RADIO TEST REPORT

For

MODEL NO. 1616
FCC ID: C3K1616
IC ID: 3048A-1616

Test Report No. R-TR41-FCCIC-1
Issue Date: March 31 2014

FCC CFR47 Part 15 Subpart C
Industry Canada RSS-210 Issue 8

Prepared by
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ACCREDITED
TESTING CERT #3472.01

1 Record of Revisions

Revision	Date	Section	Page(s)	Summary of Changes	Author/Revised By:
1.0	03/31/2014	All	All	First Version	Sajay Jose

Microsoft

Table of Contents

Microsoft

Test Report Attestation

Microsoft Corporation
Model: 1616
FCC ID: C3K1616
IC ID: 3048A-1616

Applicable Standards

Specification	Test Result
FCC CFR47 Rule Parts 15.209, 15.247	Pass
Industry Canada RSS-210 Issue 8	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 pertains to the specific sample tested, under the conditions and operating modes as provided by the customer. All indications of Pass/Fail in this report are opinions expressed by the Microsoft EMC Laboratory based on interpretations and/or observations of test result on the tested sample only.

This report shall not be used to claim product certification, approval, or endorsement by A2LA or any agency of any Government.
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Written By: Jennifer Liu
EMC Test Engineer

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

Approved By: Hasnain Syed
Director of Compliance

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

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.
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)	6.10

5 Product Description

Company Name:	Microsoft Corporation
Address:	One Microsoft Way
City, State, Zip:	Redmond, WA 98052-6399
Customer Contact:	Steve Stegner
Functional Description of the EUT:	Wireless input accessory device.
Model:	1616
FCC ID:	C3K1616
IC ID:	3048A-1616
Radio Description:	BT LE (2402- 2480 MHz)
Modulation:	GFSK
EUT Classification:	DTS
Equipment Design State:	DV
Equipment Condition:	Good

5.1 Test Configurations

Test software “nRFgo Studio” (V1.16.0) from Nordic Semiconductor is used to program the EUT.

Since the EUT only supports Advertising mode, channels 0, 19 and 39 are used for as the Low/Mid/High channels of test. Data mode is not supported by the device.

Additionally, the EUT is battery powered and cannot be connected to AC outlet either directly or indirectly. Hence power line conducted emissions test is not applicable for this EUT.

5.2 Environmental Conditions

Ambient air temperature of the test site was within the range of 10 ºC to 40 ºC (50 ºF to 104 ºF) 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.

6 Test Results Summary

Test Description	FCC CFR 47/ IC Rule Part	Limit	Test Result
6dB Bandwidth	15.247 (a)(2) RSS-210 [A8.2]	> 500kHz	Pass
Output Power	15.247 (b)(3) RSS-210 [A8.4]	< 1 Watt	Pass
Power Spectral Density	15.247 (e) RSS-210 [A8.2]	< 8dBm/3kHz	Pass
Conducted Band Edge/Spurious Emissions	15.247 (d) RSS-210 [A8.5]	< 20dBc	Pass
Radiated Spurious Emissions/ Restricted Band Emissions	15.205, 15.209 RSS-210 [A8.5]	FCC CFR 47 15.209 limits	Pass
AC Power line Conducted Emissions	15.207	FCC CFR 47 15.207 limits	N/A

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 Due
Agilent	Spectrum Analyzer	N9030A	RF-011	5/13/2014
Sunol Sciences	Antenna	DRH-118	RF-035	9/4/2014
ETS-Lindgren	Antenna	3160-09	RF-037	N/A*
ETS-Lindgren	Antenna	6512	RF-202	12/13/2014
Micro-Tronix	Notch Filter	BRM50702-02	RF-055	N/A*
Rohde & Schwarz	Pre-Amp	TS-PR18	RF-041	N/A*
Rohde & Schwarz	Pre-Amp	TS-PR26	RF-042	N/A*
Rohde & Schwarz	Signal Generator	SMB 100A	RF-013	9/12/2014
Rohde & Schwarz	EMI Test Receiver	ESU40	RF-012	7/31/2014
Rohde & Schwarz	Switch Control Unit	OSP130	RF-018	N/A*
Rohde & Schwarz	Switch Control Unit	OSP150	RF-019	N/A*
Rosenburger	RF Cable	L72-449-915	EMC-326	N/A*
Rohde & Schwarz	Software	EMC-32 V9.0.10	N/A	N/A

*Note: List of equipment that fall under the category of cables, pre-amplifiers or switching panels with Calibration due date of “n/a” have regular in house verification.

The calibrations of the measuring instruments, including any accessories that may affect such calibration, are checked frequently to ensure their accuracy.

8 Test Site Description

8.1 Radiated Emissions Test Site

Radiated measurements are performed in a 3m semi-anechoic chamber manufactured by TDK which fully meets NSA requirements for the frequency range of 30MHz to 1000MHz and SVSWR for 1-18GHz.

A Sunol antenna mast and turntable are used for changing Antenna height and azimuth. For all measurements, the Antenna height is varied from 1 meter to 4 meters and the turn table rotated 360 degrees to determine the highest emissions. A non-conducting 1m x 1.5m x 80cm table is installed on the turntable to support the EUT.

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

For radiated emissions above 1GHz, linearly polarized horn antennas are used. RF absorbers cover the ground plane such that the site validation criterion called out in CISPR 16-1-4 is met. For radiated measurements below 1GHz, Linearly polarized broadband antennas are used. The RF absorbers are removed to reveal the ground plane.

8.2 Antenna port conducted measurements

All antenna port conducted measurements are performed on a bench-top setup consisting of a Spectrum Analyzer, Communication tester (where applicable), 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

