



# RADIO TEST REPORT

For

MODEL NO.: 1769

FCC ID: C3K1769

IC ID: 3048A-1769

Test Report No. R-TR402-FCCISED-BTLE-2

Issue Date: April 20, 2017

FCC CFR47 Part 15 Subpart C  
Innovation, Science and Economic Development  
Canada RSS-247 Issue 1

*Prepared by*

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TESTING CERT #3472.01

# 1 Record of Revisions

Revision	Date	Section	Page(s)	Summary of Changes	Author/ Revised
1.0	03/23/2017	All	All	Version 1.0	Daniel Salinas
2.0	04/20/2017	9.2.2, 9.4.2, 9.5.2, 9.6.2, 9.7.2, 9.8.2	18, 22, 24, 26, 30, 32.	Updated KDB Version details of KDB558074 from V03R05 to V04.	Daniel Salinas

## Table of Contents

1	Record of Revisions.....	2
2	Deviations from Standards .....	7
3	Facilities and Accreditations .....	7
3.1	Test Facility .....	7
3.2	Accreditations .....	7
3.3	Test Equipment .....	7
4	Measurement Uncertainty.....	7
5	Product Description .....	8
5.1	Test Configurations .....	8
5.2	Environmental Conditions.....	8
5.3	Antenna Requirements.....	8
5.4	Equipment Modifications .....	9
5.5	Dates of Testing .....	9
6	Test Results Summary .....	10
7	Test Equipment List.....	11
8	Test Site Description.....	13
8.1	Radiated Emissions Test Site.....	13
8.1.1	Radiated Measurements in 30 MHz - 1000 MHz .....	13
8.1.2	Radiated Measurements above 1GHz .....	13
8.2	Antenna port conducted measurements.....	13
8.3	Test Setup Diagrams.....	13
9	Test Results- Conducted .....	16
9.1	Duty Cycle .....	16
9.1.1	Test Requirement:.....	16
9.1.2	Test Method: .....	16
9.1.3	Limits: .....	16
9.1.4	Test Results: .....	16
9.1.5	Test Data:.....	17
9.2	6-dB Bandwidth .....	18
9.2.1	Test Requirement:.....	18
9.2.2	Test Method: .....	18
9.2.3	Limits: .....	18
9.2.4	Test Results: .....	18

9.2.5	Test Data: .....	19
9.3	99% Occupied Bandwidth .....	20
9.3.1	Test Requirement: .....	20
9.3.2	Test Method: .....	20
9.3.3	Limits: .....	20
9.3.4	Test Results: .....	20
9.3.5	Test Data: .....	21
9.4	Output Power .....	22
9.4.1	Test Requirement: .....	22
9.4.2	Test Method: .....	22
9.4.3	Limits: .....	22
9.4.4	Test Results: .....	22
9.4.5	Test Data: .....	23
9.5	Peak Power Density .....	24
9.5.1	Test Requirement: .....	24
9.5.2	Test Method: .....	24
9.5.3	Limits: .....	24
9.5.4	Test Results: .....	24
9.5.5	Test Data: .....	25
9.6	Conducted Spurious Emissions .....	26
9.6.1	Test Requirement: .....	26
9.6.2	Test Method: .....	26
9.6.3	Limits: .....	26
9.6.4	Test Result: .....	26
9.6.5	Test Data: .....	27
9.7	Conducted Band Edge Emissions .....	30
9.7.1	Test Requirement: .....	30
9.7.2	Test Method: .....	30
9.7.3	Limits: .....	30
9.7.4	Test Result: .....	30
9.7.5	Test Data: .....	31
9.8	Radiated Spurious and Band Edge Emissions .....	32
9.8.1	Test Requirement: .....	32
9.8.2	Test Method: .....	32

9.8.3	Limits: .....	35
9.8.4	Test Result: .....	35
9.8.5	Test Data: .....	36
9.9	AC Line Conducted Emissions .....	42
9.9.1	Test Requirements .....	42
9.9.2	Test Method .....	42
9.9.3	Limit.....	42
9.9.4	Test Result: .....	42
9.9.5	Test Data: .....	43

# Test Report Attestation

**Microsoft Corporation**

**Model:** 1769

**FCC ID:** C3K1769

**IC ID:** 3048A-1769

**Applicable Standards**

Specification	Test Result
FCC 47CFR Rule Parts 15.207, 15.209, 15.247	Pass
Innovation, Science and Economic Development Canada RSS-247 Issue 1, RSS-GEN Issue 4	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.

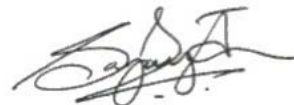
This report shall not be used to claim product certification, approval, or endorsement by A2LA or any agency of any Government. Reproduction, duplication or publication of extracts from this test report is prohibited and requires prior written approval of Microsoft EMC Laboratory.

This report replaces the previously issued report #R-TR402-FCCISED-BTLE-1 issued by Microsoft EMC Labs on 3/23/2017.



Written By: Daniel Salinas

Radio Test Lead



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 67<sup>th</sup> 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-3, 3048A-4

### 3.3 Test Equipment

The site and related equipment are constructed in conformance with the requirements of ANSI C63.4:2014 and other equivalent applicable standards.

Test site requirements for measurements above 1 GHz are in accordance with ANSI C63.4:2014.

ANSI C63.10:2013 and the appropriate KDB test methods were followed.

## 4 Measurement Uncertainty

The following measurement uncertainty levels have been estimated for tests performed on the product, as specified in ETSI TR 100 028. This represents an expanded uncertainty expressed at 95% confidence level using a coverage factor  $k=2$ . These levels are for reference only and not included to determine product compliance.

Expanded uncertainty calculations are available upon request.

Test item	Uncertainty	Unit
Radiated disturbance (30 MHz to 1 GHz)	5.99	dB
Radiated disturbance (1 GHz to 18 GHz)	5.12	dB
Conducted Disturbance at Mains Port	3.31	dB
Uncertainty for Conducted Power test	1.277	dB
Uncertainty for Conducted Spurious emission test	2.742	dB
Uncertainty for Bandwidth test	4.98	kHz
Uncertainty for DC power test	0.05	%
Uncertainty for test site temperature	0.5	°C
Uncertainty for test site Humidity	3	%
Uncertainty for time	0.189	%

## 5 Product Description

Company Name:	Microsoft Corporation
Address:	One Microsoft Way
City, State, Zip:	Redmond, WA 98052-6399
Customer Contact:	Mike Boucher
Functional Description of the EUT:	Portable Computing Device with IEEE 802.11a/b/g/n/ac MIMO supporting 20/40/80 MHz bandwidths, and Bluetooth 4.0 Radios.
Model:	1769
FCC ID:	C3K1769
IC ID:	3048A-1769
Radio under test:	BTLE (2402- 2480 MHz)
Modulation(s):	GFSK
Antenna Information:	Integral Antenna. <b>Manufacturer declared max Antenna Gain in 2.4GHz band of operation: 3.4 dBi</b>
EUT Classification:	DTS
Equipment Design State:	Prototype/Production Equivalent
Equipment Condition:	Good
Test Sample Details:	RF Conducted Test Sample SN: 005372463857 RF Radiated Test Sample SN: 010566364757; 014995763957; 010557364757

### 5.1 Test Configurations

Test software “WiFi Tool” (V2.7.5) provided by the customer and “Lab Tool” (V2.0.0.77) from the module vendor was used to program the EUT to transmit continuously in Bluetooth LE mode. The device can operate in only GFSK modulation. Channel numbers 0, 19 and 38 were used as Low, Mid and High Channels respectively.

### 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 December 19, 2016- January 17, 2017, and March 15–March 16, 2017.

## 6 Test Results Summary

Test Description	FCC CFR 47/ ISED Rule Part	Limit	Test Result
Duty Cycle	Reporting & Measurements	Reporting & Measurement Purposes only	N/A
6dB Bandwidth	15.247 (a)(2) RSS-247 [5.2]	≥ 500kHz	Pass
Occupied Bandwidth	Reporting & Measurements	Reporting & Measurement Purposes only	N/A
Output Power	15.247 (b)(3) RSS-247 [5.4]	≤ 1 Watt	Pass
Equivalent Isotropic Radiated Power	RSS-247 [5.4]	≤ 4 Watt	Pass
Power Spectral Density	15.247 (e) RSS-247 [5.2]	≤ 8dBm/3kHz	Pass
Conducted Band Edge/Unwanted Emissions	15.247 (d) RSS-247 [5.5]	At least 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]	Pass

## 7 Test Equipment List

Equipment used for Radiated and Conducted Measurements				
Manufacturer	Description	Model #	Asset #	Calibration Due
Rohde & Schwarz	EMI Test Receiver	ESU40	RF-012	4/14/2017
Rohde & Schwarz	EMI Test Receiver	ESU40	RF-229	4/13/2017
Rohde & Schwarz	Signal Analyzer	FSV40	RF-228	4/12/2017
Keysight	Spectrum Analyzer	N9030A	EMC-846	4/19/2017
Sunol Sciences	Antenna - Broadband Hybrid	JB6	RF-039	5/26/2017
ETS-Lindgren	Antenna - Double-Ridged Guide	3117-PA	EMC-858	4/21/2017
ETS-Lindgren	Antenna - Double-Ridged Guide	3117	RF-137	2/25/2017
ETS-Lindgren	Antenna - Standard Gain	3160-09	RF-179	N/A
ETS-Lindgren	Antenna - Standard Gain	3160-09	EMC-452	N/A
Rohde & Schwarz	Custom Filter Bank	SFUNIT RX	RF-323	N/A
Rohde & Schwarz	Custom Filter Bank	SFUNIT RX	RF-324	N/A
Rohde & Schwarz	Preamplifier	TS-PR26	RF-042	N/A
Rohde & Schwarz	Open Switch and Control Unit	OSP130	RF-018	N/A
Rohde & Schwarz	Open Switch and Control Unit	OSP150	RF-019	N/A
Rohde & Schwarz	Open Switch and Control Unit	OSP130	RF-249	N/A
Rohde & Schwarz	Open Switch and Control Unit	OSP150	RF-250	N/A
Murata	RF Cable	MXHQ87WA3000	RF-395	N/A
Micro-Coax	RF Cable	UFC142A	RF-088	N/A
MegaPhase	RF Cable	EMC3-N1N1-394	EMC-1034	N/A

Manufacturer	Description	Model #	Asset #	Calibration Due
Huber & Suhner	RF Cable	SucoFlex 106A	RF-351	N/A
Micro-Coax	RF Cable	UTI Flex	RF-359	N/A
Sucoflex	RF Cable	104PE	RF-430	N/A
Huber & Suhner	RF Cable	Sucoflex 102A	RF-269	N/A
Huber & Suhner	RF Cable	SucoFlex 106A	RF-351	N/A
Pasternack	10dB Attenuator	PE7087-10	RF-125	N/A
Pasternack	10dB Attenuator	PE7087-10	RF-341	N/A
Madge Tech	THP Monitor	PRHTemp2000	EMC-679	11/15/2017
Madge Tech	THP Monitor	PRHTemp2000	EMC-681	10/25/2017
Rohde & Schwarz	EMC 32 Test Software	V10.01.0	N/A	N/A

Note: Items with Calibration Due date marked as N/A are characterized before use, where applicable.

