Witnessed by - N/A
EUT Maximum Frequency - 2480MHz

Notes:
New Display 0.3m cable Client supplied ferrite BT high channel TX DH1

Data Taken at 11/15/2018

| Frequency (MHz) | Peak Reading (dBµV) | Correction Factor (dB/m) | Adjusted Peak Amplitude (dBµV/m) | Lim2: FCC_pt15_209 (dBµV/m) | Lim2 Margin (dB) | Lim2 Test Results (Pass/Fail) | Worst Margin Lim2 (dB) |
|---|---|---|---|---|---|---|---|
| 260.448 | 49.7 | -16.4 | 33.3 | 46 | -12.7 | PASS | |
| 290.275 | 52.3 | -15.3 | 37.1 | 46 | -8.9 | PASS | |
| 303.419 | 53 | -15 | 38 | 46 | -8 | PASS | -8 |
| 306.086 | 52.2 | -14.9 | 37.3 | 46 | -8.7 | PASS | |
| 424.208 | 43.7 | -11.5 | 32.2 | 46 | -13.8 | PASS | |
| 594.006 | 46.1 | -8.4 | 37.7 | 46 | -8.3 | PASS | |

Curtis Straus - a Bureau Veritas Company
Radiated Emissions Electric Field 3m Distance
Top Peaks Vertical 30-1000MHz
Operator: CCH

Work Order - S0817
EUT Power Input - 13.8V DC
Test Site - CH1
Conditions - 21.4°C; 35%RH; 1008mBar
Witnessed by - N/A
EUT Maximum Frequency - 2480MHz

Notes:
New Display 0.3m cable Client supplied ferrite BT high channel TX DH1

Data Taken at 11/15/2018

| Frequency (MHz) | Peak Reading (dBµV) | Correction Factor (dB/m) | Adjusted Peak Amplitude (dBµV/m) | Lim2: FCC_pt15_209 (dBµV/m) | Lim2 Margin (dB) | Lim2 Test Results (Pass/Fail) | Worst Margin Lim2 (dB) |
|---|---|---|---|---|---|---|---|
| 30.267 | 34.7 | -8.1 | 26.6 | 40 | -13.4 | PASS | |
| 36.547 | 41 | -13.2 | 27.8 | 40 | -12.2 | PASS | |
| 38.318 | 41.8 | -15.2 | 26.6 | 40 | -13.4 | PASS | |
| 415.648 | 47.4 | -12 | 35.4 | 46 | -10.6 | PASS | -10.6 |
| 424.159 | 45.5 | -11.5 | 34 | 46 | -12 | PASS | |
| 593.861 | 42.9 | -8.4 | 34.5 | 46 | -11.5 | PASS | |

30-1000MHz CH78

Curtis Straus - a Bureau Veritas Company
Radiated Emissions Electric Field 3m Distance
1-6GHz Horizontal Data
Operator: CCH

Work Order - S0817
EUT Power Input - 13.8V DC
Test Site - CH 1
Conditions - 21.4°C; 35%RH; 1008mBar
Witnessed by - N/A
EUT Maximum Frequency - 2480MHz

Notes:
New Display 0.3m cable Client supplied ferrite BT low channel TX DH1

Data Taken at 11/15/2018

| Frequency (MHz) | Raw Peak Reading (dBµV) | Raw Avg Reading (dBµV) | Correction Factor (dB/m) | Adjusted Peak Amplitude (dBµV/m) | Pk Lim: FCC_pt15_209_Peak (dBµV/m) | Peak Margin (dB) | Peak Results (Pass/Fail) | Worst Peak Margin (dB) | Adjusted Avg Amplitude (dBµV/m) | Av Lim: FCC_pt15_209_Average (dBµV/m) | Avg Margin (dB) | Avg Results (Pass/Fail) | Worst Average Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1349.1 | 40.5 | 32.6 | -3.3 | 37.1 | 74 | -36.9 | PASS | | 29.2 | 54 | -24.8 | PASS | |
| 2181.5 | 41.2 | 32.7 | 1.3 | 42.6 | 74 | -31.4 | PASS | | 34 | 54 | -20 | PASS | |
| 5836.9 | 41.3 | 31.4 | 5.4 | 46.7 | 74 | -27.3 | PASS | -27.3 | 36.8 | 54 | -17.2 | PASS | -17.2 |

Curtis Straus - a Bureau Veritas Company
Radiated Emissions Electric Field 3m Distance
1-6GHz Vertical Data
Operator: CCH

Work Order - S0817
EUT Power Input - 13.8V DC
Test Site - CH 1
Conditions - 21.4°C; 35%RH; 1008mBar
Witnessed by - N/A
EUT Maximum Frequency - 2480MHz

Notes:
New Display 0.3m cable Client supplied ferrite BT low channel TX DH1

Data Taken at 11/15/2018

| Frequency (MHz) | Raw Peak Reading (dBµV) | Raw Avg Reading (dBµV) | Correction Factor (dB/m) | Adjusted Peak Amplitude (dBµV/m) | Pk Lim: FCC_pt15_209_Peak (dBµV/m) | Peak Margin (dB) | Peak Results (Pass/Fail) | Worst Peak Margin (dB) | Adjusted Avg Amplitude (dBµV/m) | Av Lim: FCC_pt15_209_Average (dBµV/m) | Avg Margin (dB) | Avg Results (Pass/Fail) | Worst Avg Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2146.4 | 42.1 | 32.7 | 1 | 43.1 | 74 | -30.9 | PASS | | 33.7 | 54 | -20.3 | PASS | |
| 3178.8 | 42.9 | 32.9 | 2.2 | 45.1 | 74 | -28.9 | PASS | -28.9 | 35.1 | 54 | -18.9 | PASS | |
| 5270.8 | 40 | 31.4 | 4.5 | 44.5 | 74 | -29.5 | PASS | | 35.9 | 54 | -18.1 | PASS | -18.1 |

## 1-6GHz CH0

Curtis Straus - a Bureau Veritas Company
Radiated Emissions Electric Field 3m Distance
1-6GHz Horizontal Data
Operator: CCH

Work Order - S0817
EUT Power Input - 13.8V DC
Test Site - CH 1
Conditions - 21.4°C; 35%RH; 1008mBar
Witnessed by - N/A
EUT Maximum Frequency - 2480MHz

Notes:
New Display 0.3m cable Client supplied ferrite BT mid channel TX DH1

Data Taken at 11/15/2018

| Frequency (MHz) | Raw Peak Reading (dBµV) | Raw Avg Reading (dBµV) | Correction Factor (dB/m) | Adjusted Peak Amplitude (dBµV/m) | Pk Lim: FCC_pt15_209_Peak (dBµV/m) | Peak Margin (dB) | Peak Results (Pass/Fail) | Worst Peak Margin (dB) | Adjusted Avg Amplitude (dBµV/m) | Av Lim: FCC_pt15_209_Average (dBµV/m) | Avg Margin (dB) | Avg Results (Pass/Fail) | Worst Average Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2172.9 | 41.8 | 32.7 | 1.3 | 43 | 74 | -31 | PASS | | 33.9 | 54 | -20.1 | PASS | |
| 4746.4 | 40.5 | 32 | 3.1 | 43.6 | 74 | -30.4 | PASS | | 35.2 | 54 | -18.8 | PASS | |
| 5258.3 | 39.9 | 31.5 | 4.5 | 44.4 | 74 | -29.6 | PASS | | 36 | 54 | -18 | PASS | |
| 5810.2 | 41 | 31.4 | 5.5 | 46.5 | 74 | -27.5 | PASS | -27.5 | 36.9 | 54 | -17.1 | PASS | -17.1 |

Curtis Straus - a Bureau Veritas Company
Radiated Emissions Electric Field 3m Distance
1-6GHz Vertical Data
Operator: CCH
Notes:
New Display 0.3m cable Client supplied ferrite BT mid channel TX DH1

Work Order - S0817
EUT Power Input - 13.8V DC
Test Site - CH 1
Conditions - 21.4°C; 35%RH; 1008mBar
Witnessed by - N/A
EUT Maximum Frequency - 2480MHz

Data Taken at 11/15/2018

| Frequency (MHz) | Raw Peak Reading (dBµV) | Raw Avg Reading (dBµV) | Correction Factor (dB/m) | Adjusted Peak Amplitude (dBµV/m) | Pk Lim: FCC_pt15_209_Peak (dBµV/m) | Peak Margin (dB) | Peak Results (Pass/Fail) | Worst Peak Margin (dB) | Adjusted Avg Amplitude (dBµV/m) | Av Lim: FCC_pt15_209_Average (dBµV/m) | Avg Margin (dB) | Avg Results (Pass/Fail) | Worst Avg Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1388.8 | 41.9 | 32.4 | -3.2 | 38.7 | 74 | -35.3 | PASS | | 29.2 | 54 | -24.8 | PASS | |
| 2147 | 43.2 | 32.7 | 1 | 44.2 | 74 | -29.8 | PASS | | 33.7 | 54 | -20.3 | PASS | |
| 4610.7 | 41.1 | 32.7 | 3.4 | 44.5 | 74 | -29.5 | PASS | | 36.1 | 54 | -17.9 | PASS | -17.9 |
| 5261.8 | 40.7 | 31.5 | 4.5 | 45.2 | 74 | -28.8 | PASS | -28.8 | 36 | 54 | -18 | PASS | |

1-6GHz CH39

Curtis Straus - a Bureau Veritas Company
Radiated Emissions Electric Field 3m Distance
1-6GHz Horizontal Data
Operator: CCH
Notes:
New Display 0.3m cable Client supplied ferrite BT high channel TX DH1

Work Order - S0817
EUT Power Input - 13.8V DC
Test Site - CH 1
Conditions - 21.4°C; 35%RH; 1008mBar
Witnessed by - N/A
EUT Maximum Frequency - 2480MHz

Data Taken at 11/15/2018

| Frequency (MHz) | Raw Peak Reading (dBµV) | Raw Avg Reading (dBµV) | Correction Factor (dB/m) | Adjusted Peak Amplitude (dBµV/m) | Pk Lim: FCC_pt15_209_Peak (dBµV/m) | Peak Margin (dB) | Peak Results (Pass/Fail) | Worst Peak Margin (dB) | Adjusted Avg Amplitude (dBµV/m) | Av Lim: FCC_pt15_209_Average (dBµV/m) | Avg Margin (dB) | Avg Results (Pass/Fail) | Worst Average Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2150.7 | 43.8 | 32.7 | 1.1 | 44.9 | 74 | -29.1 | PASS | | 33.8 | 54 | -20.2 | PASS | |
| 3149.2 | 41.5 | 32.9 | 2.1 | 43.6 | 74 | -30.4 | PASS | | 35 | 54 | -19 | PASS | |
| 5260.5 | 41 | 31.4 | 4.5 | 45.5 | 74 | -28.5 | PASS | | 35.9 | 54 | -18.1 | PASS | |
| 5276.2 | 39.5 | 31.4 | 4.5 | 44 | 74 | -30 | PASS | | 36 | 54 | -18 | PASS | |
| 5822.5 | 42.5 | 31.4 | 5.4 | 48 | 74 | -26 | PASS | -26 | 36.8 | 54 | -17.2 | PASS | -17.2 |

Curtis Straus - a Bureau Veritas Company
Radiated Emissions Electric Field 3m Distance
1-6GHz Vertical Data
Operator: CCH
Notes:
New Display 0.3m cable Client supplied ferrite BT high channel TX DH1

Work Order - S0817
EUT Power Input - 13.8V DC
Test Site - CH 1
Conditions - 21.4°C; 35%RH; 1008mBar
Witnessed by - N/A
EUT Maximum Frequency - 2480MHz

Data Taken at 11/15/2018

| Frequency (MHz) | Raw Peak Reading (dBµV) | Raw Avg Reading (dBµV) | Correction Factor (dB/m) | Adjusted Peak Amplitude (dBµV/m) | Pk Lim: FCC_pt15_209_Peak (dBµV/m) | Peak Margin (dB) | Peak Results (Pass/Fail) | Worst Peak Margin (dB) | Adjusted Avg Amplitude (dBµV/m) | Av Lim: FCC_pt15_209_Average (dBµV/m) | Avg Margin (dB) | Avg Results (Pass/Fail) | Worst Avg Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1303.2 | 40.6 | 32.2 | -3.1 | 37.5 | 74 | -36.5 | PASS | | 29.1 | 54 | -24.9 | PASS | |
| 2130.6 | 40.9 | 32.6 | 0.9 | 41.8 | 74 | -32.2 | PASS | | 33.5 | 54 | -20.5 | PASS | |
| 5265.3 | 39.5 | 31.5 | 4.5 | 44 | 74 | -30 | PASS | | 36 | 54 | -18 | PASS | |
| 5983.8 | 40.8 | 31.6 | 5.2 | 46 | 74 | -28 | PASS | -28 | 36.8 | 54 | -17.2 | PASS | -17.2 |

1-6GHz CH78

Curtis Straus - a Bureau Veritas Company
Radiated Emissions Electric Field 1m Distance
6-18GHz Horizontal Data
Operator: CCH

Work Order - S0817
EUT Power Input - 13.8V DC
Test Site - CH 1
Conditions - 21.4°C; 35%RH; 1008mBar
Witnessed by - N/A
EUT Maximum Frequency - 2480MHz

Notes:
New Display 0.3m cable Client supplied ferrite BT low channel TX DH1

Data Taken at 11/15/2018

| Frequency (MHz) | Raw Peak Reading (dBµV) | Raw Avg Reading (dBµV) | Correction Factor (dB/m) | Adjusted Peak Amplitude (dBµV/m) | Pk Lim: FCC_pt15_209_Peak (dBµV/m) | Peak Margin (dB) | Peak Test Results (Pass/Fail) | Worst Peak Margin (dB) | Adjusted Avg Amplitude (dBµV/m) | Av Lim: FCC_pt15_209_Average (dBµV/m) | Avg Margin (dB) | Avg Test Results (Pass/Fail) | Worst Avg Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15260.4 | 41.8 | 33.7 | 15.2 | 57 | 83.5 | -26.5 | PASS | | 48.9 | 63.5 | -14.6 | PASS | |
| 15871.8 | 43.2 | 33.8 | 16.3 | 59.5 | 83.5 | -24 | PASS | | 50.1 | 63.5 | -13.4 | PASS | |
| 16496.2 | 42.8 | 33.7 | 17.3 | 60.1 | 83.5 | -23.4 | PASS | | 51 | 63.5 | -12.5 | PASS | |
| 17083 | 42.2 | 33.3 | 17.9 | 60 | 83.5 | -23.5 | PASS | | 51.1 | 63.5 | -12.4 | PASS | |
| 17838.2 | 41.6 | 32 | 19.8 | 61.3 | 83.5 | -22.2 | PASS | -22.2 | 51.7 | 63.5 | -11.8 | PASS | -11.8 |

Curtis Straus - a Bureau Veritas Company
Radiated Emissions Electric Field 1m Distance
6-18GHz Vertical Data
Operator: CCH

Work Order - S0817
EUT Power Input - 13.8V DC
Test Site - CH 1
Conditions - 21.4°C; 35%RH; 1008mBar
Witnessed by - N/A
EUT Maximum Frequency - 2480MHz

Notes:
New Display 0.3m cable Client supplied ferrite BT low channel TX DH1

Data Taken at 11/15/2018

| Frequency (MHz) | Raw Peak Reading (dBµV) | Raw Avg Reading (dBµV) | Correction Factor (dB/m) | Adjusted Peak Amplitude (dBµV/m) | Pk Lim: FCC_pt15_209_Peak (dBµV/m) | Peak Margin (dB) | Peak Results (Pass/Fail) | Worst Peak Margin (dB) | Adjusted Avg Amplitude (dBµV/m) | Av Lim: FCC_pt15_209_Average (dBµV/m) | Avg Margin (dB) | Avg Results (Pass/Fail) | Worst Avg Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15273 | 42 | 33.6 | 15.3 | 57.3 | 83.5 | -26.2 | PASS | | 48.9 | 63.5 | -14.6 | PASS | |
| 15856.5 | 42.4 | 33.6 | 16.3 | 58.8 | 83.5 | -24.7 | PASS | | 50 | 63.5 | -13.5 | PASS | |
| 16484.4 | 43.5 | 33.5 | 17.3 | 60.8 | 83.5 | -22.7 | PASS | -22.7 | 50.9 | 63.5 | -12.6 | PASS | |
| 17103.6 | 42.5 | 33.3 | 17.9 | 60.3 | 83.5 | -23.2 | PASS | | 51.2 | 63.5 | -12.3 | PASS | |
| 17753.8 | 41.7 | 33.1 | 19 | 60.8 | 83.5 | -22.7 | PASS | | 52.2 | 63.5 | -11.3 | PASS | -11.3 |

## 6-18GHz CH0

Curtis Straus - a Bureau Veritas Company
Radiated Emissions Electric Field 1m Distance
6-18GHz Horizontal Data
Operator: CCH

Work Order - S0817
EUT Power Input - 13.8V DC
Test Site - CH 1
Conditions - 21.4°C; 35%RH; 1008mBar
Witnessed by - N/A
EUT Maximum Frequency - 2480MHz