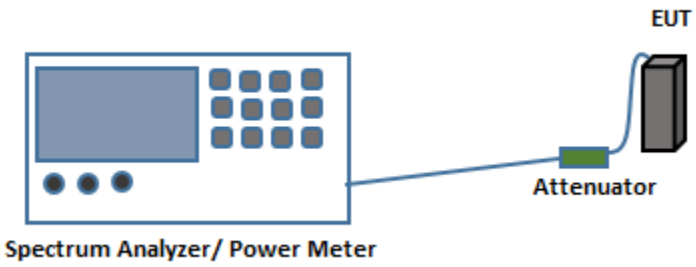


Fig.1. Test Setup for Antenna port conducted measurements

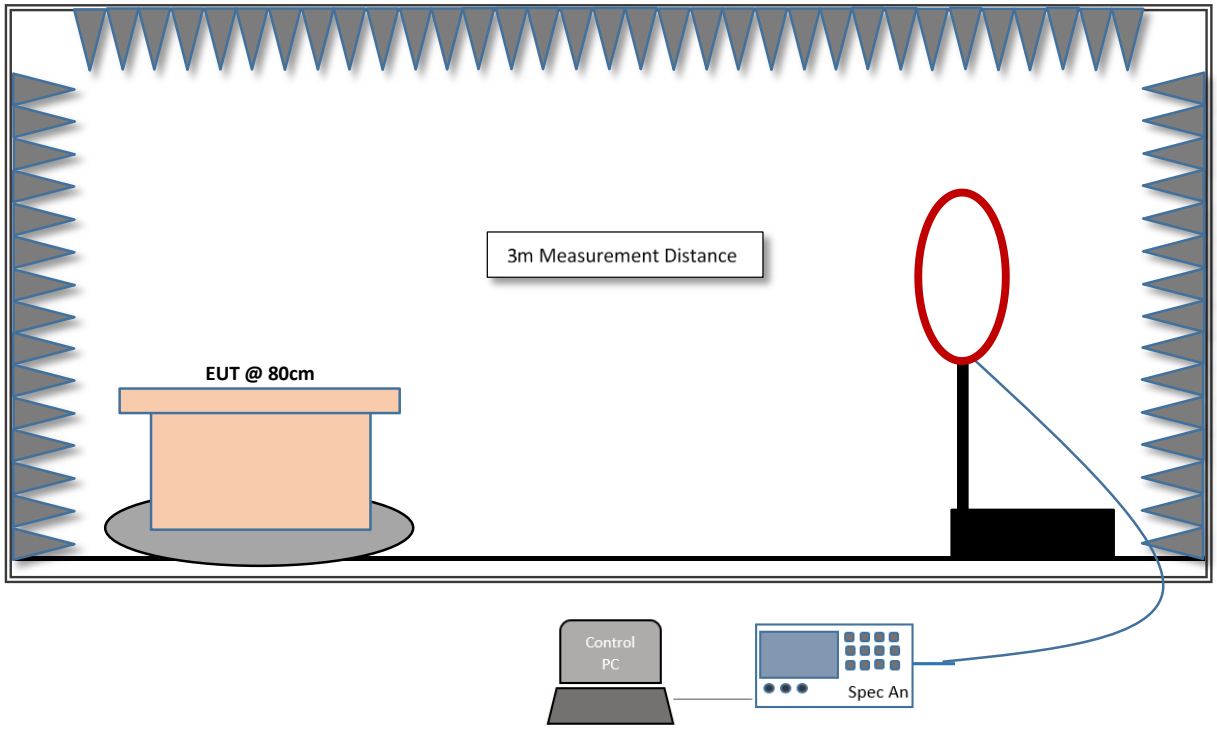


Fig.2. Test Setup for Radiated measurements <30 MHz

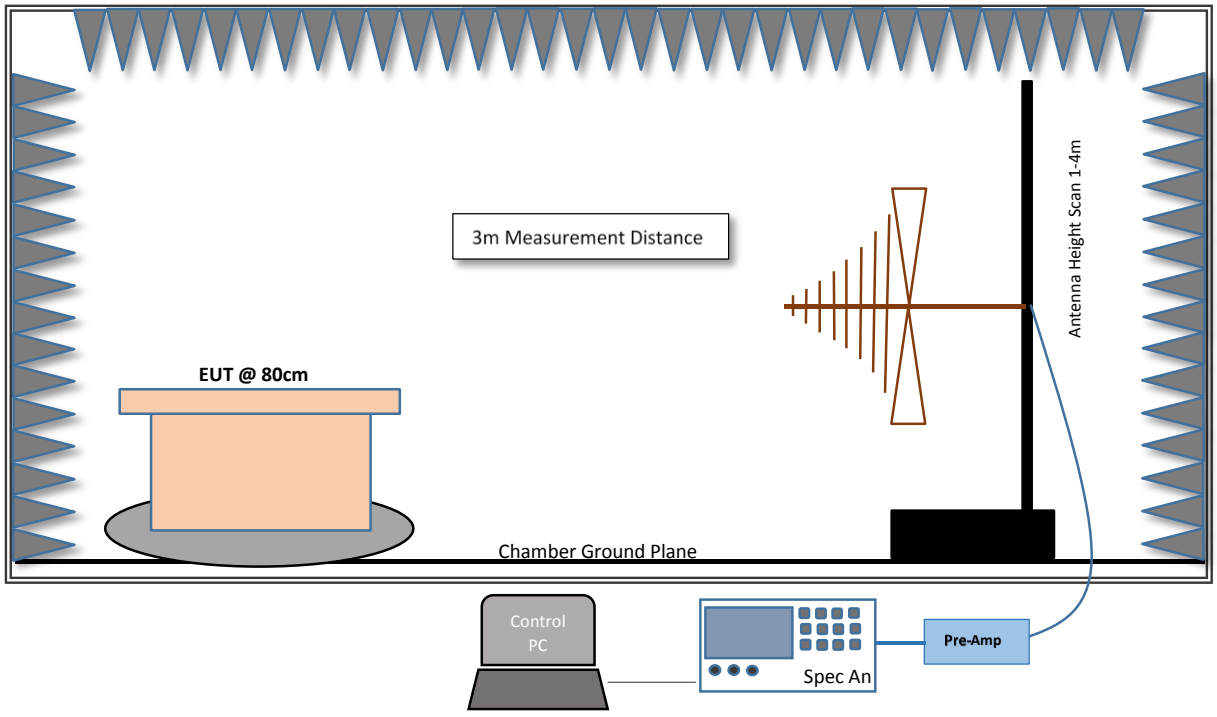


Fig.3. Test Setup for Radiated measurements in 30MHz- 1GHz Range

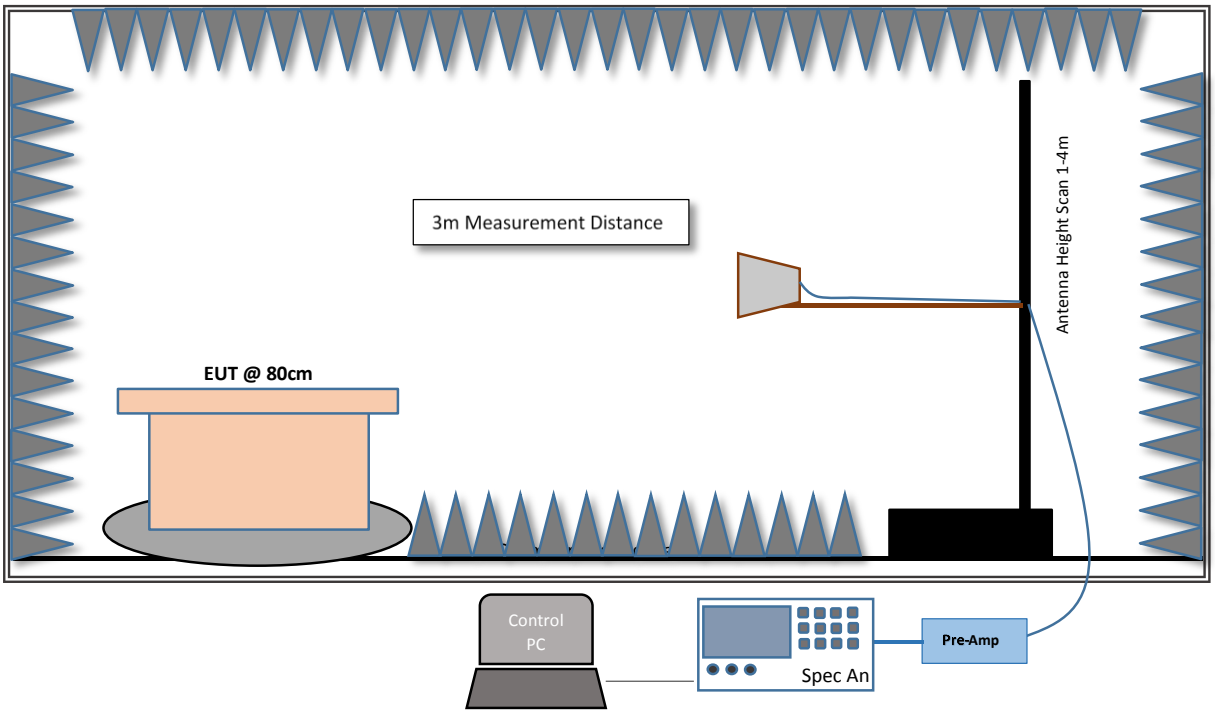


Fig.4. Test Setup for Radiated measurements in 1GHz- 18GHz Range

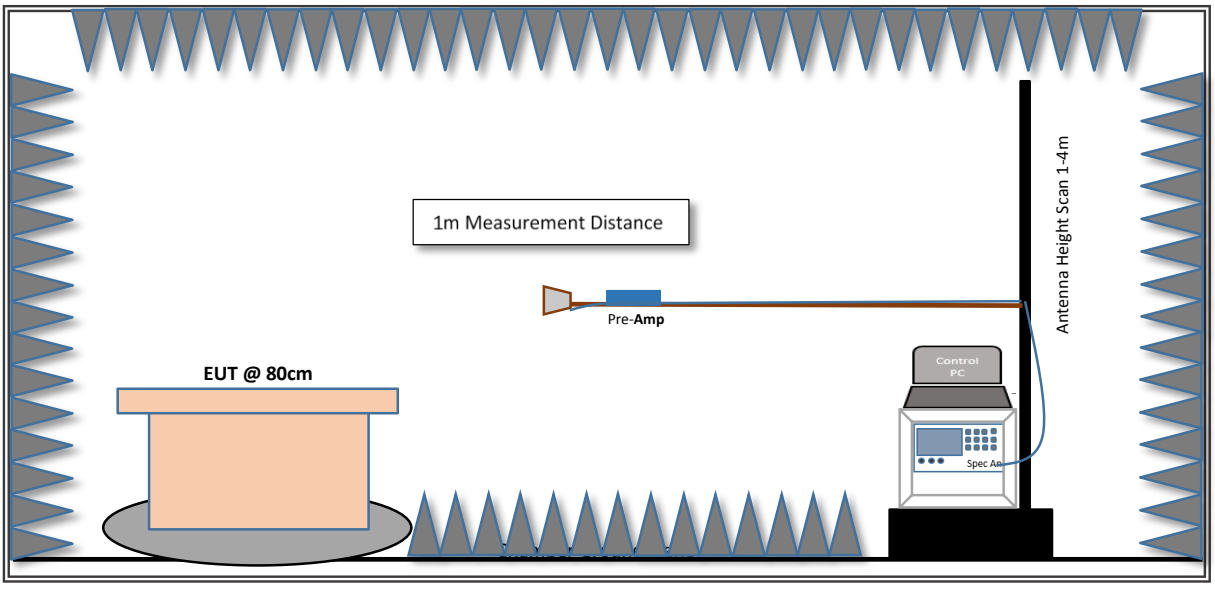


Fig.5. Test Setup for Radiated measurements >18GHz

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-210 [A8.2]

9.1.2 Test Method:

Measurements are performed according to the procedure defined in KDB 558074- Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 V03R01.

Spectrum Analyzer settings:
RBW= 100 kHz
VBW= 1 MHz
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:

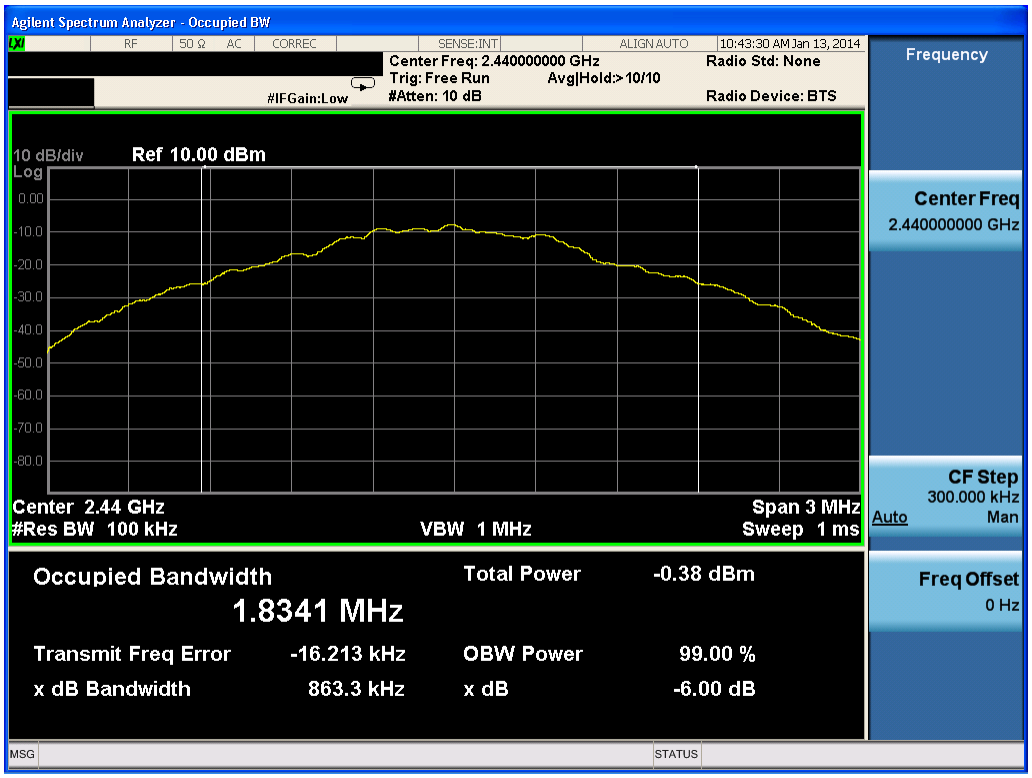
The 6-dB bandwidth shall be at least 500 kHz

9.1.4 Test Results:

Frequency (MHz)	Test Mode	Channel No.	6dB Bandwidth (kHz)	Limit (kHz)	Result
2402	BT LE	0	904.9	500	PASS
2440	BT LE	19	863.3	500	PASS
2480	BT LE	39	926.6	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-210 [A8.4]

9.2.2 Test Method:

Measurements are performed according to the procedure defined in KDB 558074- Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 V03R01.

