



RADIO TEST REPORT

For

MODEL NO. 1710

FCC ID: C3K1710

IC ID: 3048A-1710

Test Report No. R-TR188-FCCIC-BTLE-1

Issue Date: 09/08/2015

FCC CFR47 Part 15 Subpart C
Industry Canada RSS-247 Issue 1

Prepared by

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1 Record of Revisions

[illegible]

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Test Report Attestation

Microsoft Corporation**Model:** 1710**FCC ID:** C3K1710**IC ID:** 3048A-1710**Applicable Standards**

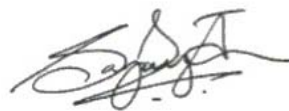
Specification	Test Result
FCC CFR47 Rule Parts 15.207, 15.209, 15.247	Pass
Industry Canada RSS-247 Issue 1	Pass

Microsoft EMC Laboratory attests that the product model identified in this report has been tested to and meets the requirements identified in the above standards. The test results in this report solely pertain to the specific sample tested, under the conditions and operating modes as provided by the customer.

This report shall not be used to claim product certification, approval, or endorsement by A2LA or any agency of any Government. Reproduction, duplication or publication of extracts from this test report is prohibited and requires prior written approval of Microsoft EMC Laboratory.



Written By: Daniel Salinas
Radio Test Engineer



Reviewed/ Issued By: Sajay Jose
EMC/RF Compliance Lab Manager

2 Deviations from Standards

None.

3 Facilities and Accreditations

3.1 Test Facility

All test facilities used to collect the test data are located at
Microsoft EMC Laboratory,
17760 NE 67th Ct,
Redmond WA, 98052, USA

3.2 Accreditations

The lab is established and follows procedures as outlined in IEC/ISO 17025 and A2LA accreditation requirements.

A2LA Accredited Testing Certificate Number: 3472.01

FCC Registration Number: US1141

IC Site Registration Numbers: 3048A-1, 3048A-2, 3048A-3, 3048A-4

3.3 Test Equipment

The site and related equipment are constructed in conformance with the requirements of ANSI C63.4, CISPR 16-1-1 and other equivalent applicable standards. Test site requirements for measurements above 1 GHz are in accordance with ANSI C63.4:2009. ANSI C63.10:2013 and the appropriate KDB test methods were followed.

The calibrations of the measuring instruments, including any accessories that may affect such calibration, are checked frequently to assure their accuracy. Adjustments are made and correction factors applied in accordance with instructions contained in the user manual for the measuring equipment.

4 Measurement Uncertainty

The following measurement uncertainty levels have been estimated for tests performed on the product, as specified in CISPR 16-4-2. This represents an expanded uncertainty expressed at 95% confidence level using a coverage factor $k=2$.

Expanded uncertainty calculations are available upon request.

Test item	Value (dB)
Radiated disturbance (30 MHz to 1 GHz)	6.01
Radiated disturbance (1 GHz to 18 GHz)	4.80

5 Product Description

Company Name:	Microsoft Corporation
Address:	One Microsoft Way
City, State, Zip:	Redmond, WA 98052-6399
Customer Contact:	Sahithi Kandula
Functional Description of the EUT:	Wireless input accessory device
Model:	1710
FCC ID:	C3K1710
IC ID:	3048A-1710
Radio Description:	BT LE (2402- 2480 MHz)
Modulation:	GFSK
Antenna Type and Gain:	Internal -2.41 dBi Gain
EUT Classification:	DTS
Equipment Design State:	EV2/Production
Equipment Condition:	Good
Test Sample Details:	SN: R-188-061715-05 - Conducted SN: 0007061521574 - Radiated

5.1 Test Configurations

The EUT was preprogrammed to transmit continuously in GFSK mode. Channel numbers 0, 19 and 39 are used as the Low/Mid/High channels of test.

When in Low energy mode operation, the Bluetooth transmitter hops pseudo-randomly between 40 channels, three of which are “advertising channels”. Operation on the advertising channels does not qualify the EUT as a FHSS, and so the EUT is certified as a DTS device. The data shown in this report reflects the device when it transmits on its advertising channels.

5.2 Environmental Conditions

Ambient air temperature of the test site was within the range of 10 °C to 40 °C (50 °F to 104 °F) unless the EUT specified testing over a different temperature range. Humidity levels were in the range of 10% to 90% relative humidity. Testing conditions were within tolerance and any deviations required from the EUT are reported.

5.3 Antenna Requirements

The antennas are permanently attached and there are no provisions for connection to an external antenna.

5.4 Equipment Modifications

No modifications were made during testing.

5.5 Dates of Testing

Testing was performed on June 19th – 23rd, July 10th and July 16th 2015.

6 Test Results Summary

Test Description	FCC CFR 47/ IC Rule Part	Limit	Test Result
6dB Bandwidth	15.247 (a)(2) RSS-247 [5.2]	> 500kHz	Pass
Output Power	15.247 (b)(3) RSS-247 [5.4]	< 1 Watt	Pass
Power Spectral Density	15.247 (e) RSS-247 [5.2]	< 8dBm/3kHz	Pass
Conducted Band Edge/Spurious Emissions	15.247 (d) RSS-247 [5.5]	< 20dBc	Pass
Radiated Spurious Emissions/ Restricted Band Emissions	15.205, 15.209 RSS-247 [5.5], RSS-Gen [8.9]	FCC CFR 47 15.209 limits RSS-Gen [8.9]	Pass
AC Power line Conducted Emissions	15.207 RSS-Gen [8.8]	FCC CFR 47 15.207 limits RSS-Gen [8.8]	N/A *

* Note1: The device is battery powered and cannot be directly/indirectly connected to an AC outlet.

7 Test Equipment List

The site and related equipment are in conformance with the requirements of ANSI C63.4, CISPR 16-1-1, and other equivalent applicable standards.

Manufacturer	Description	Model #	Asset #	Calibration/ Verification Due
Agilent	Spectrum Analyzer	N9030A	RF-011	2/29/2016
Rohde & Schwarz	EMI Test Receiver	ESU40	RF-012	4/12/2016
Rohde & Schwarz	Signal Analyzer	FSV40	RF-245	4/10/2016
Sunol Sciences	Antenna - Broadband Hybrid	JB6	EMC-008	3/4/2016
ETS-Lindgren	Antenna	3117	RF-137	3/29/2016
ETS-Lindgren	Antenna - Standard Gain	3160-09	RF-179	4/30/2016
Rohde & Schwarz	Pre-Amp	TS-PR26	RF-042	1/6/2016
Maturo	Antenna Mast	TAM4.0	RF-225	N/A
Maturo	Antenna Tower Controller	NCD	RF-002	N/A
Sunol Sciences	System Controller	SC110V	RF-001	N/A
Rohde & Schwarz	Switch and Control Unit	OSP130	RF-018	1/6/2016
Rohde & Schwarz	Switch and Control Unit	OSP150	RF-019	1/6/2016
Rohde & Schwarz	Signal Generator	SMB 100A	RF-190	11/5/2015
N/A	RF Cable	N/A	RF-332	1/6/2016
Madge Tech	THP Monitor	PRH Temp 2000	EMC-681	11/5/2015
Rohde & Schwarz	Software	EMC-32 V9.15	N/A	N/A

8 Test Site Description

8.1 Radiated Emissions Test Site

Radiated measurements were performed in a 3m semi-anechoic chamber, which fully meets NSA requirements for the frequency range of 30MHz to 1000MHz.

An antenna mast is used to adjust the height of the measurement antenna and a turntable is used to adjust the EUT azimuth. A non-conducting 1m x 1.5m x 80cm table was installed on the turntable to support the EUT. For measurements below 1 GHz, the antenna height was varied from 1 meter to 4 meters and the turn table rotated 360 degrees to determine the highest emissions.

Measurements above 1 GHz were performed with a device positioner, which supported the EUT 150 cm above the ground plane. The measurement antenna remained fixed at 150 cm while the device positioner and turntable rotated the EUT about its orthogonal axis to investigate emissions. A 2.4m x 2.4m absorber configuration was used for measurements from 1 to 18 GHz in accordance with ANSI C63.4:2009.

The EUT and its support equipment were exercised and cabling manipulated to maximize each emission.

For radiated measurements below 1GHz, linearly polarized broadband antennas were used. Radiated emissions above 1GHz were performed using horn antennas.

8.2 Antenna port conducted measurements

All antenna port conducted measurements were performed on a bench-top setup consisting of a spectrum analyzer, power meter (as necessary), splitters/combiners (as necessary), attenuators, and pre-characterized RF cables.

The correction factors between the EUT and the Spectrum Analyzer is added internally in the Analyzer settings. The plots displayed accounts for these correction factors.