Equipment used for Line Conducted Emissions Measurement				
Manufacturer	Description	Model #	Asset #	Calibration Due
Rohde & Schwarz	EMI Test Receiver	ESR3	EMC-669	4/12/2017
Teseq	LISN	NNB 51	EMC-057	6/22/2017
Teseq	LISN	NNB 51	EMC-056	5/3/2017
Micro-Coax	RF Cable	UFA210A-1-1800-50U50U	EMC-367	N/A
ETS-Lindgren	TILE Test Software	7.1.3.60	EMC-985	N/A
Fluke	Multimeter	87V	EMC-650	7/25/2017
Madge Tech	THP Monitor	PRHTemp2000	EMC-170	8/31/2017

Note: Items with Calibration Due date marked as N/A are characterized before use, where applicable.

## 8 Test Site Description

### 8.1 Radiated Emissions Test Site

Radiated measurements are performed in a 3m semi-anechoic chamber, which meets NSA requirements for the frequency range of 30MHz to 1000MHz. For measurements above 1 GHz, absorbers are placed on the ground plane between the receiving antenna and the EUT to meet Site VSWR requirements in accordance with ANSI C63.4:2014.

#### 8.1.1 Radiated Measurements in 30 MHz - 1000 MHz

The EUT is positioned on a turntable at a height of 80cm using a non-conducting table. A linearly polarized broadband antenna is positioned at 3m from the EUT periphery. The turntable is rotated 360 degrees, and the antenna height varied from 1m to 4m to determine the highest emissions. This is repeated for both Horizontal and Vertical polarizations of the measurement antenna. All possible orientations of the EUT were investigated for emissions and the vertical standing orientation was identified as the worst-case configuration.

#### 8.1.2 Radiated Measurements above 1GHz

The EUT is positioned on a Turntable at a height of 1.5m. A linearly polarized antenna is positioned 3m from the EUT periphery. Guidelines in ANSI C63.10:2013 were followed with respect to maximizing the emissions. The measurement antenna is set at a fixed 1.5m height while the turntable is rotated 360 degrees and the EUT elevation angle is varied from 0 to 150 degrees to determine the highest emissions. This is repeated for both Horizontal and Vertical polarizations of the measurement antenna. Measurements above 18GHz were performed at a 3m distance. Near field scanning is performed to identify frequencies above 1GHz.

### 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 were added internally in the analyzer settings, where applicable. The plots displayed take these correction factors into account.

### 8.3 Test Setup Diagrams

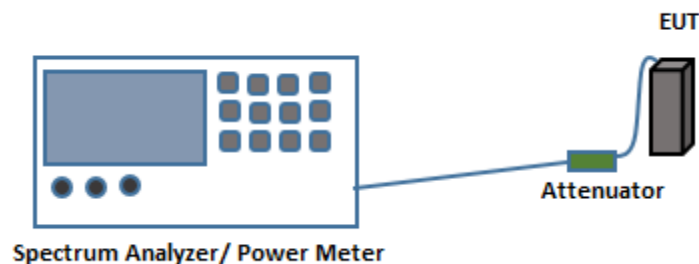


Fig.1. Test Setup for Antenna port conducted measurements

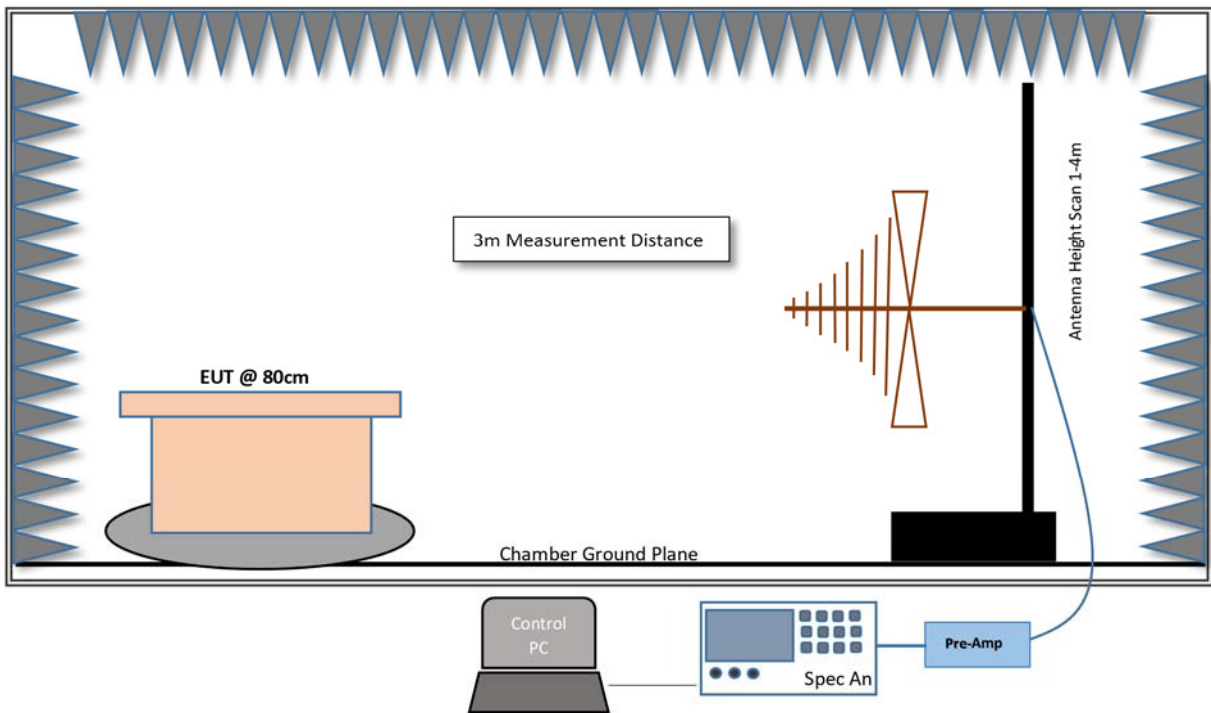


Fig.2. Test Setup for Radiated measurements in 30MHz- 1GHz Range

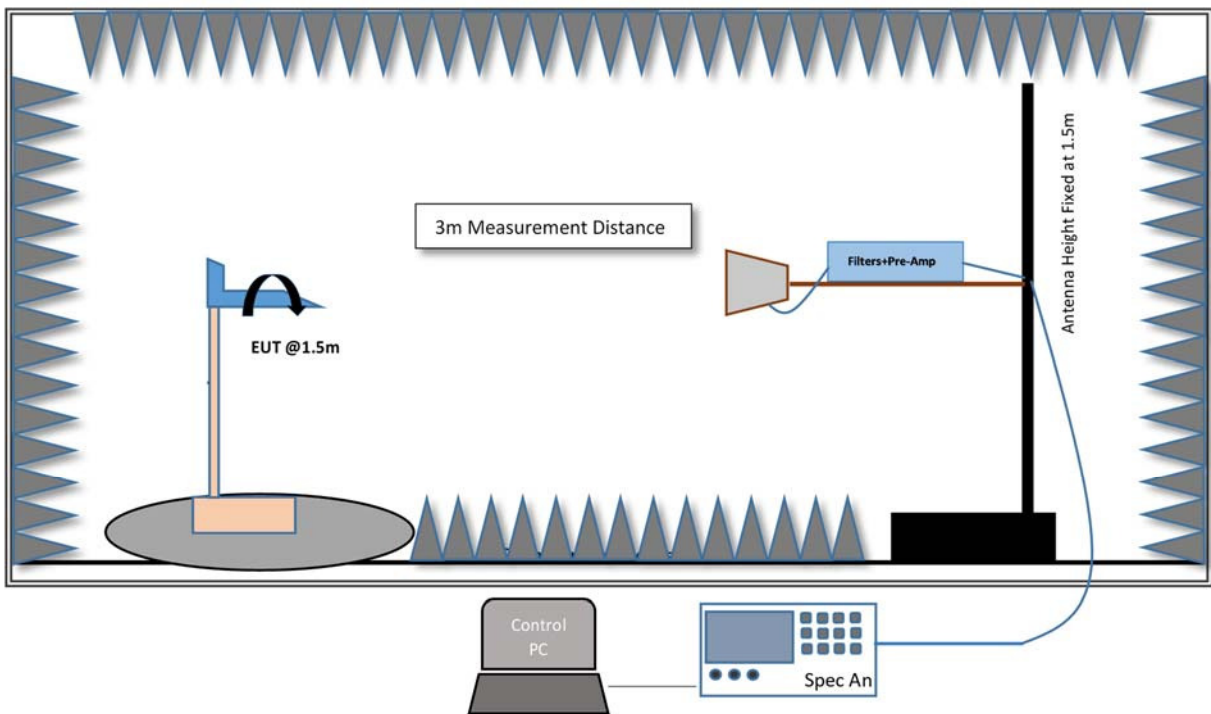


Fig.3. Test Setup for Radiated measurements in 1GHz- 18GHz Range

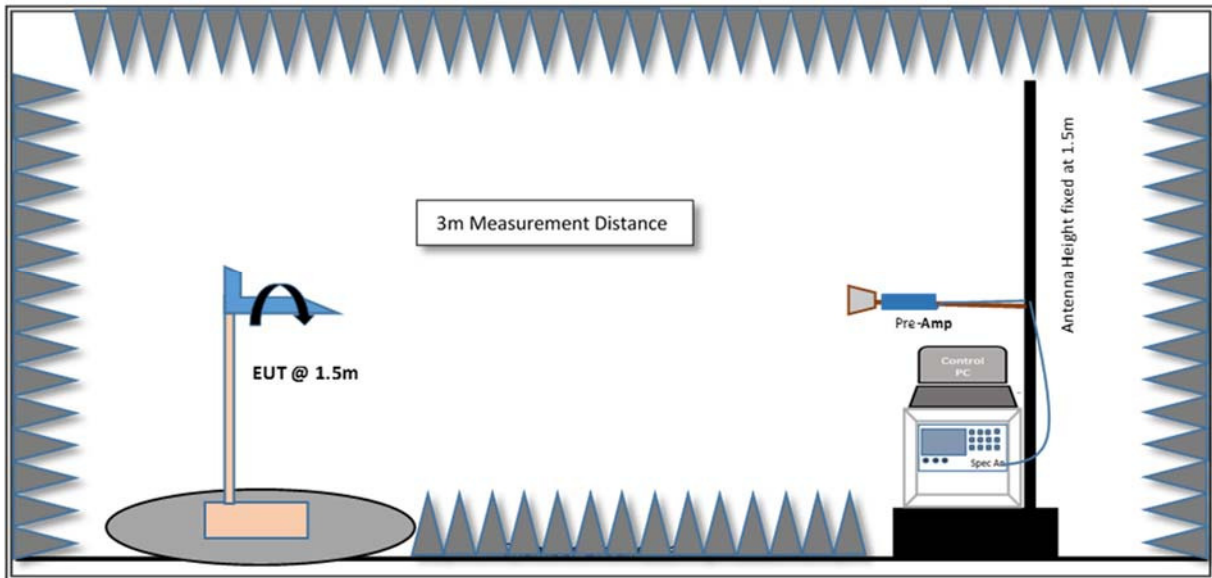


Fig.4. Test Setup for Radiated measurements >18GHz

## 9 Test Results- Conducted

### 9.1 Duty Cycle

#### 9.1.1 Test Requirement:

Reporting and measurement purposes only.

