

Report on the FCC and ISED Testing of: Apple Inc. Model: A2159

In accordance with FCC 47 CFR Part 15C and Industry Canada RSS-247 and Industry Canada RSS-GEN

Prepared for: Apple Inc.
One Apple Park Way
Cupertino, California 95014, USA

FCC ID: BCGA2159 IC: 579C-A2159

COMMERCIAL-IN-CONFIDENCE

Document Number: 75945152-12 | Issue: 01



Add value.
Inspire trust.

SIGNATURE			
NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Matthew Russell	RF Team Leader	Authorised Signatory	08 May 2019

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD document control rules.

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Part 15C and Industry Canada RSS-247 and Industry Canada RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

SIGNATURE			
NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Phillip Harrison	Senior Engineer	Testing	08 May 2019
Mehadi Choudhury	Engineer	Testing	08 May 2019
George Porter / Daniel Bishop	Assistant Engineers	Testing	08 May 2019
Cristian Onaca / Malik Mohammed	Shift Technicians	Testing	08 May 2019
Jay Balendrarajah	Shift Technician	Testing	08 May 2019

FCC Accreditation

90987 Octagon House, Fareham Test Laboratory

Industry Canada Accreditation

IC2932B-1 Octagon House, Fareham Test Laboratory

EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with FCC 47 CFR Part 15C: 2017, Industry Canada RSS-247: Issue 2 (2017-02) and Industry Canada RSS-GEN: Issue 5 (2018-04).

	DISCLAIMER AND COPYRIGHT This non-binding report has been prepared by TÜV SÜD with all reasonable skill and care. The document is confidential to the potential Client and TÜV SÜD. No part of this document may be reproduced without the prior written approval of TÜV SÜD. © 2019 TÜV SÜD.
	ACCREDITATION Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation. Results of tests not covered by our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited).

TÜV SÜD
is a trading name of TÜV SÜD Ltd
Registered in Scotland at East Kilbride,
Glasgow G75 0QF, United Kingdom
Registered number: SC215164

TÜV SÜD Ltd is a
TÜV SÜD Group Company

Phone: +44 (0) 1489 558100
Fax: +44 (0) 1489 558101
www.tuv-sud.co.uk

TÜV SÜD
Octagon House
Concorde Way
Fareham
Hampshire PO15 5RL
United Kingdom



Contents

1	Report Summary	2
1.1	Report Modification Record.....	2
1.2	Introduction.....	2
1.3	Brief Summary of Results	3
1.4	Product Information	4
1.5	Test Setup Diagram(s)	4
1.6	Deviations from the Standard.....	5
1.7	EUT Modification Record	6
1.8	Test Location	6
2	Test Details	7
2.1	Maximum Conducted Output Power	7
2.2	Power Spectral Density	11
2.3	Emission Bandwidth	15
2.4	Authorised Band Edges	35
2.5	Restricted Band Edges.....	43
2.6	Spurious Radiated Emissions	70
3	Measurement Uncertainty	81



1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	08 May 2019

Table 1

1.2 Introduction

Applicant	Apple Inc.
Manufacturer	Apple Inc.
Model Number(s)	A2159
Serial Number(s)	C02Y4006L59F, C02Y3009L5C1
Hardware Version(s)	REV 1.0
Software Version(s)	18F65
Number of Samples Tested	2
Test Specification/Issue/Date	FCC 47 CFR Part 15C: 2017 Industry Canada RSS-247: Issue 2 (2017-02) Industry Canada RSS-GEN: Issue 5 (2018-04)
Order Number	0540175066
Date	21-February-2019
First Date of Receipt of EUT	06-February-2019
Start of Test	06-February-2019
Finish of Test	22-March 2019
Name of Engineer(s)	Phillip Harrison, Malik Mohammed, George Porter, Cristian Onaca, Jay Balendrarajah, Daniel Bishop.
Related Document(s)	ANSI C63.10 (2013) KDB 662911 D01 v02r01



1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15C, Industry Canada RSS-247 and Industry Canada RSS-GEN is shown below.

Section	Specification Clause			Test Description	Result	Comments/Base Standard
	Part 15C	RSS-247	RSS-GEN			
Configuration and Mode: 802.11 b/g/n						
2.1	15.247 (b)(3)	5.4	6.12	Maximum Conducted Output Power	Pass	ANSI C63.10 KDB 662911 D01 v02r01
2.2	15.247 (e)	5.2	-	Power Spectral Density	Pass	ANSI C63.10 KDB 662911 D01 v02r01
2.3	15.247 (a)(2)	5.2	6.7	Emission Bandwidth	Pass	ANSI C63.10
2.4	15.247 (d)	5.5	-	Authorised Band Edges	Pass	ANSI C63.10
2.5	15.205	-	8.10	Restricted Band Edges	Pass	ANSI C63.10
2.6	15.247 (d), 15.205	5.5	6.13	Spurious Radiated Emissions	Pass	ANSI C63.10

Table 2



1.4 Product Information

1.4.1 Technical Description

The Equipment Under Test (EUT) was a laptop computer with Bluetooth, Bluetooth Low Energy and 802.11 a/b/g/n/ac capabilities in the 2.4 GHz and 5.0 GHz bands.

1.4.2 Antenna Gain Table

Core 0

Frequency (MHz)	Peak Gain (dBi)	Conducted Cable Loss (dB)
2400 – 2480	1.91	0.7

Table 3

Core 1

Frequency (MHz)	Peak Gain (dBi)	Conducted Cable Loss (dB)
2400 – 2480	2.39	0.7

Table 4

1.5 Test Setup Diagram(s)

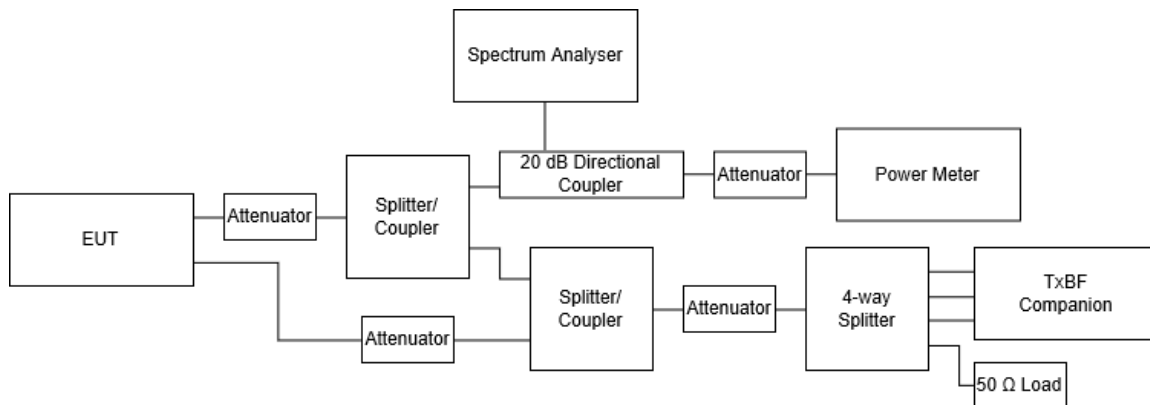
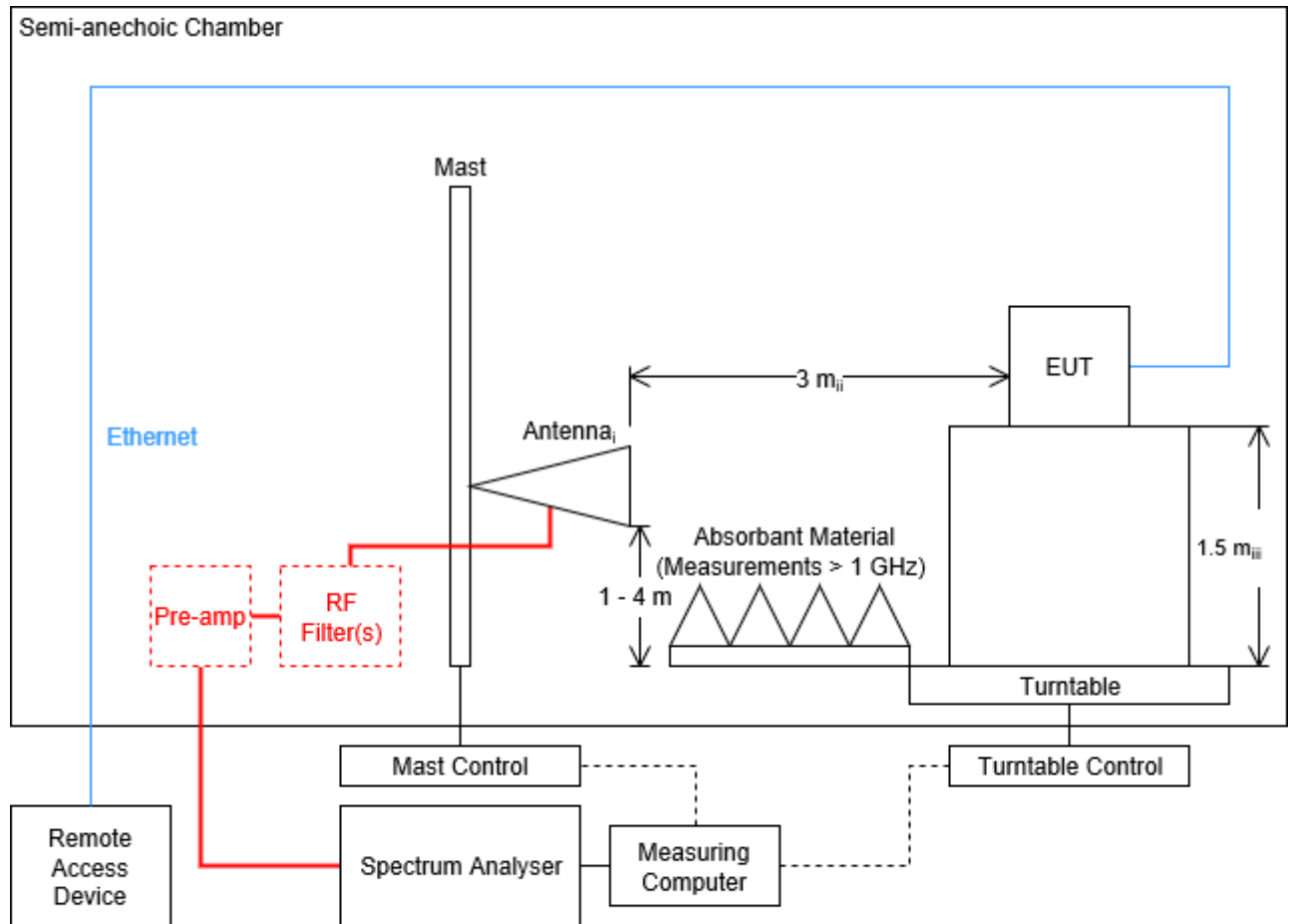


Figure 1 - Conducted Test Setup



- i Antenna is boresighted for measurements > 1 GHz.
- ii Distance from antenna to EUT is 1 m for measurements > 18 GHz.
- iii Height of EUT above the ground plane is 0.8 m for measurements < 1 GHz.

Figure 2 – Radiated Test Setup Diagram

1.5.1 EUT Configuration and Rationale for Radiated Spurious Emissions

The EUT was placed on the non-conducting platform in a manner typical of a normal installation. The lid was tilted to 90 degrees with reference to the ground plane.

Ports on the EUT were terminated with loads as described in ANSI C63.4 clause 6.2.4. Interconnecting cables were connected and pre-scans performed to determine whether the level of the emissions were increased by >2 dB and emission measurements performed in the worst-case configuration.

1.6 Deviations from the Standard

No deviations from the applicable test standard were made during testing.



1.7 EUT Modification Record

The table below details modifications made to the EUT during the test programme.
 The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
Serial Number: C02Y4006L59F			
0	As supplied by the customer	Not Applicable	Not Applicable
Serial Number: C02Y3009L5C1			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 5

1.8 Test Location

TÜV SÜD conducted the following tests at our Fareham Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: 802.11 b/g/n		
Maximum Conducted Output Power	Philip Harrison	UKAS
Power Spectral Density	Philip Harrison	UKAS
Emission Bandwidth	Philip Harrison	UKAS
Authorised Band Edges	Cristian Onaca, George Porter, Jay Balendrarajah, Daniel Bishop, Malik Mohammed.	UKAS
Restricted Band Edges		UKAS
Spurious Radiated Emissions		UKAS

Table 6

Office Address:

Octagon House
 Concorde Way
 Segensworth North
 Fareham
 Hampshire
 PO15 5RL
 United Kingdom



2 Test Details

2.1 Maximum Conducted Output Power

2.1.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (b)
Industry Canada RSS-247, 5.4
Industry Canada RSS-GEN, 6.12

2.1.2 Equipment Under Test and Modification State

A2519, S/N: C02Y3009L5C1 - Modification State 0

2.1.3 Date of Test

05-March-2019 to 22-March-2019

2.1.4 Test Method

The test was performed in accordance with ANSI C63.10 clause 11.9.2.3.2 Method AVGPM-G.

MIMO output port summing was performed in accordance with KDB 662911 D01. For the CDD results the Directional Gain was calculated in accordance with clause F)2)f)(i) using worst-case individual gain and an array gain of zero. For transmit beamforming (TxBF) mode was calculated in accordance with clause F)2)d)(i).

The output power was verified as being the same from each transmit chain, but the antenna gains were not identical, therefore the modes reported for SISO or 2x2 MIMO operation are those giving the highest EIRP and/or lowest conducted limit based on the combination of antennas giving highest total directional gain.

2.1.5 Environmental Conditions

Ambient Temperature	21.2 - 24.3 °C
Relative Humidity	34.9 - 35.6 %



2.1.6 Test Results

802.11b / 1 Mbps / SISO / Core 1

Channel	Bottom	Middle	Top
Frequency (MHz)	2412	2442	2472
Antenna Directional Gain (dBi)	2.39	2.39	2.39
15.407 Conducted Power Limit (dBm)	30.00	30.00	30.00
RSS-247 Conducted Power Limit (dBm)	30.00	30.00	30.00
Conducted Power (dBm)	17.62	17.66	10.83
RSS-247 EIRP Limit (dBm)	36.00	36.00	36.00
EIRP Power (dBm)	20.02	20.05	13.22

Table 7

802.11b / 1 Mbps / MIMO CDD / Cores 0+1

Channel	Bottom	Middle	Top
Frequency (MHz)	2412	2442	2472
Conducted Power Core 0 (dBm)	17.48	17.66	10.18
Conducted Power Core 1 (dBm)	17.42	17.50	10.30
Antenna Directional Gain (dBi)	2.39	2.39	2.39
15.407 Conducted Power Limit (dBm)	30.00	30.00	30.00
RSS-247 Conducted Power Limit (dBm)	30.00	30.00	30.00
Total Conducted Power (dBm)	20.46	20.59	13.25
RSS-247 EIRP Limit (dBm)	36.00	36.00	36.00
EIRP Power (dBm)	22.85	22.98	15.64

Table 8

802.11g / 6 Mbps / SISO / Core 1

Channel	Bottom	Middle	Top
Frequency (MHz)	2412	2442	2472
Antenna Directional Gain (dBi)	2.39	2.39	2.39
15.407 Conducted Power Limit (dBm)	30.00	30.00	30.00
RSS-247 Conducted Power Limit (dBm)	30.00	30.00	30.00
Conducted Power (dBm)	13.84	17.71	-0.06
RSS-247 EIRP Limit (dBm)	36.00	36.00	36.00
EIRP Power (dBm)	16.23	20.10	2.33

Table 9

802.11n / HT20 MCS0 / SISO / Core 1

Channel	Bottom	Middle	Top
Frequency (MHz)	2412	2442	2472
Antenna Directional Gain (dBi)	2.39	2.39	2.39
15.407 Conducted Power Limit (dBm)	30.00	30.00	30.00
RSS-247 Conducted Power Limit (dBm)	30.00	30.00	30.00
Conducted Power (dBm)	13.86	17.44	0.16
RSS-247 EIRP Limit (dBm)	36.00	36.00	36.00
EIRP Power (dBm)	16.26	19.83	2.54

Table 10



802.11n / HT20 MCS0 / MIMO CDD / Cores 0+1

Channel	Bottom	Middle	Top
Frequency (MHz)	2412	2442	2472
Conducted Power Core 0 (dBm)	13.00	17.58	-1.08
Conducted Power Core 1 (dBm)	12.80	17.46	-0.94
Antenna Directional Gain (dBi)	2.39	2.39	2.39
15.407 Conducted Power Limit (dBm)	30.00	30.00	30.00
RSS-247 Conducted Power Limit (dBm)	30.00	30.00	30.00
Total Conducted Power (dBm)	15.91	20.53	2.00
RSS-247 EIRP Limit (dBm)	36.00	36.00	36.00
EIRP Power (dBm)	18.30	22.92	4.39

Table 11

802.11n / HT20 MCS0 / MIMO TxBF / Cores 0+1

Channel	Bottom	Middle	Top
Frequency (MHz)	2412	2442	2472
Conducted Power Core 0 (dBm)	10.89	17.72	-3.11
Conducted Power Core 1 (dBm)	10.88	17.43	-3.01
Antenna Directional Gain (dBi)	5.16	5.16	5.16
15.407 Conducted Power Limit (dBm)	30.00	30.00	30.00
RSS-247 Conducted Power Limit (dBm)	30.00	30.00	30.00
Total Conducted Power (dBm)	13.89	20.59	-0.05
RSS-247 EIRP Limit (dBm)	36.00	36.00	36.00
EIRP Power (dBm)	19.06	25.75	5.11

Table 12

The antenna gain did not exceed 6 dBi and hence the conducted output power limit was not reduced in accordance with 15.247(b)(4).

FCC 47 CFR Part 15, Limit Clause 15.247 (b)(3)

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

Industry Canada RSS-247, Limit Clause 5.4 (b)

For DTSSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1 W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e) of the specification.



2.1.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 3.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Attenuator 10dB 10W	Weinschel	47-10-34	398	12	18-July-2019
Multimeter	Iso-tech	IDM101	2424	12	12-Dec-2019
Hygrometer	Rotronic	I-1000	2891	12	18-Sep-2019
ZVA40 Network Analyser	Rohde & Schwarz	100127	3548	12	17-Oct-2019
ZV-Z54 Calibration Unit	Rohde & Schwarz	1000001	4368	12	22-Oct-2019
PXA Signal Analyser	Keysight Technologies	N9030A	4653	12	06-Feb-2020
Power splitter - 2 port	Mini-Circuits	ZN2PD-63-S+	4742	12	19-Sept-2019
Power splitter - 2 port	Mini-Circuits	ZN2PD-63-S+	4743	12	19-Sept-2019
USB Power Sensor	Boonton	RTP5006	5187	12	12-Dec-2019
AC Programmable Power Supply	iTech	IT7324	5225	-	O/P Mon
Power Splitter, 4 way	Mini-Circuits	ZN4PD1-63-S+	5235	-	O/P Mon
Attenuator 10dB 2W	Telegartner	J01156A0031	N/A	-	O/P Mon
Attenuator 10dB 2W	Telegartner	J01156A0031	N/A	-	O/P Mon
Attenuator 10dB 2W	Telegartner	J01156A0031	N/A	-	O/P Mon

Table 13

O/P Mon – Output Monitored using calibrated equipment



2.2 Power Spectral Density

2.2.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (e)
Industry Canada RSS-247, Clause 5.2

2.2.2 Equipment Under Test and Modification State

A2519, S/N: C02Y3009L5C1 - Modification State 0

2.2.3 Date of Test

05-March-2019 to 22-March-2019

2.2.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 11.10.2. or 11.10.5.

The output power was verified as being the same from each transmit chain, but the antenna gains were not identical. Therefore, the modes reported here for SISO or 2x2 MIMO operation are those giving the highest EIRP and/or lowest conducted limit based on the combination of antennas giving highest total directional gain.

2.2.5 Environmental Conditions

Ambient Temperature	21.2 - 24.3 °C
Relative Humidity	34.9 - 35.6 %



2.2.6 Test Results

802.11b / 1 Mbps / SISO / Core 1

Channel	Bottom	Middle	Top
Frequency (MHz)	2412	2442	2472
Raw Conducted PSD (dBm/30kHz)	-3.17	-3.52	-10.34
Duty Cycle Correction (dB)	N/A SA-1	N/A SA-1	N/A SA-1
15.247 Conducted PSD Limit (dBm/3kHz)	8.00	8.00	8.00
RSS-247 Conducted PSD Limit (dBm/3kHz)	8.00	8.00	8.00
Conducted PSD Result (dBm/30kHz)	-3.17	-3.52	-10.34

Table 14

802.11b / 1 Mbps / MIMO CDD / Cores 0+1

Channel	Bottom	Middle	Top
Frequency (MHz)	2412	2442	2472
Conducted PSD Core 0 (dBm/30kHz)	-3.37	-3.43	-10.87
Conducted PSD Core 1 (dBm/30kHz)	-3.07	-3.52	-10.71
Duty Cycle Correction (dB)	N/A SA-1	N/A SA-1	N/A SA-1
15.247 Conducted PSD Limit (dBm/3kHz)	8.00	8.00	8.00
RSS-247 Conducted PSD Limit (dBm/3kHz)	8.00	8.00	8.00
Conducted PSD Result (dBm/30kHz)	-0.21	-0.46	-7.78

Table 15

802.11g / 6 Mbps / SISO / Core 1

Channel	Bottom	Middle	Top
Frequency (MHz)	2412	2442	2472
Raw Conducted PSD (dBm/30kHz)	-7.50	-2.85	-24.31
Duty Cycle Correction (dB)	N/A SA-1	N/A SA-1	N/A SA-1
15.247 Conducted PSD Limit (dBm/3kHz)	8.00	8.00	8.00
RSS-247 Conducted PSD Limit (dBm/3kHz)	8.00	8.00	8.00
Conducted PSD Result (dBm/30kHz)	-7.50	-2.85	-24.31

Table 16

802.11n / HT20 MCS0 / SISO / Core 1

Channel	Bottom	Middle	Top
Frequency (MHz)	2412	2442	2472
Raw Conducted PSD (dBm/30kHz)	-7.80	-3.76	-19.46
Duty Cycle Correction (dB)	N/A SA-1	N/A SA-1	N/A SA-1
15.247 Conducted PSD Limit (dBm/3kHz)	8.00	8.00	8.00
RSS-247 Conducted PSD Limit (dBm/3kHz)	8.00	8.00	8.00
Conducted PSD Result (dBm/30kHz)	-7.80	-3.76	-19.46

Table 17



802.11n / HT20 MCS0 / MIMO CDD / Cores 0+1

Channel	Bottom	Middle	Top
Frequency (MHz)	2412	2442	2472
Conducted PSD Core 0 (dBm/30kHz)	-11.17	-3.92	-23.44
Conducted PSD Core 1 (dBm/30kHz)	-9.11	-4.34	-25.36
Duty Cycle Correction (dB)	N/A SA-1	N/A SA-1	N/A SA-1
15.247 Conducted PSD Limit (dBm/3kHz)	8.00	8.00	8.00
RSS-247 Conducted PSD Limit (dBm/3kHz)	8.00	8.00	8.00
Conducted PSD Result (dBm/30kHz)	-7.01	-1.11	-21.29

Table 18

802.11n / HT20 MCS0 / MIMO TxBF / Cores 0+1

Channel	Bottom	Middle	Top
Frequency (MHz)	2412	2442	2472
Conducted PSD Core 0 (dBm/30kHz)	-9.05	-1.82	-25.06
Conducted PSD Core 1 (dBm/30kHz)	-7.55	-2.12	-21.61
Duty Cycle Correction (dB)	N/A SA-3	N/A SA-3	N/A SA-3
15.247 Conducted PSD Limit (dBm/3kHz)	8.00	8.00	8.00
RSS-247 Conducted PSD Limit (dBm/3kHz)	8.00	8.00	8.00
Conducted PSD Result (dBm/30kHz)	-5.23	1.05	-19.99

Table 19



2.2.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 3.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Attenuator 10dB 10W	Weinschel	47-10-34	398	12	18-July-2019
Multimeter	Iso-tech	IDM101	2424	12	12-Dec-2019
Hygrometer	Rotronic	I-1000	2891	12	18-Sep-2019
ZVA40 Network Analyser	Rohde & Schwarz	100127	3548	12	17-Oct-2019
ZV-Z54 Calibration Unit	Rohde & Schwarz	1000001	4368	12	22-Oct-2019
PXA Signal Analyser	Keysight Technologies	N9030A	4653	12	06-Feb-2020
Power splitter - 2 port	Mini-Circuits	ZN2PD-63-S+	4742	12	19-Sept-2019
Power splitter - 2 port	Mini-Circuits	ZN2PD-63-S+	4743	12	19-Sept-2019
USB Power Sensor	Boonton	RTP5006	5187	12	12-Dec-2019
AC Programmable Power Supply	iTech	IT7324	5225	-	O/P Mon
Power Splitter, 4 way	Mini-Circuits	ZN4PD1-63-S+	5235	-	O/P Mon
Attenuator 10dB 2W	Telegartner	J01156A0031	N/A	-	O/P Mon
Attenuator 10dB 2W	Telegartner	J01156A0031	N/A	-	O/P Mon
Attenuator 10dB 2W	Telegartner	J01156A0031	N/A	-	O/P Mon

Table 20

O/P Mon – Output Monitored using calibrated equipment



2.3 Emission Bandwidth

2.3.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(2)
Industry Canada RSS-247, 5.2
Industry Canada RSS-GEN, 6.7

2.3.2 Equipment Under Test and Modification State

A2519, S/N: C02Y3009L5C1 - Modification State 0

2.3.3 Date of Test

05-March-2019 to 22-March-2019

2.3.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 11.8.2 and RSS-GEN clause 6.7.

