



Test Report

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

Report No	ES1636-1
Client	Harman International Industries Inc. Mark Bowman
Address	30001 Cabot Dr. Novi, MI 48377
Phone	1-248-254-7751
Items tested FCC ID IC	INFO3.5 CSM MY20 2AHPN-BE2843 6434C-BE2843
Equipment Type Equipment Code	Digital Transmission System DTS
FCC/IC Rule Parts	CFR Title 47 FCC Part 15.247, ISED Canada RSS-247 Issue 2
Test Dates	09/20/2018 to 11/15/2018
Results	As detailed within this report
Prepared by	 Christopher Hamel – Test Engineer
Authorized by	 Yunus Faziloglu – Sr. Engineer
Issue Date	11/30/2018
Conditions of Issue	This Test Report is issued subject to the conditions stated in the 'Conditions of Testing' section on page 18 of this report.

Curtis-Straus LLC is accredited by the American Association for Laboratory Accreditation for the specific scope of accreditation under Certificate Number 1627-01. This report may contain data which is not covered by the A2LA accreditation.



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Contents

Contents.....	2
Summary.....	3
Test Methodology.....	4
Product Tested - Configuration Documentation	5
Statement of Conformity	6
Test Results	7
Radiated Spurious Emissions	7
AC Line Conducted Emissions.....	16
Measurement Uncertainty.....	17
Conditions Of Testing.....	18
Appendix A.....	20

Report REV Sep-08-2017 - YF

Summary

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

The product is the INFO3.5 CSM MY20. It is a direct sequence spread spectrum transmitter that operates in the 2412-2462MHz frequency range.

Supported 802.11 modes: 802.11b, 802.11g and 802.11n (HT20).

Antenna Type: External detachable

Gain: 1.3dBi

We found that the product met the above requirements with modification.

Modifications: Power reduction for 802.11n (HT20) from 14 to 12.

Test samples were received in good condition.

Test Methodology

All testing was performed according to the following rules/procedures/documents;
CFR Title 47 FCC Part 15.247, ISED Canada RSS-247 Issue 2, ISED Canada RSS-Gen Issue 5, FCC KDB 558074 D01 15.247 Measurement Guidance v05 and ANSI C63.10-2013

Radiated emissions were maximized by rotating the device around 3 orthogonal planes (X, Y and Z) as well as varying the test antenna's height and polarity. EUT antenna is external and it was maximized separately.

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

The following bandwidths were used during radiated spurious emissions testing.

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

Product Tested - Configuration Documentation

EUT Configuration										
Work Order:	S1636									
Company:	Harman International Industries Inc.									
Company Address:	30001 Cabot Dr.									
	Novi MI 48377									
Contact:	Mark Bowman									
	MN			PN			SN			
EUT:	INFO3.5 CSM MY20			--			--			
EUT Description:	Automotive Infotainment Unit with Bluetooth/WLAN									
EUT Max Frequency:	5825 MHz									
EUT Min Frequency:	5825 MHz									
EUT Components	MN						SN			
Head Unit	INFO3.5 CSM MY20									
Support Equipment	MN						SN			
ADB Dev board										
Port Label	Port Type	# ports	# populated	cable type	shielded	ferrites	length (m)	in/out	under test	comment
USB Port	other	1	1	other	Yes	No	1.5	in	yes	
Power/Low speed signal	other	2	2	other	No	No	1	in	yes	
Display	other	1	1	other	Yes	No	1.5	in	yes	
Back up cam	other	1	1	other	Yes	No	2	in	yes	Orange Fakra
External 2.4G wifi	other	1	1	other	Yes	No		in	yes	Beige Fakra
GPS port	other	1	1	other	Yes	No	2	in	yes	Blue fakra Cable
AM/FM Antenna	other	2	2	other	Yes	No	2	in	yes	Black Fakra am and fm, Green FM only
Sdards	other	1	1	other	Yes	No	1.5	in	yes	Yellow Fakra Cable
Software Operating Mode Description:										
EUT placed in required test modes via commands supplied by client.										