Notes:
New Display 0.3m cable Client supplied ferrite BT mid channel TX DH1

Data Taken at 11/15/2018

| Frequency (MHz) | Raw Peak Reading (dBµV) | Raw Avg Reading (dBµV) | Correction Factor (dB/m) | Adjusted Peak Amplitude (dBµV/m) | Pk Lim: FCC_pt15_209_Peak (dBµV/m) | Peak Margin (dB) | Peak Test Results (Pass/Fail) | Worst Peak Margin (dB) | Adjusted Avg Amplitude (dBµV/m) | Av Lim: FCC_pt15_209_Average (dBµV/m) | Avg Margin (dB) | Avg Test Results (Pass/Fail) | Worst Avg Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12664 | 38.9 | 30.2 | 15.6 | 54.6 | 83.5 | -28.9 | PASS | | 45.8 | 63.5 | -17.7 | PASS | |
| 15370.1 | 40.8 | 31.5 | 15.4 | 56.2 | 83.5 | -27.3 | PASS | | 46.9 | 63.5 | -16.6 | PASS | |
| 15866.5 | 42.9 | 33.7 | 16.3 | 59.2 | 83.5 | -24.3 | PASS | | 50 | 63.5 | -13.5 | PASS | |
| 16507.3 | 43.5 | 33.5 | 17.3 | 60.8 | 83.5 | -22.7 | PASS | | 50.9 | 63.5 | -12.6 | PASS | |
| 17125.1 | 43 | 33.4 | 18 | 61 | 83.5 | -22.5 | PASS | | 51.4 | 63.5 | -12.1 | PASS | |
| 17832.7 | 42.1 | 32.1 | 19.7 | 61.8 | 83.5 | -21.7 | PASS | -21.7 | 51.8 | 63.5 | -11.7 | PASS | -11.7 |

Curtis Straus - a Bureau Veritas Company
Radiated Emissions Electric Field 1m Distance
6-18GHz Vertical Data
Operator: CCH

Work Order - S0817
EUT Power Input - 13.8V DC
Test Site - CH 1
Conditions - 21.4°C; 35%RH; 1008mBar
Witnessed by - N/A
EUT Maximum Frequency - 2480MHz

Notes:
New Display 0.3m cable Client supplied ferrite BT mid channel TX DH1

Data Taken at 11/15/2018

| Frequency (MHz) | Raw Peak Reading (dBµV) | Raw Avg Reading (dBµV) | Correction Factor (dB/m) | Adjusted Peak Amplitude (dBµV/m) | Pk Lim: FCC_pt15_209_Peak (dBµV/m) | Peak Margin (dB) | Peak Results (Pass/Fail) | Worst Peak Margin (dB) | Adjusted Avg Amplitude (dBµV/m) | Av Lim: FCC_pt15_209_Average (dBµV/m) | Avg Margin (dB) | Avg Results (Pass/Fail) | Worst Avg Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15254.1 | 41.9 | 33.6 | 15.2 | 57 | 83.5 | -26.5 | PASS | | 48.8 | 63.5 | -14.7 | PASS | |
| 15880 | 42.1 | 33.6 | 16.3 | 58.4 | 83.5 | -25.1 | PASS | | 49.9 | 63.5 | -13.6 | PASS | |
| 16493.7 | 43.3 | 33.6 | 17.3 | 60.7 | 83.5 | -22.8 | PASS | | 50.9 | 63.5 | -12.6 | PASS | |
| 17099.3 | 41.8 | 33.3 | 17.9 | 59.7 | 83.5 | -23.8 | PASS | | 51.1 | 63.5 | -12.4 | PASS | |
| 17738.6 | 43.1 | 33.1 | 19.1 | 62.3 | 83.5 | -21.2 | PASS | -21.2 | 52.2 | 63.5 | -11.3 | PASS | -11.3 |

6-18GHz CH39

Curtis Straus - a Bureau Veritas Company
Radiated Emissions Electric Field 1m Distance
6-18GHz Horizontal Data
Operator: CCH

Work Order - S0817
EUT Power Input - 13.8V DC
Test Site - CH 1
Conditions - 21.4°C; 35%RH; 1008mBar
Witnessed by - N/A
EUT Maximum Frequency - 2480MHz

Notes:
New Display 0.3m cable Client supplied ferrite BT high channel TX DH1

Data Taken at 11/15/2018

| Frequency (MHz) | Raw Peak Reading (dBµV) | Raw Avg Reading (dBµV) | Correction Factor (dB/m) | Adjusted Peak Amplitude (dBµV/m) | Pk Lim: FCC_pt15_209_Peak (dBµV/m) | Peak Margin (dB) | Peak Test Results (Pass/Fail) | Worst Peak Margin (dB) | Adjusted Avg Amplitude (dBµV/m) | Av Lim: FCC_pt15_209_Average (dBµV/m) | Avg Margin (dB) | Avg Test Results (Pass/Fail) | Worst Avg Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9527.6 | 41.7 | 32.2 | 9.1 | 50.8 | 83.5 | -32.7 | PASS | | 41.3 | 63.5 | -22.2 | PASS | |
| 15284.5 | 42.8 | 33.3 | 15.3 | 58 | 83.5 | -25.5 | PASS | | 48.6 | 63.5 | -14.9 | PASS | |
| 15838.8 | 43.8 | 33.3 | 16.3 | 60.1 | 83.5 | -23.4 | PASS | | 49.6 | 63.5 | -13.9 | PASS | |
| 16541.8 | 41.7 | 33.2 | 17.1 | 58.8 | 83.5 | -24.7 | PASS | | 50.3 | 63.5 | -13.2 | PASS | |
| 17136.9 | 42 | 33.5 | 17.9 | 60 | 83.5 | -23.5 | PASS | | 51.5 | 63.5 | -12 | PASS | |
| 17723.8 | 41.6 | 33.1 | 19.2 | 60.8 | 83.5 | -22.7 | PASS | -22.7 | 52.3 | 63.5 | -11.2 | PASS | -11.2 |

Curtis Straus - a Bureau Veritas Company
Radiated Emissions Electric Field 1m Distance
6-18GHz Vertical Data
Operator: CCH

Work Order - S0817
EUT Power Input - 13.8V DC
Test Site - CH 1
Conditions - 21.4°C; 35%RH; 1008mBar
Witnessed by - N/A
EUT Maximum Frequency - 2480MHz

Notes:
New Display 0.3m cable Client supplied ferrite BT high channel TX DH1

Data Taken at 11/15/2018

| Frequency (MHz) | Raw Peak Reading (dBµV) | Raw Avg Reading (dBµV) | Correction Factor (dB/m) | Adjusted Peak Amplitude (dBµV/m) | Pk Lim: FCC_pt15_209_Peak (dBµV/m) | Peak Margin (dB) | Peak Results (Pass/Fail) | Worst Peak Margin (dB) | Adjusted Avg Amplitude (dBµV/m) | Av Lim: FCC_pt15_209_Average (dBµV/m) | Avg Margin (dB) | Avg Results (Pass/Fail) | Worst Avg Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15268.9 | 42 | 33.7 | 15.2 | 57.2 | 83.5 | -26.3 | PASS | | 48.9 | 63.5 | -14.6 | PASS | |
| 15869.5 | 42.6 | 33.8 | 16.3 | 59 | 83.5 | -24.5 | PASS | | 50.1 | 63.5 | -13.4 | PASS | |
| 16510.7 | 42.2 | 33.5 | 17.3 | 59.5 | 83.5 | -24 | PASS | | 50.8 | 63.5 | -12.7 | PASS | |
| 17121.8 | 42.2 | 33.4 | 18 | 60.1 | 83.5 | -23.4 | PASS | | 51.3 | 63.5 | -12.2 | PASS | |
| 17688.3 | 42 | 32.5 | 19.3 | 61.4 | 83.5 | -22.1 | PASS | -22.1 | 51.8 | 63.5 | -11.7 | PASS | -11.7 |

6-18GHz CH78

## Radiated Emissions Table

**Date:** 15-Nov-18 **Company:** Harman Int. **Work Order:** S0817
**Engineer:** Chris Hamel **EUT Desc:** NGRadio **EUT Operating Voltage/Frequency:** 13.8V DC
**Temp:** 21.4°C **Humidity:** 35% **Pressure:** 1008mBar
**Frequency Range:** 18-26.5GHz **Measurement Distance:** 0.1 m
**Notes:** No Emissions Found **EUT Max Freq:** 2480MHz
Channels 0 39 78

| Antenna Polarization (H / V) | Frequency (MHz) | Peak Reading (dBµV) | Average Reading (dBµV) | Preamp Factor (dB) | Antenna Factor (dB/m) | Cable Factor (dB) | Adjusted Peak Reading (dBµV/m) | Adjusted Avg Reading (dBµV/m) | FCC 15.209 - Peak Limit (dBµV/m) | FCC 15.209 - Peak Margin (dB) | FCC 15.209 - Peak Result (Pass/Fail) | FCC 15.209 - Average Limit (dBµV/m) | FCC 15.209 - Average Margin (dB) | FCC 15.209 - Average Result (Pass/Fail) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | | | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |

***Table Result:*** Pass by N/A dB ***Worst Freq:*** N/A MHz

**Test Site:** EMI Chamber 1 **Cable 1:** Asset #2328 **Cable 2:** --- **Cable 3:** ---
**Analyzer:** Rental SA#3 **Preamp:** 18-26.5GHz **Antenna:** 18-26.5GHz Horn **Preselector:** ---
CSsoft Radiated Emissions Calculator v 1.017.211

Adjusted Reading = Reading - Preamp Factor + Antenna Factor + Cable Factor

## 18-26.5GHz All Channels

Rev. 11/8/2018

| Spectrum Analyzers / Receivers /Preselectors | Range | MN | Mfr | SN | Asset | Cat | Calibration Due | Calibrated on |
|---|---|---|---|---|---|---|---|---|
| Rental MXE EMI Receiver(1170725) | 20Hz-26.5GHz | N9038A | Agilent | MY51210151 | 1170725 | I | 4/10/2019 | 4/10/2018 |
| **Radiated Emissions Sites** | **FCC Code** | **IC Code** | **VCCI Code** | **Range** | **Asset** | **Cat** | **Calibration Due** | **Calibrated on** |
| EMI Chamber 1 | 719150 | 2762A-6 | A-0015 | 30-1000MHz | 1685 | I | 12/21/2018 | 12/21/2016 |
| EMI Chamber 1 | 719150 | 2762A-6 | A-0015 | 1-18GHz | 1685 | I | 12/21/2018 | 12/21/2016 |
| **Preamps /Couplers Attenuators / Filters** | **Range** | **MN** | **Mfr** | **SN** | **Asset** | **Cat** | **Calibration Due** | **Calibrated on** |
| 2310 PA | 1-1000MHz | PAM-103 | COM-POWER | 441175 | 2310 | II | 10/29/2019 | 10/29/2018 |
| 2111 HF Preamp | 0.5-18GHz | PAM-118A | COM-POWER | 551063 | 2111 | II | 11/19/2018 | 11/19/2017 |
| HF (Yellow) | 18-26.5GHz | AFS4-18002650-60-8P-4 | CS | 467559 | 1266 | II | 10/24/2019 | 10/24/2018 |
| **Antennas** | **Range** | **MN** | **Mfr** | **SN** | **Asset** | **Cat** | **Calibration Due** | **Calibrated on** |
| Red-Black Bilog | 30-2000MHz | JB1 | Sunol | A091604-2 | 1106 | I | 2/28/2019 | 2/28/2017 |
| HF (White) Horn | 18-26.5GHz | 801-WLM | Waveline | 758 | 758 | III | Verify before Use | date of test |
| Blue Horn | 1-18Ghz | 3117 | ETS | 157647 | 1861 | I | 2/14/2019 | 2/14/2017 |
| **Meteorological Meters/Chambers** | | **MN** | **Mfr** | **SN** | **Asset** | **Cat** | **Calibration Due** | **Calibrated on** |
| Weather Clock (Pressure Only) | | BA928 | Oregon Scientific | C3166-1 | 831 | I | 5/15/2020 | 5/15/2018 |
| TH A#2080 | | HTC-1 | HDE | | 2080 | II | 3/23/2019 | 3/23/2018 |
| **Cables** | **Range** | | **Mfr** | | | **Cat** | **Calibration Due** | **Calibrated on** |
| Asset #2459 | 9KHz-18GHz | | MegaPhase | | | II | 10/31/2019 | 10/31/2018 |
| Asset #2464 | 9KHz-18GHz | | MegaPhase | | | II | 10/31/2019 | 10/31/2018 |
| Asset #2480 | 9KHz-18GHz | | MegaPhase | | | II | 10/29/2019 | 10/29/2018 |
| Asset #2328 | 1 - 26.5GHz | PE350-72 | Pasternack | 1539 | | II | 2/12/2019 | 2/12/2018 |

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

TEU

# Radiated Band Edge

## Radiated Band Edge

**Date:** 15-Nov-18 **Company:** Harman Int. **Work Order:** S0817
**Engineer:** Chris Hamel **EUT Desc:** NGRadio **EUT Operating Voltage/Frequency:** 13.8V DC
**Temp:** 21.4°C **Humidity:** 35% **Pressure:** 1008mBar
**Frequency Range:** 2310-2500MHz **Measurement Distance:** 3 m
**Notes:** Worst case antenna polarization: H **EUT Max Freq:** 2480MHz
EUT in X "installed orientation" with DH1 packets (worst case)

| Antenna Polarization (H / V) | Frequency (MHz) | Peak Reading (dBµV) | Average Reading (dBµV) | Preamp Factor (dB) | Antenna Factor (dB/m) | Cable Factor (dB) | Adjusted Peak Reading (dBµV/m) | Adjusted Avg Reading (dBµV/m) | FCC 15.209 Peak Limit (dBµV/m) | FCC 15.209 Peak Margin (dB) | FCC 15.209 Peak Result (Pass/Fail) | FCC 15.209 Average Limit (dBµV/m) | FCC 15.209 Average Margin (dB) | FCC 15.209 Average Result (Pass/Fail) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Low | | | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| H | 2390.0 | 11.2 | 11.2 | 0.0 | 32.2 | 1.9 | 45.3 | 45.3 | 74.0 | -28.7 | Pass | 54.0 | -8.7 | Pass |
| High | | | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| H | 2483.5 | 10.8 | 10.8 | 0.0 | 32.4 | 1.9 | 45.1 | 45.1 | 74.0 | -28.9 | Pass | 54.0 | -8.9 | Pass |

***Table Result:*** Pass by -8.7 dB ***Worst Freq:*** 2390.0 MHz

**Test Site:** EMI Chamber 1 **Cable 1:** Asset #2459 **Cable 2:** Asset #2480 **Cable 3:** ---
**Analyzer:** Rental SA#3 **Preamp:** None **Antenna:** Blue Horn **Preselector:** ---
CSsoft Radiated Emissions Calculator v 1.017.211

Adjusted Reading = Reading - Preamp Factor + Antenna Factor + Cable Factor

Rev. 11/8/2018

| Spectrum Analyzers / Receivers /Preselectors | Range | MN | Mfr | SN | Asset | Cat | Calibration Due | Calibrated on |
|---|---|---|---|---|---|---|---|---|
| Rental MXE EMI Receiver(1170725) | 20Hz-26.5GHz | N9038A | Agilent | MY51210151 | 1170725 | I | 4/10/2019 | 4/10/2018 |

| Radiated Emissions Sites | FCC Code | IC Code | VCCI Code | Range | Asset | Cat | Calibration Due | Calibrated on |
|---|---|---|---|---|---|---|---|---|
| EMI Chamber 1 | 719150 | 2762A-6 | A-0015 | 1-18GHz | 1685 | I | 12/21/2018 | 12/21/2016 |

| Antennas | Range | MN | Mfr | SN | Asset | Cat | Calibration Due | Calibrated on |
|---|---|---|---|---|---|---|---|---|
| Blue Horn | 1-18Ghz | 3117 | ETS | 157647 | 1861 | I | 2/14/2019 | 2/14/2017 |

| Meteorological Meters/Chambers | | MN | Mfr | SN | Asset | Cat | Calibration Due | Calibrated on |
|---|---|---|---|---|---|---|---|---|
| Weather Clock (Pressure Only) | | BA928 | Oregon Scientific | C3166-1 | 831 | I | 5/15/2020 | 5/15/2018 |
| TH A#2080 | | HTC-1 | HDE | | 2080 | II | 3/23/2019 | 3/23/2018 |

| Cables | Range | Mfr | Cat | Calibration Due | Calibrated on |
|---|---|---|---|---|---|
| Asset #2459 | 9KHz-18GHz | MegaPhase | II | 10/31/2019 | 10/31/2018 |
| Asset #2480 | 9KHz-18GHz | MegaPhase | II | 10/29/2019 | 10/29/2018 |

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

TEU

## AC Line Conducted Emissions

### LIMITS

| Frequency of emission (MHz) | Quasi-peak limit (dBµV) | Average limit (dBµV) |
|---|---|---|
| 0.15-0.5 | 66 to 56* | 56 to 46* |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |

*Decreases with the logarithm of the frequency.