2.3.5 Environmental Conditions

Ambient Temperature 21.2 - 24.3 °C
Relative Humidity 34.9 - 35.6 %

2.3.6 Test Results

802.11b / 1 Mbps / SISO / Core 0

Channel	Bottom	Middle	Top
Frequency (MHz)	2412	2442	2472
6 dB Bandwidth (MHz)	7.680	8.640	8.160
99% Bandwidth (MHz)	13.076	13.088	13.159

Table 21

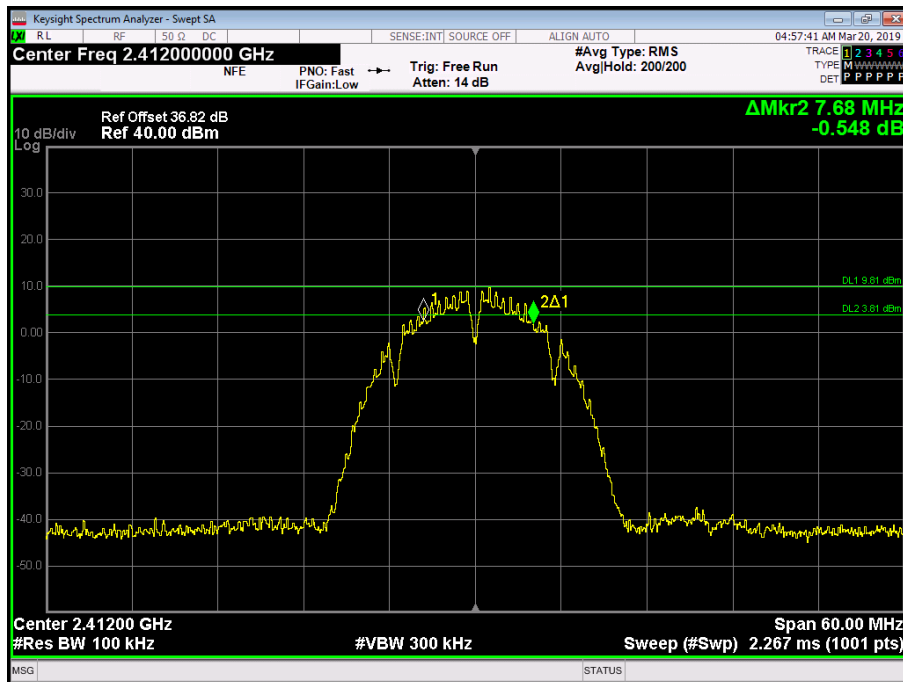


Figure 3 - 2412 MHz - 6 dB DTS Bandwidth

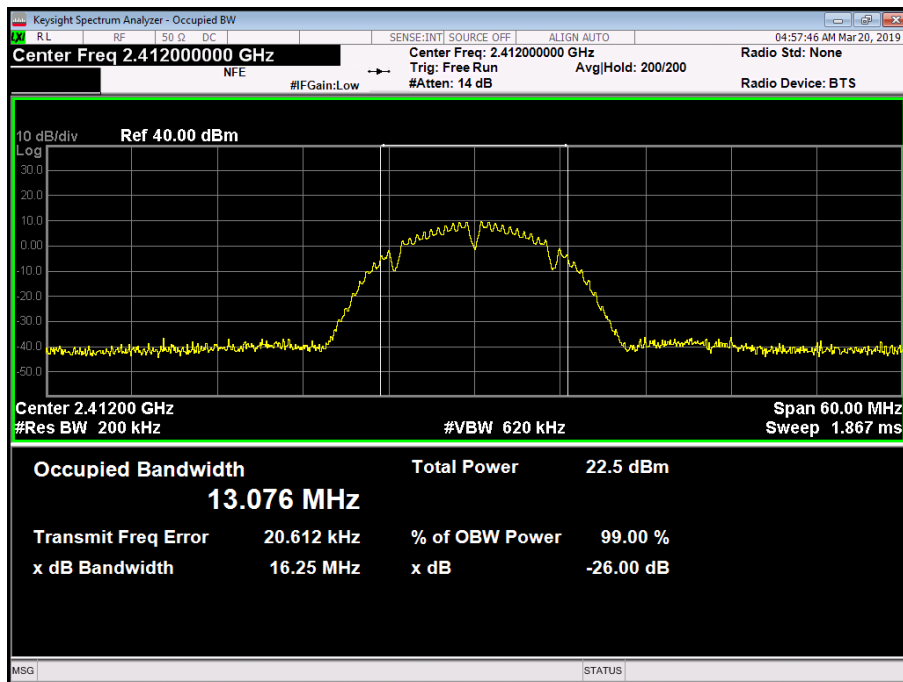


Figure 4 - 2412 MHz - 99% Occupied Bandwidth

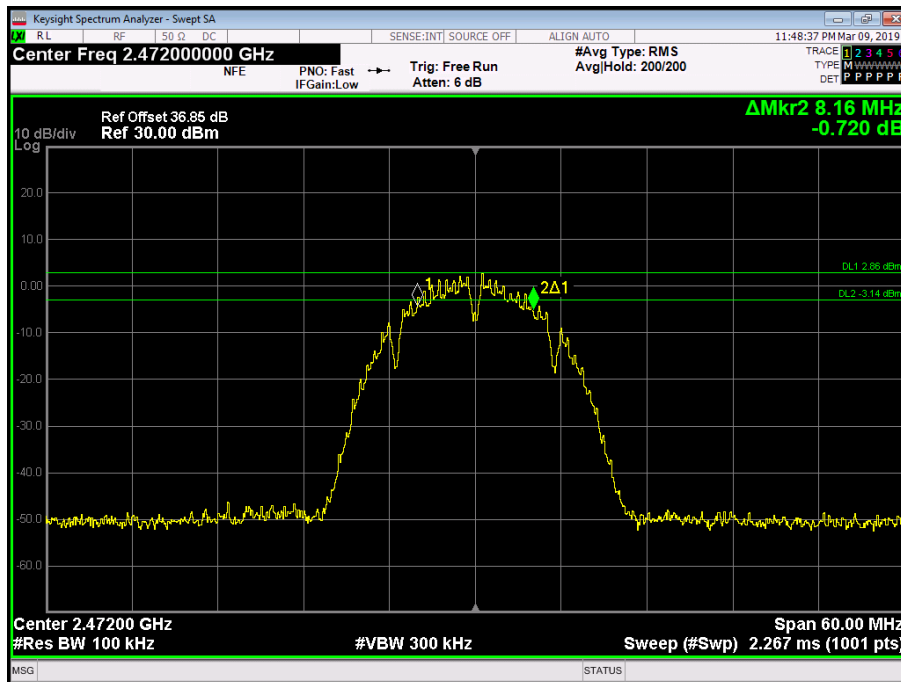


Figure 7 - 2472 MHz - 6 dB DTS Bandwidth

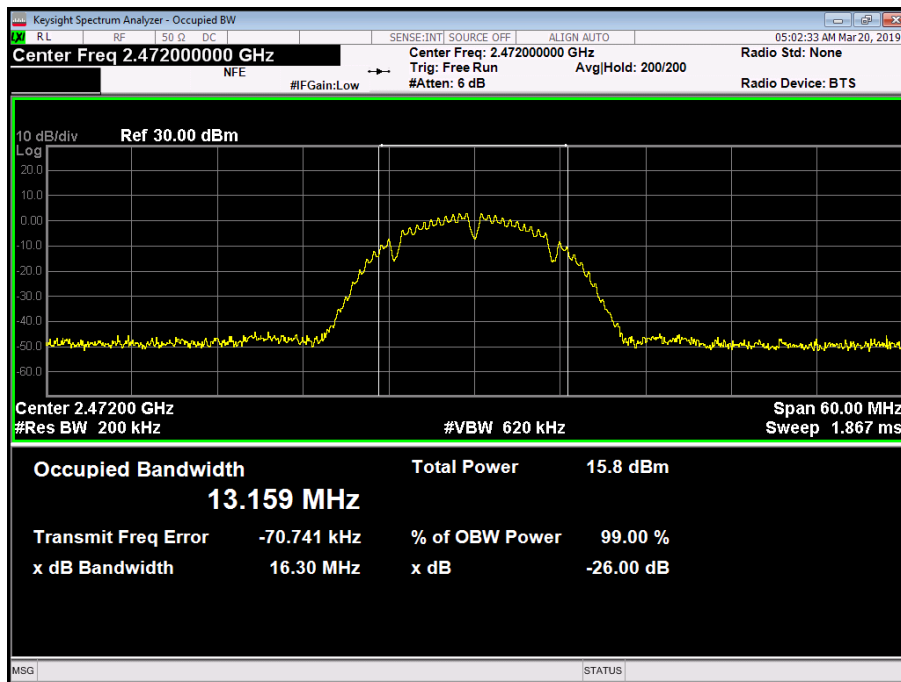


Figure 8 - 2472 MHz - 99% Occupied Bandwidth



802.11b / 1 Mbps / MIMO CDD / Cores 0+1

Channel	Bottom	Middle	Top
Frequency (MHz)	2412	2442	2472
6 dB Bandwidth (MHz)	7.680	8.100	7.680
99% Bandwidth (MHz)	13.084	13.110	13.165

Table 22

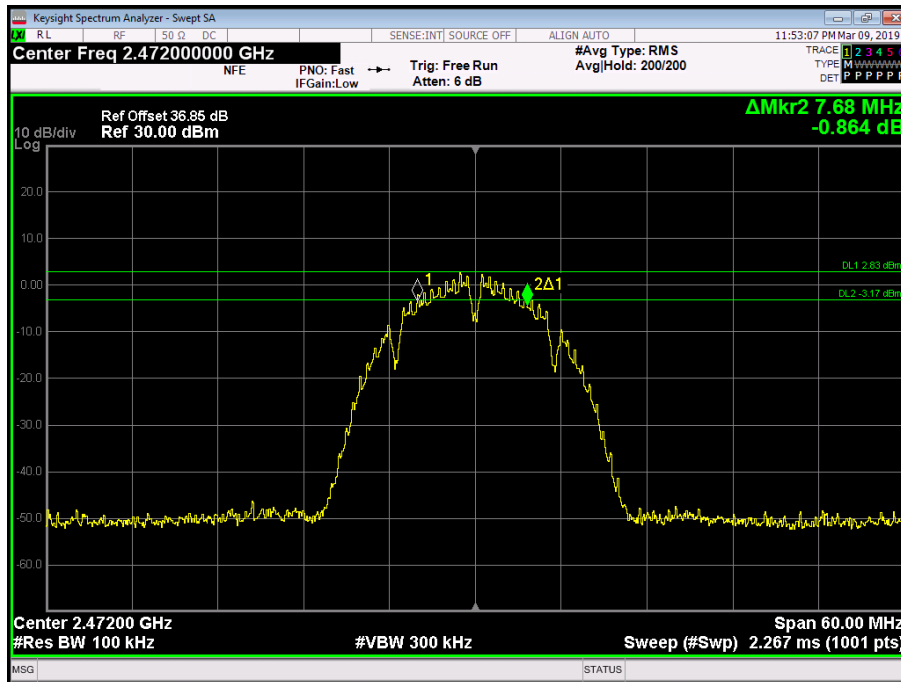


Figure 9 - 2412 MHz - 6 dB DTS Bandwidth

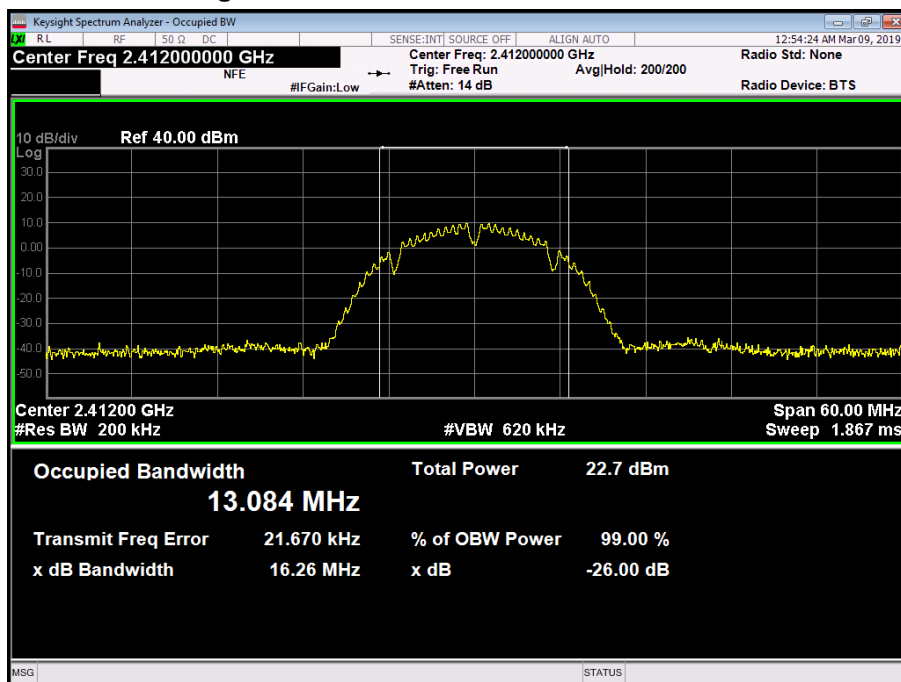


Figure 10 - 2412 MHz - 99% Occupied Bandwidth

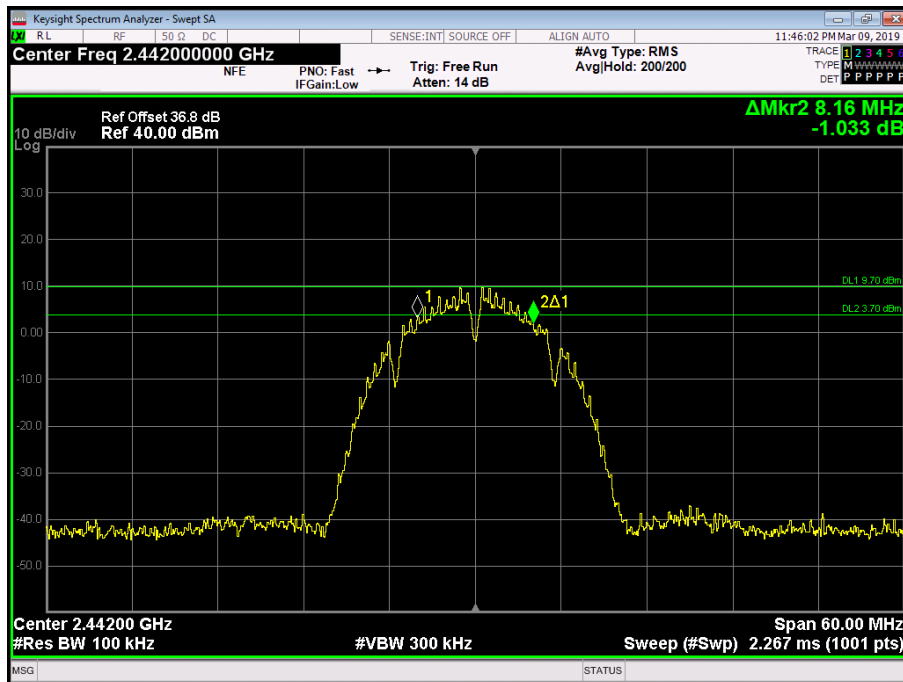


Figure 11 - 2442 MHz - 6 dB DTS Bandwidth

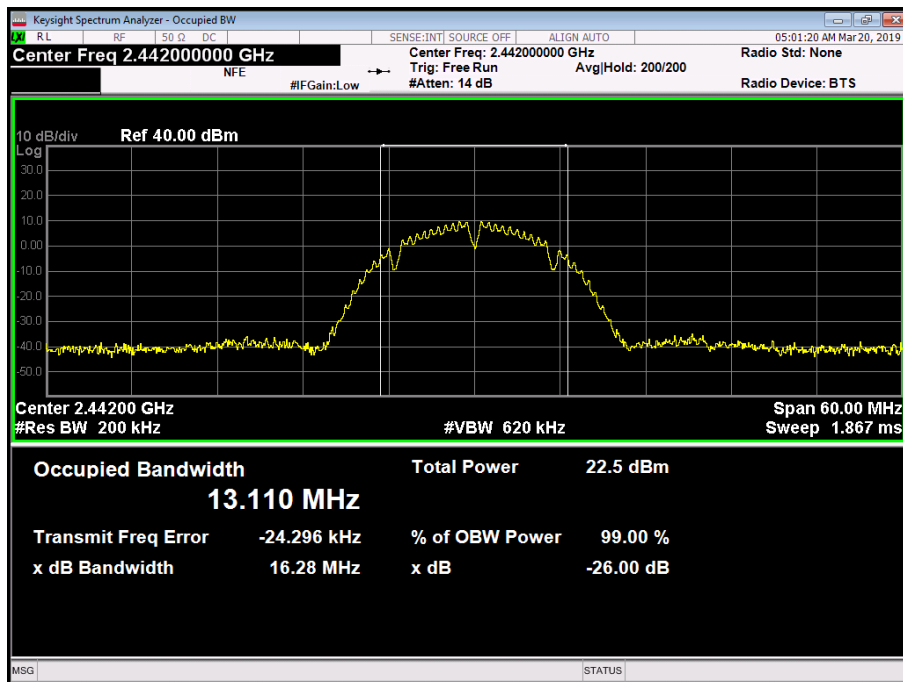


Figure 12 - 2442 MHz - 99% Occupied Bandwidth

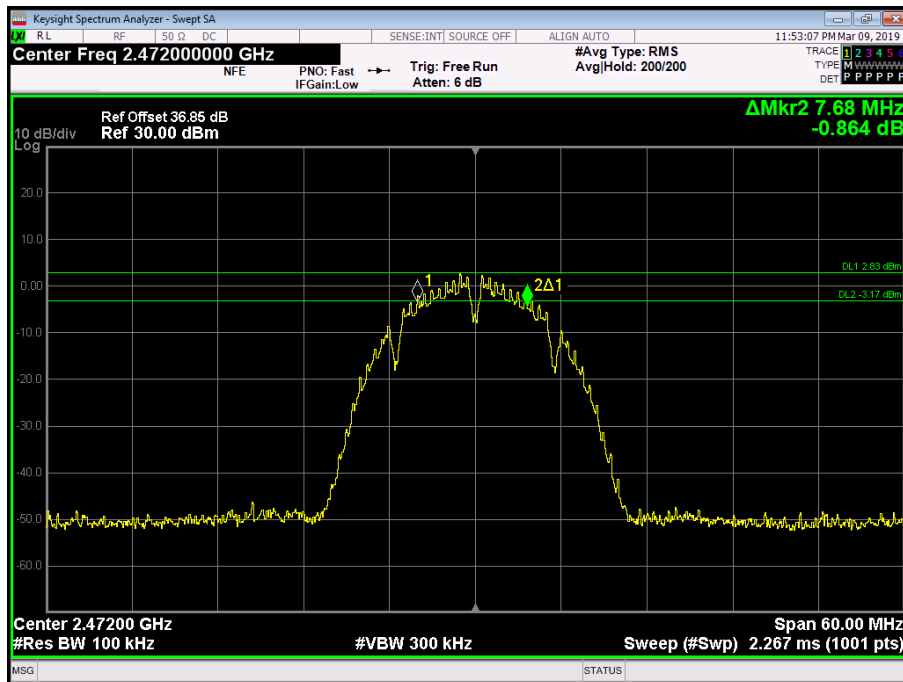


Figure 13 - 2472 MHz - 6 dB DTS Bandwidth

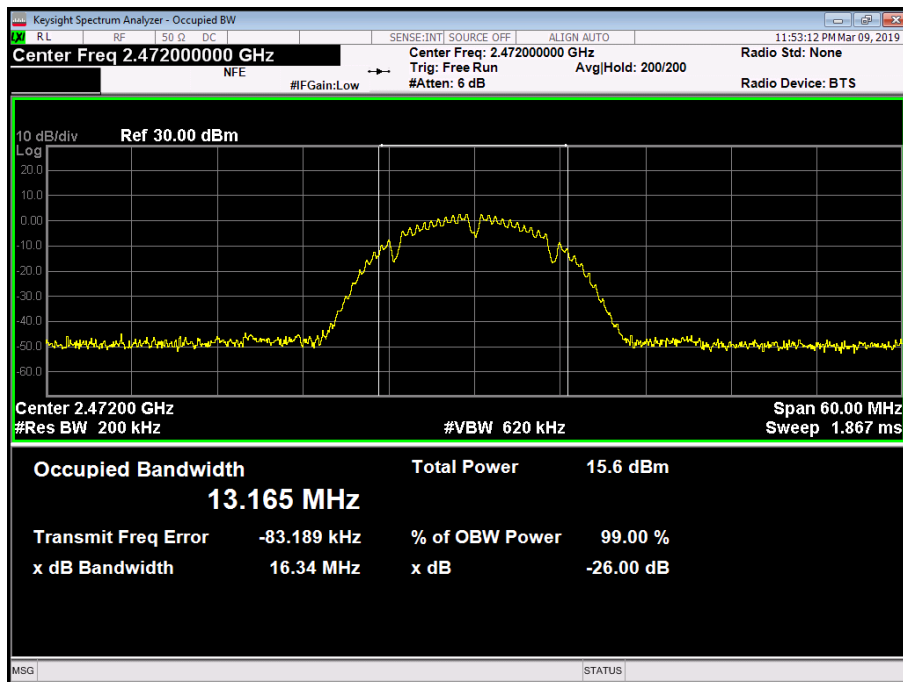


Figure 14 - 2472 MHz - 99% Occupied Bandwidth



802.11g / 6 Mbps / SISO / Core 0

Channel	Bottom	Middle	Top
Frequency (MHz)	2412	2442	2472
6 dB Bandwidth (MHz)	16.440	16.440	16.440
99% Bandwidth (MHz)	16.631	16.616	16.650