8.3 Test Setup Diagrams

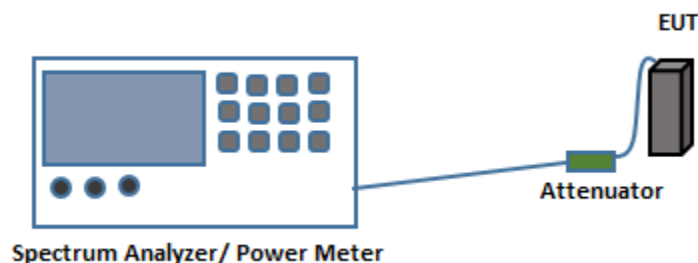


Fig.1. Test Setup for Antenna port conducted measurements

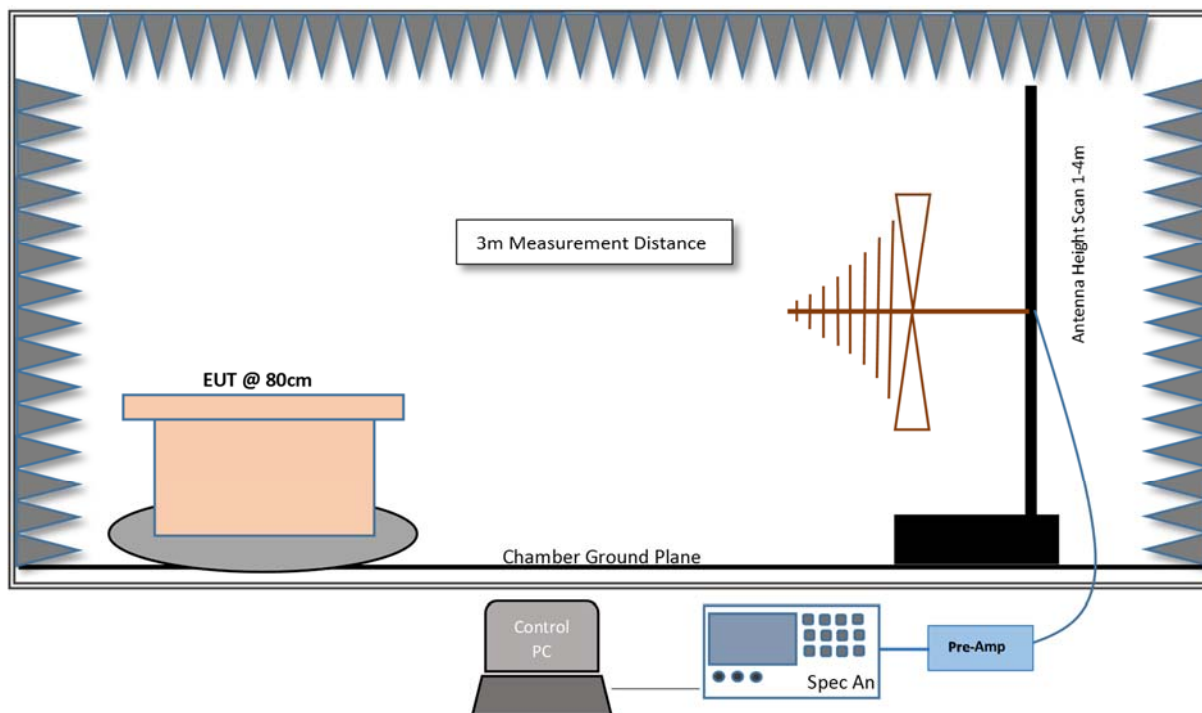


Fig.2. Test Setup for Radiated measurements in 30MHz- 1GHz Range

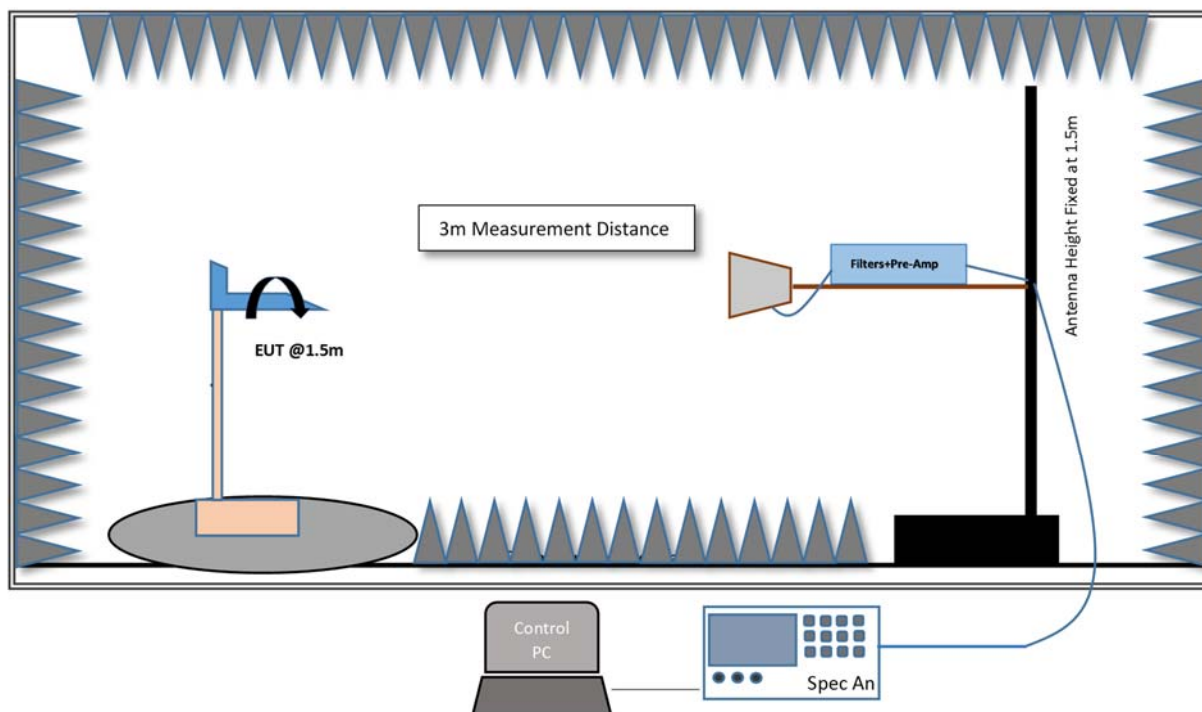


Fig.3. Test Setup for Radiated measurements in 1GHz- 18GHz Range

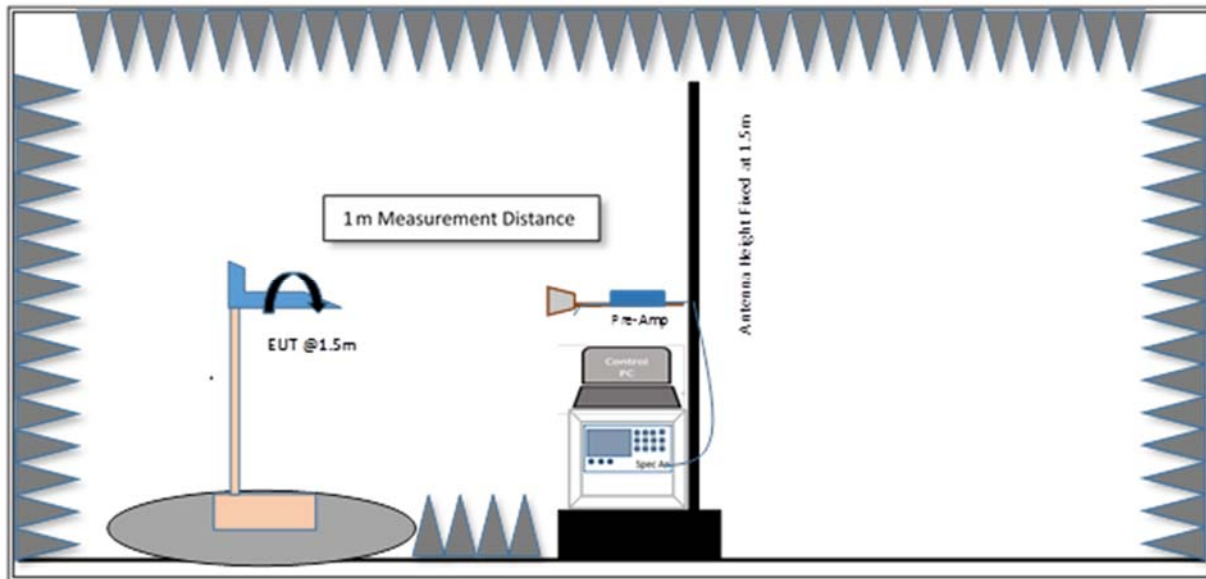


Fig.4. Test Setup for Radiated measurements >18GHz

9 Test Results- Conducted

9.1 6-dB Bandwidth

9.1.1 Test Requirement:

FCC CFR 47 Rule Part 15.247 (a)(2)

Industry Canada RSS-247 [5.2]

9.1.2 Test Method:

Measurements were performed according to the procedure defined in KDB 558074- Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 V03R02 and ANSI C63.10 2013.

Spectrum Analyzer settings:

RBW= 100 kHz

VBW= 300 kHz

Trace Mode= Peak Detector (Max Hold)

Sweep time= Auto

The in-built functionality of the Spectrum Analyzer is used to measure the 6-dB bandwidth.

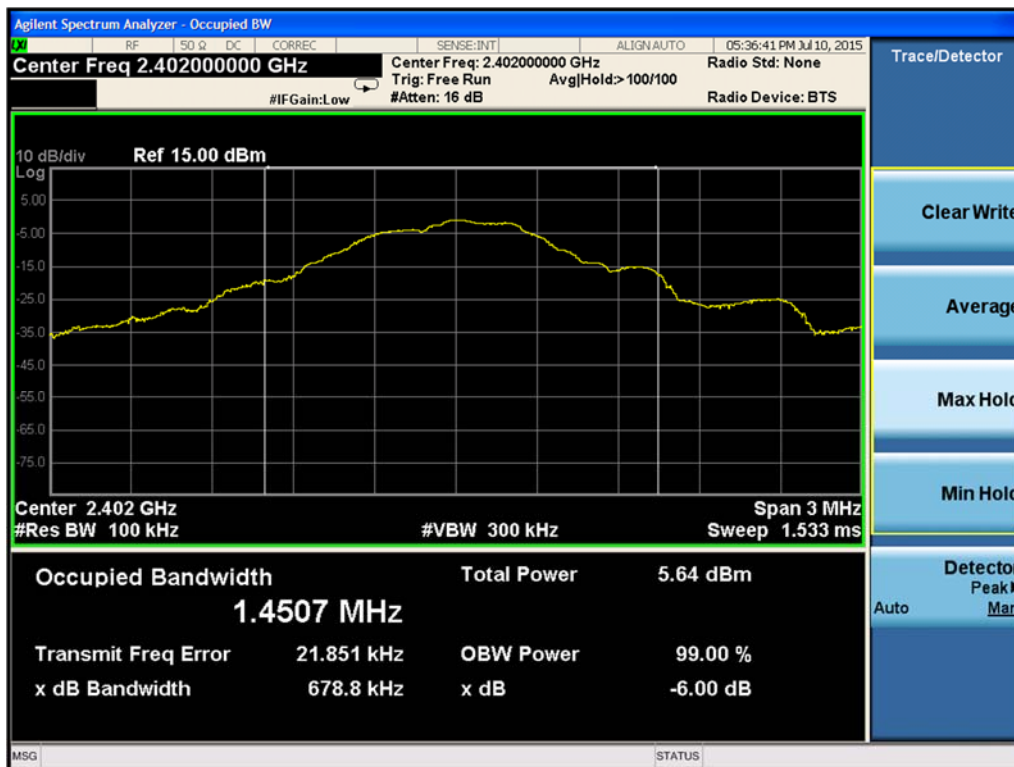
9.1.3 Limits:

The 6-dB bandwidth shall be at least 500 kHz

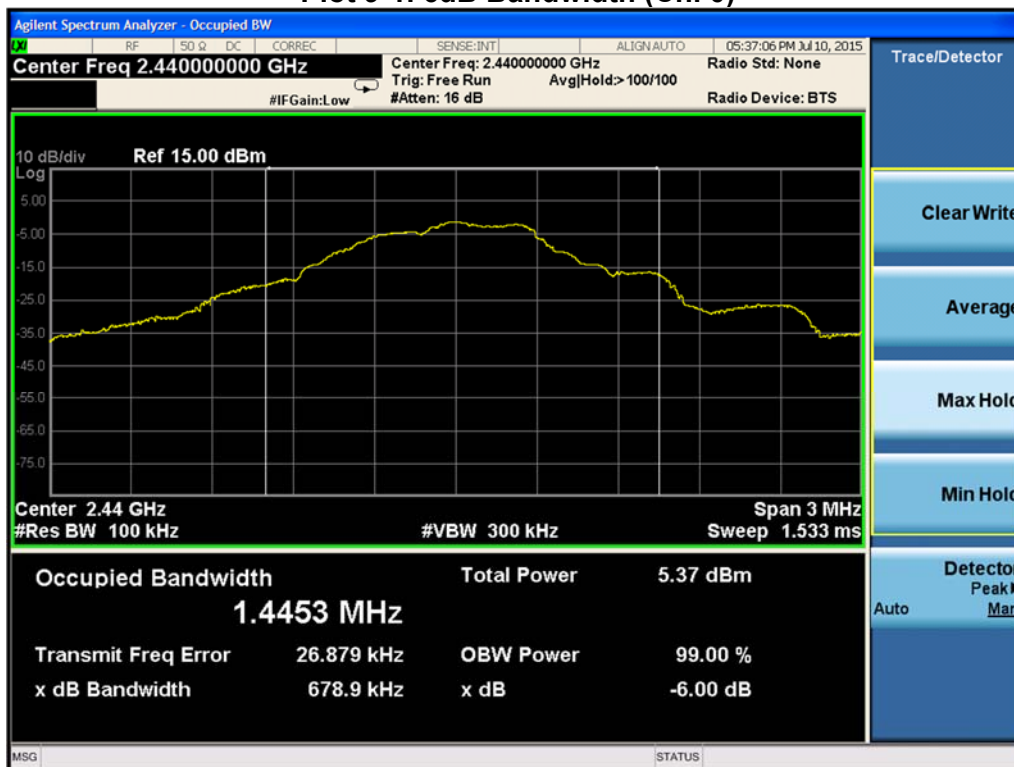
9.1.4 Test Results:

Frequency (MHz)	Test Mode	Channel No.	6dB Bandwidth (kHz)	Limit (kHz)	Result
2402	BT LE	0	678.8	>500	PASS
2440	BT LE	19	678.9	>500	PASS
2480	BT LE	39	696.3	>500	PASS

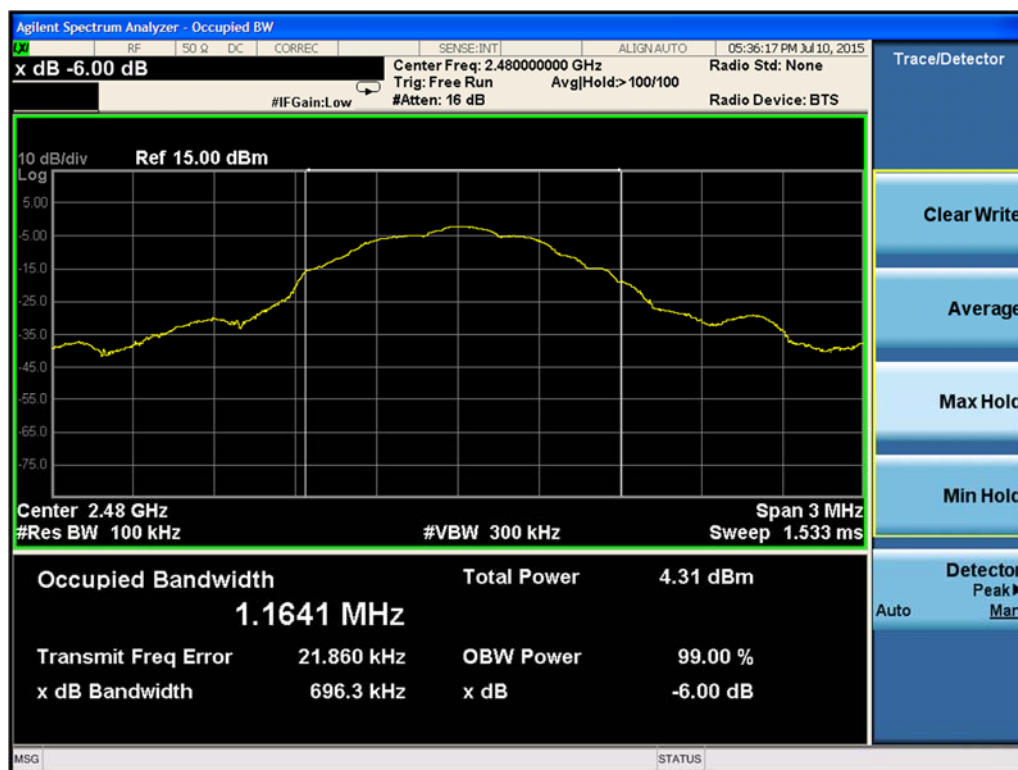
9.1.5 Test Data:



Plot 9-1. 6dB Bandwidth (Ch. 0)



Plot 9-2. 6dB Bandwidth (Ch. 19)



Plot 9-3. 6dB Bandwidth (Ch. 39)

9.2 Output Power

9.2.1 Test Requirement:

FCC CFR 47 Rule Part 15.247 (b)(3)

Industry Canada RSS-247 [5.4]

9.2.2 Test Method:

Measurements were performed according to the procedure defined in KDB 558074- Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 V03R02 and ANSI C63.10 2013.