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Statement of Conformity

RSS-GEN	RSP-100	RSS 247	Part 15	Comments
6.4			15.15(b)	There are no controls accessible to the user that varies the output power to operate in violation of the regulatory requirements.
	3.1		15.19	The label is shown in the label exhibit.
	3.2		15.21	Information to the user is shown in the instruction manual exhibit.
			15.27	No special accessories are required for compliance.
3.2			15.31	The EUT was tested in accordance with the measurement standards in this section.
6.13.2			15.33	Frequency range was investigated according to this section, unless noted in specific rule section under which the equipment operates.
6.13.1			15.35	The EUT emissions were measured using the measurement detector and bandwidth specified in this section, unless noted in specific rule section under which the equipment operates.
6.8			15.203	EUT employs detachable external antenna with 1.3dBi gain.
8.10			15.205 15.209	The fundamental is not in a Restricted band and the spurious and harmonic emissions in the Restricted bands comply with the general emission limits of 15.209 or RSS-Gen as applicable
8.8			15.207	N/A. EUT is vehicle battery powered only.

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

Test Results

Radiated Spurious Emissions

LIMITS

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

[15.247(d)]

Radiated emissions were maximized by rotating the EUT and its external antenna around 3 orthogonal planes (X, Y and Z) and worst case emissions observed in X orientation for both the EUT and its antenna. All the results below are for the worst case orientation only.

MEASUREMENTS / RESULTS

Worst case mode: 802.11b 1Mbps

Curtis Straus - a Bureau Veritas Company	Work Order - S1636
Radiated Emissions Electric Field 3m Distance	EUT Power Input - 13.8V DC
Top Peaks Vertical 30-1000MHz	Test Site - CH2
Operator: CCH ²	Conditions - 24.1°C; 54%RH; 1006mBar
Notes:	Witnessed by - N/A
802.11b 1Mbps Channel 1	EUT Maximum Frequency - 5825MHz

Data Taken at 'October 07, 2018

Frequency (MHz)	Peak Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Lim1: FCC_pt15_2 09 (dBμV/m)	Lim1 Margin (dB)	Lim1 Test Results (Pass/Fail)	Worst Margin Lim1 (dB)
30.194	32.1	-6.5	25.6	40	-14.4	PASS	
137.306	39.1	-14	25.1	43.5	-18.4	PASS	
690.521	35.4	-5.5	29.9	46	-16.1	PASS	
759.561	34.4	-3.8	30.6	46	-15.4	PASS	
828.625	35.3	-3.1	32.1	46	-13.9	PASS	-13.9
897.616	32.4	-1.8	30.7	46	-15.3	PASS	

Curtis Straus - a Bureau Veritas Company Work Order - S1636
 Radiated Emissions Electric Field 3m Distance EUT Power Input - 13.8V DC
 Top Peaks Horizontal 30-1000MHz Test Site - CH2
 Operator: CCH Conditions - 24.1°C; 54%RH; 1006mBar
 Notes: Witnessed by - N/A
 802.11b 1Mbps Channel 1 EUT Maximum Frequency - 5825MHz

Data Taken at 'October 07, 2018

Frequency (MHz)	Peak Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Lim1: FCC_pt15_2 09 (dBμV/m)	Lim1 Margin (dB)	Lim1 Test Results (Pass/Fail)	Worst Margin Lim1 (dB)
143.611	44	-14.5	29.4	43.5	-14.1	PASS	
258.047	47.1	-15.1	32	46	-14	PASS	
267.577	47.4	-14.2	33.2	46	-12.8	PASS	
690.521	37.4	-5.5	31.9	46	-14.1	PASS	
828.601	38.3	-3.1	35.2	46	-10.8	PASS	-10.8
897.689	34.3	-1.8	32.6	46	-13.4	PASS	

Curtis Straus - a Bureau Veritas Company Work Order - S1636
 Radiated Emissions Electric Field 3m Distance EUT Power Input - 13.8V DC
 Top Peaks Vertical 30-1000MHz Test Site - CH2
 Operator: CCH Conditions - 24.1°C; 54%RH; 1006mBar
 Notes: Witnessed by - N/A
 802.11b 1Mbps Channel 6 EUT Maximum Frequency - 5825MHz

Data Taken at 'October 07, 2018

Frequency (MHz)	Peak Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Lim1: FCC_pt15_2 09 (dBμV/m)	Lim1 Margin (dB)	Lim1 Test Results (Pass/Fail)	Worst Margin Lim1 (dB)
31.334	32.5	-7.4	25.1	40	-14.9	PASS	-14.9
130.929	39.1	-13.9	25.2	43.5	-18.3	PASS	
141.501	39	-14.3	24.7	43.5	-18.8	PASS	
690.497	34.2	-5.5	28.7	46	-17.3	PASS	
828.601	34.2	-3.1	31	46	-15	PASS	
918.278	32.3	-1.6	30.6	46	-15.4	PASS	