Table 23

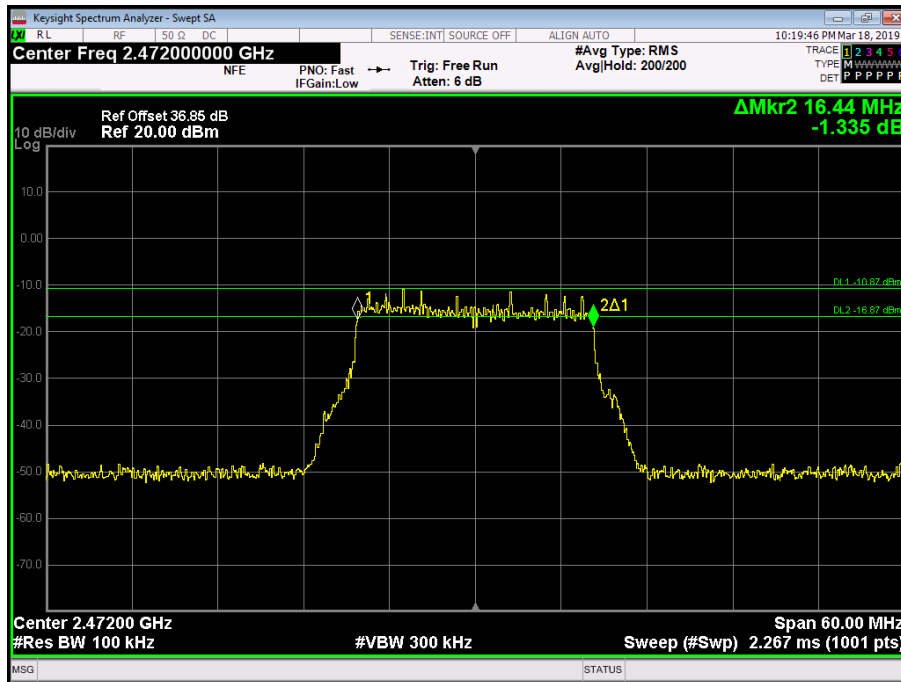


Figure 15 - 2412 MHz - 6 dB DTS Bandwidth

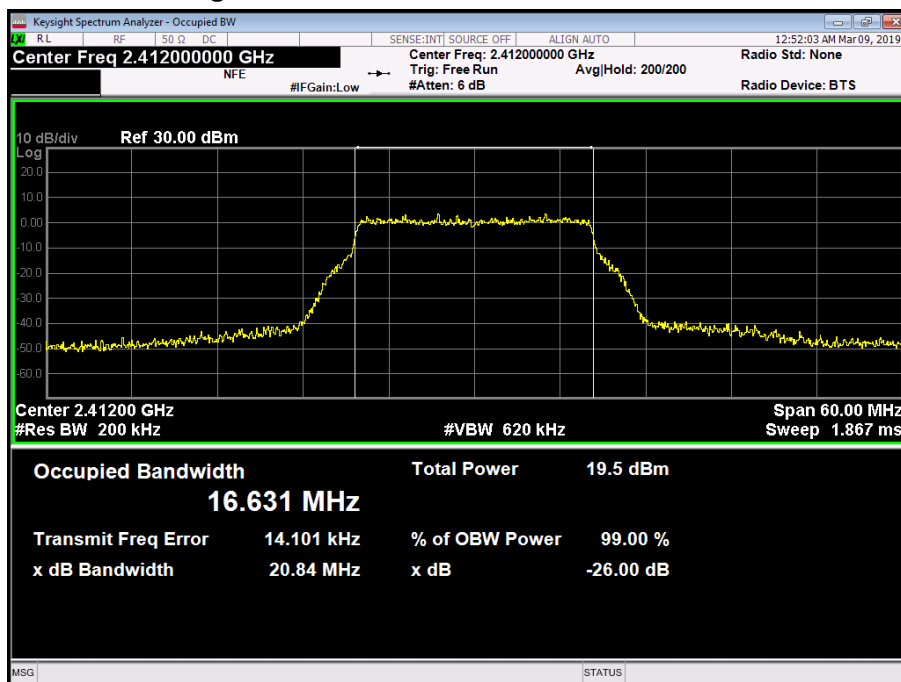


Figure 16 - 2412 MHz - 99% Occupied Bandwidth

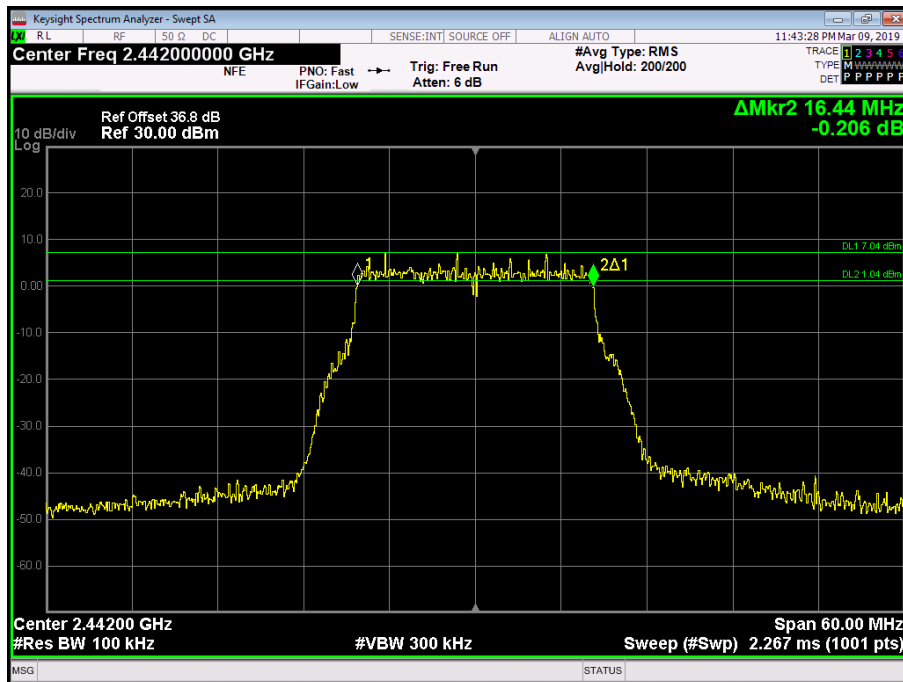


Figure 17 - 2442 MHz - 6 dB DTS Bandwidth

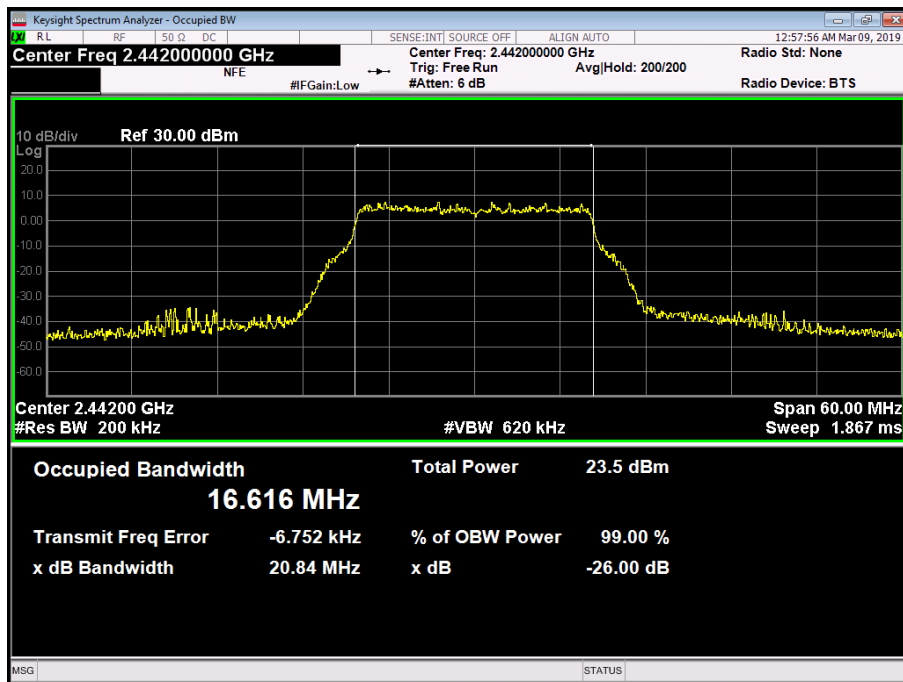


Figure 18 - 2442 MHz - 99% Occupied Bandwidth

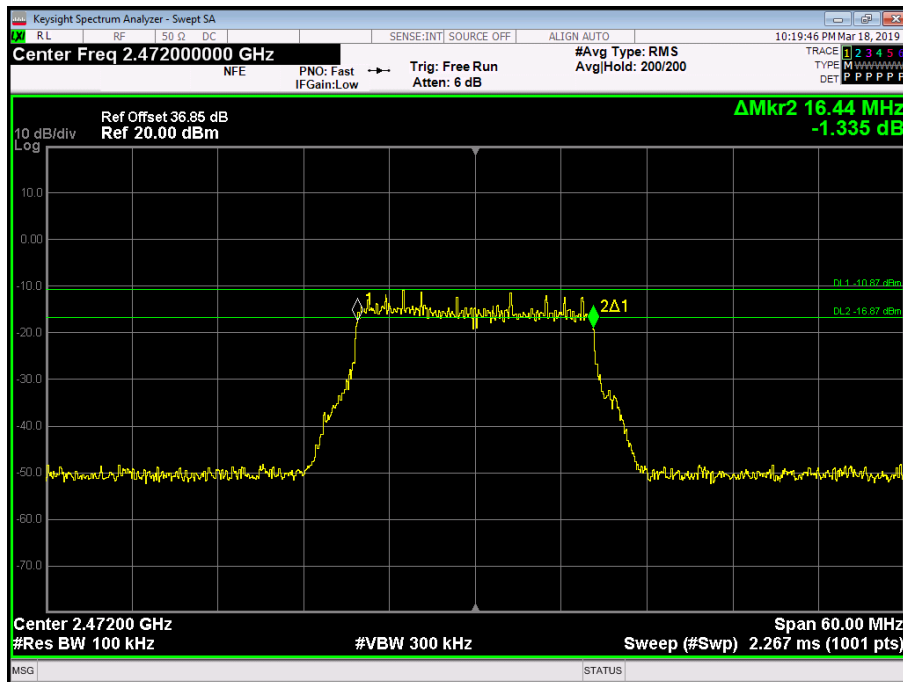


Figure 19 - 2472 MHz - 6 dB DTS Bandwidth

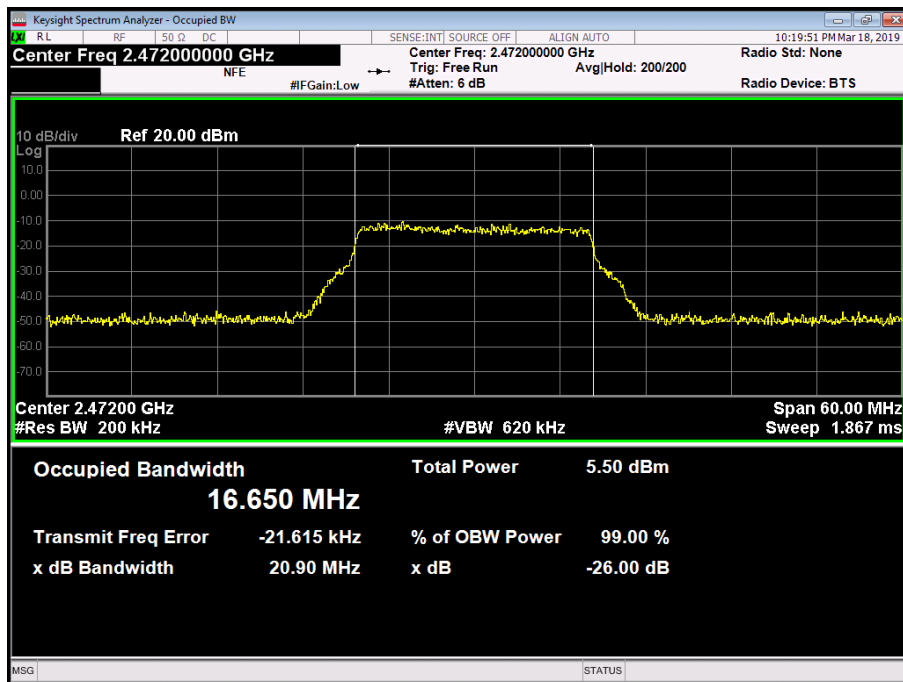


Figure 20 - 2472 MHz - 99% Occupied Bandwidth



802.11n / HT20 MCS0 / SISO / Core 0

Channel	Bottom	Middle	Top
Frequency (MHz)	2412	2442	2472
6 dB Bandwidth (MHz)	17.640	17.700	17.700
99% Bandwidth (MHz)	17.817	17.848	17.901

Table 24

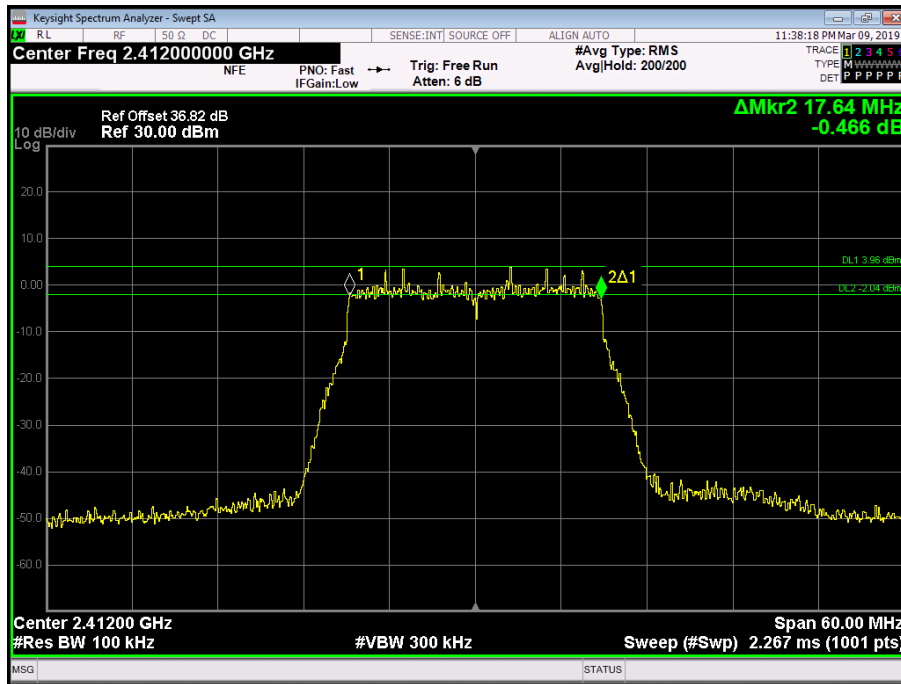


Figure 21 - 2412 MHz - 6 dB DTS Bandwidth

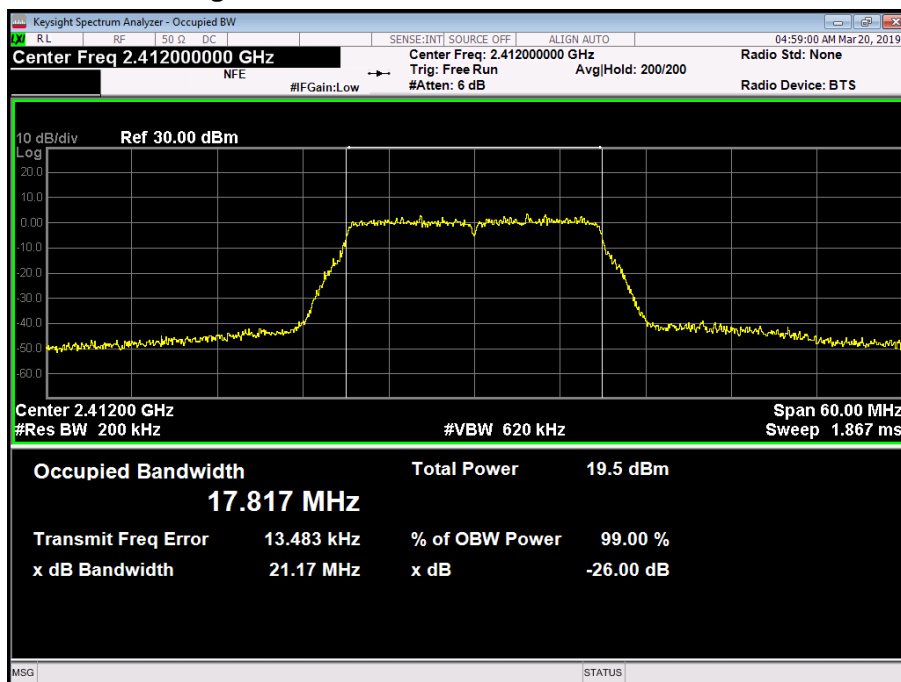


Figure 22 - 2412 MHz - 99% Occupied Bandwidth

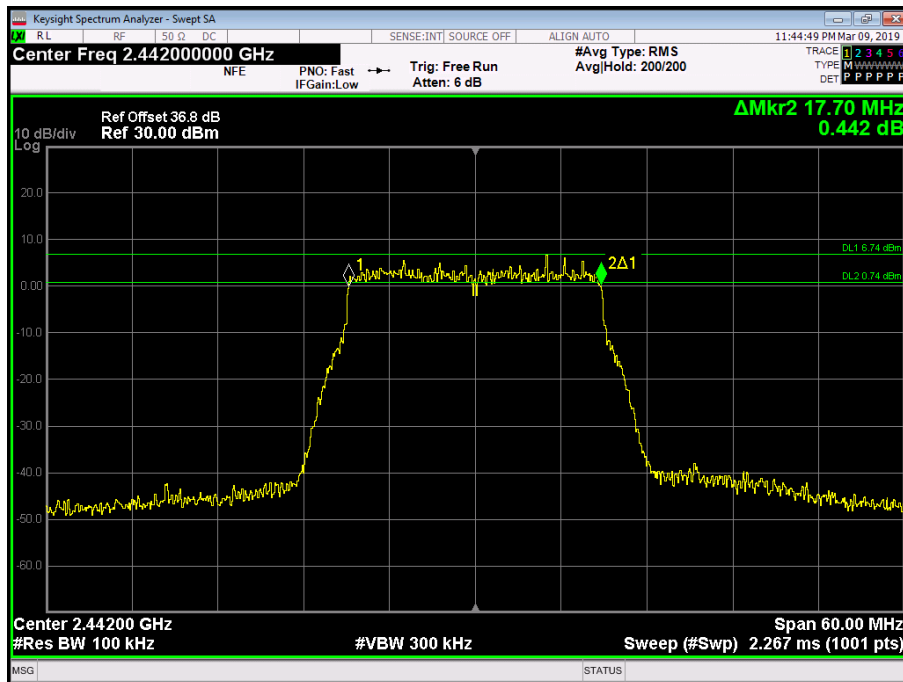


Figure 23 - 2442 MHz - 6 dB DTS Bandwidth

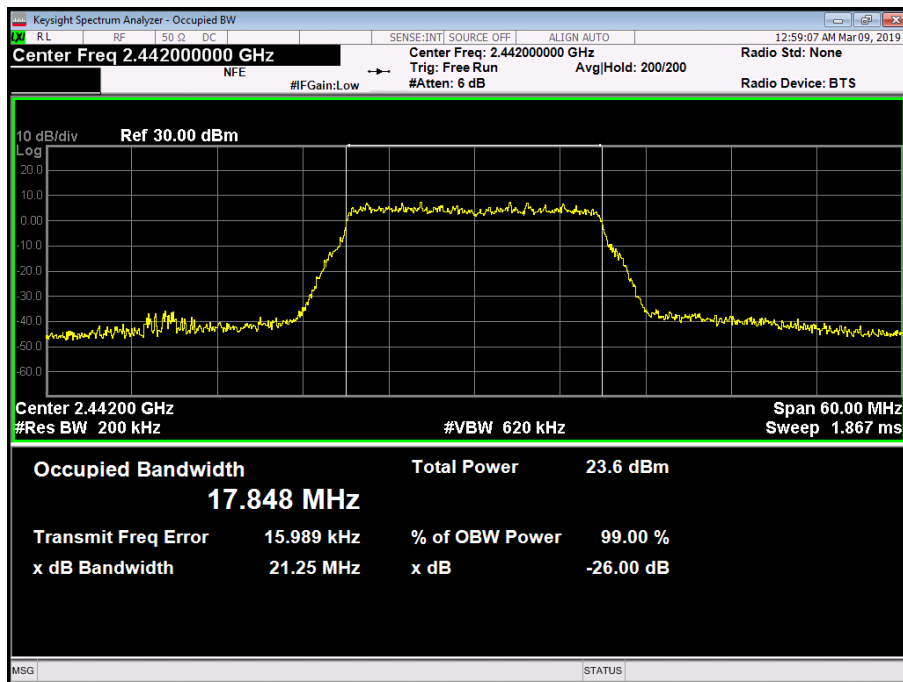


Figure 24 - 2442 MHz - 99% Occupied Bandwidth

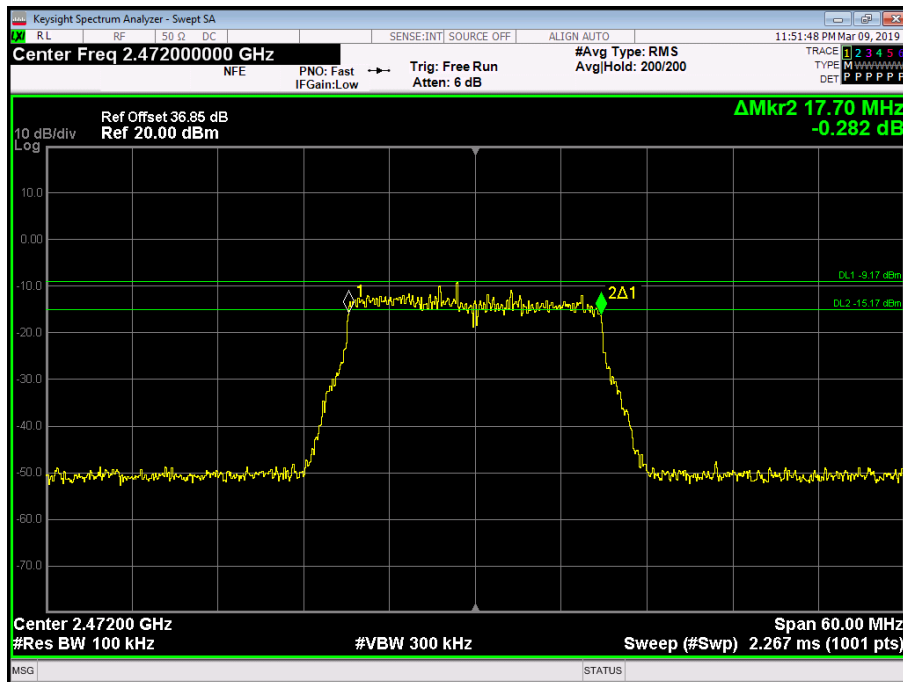


Figure 25 - 2472 MHz - 6 dB DTS Bandwidth

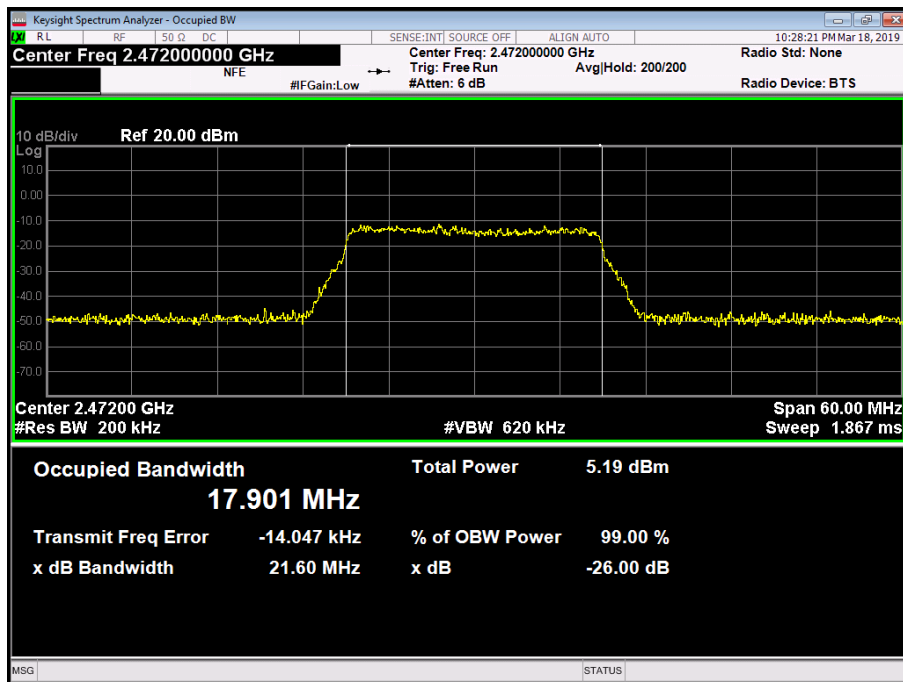


Figure 26 - 2472 MHz - 99% Occupied Bandwidth



802.11n / HT20 MCS0 / MIMO CDD / Cores 0+1

Channel	Bottom	Middle	Top
Frequency (MHz)	2412	2442	2472
6 dB Bandwidth (MHz)	17.640	17.640	17.700
99% Bandwidth (MHz)	17.843	17.861	17.891