[47 CFR 15.207(a)]

### MEASUREMENTS / RESULTS

Not Applicable. EUT is vehicle battery powered only

## *Measurement Uncertainty*

The listed uncertainties are the worst case uncertainty for the entire range of measurement. Please note that the uncertainty values are provided for informational purposes only and are not used in determining the PASS/FAIL results.

| Measurement | Expanded Uncertainty k=2 | Maximum allowable uncertainty |
|---|---|---|
| Radiated Emissions (30-1000MHz)<br>NIST<br>CISPR | <br>5.6dB<br>4.6dB | <br>N/A<br>5.2dB (Ucispr) |
| Radiated Emissions (1-26.5GHz) | 4.6dB | N/A |
| Radiated Emissions (above 26.5GHz) | 4.9dB | N/A |
| Magnetic Radiated Emissions | 5.6dB | N/A |
| Conducted Emissions<br>NIST<br>CISPR | <br>3.9dB<br>3.6dB | <br>N/A<br>3.6dB (Ucispr) |
| Telco Conducted Emissions (Current) | 2.9dB | N/A |
| Telco Conducted Emissions (Voltage) | 4.4dB | N/A |
| Electrostatic Discharge | 11.5% | N/A |
| Radiated RF Immunity (Uniform Field) | 1.6dB | N/A |
| Electrical Fast Transients | 23.1% | N/A |
| Surge | 23.1% | N/A |
| Conducted RF Immunity | 3dB | N/A |
| Magnetic Immunity | 12.8% | N/A |
| Dips and Interrupts | 2.3V | N/A |
| Harmonics | 3.5% | N/A |
| Flicker | 3.5% | N/A |
| Radio frequency (@ 2.4GHz) | $3.23 \times 10^{-8}$ | $1 \times 10^{-7}$ |
| RF power, conducted | 0.40dB | 0.75dB |
| Maximum frequency deviation:<br>• Within 300Hz and 6kHz of audio frequency / Within 6kHz and 25kHz of audio frequency | <br>3.4%<br>0.3dB | <br>5%<br>3dB |
| Adjacent channel power | 1.9dB | 3dB |
| Conducted spurious emission of transmitter, valid up to 12.75GHz | 2.39dB | 3dB |
| Conducted emission of receivers | 1.3dB | 3dB |
| Radiated emission of transmitter, valid up to 26.5GHz | 3.9dB | 6dB |
| Radiated emission of transmitter, valid up to 80GHz | 3.3dB | 6dB |
| Radiated emission of receiver, valid up to 26.5GHz | 3.9dB | 6dB |
| Radiated emission of receiver, valid up to 80GHz | 3.3dB | 6dB |
| Humidity | 2.37% | 5% |
| Temperature | 0.7°C | 1.0°C |
| Time | 4.1% | 10% |
| RF Power Density, Conducted | 0.4dB | 3dB |
| DC and low frequency voltages | 1.3% | 3% |
| Voltage (AC, <10kHz) | 1.3% | 2% |
| Voltage (DC) | 0.62% | 1% |
| The above reflects a 95% confidence level | | |

## *Conditions Of Testing*

**[Bureau Veritas Consumer Products Services, Inc., a Massachusetts corporation],** and/or its affiliates (collectively, the "Company") will conduct, at the request of the Submitter ("Client"), the tests specified on the submitted Test Request Form or equivalent in accordance with, and subject to, the following terms and conditions (collectively, "Conditions"):

1. All orders for tests are subject to acceptance by the Company, and no order will constitute a binding commitment of the Company unless and until such order is accepted by it, as evidenced by the issuance of a written report ("Test Report") by the Company. The Test Report is issued solely by the Company, is intended for the exclusive use of Client and shall not be published, used for advertising purposes, copied or replicated for distribution to any other person or entity or otherwise publicly disclosed without the prior written consent of the Company. By submitting a request for services to the Company, Client consents to the disclosure to accreditation bodies of those records of Client relevant to the accreditation body's assessment of the Company's competence and compliance with relevant accreditation criteria. The Company shall not be liable for any loss or damage whatsoever resulting from the failure of the Company to provide its services within any time period for completion estimated by the Company. If Client anticipates using the Test Report in any legal proceeding, arbitration, dispute resolution forum or other proceeding, it shall so notify the Company prior to submitting the Test Report in such proceeding. The Company has no obligation to provide a fact or expert witness at such proceeding unless the Company agrees in advance to do so for a separate and additional fee.
2. The Test Report will set forth the findings of the Company solely with respect to the test samples identified therein. Unless specifically and expressly indicated in the Test Report, the results set forth in such Test Report are not intended to be indicative or representative of the quality or characteristics of the lot from which a test sample is taken, and Client shall not rely upon the Test Report as being so indicative or representative of the lot or of the tested product in general. The Test Report will reflect the findings of the Company at the time of testing only, and the Company shall have no obligation to update the Test Report after its issuance. The Test Report will set forth the results of the tests performed by the Company based upon the written information provided to the Company. The Test Report will be based solely on the samples and written information submitted to the Company by Client, and the Company shall not be obligated to conduct any independent investigation or inquiry with respect thereto.
3. The Company may, in its sole discretion, destroy samples which have been furnished to the Company for testing and which have not been destroyed in the course of testing. The Company may delegate the performance of all or a portion of the services contemplated hereunder to an affiliate, agent or subcontractor of the Company, and Client consents to such delegation.
4. These Conditions and the Test Report represent the entire understanding of the parties hereto with respect to the subject matter hereof and of the Test Report, and no modification, variance or extrapolation with respect thereto shall be permitted without the prior written consent of the Company.
5. The names, service marks, trademarks and copyrights of the Company and its affiliates, including the names "**BUREAU VERITAS," "BUREAU VERITAS CONSUMER PRODUCTS SERVICES," "BVCPS", "MTL", "ACTS", "MTL-ACTS" and CURTIS-STRAUS** (collectively, the "Marks") are and shall remain the sole property of the Company or its affiliates and shall not be used by Client except solely to the extent that Client obtains the prior written approval of the Company and then only in the manner prescribed by the Company. Client shall not contest the validity of the Marks or take any action that might impair the value or goodwill associated with the Marks or the image or reputation of the Company or its affiliates.
6. Payment in full shall be due 30 days after the date of invoice. Interest shall be due on overdue amounts from the due date until paid at an interest rate of 1.5% per month or, if less, the maximum rate permitted by law. The Company reserves the right, at any time and from time to time, to revoke any credit extended to Client. Client shall reimburse the Company for any costs it incurs in collecting past due amounts, including court costs and fees and expenses of attorneys and collection agencies. The Test Report may not be used or relied upon by Client if and for so long as Client fails to pay when due any invoice issued by the Company or any affiliate of it to Client or any affiliate or subsidiary of Client together with interest and penalties, if any, accrued thereon.
7. The Company disclaims any and all responsibility or liability arising out of or in connection with e-mail transmissions of such information.
8. Client understands and agrees that the Company is neither an insurer nor a guarantor, that the Company does not take the place of Client or any designer, manufacturer, agent, buyer, distributor or transportation or shipping company, and that the Company disclaims all liability in such capacities. Client further understands that if it seeks assurance against loss or damage, it should obtain appropriate insurance.
9. Client agrees that the Company, by providing the services, does not take the place of Client nor any third party, nor does the Company release them from any of their obligations, nor does the Company otherwise assume, abridge, abrogate or undertake to discharge any duty of any third party to Client or any duty of Client or any third party to any other third party, and Client will not release any third party from its obligations and duties with respect to the tested goods.
10. Client shall, on a timely basis, (a) provide adequate instructions to the Company in order to enable the Company to perform properly its services, (b) provide, or cause Client's suppliers and contractors to provide, the Company with all documents necessary to enable the Company to perform its services, (c) furnish the Company with all relevant information regarding Client's intended use and purposes of the tested goods, (d) advise the Company of essential dates and deadlines relevant to the tested goods and (e) fully exercise all rights and remedies available to Client against third parties in respect of the tested goods.
11. The Company shall undertake due care and ordinary skill in the performance of its services to Client, and the Company shall accept responsibility only were such skill has not been exercised and, even in such event, only to the extent of the limitation of liability set forth herein.
12. If Client desires to assert a claim arising from or relating to (i) the performance, purported performance or non-performance of any services by the Company or (ii) the sale, resale, manufacture, distribution or use of any tested goods, it must submit that claim to the Company in a writing that sets forth with particularity the basis for such claim within 60 days from discovery of the potential claim and not more than six months after the date of issuance of the Test Report to Client. Client waives any and all such claims including, without limitation, claims that the Test Report is inaccurate, incomplete or misleading or that additional or different testing is required, unless and then only to the extent that Client submits a written claim to the Company within both such time periods.
13. CLIENT SHALL, EXCEPT TO THE EXTENT OF COMPANY'S LIABILITY TO CLIENT HEREUNDER (WHICH IN NO EVENT SHALL EXCEED THE LIMITATION OF LIABILITY HEREIN), HOLD HARMLESS AND INDEMNIFY THE COMPANY, ITS AFFILIATES AND THEIR RESPECTIVE DIRECTORS, OFFICERS, EMPLOYEES, AGENTS AND SUBCONTRACTORS AGAINST ALL ACTUAL OR ALLEGED THIRD PARTY CLAIMS FOR LOSS, DAMAGE OR EXPENSE OF WHATSOEVER NATURE AND HOWSOEVER ARISING FROM OR RELATING TO (i) THE PERFORMANCE, PURPORTED PERFORMANCE OR NON-PERFORMANCE OF ANY SERVICES BY THE COMPANY OR (ii) THE SALE, RESALE, MANUFACTURE, DISTRIBUTION OR USE OF ANY TESTED GOODS.
14. EXCEPT AS MAY OTHERWISE BE EXPRESSLY AGREED TO IN WRITING BY THE COMPANY AND NOTWITHSTANDING ANY PROVISION TO THE CONTRARY CONTAINED HEREIN OR IN ANY TEST REPORT, NO WARRANTY OR GUARANTEE, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE, IS MADE.

15. (A) IN NO EVENT WHATSOEVER SHALL THE COMPANY BE LIABLE FOR ANY CONSEQUENTIAL, SPECIAL, INCIDENTAL, EXEMPLARY OR PUNITIVE DAMAGES IN CONNECTION WITH, RELATING TO OR ARISING OUT OF THE TEST REPORT OR THE SERVICES PROVIDED BY THE COMPANY HEREUNDER, INCLUDING WITHOUT LIMITATION LOSS OF OR DAMAGE TO PROPERTY; LOSS OF INCOME, PROFIT OR USE; OR ANY CLAIMS OR DEMANDS MADE AGAINST CLIENT OR ANY OTHER PERSON BY ANY THIRD PARTY IN CONNECTION WITH, RELATING TO OR ARISING OUT OF THE SERVICES PROVIDED BY THE COMPANY HEREUNDER.

(B)NOTWITHSTANDING ANY PROVISION TO THE CONTRARY CONTAINED HEREIN, AND IN RECOGNITION OF THE RELATIVE RISKS AND BENEFITS TO CLIENT AND THE COMPANY ASSOCIATED WITH THE TESTING SERVICES CONTEMPLATED HEREBY, THE RISKS HAVE BEEN ALLOCATED SUCH THAT UNDER NO CIRCUMSTANCES WHATSOEVER SHALL THE LIABILITY OF THE COMPANY TO CLIENT OR ANY THIRD PARTY IN RESPECT OF ANY CLAIM FOR LOSS, DAMAGE OR EXPENSE, OF WHATSOEVER NATURE OR MAGNITUDE, AND HOWSOEVER ARISING, EXCEED AN AMOUNT EQUAL TO FIVE (5) TIMES THE AMOUNT OF THE FEES PAID TO THE COMPANY FOR THE SPECIFIC SERVICES WHICH GAVE RISE TO SUCH CLAIM OR U.S.$10,000, WHICHEVER IS THE LESSER AMOUNT.

16. The Company shall not be liable for any loss or damage resulting from any delay or failure in performance of its obligations hereunder resulting directly or indirectly from any event of force majeure or any event outside the control of the Company. If any such event occurs, the Company may immediately cancel or suspend its performance hereunder without incurring any liability whatsoever to Client.

17. Company's services, including these Conditions, shall be governed by, and construed in accordance with, the local laws of the country where the Company performs the tests or, in the case of tests performed in the United States of America, the laws of Massachusetts without regard to conflicts of laws principles. If any aspect(s) of these Conditions is found to be illegal or unenforceable, the validity, legality and enforceability of all remaining aspects of these Conditions shall not in any way be affected or impaired thereby. Any proceeding related to the subject matter hereof shall be brought, if at all, in the courts of the country where the Company performs the tests or, in the case of tests performed in the United States of America, in the courts of Massachusetts. Client waives the right to interpose any counterclaim or setoffs of any nature in any litigation arising hereunder.

The complete list of the Approved Subcontractors Curtis-Straus may use to delegate the performance of work can be provided upon request.
Rev.160009121(2)_#684340 v14CS

## *Appendix A*

# ES0817-1 Appendix A

**CFR Title 47 FCC Part §15.247 and ISED Canada RSS-247 Issue 2**

**DUT Information**

| | |
|---|---|
| DUT Name: | NGRadio |
| Manufacturer: | Harman International Industries, Inc. |
| Serial Number: | 21 |

79 channels are provided for BT mode:

| Channel | Freq. (MHz) | Channel | Freq. (MHz) | Channel | Freq. (MHz) | Channel | Freq. (MHz) |
|---|---|---|---|---|---|---|---|
| **0** | **2402** | 20 | 2422 | 40 | 2442 | 60 | 2462 |
| 1 | 2403 | 21 | 2423 | 41 | 2443 | 61 | 2463 |
| 2 | 2404 | 22 | 2424 | 42 | 2444 | 62 | 2464 |
| 3 | 2405 | 23 | 2425 | 43 | 2445 | 63 | 2465 |
| 4 | 2406 | 24 | 2426 | 44 | 2446 | 64 | 2466 |
| 5 | 2407 | 25 | 2427 | 45 | 2447 | 65 | 2467 |
| 6 | 2408 | 26 | 2428 | 46 | 2448 | 66 | 2468 |
| 7 | 2409 | 27 | 2429 | 47 | 2449 | 67 | 2469 |
| 8 | 2410 | 28 | 2430 | 48 | 2450 | 68 | 2470 |
| 9 | 2411 | 29 | 2431 | 49 | 2451 | 69 | 2471 |
| 10 | 2412 | 30 | 2432 | 50 | 2452 | 70 | 2472 |
| 11 | 2413 | 31 | 2433 | 51 | 2453 | 71 | 2473 |
| 12 | 2414 | 32 | 2434 | 52 | 2454 | 72 | 2474 |
| 13 | 2415 | 33 | 2435 | 53 | 2455 | 73 | 2475 |
| 14 | 2416 | 34 | 2436 | 54 | 2456 | 74 | 2476 |
| 15 | 2417 | 35 | 2437 | 55 | 2457 | 75 | 2477 |
| 16 | 2418 | 36 | 2438 | 56 | 2458 | 76 | 2478 |
| 17 | 2419 | 37 | 2439 | 57 | 2459 | 77 | 2479 |
| 18 | 2420 | 38 | 2440 | 58 | 2460 | **78** | **2480** |
| 19 | 2421 | **39** | **2441** | 59 | 2461 | | |

**Notes:** The channels marked bold in the above list were selected as representative test channels.

| | |
|---|---|
| Number of transmit chains | 1 |
| Equipment type | Frequency Hopping Spread Spectrum |

**Antenna Gain**

| Frequency | Efficiency [%] | Peak Gain [dBi] | Efficiency [dB] |
|---|---|---|---|
| 2400 | 13.19932059 | -4.084553189 | -8.794484227 |
| 2405 | 13.66930906 | -3.89609727 | -8.642534372 |
| 2410 | 13.16496285 | -4.075649699 | -8.805803621 |
| 2415 | 14.56310809 | -3.590386507 | -8.36745927 |
| 2420 | 13.89215315 | -3.779205064 | -8.572304376 |
| 2425 | 16.02714327 | -3.42864776 | -7.951438809 |
| 2430 | 15.34394041 | -3.384679029 | -8.140630968 |
| 2435 | 17.32166695 | -3.15330307 | -7.614103161 |
| 2440 | 16.70048151 | -2.938161217 | -7.772710069 |
| 2445 | 16.70804889 | -3.232548943 | -7.770742626 |
| 2450 | 16.51954036 | -3.011452559 | -7.820020405 |
| 2455 | 17.13741832 | -2.856145164 | -7.660546021 |
| 2460 | 16.86968132 | -2.672828375 | -7.728931214 |
| 2465 | 17.32074306 | -2.442075942 | -7.614334808 |
| 2470 | 17.15464436 | -2.523611304 | -7.656182811 |
| 2475 | 18.31882381 | -1.910405052 | -7.371024144 |
| 2480 | 18.65887031 | -1.975590857 | -7.29114654 |
| 2485 | 19.26810599 | -1.979182466 | -7.151609734 |
| 2490 | 19.22126854 | -1.828852981 | -7.162179537 |
| 2495 | 20.09374763 | -1.739091861 | -6.969390566 |
| 2500 | 18.85123308 | -1.931415102 | -7.246602369 |