Spectrum Analyzer settings:

Peak Power:

RBW= 1 MHz
VBW= 3 MHz
Trace Mode= Peak Detector (Max Hold)
Sweep time= Auto
Span= 5 MHz

Average Power:

RBW= 1 MHz
VBW= 3 MHz
Trace Mode= RMS Average Detector (Max Hold)
Sweep time= Auto
Span= 5 MHz

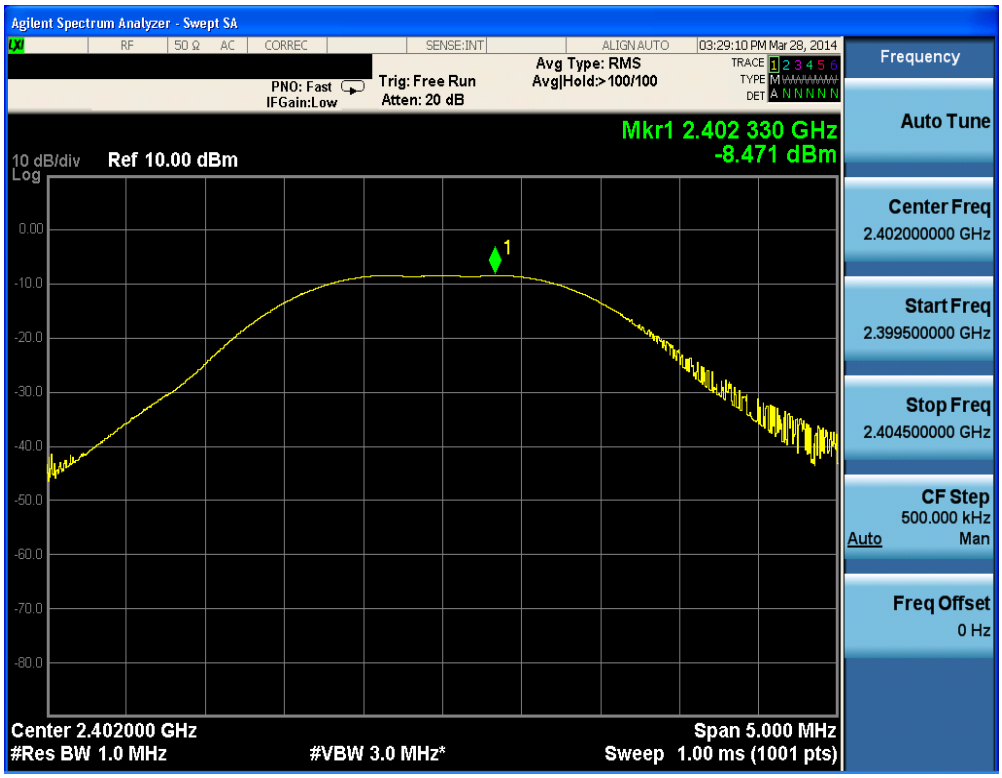
9.2.3 Limits:

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

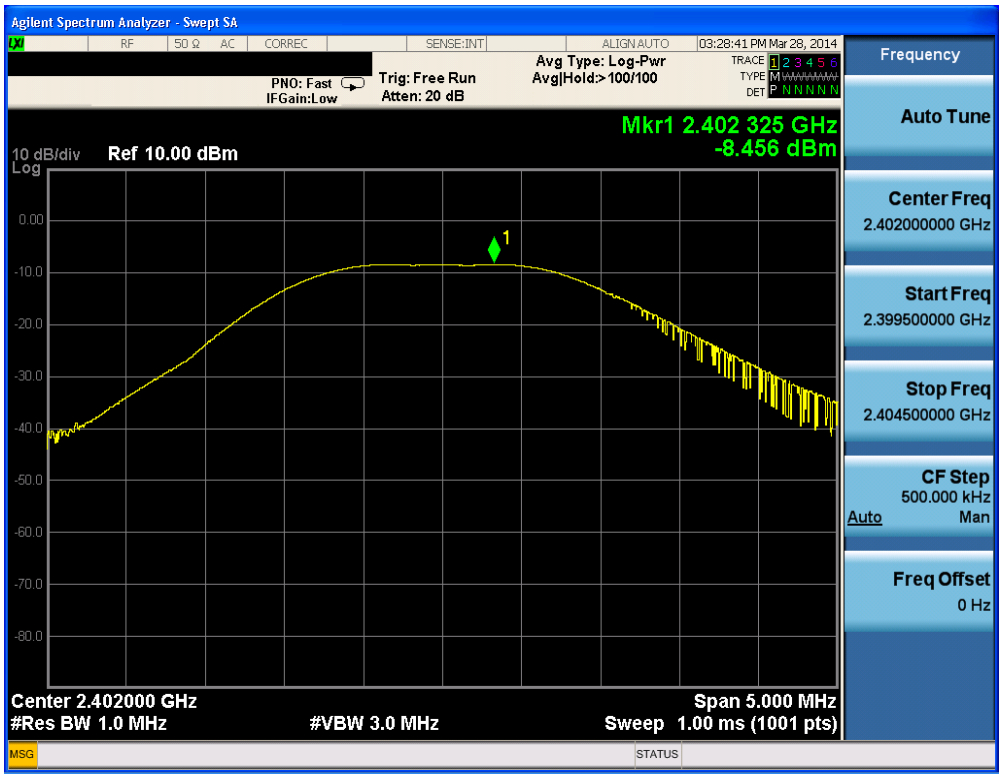
9.2.4 Test Results:

Frequency (MHz)	Test Mode	Channel No.	Peak Power (dBm)	Peak Power (W)	Result	Average Power (dBm)	Average Power (W)
2402	BT LE	0	-8.46	0.1427	PASS	-8.471	0.1422
2440	BT LE	19	-7.29	0.1867	PASS	-7.31	0.1858
2480	BT LE	39	-6.86	0.2061	PASS	-6.88	0.2051

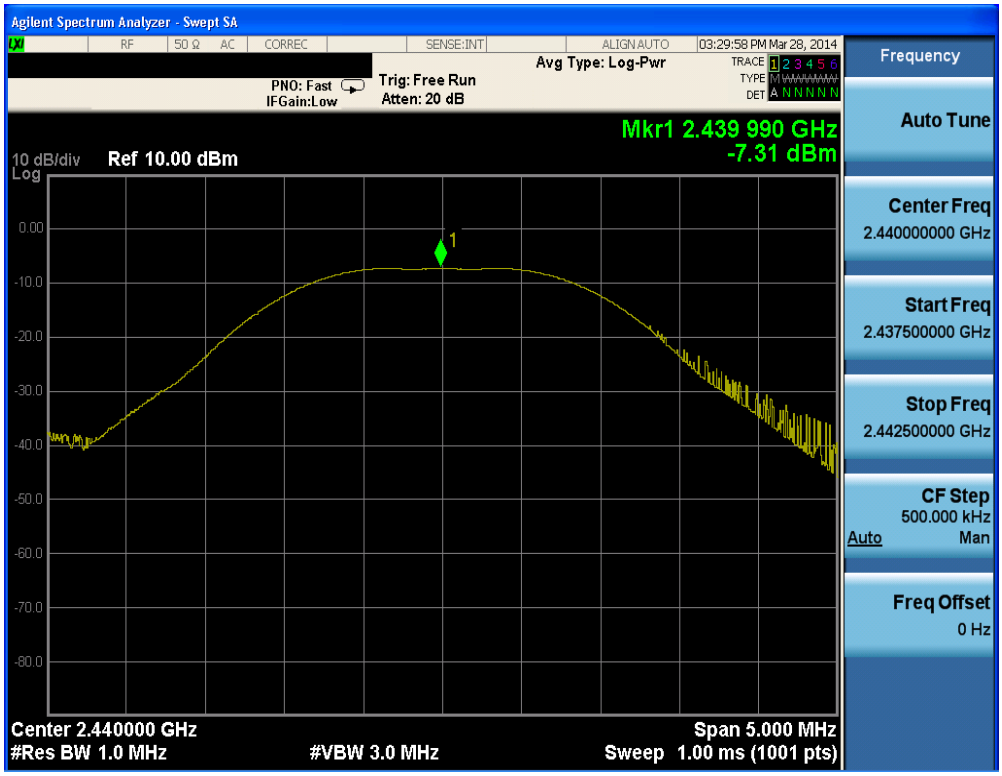
9.2.5 Test Data:



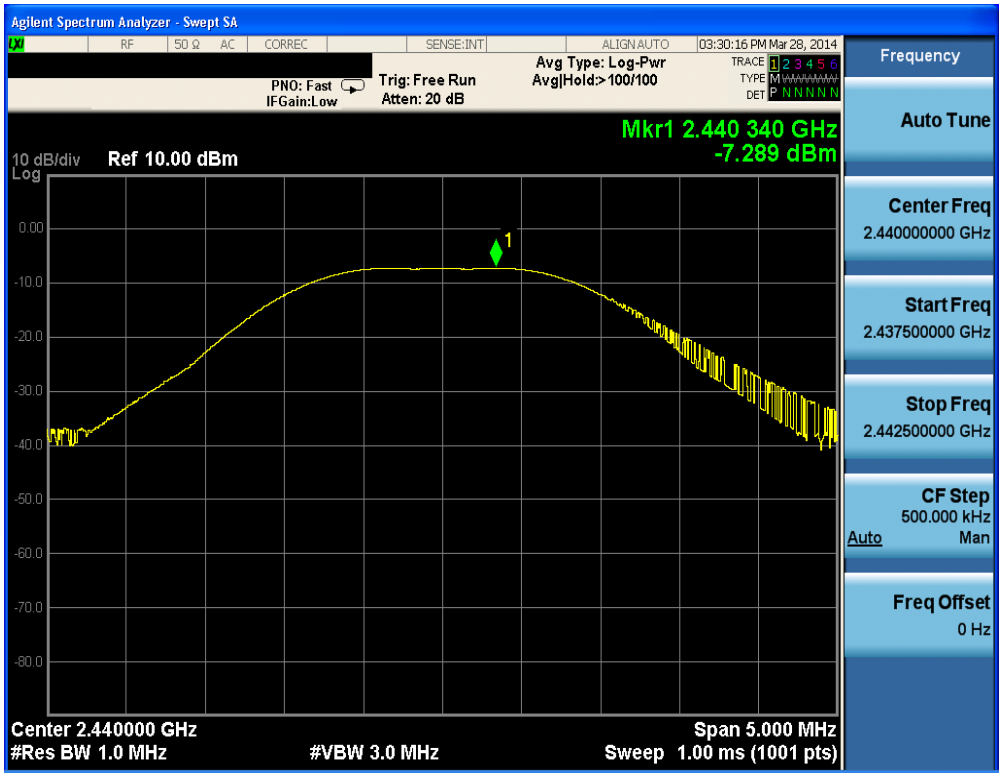
Plot 9-4. Average Power (Ch. 0)