Table 25

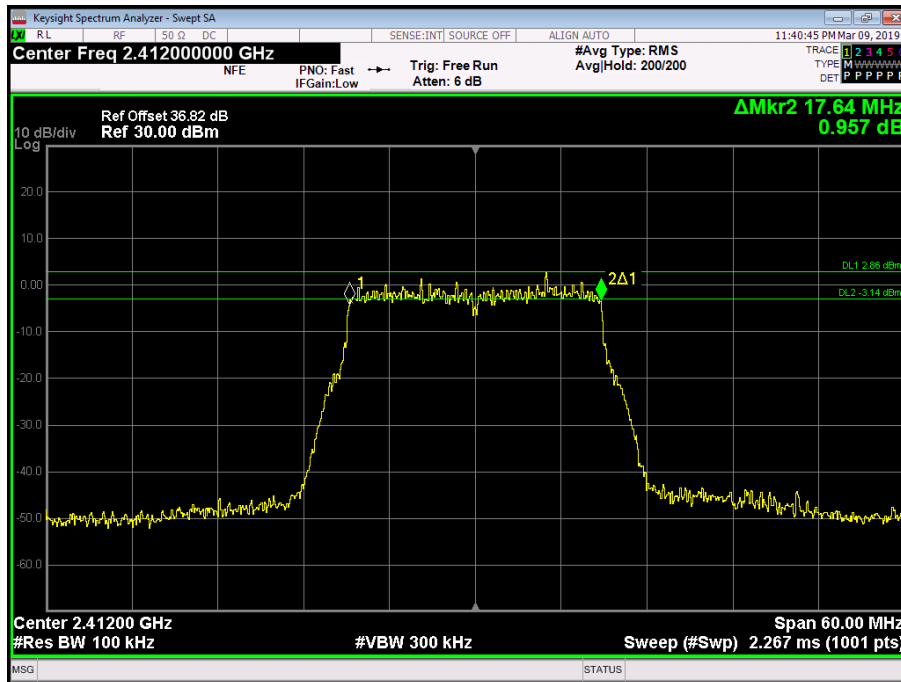


Figure 27 - 2412 MHz - 6 dB DTS Bandwidth

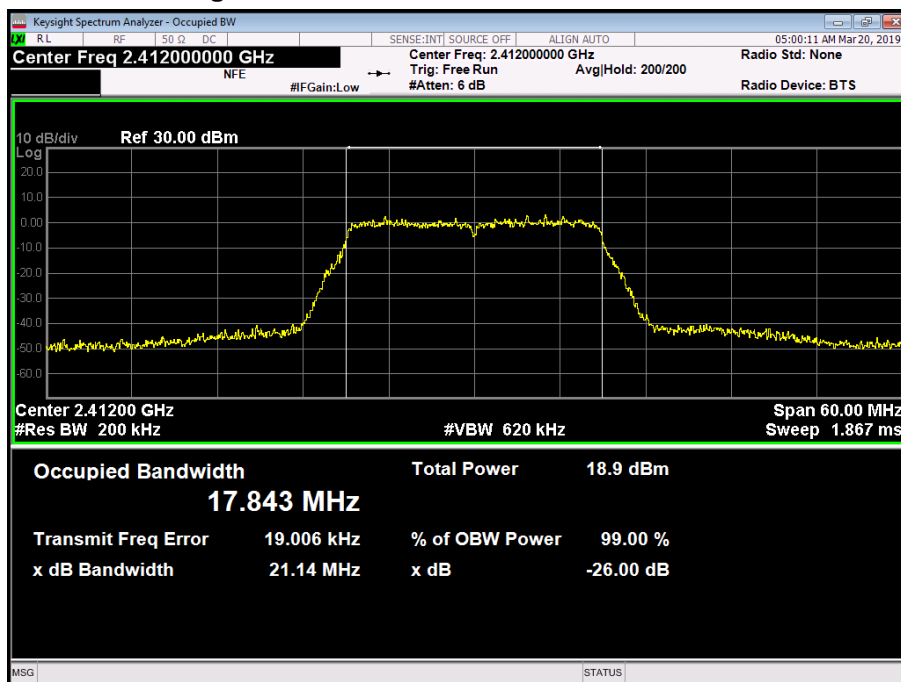


Figure 28 - 2412 MHz - 99% Occupied Bandwidth

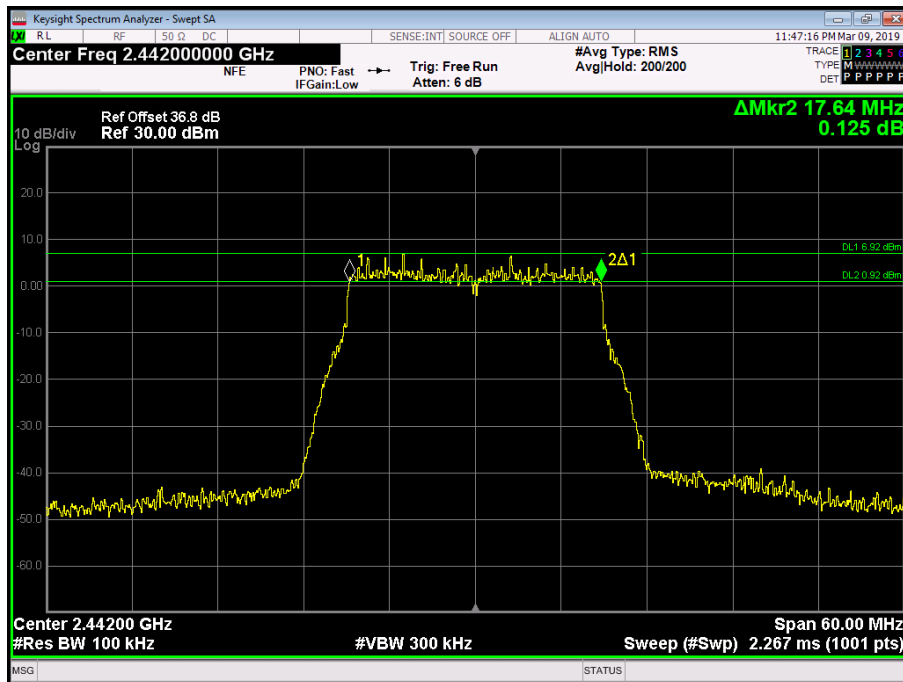


Figure 29 - 2442 MHz - 6 dB DTS Bandwidth

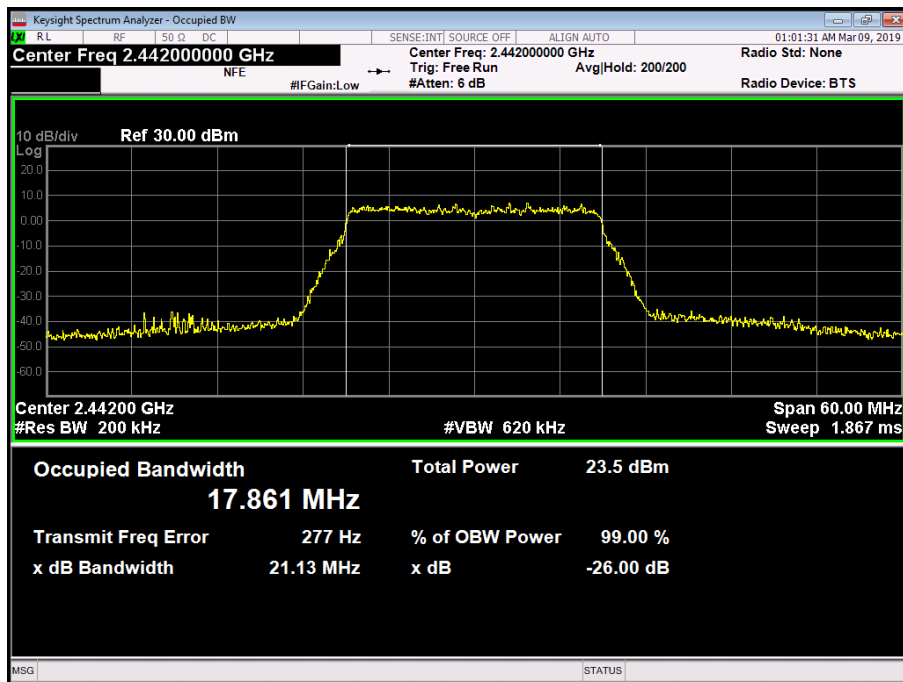


Figure 30 - 2442 MHz - 99% Occupied Bandwidth

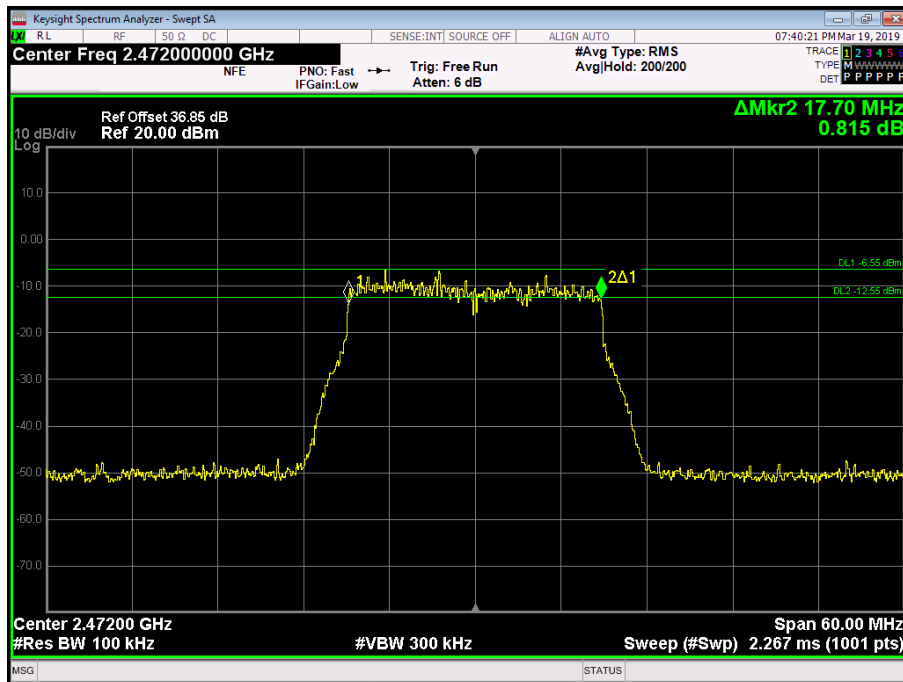


Figure 31 - 2472 MHz - 6 dB DTS Bandwidth

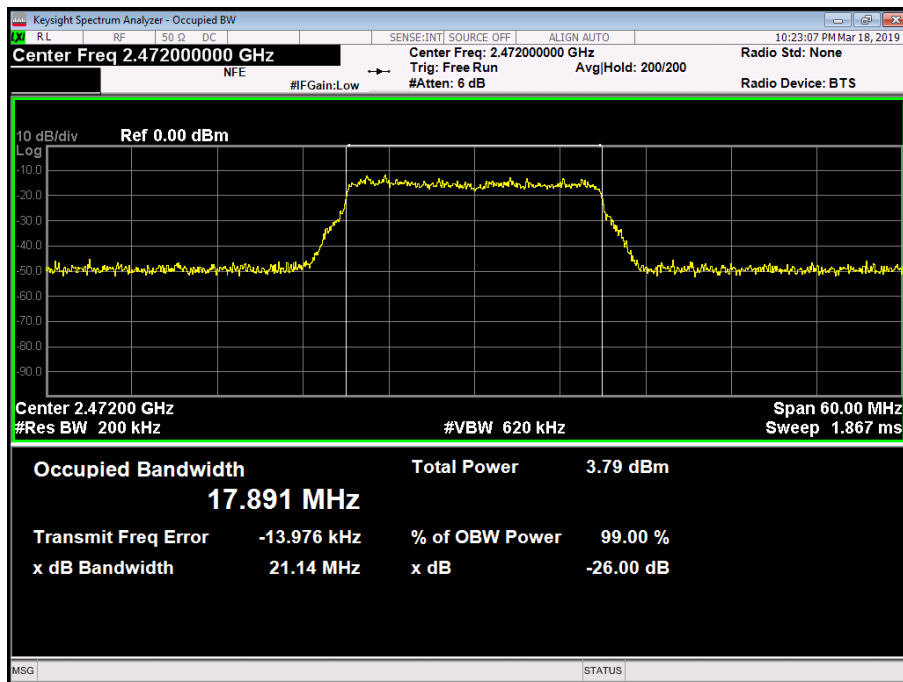


Figure 32 - 2472 MHz - 99% Occupied Bandwidth



802.11n / HT20 MCS0 / MIMO TxBF / Cores 0+1

Channel	Bottom	Middle	Top
Frequency (MHz)	2412	2442	2472
6 dB Bandwidth (MHz)	17.640	17.640	17.700
99% Bandwidth (MHz)	17.802	17.815	17.953

Table 26

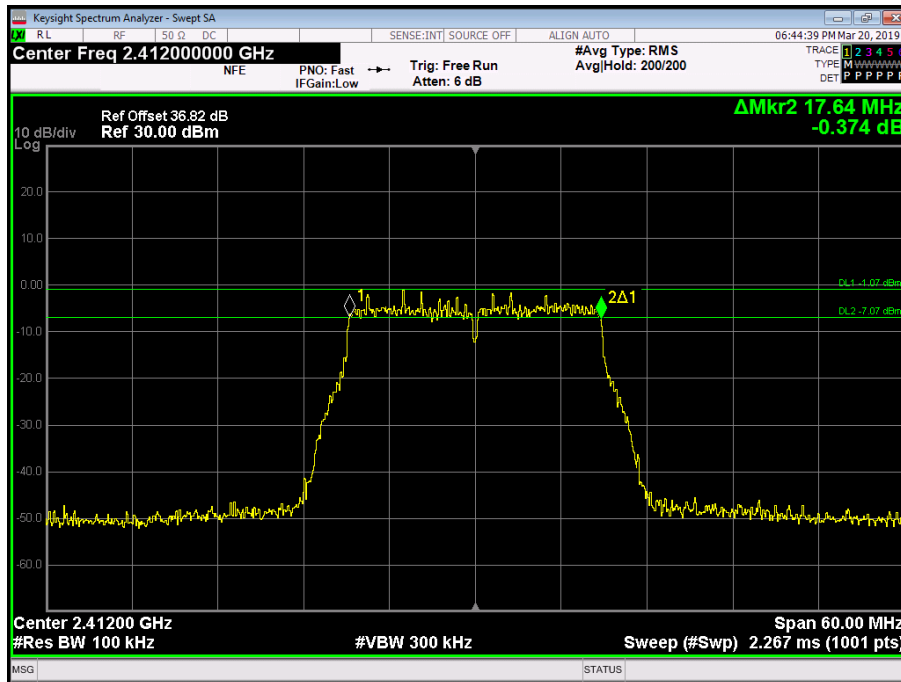


Figure 33 - 2412 MHz - 6 dB DTS Bandwidth

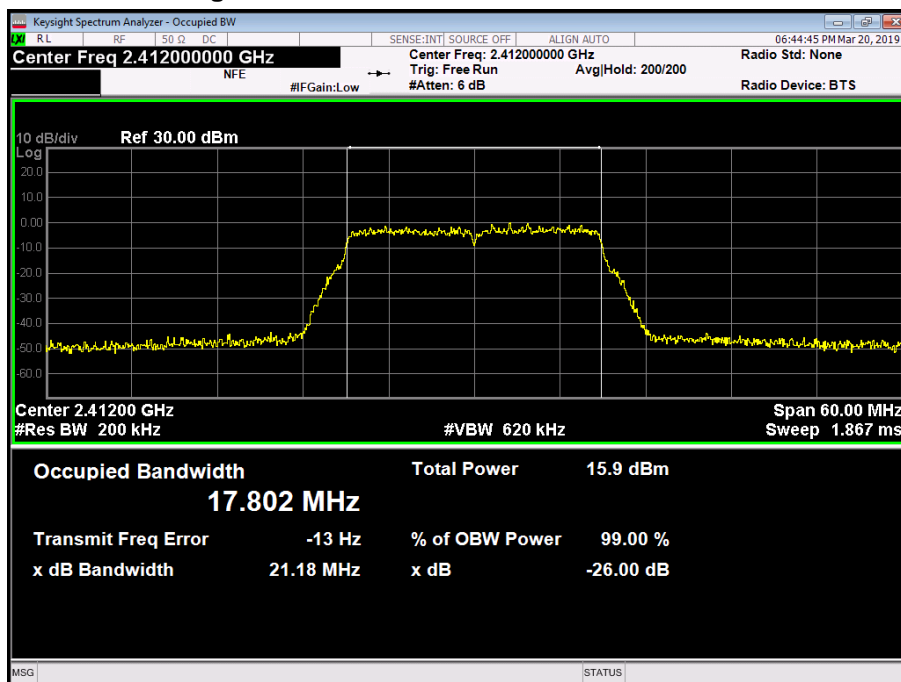


Figure 34 - 2412 MHz - 99% Occupied Bandwidth

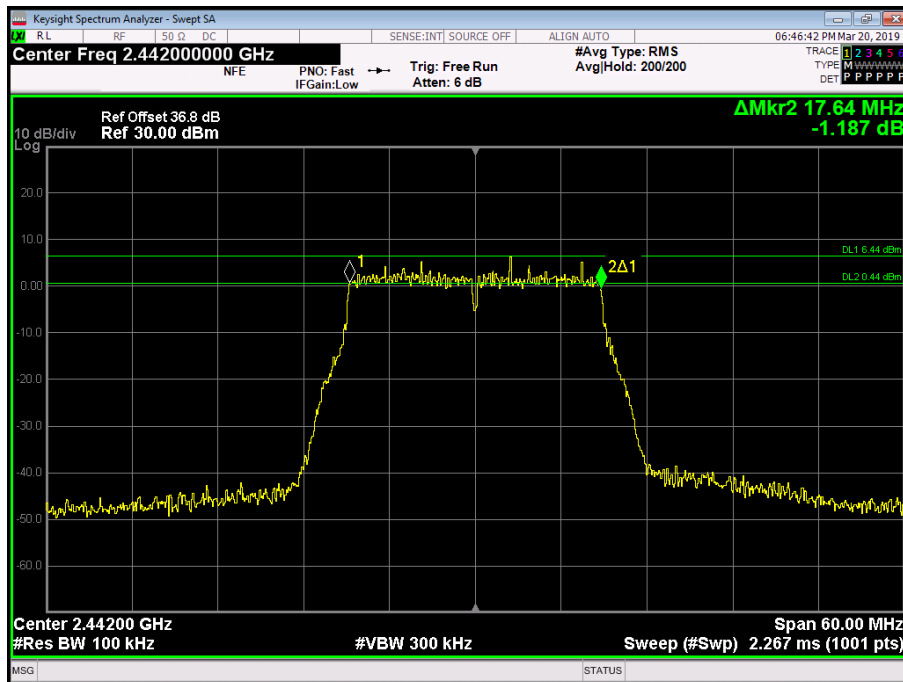


Figure 35 - 2442 MHz - 6 dB DTS Bandwidth

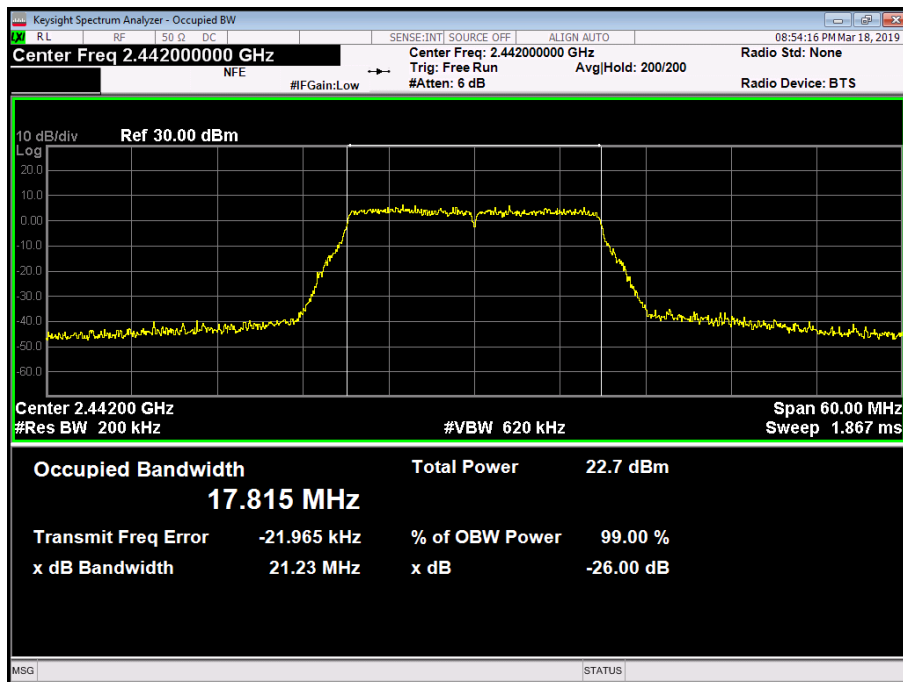


Figure 36 - 2442 MHz - 99% Occupied Bandwidth

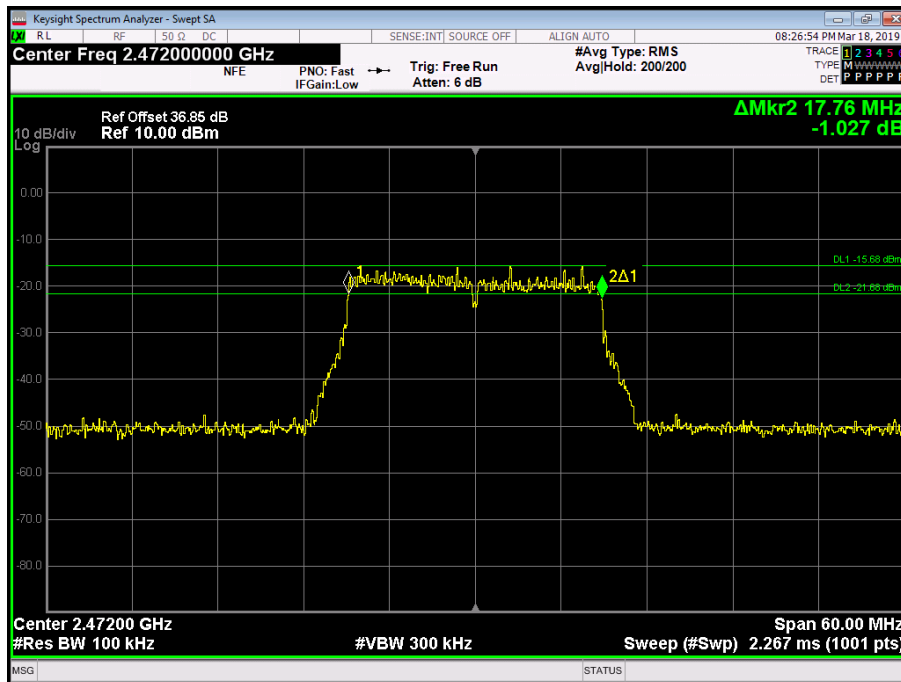


Figure 37 - 2472 MHz - 6 dB DTS Bandwidth

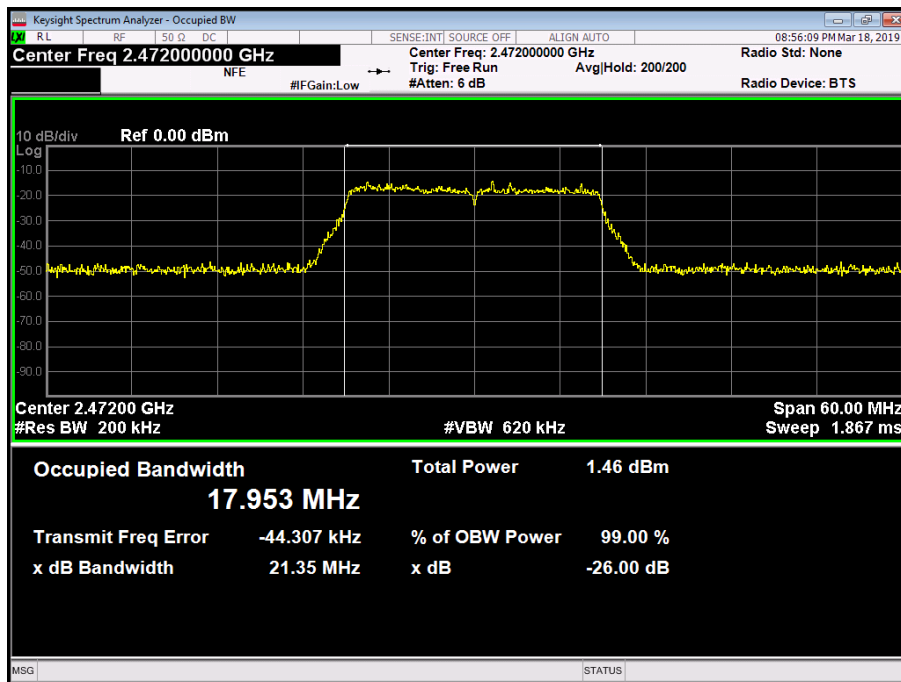


Figure 38 - 2472 MHz - 99% Occupied Bandwidth

FCC 47 CFR Part 15, Limit Clause 15.247(a)(2) and Industry Canada RSS-247, Clause 5.2(a)

The minimum 6 dB Bandwidth shall be at least 500 kHz.



2.3.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 3 and RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Attenuator 10dB 10W	Weinschel	47-10-34	398	12	18-July-2019
Multimeter	Iso-tech	IDM101	2424	12	12-Dec-2019
Hygrometer	Rotronic	I-1000	2891	12	18-Sep-2019
ZVA40 Network Analyser	Rohde & Schwarz	100127	3548	12	17-Oct-2019
ZV-Z54 Calibration Unit	Rohde & Schwarz	1000001	4368	12	22-Oct-2019
PXA Signal Analyser	Keysight Technologies	N9030A	4653	12	06-Feb-2020
Power splitter - 2 port	Mini-Circuits	ZN2PD-63-S+	4742	12	19-Sept-2019
Power splitter - 2 port	Mini-Circuits	ZN2PD-63-S+	4743	12	19-Sept-2019
USB Power Sensor	Boonton	RTP5006	5187	12	12-Dec-2019
AC Programmable Power Supply	iTech	IT7324	5225	-	O/P Mon
Power Splitter, 4 way	Mini-Circuits	ZN4PD1-63-S+	5235	-	O/P Mon
Attenuator 10dB 2W	Telegartner	J01156A0031	N/A	-	O/P Mon
Attenuator 10dB 2W	Telegartner	J01156A0031	N/A	-	O/P Mon
Attenuator 10dB 2W	Telegartner	J01156A0031	N/A	-	O/P Mon

Table 27

O/P Mon – Output Monitored using calibrated equipment



2.4 Authorised Band Edges

2.4.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (d)
Industry Canada RSS-247 Clause 5.5

2.4.2 Equipment Under Test and Modification State

A2519, S/N: C02Y4006L59F - Modification State 0

2.4.3 Date of Test

06-February-2019 to 12-March-2019

2.4.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.10.4.

2.4.5 Reported Measurements

Authorised band edge measurements were performed, with the device operating in SISO, MIMO and TxBF, across the various modes, and radio cores (Core 0, Core 1) supported by the device.

The measurements displayed within this report, have been limited to those modes and cores, which have been shown to be worst case.

Further measurements are held on file by TÜV SÜD and are available if required.