## Test Equipment Used

| Rev. 10/22/2018 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Spectrum Analyzers / Receivers /Preselectors** | **Range** | **MN** | **Mfr** | **SN** | **Asset** | **Cat** | **Calibration Due** | **Calibrated on** |
| FSV40 Signal/Spectrum Analyzer | 10Hz-40GHz | FSV40 | ROHDE & SCHWARZ | 101551 | 2200 | I | 10/1/2019 | 10/1/2018 |
| | | | | | | | | |
| **Signal Generators/Comparaison Noise Emitter** | **Range** | **MN** | **Mfr** | **SN** | **Asset** | **Cat** | **Calibration Due** | **Calibrated on** |
| SMBV100A Vector Signal Generator | 9KHz-6GHz | SMBV100A | ROHDE & SCHWARZ | 261919 | 2201 | I | 10/1/2019 | 10/1/2018 |
| SMB100A Signal Generator | 100kHz-40GHz | SMB100A | ROHDE & SCHWARZ | 179846 | 2557 | I | 10/1/2019 | 10/1/2018 |
| | | | | | | | | |
| **Power/Noise Meters** | | **MN** | **Mfr** | **SN** | **Asset** | **Cat** | **Calibration Due** | **Calibrated on** |
| OSP - open switch and control platform | 30MHz-18GHz | OSP-B157W8 | ROHDE & SCHWARZ | 1527.1144.02-100955-Ck | 2558 | I | 2/1/2019 | 2/1/2018 |
| | | | | | | | | |
| **Cables** | **Range** | | **Mfr** | | | **Cat** | **Calibration Due** | **Calibrated on** |
| DUT1 | 30MHz-26GHz | | Micro-Coax | | | III | verify before use | |
| DUT2 | 30MHz-26GHz | | Micro-Coax | | | III | verify before use | |
| DUT3 | 30MHz-26GHz | | Micro-Coax | | | III | verify before use | |
| DUT4 | 30MHz-26GHz | | Micro-Coax | | | III | verify before use | |
| | | | | | | | | |
| **Attenuators / Couplers** | **Range** | **MN** | **Mfr** | **SN** | **Asset** | **Cat** | **Calibration Due** | **Calibrated on** |
| 10dB Attenuator-01 Brown | 30MHz-26GHz | | Mini Curcuits | | | III | verify before use | |
| 10dB Attenuator-02 Yellow | 30MHz-26GHz | | Mini Curcuits | | | III | verify before use | |
| 10dB Attenuator-03 Red | 30MHz-26GHz | | Mini Curcuits | | | III | verify before use | |
| 10dB Attenuator-04 orange | 30MHz-26GHz | | Mini Curcuits | | | III | verify before use | |
| API - 30dB 20W Attenuator | 9KHz-40GHz | 89-30-11 | API Weinschel | 703 | 2121 | II | 3/23/2019 | 3/23/2018 |
| Directional Coupler | 0.5GHz-18GHz | UDC | AA MCS | 001040 | 2434 | III | verify before use | |
| | | | | | | | | |
| **Communication Tester** | **Range** | **MN** | **Mfr** | **SN** | **Asset** | **Cat** | **Calibration Due** | **Calibrated on** |
| CMW270 Wideband Radio Communication Tester | DC to 6GHz | CMW270 | ROHDE & SCHWARZ | 1201.0002K75-101066-MV | | I | 6/13/2019 | 6/13/2018 |
| | | | | | | | | |
| **Meteorological Meters/Chambers** | | **MN** | **Mfr** | **SN** | **Asset** | **Cat** | **Calibration Due** | **Calibrated on** |
| Temp/Humidity Chamber #18 | | EPX-2H | Espec | 137664 | 1645 | I | 1/5/2019 | 1/5/2018 |
| | | | | | | | | |
| All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard. | | | | | | | | |

## Summary

| Test | Frequency (MHz) | DH1 Result | DH3 Result | DH5 Result | 2-DH1 Result | 2-DH3 Result | 2-DH5 Result | 3-DH1 Result | 3-DH3 Result | 3-DH5 Result |
|---|---|---|---|---|---|---|---|---|---|---|
| Hopping Frequencies | --- (hopping) | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS |
| Band Edge (during hopping) | --- (hopping) | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS |
| Carrier Frequency Separation | 2402.000 (hopping) | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS |
| Carrier Frequency Separation | 2480.000 (hopping) | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS |
| Time of Channel Occupancy | 2402.000 (hopping) | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS |
| Time of Channel Occupancy | 2441.000 (hopping) | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS |
| Time of Channel Occupancy | 2480.000 (hopping) | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS |
| Emission Bandwidth 20 dB | 2402.000 (single) | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS |
| Occupied Channel Bandwidth 99% | 2402.000 (single) | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS |
| Band Edge low | 2402.000 (single) | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS |
| Peak output power | 2402.000 (single) | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS |
| Conducted Spurious Emissions | 2402.000 (single) | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS |
| Emission Bandwidth 20 dB | 2441.000 (single) | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS |
| Occupied Channel Bandwidth 99% | 2441.000 (single) | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS |
| Peak output power | 2441.000 (single) | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS |
| Conducted Spurious Emissions | 2441.000 (single) | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS |
| Emission Bandwidth 20 dB | 2480.000 (single) | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS |
| Occupied Channel Bandwidth 99% | 2480.000 (single) | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS |
| Band Edge high | 2480.000 (single) | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS |
| Peak output power | 2480.000 (single) | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS | PASS |
| Conducted Spurious Emissions | 2480.000 (single) | ------ | ------ | ------ | ------ | ------ | ------ | ------ | PASS | ------ |

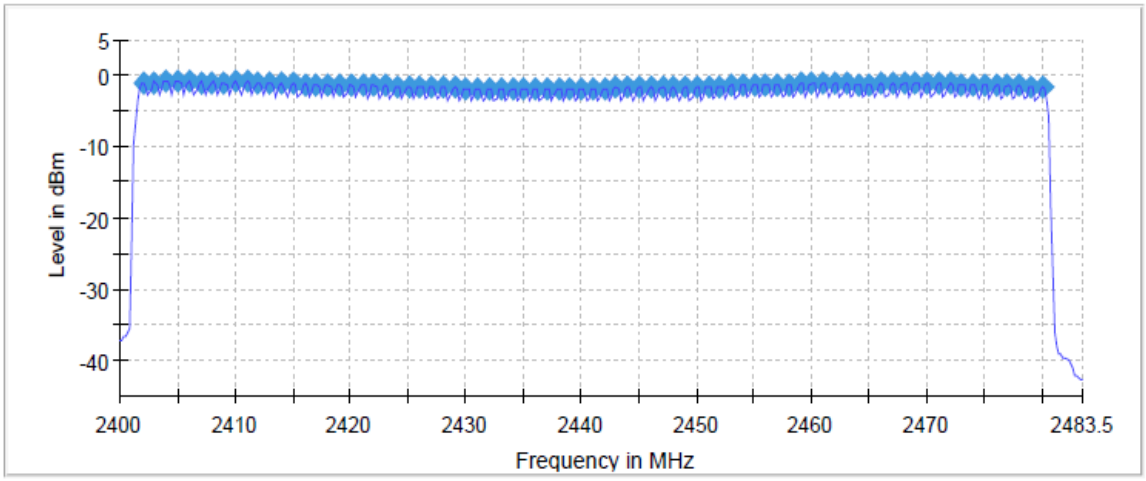
## Number of Hopping Frequencies

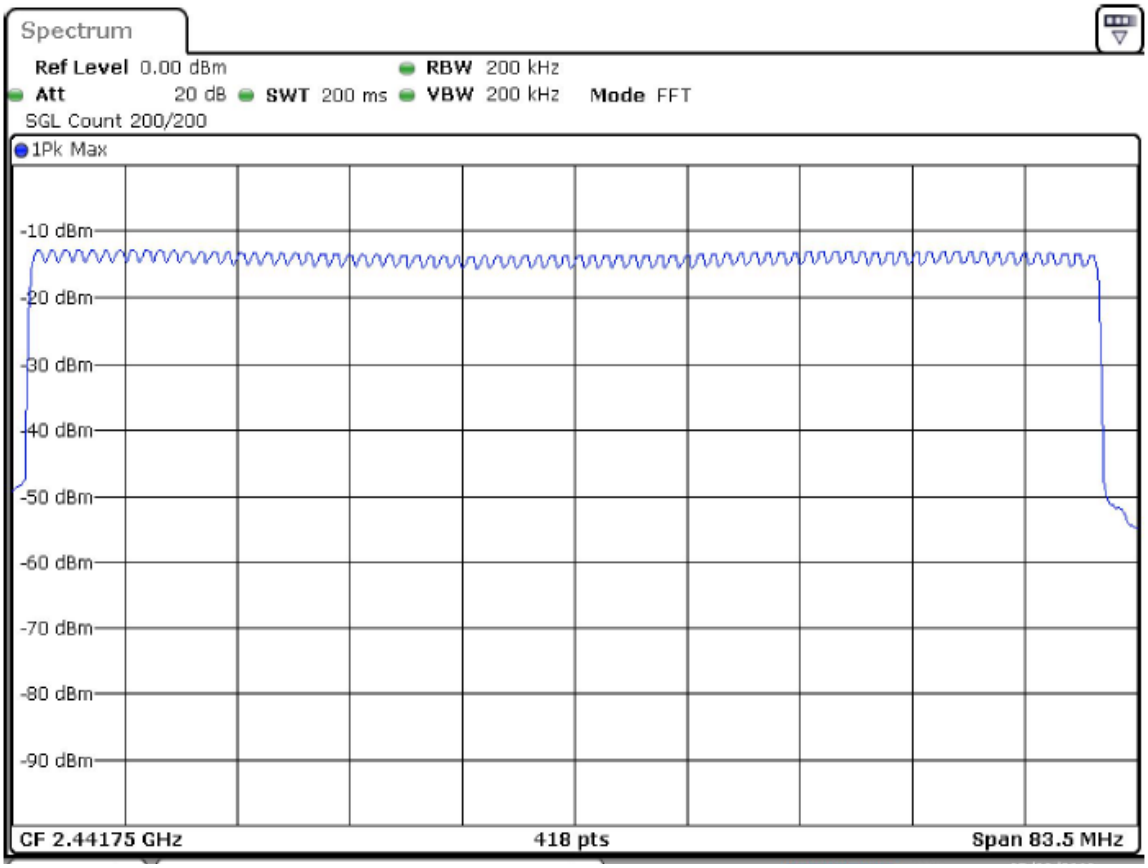
Test procedure in accordance with ANSI C63.10-2013

**Channels**

| Channels | Limit Min | Result |
|---|---|---|
| 79 | 15 | PASS |

Plot for packet type 3-DH3 shown below.




Spectrum
Ref Level 0.00 dBm
RBW 200 kHz
Att 20 dB SWT 200 ms VBW 200 kHz Mode FFT
SGL Count 200/200
1Pk Max
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
-90 dBm
CF 2.44175 GHz
418 pts
Span 83.5 MHz

## Band Edge (during hopping)

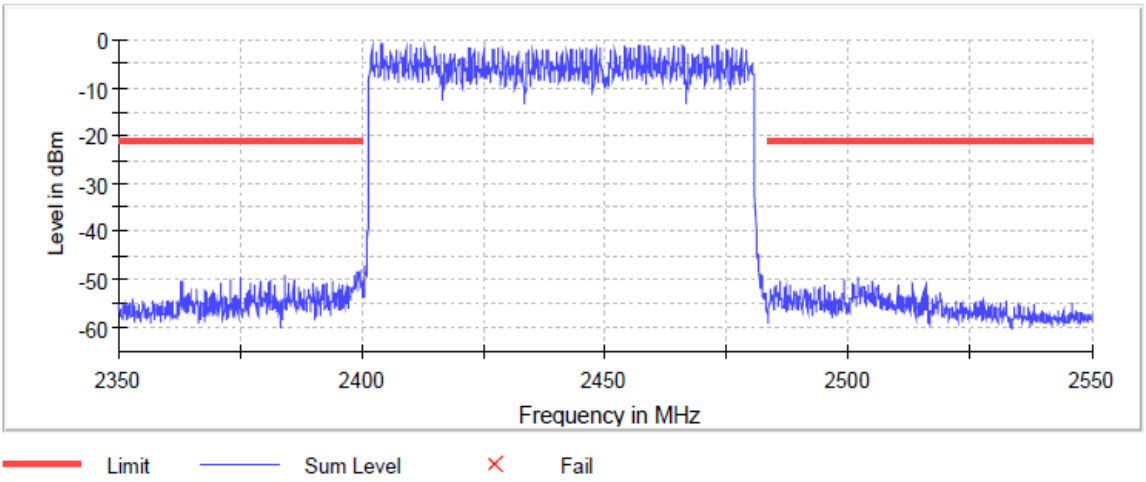
Test procedure in accordance with ANSI C63.10-2013

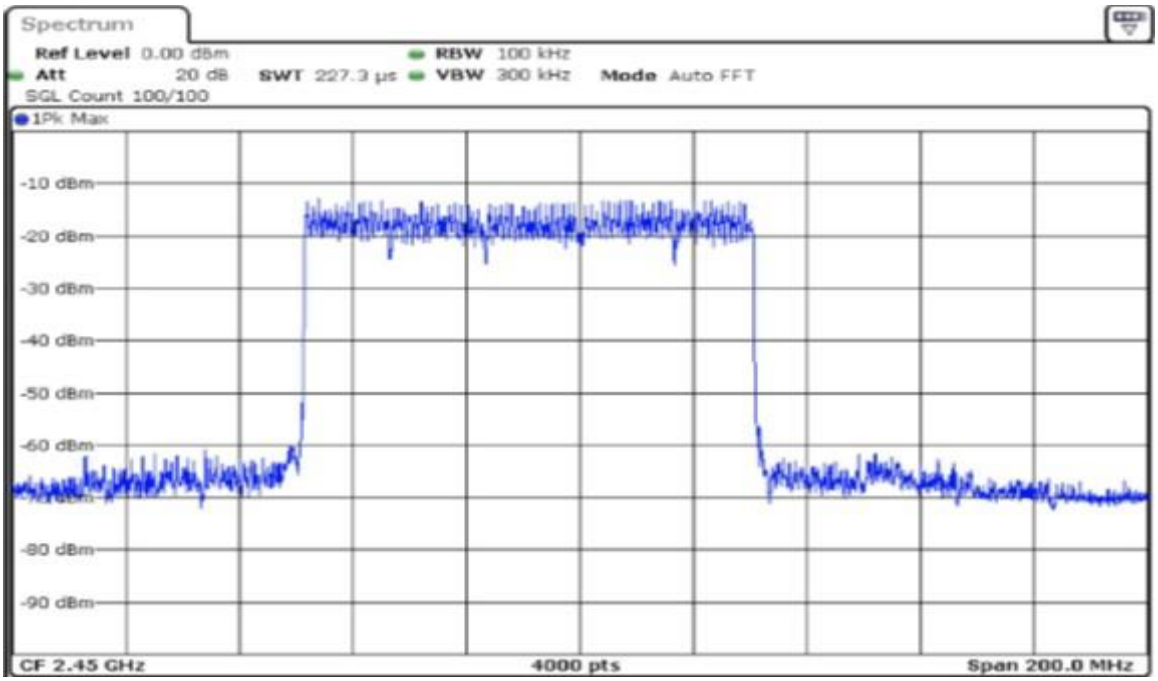
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1. Expanded Uncertainty (K=2) < 0.8 dB

**Inband Peak**

| Data Rate | Frequency (MHz) | Level (dBm) |
|---|---|---|
| DH1 | 2409.975000 | -1.0 |
| DH3 | 2403.825000 | -1.0 |
| DH5 | 2403.825000 | -1.0 |
| 2-DH1 | 2410.975000 | -1.0 |
| 2-DH3 | 2404.975000 | -1.0 |
| 2-DH5 | 2408.025000 | -1.1 |
| 3-DH1 | 2409.025000 | -1.0 |
| 3-DH3 | 2403.975000 | -0.9 |
| 3-DH5 | 2409.975000 | -1.0 |

Plots for packet type 3-DH3 shown below.