Spectrum Analyzer settings:

Peak Power:

RBW= 1 MHz

VBW= 3 MHz

Trace Mode= Peak Detector (Max Hold)

Sweep time= Auto

Span= 3 MHz

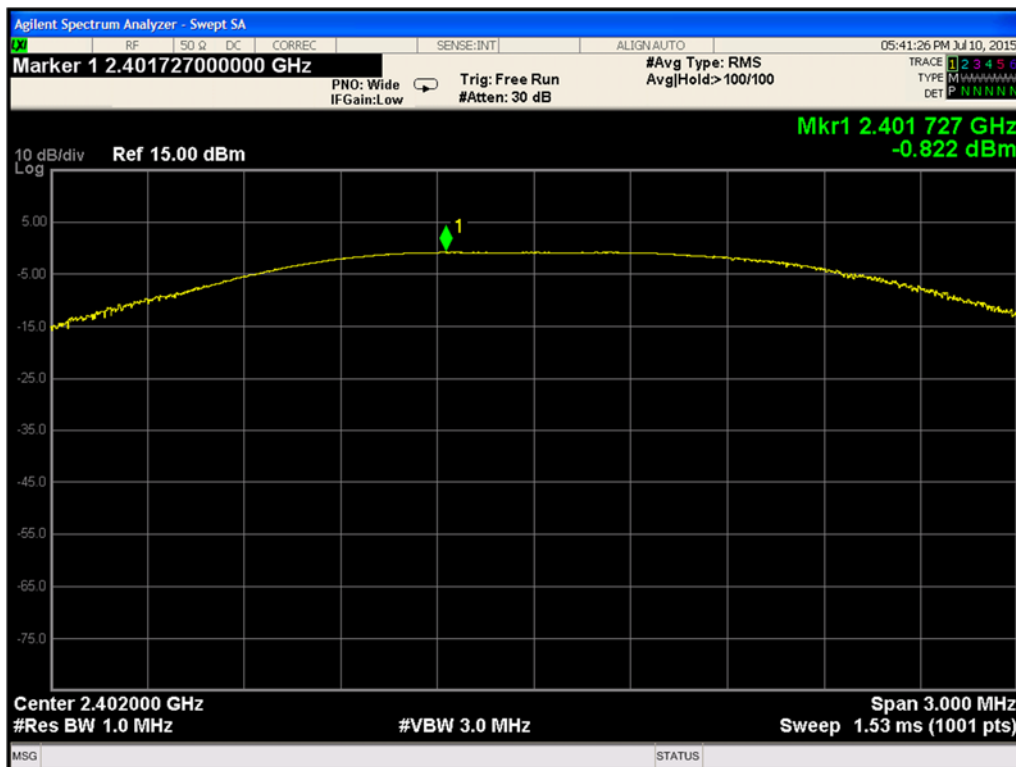
9.2.3 Limits:

The maximum permissible peak output power is 30 dBm (1 W)

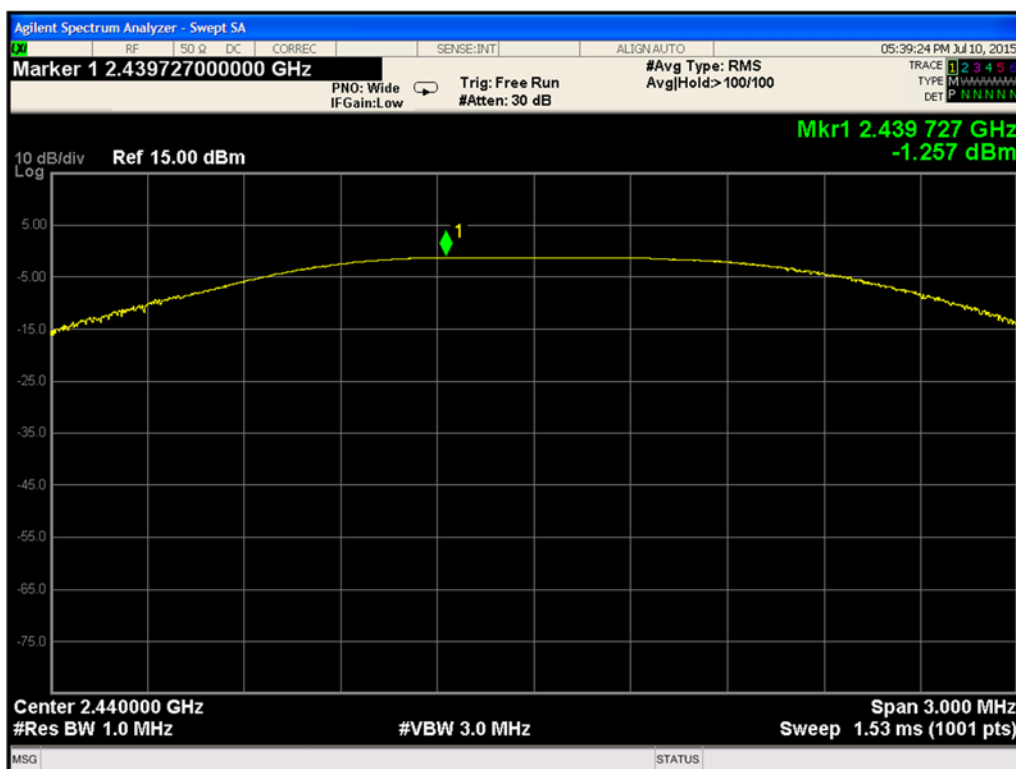
9.2.4 Test Results:

Frequency (MHz)	Test Mode	Channel No.	Peak Power (dBm)	Peak Power (W)	Result
2402	BT LE	0	-0.82	0.001	PASS
2440	BT LE	19	-1.26	0.001	PASS
2480	BT LE	39	-1.94	0.001	PASS

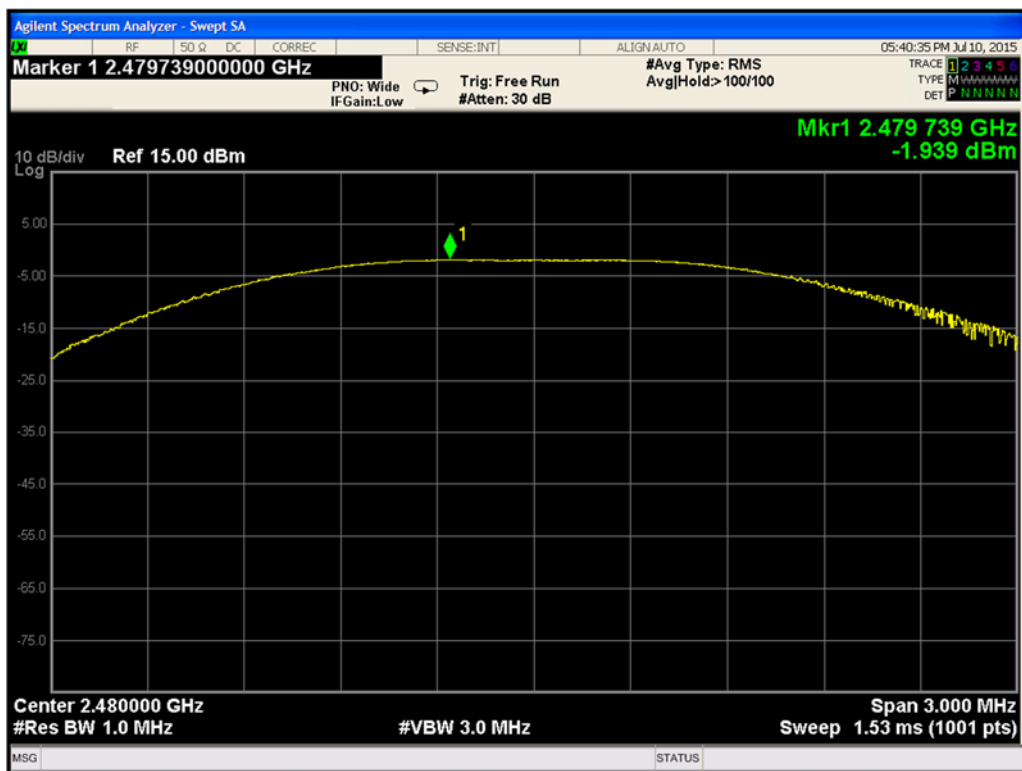
9.2.5 Test Data:



Plot 9-5. Peak Power (Ch. 0)



Plot 9-7. Peak Power (Ch. 19)



Plot 9-9. Peak Power (Ch. 39)

9.3 Peak Power Density

9.3.1 Test Requirement:

FCC CFR 47 Rule Part 15.247 (e)

Industry Canada RSS-247 [5.2]

9.3.2 Test Method:

Measurements were performed according to the procedure defined in KDB 558074- Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 V03R02 and ANSI C63.10 2013.

Spectrum Analyzer settings:

RBW= 100 kHz

VBW= 300 kHz

Trace Mode= Peak Detector (Max Hold)

Sweep time= Auto

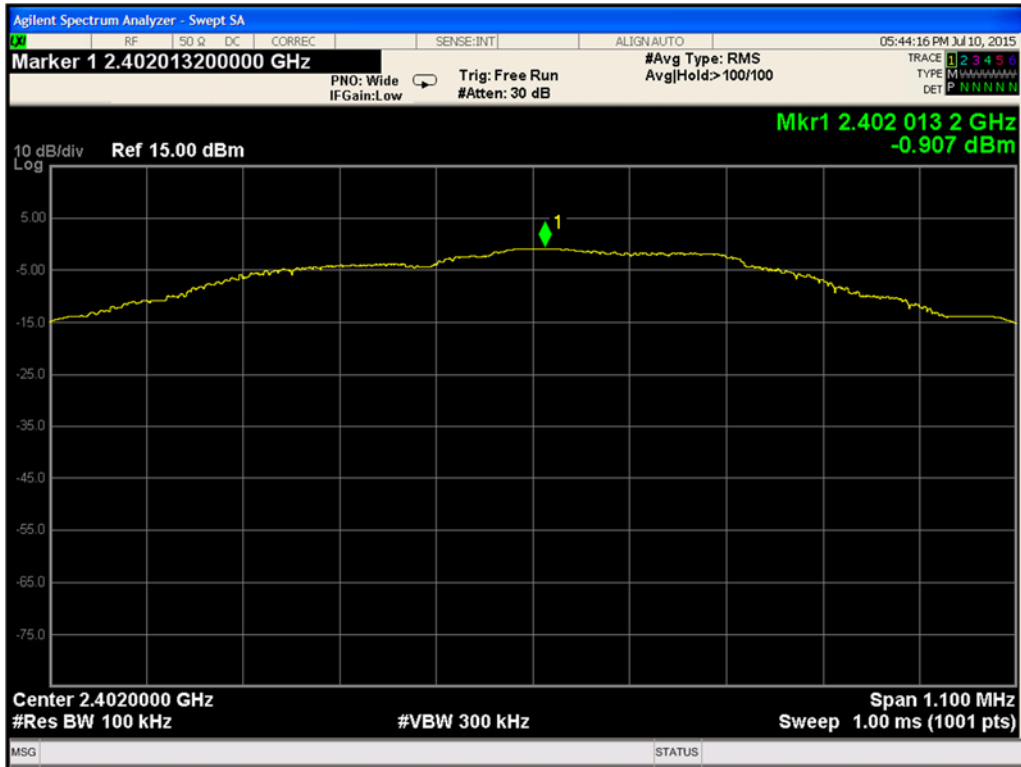
9.3.3 Limits:

The maximum permissible power density is 8 dBm/3kHz.