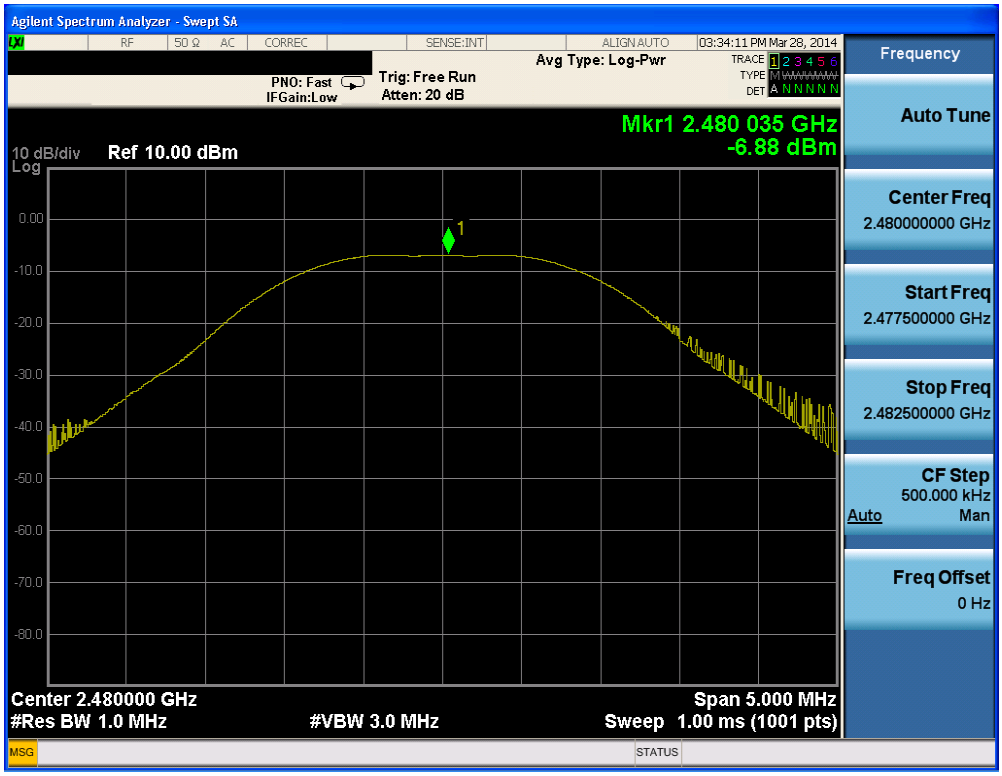
Plot 9-5. Peak Power (Ch. 0)



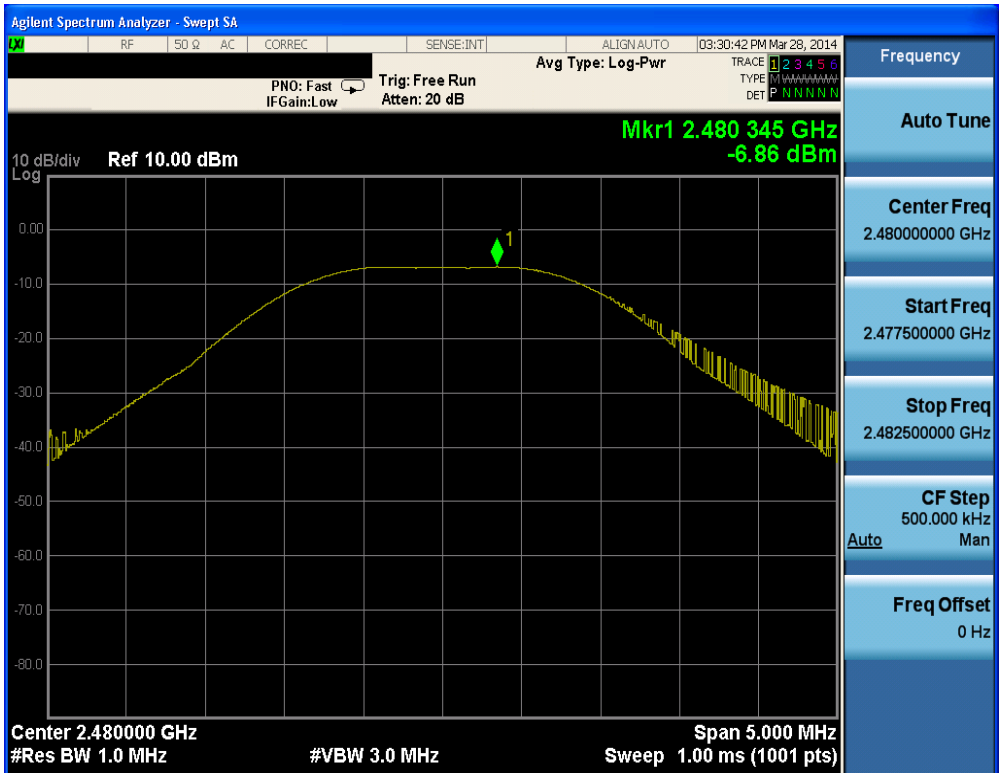
Plot 9-6. Average Power (Ch. 19)



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



Plot 9-8. Average Power (Ch. 39)



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-210 [A8.2]

9.3.2 Test Method:

Measurements are performed according to the procedure defined in KDB 558074- Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 V03R01.

Spectrum Analyzer settings:
RBW= 3 kHz
VBW= 1 MHz
Trace Mode= Peak Detector (Max Hold)
Sweep time= Auto

9.3.3 Limits:

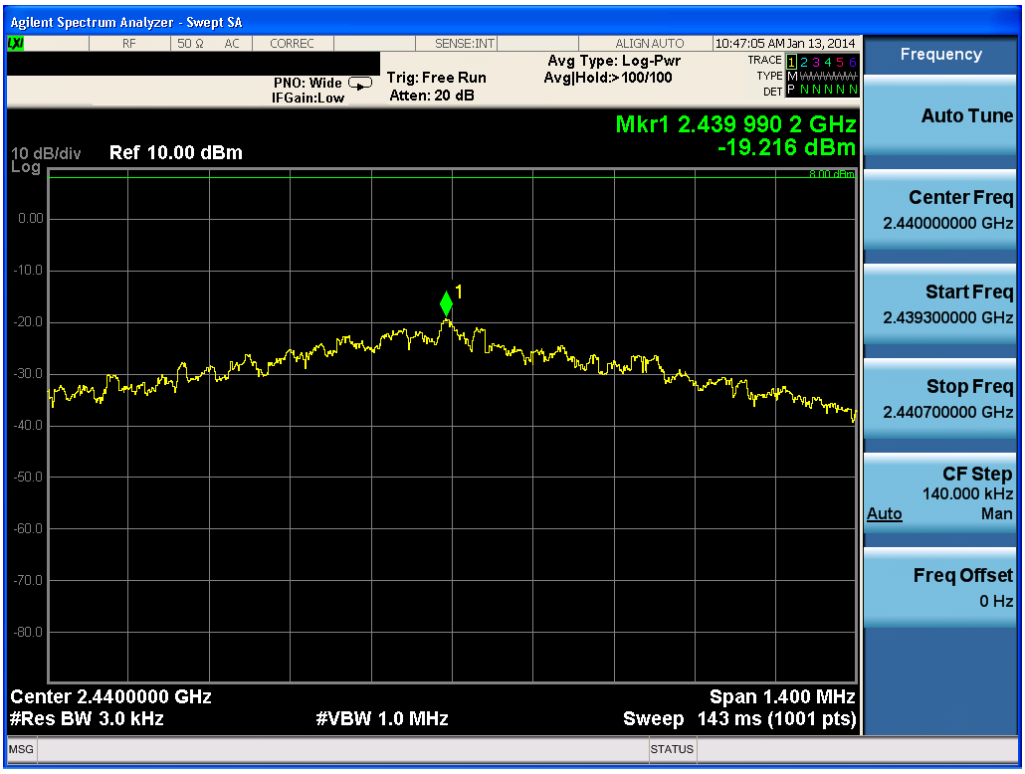
The maximum permissible power density is 8 dBm/3kHz.