Spectrum
Ref Level 0.00 dBm
RBW 100 kHz
Att 20 dB
SWT 227.3 µs
VBW 300 kHz
Mode Auto FFT
SGL Count 100/100
1Pk Max
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-80 dBm
-90 dBm
CF 2.45 GHz
4000 pts
Span 200.0 MHz

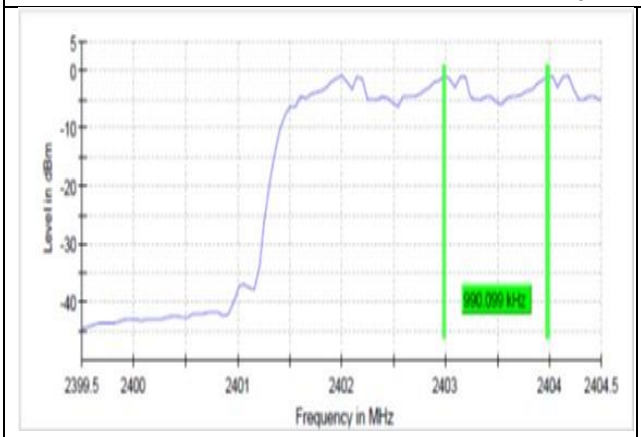
## Carrier Frequency Separation

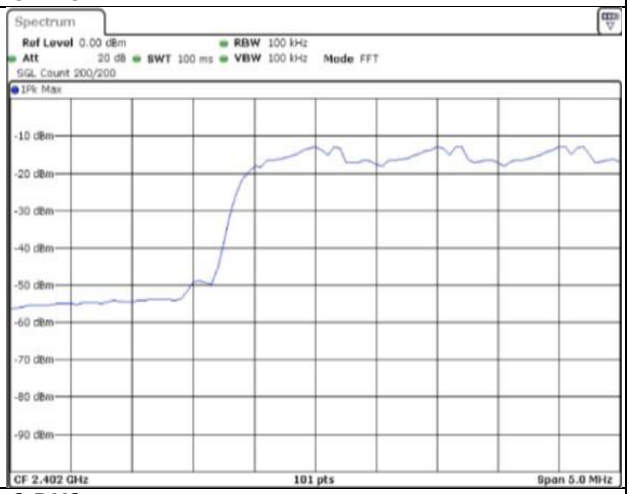
Test procedure in accordance with ANSI C63.10-2013
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1. Expanded Uncertainty(k = 2) < 1%

| Hopping Mode | | | | |
|---|---|---|---|---|
| Packet Type | 2402MHz | | 2480MHz | |
| | Frequency Separation (MHz) | Minimum Limit (MHz) | Frequency Separation (MHz) | Minimum Limit (MHz) |
| DH1 | 0.990099 | 0.633664 | 0.990099 | 0.633664 |
| DH3 | 0.990099 | 0.653465 | 0.990099 | 0.653465 |
| DH5 | 0.990099 | 0.653465 | 0.990099 | 0.653465 |
| 2-DH1 | 0.940594 | 0.871287 | 0.990099 | 0.871287 |
| 2-DH3 | 0.990099 | 0.871287 | 0.990099 | 0.871287 |
| 2-DH5 | 0.990099 | 0.871287 | 0.990099 | 0.871287 |
| 3-DH1 | 0.990099 | 0.851485 | 0.990099 | 0.851485 |
| 3-DH3 | 0.990099 | 0.871287 | 0.940594 | 0.871287 |
| 3-DH5 | 0.990099 | 0.871287 | 0.940594 | 0.871287 |

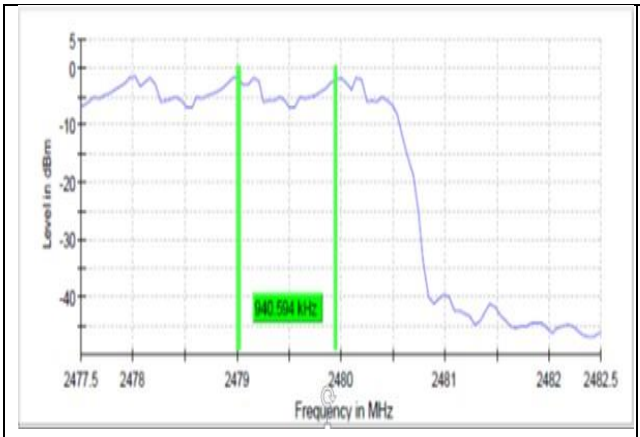
*Limit is 2/3 of the widest 20dB bandwidth of the corresponding packet type.

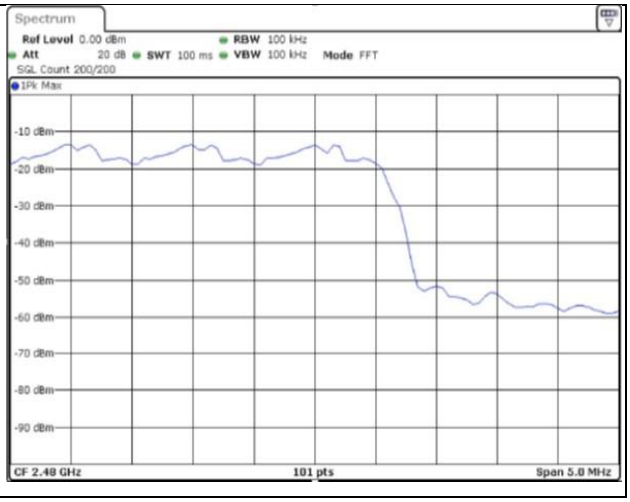
**2402MHz 3-DH3**




**2480MHz 3-DH3**


Level in dBm
5
0
-10
-20
-30
-40
640.594 kHz
2477.5
2478
2479
2480
2481
2482
2482.5
Frequency in MHz


Spectrum
Ref Level 0.00 dBm
RBW 100 kHz
Att 20 dB SWT 100 ms VBW 100 kHz Mode FFT
SGL Count 200/200
1Pk Max
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
-90 dBm
CF 2.48 GHz
101 pts
Span 5.0 MHz

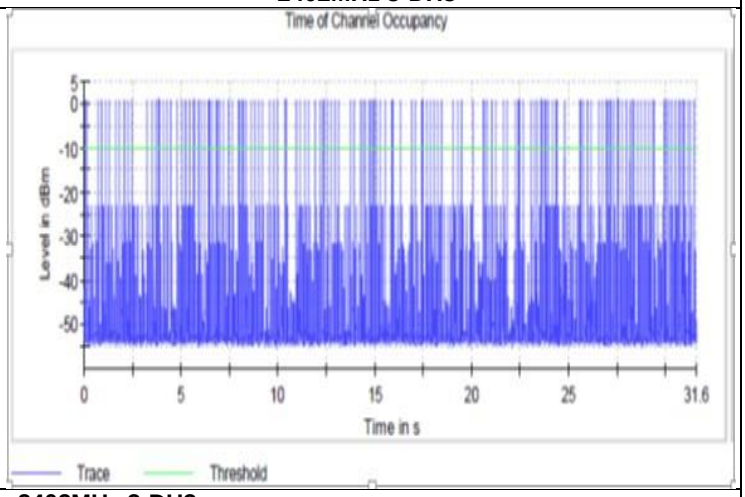
## Time of Channel Occupancy (Dwell Time)

Test procedure in accordance with ANSI C63.10-2013
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1. Expanded Uncertainty (K=2) < 1%

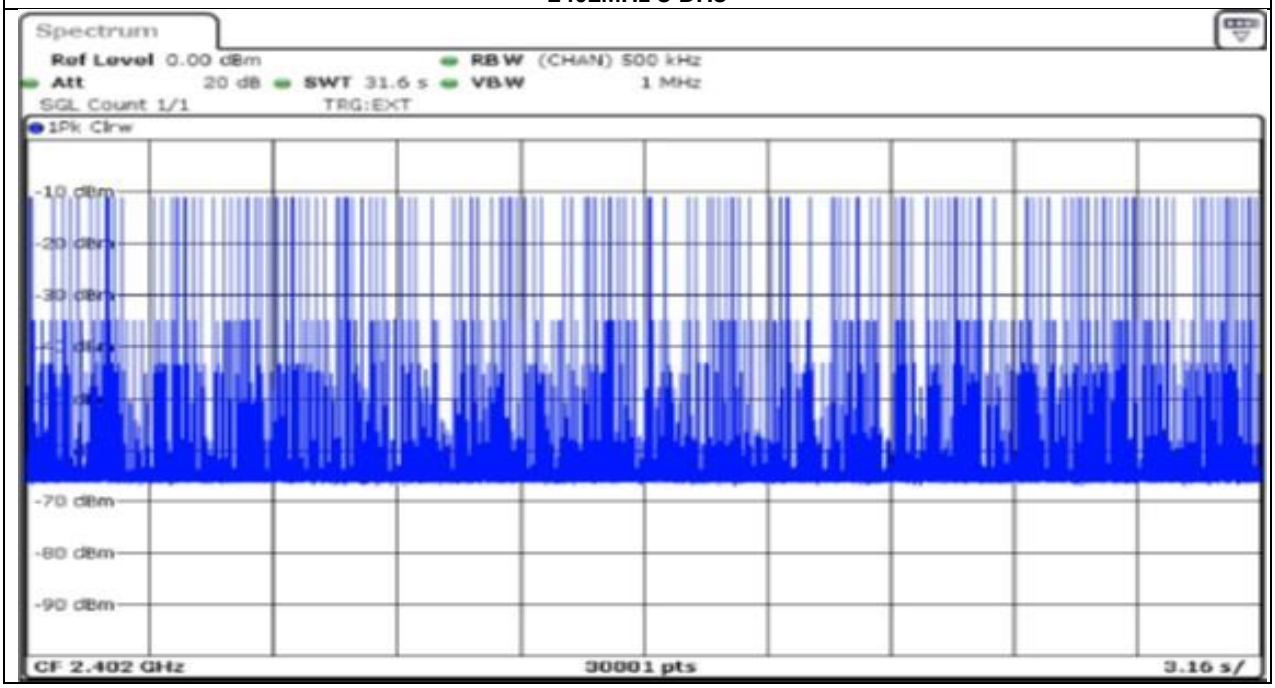
**2402MHz**

| Data Rate | Time (ms) | Limit Max (ms) | Result |
|---|---|---|---|
| DH1 | 146.850 | 400.000 | PASS |
| DH3 | 270.680 | 400.000 | PASS |
| DH5 | 316.850 | 400.000 | PASS |
| 2-DH1 | 141.880 | 400.000 | PASS |
| 2-DH3 | 269.070 | 400.000 | PASS |
| 2-DH5 | 278.450 | 400.000 | PASS |
| 3-DH1 | 141.630 | 400.000 | PASS |
| 3-DH3 | 269.810 | 400.000 | PASS |
| 3-DH5 | 312.230 | 400.000 | PASS |

**2402MHz 3-DH3**



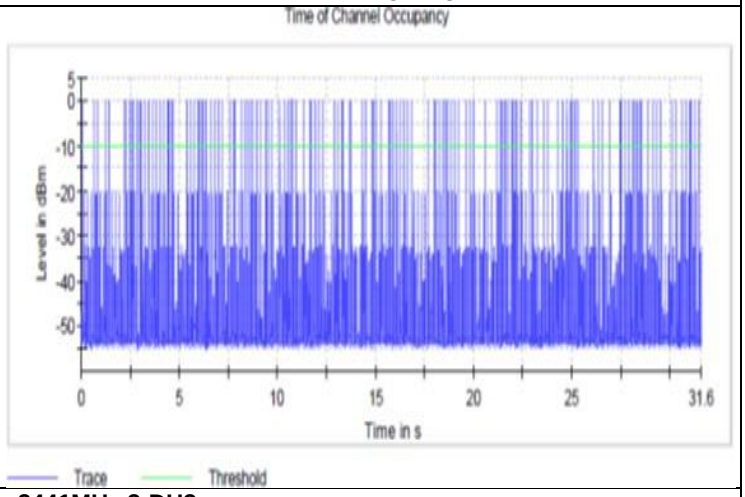

**2402MHz 3-DH3**



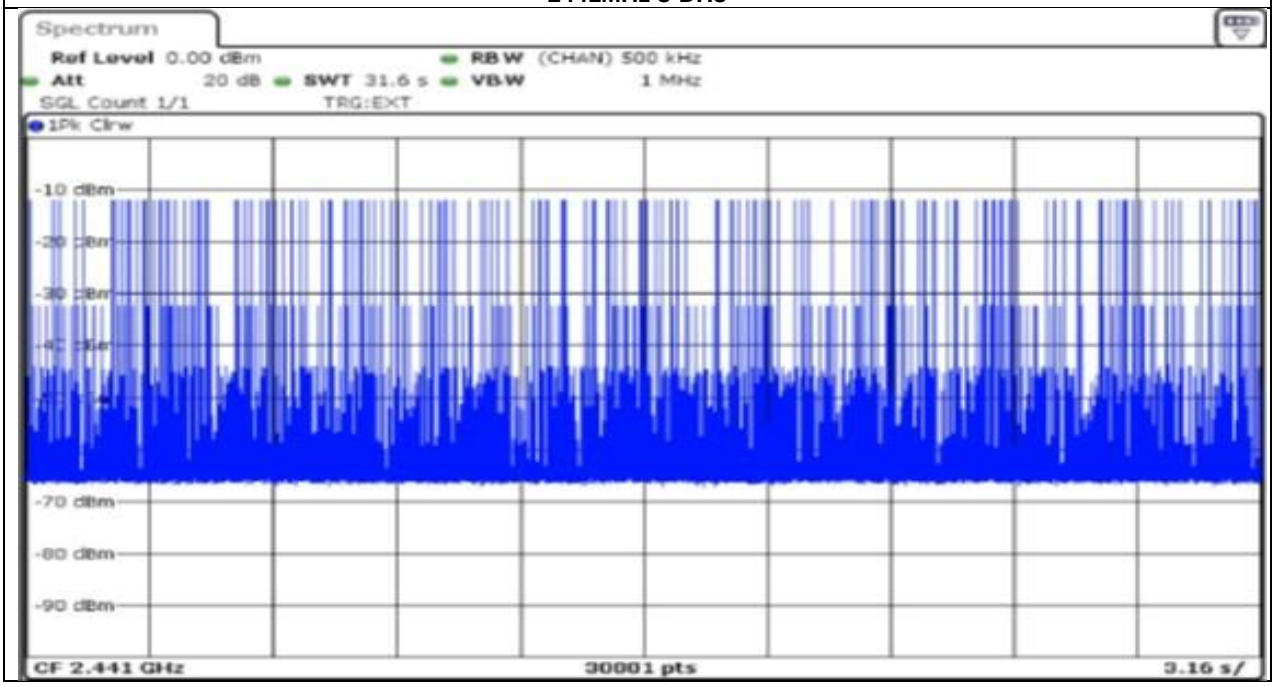
**2441MHz**

| Data Rate | Time (ms) | Limit Max (ms) | Result |
|---|---|---|---|
| DH1 | 146.020 | 400.000 | PASS |
| DH3 | 282.540 | 400.000 | PASS |
| DH5 | 316.760 | 400.000 | PASS |
| 2-DH1 | 140.640 | 400.000 | PASS |
| 2-DH3 | 265.370 | 400.000 | PASS |
| 2-DH5 | 229.800 | 400.000 | PASS |
| 3-DH1 | 139.110 | 400.000 | PASS |
| 3-DH3 | 255.810 | 400.000 | PASS |
| 3-DH5 | 296.550 | 400.000 | PASS |

**2441MHz 3-DH3**



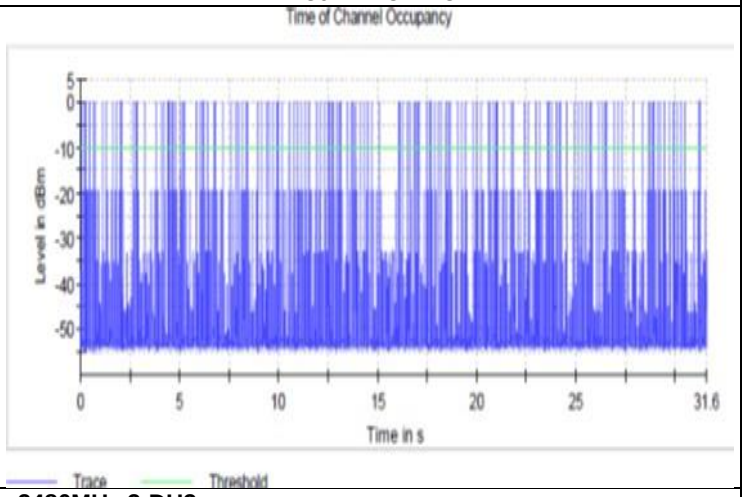

**2441MHz 3-DH3**



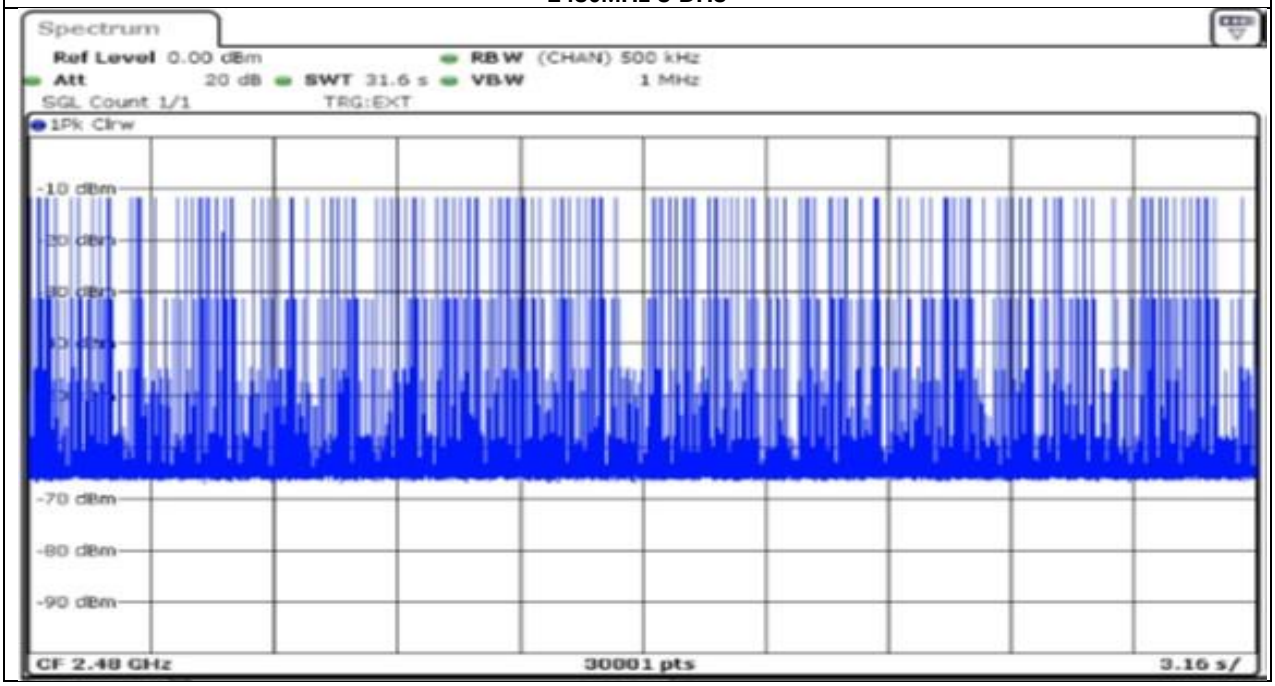
**2480MHz**

| Data Rate | Time (ms) | Limit Max (ms) | Result |
|---|---|---|---|
| DH1 | 146.130 | 400.000 | PASS |
| DH3 | 284.270 | 400.000 | PASS |
| DH5 | 331.580 | 400.000 | PASS |
| 2-DH1 | 140.830 | 400.000 | PASS |
| 2-DH3 | 264.970 | 400.000 | PASS |
| 2-DH5 | 298.830 | 400.000 | PASS |
| 3-DH1 | 139.910 | 400.000 | PASS |
| 3-DH3 | 254.070 | 400.000 | PASS |
| 3-DH5 | 284.090 | 400.000 | PASS |