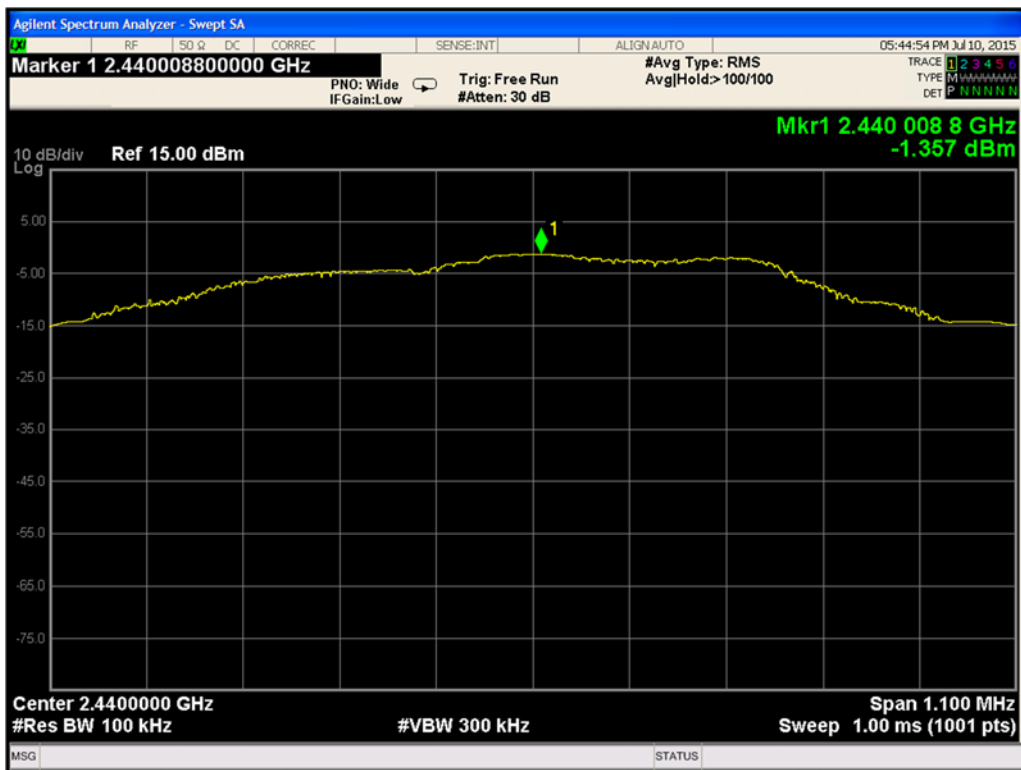
9.3.4 Test Results:

Frequency (MHz)	Test Mode	Channel No.	Power Spectral Density (dBm/100kHz)	Limit (dBm/3kHz)	Result
2402	BT LE	0	-0.907	8	PASS
2440	BT LE	19	-1.357	8	PASS
2480	BT LE	39	-2.057	8	PASS

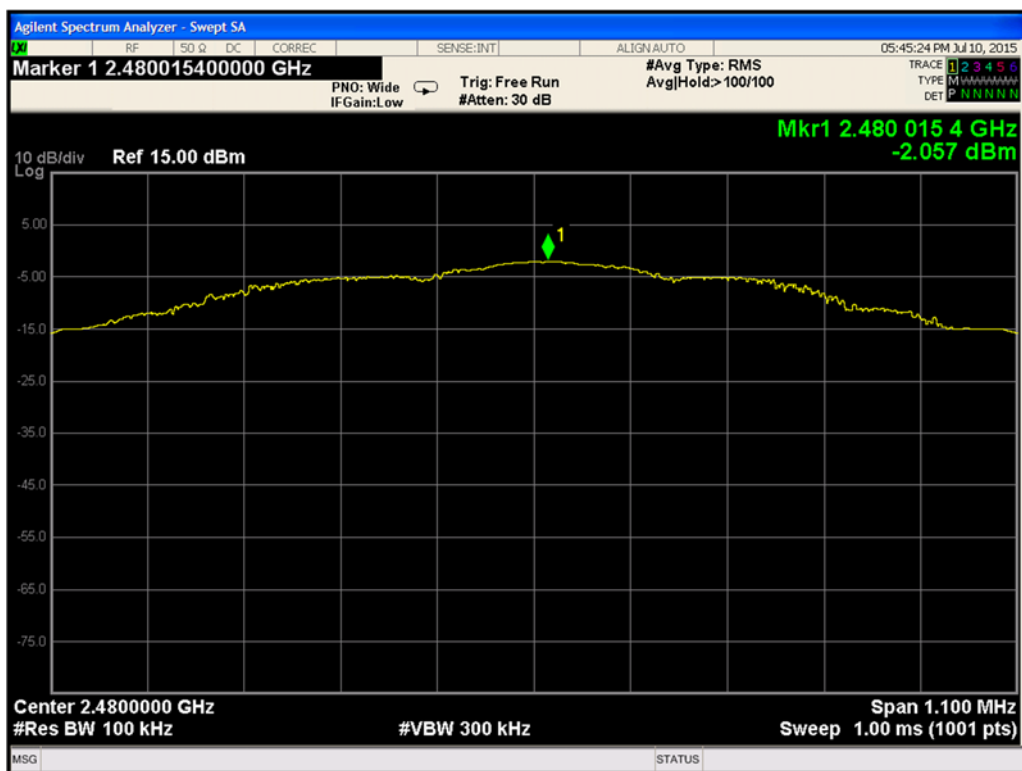
9.3.5 Test Data:



Plot 9-10. Power Spectral Density (Ch. 0)



Plot 9-11. Power Spectral Density (Ch. 19)



Plot 9-12. Power Spectral Density (Ch. 39)

9.4 Conducted Spurious Emissions

9.4.1 Test Requirement:

FCC CFR 47 Rule Part 15.247 (d)

Industry Canada RSS-247 [5.5]

9.4.2 Test Method:

Measurements were performed according to the procedure defined in KDB 558074- Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 V03R02 and ANSI C63.10 2013.

Spectrum Analyzer settings:

Identification of Reference Level:

RBW= 100 kHz

VBW $\geq 3 \times$ RBW

Trace Mode= Peak Detector (Max Hold)

Sweep time= Auto

Span= 3 MHz

Peak Marker function to determine the max PSD level.

Conducted Spurious Emissions:

RBW= 1MHz

VBW $\geq 3 \times$ RBW

Trace Mode= Peak Detector (Max Hold)

Sweep time= Auto

Span= 30 MHz- 12 GHz; 12 GHz – 25 GHz

Sweep Points= 30000

9.4.3 Limits:

All spurious emissions >20 dBc.

9.4.4 Test Result:

Pass.

9.4.5 Test Data:

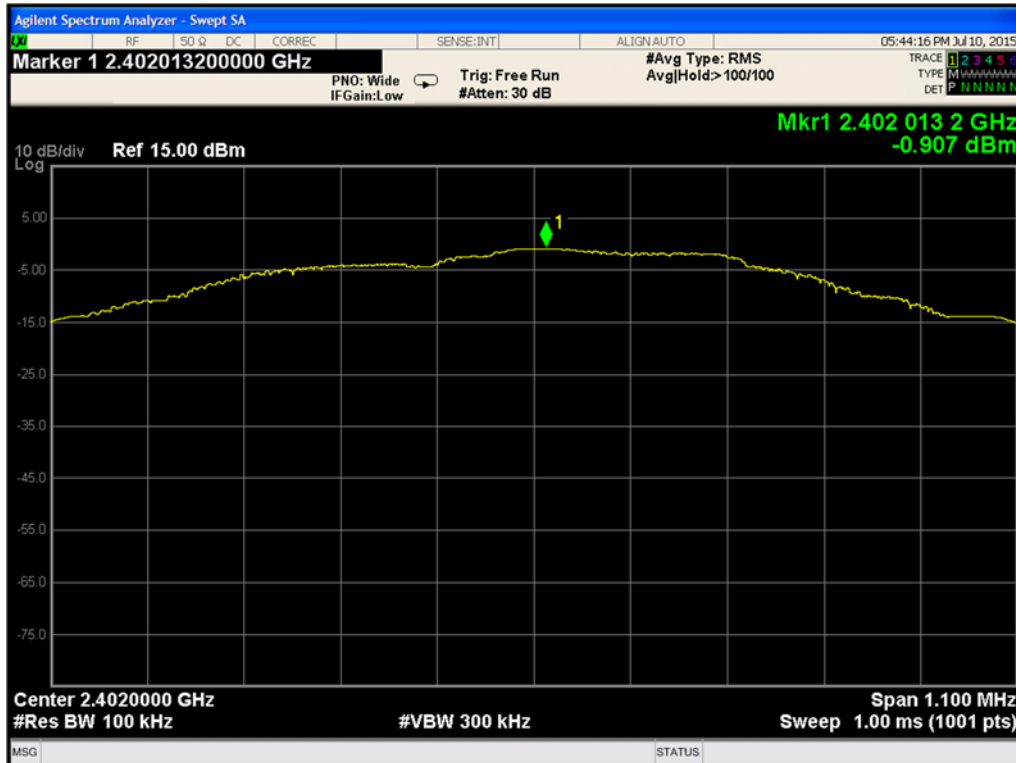
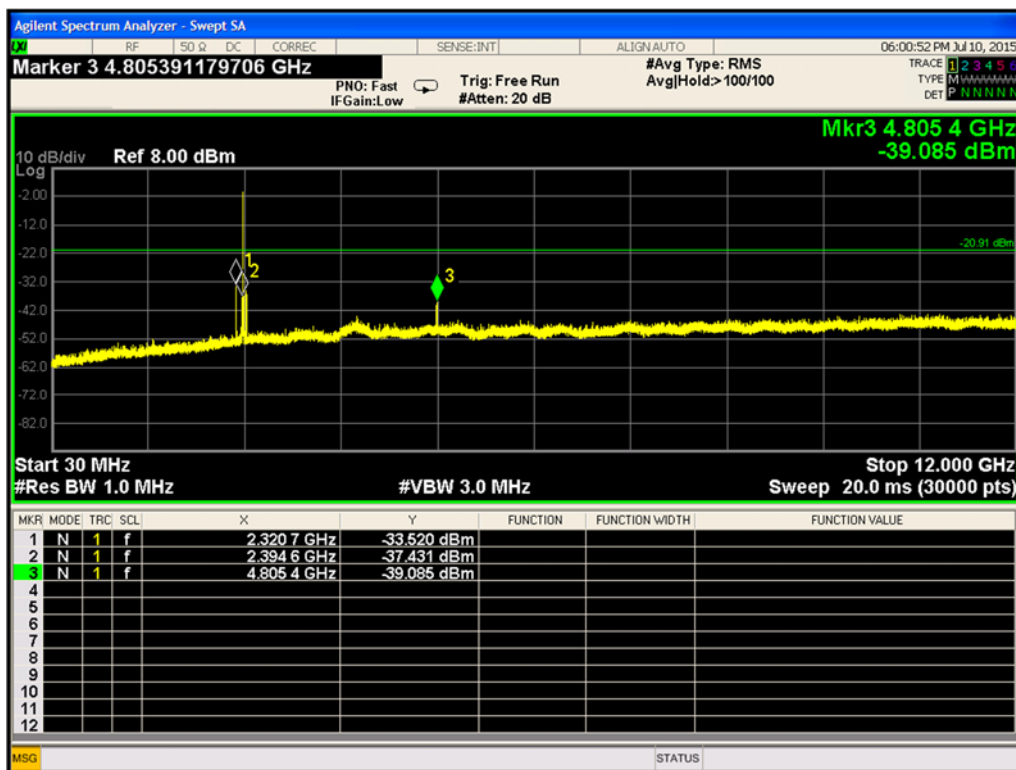


Figure 9-13. Reference Level Measurement (Ch.0)



Plot 9-14. Conducted Spurious Emissions 30-1000 MHz (Ch. 0)

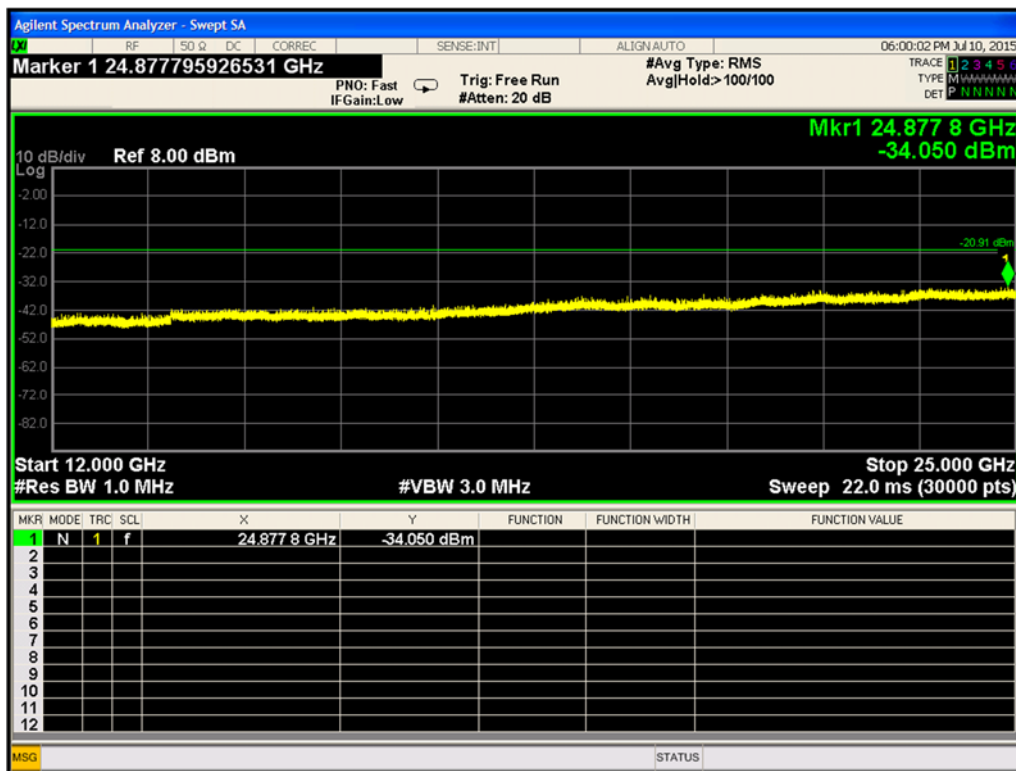


Figure 9-15. Conducted Spurious Emissions 1-25 GHz (ch.0)