9.3.4 Test Results:

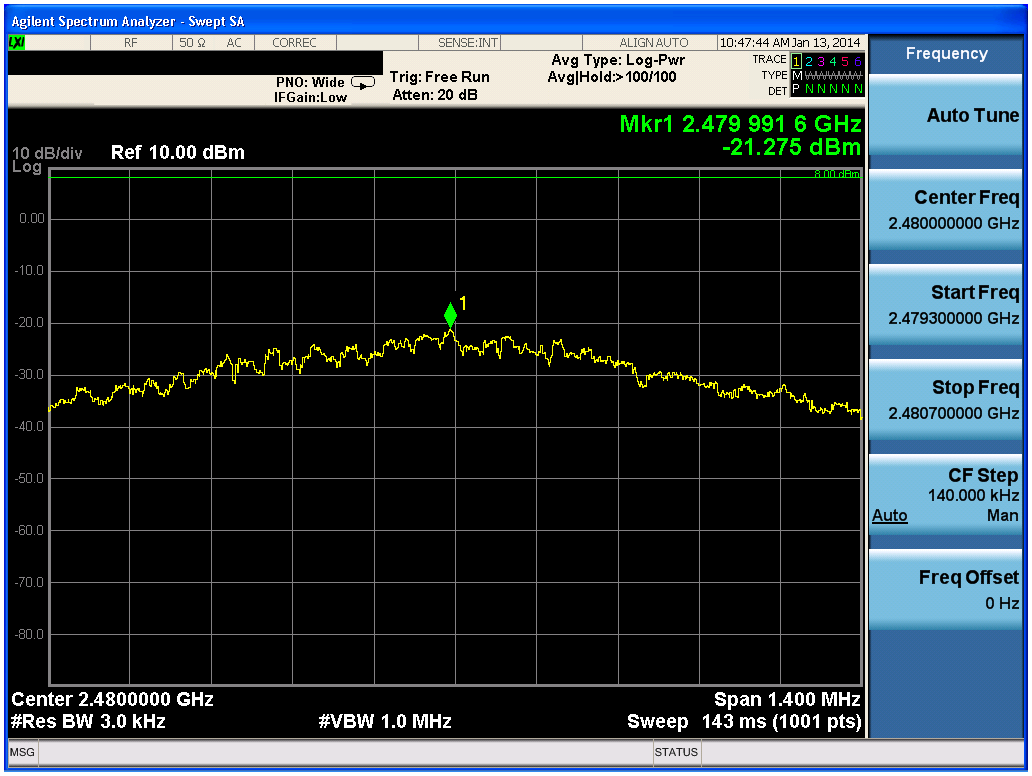
Frequency (MHz)	Test Mode	Channel No.	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
2402	BT LE	0	-20.499	8	PASS
2440	BT LE	19	-21.275	8	PASS
2480	BT LE	39	-19.216	8	PASS

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 and Band Edge Emissions

9.4.1 Test Requirement:

FCC CFR 47 Rule Part 15.247 (d)

Industry Canada RSS-210 [A8.5]

9.4.2 Test Method:

Measurements are performed according to the procedure defined in KDB 558074- Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 V03R01.

Spectrum Analyzer settings:

Band Edge Emissions:

RBW= 100 kHz
VBW ≥ 3 x RBW
Trace Mode= Peak Detector (Max Hold)
Sweep time= Auto
Span= 20 MHz

Conducted Spurious Emissions:

RBW= 1 MHz
VBW≥ 3 x RBW
Trace Mode= Peak Detector (Max Hold)
Sweep time= Auto
Span= 30 MHz- 26 GHz

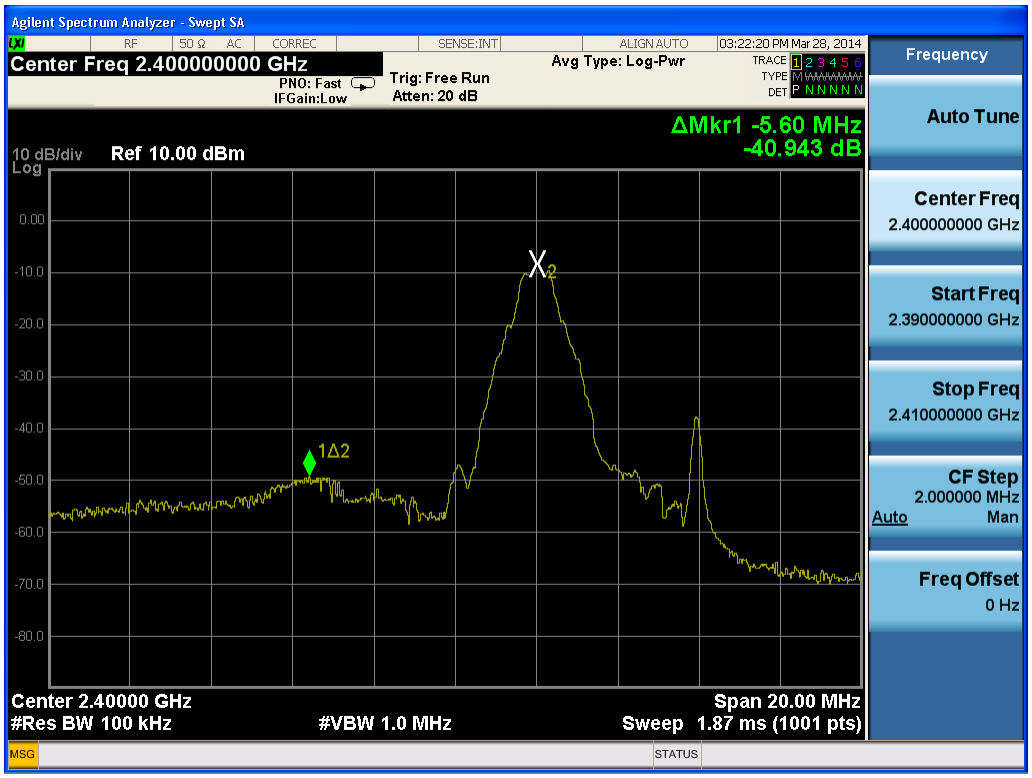
9.4.3 Limits:

All spurious emissions >20 dBc.

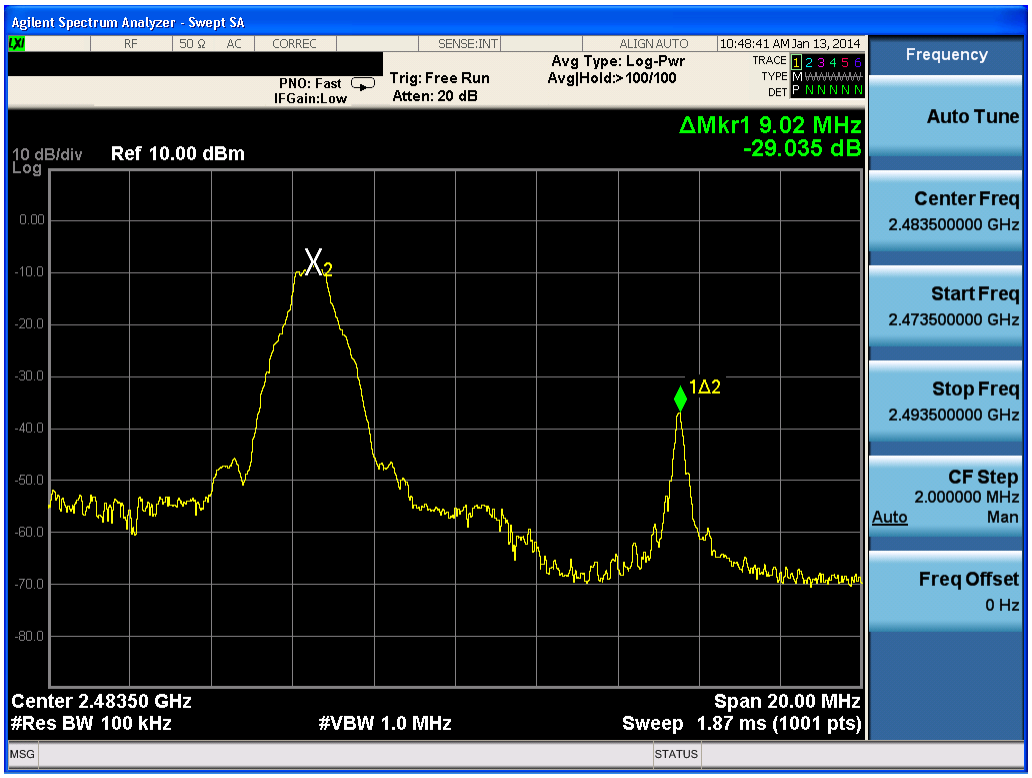
9.4.4 Test Result:

Pass.

9.4.5 Test Data:



Plot 9-13. Conducted-Low Band Edge (Ch. 0)



Plot 9-14. Conducted- High Band Edge (Ch. 39)

Plot 9-15. Conducted Spurious Emissions (Ch. 0)

Plot 9-16. Conducted Spurious Emissions (Ch. 19)

Plot 9-17. Conducted Spurious Emissions (Ch. 39)

9.5 Radiated Spurious and Band Edge Emissions

9.5.1 Test Requirement:

FCC CFR 47 Rule Part 15.247 (d)

Industry Canada RSS-210 [A8.5]

9.5.2 Test Method:

Measurements are performed according to the procedure defined in KDB 558074- Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 V03R01.

Radiated spurious emissions are checked from 10 kHz to the 10th harmonic of the highest fundamental frequency of the transmitter.

The EUT is tested in the low, middle and high channels and in three orthogonal axes. Antenna height and polarities are adjusted to record the maximum emissions and the worst case data is shown below.