#### 9.1.2 Test Method:

Measurements were performed according to the procedure defined in ANSI C63.10 (2013) American National Standard of Procedure for Compliance Testing of Unlicensed Wireless Devices.

#### Spectrum Analyzer Settings:

RBW  $\geq$  Occupied Bandwidth if possible; otherwise, set RBW to the largest available value

VBW  $\geq$  RBW  $\geq$  Signal Period

Detector = Peak

Span = 0 Hz

Sweep points > 100

#### 9.1.3 Limits:

Reporting and measurement purposes only.

#### 9.1.4 Test Results:

Frequency (MHz)	On Time (ms)	Period (ms)	Duty Cycle (%)	Correction Factor (dB)
2402	0.390	0.625	62.4	2.048



9.1.5 Test Data:

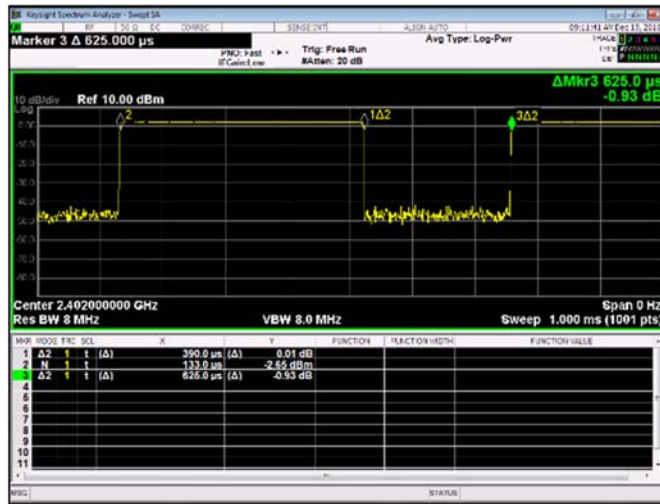


Figure 9-1 Duty Cycle 2402MHz (Ch.0)

## 9.2 6-dB Bandwidth

### 9.2.1 Test Requirement:

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

ISED RSS-247 [5.2]

### 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 V04 and ANSI C63.10 2013.

#### Spectrum Analyzer settings:

RBW= 100 kHz

VBW  $\geq$  3 RBW.

Trace Mode= Peak Detector (Max Hold)

Sweep time= Auto Couple

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

### 9.2.3 Limits:

The 6-dB bandwidth shall be at least 500 kHz

### 9.2.4 Test Results:

Frequency (MHz)	Test Mode	Channel No.	6dB Bandwidth (kHz)	Limit (kHz)	Result
2402	BT LE	0	666.7	>500	Pass
2440	BT LE	19	666.3	>500	Pass
2480	BT LE	39	666.3	>500	Pass

9.2.5 Test Data:



Figure 9-2 6dB Bandwidth (Ch. 0)

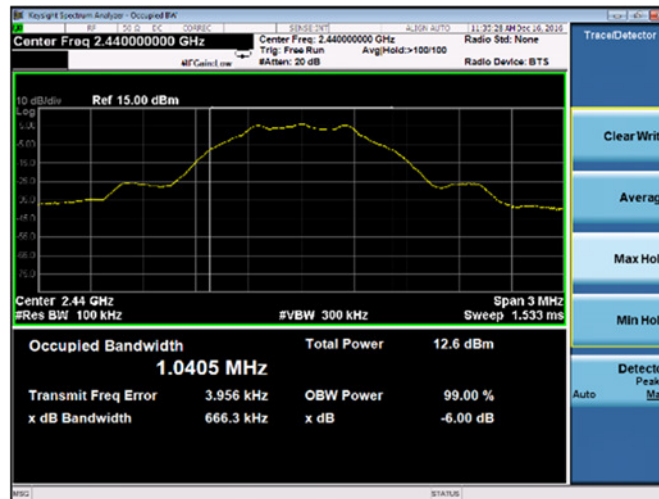


Figure 9-3 6dB Bandwidth (Ch. 19)



Figure 9-4 6dB Bandwidth (Ch. 39)

### 9.3 99% Occupied Bandwidth

#### 9.3.1 Test Requirement:

The 99% Occupied Channel Bandwidth is the bandwidth that contains 99 % of the power of the signal. This test is performed for reporting and measurement purposes only.

#### 9.3.2 Test Method:

Measurements are performed according to ANSI C63.10 (2013).

#### Spectrum Analyzer settings:

Set analyzer center frequency to the nominal EUT channel frequency

Span is set to between 1.5 and 5.0 times the DTS bandwidth

RBW to: 1% to 5% of the OBW

VBW  $\geq$  3 RBW

Detector = Peak

Sweep time = Auto Couple

Trace mode = max hold

Use the 99% power bandwidth function of the instrument.

#### 9.3.3 Limits:

For reporting purpose only.

#### 9.3.4 Test Results:

Frequency (MHz)	Test Mode	Channel No.	99% Bandwidth (MHz)
2402	BT LE	0	1.02
2440	BT LE	19	1.02
2480	BT LE	39	1.02

9.3.5 Test Data:



Figure 9-5 99% Bandwidth (Ch. 0)



Figure 9-6 99% Bandwidth (Ch. 19)



Figure 9-7 99% Bandwidth (Ch. 39)

## 9.4 Output Power

### 9.4.1 Test Requirement:

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

ISED RSS-247 [5.4]

### 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 V04 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 Couple

Span= 3 MHz

### 9.4.3 Limits:

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

RSS-247: The maximum peak conducted output power shall not exceed 30dBm (1 W) and the maximum radiated output power shall not exceed 36dBm (4 W) EIRP.

### 9.4.4 Test Results:

Frequency (MHz)	Mode	Channel No.	Cond. Peak Power (dBm)	Cond. Peak Power (W)	Limit (dBm)	Margin (dB)	Result
2402	BT LE	0	4.06	0.0025	30	-25.94	Pass
2440	BT LE	19	4.11	0.0026	30	-25.89	Pass
2480	BT LE	39	4.73	0.0300	30	-25.27	Pass

Frequency (MHz)	Mode	Channel No.	Cond. Peak Power (dBm)	Max Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)	Result
2402	BT LE	0	4.06	3.4	7.46	36	-28.54	Pass
2440	BT LE	19	4.11	3.4	7.51	36	-28.49	Pass
2480	BT LE	39	4.73	3.4	8.13	36	-27.87	Pass

9.4.5 Test Data:

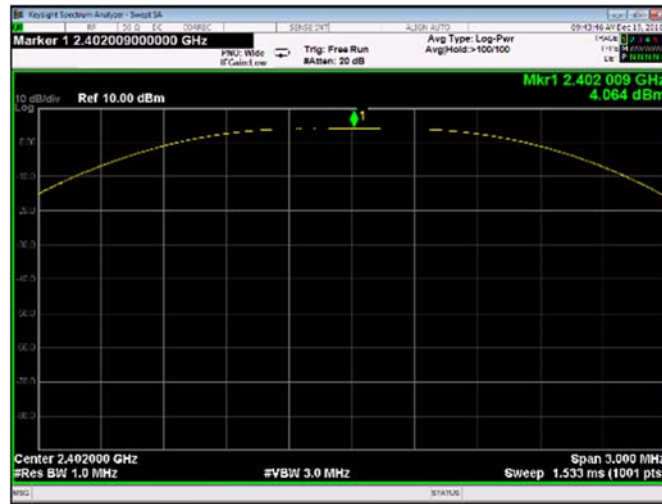


Figure 9-8 Peak Power (Ch. 0)

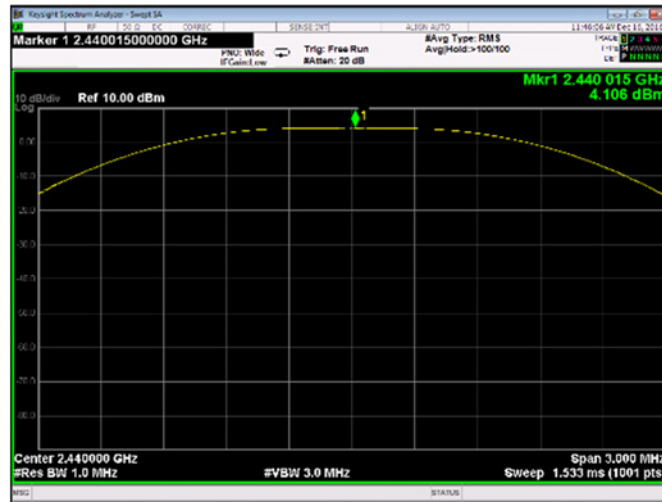


Figure 9-9 Peak Power (Ch. 19)