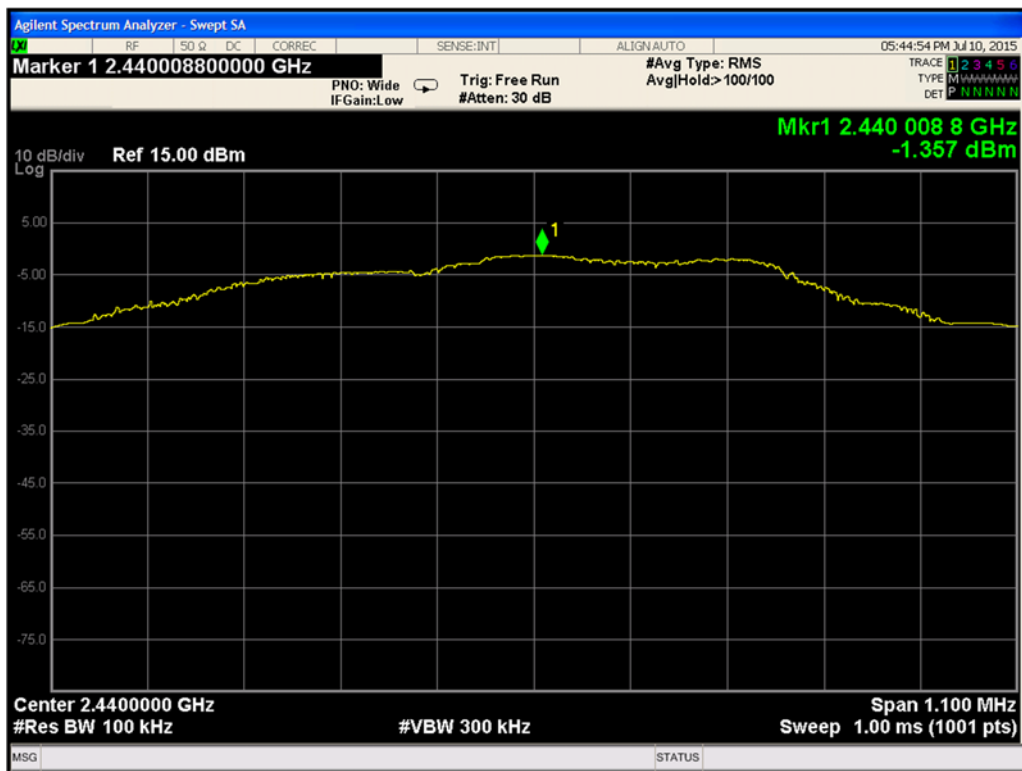
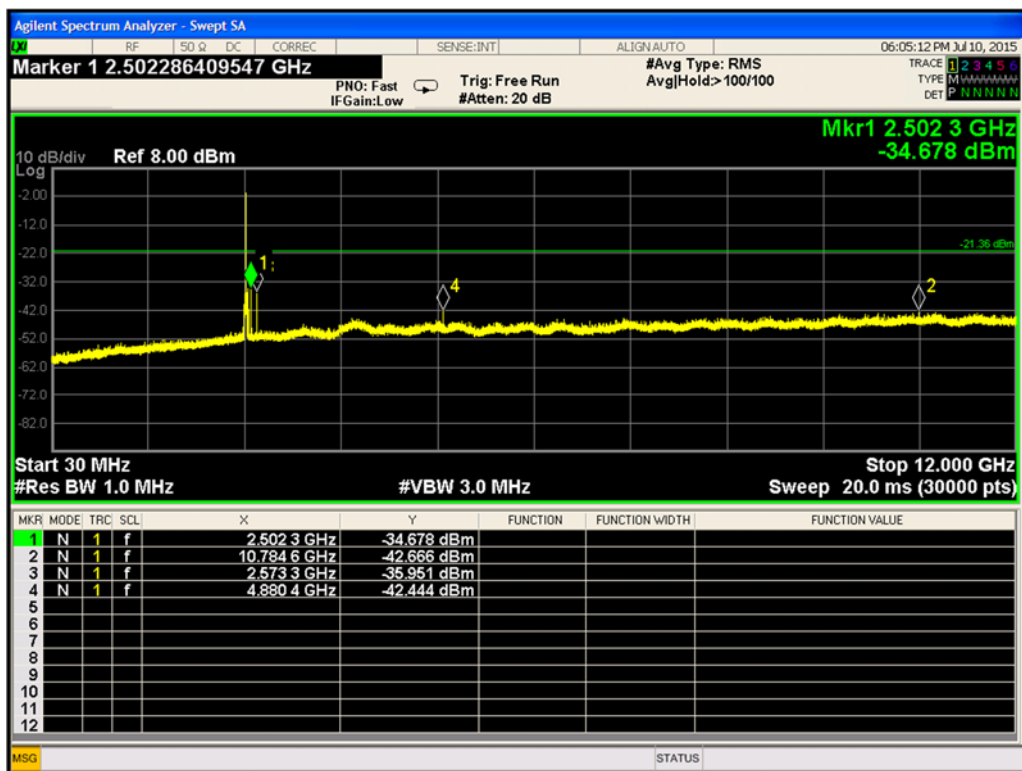
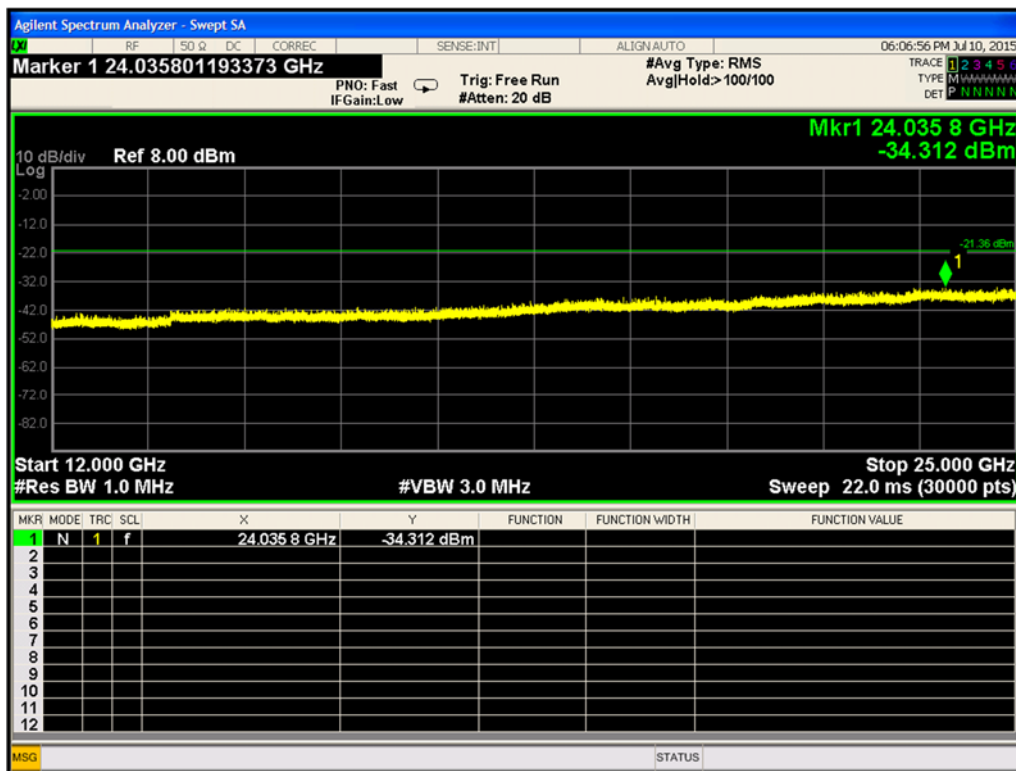


Figure 9-16. Reference Level Measurement (ch.19)



Plot 9-17. Conducted Spurious Emissions 30-1000 MHz (Ch. 19)



Plot 9-18. Conducted Spurious Emissions 1-25 GHz (Ch. 19)

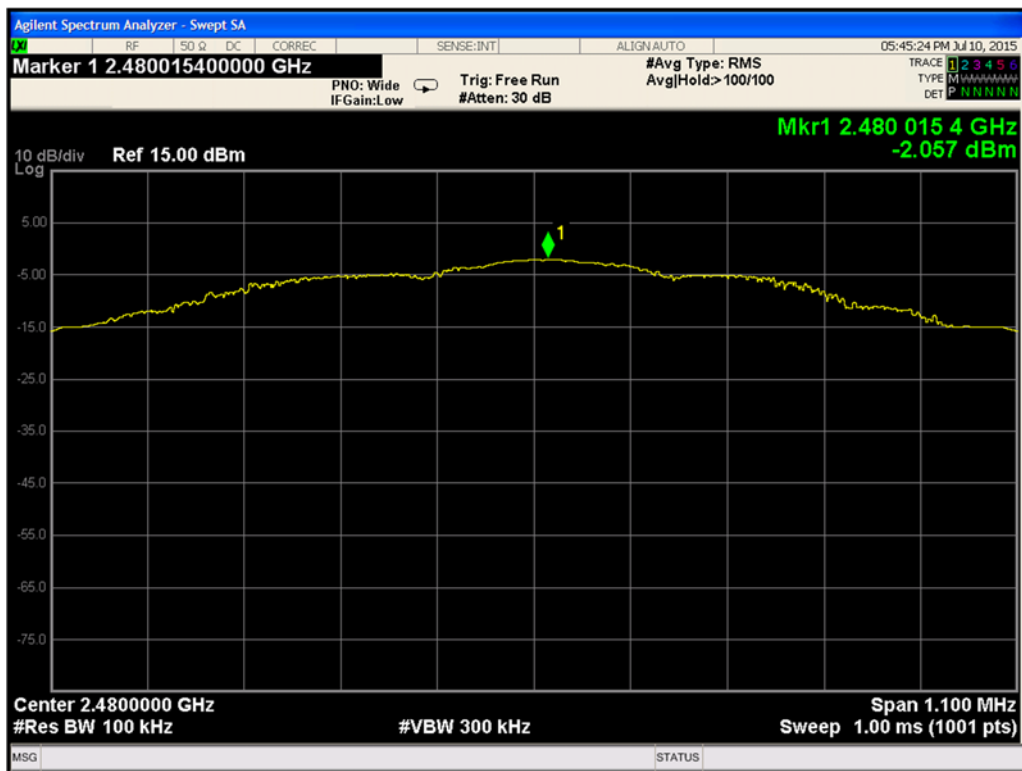


Figure 9-19. Reference Level Measurement (ch.39)

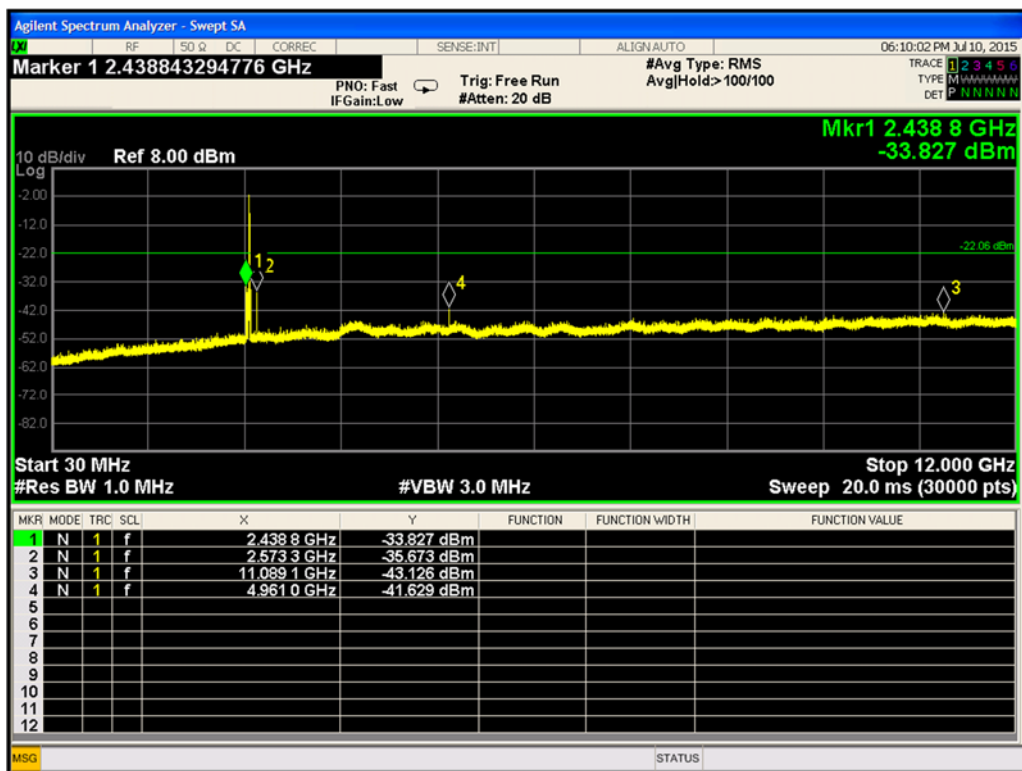


Figure 9-20. Conducted Spurious Emissions 30-1000 MHz (ch.39)