**2480MHz 3-DH3**




**2480MHz 3-DH3**

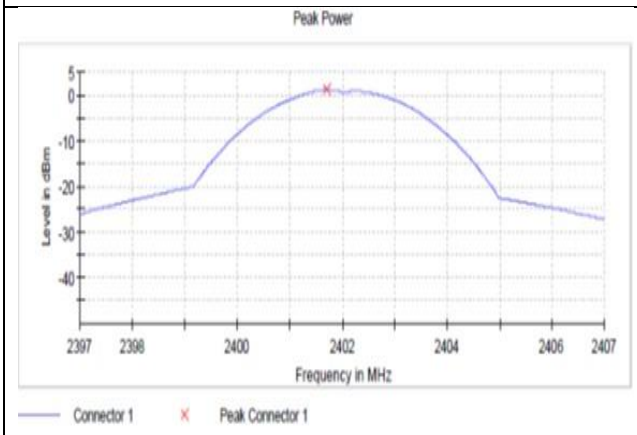


## Peak Output Power

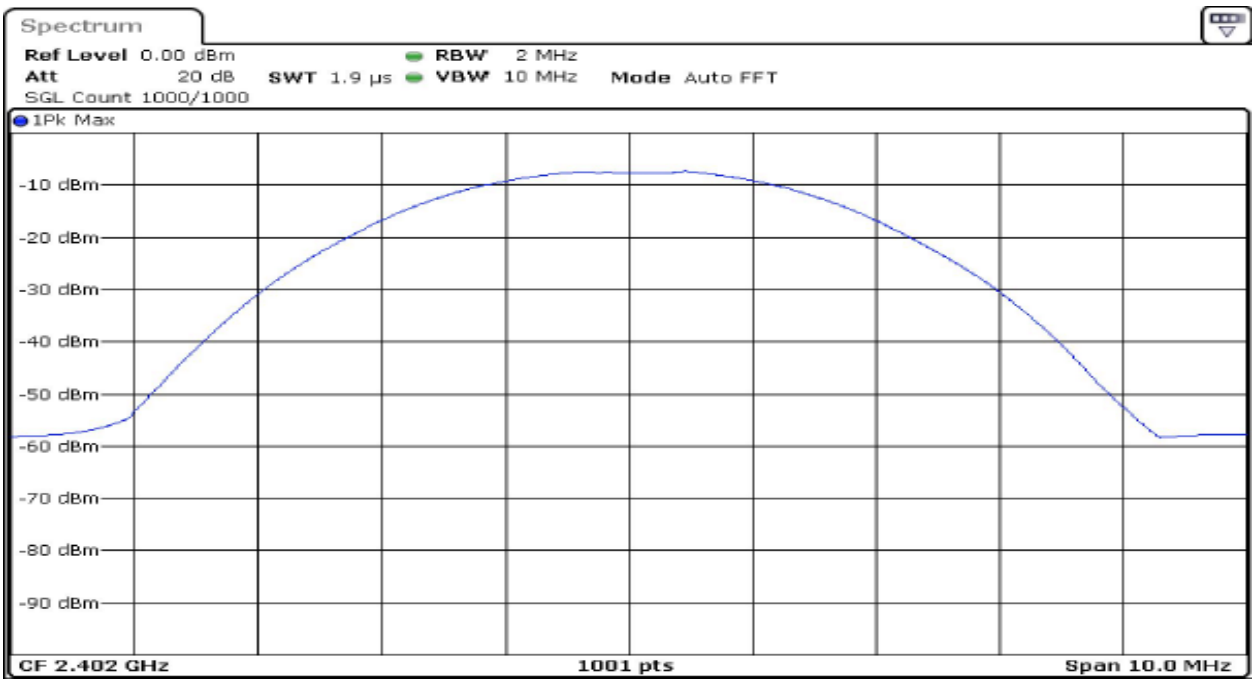
Test procedure in accordance with ANSI C63.10-2013

| Data Rate | 2402MHz | 2441MHz | 2480MHz | Limit dBm |
|---|---|---|---|---|
| DH1 | -0.987 | -1.882 | -1.668 | 20.96 |
| DH3 | -0.943 | -1.886 | -1.643 | 20.96 |
| DH5 | -0.957 | -1.86 | -1.624 | 20.96 |
| 2-DH1 | 0.565 | -0.32 | -0.108 | 20.96 |
| 2-DH3 | 0.558 | -0.357 | -0.137 | 20.96 |
| 2-DH5 | 0.525 | -0.199 | -0.108 | 20.96 |
| 3-DH1 | 0.761 | -0.075 | -0.036 | 20.96 |
| 3-DH3 | 1.078 | 0.093 | 0.233 | 20.96 |
| 3-DH5 | 1.04 | 0.096 | 0.238 | 20.96 |

**2402MHz 3-DH3**




**2402MHz 3-DH3**



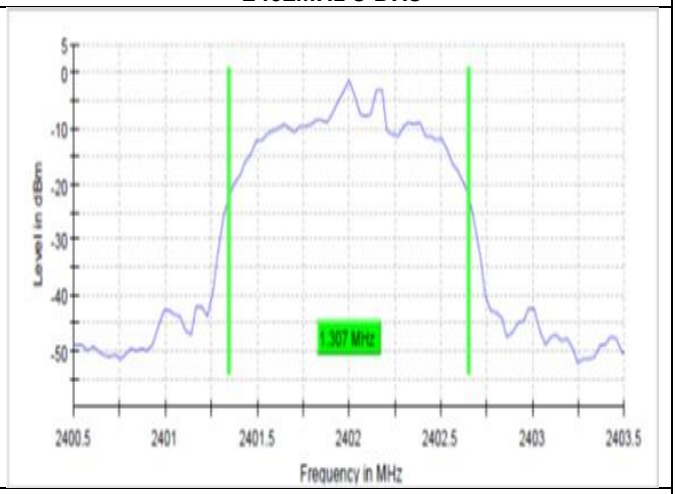
## Emission Bandwidth 20 dB

Test procedure in accordance with ANSI C63.10-2013
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1. Expanded Uncertainty (K=2) < 2%

**2402MHz**

| Data Rate | Bandwidth (MHz) | Band Edge Left (MHz) | Band Edge Right (MHz) | Result |
|---|---|---|---|---|
| DH1 | 0.950496 | 2401.524752 | 2402.475248 | PASS |
| DH3 | 0.980198 | 2401.524752 | 2402.504950 | PASS |
| DH5 | 0.980198 | 2401.524752 | 2402.504950 | PASS |
| 2-DH1 | 1.306930 | 2401.346535 | 2402.653465 | PASS |
| 2-DH3 | 1.306930 | 2401.346535 | 2402.653465 | PASS |
| 2-DH5 | 1.306930 | 2401.346535 | 2402.653465 | PASS |
| 3-DH1 | 1.277227 | 2401.376238 | 2402.653465 | PASS |
| 3-DH3 | 1.306930 | 2401.346535 | 2402.653465 | PASS |
| 3-DH5 | 1.306930 | 2401.346535 | 2402.653465 | PASS |

**2402MHz 3-DH3**

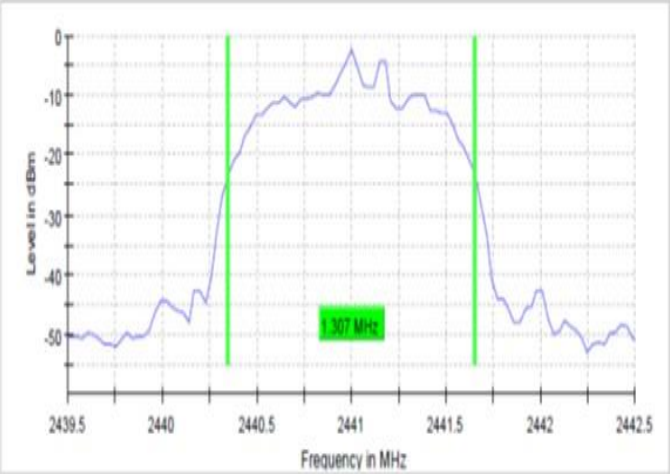



**2402MHz 3-DH3**

**2441MHz**

| Data Rate | Bandwidth (MHz) | Band Edge Left (MHz) | Band Edge Right (MHz) | Result |
|---|---|---|---|---|
| DH1 | 0.950496 | 2440.524752 | 2441.475248 | PASS |
| DH3 | 0.980198 | 2440.524752 | 2441.504950 | PASS |
| DH5 | 0.980198 | 2440.524752 | 2441.504950 | PASS |
| 2-DH1 | 1.306930 | 2440.346535 | 2441.653465 | PASS |
| 2-DH3 | 1.306930 | 2440.346535 | 2441.653465 | PASS |
| 2-DH5 | 1.306930 | 2440.346535 | 2441.653465 | PASS |
| 3-DH1 | 1.277227 | 2440.376238 | 2441.653465 | PASS |
| 3-DH3 | 1.306930 | 2440.346535 | 2441.653465 | PASS |
| 3-DH5 | 1.306930 | 2440.346535 | 2441.653465 | PASS |

**2441MHz 3-DH3**

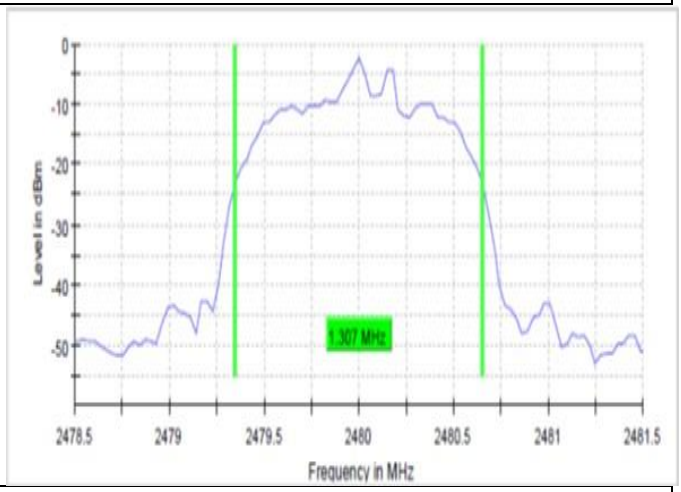



**2441MHz 3-DH3**

**2480MHz**

| Data Rate | Bandwidth (MHz) | Band Edge Left (MHz) | Band Edge Right (MHz) | Result |
|---|---|---|---|---|
| DH1 | 0.950496 | 2479.524752 | 2480.475248 | PASS |
| DH3 | 0.980198 | 2479.524752 | 2480.504950 | PASS |
| DH5 | 0.980198 | 2479.524752 | 2480.504950 | PASS |
| 2-DH1 | 1.306930 | 2479.346535 | 2480.653465 | PASS |
| 2-DH3 | 1.306930 | 2479.346535 | 2480.653465 | PASS |
| 2-DH5 | 1.306930 | 2479.346535 | 2480.653465 | PASS |
| 3-DH1 | 1.277227 | 2479.376238 | 2480.653465 | PASS |
| 3-DH3 | 1.306930 | 2479.346535 | 2480.653465 | PASS |
| 3-DH5 | 1.306930 | 2479.346535 | 2480.653465 | PASS |

**2480MHz 3-DH3**




**2480MHz 3-DH3**

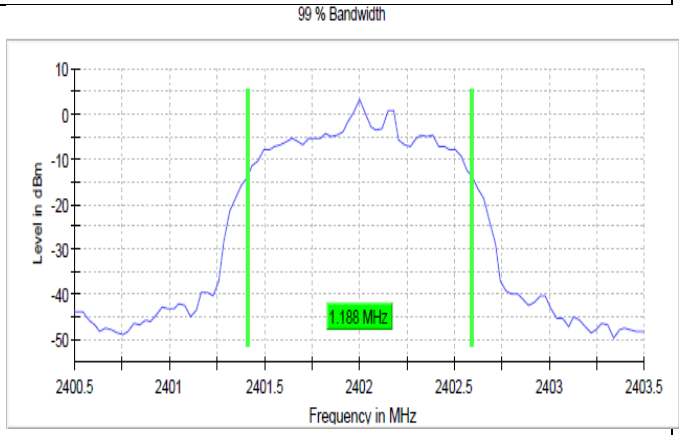
## Occupied Channel Bandwidth 99%

Test procedure in accordance with ANSI C63.10-2013
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1. Expanded Uncertainty (K=2) < 2%

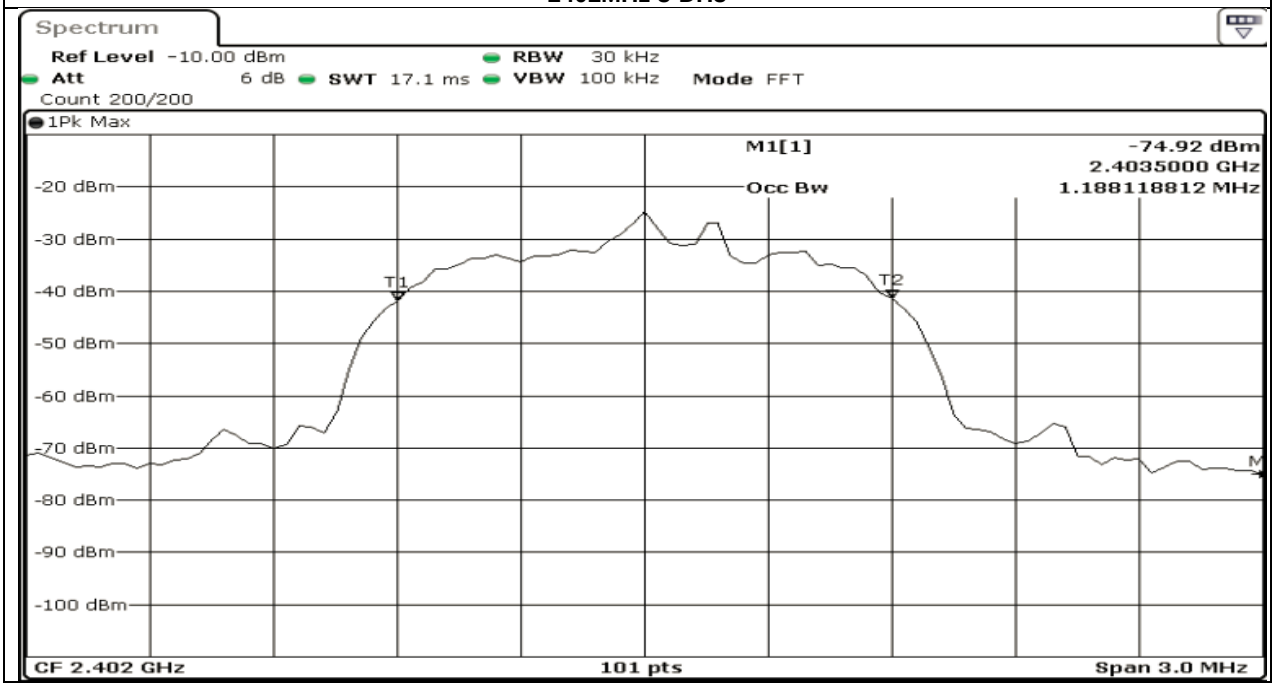
**2402MHz**

| Data Rate | Bandwidth (MHz) | Band Edge Left (MHz) | Band Edge Right (MHz) | Result |
|---|---|---|---|---|
| DH1 | 0.772278 | 2401.613861 | 2402.386139 | PASS |
| DH3 | 0.831684 | 2401.584158 | 2402.415842 | PASS |
| DH5 | 0.861387 | 2401.554455 | 2402.415842 | PASS |
| 2-DH1 | 1.158415 | 2401.405941 | 2402.564356 | PASS |
| 2-DH3 | 1.188118 | 2401.405941 | 2402.594059 | PASS |
| 2-DH5 | 1.188118 | 2401.405941 | 2402.594059 | PASS |
| 3-DH1 | 1.128712 | 2401.435644 | 2402.564356 | PASS |
| 3-DH3 | 1.188118 | 2401.405941 | 2402.594059 | PASS |
| 3-DH5 | 1.188118 | 2401.405941 | 2402.594059 | PASS |