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Curtis Straus - a Bureau Veritas Company Work Order - S1636
 Radiated Emissions Electric Field 3m Distance EUT Power Input - 13.8V DC
 Top Peaks Horizontal 30-1000MHz Test Site - CH2
 Operator: CCH Conditions - 24.1°C; 54%RH; 1006mBar
 Notes: Witnessed by - N/A
 802.11b 1Mbps Channel 6 EUT Maximum Frequency - 5825MHz

Data Taken at 'October 07, 2018

Frequency (MHz)	Peak Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Lim1: FCC_pt15_2 09 (dBμV/m)	Lim1 Margin (dB)	Lim1 Test Results (Pass/Fail)	Worst Margin Lim1 (dB)
30.412	31.8	-6.7	25.1	40	-14.9	PASS	
143.636	44.9	-14.5	30.4	43.5	-13.1	PASS	
268.596	46.9	-14.1	32.8	46	-13.2	PASS	
759.537	35.3	-3.8	31.6	46	-14.4	PASS	
828.601	38.6	-3.1	35.4	46	-10.6	PASS	-10.6
897.641	34.1	-1.8	32.4	46	-13.6	PASS	

Curtis Straus - a Bureau Veritas Company Work Order - S1636
 Radiated Emissions Electric Field 3m Distance EUT Power Input - 13.8V DC
 Top Peaks Vertical 30-1000MHz Test Site - CH2
 Operator: CCH Conditions - 24.1°C; 54%RH; 1006mBar
 Notes: Witnessed by - N/A
 802.11b 1Mbps Channel 11 EUT Maximum Frequency - 5825MHz

Data Taken at 'October 07, 2018

Frequency (MHz)	Peak Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Lim1: FCC_pt15_2 09 (dBμV/m)	Lim1 Margin (dB)	Lim1 Test Results (Pass/Fail)	Worst Margin Lim1 (dB)
30.679	32.3	-6.9	25.5	40	-14.5	PASS	-14.5
130.929	38.4	-13.9	24.5	43.5	-19	PASS	
141.501	38.7	-14.3	24.4	43.5	-19.1	PASS	
143.587	39.6	-14.5	25	43.5	-18.5	PASS	
828.601	34.1	-3.1	31	46	-15	PASS	
897.665	32.2	-1.8	30.4	46	-15.6	PASS	

Curtis Straus - a Bureau Veritas Company
 Radiated Emissions Electric Field 3m Distance
 Top Peaks Horizontal 30-1000MHz
 Operator: CCH
 Notes:
 802.11b 1Mbps Channel 11

Work Order - S1636
 EUT Power Input - 13.8V DC
 Test Site - CH2
 Conditions - 24.1°C; 54%RH; 1006mBar
 Witnessed by - N/A
 EUT Maximum Frequency - 5825MHz

Data Taken at 'October 07, 2018

Frequency (MHz)	Peak Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Lim1: FCC_pt15_2 09 (dBμV/m)	Lim1 Margin (dB)	Lim1 Test Results (Pass/Fail)	Worst Margin Lim1 (dB)
30.218	33.4	-6.5	26.8	40	-13.2	PASS	
143.587	44.8	-14.5	30.3	43.5	-13.2	PASS	
262.072	46.9	-14.7	32.3	46	-13.7	PASS	
786.309	37.3	-3.5	33.8	46	-12.2	PASS	
828.601	39.6	-3.1	36.5	46	-9.5	PASS	-9.5
897.641	34.4	-1.8	32.7	46	-13.3	PASS	

30-1000MHz

Curtis Straus - a Bureau Veritas Company
 Radiated Emissions Electric Field 3m Distance
 1-6GHz Vertical Data
 Operator: CCH
 Notes:
 802.11b 1Mbps Channel 1

Work Order - S1636
 EUT Power Input - 13.8V DC
 Test Site - CH2
 Conditions - 24.1°C; 54%RH; 1006mBar
 Witnessed by - N/A
 EUT Maximum Frequency - 5825MHz