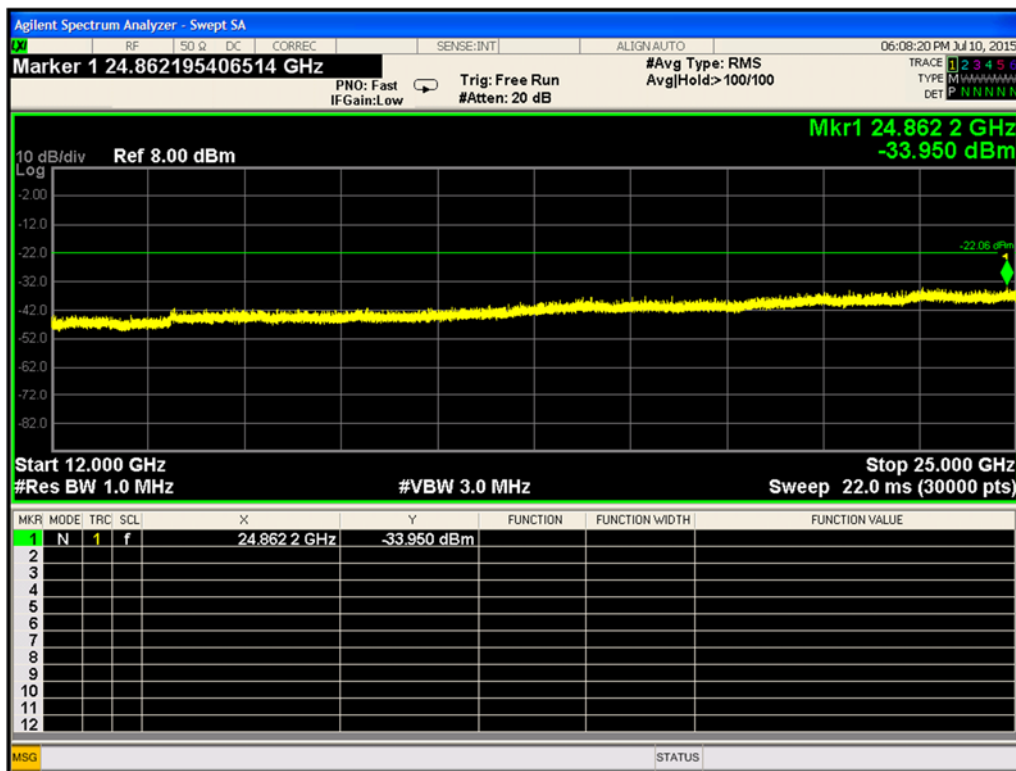


Figure 9-21. Conducted Spurious Emissions 1-25GHz (ch.39)

Channel	Carrier Frequency (MHz)	Emission Frequency (MHz)	Emissions Amplitude (dBm)	Limit (dBm)	Result
0	2402	2320.7	-33.52	-20.91	Pass
0	2402	2394.6	-37.431	-20.91	Pass
0	2402	4805.4	-39.085	-20.91	Pass
0	2402	24877.8	-34.050	-20.91	Pass
19	2440	2502.3	-34.678	-21.36	Pass
19	2440	2573.3	-35.95	-21.36	Pass
19	2440	4880.4	-42.44	-21.36	Pass
19	2440	10784.6	-42.67	-21.36	Pass
19	2440	24035.8	-34.31	-21.36	Pass
39	2480	2438.8	-33.83	-22.06	Pass
39	2480	2573.3	-35.67	-22.06	Pass
39	2480	4961.0	-41.63	-22.06	Pass
39	2480	11089.1	-43.13	-22.06	Pass
39	2480	24862.2	-33.95	-22.06	Pass

9.5 Conducted Band Edge Emissions

9.5.1 Test Requirement:

FCC CFR 47 Rule Part 15.247 (d)

Industry Canada RSS-247 [5.5]

9.5.2 Test Method:

Measurements were performed according to the procedure defined in KDB 558074- Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 V03R02 and ANSI C63.10 2013.

Spectrum Analyzer settings:

Band Edge Emissions:

RBW= 100 kHz

VBW $\geq 3 \times$ RBW

Detector= Peak

Sweep time= Auto

Span = 10MHz

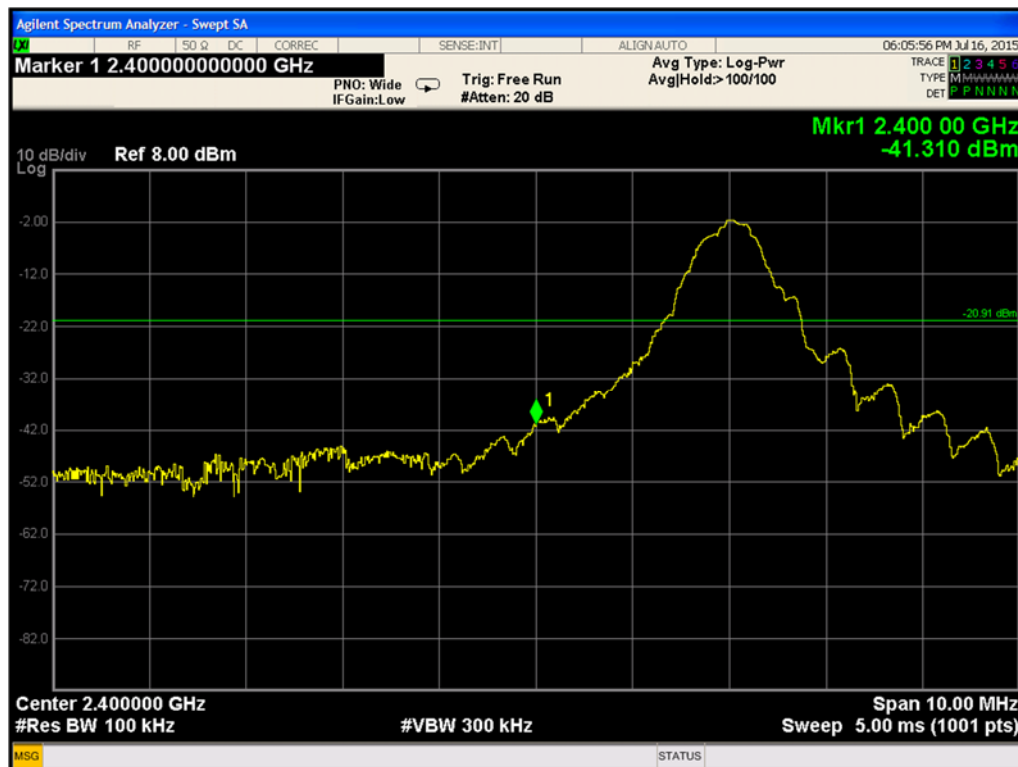
9.5.3 Limits:

All spurious emissions >20 dBc.

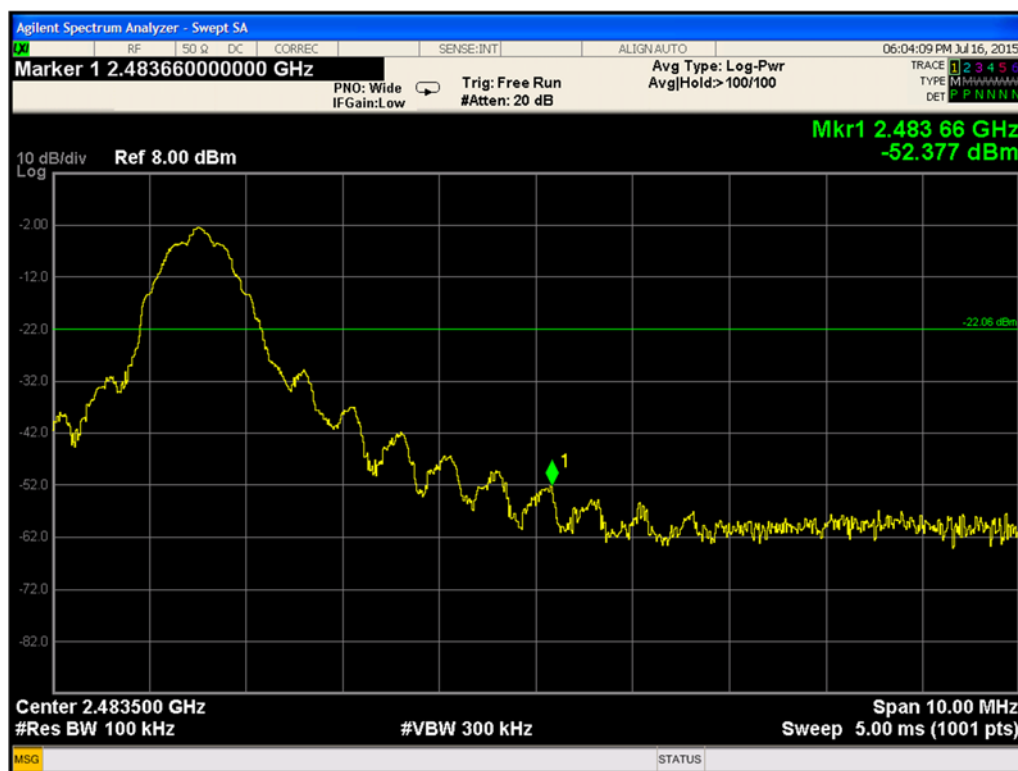
9.5.4 Test Result:

Pass.

9.5.5 Test Data:



Plot 9-22. Conducted-Low Band Edge (Ch. 0)



Plot 9-23. Conducted- High Band Edge (Ch. 39)

9.6 Radiated Spurious and Band Edge Emissions

9.6.1 Test Requirement:

FCC CFR 47 Rule Part 15.247 (d)

Industry Canada RSS-247 [5.5] and RSS GEN [8.9]

9.6.2 Test Method:

Measurements were performed according to the procedure defined in KDB 558074- Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 V03R02 and ANSI C63.10 2013.

Radiated spurious measurements were made from 30MHz to the 10th harmonic of the fundamental frequency of the transmitter. The limit for radiated spurious emissions is per 15.209 and RSS-Gen. Additionally, emissions found in the restricted bands as listed in 15.205 were tested for compliance per limits 15.209.

The EUT was tested near the low, middle and high channels of operation. Guidelines in ANSI C63.10 2013 were followed with respect to maximizing the emission by rotating the EUT about its vertical and horizontal axis and adjusting the measurement antenna polarization. Worst case maximized data is shown in this test report.

A pre-amp and a high pass filter were required for this test, in order to provide the measuring system with sufficient sensitivity. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength.

Sample Calculation:

Field Strength Level: Amplitude (Analyzer level) + AFCL (Antenna Factor and Cable losses) – Amplifier Gain = 50 dBμV + 33 dB – 25 dB = 78dBμV/m

Spectrum Analyzer Settings:

Radiated Spurious Emissions

30 MHz- 1 GHz:

RBW= 120 kHz

VBW ≥ 3 X RBW

Trace Mode: Peak Detector (Max Hold). Final measurements performed using QP Detector.

Span= 30 MHz- 1 GHz

Sweep time= Auto

Above 1 GHz:

RBW= 1 MHz

VBW= 3 MHz

Trace Mode: Peak Detector (Max Hold) and RMS Average Detector (Max Hold)

Span= 1- 18 GHz and 18- 26.5 GHz.