**2402MHz 3-DH3**



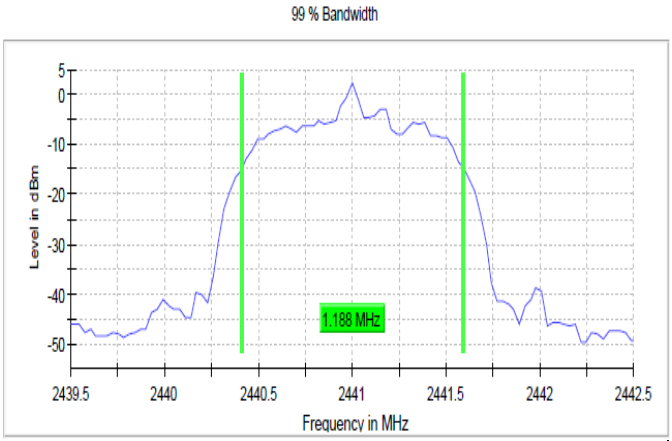

**2402MHz 3-DH3**



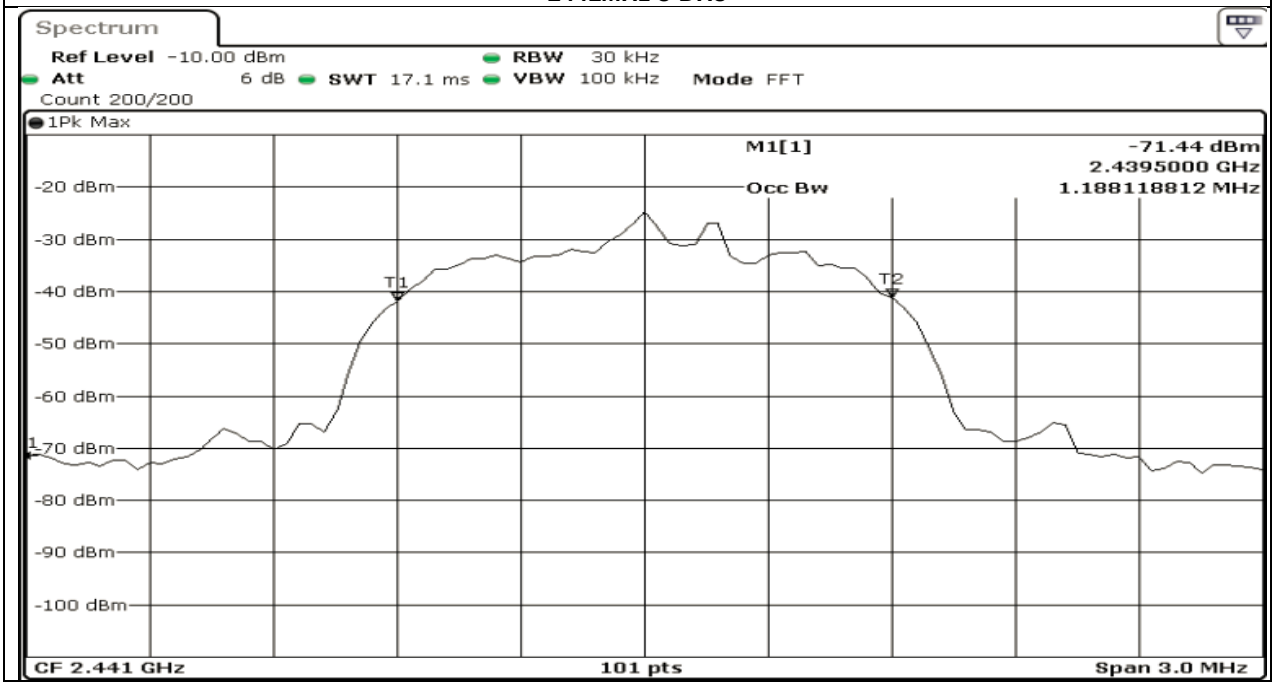
**2441MHz**

| Data Rate | Bandwidth (MHz) | Band Edge Left (MHz) | Band Edge Right (MHz) | Result |
|---|---|---|---|---|
| DH1 | 0.801981 | 2440.613861 | 2441.415842 | PASS |
| DH3 | 0.831684 | 2440.584158 | 2441.415842 | PASS |
| DH5 | 0.831684 | 2440.584158 | 2441.415842 | PASS |
| 2-DH1 | 1.128712 | 2440.435644 | 2441.564356 | PASS |
| 2-DH3 | 1.188118 | 2440.405941 | 2441.594059 | PASS |
| 2-DH5 | 1.188118 | 2440.405941 | 2441.594059 | PASS |
| 3-DH1 | 1.158415 | 2440.435644 | 2441.594059 | PASS |
| 3-DH3 | 1.188118 | 2440.405941 | 2441.594059 | PASS |
| 3-DH5 | 1.188118 | 2440.405941 | 2441.594059 | PASS |

**2441MHz 3-DH3**



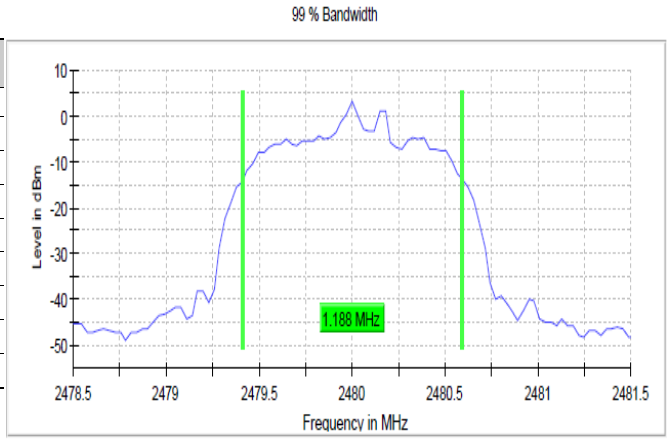

**2441MHz 3-DH3**



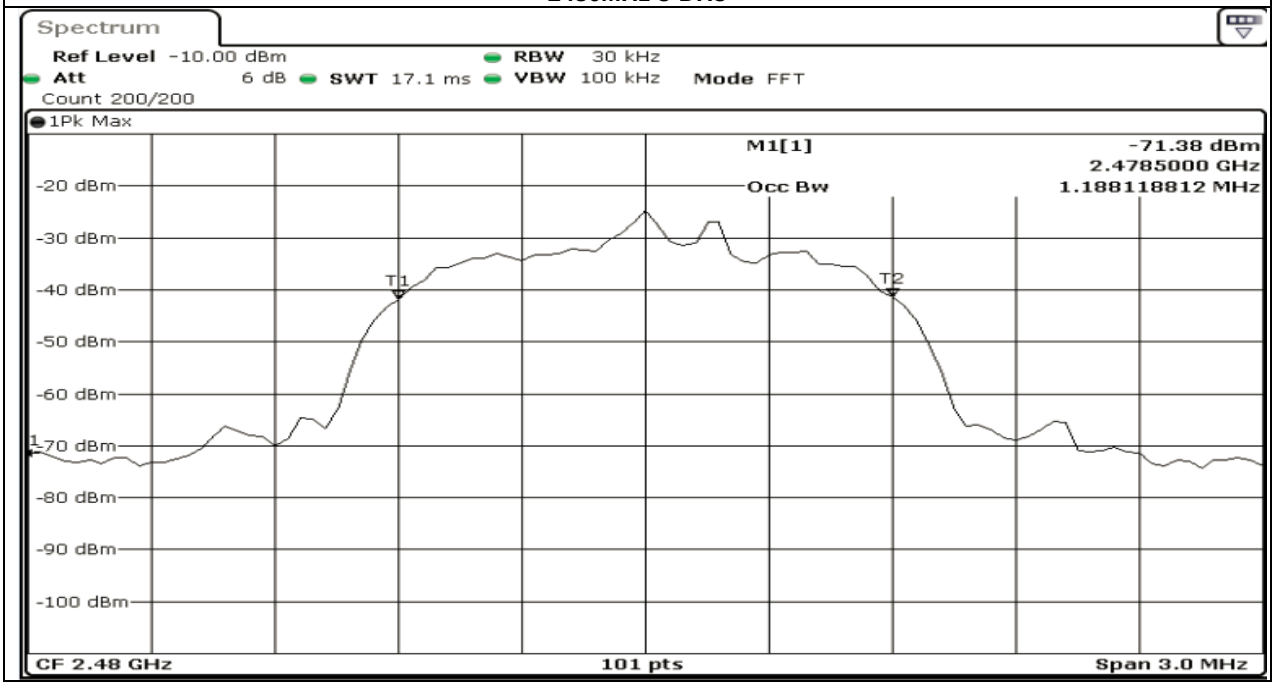
**2480MHz**

| Data Rate | Bandwidth (MHz) | Band Edge Left (MHz) | Band Edge Right (MHz) | Result |
|---|---|---|---|---|
| DH1 | 0.801981 | 2479.613861 | 2480.415842 | PASS |
| DH3 | 0.891090 | 2479.554455 | 2480.445545 | PASS |
| DH5 | 0.831684 | 2479.584158 | 2480.415842 | PASS |
| 2-DH1 | 1.158415 | 2479.405941 | 2480.564356 | PASS |
| 2-DH3 | 1.188118 | 2479.405941 | 2480.594059 | PASS |
| 2-DH5 | 1.188118 | 2479.405941 | 2480.594059 | PASS |
| 3-DH1 | 1.158415 | 2479.435644 | 2480.594059 | PASS |
| 3-DH3 | 1.188118 | 2479.405941 | 2480.594059 | PASS |
| 3-DH5 | 1.188118 | 2479.405941 | 2480.594059 | PASS |

**2480MHz 3-DH3**




**2480MHz 3-DH3**



## Band Edge Low (2402 MHz)

Test procedure in accordance with ANSI C63.10-2013
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1. Expanded Uncertainty (K=2) < 0.8 dB

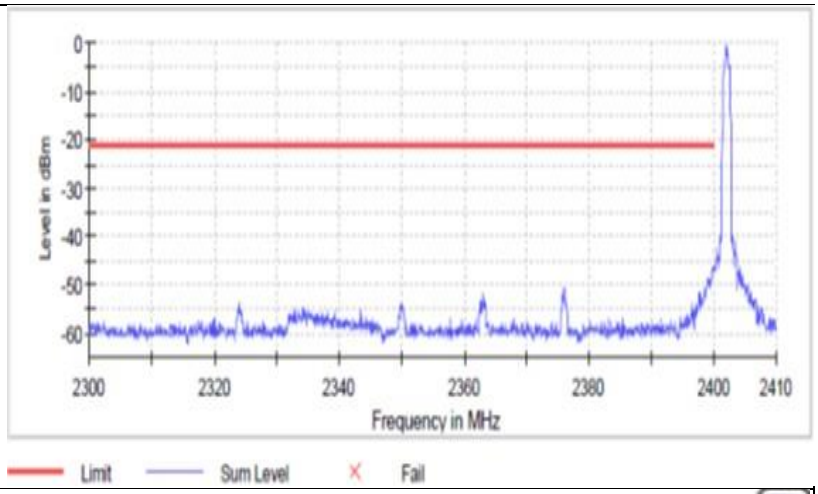
### Inband Peak

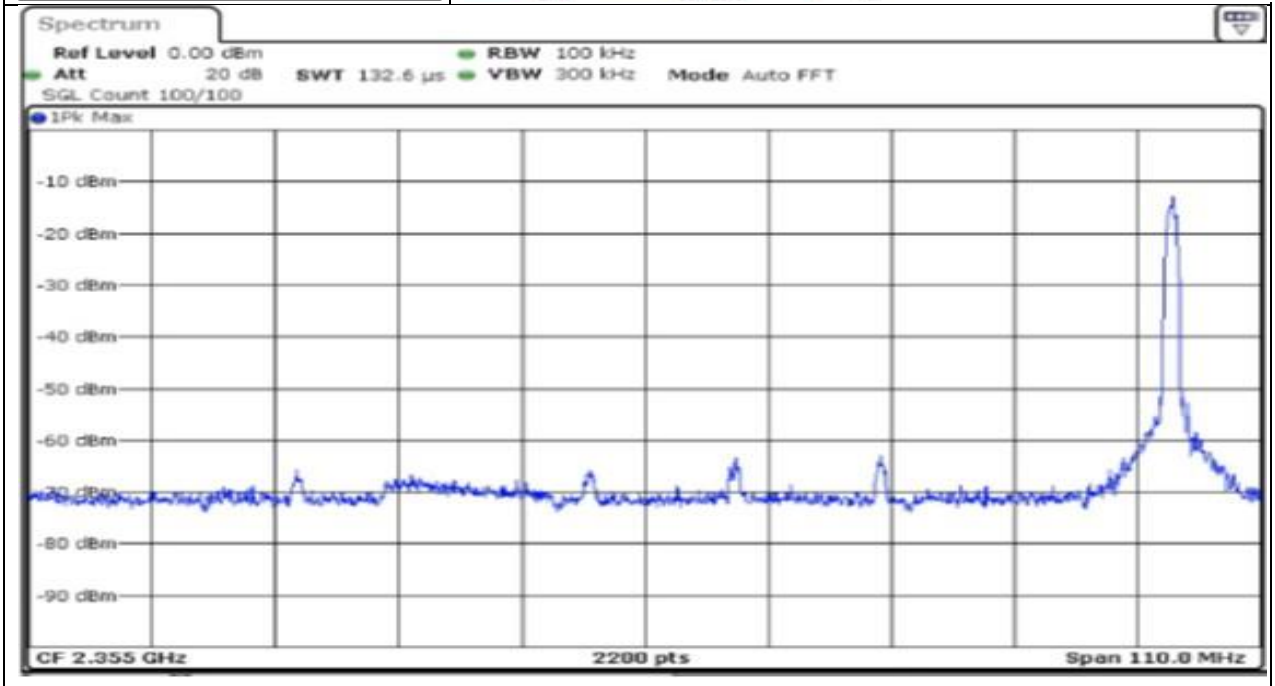
| Data Rate | Frequency (MHz) | Level (dBm) |
|---|---|---|
| DH1 | 2401.975000 | -1.0 |
| DH3 | 2402.025000 | -1.1 |
| DH5 | 2401.975000 | -1.0 |
| 2-DH1 | 2401.975000 | -1.0 |
| 2-DH3 | 2401.975000 | -1.0 |
| 2-DH5 | 2401.975000 | -1.0 |
| 3-DH1 | 2401.975000 | -1.0 |
| 3-DH3 | 2401.975000 | -1.0 |
| 3-DH5 | 2402.025000 | -1.0 |

### 2402 MHz 3-DH3

**Measurement**

| Frequency (MHz) | Level (dBm) | Margin (dB) | Limit (dBm) | Result |
|---|---|---|---|---|
| 2399.925000 | -46.5 | 25.5 | -21.0 | PASS |
| 2399.975000 | -46.5 | 25.5 | -21.0 | PASS |
| 2399.725000 | -46.6 | 25.7 | -21.0 | PASS |
| 2399.775000 | -46.7 | 25.7 | -21.0 | PASS |
| 2399.875000 | -47.0 | 26.1 | -21.0 | PASS |
| 2399.675000 | -47.1 | 26.1 | -21.0 | PASS |
| 2399.825000 | -47.2 | 26.3 | -21.0 | PASS |
| 2399.625000 | -48.4 | 27.4 | -21.0 | PASS |
| 2399.025000 | -48.7 | 27.7 | -21.0 | PASS |
| 2398.975000 | -48.7 | 27.7 | -21.0 | PASS |
| 2399.075000 | -48.8 | 27.8 | -21.0 | PASS |
| 2399.375000 | -48.8 | 27.9 | -21.0 | PASS |
| 2399.125000 | -48.9 | 27.9 | -21.0 | PASS |
| 2399.575000 | -49.1 | 28.1 | -21.0 | PASS |
| 2399.525000 | -49.1 | 28.2 | -21.0 | PASS |



## Band Edge High (2480 MHz)

Test procedure in accordance with ANSI C63.10-2013
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1. Expanded Uncertainty (K=2) < 0.8 dB