Data Taken at 'October 07, 2018

Frequency (MHz)	Raw Peak Reading (dBμV)	Raw Avg Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_2 09_Peak (dBμV/m)	Peak Margin (dB)	Peak Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBμV/m)	Av Lim: FCC_pt15_2 09_Average (dBμV/m)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Avg Margin (dB)
1355.7	40.5	32.1	-3.5	37	74	-37	PASS		28.6	54	-25.4	PASS	
2173.2	42.8	32.3	1.9	44.7	74	-29.3	PASS		34.1	54	-19.9	PASS	
3086.9	42.7	32.6	2.1	44.9	74	-29.1	PASS		34.7	54	-19.3	PASS	
5783.1	39.3	30.6	6.1	45.4	74	-28.6	PASS	-28.6	36.8	54	-17.2	PASS	-17.2

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Curtis Straus - a Bureau Veritas Company
 Radiated Emissions Electric Field 3m Distance
 1-6GHz Horizontal Data
 Operator: CCH
 Notes:
 802.11b 1Mbps Channel 1

Work Order - S1636
 EUT Power Input - 13.8V DC
 Test Site - CH2
 Conditions - 24.1°C; 54%RH; 1006mBar
 Witnessed by - N/A
 EUT Maximum Frequency - 5825MHz

Data Taken at 'October 07, 2018

Frequency (MHz)	Raw Peak Reading (dBμV)	Raw Avg Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_2 09_Peak (dBμV/m)	Peak Margin (dB)	Peak Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBμV/m)	Av Lim: FCC_pt15_2 09_Average (dBμV/m)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Average Margin (dB)
1247.5	41.9	31.9	-3.5	38.4	74	-35.6	PASS		28.4	54	-25.6	PASS	
2159.9	41	32.3	1.8	42.7	74	-31.3	PASS		34.1	54	-19.9	PASS	
3202.1	42.4	32.7	2.5	44.9	74	-29.1	PASS		35.2	54	-18.8	PASS	
5869.5	39.1	30.5	6.1	45.2	74	-28.8	PASS	-28.8	36.6	54	-17.4	PASS	-17.4

Curtis Straus - a Bureau Veritas Company
 Radiated Emissions Electric Field 3m Distance
 1-6GHz Vertical Data
 Operator: CCH
 Notes:
 802.11b 1Mbps Channel 6

Work Order - S1636
 EUT Power Input - 13.8V DC
 Test Site - CH2
 Conditions - 24.1°C; 54%RH; 1006mBar
 Witnessed by - N/A
 EUT Maximum Frequency - 5825MHz

Data Taken at 'October 07, 2018

Frequency (MHz)	Raw Peak Reading (dBμV)	Raw Avg Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_2 09_Peak (dBμV/m)	Peak Margin (dB)	Peak Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBμV/m)	Av Lim: FCC_pt15_2 09_Average (dBμV/m)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Avg Margin (dB)
1331.3	40.8	32.2	-3.5	37.3	74	-36.7	PASS		28.7	54	-25.3	PASS	
2161.6	40.6	32.3	1.8	42.4	74	-31.6	PASS		34	54	-20	PASS	
3246.8	41.3	32.6	2.2	43.4	74	-30.6	PASS		34.7	54	-19.3	PASS	
5856.8	39.8	30.5	6.1	45.9	74	-28.1	PASS	-28.1	36.6	54	-17.4	PASS	-17.4

Curtis Straus - a Bureau Veritas Company
 Radiated Emissions Electric Field 3m Distance
 1-6GHz Horizontal Data
 Operator: CCH
 Notes:
 802.11b 1Mbps Channel 6

Work Order - S1636
 EUT Power Input - 13.8V DC
 Test Site - CH2
 Conditions - 24.1°C; 54%RH; 1006mBar
 Witnessed by - N/A
 EUT Maximum Frequency - 5825MHz

Data Taken at 'October 07, 2018

Frequency (MHz)	Raw Peak Reading (dBμV)	Raw Avg Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_2 09_Peak (dBμV/m)	Peak Margin (dB)	Peak Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBμV/m)	Av Lim: FCC_pt15_2 09_Average (dBμV/m)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Average Margin (dB)
1285.4	42.1	32.1	-3.2	38.9	74	-35.1	PASS		28.9	54	-25.1	PASS	
2185.2	41.4	32.3	2	43.4	74	-30.6	PASS		34.3	54	-19.7	PASS	
3145.5	41.6	32.8	2.3	43.9	74	-30.1	PASS		35.1	54	-18.9	PASS	
5758.1	38.7	30.7	6.1	44.8	74	-29.2	PASS	-29.2	36.8	54	-17.2	PASS	-17.2