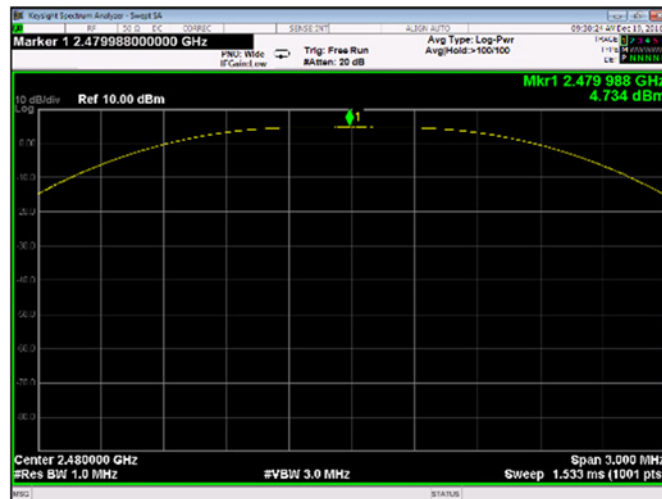


Figure 9-10 Peak Power (Ch. 39)

## 9.5 Peak Power Density

### 9.5.1 Test Requirement:

FCC CFR 47 Rule Part 15.247 (e)

ISED RSS-247 [5.2]

### 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 V04 and ANSI C63.10 2013.

#### Spectrum Analyzer settings:

RBW= 100 kHz

VBW= 300 kHz

Trace Mode= Peak Detector (Max Hold)

Sweep time= Auto Couple

Use the peak marker function to determine the maximum amplitude level within the RBW

If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

### 9.5.3 Limits:

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

### 9.5.4 Test Results:

Frequency (MHz)	Test Mode	Channel No.	Power Spectral Density (dBm/100kHz)	Limit (dBm/3kHz)	Result
2402	BT LE	0	3.75	8	Pass
2440	BT LE	19	3.62	8	Pass
2480	BT LE	39	4.42	8	Pass

The test data shows that the EUT passes the requirement using 100kHz RBW setting and hence will meet the requirement for 3kHz BW.



9.5.5 Test Data:



Figure 9-11 Power Spectral Density (Ch. 0)

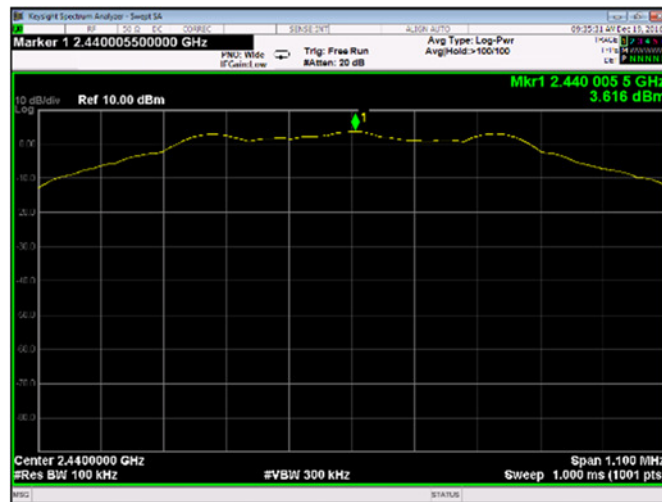


Figure 9-12 Power Spectral Density (Ch. 19)

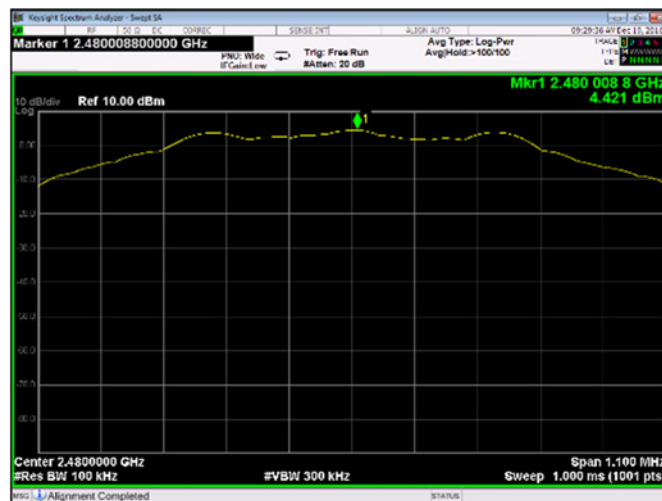


Figure 9-13 Power Spectral Density (Ch. 39)

## 9.6 Conducted Spurious Emissions

### 9.6.1 Test Requirement:

FCC CFR 47 Rule Part 15.247 (d)

ISED RSS-247 [5.5]

### 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 V04 and ANSI C63.10 2013.

#### Spectrum Analyzer settings:

##### **Identification of Reference Level:**

RBW= 100 kHz

VBW  $\geq$  3 x RBW

Trace Mode= Peak Detector (Max Hold)

Sweep time= Auto Couple

Span >1.5 times DTS Bandwidth

Peak Marker function to determine the max PSD level.

##### **Conducted Spurious Emissions:**

RBW= 1 MHz

VBW  $\geq$  3 x RBW = 3 MHz

Trace Mode= Peak Detector (Max Hold)

Sweep time= Auto Couple

Span= 30 MHz- 12 GHz; 12 GHz – 25 GHz

Sweep Points= 30000

### 9.6.3 Limits:

All spurious emissions at least 20 dBc.

### 9.6.4 Test Result:

Channel	Carrier Frequency (MHz)	Emission Frequency (MHz)	Emissions Amplitude (dBm/MHz)	Limit (dBm)	Margin (dB)	Result
0	2402	3801.35	-44.35	-16.25	-28.10	Pass
0	2402	23216.4	-31.07	-16.25	-14.82	Pass
19	2440	3844.04	-44.24	-16.38	-27.86	Pass
19	2440	22884.5	-30.34	-16.38	-13.96	Pass
39	2480	3814.12	-42.87	-15.58	-27.29	Pass
39	2480	232147.7	-37.44	-15.58	-21.86	Pass

9.6.5 Test Data:



Figure 9-14 Reference Level Measurement (Ch.0)

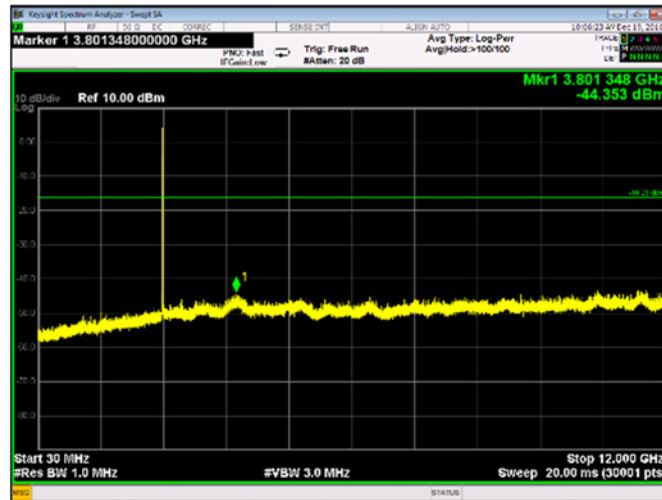


Figure 9-15 Conducted Spurious Emissions 30-12000 MHz (Ch. 0)

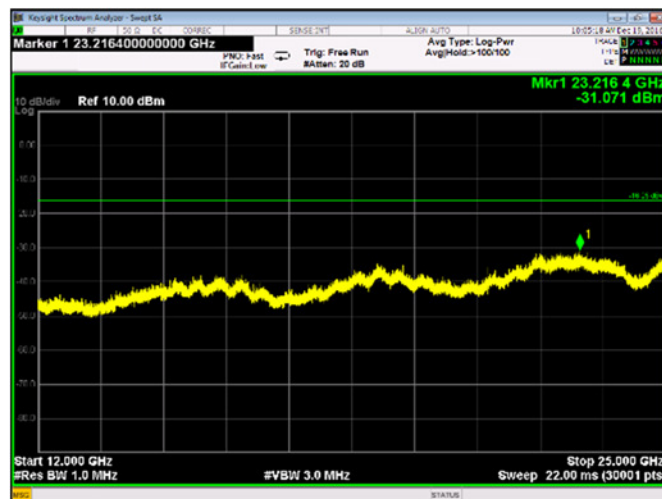


Figure 9-16 Conducted Spurious Emissions 12-25 GHz (Ch.0)



Figure 9-17 Reference Level Measurement (Ch.19)

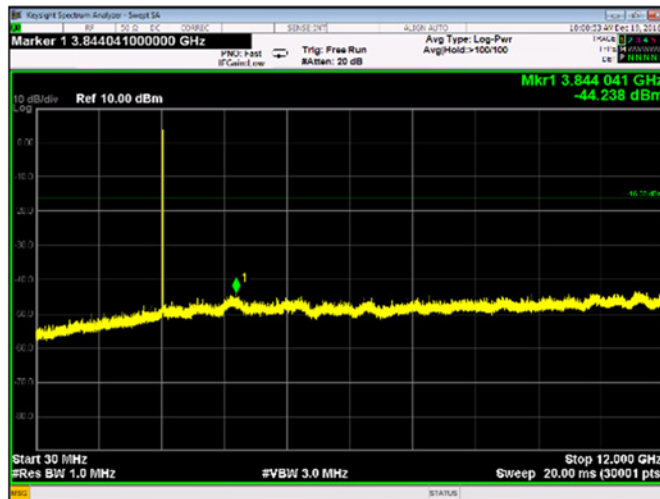


Figure 9-18 Conducted Spurious Emissions 30-12000 MHz (Ch. 19)



Figure 9-19 Conducted Spurious Emissions 12-25 GHz (Ch. 19)



Figure 9-20 Reference Level Measurement (Ch.39)

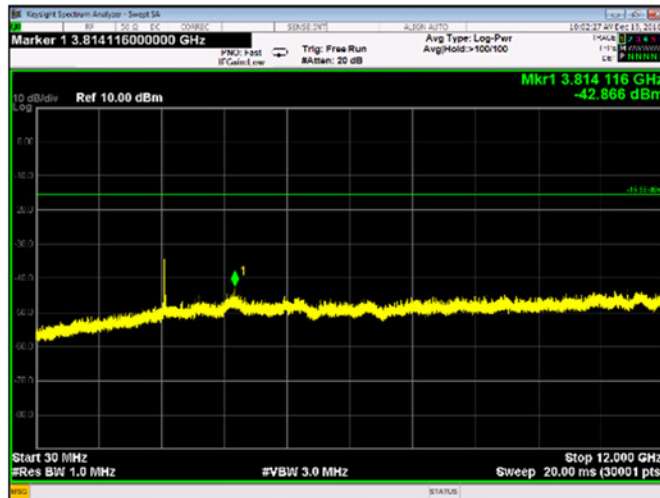


Figure 9-21 Conducted Spurious Emissions 30-12000 MHz (Ch.39)