Sweep time= Auto

**Spectrum Analyzer Settings:
Restricted Band-Edge Emissions**

RBW= 1 MHz

VBW= 3 MHz

Trace Mode: Peak Detector (Max Hold) and RMS Average Detector (Max Hold)

Span= 2310 – 2500 MHz

Sweep Points = 801

Sweep Time = Peak: Auto; Average: 100 s

9.6.3 Limits:

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (meters)	Corrected Field Strength for 3m measurement distance (dBμV/m)
0.009-0.490	2400/F (kHz)	300	48.5- 13.8
0.490-1.705	24000/F (kHz)	30	33.8- 23.0
1.705-30	30	30	29.5
30-88	100	3	40
88-216	150	3	43.5
216-960	200	3	46
960-1000	500	3	54
Above 1000	500	3	54 (Average) 74 (Peak)

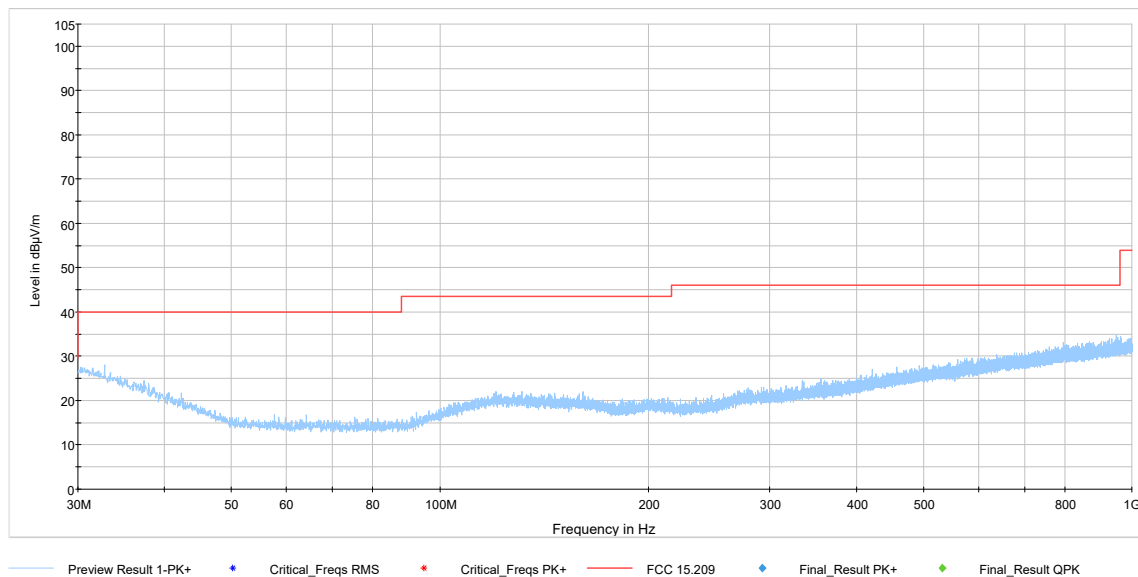
9.6.4 Test Result:

Pass.

9.6.5 Test Data:

9.6.5.1 Emissions in 30 MHz- 1 GHz range

Worst case data in mid-channel of operation shown below.
No significant emissions to report above noise floor.

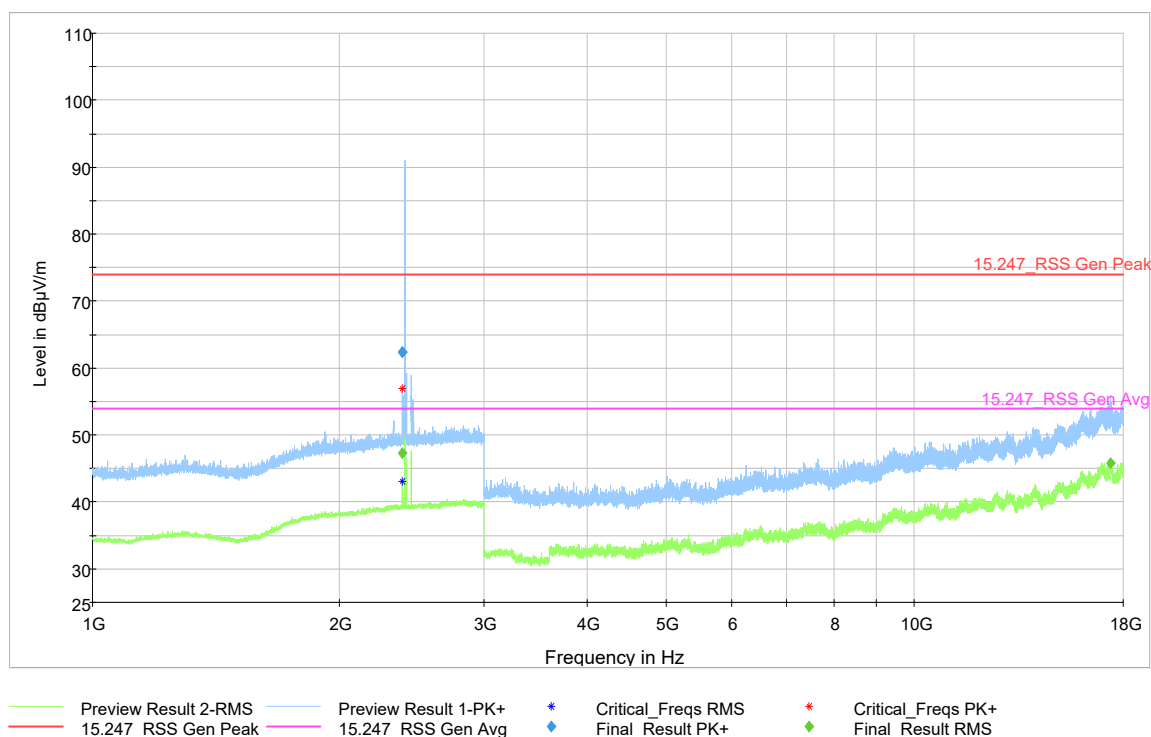


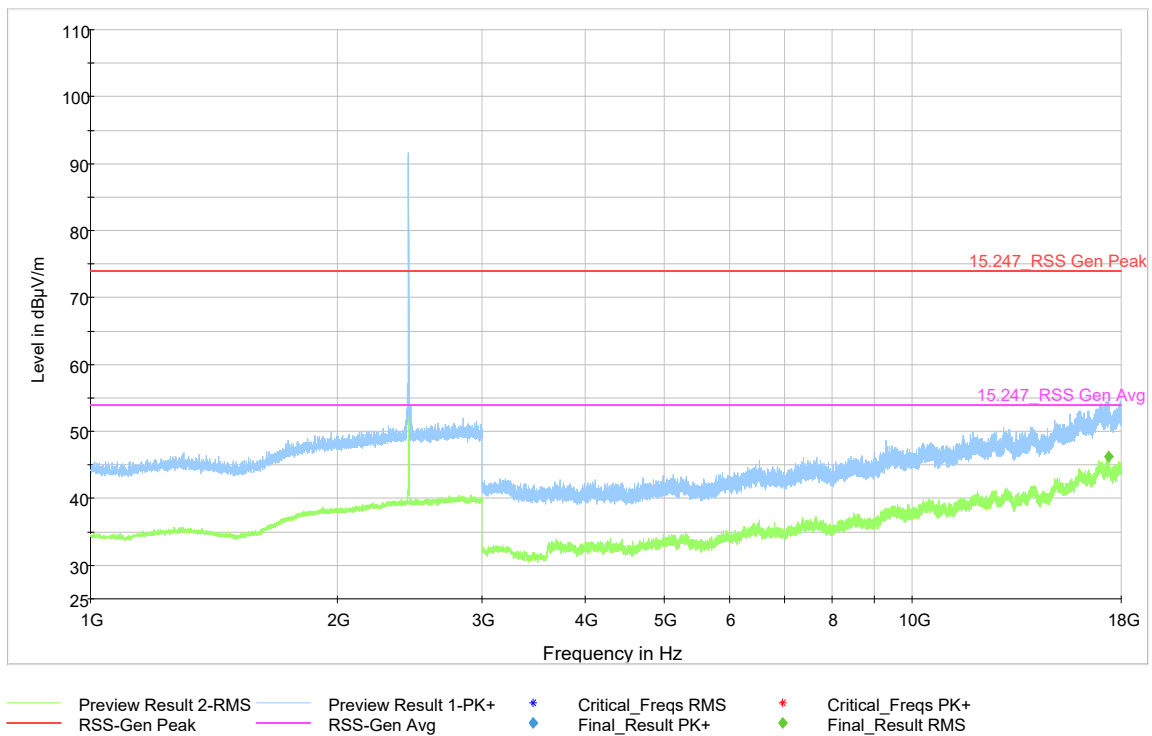
Plot 9-24. Radiated Spurious Emissions (Ch. 19) (30MHz - 1GHz)

9.6.5.2 Emissions in 1-18 GHz range

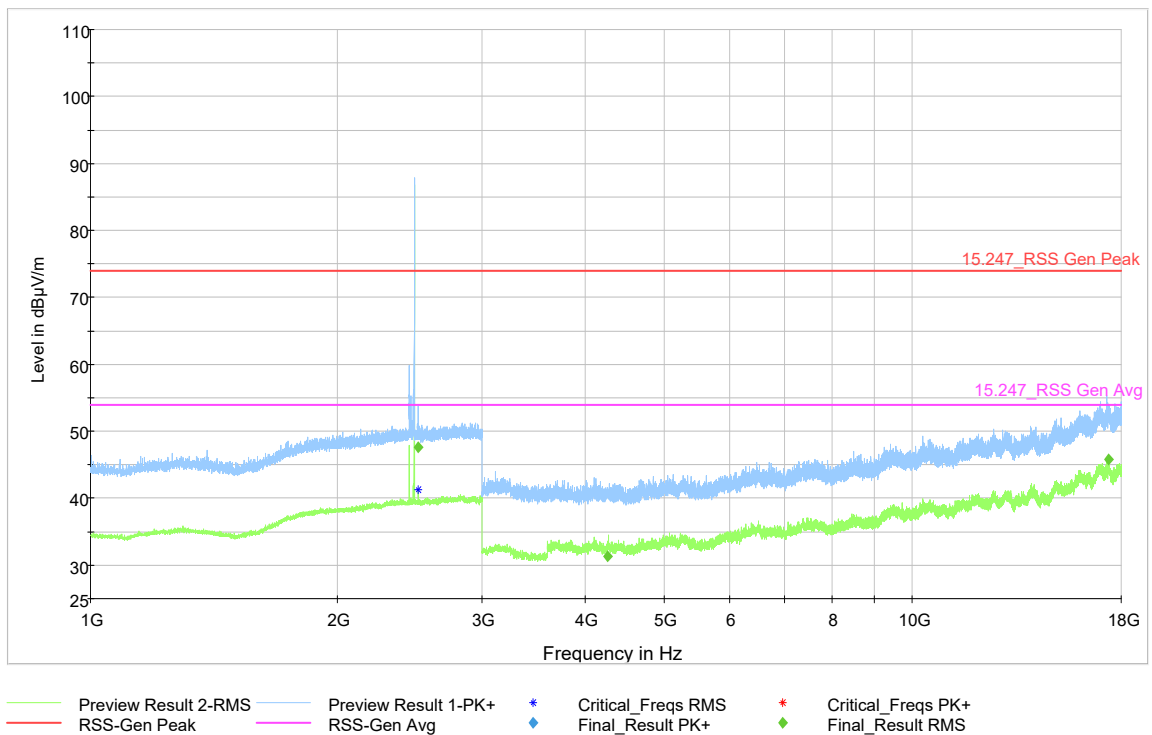
RSE 1- 18GHz Average Data						
Carrier Frequency (MHz)	Frequency (MHz)	Raw Avg. Amplitude (dB μ V)	Correction Factor (dB)	Corrected Avg. Field Strength (dB μ V/m)	Average Limit (dB μ V/m)	Margin (dB)
2402	2383.33	34.58	12.8	47.38	54	-6.62
2402	17374.00	21.34	24.4	45.74	54	-8.26
2480	2505.2667	34.62	13.0	47.62	54	-6.38
2480	4267.9	24.13	7.2	31.33	54	-22.67
2480	17356.5	21.44	24.3	45.74	54	-8.26

RSE 1- 18GHz Peak Data						
Carrier Frequency (MHz)	Frequency (MHz)	Raw Peak Amplitude (dB μ V)	Correction Factor (dB)	Corrected Peak Field Strength (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)
2402	2383.33	49.52	12.8	62.32	74	-11.68





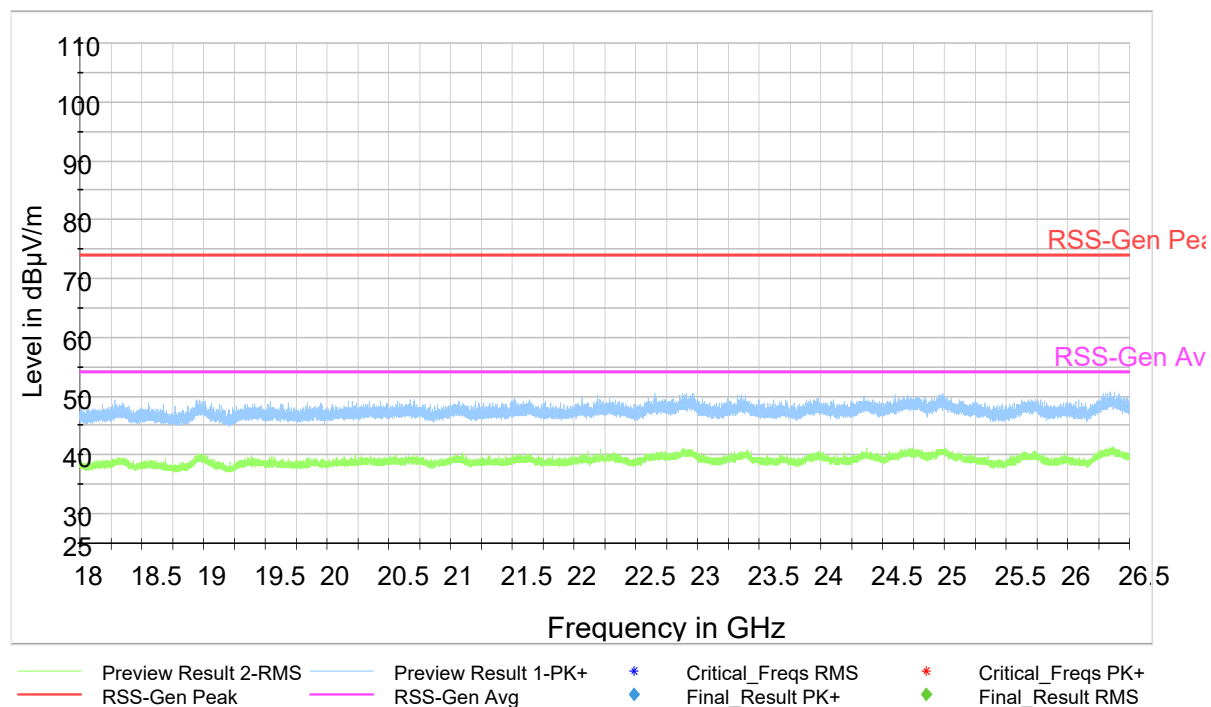
Plot 9-26. Radiated Spurious Emissions 1-18 GHz (Ch. 19)