2.4.6 Environmental Conditions

Ambient Temperature	21.7 - 29.4 °C
Relative Humidity	22.5 – 45.0 %



2.4.7 Test Results

SISO (Core 0 / Core 1)

Mode	Data Rate/MCS	Frequency (MHz)	Band Edge Frequency (MHz)	Level (dBc)
802.11b	1 Mbps	2412	2400.0	-37.04

Table 28

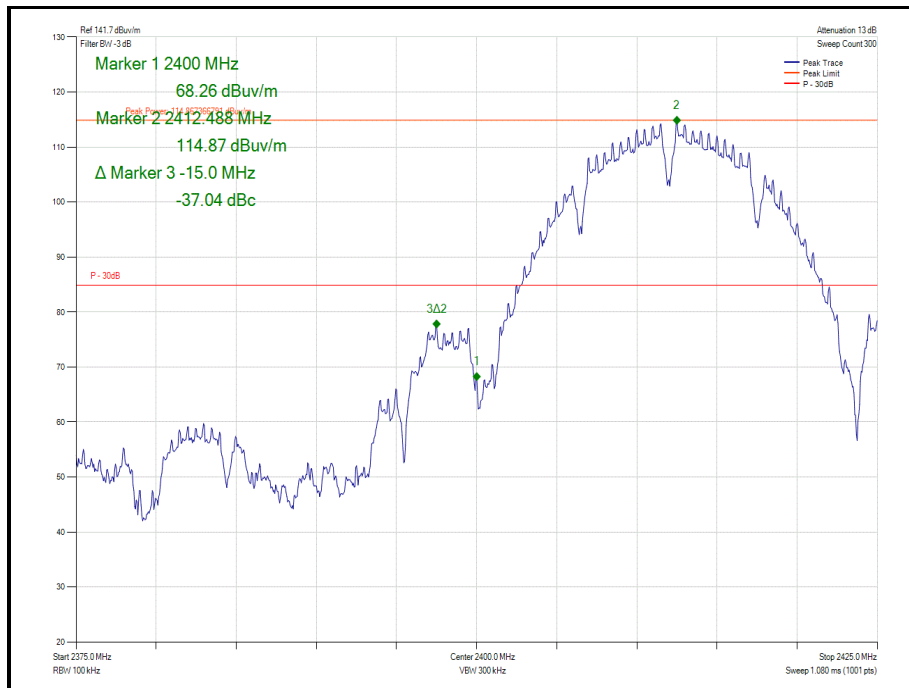


Figure 39 - 2412 MHz - Band Edge Frequency 2400.0 MHz



Mode	Data Rate/MCS	Frequency (MHz)	Band Edge Frequency (MHz)	Level (dBc)
802.11g	6 Mbps	2412	2400.0	-39.15

Table 29

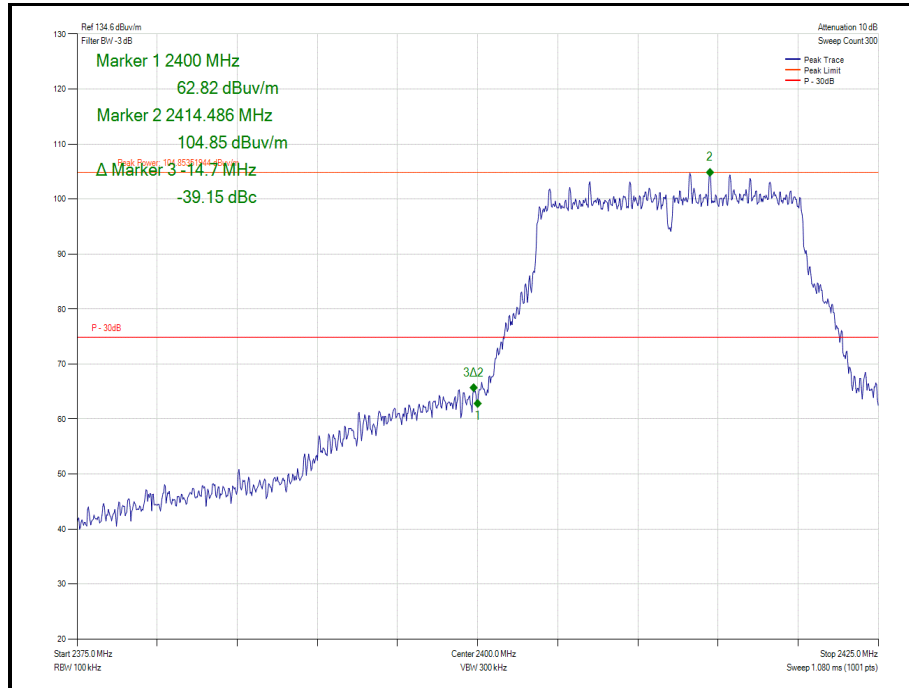


Figure 40 - 2412 MHz - Band Edge Frequency 2400.0 MHz



Mode	Data Rate/MCS	Frequency (MHz)	Band Edge Frequency (MHz)	Level (dBc)
802.11n	MCS0	2412	2400.0	-39.15

Table 30

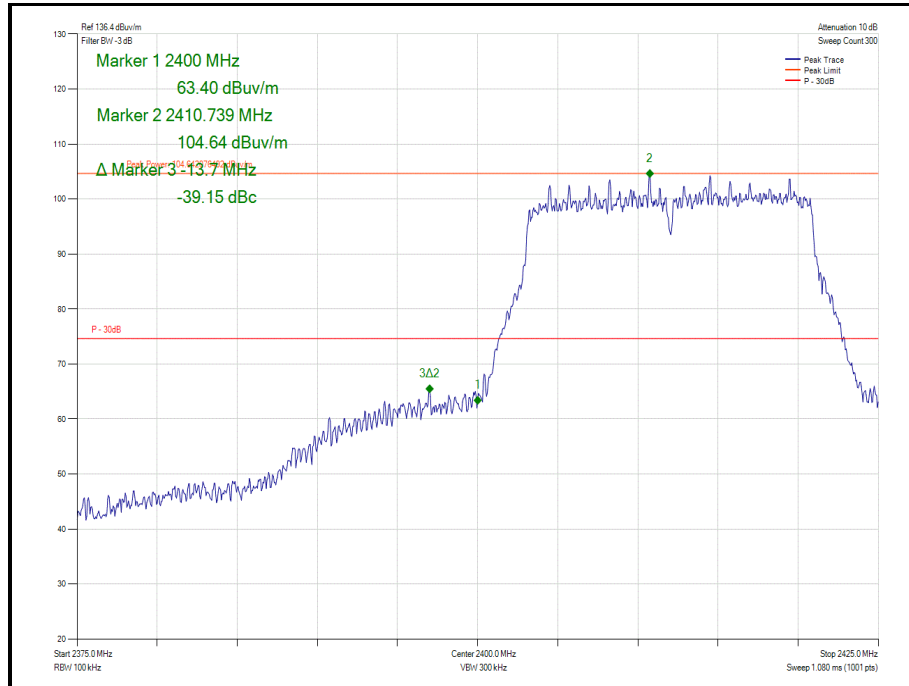


Figure 41 - 2412 MHz - Band Edge Frequency 2400.0 MHz



MIMO 2 Tx, TXBF

Mode	Data Rate/MCS	Frequency (MHz)	Band Edge Frequency (MHz)	Level (dBc)
802.11n	MCS0	2412	2400.0	-44.25

Table 31

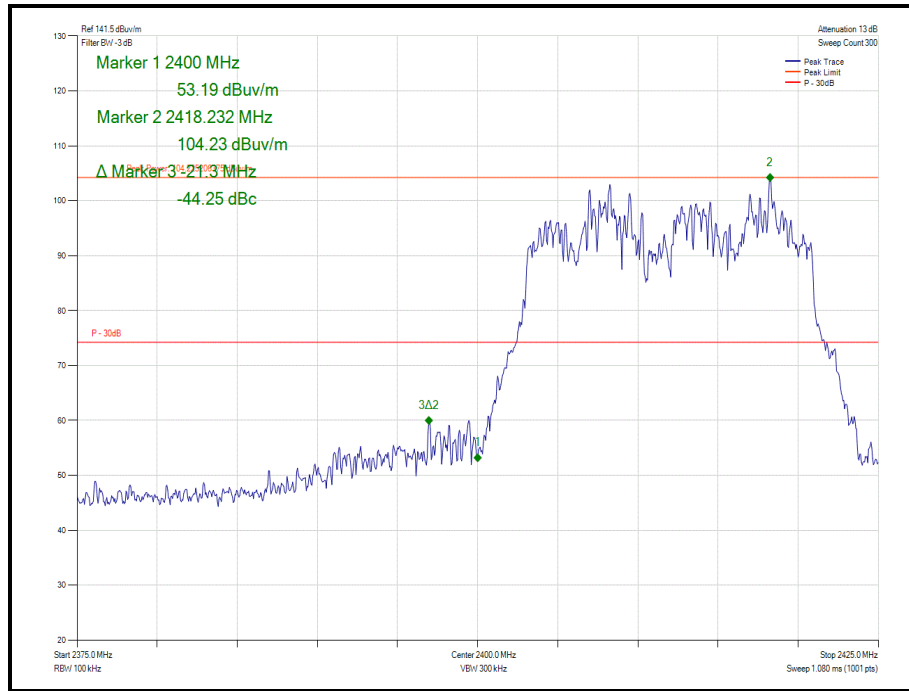


Figure 42 - 2412 MHz - Band Edge Frequency 2400.0 MHz



MIMO 2Tx CDD

Mode	Data Rate/MCS	Frequency (MHz)	Band Edge Frequency (MHz)	Level (dBc)
802.11b	1 Mbps	2412	2400.0	-35.18

Table 32

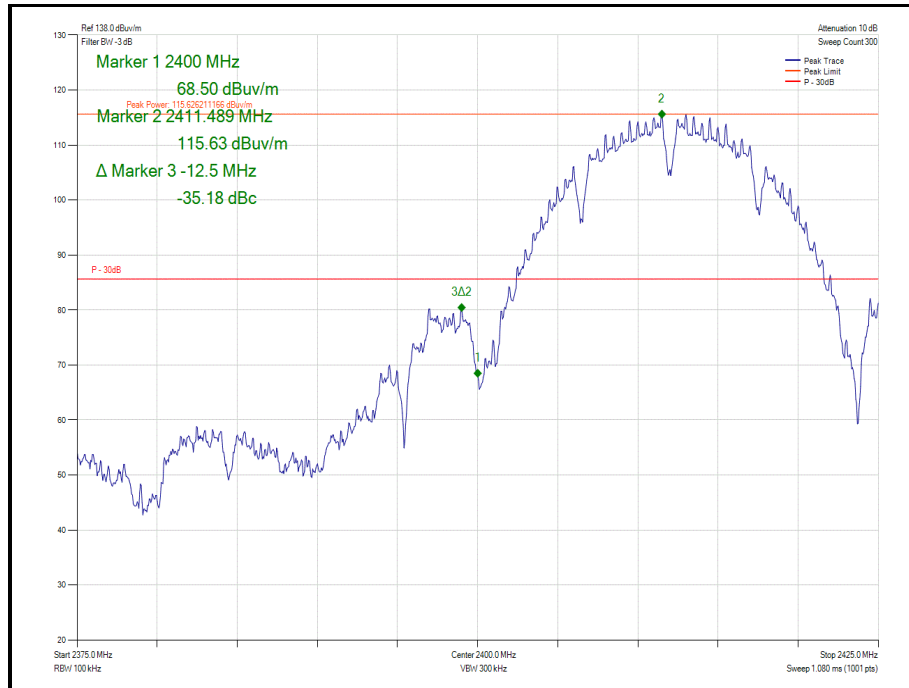


Figure 43 - 2412 MHz - Band Edge Frequency 2400.0 MHz



Mode	Data Rate/MCS	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Level (dBc)
802.11n	MCS0	2412	2400.0	-41.97

Table 33

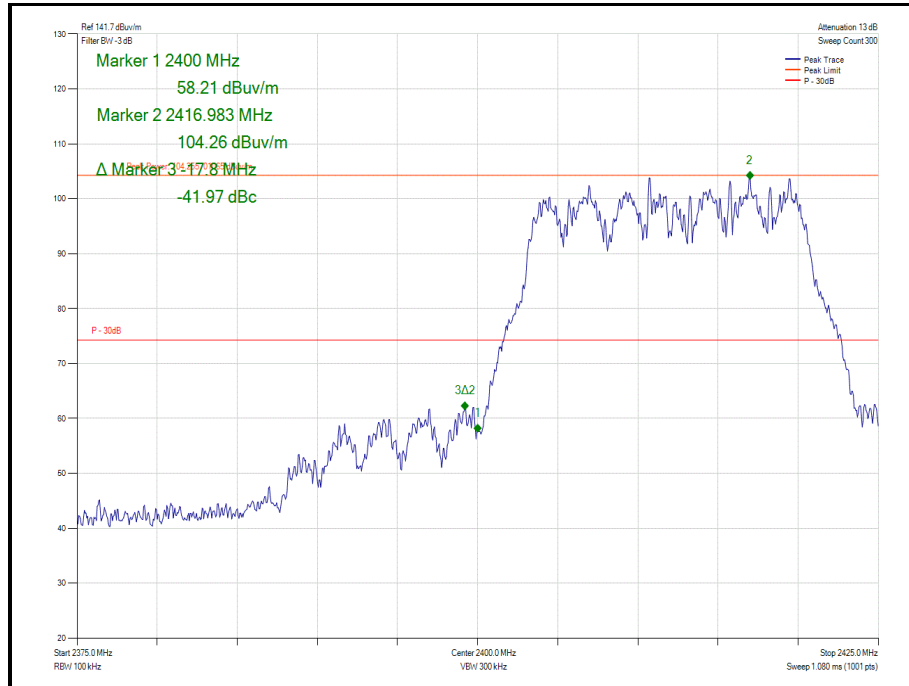


Figure 44 - 2412 MHz – Band Edge Frequency 2400.0 MHz

FCC 47 CFR Part 15, Limit Clause 15.247 (d)

20 dB below the fundamental measured in a 100 kHz bandwidth using a peak detector. If the transmitter complies with the conducted power limits, based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB below the fundamental instead of 20 dB.

Industry Canada RSS-247, Limit Clause 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.



2.4.8 Test Location and Test Equipment Used

This test was carried out in RF Chamber 11.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Hygromer	Rotronic	Hygropalm	2404	12	26 April 2019
Multimeter	Iso-tech	IDM101	2424	12	12-Dec-2019
Double Ridge Broadband Horn Antenna	Schwarzbeck	BBHA 9120 B	4848	12	26-Apr-2019
EMI Test Receiver	Rohde & Schwarz	ESW44	5084	12	12-Sep-2019
8m N-Type RF Cable	Teledyne	PR90-088-8MTR	5095	12	12-Sep-2019
Cable (18GHz)	Rosenberger	LU7-071-2000	5107	12	04-Oct-2019
EmX Software	TUV SUD	-	-	-	Software
Screened Room (11)	Rainford	Rainford	5136	36	01-Nov-2021
Mast	Maturo	TAM 4.0-P	5158	-	TU
Mast and Turntable Controller	Maturo	Maturo NCD	5159	-	TU
Turntable	Maturo	TT 15WF	5160	-	TU

Table 34

TU – Traceability Unscheduled



2.5 Restricted Band Edges

2.5.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.205
Industry Canada RSS-GEN 8.10

2.5.2 Equipment Under Test and Modification State

A2519, S/N: C02Y4006L59F - Modification State 0

2.5.3 Date of Test

06-February-2019 to 12-March-2019

2.5.4 Test Method

Testing was performed in accordance with ANSI C63.10, clause 6.10.5 and 11.12.1.

The following conversion can be applied to convert from dB μ V/m to μ V/m:
 $10^{(\text{Field Strength in dB}\mu\text{V/m}/20)}$.

2.5.5 Reported Measurements

Authorised band edge measurements were performed, with the device operating in SISO, MIMO and TxBF, across the various modes, and radio cores (Core 0, Core 1) supported by the device.

The measurements displayed within this report, have been limited to those modes and cores, which have been shown to be worst case.

Further measurements are held on file by TÜV SÜD and are available if required.

2.5.6 Environmental Conditions

Ambient Temperature	21.7 - 29.4 °C
Relative Humidity	22.5 – 45.0 %



2.5.7 Test Results

SISO (Core 0 / Core 1)

Mode	Data Rate/MCS	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
802.11b	1 Mbps	2462	2483.5	57.81	47.37
802.11b	1 Mbps	2412	2390.0	59.07	51.09

Table 35

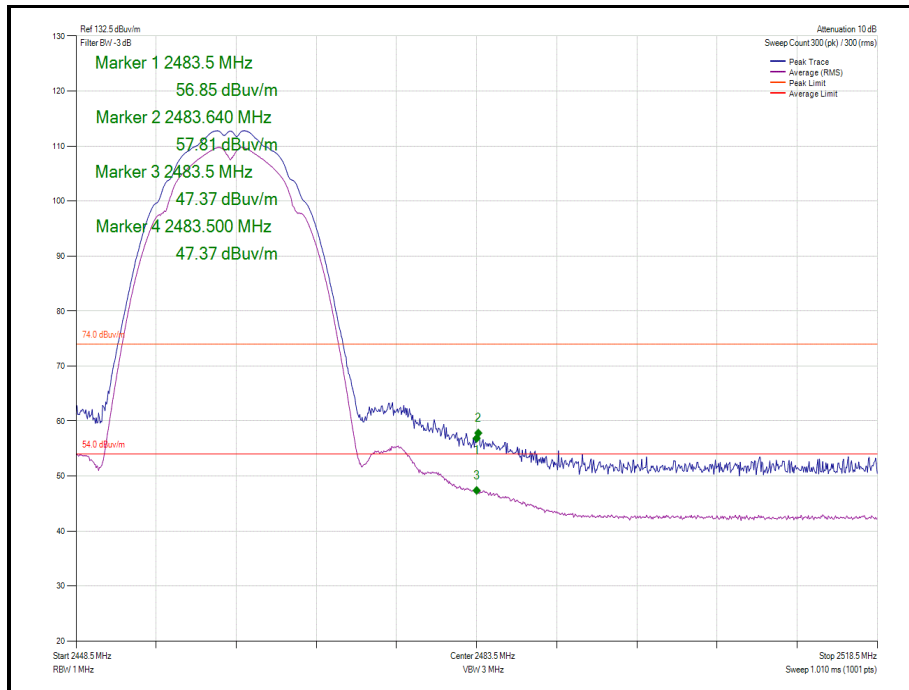


Figure 45 - 2462 MHz - Band Edge Frequency 2483.5 MHz

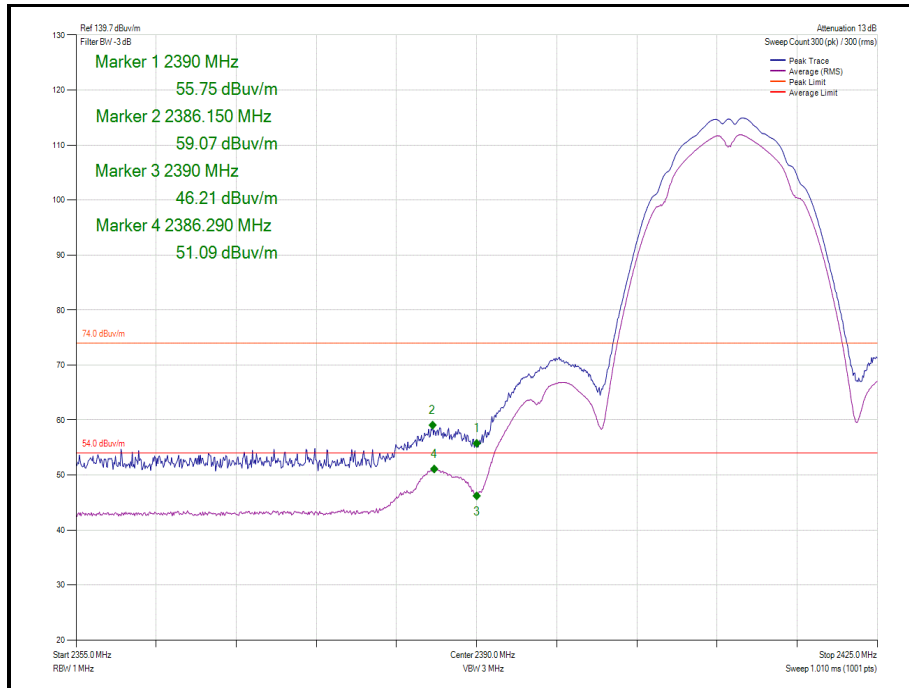


Figure 46 - 2412 MHz - Band Edge Frequency 2390.0 MHz



Mode	Data Rate/MCS	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
802.11b	1 Mbps	2467	2483.5	55.8	46.91
802.11b	1 Mbps	2472	2483.5	62.15	51.22

Table 36

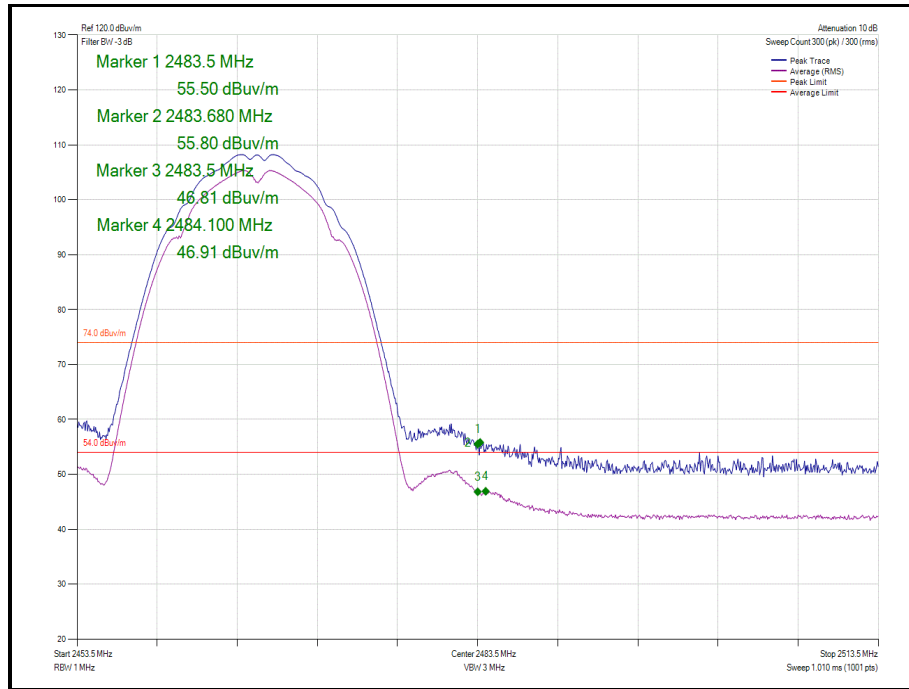


Figure 47 - 2467 MHz - Band Edge Frequency 2483.5 MHz

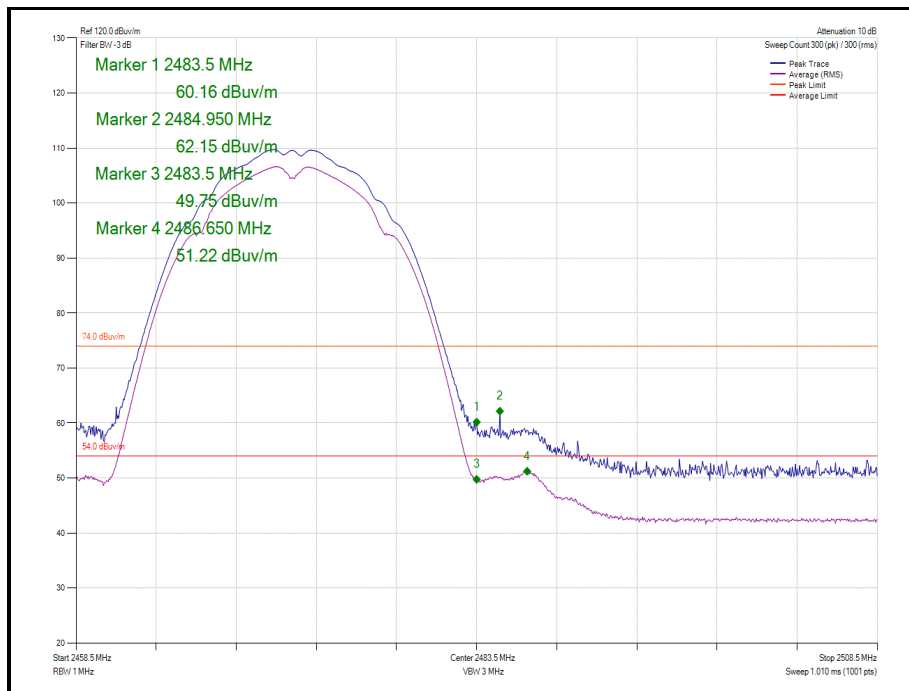


Figure 48 - 2472 MHz - Band Edge Frequency 2483.5 MHz



Mode	Data Rate/MCS	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
802.11g	6 Mbps	2462	2483.5	63.97	47.77
802.11g	6 Mbps	2412	2390.0	64.44	51.31

Table 37

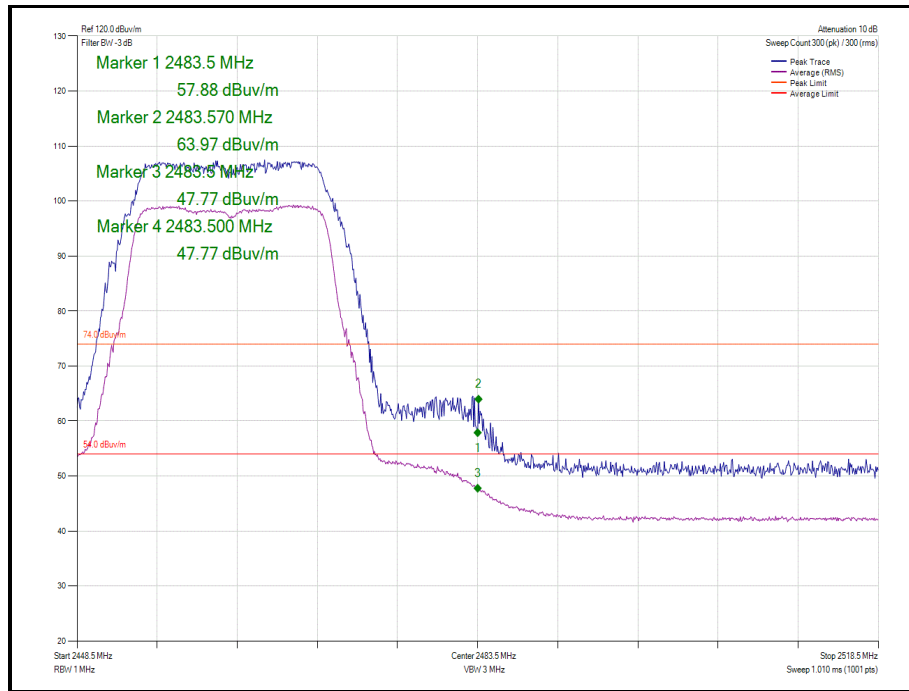


Figure 49 - 2462 MHz - Band Edge Frequency 2483.5 MHz

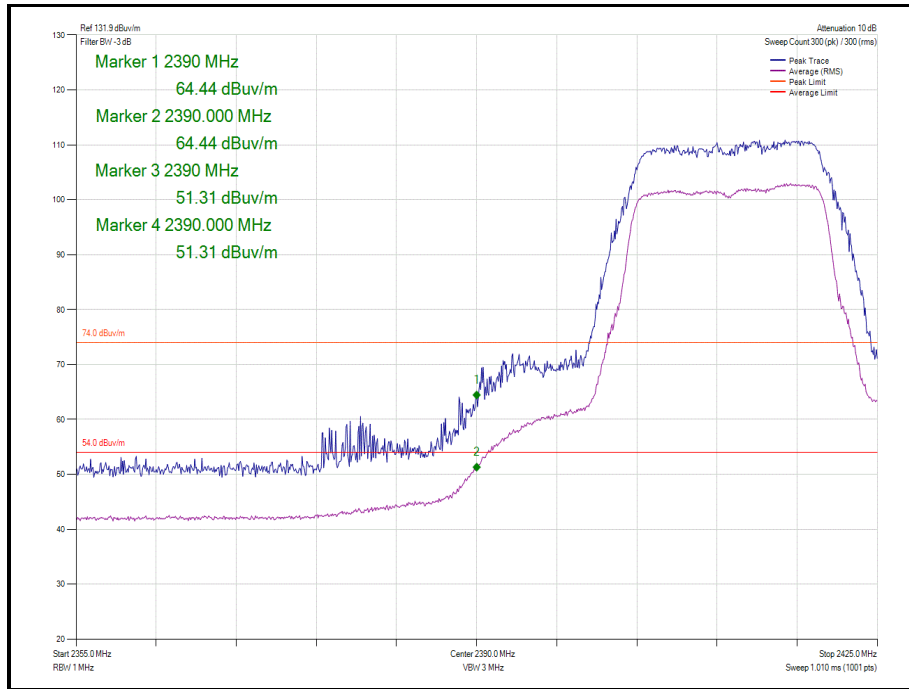


Figure 50 - 2412 MHz - Band Edge Frequency 2390.0 MHz



Mode	Data Rate/MCS	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
802.11g	6 Mbps	2467	2483.5	57.87	46.58
802.11g	6 Mbps	2472	2483.5	62.67	48.22