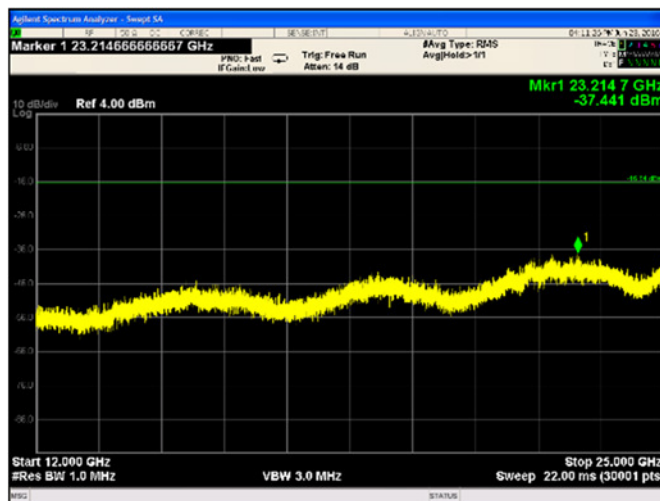


Figure 9-22 Conducted Spurious Emissions 12-25GHz (Ch.39)

## 9.7 Conducted Band Edge Emissions

### 9.7.1 Test Requirement:

FCC CFR 47 Rule Part 15.247 (d)

ISED RSS-247 [5.5]

### 9.7.2 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 V04 and ANSI C63.10 2013.

#### **Spectrum analyzer settings:**

Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation

RBW = 100 kHz

VBW = 300 kHz

Sweep = Auto Couple

Detector function = Peak

Trace = Max Hold

The trace was allowed to stabilize. The marker was set on the emission at the band edge, or on the highest modulation product outside of the band if this level is greater than that at the band edge. The delta marker function was set, and the marker-to-peak function moved to the peak of the in-band emission.

### 9.7.3 Limits:

All spurious emissions at least 20 dBc.

### 9.7.4 Test Result:

Pass.

### 9.7.5 Test Data:

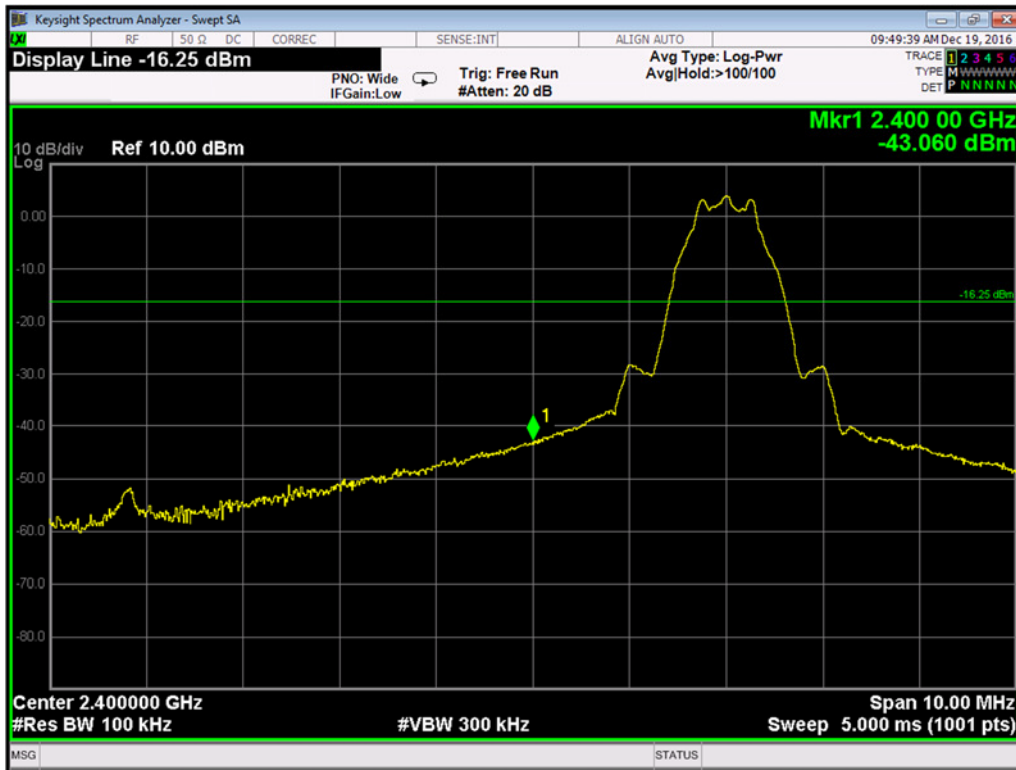


Figure 9-23 Conducted-Low Band Edge (Ch. 0)

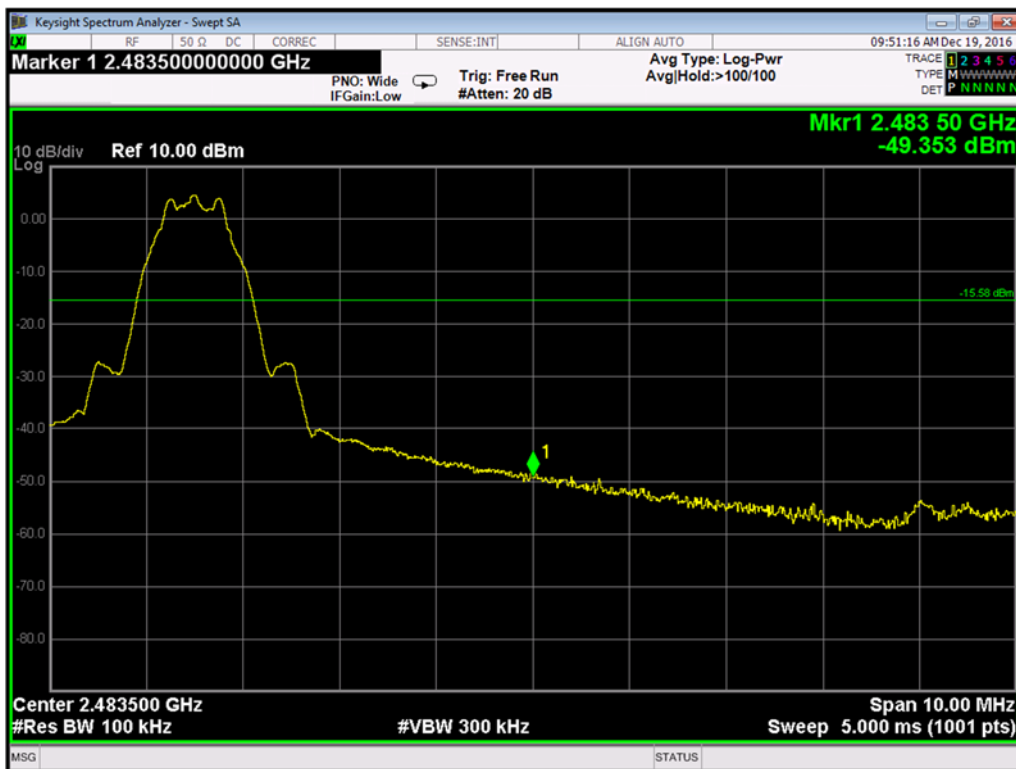


Figure 9-24 Conducted- High Band Edge (Ch. 39)

## 9.8 Radiated Spurious and Band Edge Emissions

### 9.8.1 Test Requirement:

FCC CFR 47 Rule Part 15.247 (d)

ISED RSS-247 [5.5] and RSS GEN [8.9]

### 9.8.2 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 V04 and ANSI C63.10 2013.

Radiated spurious measurements are made from 30MHz to the 10th harmonic of the fundamental frequency of the transmitter. Measurements below 30MHz were not performed since the radio circuitry of the EUT does not contain clocks below 30MHz. The limit for radiated spurious emissions is per 15.209 and RSS-247 [5.5]. Additionally, emissions found in the restricted bands listed in 15.205 and RSS-Gen were tested for compliance per limits in 15.209 and RSS-Gen.

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 emissions.

A pre-amp and a high pass filter were required for this test, 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.

Both horizontal and vertical antenna polarizations were investigated. Worst-case maximized data for both polarizations is shown in this test report.



**Radiated Spurious Emissions****Spectrum Analyzer Settings:*****30 MHz- 1 GHz:***

RBW= 120 kHz

VBW  $\geq 3 \times$  RBW

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

Span= 30 MHz- 1 GHz

Sweep time= Auto

Sweep points  $\geq 2 \times$  Span/RBW***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

Sweep points  $\geq 2 \times$  Span/RBW**Final Measurements above 1 GHz****Peak Measurements****Spectrum Analyzer Settings:**

RBW= 1 MHz

VBW= 3 MHz

Trace Mode: Peak Detector (Max Hold)

Span= wide enough to encompass the emission

Sweep Points  $\geq 2 \times$  Span/RBW

Sweep Time = Auto

**RMS Average Measurements****Spectrum Analyzer Settings:**

RBW= 1 MHz

VBW  $\geq 3 \times$  RBW

Detector= RMS

Span= wide enough to encompass the emission

Sweep points  $\geq 2 \times$  Span/RBW

Sweep time = auto

Trace= Average at least 100 traces

Trace Averaging Type= power (RMS)

The duty cycle correction factor is added to the emission level.

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

RBW= 1 MHz

VBW= 3 MHz

Trace Mode: Peak Detector (Max Hold)

Span= 2310 – 2500 MHz

Sweep Points = 401

Sweep Time = Auto

**Average Measurements (Reduced Video Bandwidth Method)****Spectrum Analyzer Settings:**

RBW= 1 MHz

VBW= 2 kHz

VBW Mode = Linear

Trace Mode: Peak Detector (Max Hold)

Span= 2310 – 2500 MHz

Sweep Points = 401

Sweep Time = Auto

Sweep Count = 200

**Sample Calculation:**

Field Strength Level: Amplitude (Analyzer level) + AFCL (Antenna Factor and Cable losses) –  
Amplifier Gain = 50 dBuV + 33 dB – 25 dB = 58dBuV/m

**9.8.3 Limits:**

Frequency (MHz)	Field Strength ( $\mu\text{V}/\text{m}$ )	Measurement Distance (meters)	Corrected Field Strength for 3m measurement distance ( $\text{dB}\mu\text{V}/\text{m}$ )
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 (Restricted Frequency Bands)	500	3	54 (Average) 74 (Peak)

**9.8.4 Test Result:**

Pass.