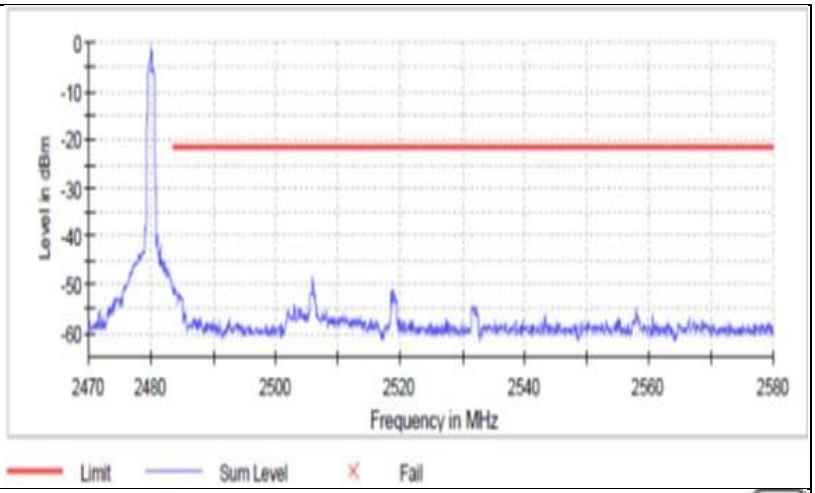
### Inband Peak

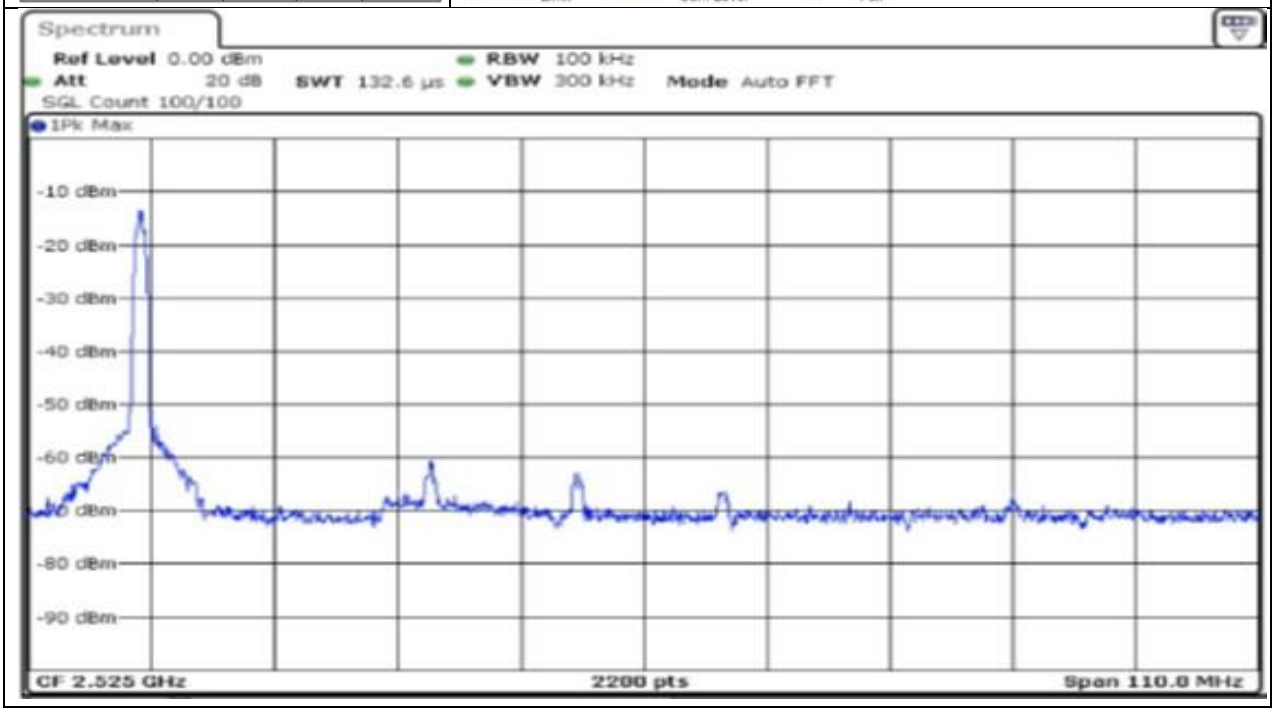
| Data Rate | Frequency (MHz) | Level (dBm) |
|---|---|---|
| DH1 | 2479.975000 | -1.6 |
| DH3 | 2480.025000 | -1.7 |
| DH5 | 2480.025000 | -1.7 |
| 2-DH1 | 2479.975000 | -1.6 |
| 2-DH3 | 2479.975000 | -1.6 |
| 2-DH5 | 2479.975000 | -1.6 |
| 3-DH1 | 2480.025000 | -1.6 |
| 3-DH3 | 2479.975000 | -1.6 |
| 3-DH5 | 2479.975000 | -1.6 |

### 2480 MHz 3-DH3

**Measurement**

| Frequency (MHz) | Level (dBm) | Margin (dB) | Limit (dBm) | Result |
|---|---|---|---|---|
| 2506.025000 | -48.8 | 27.2 | -21.6 | PASS |
| 2505.975000 | -48.9 | 27.3 | -21.6 | PASS |
| 2506.175000 | -49.4 | 27.8 | -21.6 | PASS |
| 2506.125000 | -49.6 | 28.0 | -21.6 | PASS |
| 2506.075000 | -50.0 | 28.4 | -21.6 | PASS |
| 2483.825000 | -50.4 | 28.8 | -21.6 | PASS |
| 2483.775000 | -50.4 | 28.8 | -21.6 | PASS |
| 2483.525000 | -50.6 | 29.0 | -21.6 | PASS |
| 2483.875000 | -50.8 | 29.1 | -21.6 | PASS |
| 2505.925000 | -50.8 | 29.2 | -21.6 | PASS |
| 2483.725000 | -51.0 | 29.4 | -21.6 | PASS |
| 2519.025000 | -51.0 | 29.4 | -21.6 | PASS |
| 2483.575000 | -51.1 | 29.5 | -21.6 | PASS |
| 2518.975000 | -51.1 | 29.5 | -21.6 | PASS |
| 2505.875000 | -51.2 | 29.6 | -21.6 | PASS |



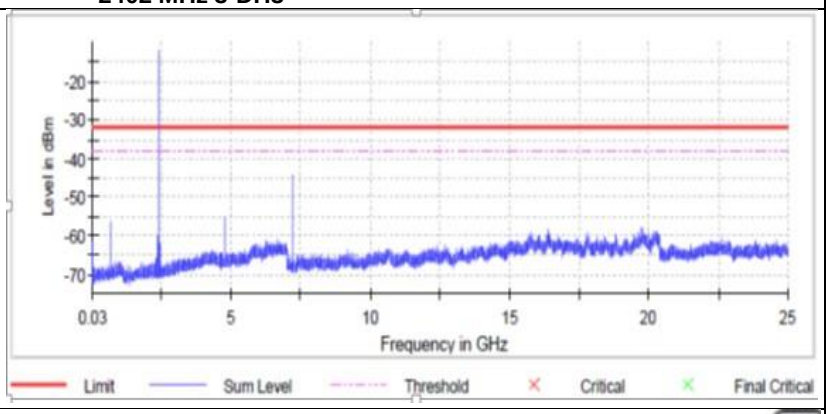
## Conducted Spurious Emissions

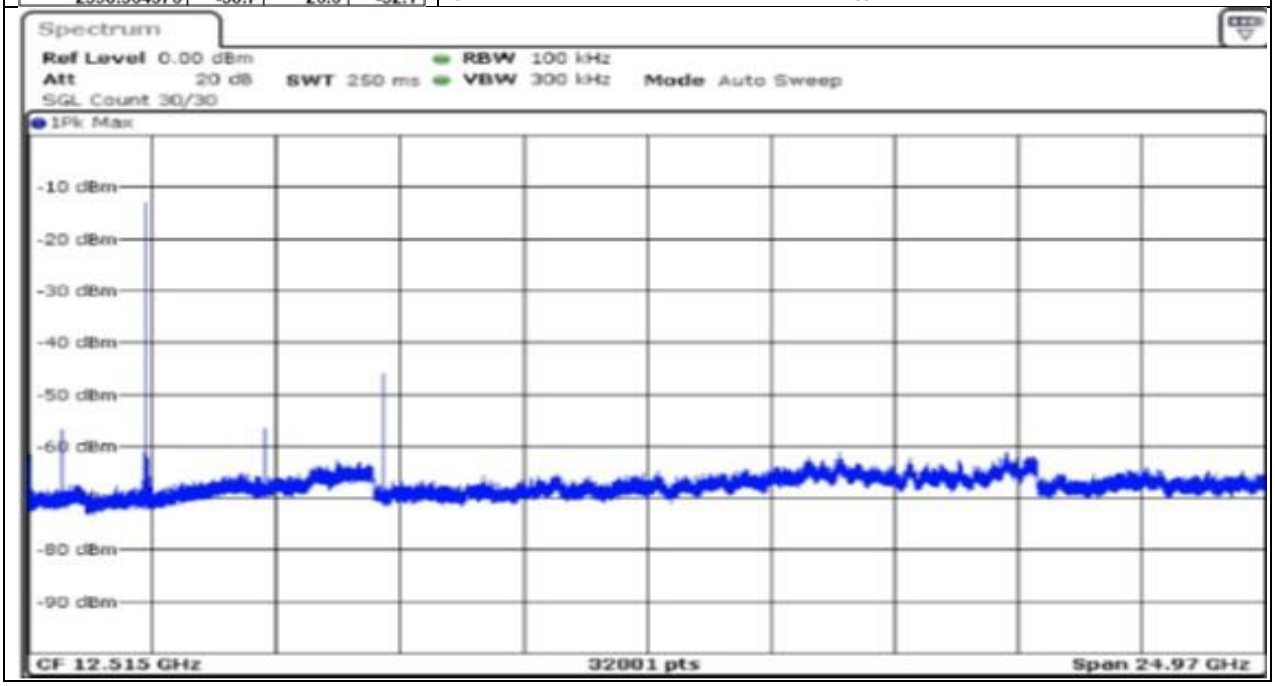
Test procedure in accordance with ANSI C63.10-2013
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1. Expanded Uncertainty (K=2) < 0.8 dB

**2402 MHz 3-DH3**

### Pre Measurements

| Frequency (MHz) | Level (dBm) | Margin (dB) | Limit (dBm) |
|---|---|---|---|
| 7205.919659 | -44.2 | 12.1 | -32.1 |
| 7206.699947 | -48.5 | 16.4 | -32.1 |
| 7205.139371 | -53.6 | 21.6 | -32.1 |
| 2399.344864 | -55.0 | 22.9 | -32.1 |
| 4804.192838 | -55.3 | 23.2 | -32.1 |
| 702.998500 | -56.4 | 24.3 | -32.1 |
| 19772.459767 | -58.0 | 25.9 | -32.1 |
| 699.877348 | -58.1 | 26.0 | -32.1 |
| 19757.634293 | -58.2 | 26.1 | -32.1 |
| 19771.679479 | -58.2 | 26.1 | -32.1 |
| 16412.539139 | -58.3 | 26.2 | -32.1 |
| 19776.361207 | -58.3 | 26.3 | -32.1 |
| 19780.262648 | -58.4 | 26.4 | -32.1 |
| 19786.504953 | -58.7 | 26.6 | -32.1 |
| 2398.564576 | -58.7 | 26.6 | -32.1 |

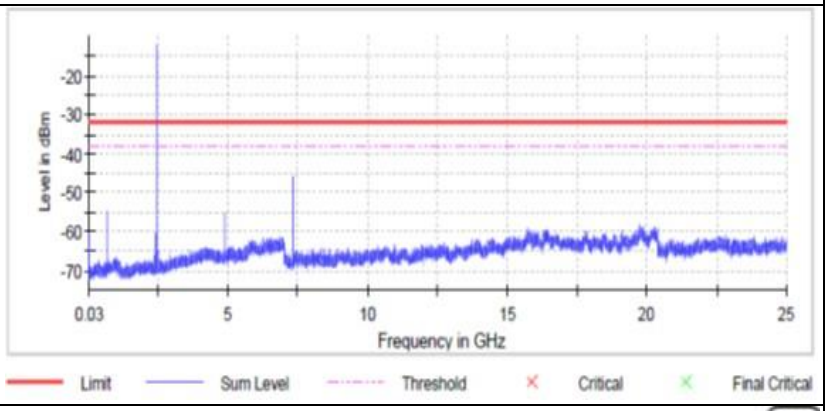


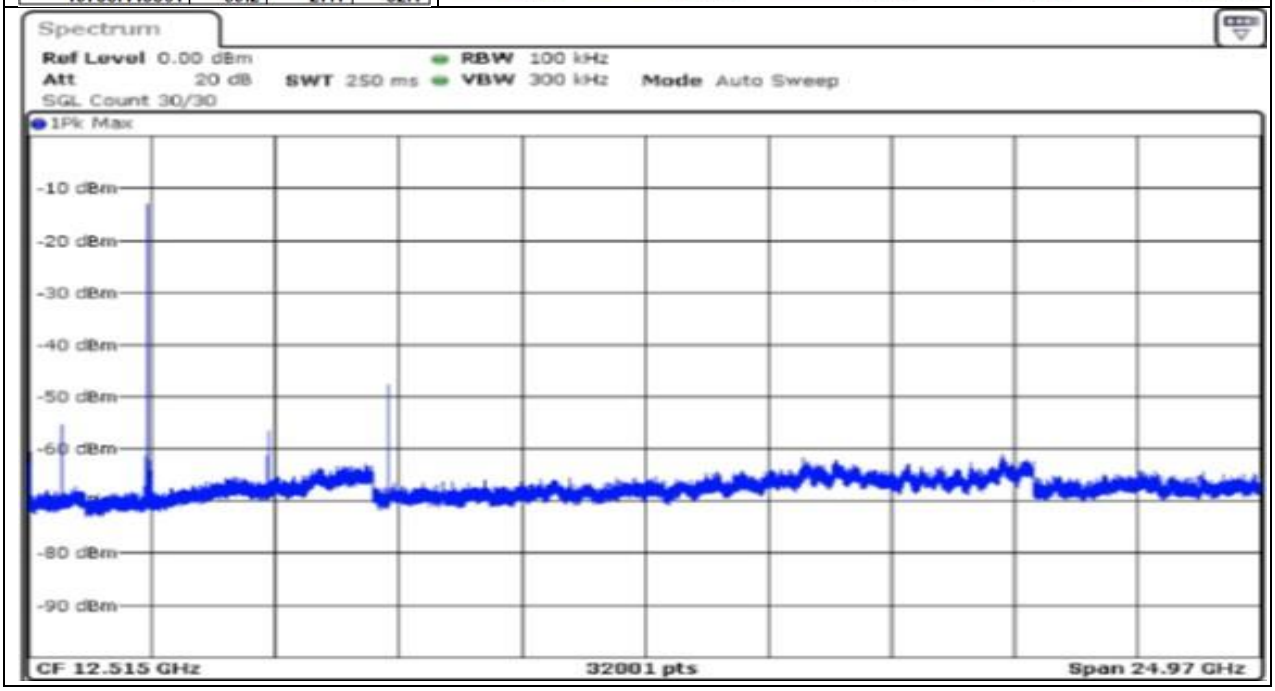



**2441 MHz 3-DH3**

## Pre Measurements

| Frequency (MHz) | Level (dBm) | Margin (dB) | Limit (dBm) |
|---|---|---|---|
| 7322.962876 | -45.9 | 13.8 | -32.1 |
| 7322.182588 | -50.4 | 18.3 | -32.1 |
| 7323.743164 | -50.8 | 18.8 | -32.1 |
| 702.998500 | -54.9 | 22.8 | -32.1 |
| 4882.221649 | -55.2 | 23.1 | -32.1 |
| 699.877348 | -56.1 | 24.1 | -32.1 |
| 19754.513140 | -57.8 | 25.7 | -32.1 |
| 19769.338614 | -58.7 | 26.6 | -32.1 |
| 703.778788 | -58.7 | 26.7 | -32.1 |
| 19735.786225 | -58.9 | 26.8 | -32.1 |
| 20268.723009 | -58.9 | 26.9 | -32.1 |
| 19720.180463 | -59.0 | 26.9 | -32.1 |
| 19725.642480 | -59.0 | 26.9 | -32.1 |
| 19772.459767 | -59.2 | 27.1 | -32.1 |
| 19733.445361 | -59.2 | 27.1 | -32.1 |



**2480 MHz 3-DH3**

**Pre Measurements**

| Frequency (MHz) | Level (dBm) | Margin (dB) | Limit (dBm) |
|---|---|---|---|
| 7440.006094 | -48.3 | 15.9 | -32.4 |
| 7440.786382 | -52.7 | 20.3 | -32.4 |
| 7439.225805 | -52.8 | 20.4 | -32.4 |
| 702.998500 | -56.3 | 23.9 | -32.4 |
| 4960.250461 | -57.2 | 24.9 | -32.4 |
| 703.778788 | -57.7 | 25.3 | -32.4 |
| 19756.854005 | -57.9 | 25.5 | -32.4 |
| 19868.435205 | -58.1 | 25.7 | -32.4 |
| 19808.353020 | -58.1 | 25.7 | -32.4 |
| 19708.476141 | -58.6 | 26.2 | -32.4 |
| 19756.073716 | -58.7 | 26.3 | -32.4 |
| 20217.223993 | -58.7 | 26.3 | -32.4 |
| 19772.459767 | -58.9 | 26.5 | -32.4 |
| 19795.868410 | -58.9 | 26.5 | -32.4 |
| 20164.944689 | -58.9 | 26.5 | -32.4 |