Table 38

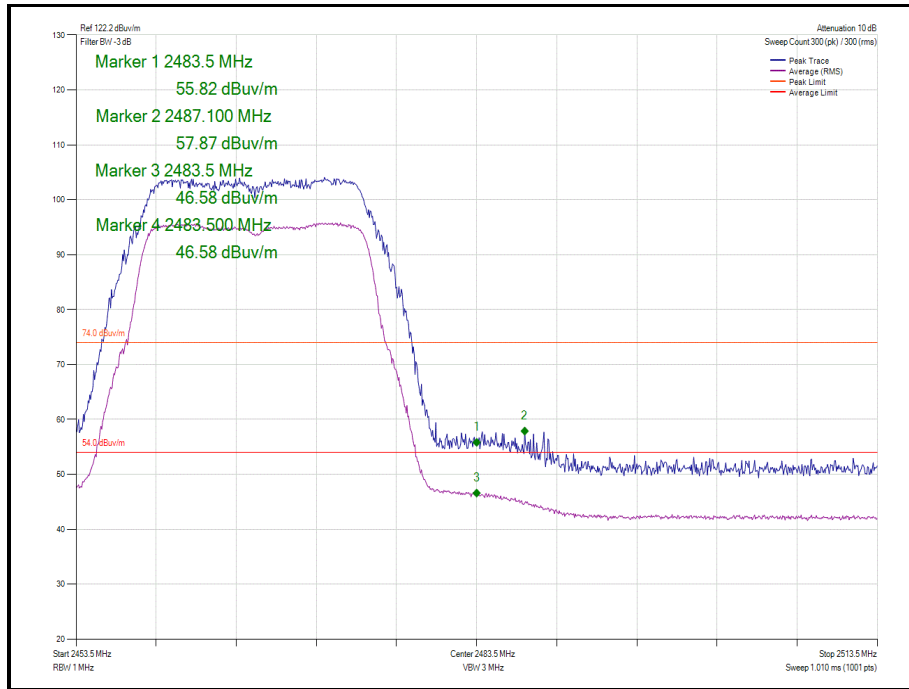


Figure 51 - 2467 MHz - Band Edge Frequency 2483.5 MHz

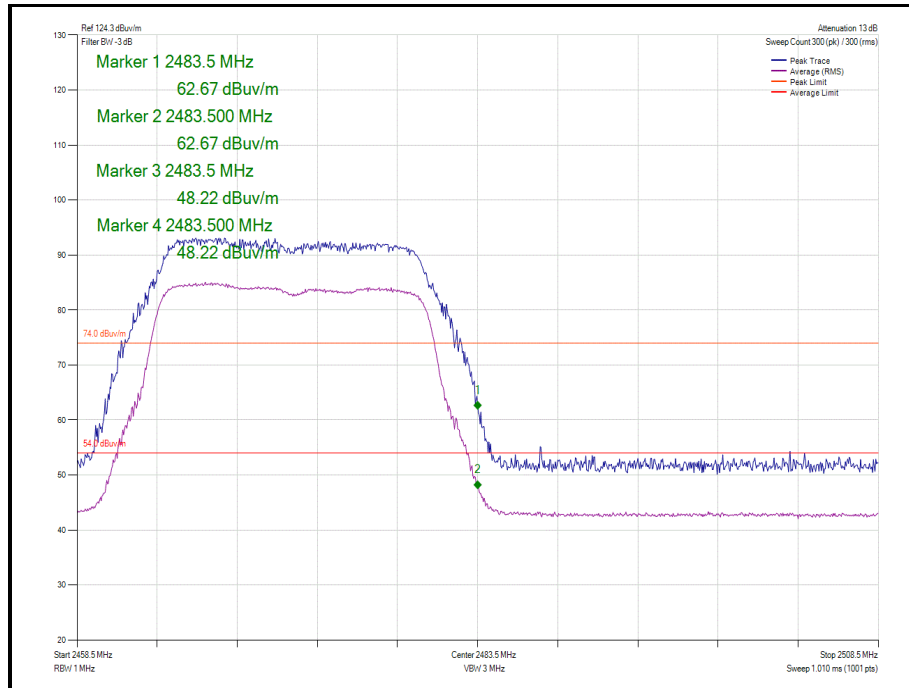


Figure 52 - 2472 MHz - Band Edge Frequency 2483.5 MHz



Mode	Data Rate/MCS	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
802.11n	MCS0	2462	2483.5	65.79	51.42
802.11n	MCS0	2412	2390.0	63.07	51.51

Table 39

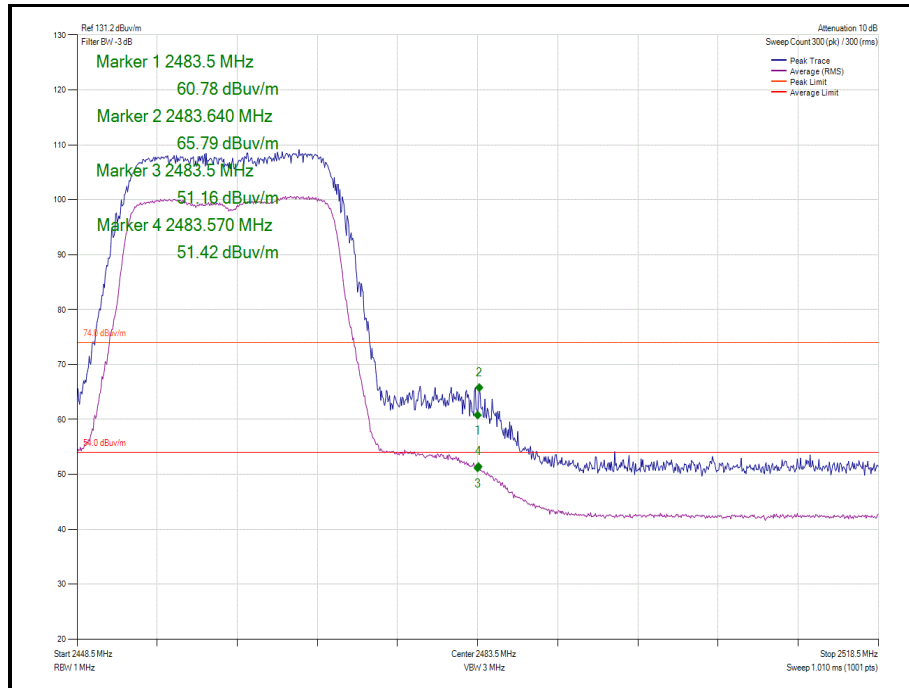


Figure 53 - 2462 MHz - Band Edge Frequency 2483.5 MHz

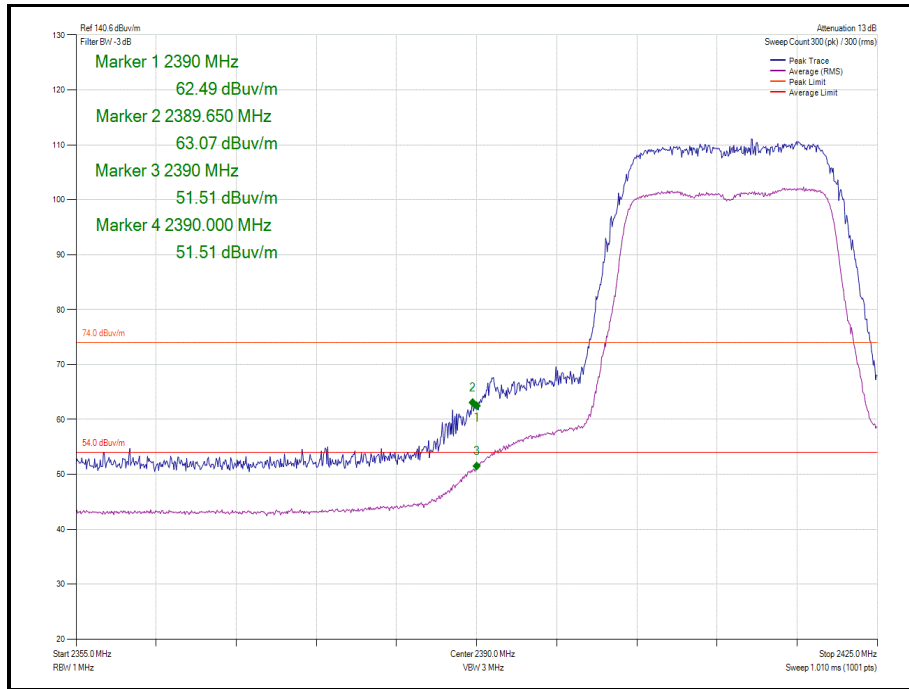


Figure 54 - 2412 MHz - Band Edge Frequency 2390.0 MHz



Mode	Data Rate/MCS	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
802.11n	MCS0	2467	2483.5	60.17	48.57
802.11n	MCS0	2472	2483.5	65.16	49.23

Table 40

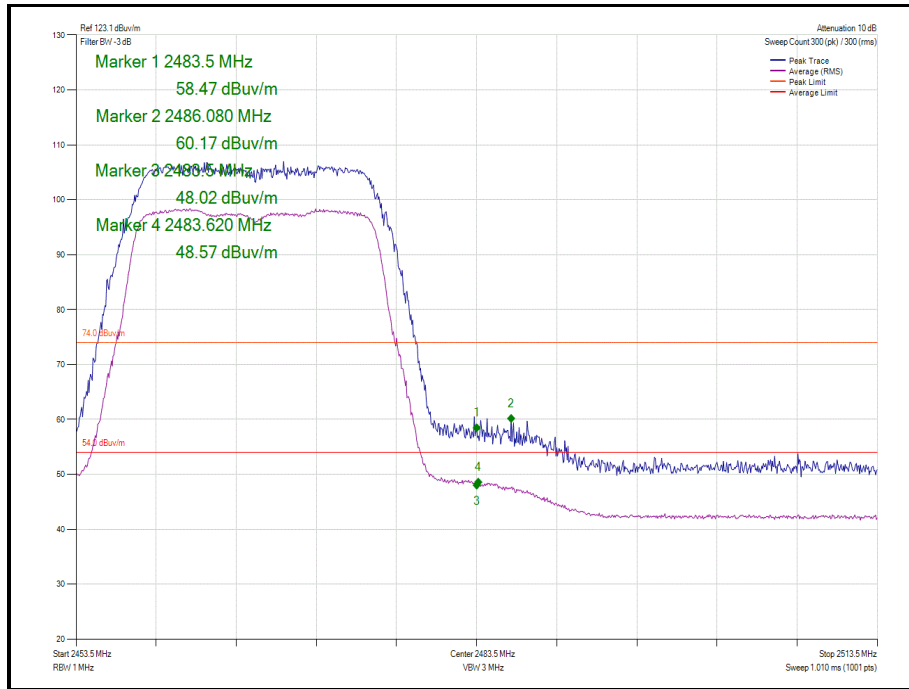


Figure 55 - 2467 MHz - Band Edge Frequency 2483.5 MHz

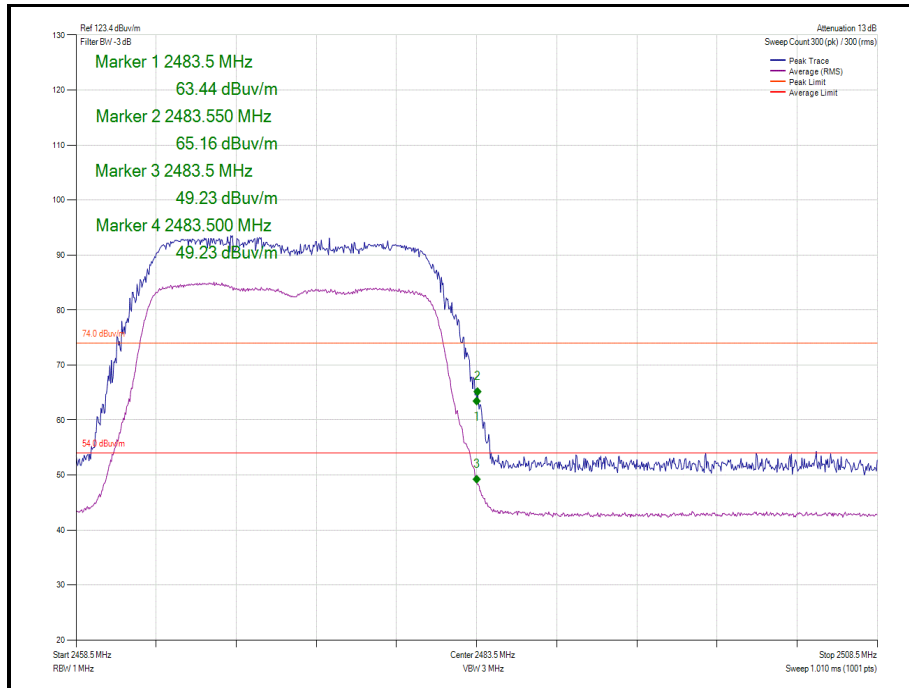


Figure 56 - 2472 MHz - Band Edge Frequency 2483.5 MHz



(MIMO 2 Tx, TXBF)

Mode	Data Rate/MCS	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dB μ V/m)	Average Level (dB μ V/m)
802.11n	MCS0	2462	2483.5	60.45	49.17
802.11n	MCS0	2412	2390.0	61.09	50.31

Table 41

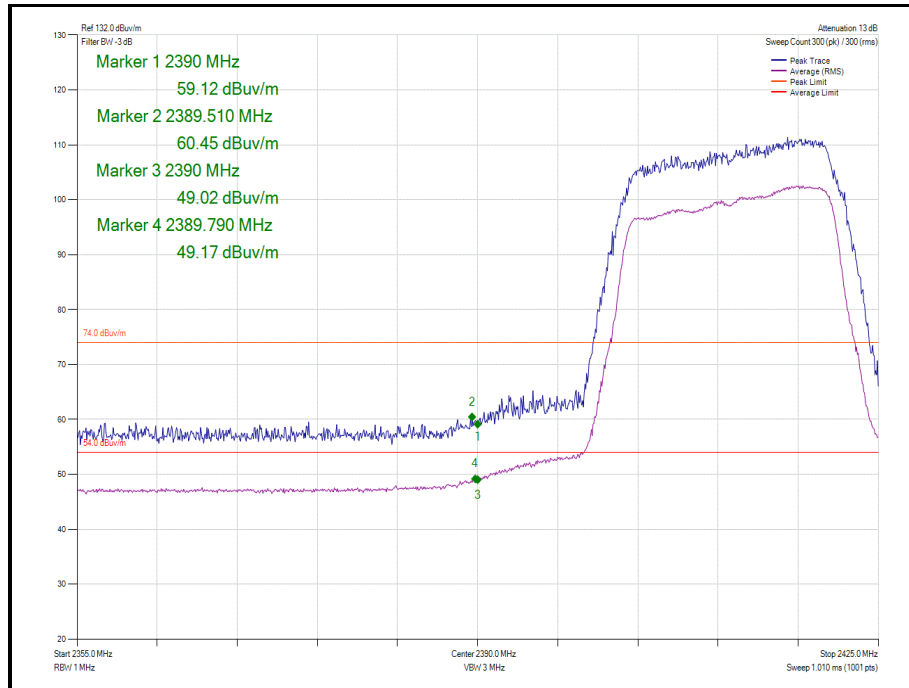


Figure 57 - 2412 MHz - Band Edge Frequency 2390.0 MHz

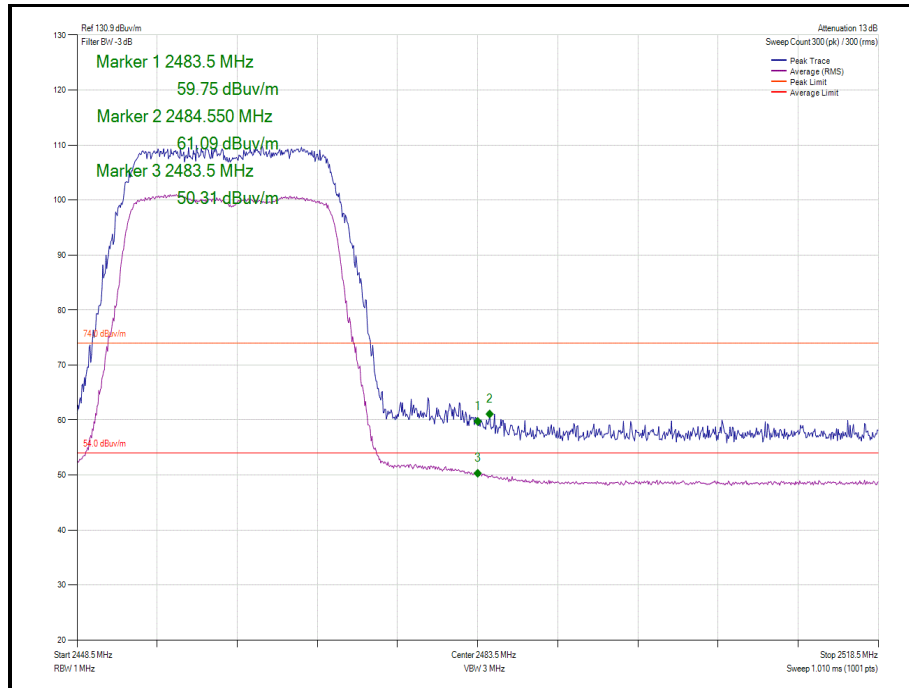


Figure 58 - 2462 MHz - Band Edge Frequency 2483.5 MHz



Mode	Data Rate/MCS	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
802.11n	MCS0	2467	2483.5	59.42	49.37
802.11n	MCS0	2472	2483.5	61.62	50.05

Table 42

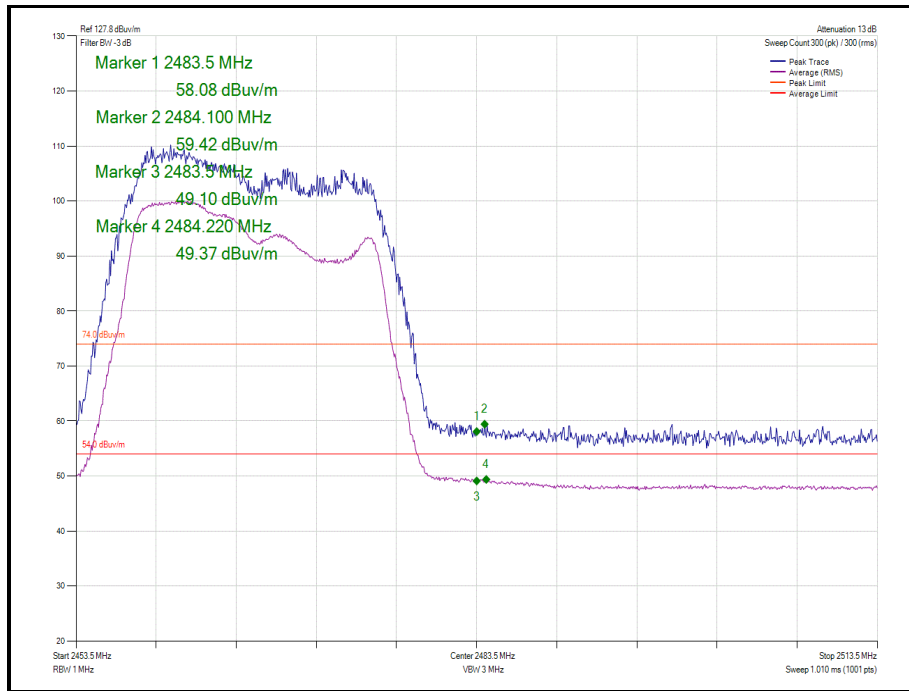


Figure 59 - 2467 MHz - Band Edge Frequency 2483.5 MHz

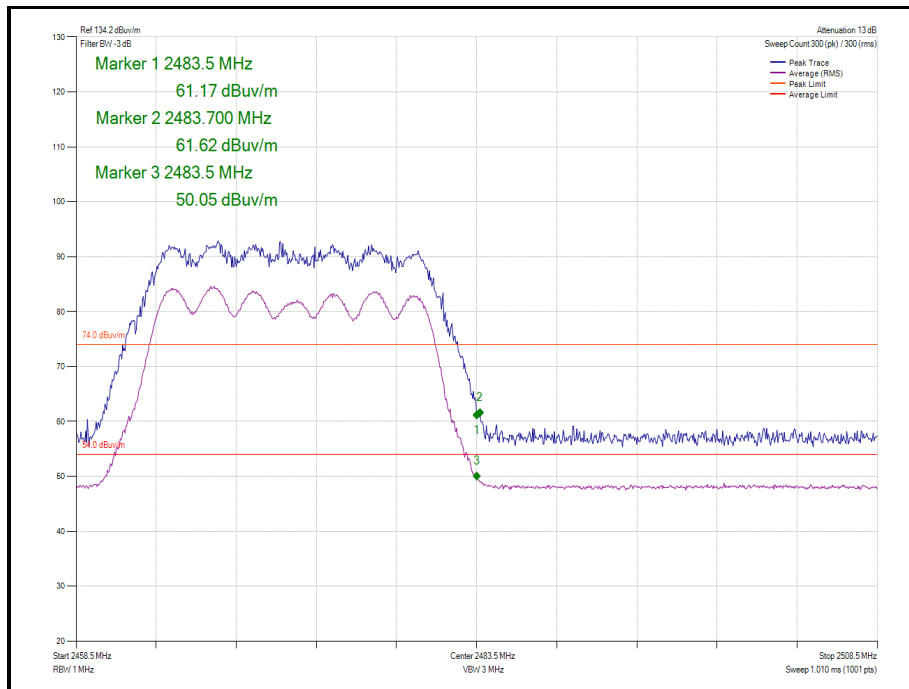


Figure 60 - 2472 MHz - Band Edge Frequency 2483.5 MHz



(MIMO 2Tx) CDD

Mode	Data Rate/MCS	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dB μ V/m)	Average Level (dB μ V/m)
802.11b	1 Mbps	2462	2483.5	57.09	46.85
802.11b	1 Mbps	2412	2390.0	59.76	51.24

Table 43

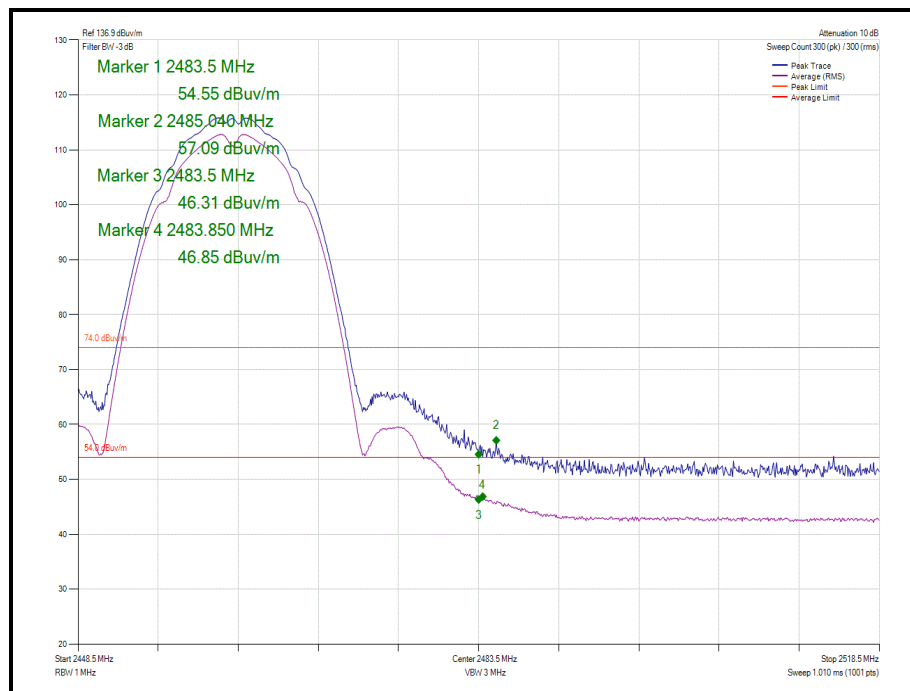


Figure 61 - 2462 MHz - Band Edge Frequency 2483.5 MHz

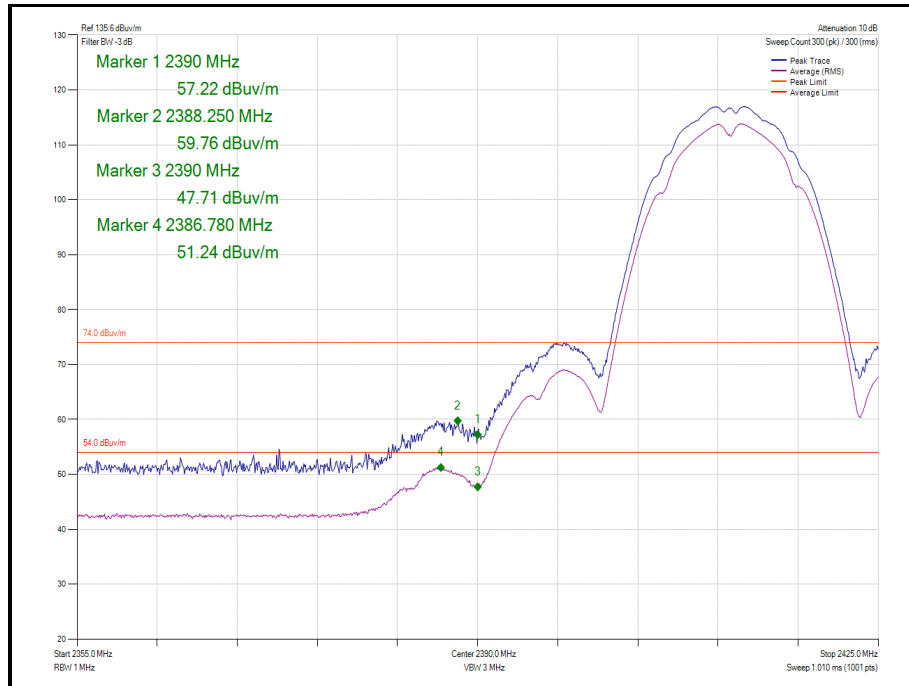


Figure 62 - 2412 MHz - Band Edge Frequency 2390.0 MHz



Mode	Data Rate/MCS	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
802.11b	1 Mbps	2467	2483.5	56.95	46.12
802.11b	1 Mbps	2472	2483.5	58.05	47.42