9.8.5 Test Data:

9.8.5.1 Radiated Restricted Band-edge emissions

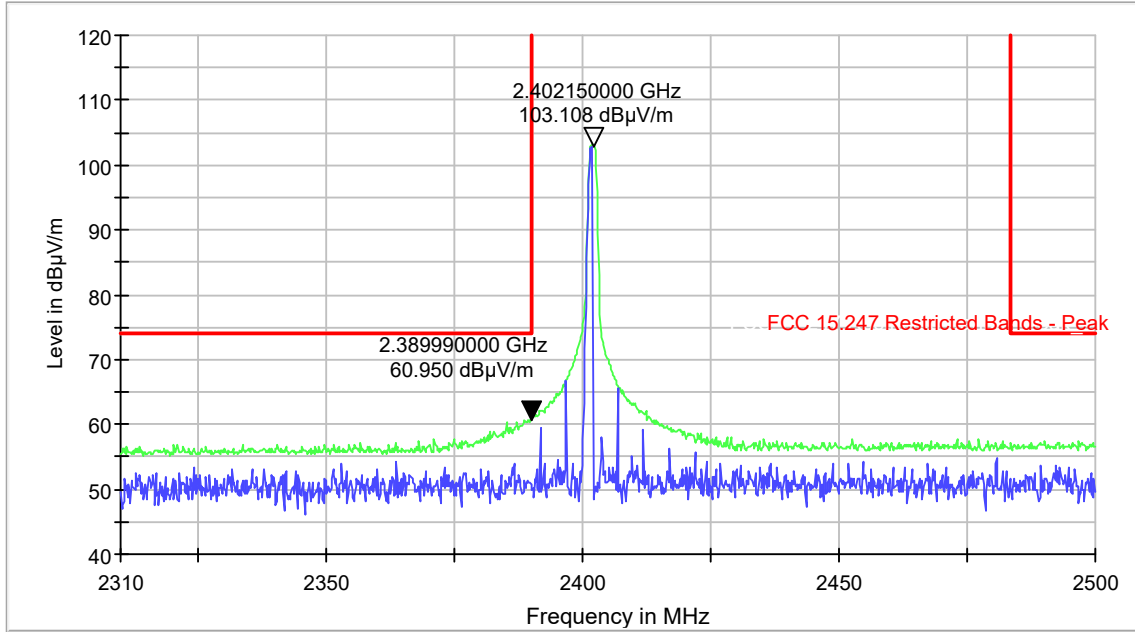


Figure 9-25 Radiated Restricted Band Edge (Ch. 0) Peak

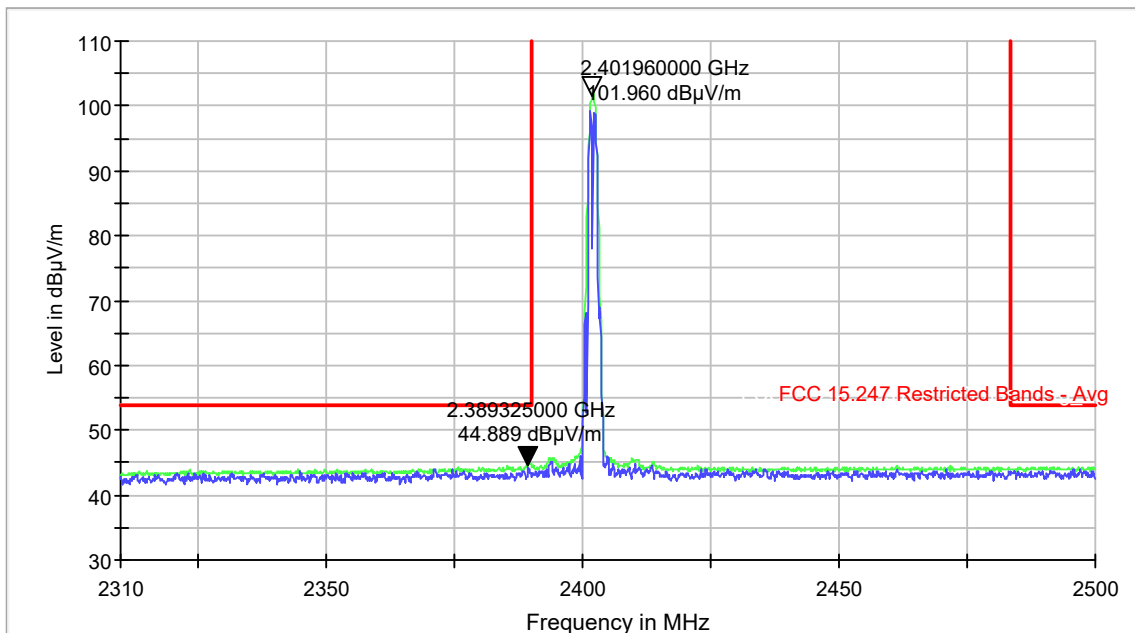
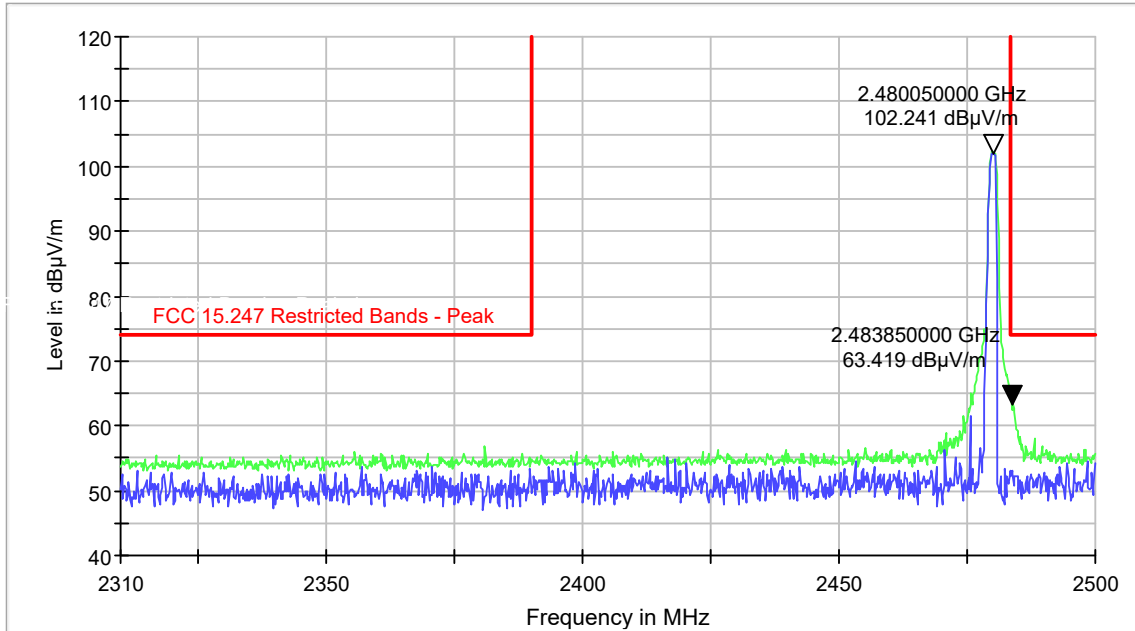
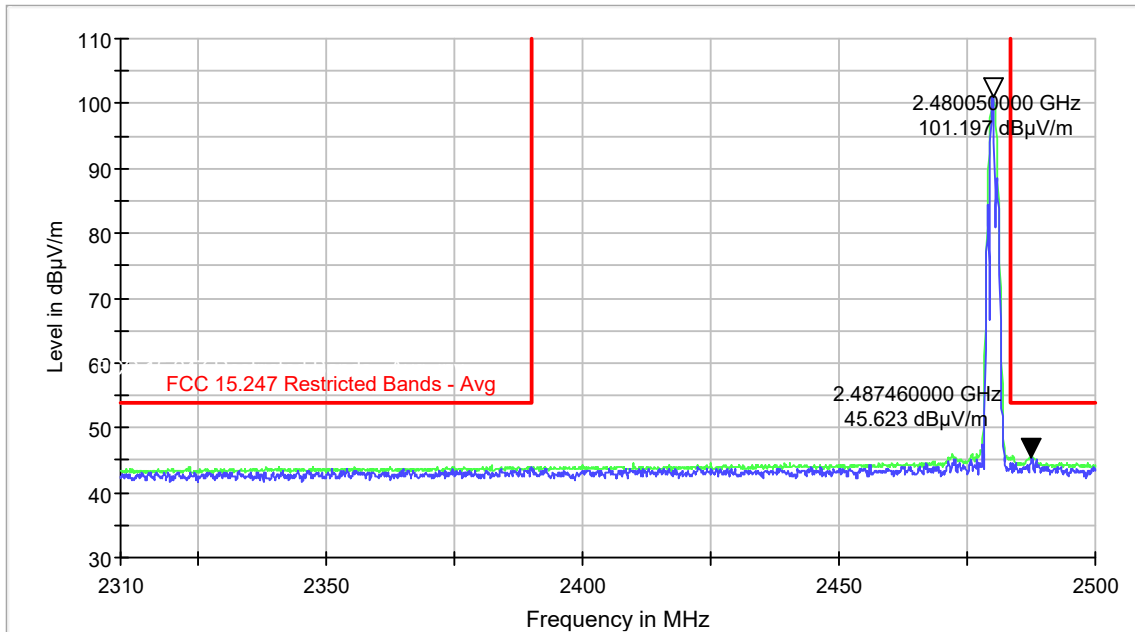


Figure 9-26 Radiated Restricted Band Edge (Ch. 0) Average



— PK+\_MAXH [Result Table.Result:2]      — PK+\_CLRWR [Result Table.Result:1]  
— FCC 15.247 Restricted Bands - Peak\_inv [...]      — FCC 15.247 Restricted Bands - Peak [...]

**Figure 9-27 Radiated Restricted Band Edge (Ch. 39) Peak**



— PK+\_MAXH [Result Table.Result:2]      — PK+\_CLRWR [Result Table.Result:1]  
— FCC 15.247 Restricted Bands - Avg\_inv [...]      — FCC 15.247 Restricted Bands - Avg [...]

**Figure 9-28 Radiated Restricted Band Edge (Ch. 39) Average**

9.8.5.2 Emissions in 30 MHz- 1 GHz range

All channels were tested and worst case results from channel 39- 2480 MHz shown here.