Plot 9-27. Radiated Spurious Emissions 1-18 GHz (Ch. 39)

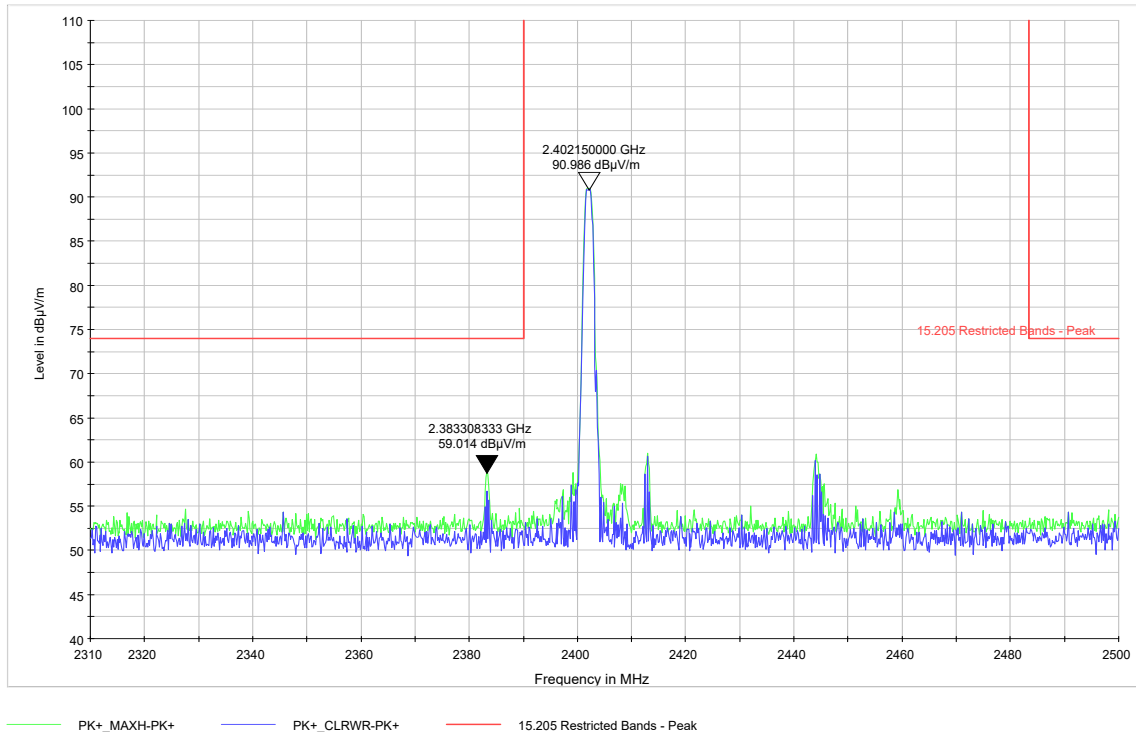
9.6.5.3 Emissions in 18-26.5 GHz range

Worst case data in mid-channel of operation shown below.
No significant emissions to report above noise floor.

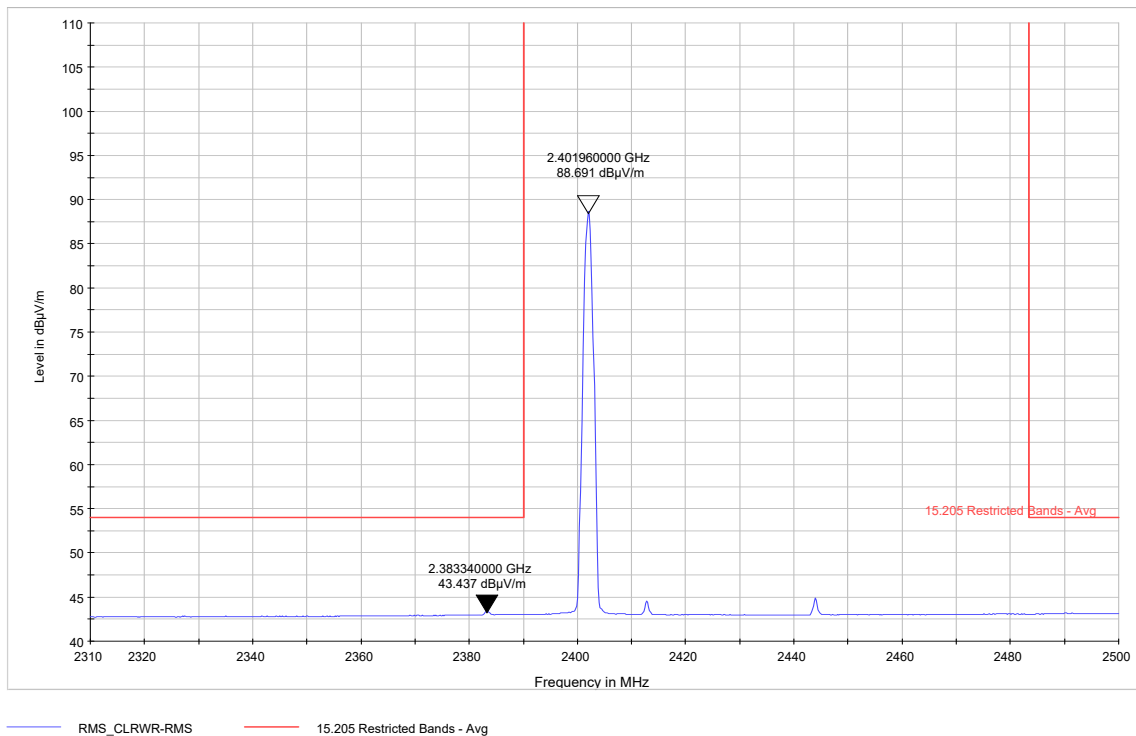


Plot 9-25. Radiated Spurious Emissions (Ch. 0) (18 – 26.5 GHz)

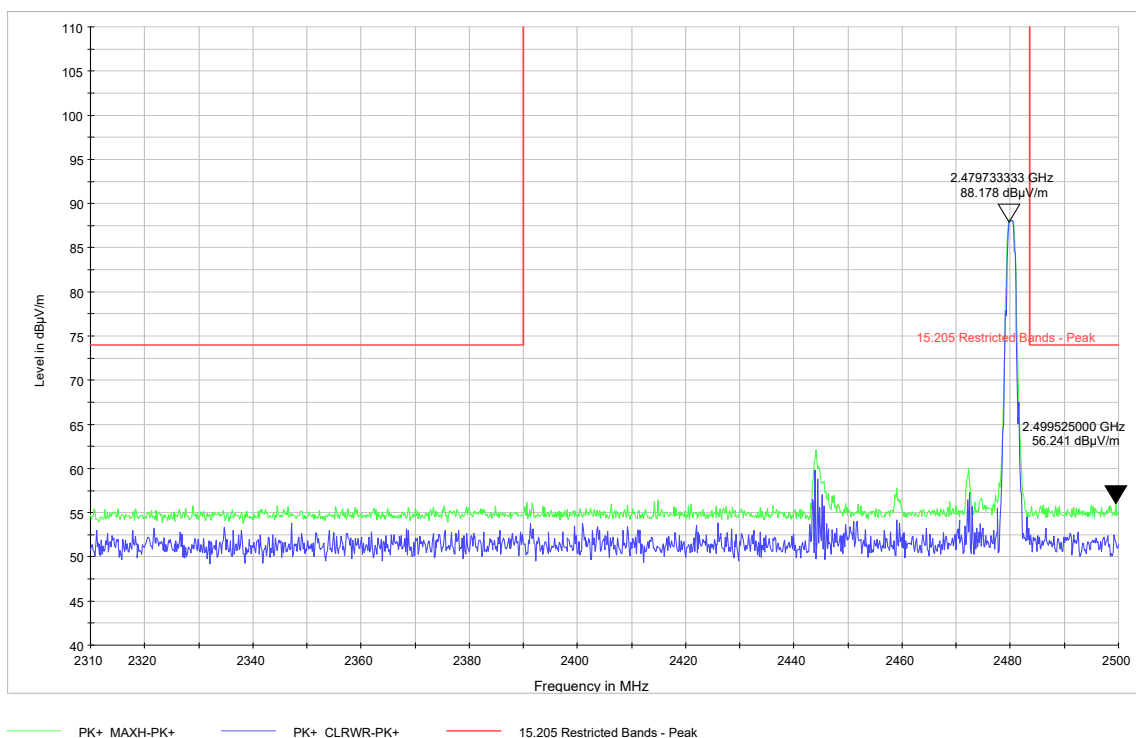
9.6.5.4 Radiated restricted Band-edge emissions



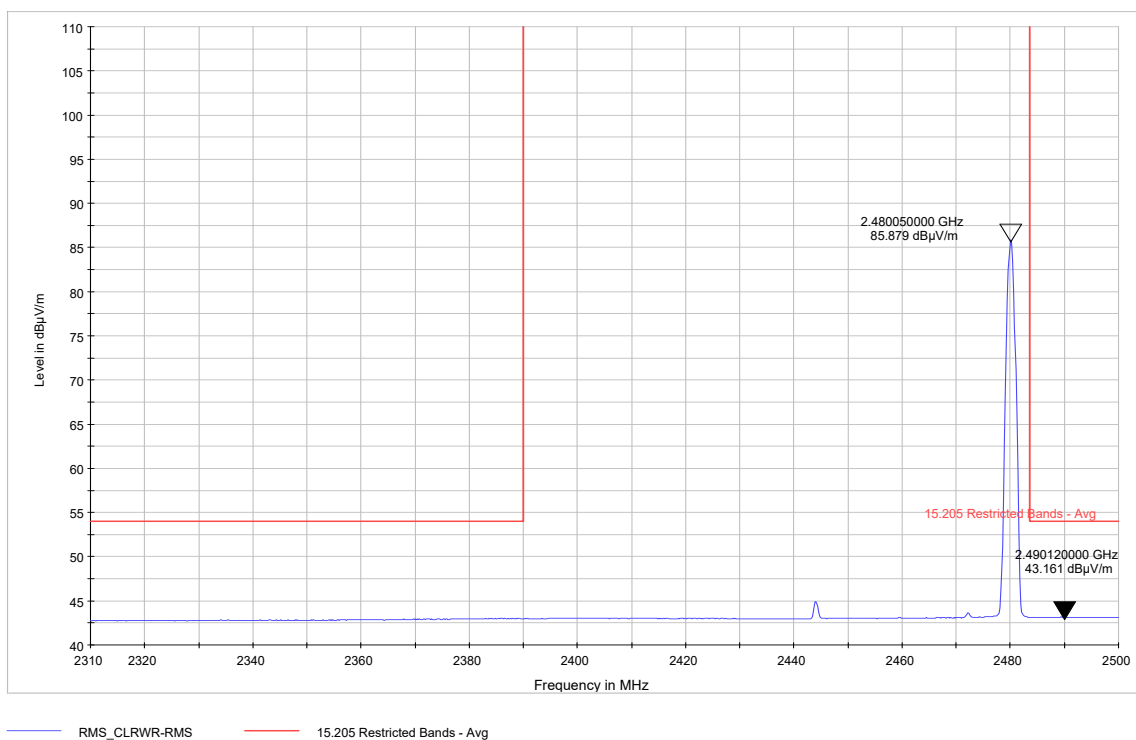
Plot 9-28. Radiated Restricted Band Edge (Ch. 0) Peak



Plot 9-29. Radiated Restricted Band Edge (Ch. 0) Average



Plot 9-30. Radiated Restricted Band Edge (Ch. 39) Peak



Plot 9-31. Radiated Restricted Band Edge (Ch. 39) Average

End of Report