Table 44

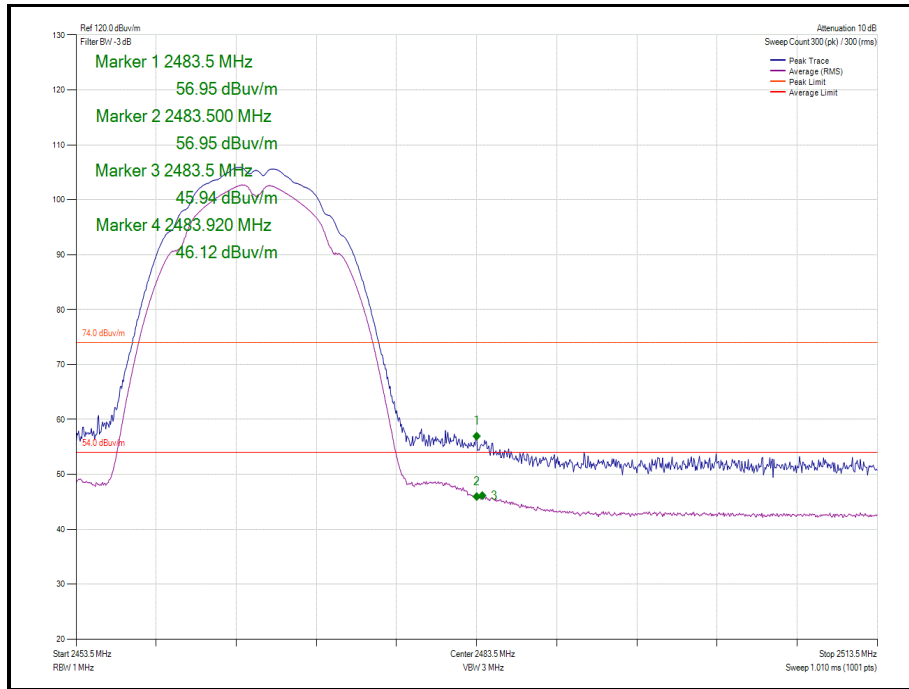


Figure 63 - 2467 MHz - Band Edge Frequency 2483.5 MHz

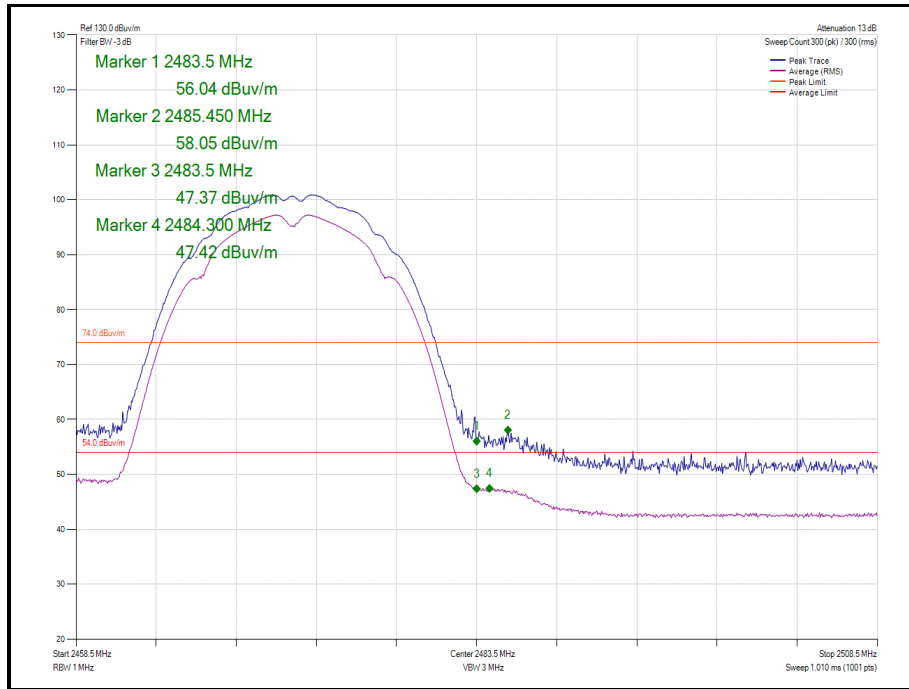


Figure 64 - 2472 MHz - Band Edge Frequency 2483.5 MHz



Mode	Data Rate/MCS	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
802.11n	MCS0	2462	2483.5	56.94	46.21
802.11n	MCS0	2412	2390.0	64.31	51.66

Table 45

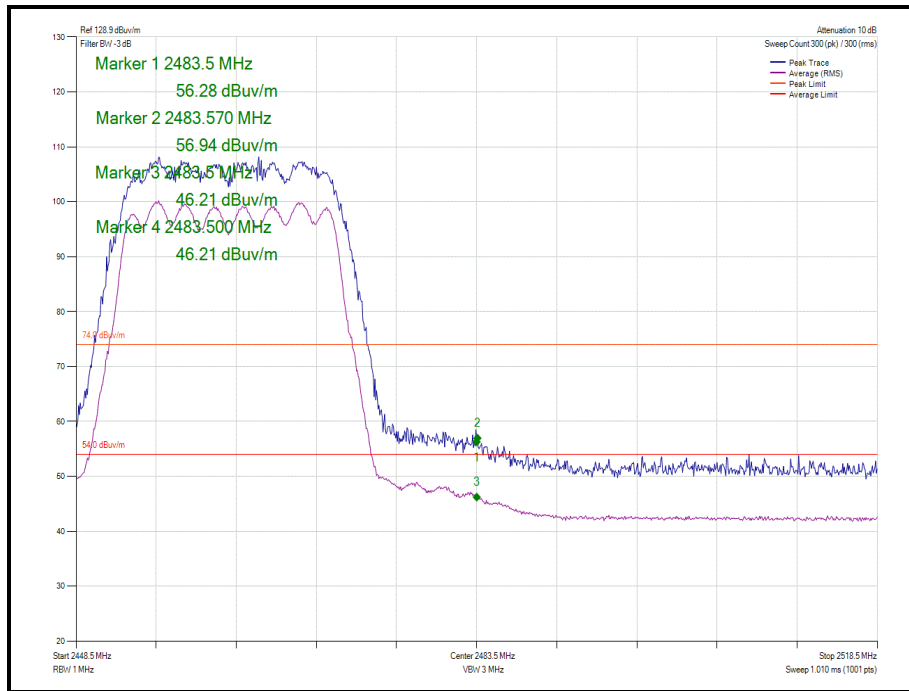


Figure 65 - 2462 MHz - Band Edge Frequency 2483.5 MHz

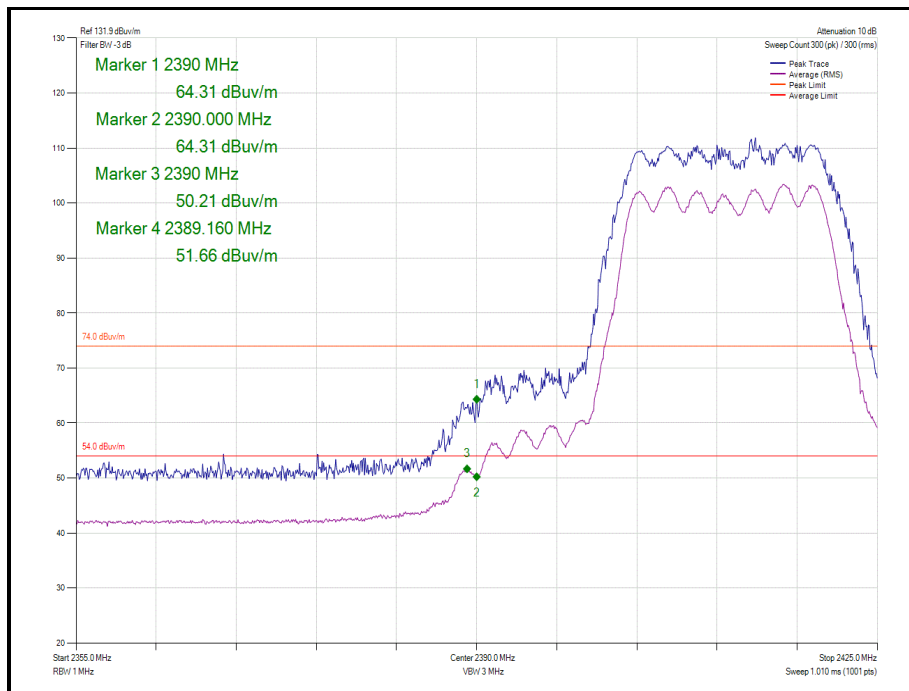


Figure 66 - 2412 MHz - Band Edge Frequency 2390.0 MHz



Mode	Data Rate/MCS	Tx Frequency (MHz)	Band Edge Frequency (MHz)	Peak Level (dBμV/m)	Average Level (dBμV/m)
802.11n	MCS0	2467	2483.5	55.87	46.41
802.11n	MCS0	2472	2483.5	66.14	49.28

Table 46

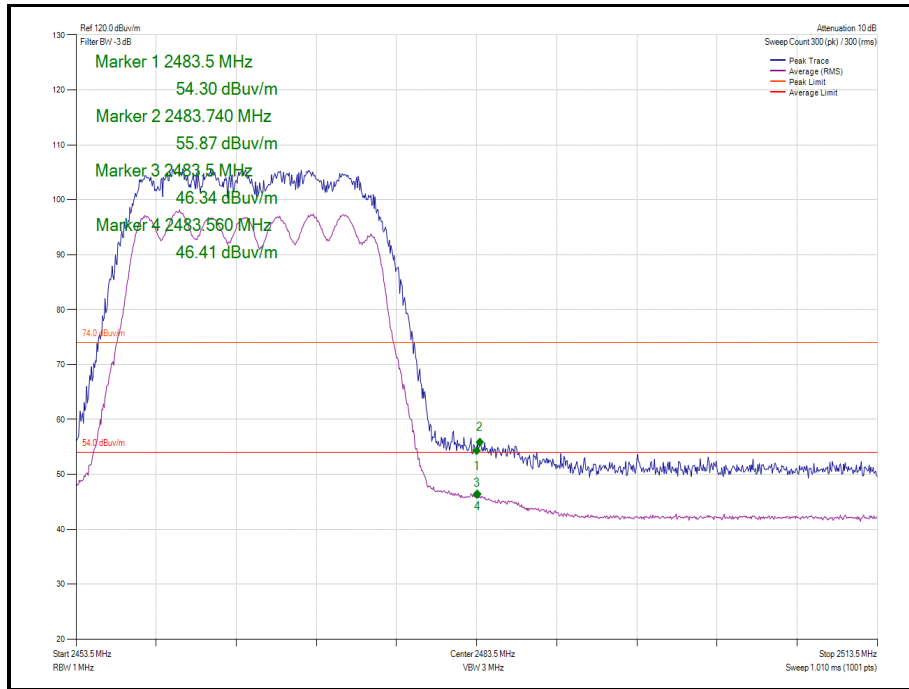


Figure 67 - 2467 MHz - Band Edge Frequency 2483.5 MHz

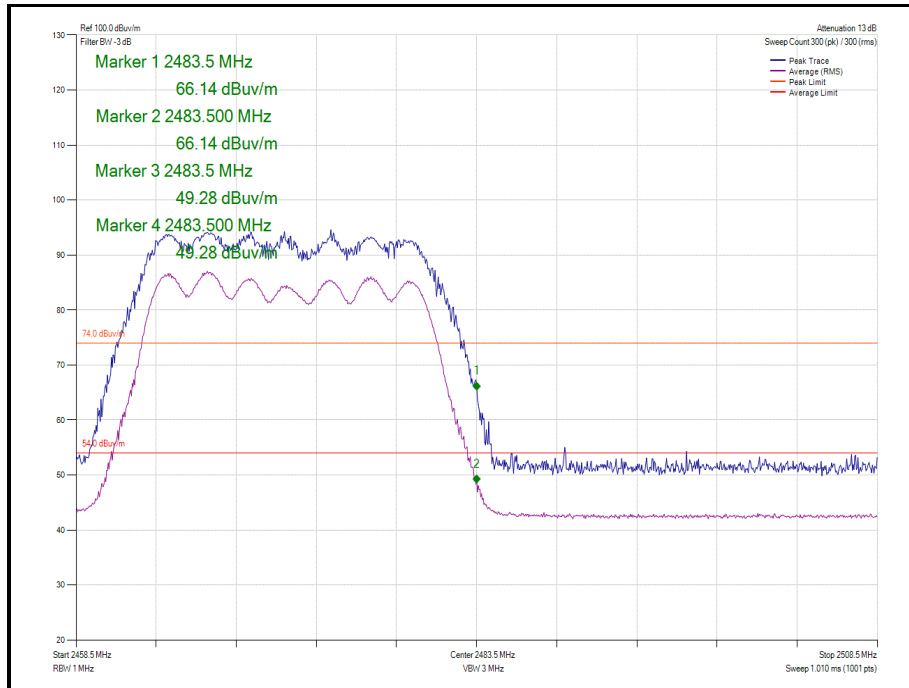


Figure 68 - 2472 MHz – Band Edge Frequency 2483.5 MHz



FCC 47 CFR Part 15, Limit Clause 15.209

Frequency (MHz)	Field Strength ($\mu\text{V}/\text{m}$ at 3 m)
30 to 88	100
88 to 216	150
216 to 960	200
Above 960	500

Table 47

Industry Canada RSS-GEN, Limit Clause 8.9

Frequency (MHz)	Field Strength ($\mu\text{V}/\text{m}$ at 3 metres)
30-88	100
88-216	150
216-960	200
Above 960*	500

Table 48

*Unless otherwise specified, for all frequencies greater than 1 GHz, the radiated emission limits for licence-exempt radio apparatus stated in applicable RSSs (including RSS-Gen) are based on measurements using a linear average detector function having a minimum resolution bandwidth of 1 MHz. If an average limit is specified for the EUT, then the peak emission shall also be measured with instrumentation properly adjusted for such factors as pulse desensitization to ensure the peak emission is less than 20 dB above the average limit.



2.5.8 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 11

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Hygromer	Rotronic	Hygropalm	2404	12	26-April-2019
Multimeter	Iso-tech	IDM101	2424	12	12-Dec-2019
Double Ridge Broadband Horn Antenna	Schwarzbeck	BBHA 9120 B	4848	12	12-Sept-2019
EMI Test Receiver	Rohde & Schwarz	ESW44	5084	12	12-Sept-2019
8m N-Type RF Cable	Teledyne	PR90-088-8MTR	5095	12	04-Oct-2019
Cable (18GHz	Rosenberger	LU7-071-2000	5107	12	05-Oct-2019
EmX Software	TUV SUD	-	-	-	Software
Screened Room (11)	Rainford	Rainford	5136	12	01-Nov-2019
Mast	Maturo	TAM 4.0-P	5158	-	TU
Mast and Turntable Controller	Maturo	Maturo NCD	5159	-	TU
Mast and Turntable Controller	Maturo	Maturo NCD	5159	-	TU

Table 49

TU – Traceability Unscheduled



2.6 Spurious Radiated Emissions

2.6.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (d) & 15.205
Industry Canada RSS-247 Clause 5.5
Industry Canada RSS-GEN Clause 6.13

2.6.2 Equipment Under Test and Modification State

A2519, S/N: C02Y4006L59F - Modification State 0

2.6.3 Date of Test

06-February-2019 to 12-March-2019

2.6.4 Test Method

Testing was performed in accordance with ANSI C63.10 clause 6.3, 6.5 and 6.6.

In the 30 MHz to 1 GHz range pre-scans were only performed on mid channel (2437 MHz) and any emissions identified then measured on bottom (2412 MHz) and top (2472 MHz).

The plots shown are the characterization of the EUT. The limits on the plots represent the most stringent case for restricted bands, (54/74 dBuV/m @ 3m and 64/84 dBuV/m @ 1m) when compared to 20 dBc outside restricted bands. The limits shown have been used as a threshold to determine where further measurements are necessary. Where results are within 10 dB of the limits shown on the plots, further investigation was carried out and reported in results tables.

The following conversion can be applied to convert from dB μ V/m to μ V/m:
 $10^{(\text{Field Strength in dB}\mu\text{V/m}/20)}$.

2.6.5 Reported Measurements

The >1 GHz measurements displayed within this report, have been limited to 802.11b mode, as tests on other modes have been shown to provide a similar emissions profile.

The measurements <1GHz are 802.11g mode, as this was shown to be worst case.

Further measurements are held on file by TÜV SÜD, and are available if required

2.6.6 Environmental Conditions

Ambient Temperature	21.7 - 29.4 °C
Relative Humidity	22.5 – 45.0 %



2.6.7 Test Results

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dB)	Angle(Deg)	Height(m)	Polarity
249.983	35.37	46	10.63	34	100	Vertical
249.994	35.85	46	10.15	187	130	Horizontal
382.559	27.96	46	18.04	157	100	Horizontal
406.459	29.08	46	16.92	169	100	Horizontal

Table 50 –2437 MHz - 30 MHz to 1 GHz – Radiated

*No other emissions were detected within 20 dB of the limit

Frequency (GHz)	Result (µV/m)		Limit (µV/m)		Margin (dB)	
	Peak	Average	Peak	Average	Peak	Average
4.823	*	41.78	74.0	54.0	n/a	12.22
7.234	*	37.38	74.0	54.0	n/a	16.62

Table 51 – 2412 MHz - 1 GHz to 26 GHz – Radiated

*No other emissions were detected within 10 dB of the limit

Frequency (GHz)	Result (µV/m)		Limit (µV/m)		Margin (dB)	
	Peak	Average	Peak	Average	Peak	Average
4.873	*	39.71	74.0	54.0	n/a	14.29
7.311	*	37.13	74.0	54.0	n/a	16.87
12.185	*	37.45	74.0	54.0	n/a	16.55

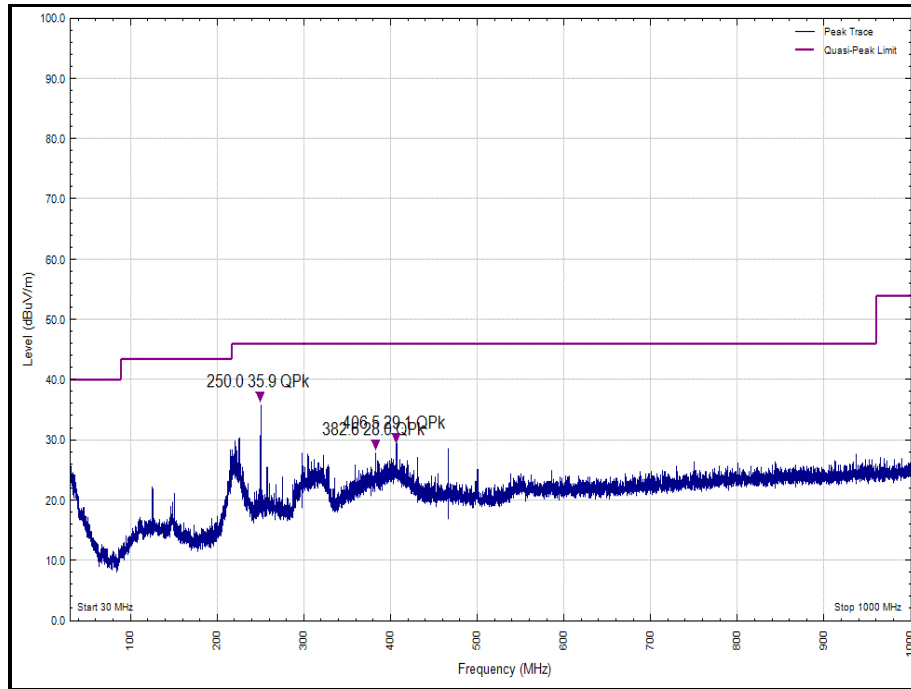
Table 52 – 2437 MHz - 1 GHz to 26 GHz – Radiated

*No other emissions were detected within 10 dB of the limit

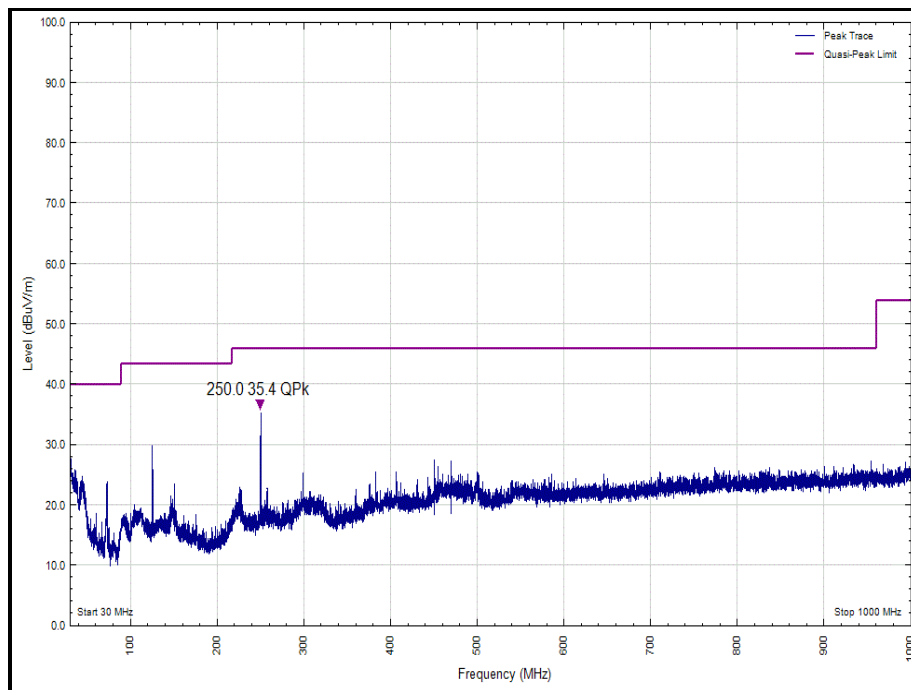
Frequency (GHz)	Result (µV/m)		Limit (µV/m)		Margin (dB)	
	Peak	Average	Peak	Average	Peak	Average
4.944	*	41.71	74.0	54.0	n/a	12.29
7.415	*	43.26	74.0	54.0	n/a	10.74
7.416	*	37.73	74.0	54.0	n/a	16.27
12.359	*	36.96	74.0	54.0	n/a	17.04