RSE 30-1000 MHz						
Carrier Frequency (MHz)	Emission Frequency (MHz)	Raw Quasi-Peak Amplitude (dBµV/m)	Correction Factor (dB)	Corrected Quasi-Peak Field Strength (dBµV/m)	Quasi-Peak Limit (dBµV/m)	Quasi-Peak Margin (dB)
2480	30.76	-0.81	27.10	26.29	40.00	-13.71
2480	73.52	-2.84	14.50	11.66	40.00	-28.34
2480	131.33	-0.53	20.40	19.87	43.50	-23.63
2480	214.30	-2.01	18.80	16.79	43.50	-26.71
2480	384.00	6.81	23.00	29.81	46.00	-16.19
2480	958.23	-0.71	31.60	30.89	46.00	-15.11

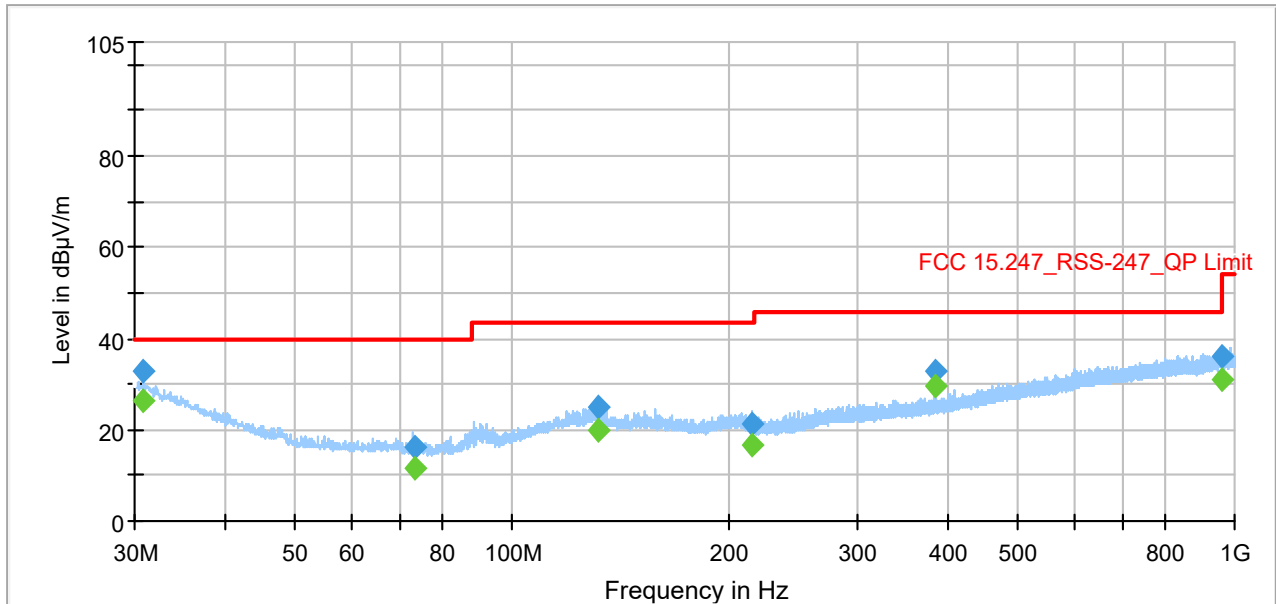


Figure 9-29 Radiated Spurious Emissions (Ch. 39) 2480 (30MHz - 1GHz)

9.8.5.3 Emissions in 1-18 GHz range

RSE 1 - 18GHz Average Data							
Carrier Frequency (MHz)	Frequency (MHz)	Raw Avg. Amplitude (dBµV)	Correction Factor (dB)	DC Correction Factor	Corrected Avg. Field Strength (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
2402	17906.00	33.07(NF)	14.3	--	47.37	54	-6.63
2440	17905.00	34.37(NF)	14.3	--	48.67	54	-5.33
2480	4960.00	26.87	10.0	2.05	38.92	54	-15.08

NF: Noise Floor.

RSE 1 - 18GHz Peak Data						
Carrier Frequency (MHz)	Frequency (MHz)	Raw Peak Amplitude (dBµV)	Correction Factor (dB)	Corrected Peak Field Strength (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
2402	17891.50	41.86	14.3	56.16	74	-17.84
2440	17911.00	41.87	14.3	56.17	74	-17.83
2480	4960.00	37.39	10.0	47.39	74	-26.61

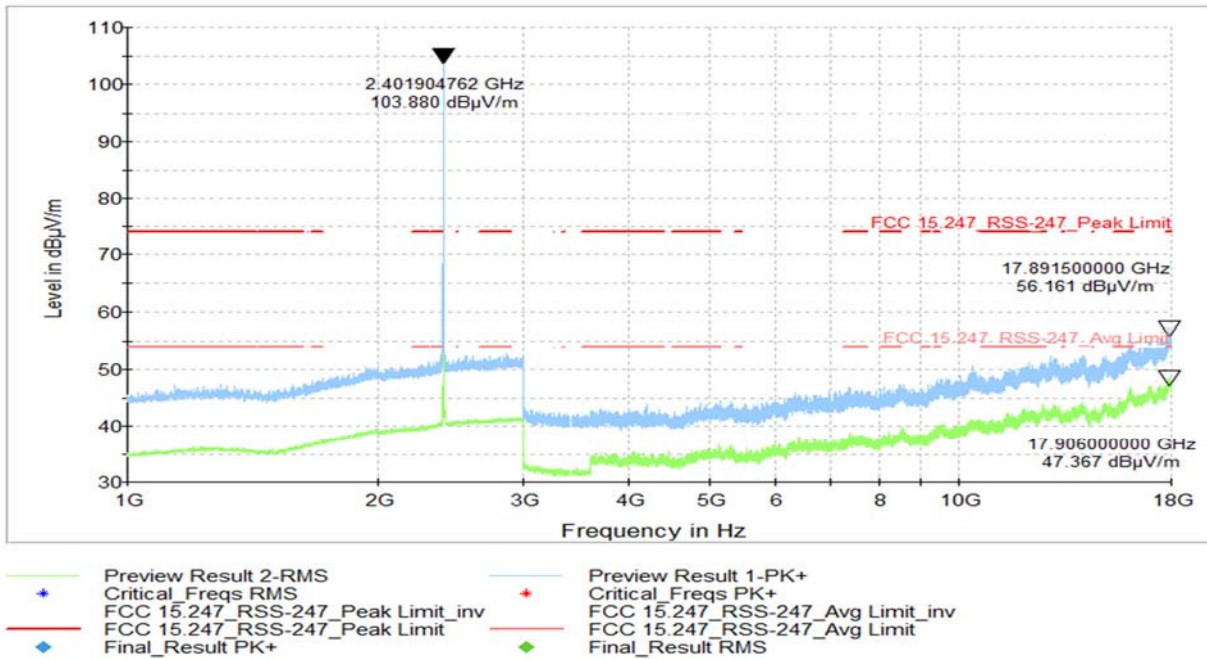


Figure 9-30 Radiated Spurious Emissions 1-18 GHz (Ch. 0)

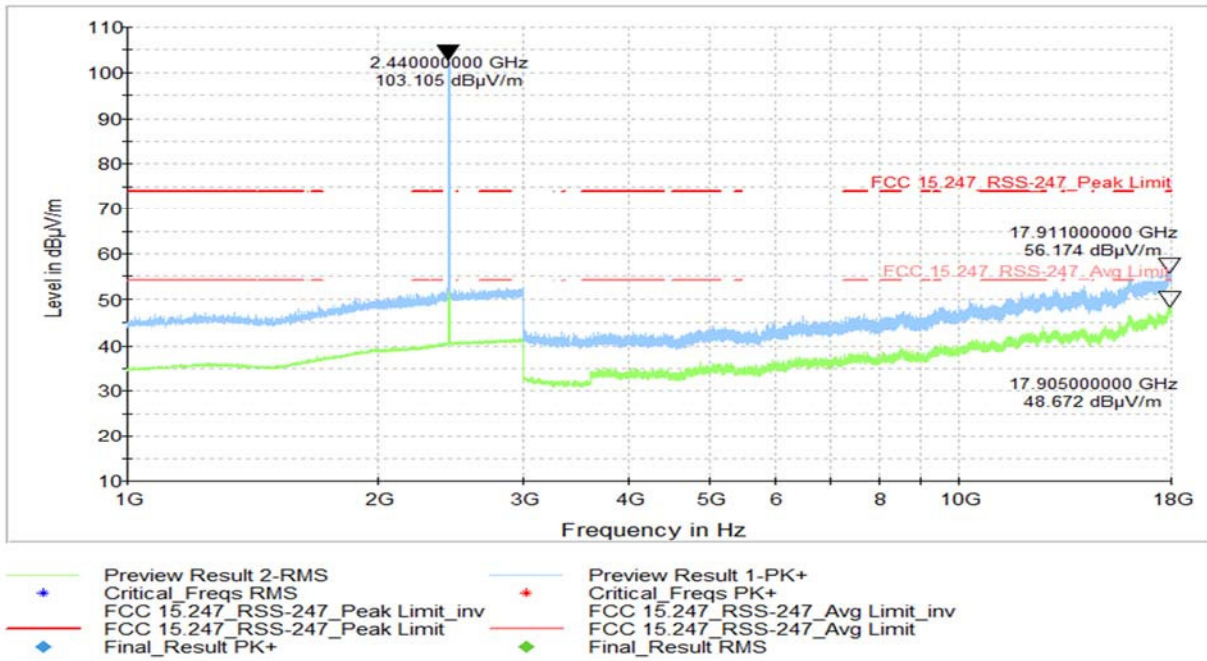


Figure 9-31 Radiated Spurious Emissions 1-18 GHz (Ch. 19)