Spectrum Analyzer Settings:

Below 30 MHz:

Span= 10 kHz- 30 MHz
RBW= 200 Hz (9 kHz- 150 kHz); 9 kHz (150 kHz- 30 MHz)
VBW ≥ 3 X RBW
Trace Mode: Peak Detector (Max Hold)
Sweep time= Auto

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

Sample Calculation:

Electric Field Strength Level= Amplitude (Analyzer level) + AFCL (Antenna Factor and Cable losses) – Amplifier Gain
Eg: Electric Field Strength = 96 dBµV+ 12 dB- 10 dBi= 98 dBµV/m

9.5.3 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)

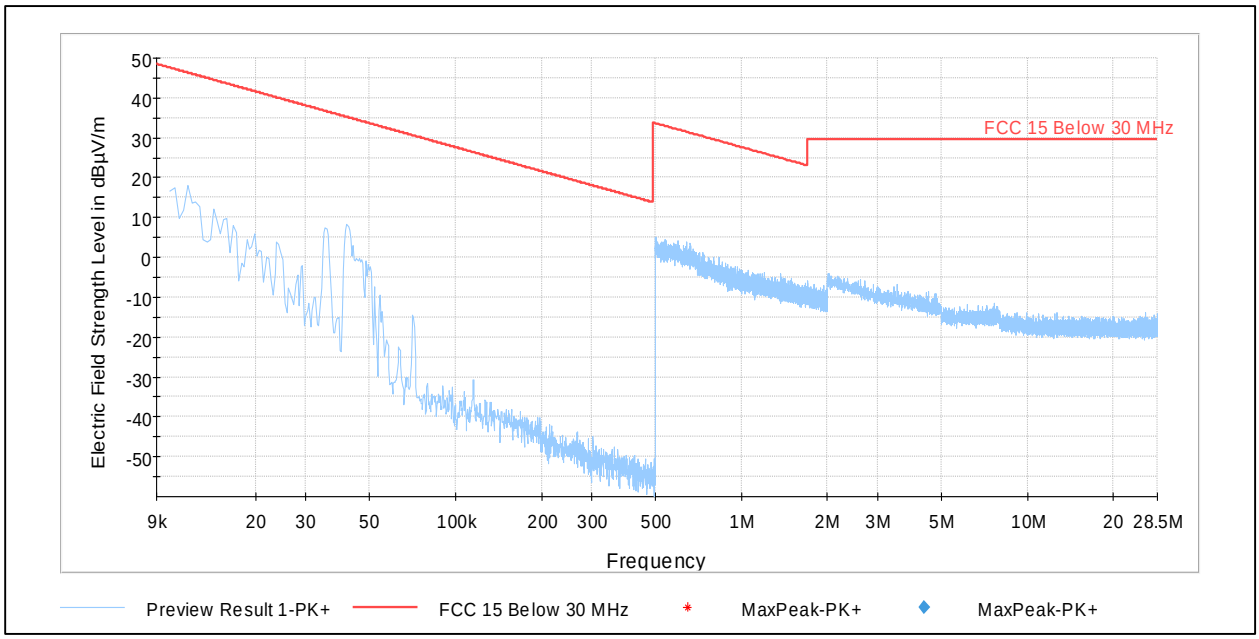
9.5.4 Test Result:

Pass.

9.5.5 Test Data:

9.5.5.1 Emissions in 10 kHz- 30 MHz range

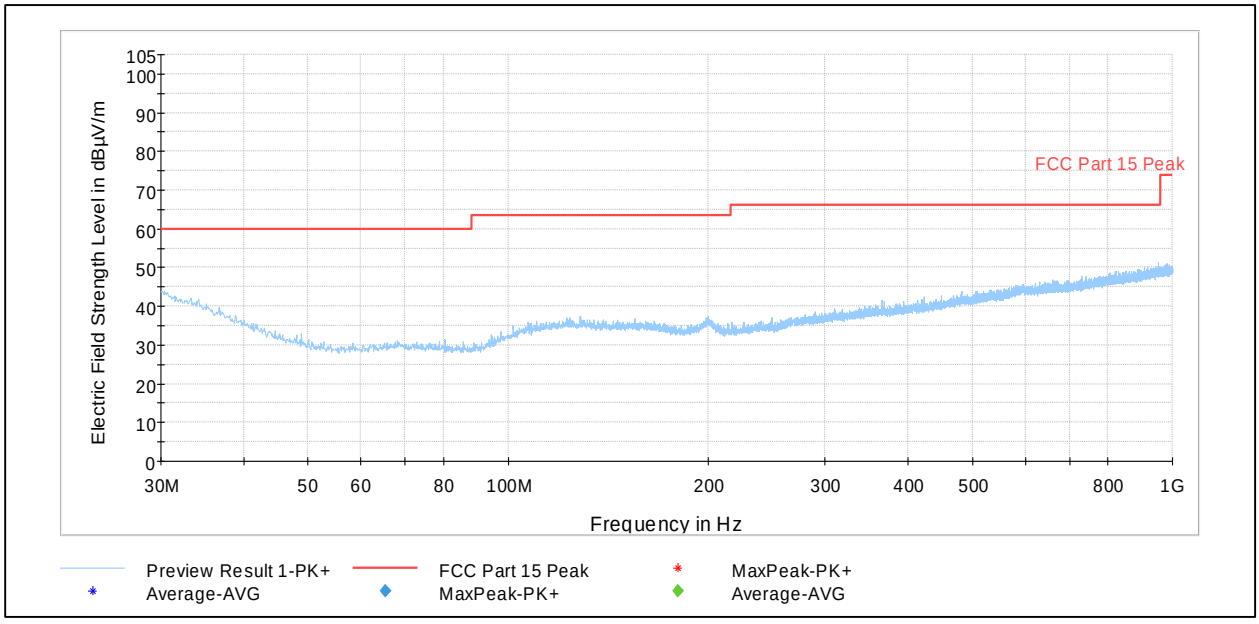
Worst case configuration and results shown below.
No significant emissions to report above noise floor.



Plot 9-18. Radiated Spurious Emissions (Ch. 19) (X axis) (10 kHz – 30 MHz)

9.5.5.2 Emissions in 30 MHz- 1 GHz range

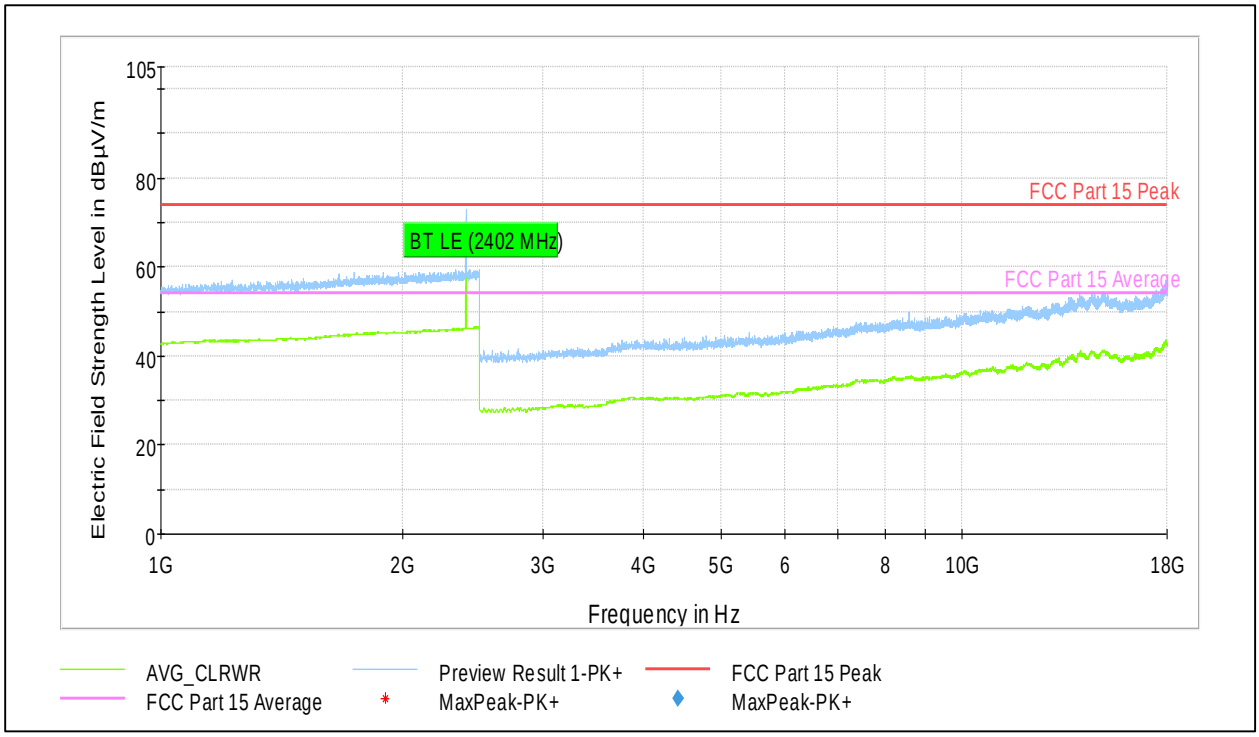
Worst case results shown below.
No significant emissions to report above noise floor.



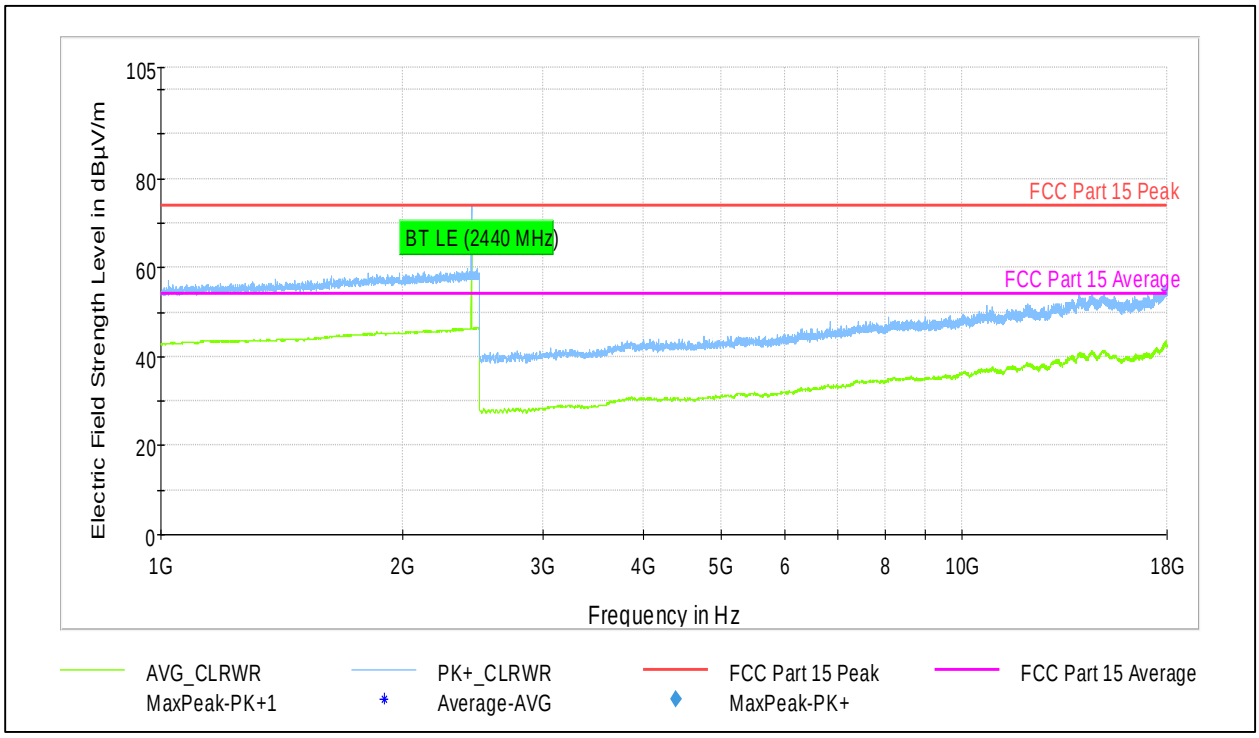
Plot 9-19. Radiated Spurious Emissions (Ch. 19) (30MHz - 1GHz)