Table 53 - 2472 MHz - 1 GHz to 26 GHz – Radiated

*No other emissions were detected within 10 dB of the limit



**Figure 69 – 2437 MHz - 30 MHz to 1 GHz
Polarity: Horizontal**



**Figure 70 - 2437 MHz - 30 MHz to 1 GHz
Polarity: Vertical**

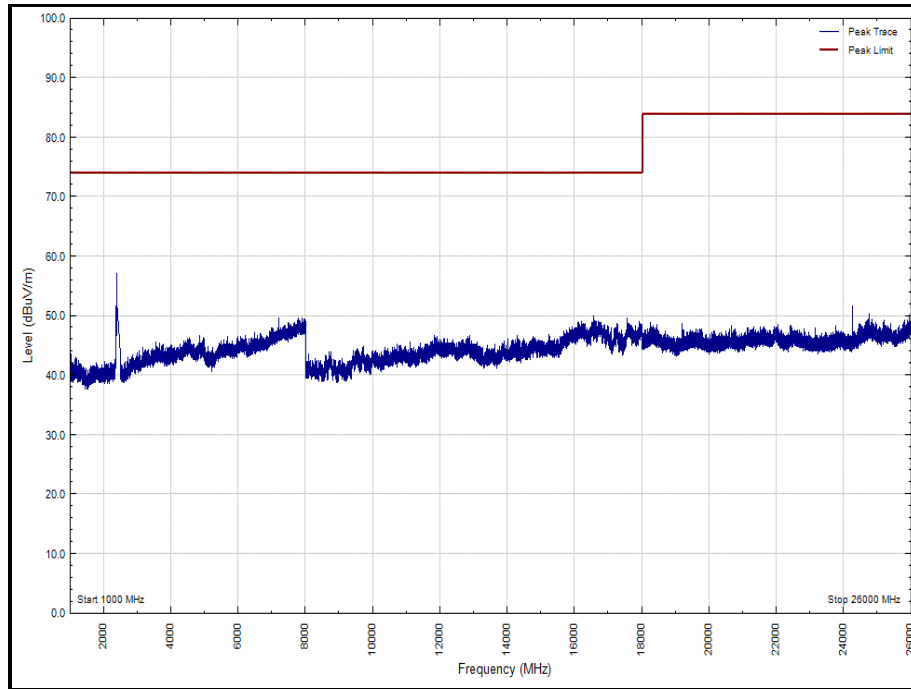


Figure 71 - 2412 MHz - 1 GHz to 26 GHz (Peak)
Polarity: Horizontal

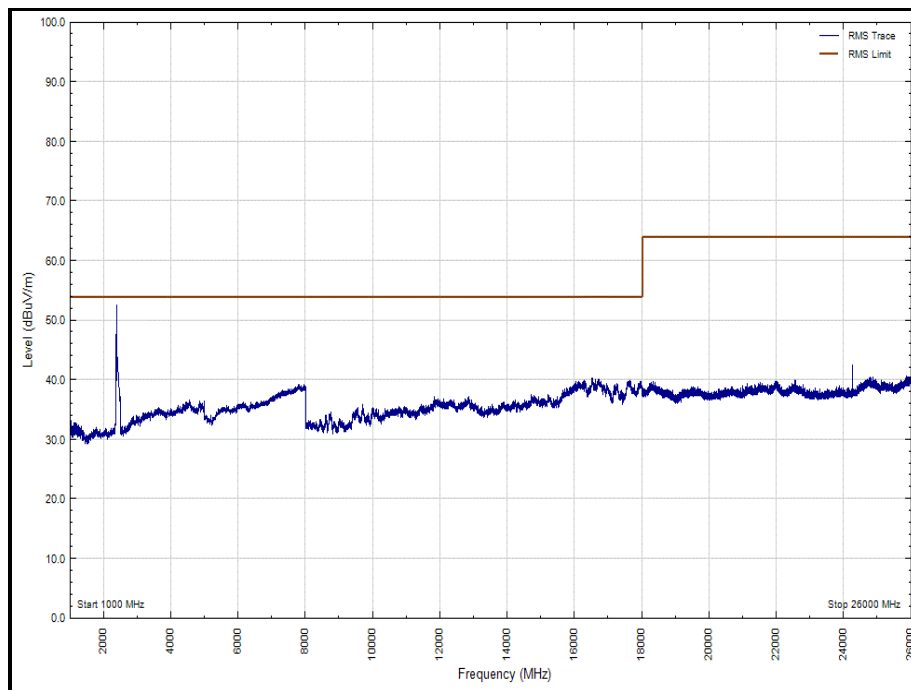


Figure 72 - 2412 MHz - 1 GHz to 26 GHz (Average)
Polarity: Horizontal

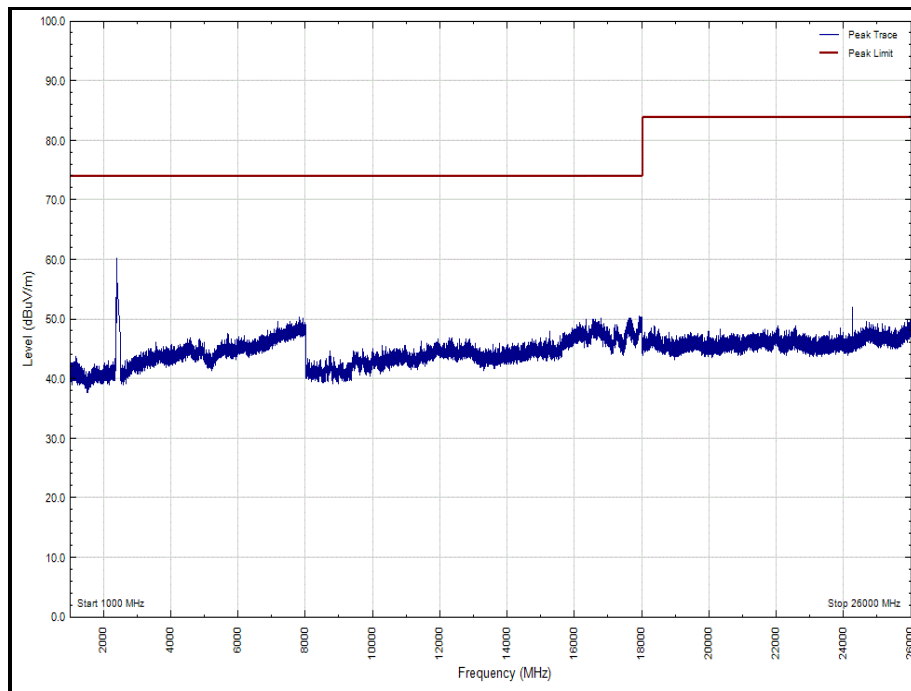


Figure 73 - 2412 MHz - 1 GHz to 26 GHz (Peak)
Polarity: Vertical

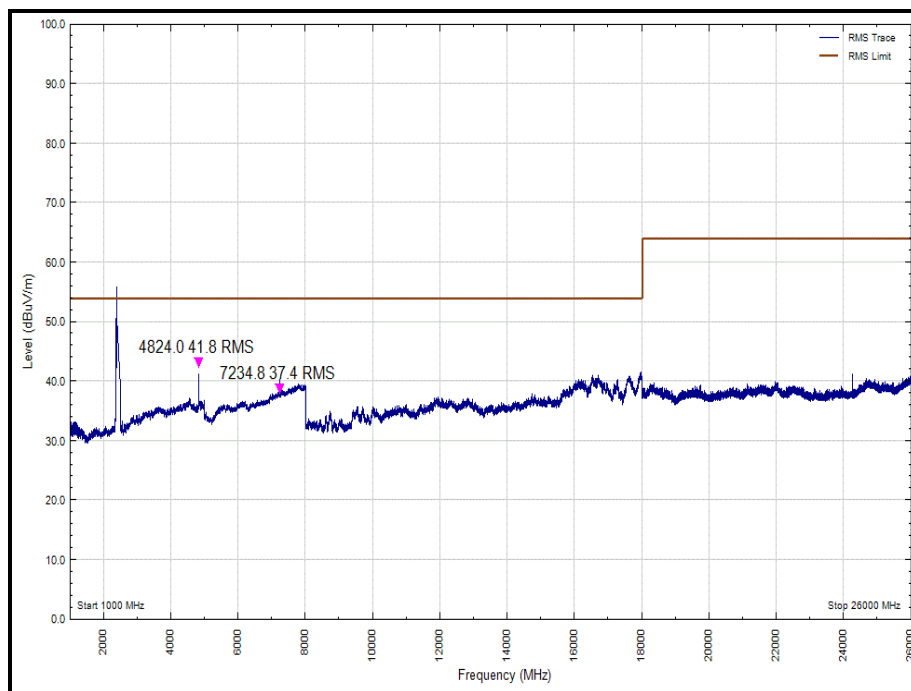


Figure 74 - 2412 MHz - 1 GHz to 26 GHz (Average)
Polarity: Vertical

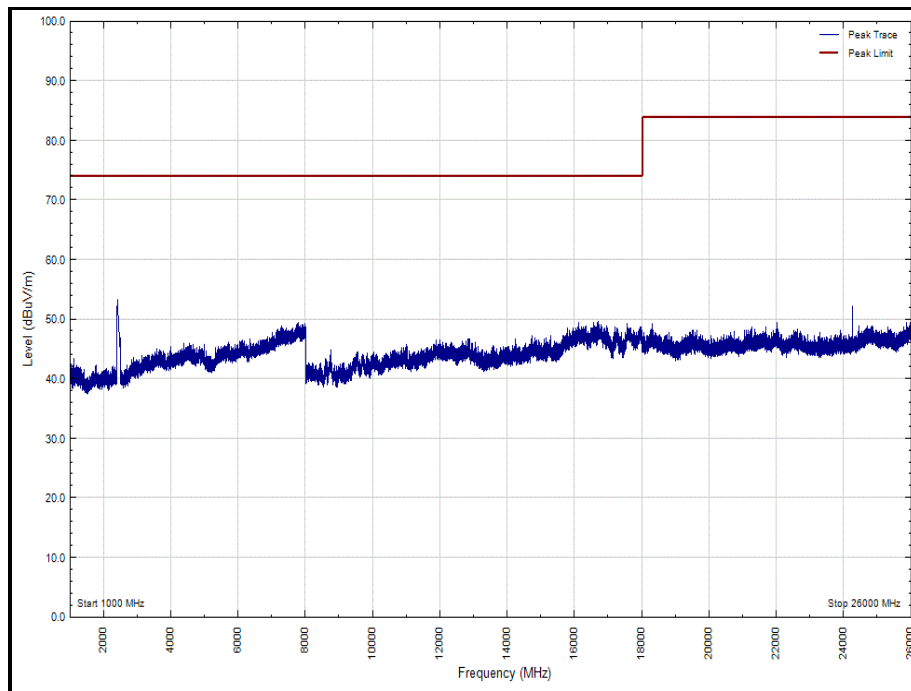


Figure 75 - 2437 MHz - 1 GHz to 26 GHz (Peak)
Polarity: Horizontal

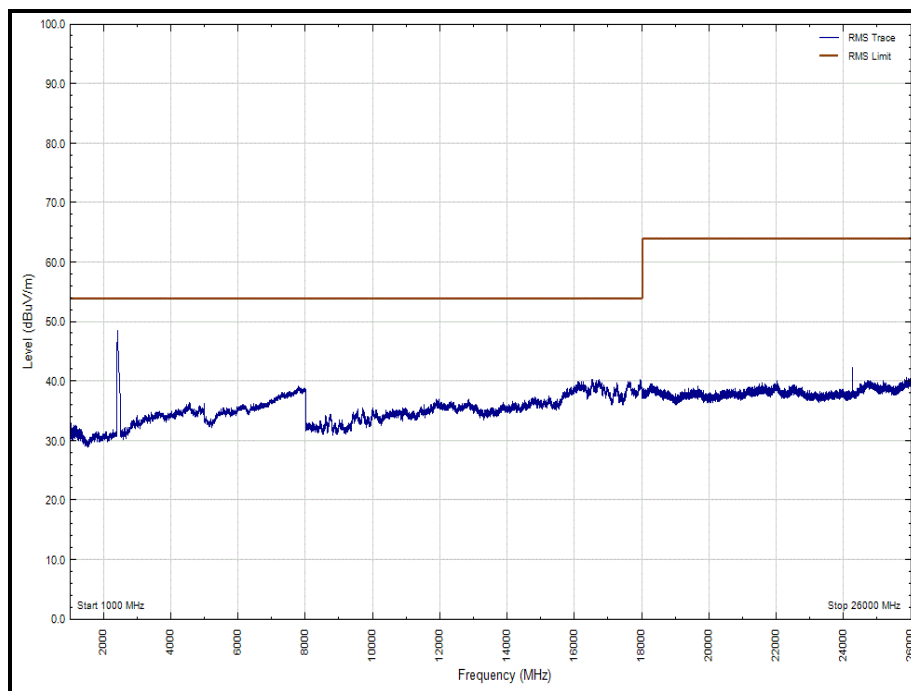


Figure 76 - 2437 MHz - 1 GHz to 26 GHz (Average)
Polarity: Horizontal

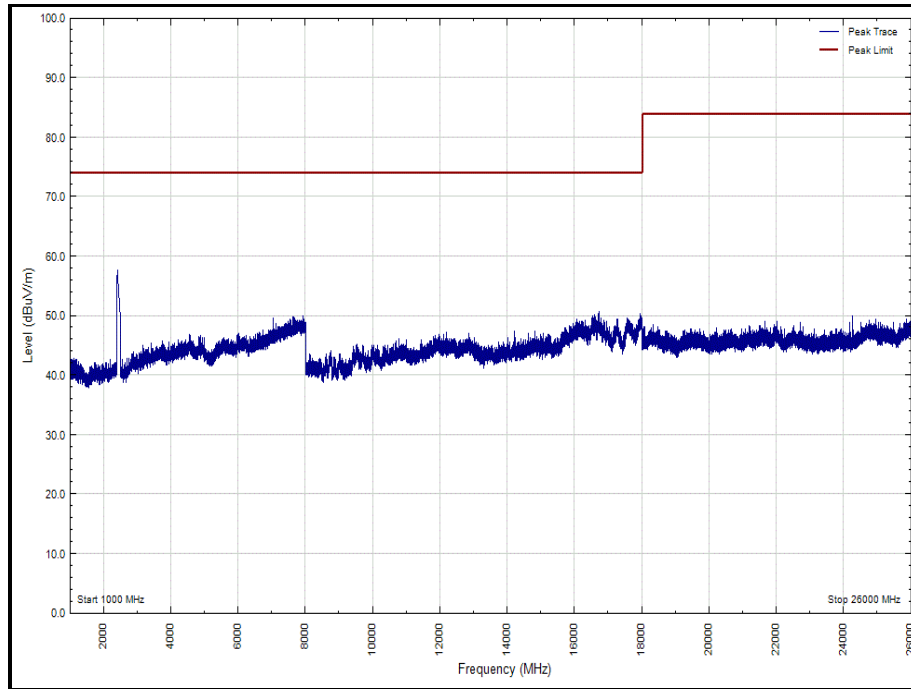


Figure 77 - 2437 MHz - 1 GHz to 26 GHz (Peak)
Polarity: Vertical

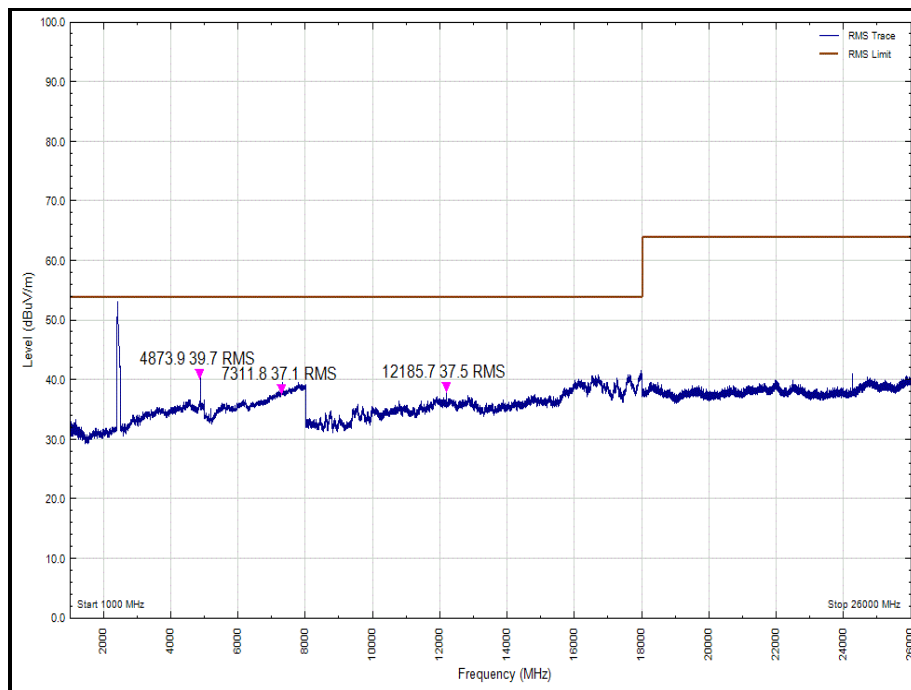


Figure 78 - 2437 MHz - 1 GHz to 26 GHz (Average)
Polarity: Vertical

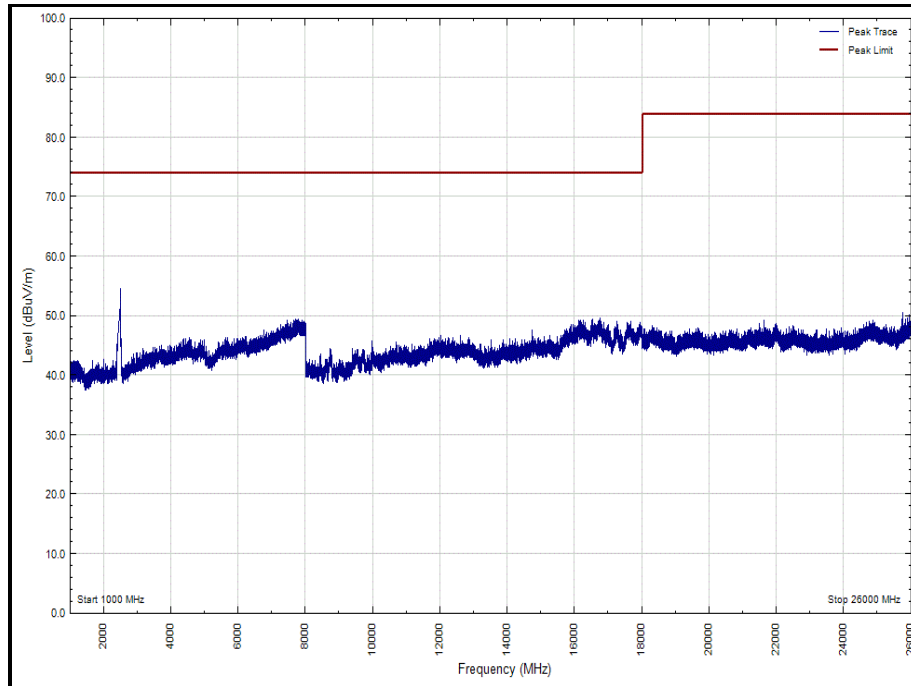


Figure 79 - 2472 MHz 1 GHz to 26 GHz (Peak)
Polarity: Horizontal

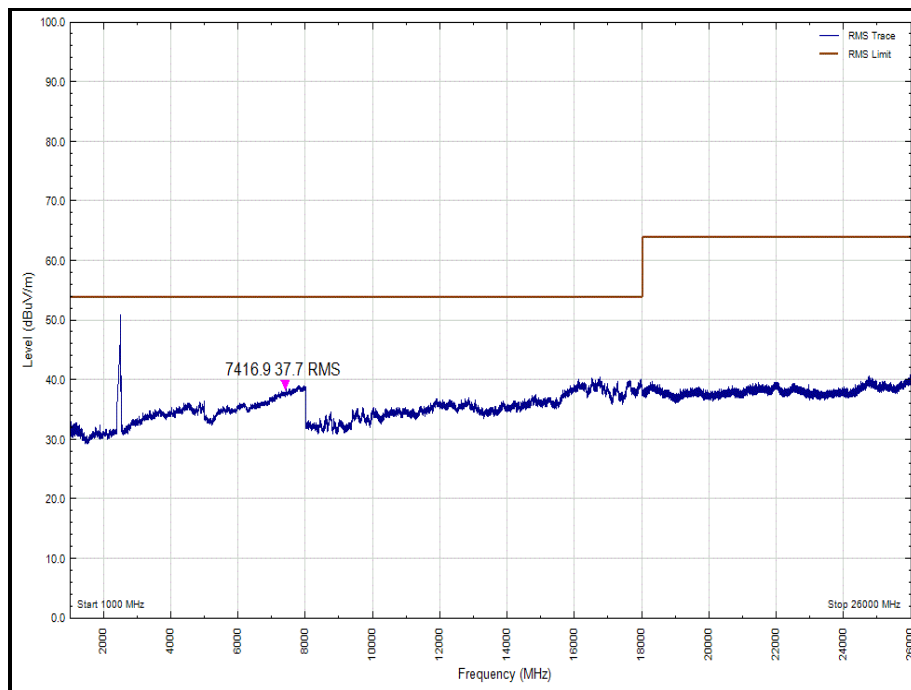


Figure 80 - 2472 MHz - 1 GHz to 26 GHz (Average)
Polarity: Horizontal

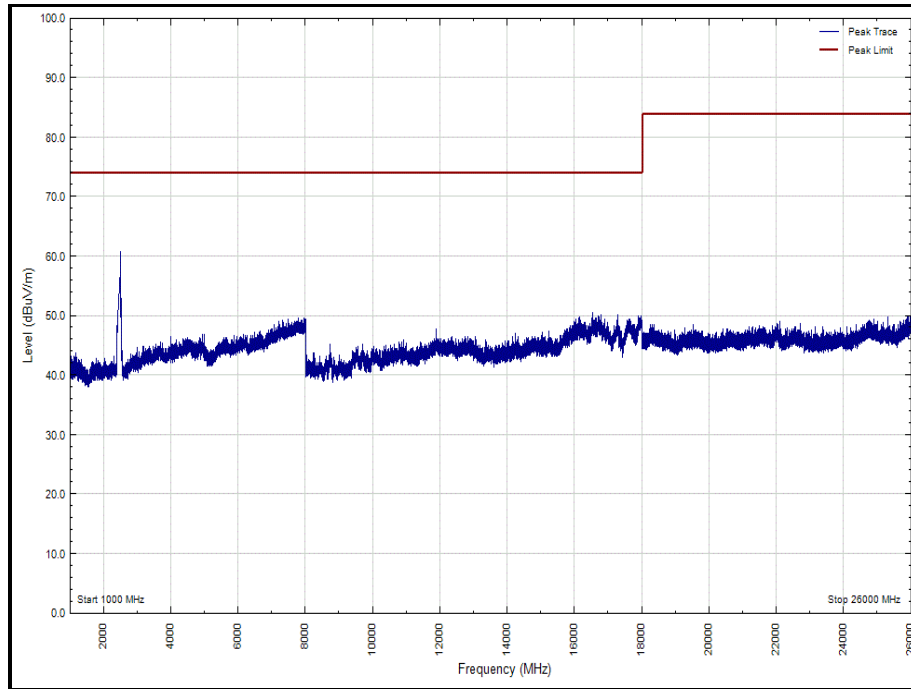


Figure 81 - 2472 MHz 1 GHz to 26 GHz (Peak)
Polarity: Vertical

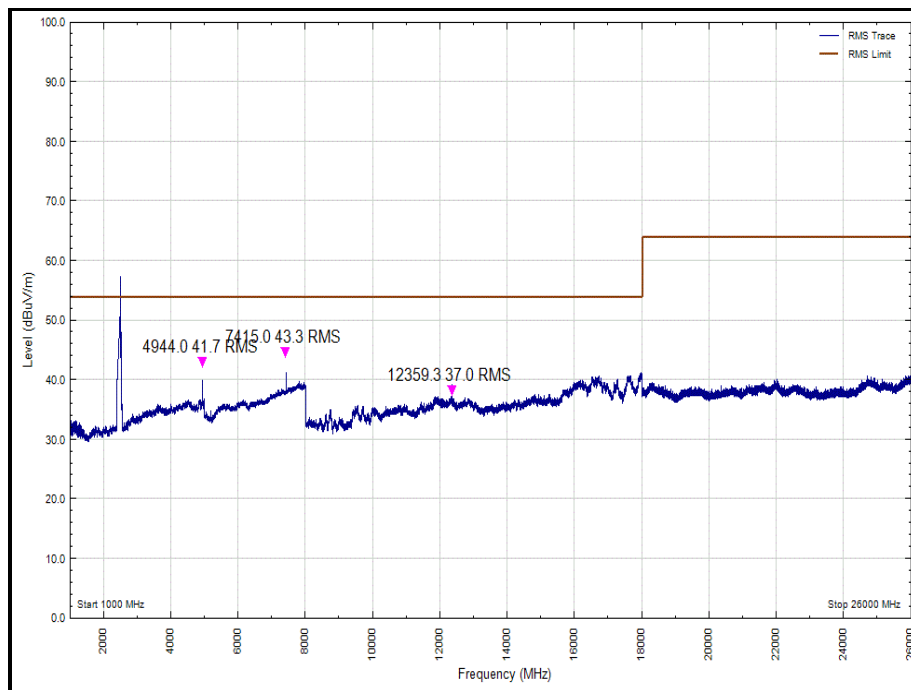


Figure 82 - 2472 MHz - 1 GHz to 26 GHz (Average)
Polarity: Vertical

FCC 47 CFR Part 15, Limit Clause 15.247 (d)



In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in 15.209(a)

Industry Canada RSS-247, Limit Clause 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.



2.6.8 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 11

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Antenna 18-40GHz (Double Ridge Guide)	Link Microtek Ltd	AM180HA-K-TU2	230	24	02-May-2020
Antenna with permanent attenuator (Bilog)	Schaffner	CBL6143	287	24	15-May-2020
Pre-Amplifier	Phase One	PS04-0086	1533	12	08-Feb-2020
Hygromer	Rotronic	Hygropalm	2404	12	26-Apr-2019
Cable 1503 2M 2.92(P)m 2.92(P)m	Rhophase	KPS-1503A-2000-KPS	4293	12	26-Oct-2019
Cable (Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4526	6	26-Apr-2019
High Pass Filter (4GHz)	K&L Microwave	11SH10-4000/X18000-0/0	4599	12	04-Sep-2019
Double Ridged Waveguide Horn Antenna	ETS-Lindgren	3117	4722	12	05-Mar-2020
4dB Attenuator	Pasternack	PE7047-4	4935	24	28-Nov-2019
Band Reject Filter - 2.425 GHz	Wainwright	WRCGV14-2390-2400-2450-2460-50SS	5066	12	02-Oct-2019
Band Reject Filter - 2.4585 GHz	Wainwright	WRCGV14-2423.5-2433.5-2483.5-2493.5-50SS	5068	12	02-Oct-2019
Band Reject Filter - 5.795GHz	Wainwright	WRCJV10-5725-5755-5835-5865-50SS	5070	12	01-Oct-2019
EMI Test Receiver	Rohde & Schwarz	ESW44	5084	12	12-Sep-2019
8m N-Type RF Cable	Teledyne	PR90-088-8MTR	5095	12	04-Oct-2019
Cable (18GHz)	Rosenberger	LU7-071-1000	5101	12	04-Oct-2019
Cable (18GHz)	Rosenberger	LU7-071-1000	5102	12	04-Oct-2019
Cable (18GHz)	Rosenberger	LU7-071-1000	5104	12	05-Oct-2019
Cable (18GHz)	Rosenberger	LU7-071-2000	5107	12	05-Oct-2019

Table 54



3 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

Test Name	Measurement Uncertainty
Maximum Conducted Output Power	± 3.2 dB
Power Spectral Density	± 3.2 dB
Emission Bandwidth	± 358.561 kHz
Authorised Band Edges	30 MHz to 1 GHz: ± 5.2 dB 1 GHz to 40 GHz: ± 6.3 dB
Restricted Band Edges	30 MHz to 1 GHz: ± 5.2 dB 1 GHz to 40 GHz: ± 6.3 dB
Spurious Radiated Emissions	30 MHz to 1 GHz: ± 5.2 dB 1 GHz to 40 GHz: ± 6.3 dB

Table 55