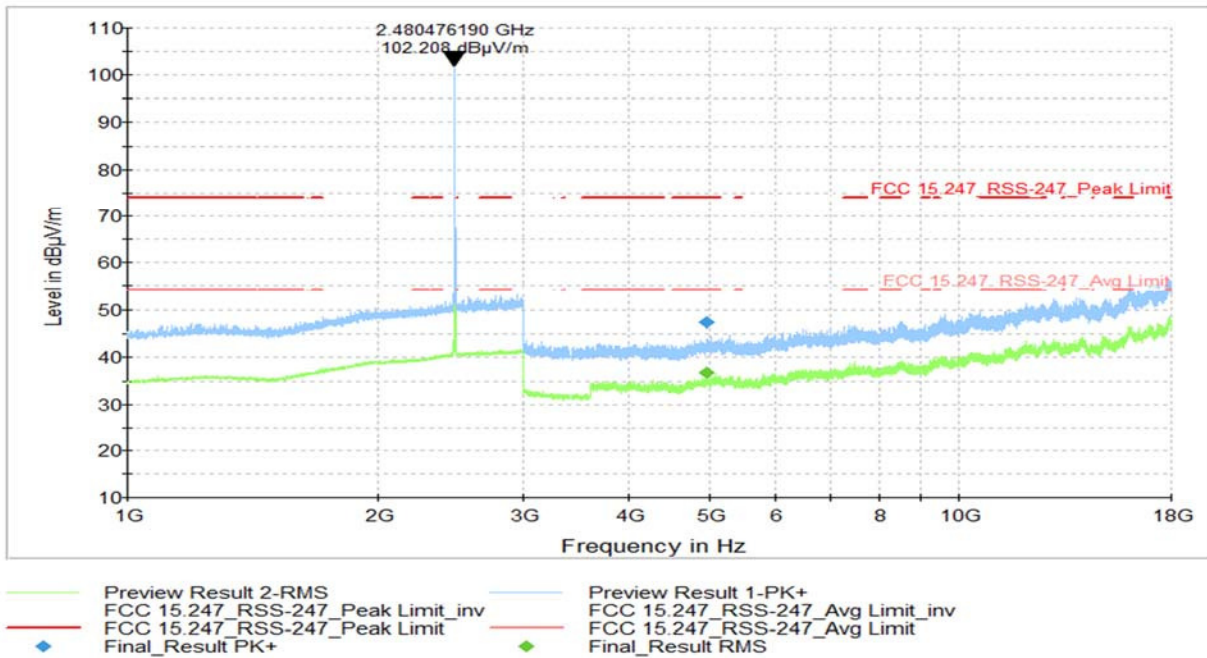
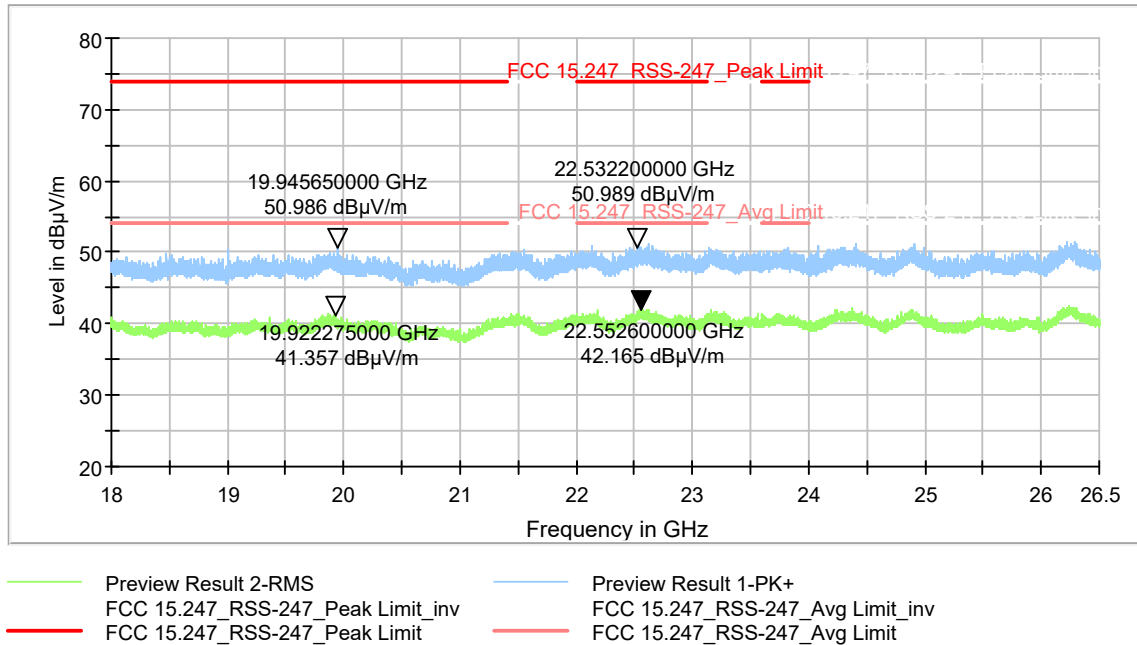


Figure 9-32 Radiated Spurious Emissions 1-18 GHz (Ch. 39)



**9.8.5.4 Emissions in 18-26.5 GHz range**

All channels were tested and worst case results from channel 39- 2480 MHz shown here. No significant emissions to report above noise floor.



**Figure 9-33 Radiated Spurious Emissions (Ch. 39) (18 – 26.5 GHz)**

## 9.9 AC Line Conducted Emissions

### 9.9.1 Test Requirements

FCC CFR 47 Rule Part 15.207 (a)

ISED RSS Gen [8.8]

### 9.9.2 Test Method

Conducted power line measurements are made over the frequency range from 150 kHz to 30 MHz to determine the line-to-ground radio-noise voltage that is conducted from the EUT power-input terminals that are directly (or indirectly) connected to a public power network. The measurements were made using a LISN (Line Impedance Stabilization Network).

The EUT is set to continuously transmit on Ch.39.

#### EMI Receiver Settings:

**150 kHz – 30 MHz:**

RBW= 9 kHz

VBW  $\geq$  3 X RBW

Trace Mode: Peak Detector (Max Hold).

Final measurements were performed using Quasi-Peak and Average Detectors.

Span= 150 kHz – 30 MHz

Sweep time= Auto

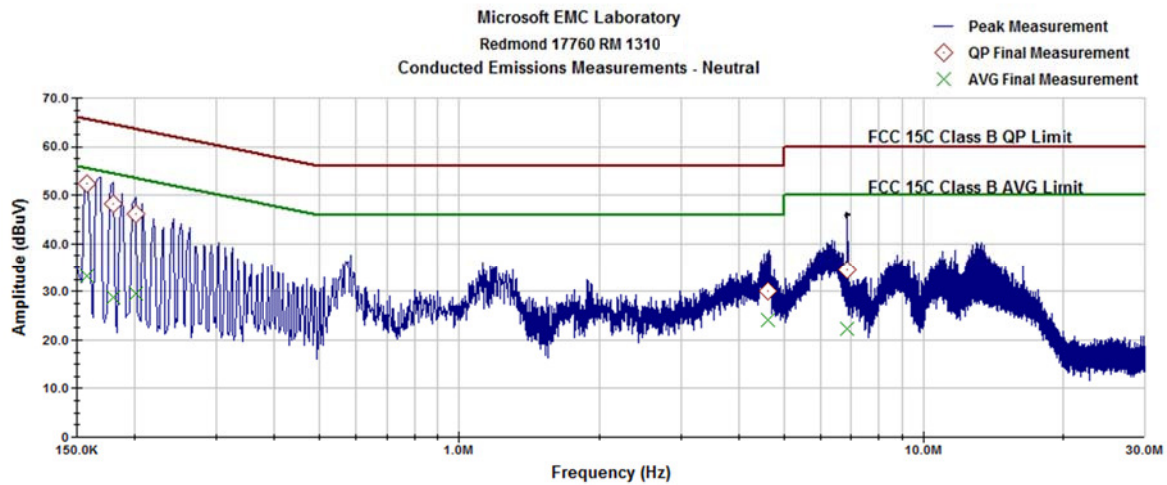
### 9.9.3 Limit

Frequency of emission (MHz)	Conducted limit (dB $\mu$ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

### 9.9.4 Test Result:

Pass

9.9.5 Test Data:

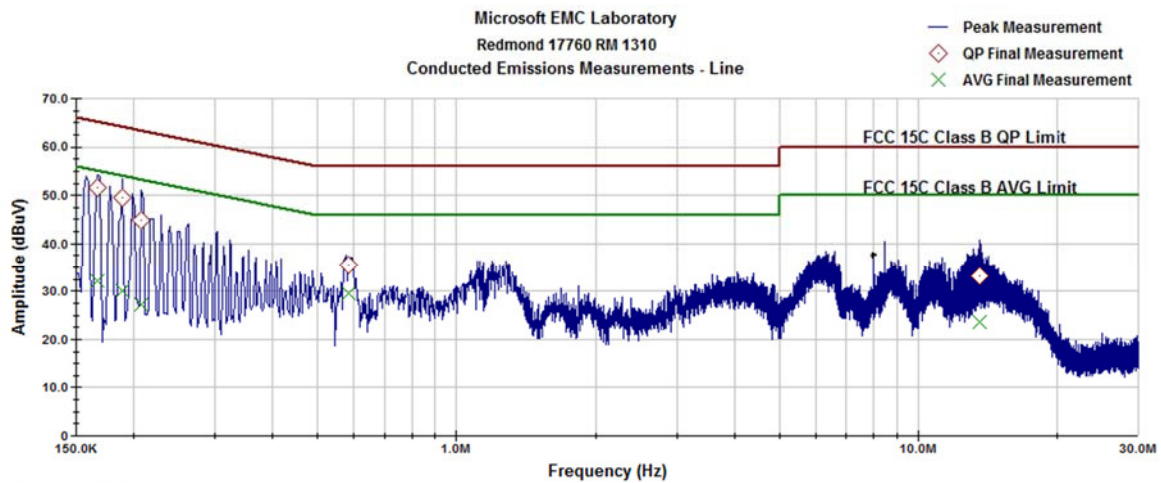


Operator: Vishwas

Current Time -12:40:14 PM, Friday, December 23, 2016

CE Profile V2.1

Figure 9-34 AC Line Conducted Emissions- Neutral (150 kHz- 30 MHz)



Operator: Vishwas

Current Time -12:32:56 PM, Friday, December 23, 2016

CE Profile V2.1

Figure 9-35 AC Line Conducted Emissions- Line (150 kHz- 30 MHz)

Frequency (MHz)	Quasi-Peak Net Reading (dB $\mu$ V)	AVG Net Reading (dB $\mu$ V)	Quasi-Peak Limit (dB $\mu$ V)	Average Limit (dB $\mu$ V)	Line Tested (L or N)	Quasi-Peak Margin (dB)	Average Margin (dB)
0.157	52.25	33.15	65.79	55.79	N	-13.54	-22.63
0.18	48.09	28.70	65.14	55.14	N	-17.05	-26.45
0.201	46.27	29.63	64.56	54.56	N	-18.29	-24.93
4.634	30.18	23.98	56.00	46.00	N	-25.82	-22.02
6.838	34.36	22.41	60.00	50.00	N	-25.64	-27.59
0.167	51.50	32.24	65.52	55.52	L	-14.02	-23.28
0.189	49.48	29.99	64.88	54.88	L	-15.39	-24.89
0.208	44.96	27.16	64.34	54.34	L	-19.38	-27.19
0.583	35.56	29.56	56.00	46.00	L	-20.45	-16.44
13.585	33.21	23.68	60.00	50.00	L	-26.79	-26.32

# End of Report