9.5.5.3 Emissions in 1-18 GHz range

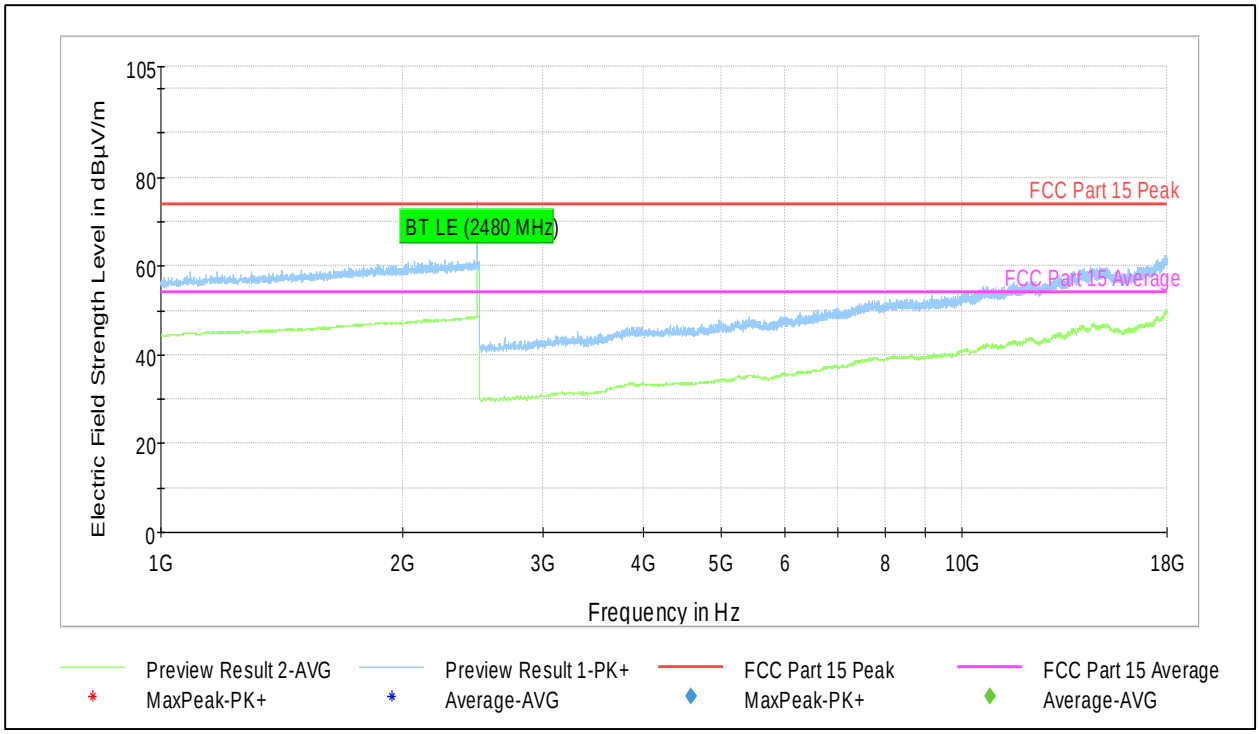
No significant emissions to report above noise floor.



Plot 9-20. Radiated Spurious Emissions (Ch. 0) (1-18GHz)



Plot 9-21. Radiated Spurious Emissions (Ch. 19) (1-18GHz)

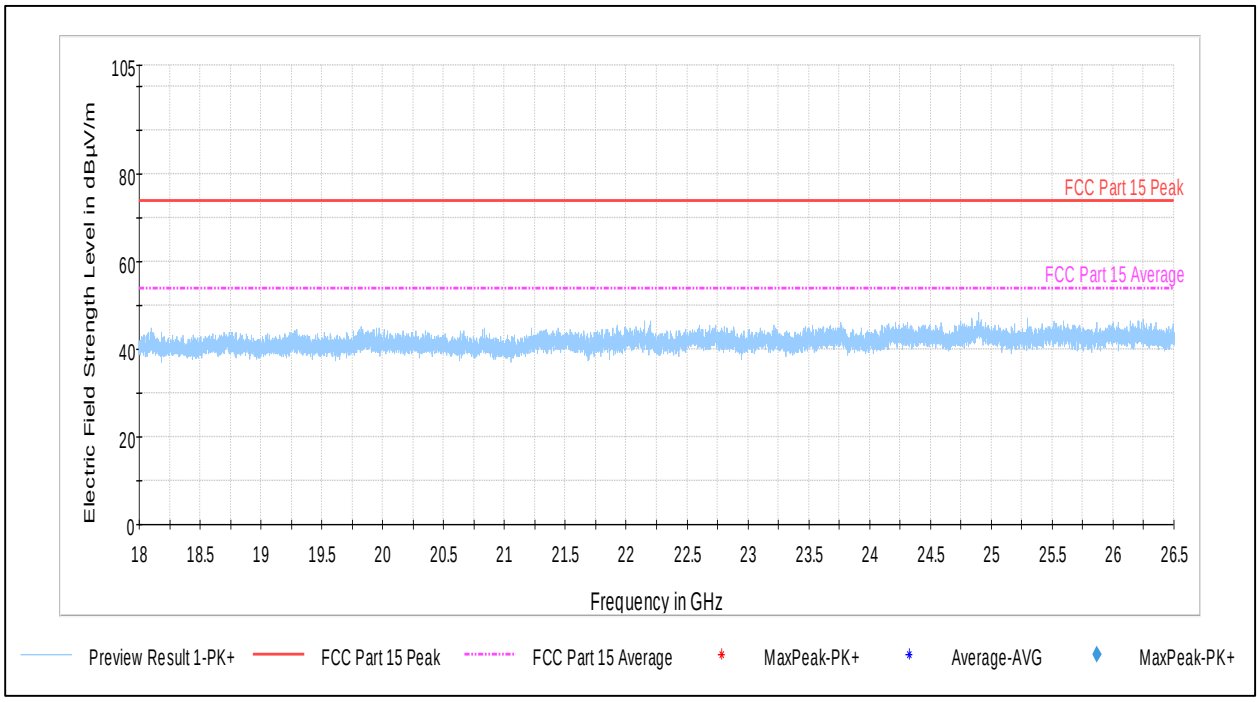


Plot 9-22. Radiated Spurious Emissions (Ch. 39) (1-18GHz)

9.5.5.4 Emissions in 18-26.5 GHz range

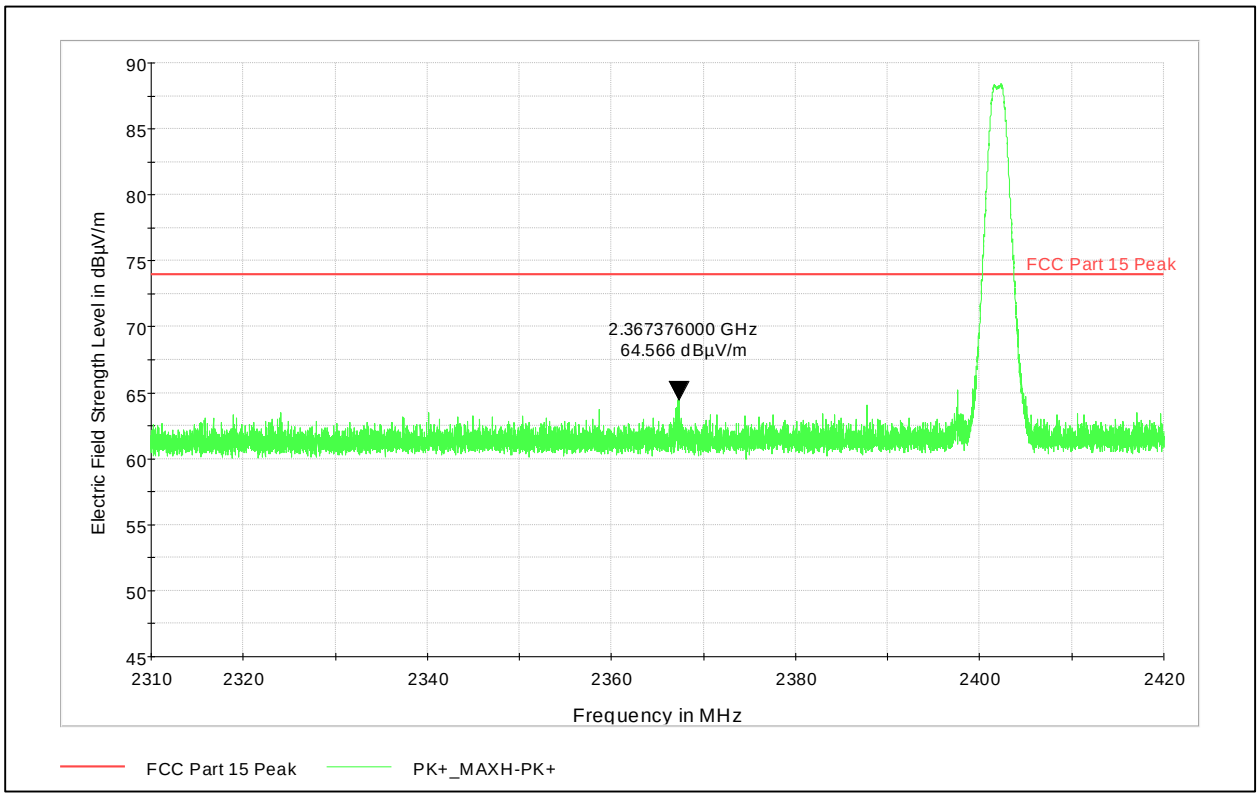
Worst case results shown below.

No significant emissions to report above noise floor.

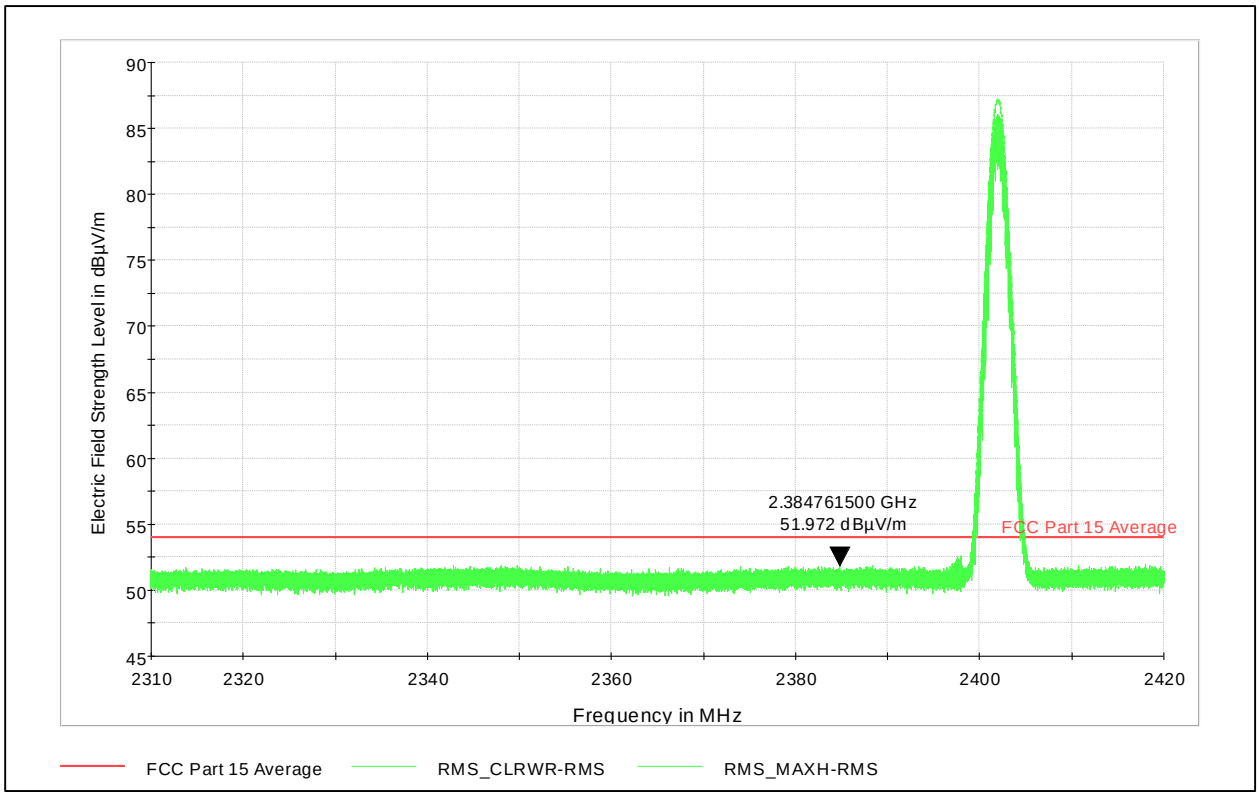


Plot 9-23. Radiated Spurious Emissions (Ch. 19) (18 – 26.5 GHz)

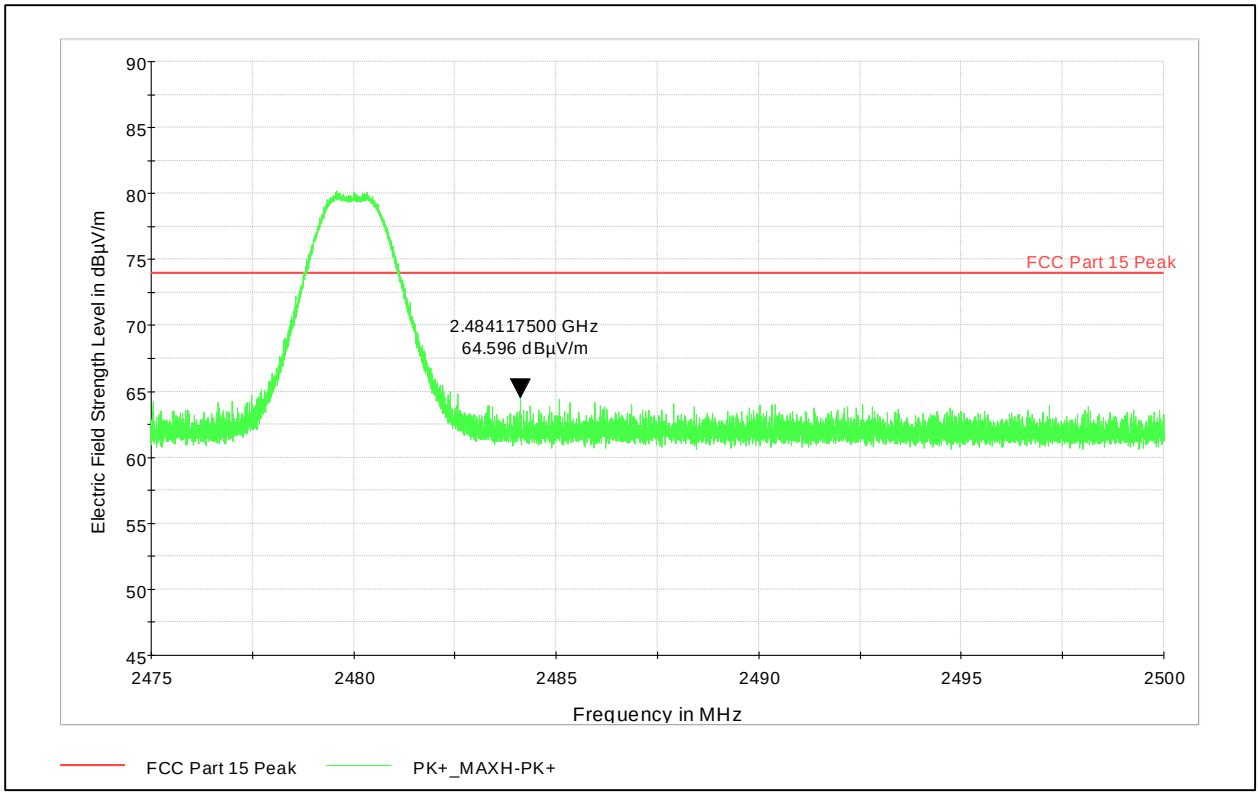
9.5.5.5 Radiated restricted Band-edge emissions



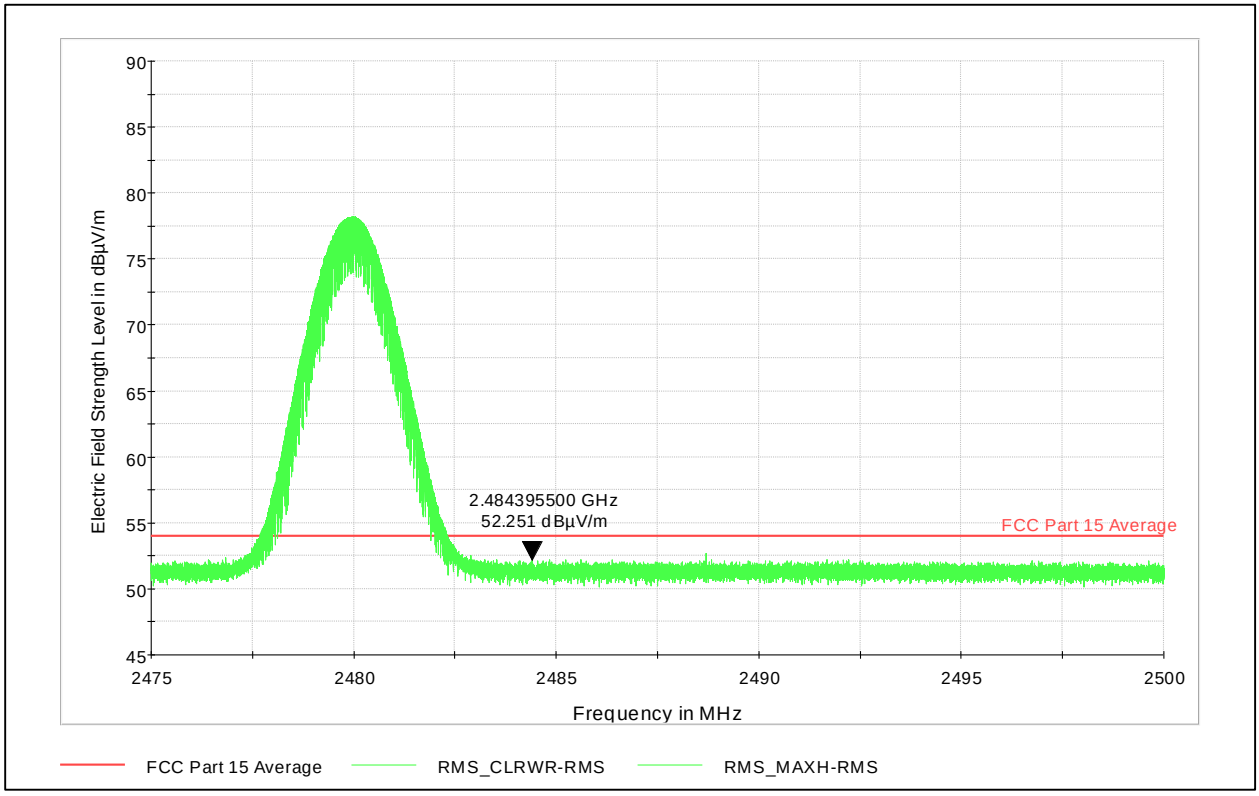
Plot 9-24. Radiated Restricted Band Edge (Ch. 0) Peak



Plot 9-25. Radiated Restricted Band Edge (Ch. 0) Average



Plot 9-26. Radiated Restricted Band Edge (Ch. 39) Peak



Plot 9-27. Radiated Restricted Band Edge (Ch. 39) Average

Microsoft

End of Report