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Curtis Straus - a Bureau Veritas Company
 Radiated Emissions Electric Field 3m Distance
 1-6GHz Vertical Data
 Operator: CCH
 Notes:
 802.11b 1Mbps Channel 11

Work Order - S1636
 EUT Power Input - 13.8V DC
 Test Site - CH2
 Conditions - 24.1°C; 54%RH; 1006mBar
 Witnessed by - N/A
 EUT Maximum Frequency - 5825MHz

Data Taken at 'October 07, 2018

Frequency (MHz)	Raw Peak Reading (dBμV)	Raw Avg Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_2 09_Peak (dBμV/m)	Peak Margin (dB)	Peak Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBμV/m)	Av Lim: FCC_pt15_2 09_Average (dBμV/m)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Avg Margin (dB)
2156.6	40.2	32.4	1.7	42	74	-32	PASS		34.1	54	-19.9	PASS	
3224.4	42.6	32.6	2.3	44.9	74	-29.1	PASS		34.9	54	-19.1	PASS	
5596.3	42	30.6	5.5	47.5	74	-26.5	PASS	-26.5	36.1	54	-17.9	PASS	-17.9

Curtis Straus - a Bureau Veritas Company
 Radiated Emissions Electric Field 3m Distance
 1-6GHz Horizontal Data
 Operator: CCH
 Notes:
 802.11b 1Mbps Channel 11

Work Order - S1636
 EUT Power Input - 13.8V DC
 Test Site - CH2
 Conditions - 24.1°C; 54%RH; 1006mBar
 Witnessed by - N/A
 EUT Maximum Frequency - 5825MHz

Data Taken at 'October 07, 2018

Frequency (MHz)	Raw Peak Reading (dBμV)	Raw Avg Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_2 09_Peak (dBμV/m)	Peak Margin (dB)	Peak Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBμV/m)	Av Lim: FCC_pt15_2 09_Average (dBμV/m)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Average Margin (dB)
1710.9	41.2	32.1	-2.6	38.6	74	-35.4	PASS		29.5	54	-24.5	PASS	
1723.3	40.9	32	-2.5	38.4	74	-35.6	PASS		29.5	54	-24.5	PASS	
2106.8	41.5	32.3	1	42.5	74	-31.5	PASS		33.3	54	-20.7	PASS	
3015.8	40.4	32.5	2.2	42.6	74	-31.4	PASS		34.7	54	-19.3	PASS	
4603.5	40.8	31.1	3.6	44.4	74	-29.6	PASS		34.6	54	-19.4	PASS	
5866.6	39.2	30.5	6.1	45.3	74	-28.7	PASS	-28.7	36.6	54	-17.4	PASS	-17.4

1-6GHz

Curtis Straus - a Bureau Veritas Company
 Radiated Emissions Electric Field 1m Distance
 6-18GHz Vertical Data
 Operator: CCH
 Notes:
 802.11b 1Mbps Channel 11

Work Order - S1636
 EUT Power Input - 13.8V DC
 Test Site - CH2
 Conditions - 24.1°C; 54%RH; 1006mBar
 Witnessed by - N/A
 EUT Maximum Frequency - 5825MHz

Data Taken at 'October 07, 2018

Frequency (MHz)	Raw Peak Reading (dBμV)	Raw Avg Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_2 09_Peak (dBμV/m)	Peak Margin (dB)	Peak Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBμV/m)	Av Lim: FCC_pt15_2 09_Average (dBμV/m)	Avg Margin (dB)	Avg Results (Pass/Fail)	Worst Avg Margin (dB)
17994.7	39	30.5	21.4	60.4	83.5	-23.1	PASS	-23.1	51.9	63.5	-11.6	PASS	-11.6



Curtis Straus - a Bureau Veritas Company
 Radiated Emissions Electric Field 1m Distance
 6-18GHz Horizontal Data
 Operator: CCH
 Notes:
 802.11b 1Mbps Channel 1

Work Order - S1636
 EUT Power Input - 13.8V DC
 Test Site - CH2
 Conditions - 24.1°C; 54%RH; 1006mBar
 Witnessed by - N/A
 EUT Maximum Frequency - 5825MHz

Data Taken at 'October 07, 2018

Frequency (MHz)	Raw Peak Reading (dBμV)	Raw Avg Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_2 09_Peak (dBμV/m)	Peak Margin (dB)	Peak Test Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBμV/m)	Av Lim: FCC_pt15_2 09_Average (dBμV/m)	Avg Margin (dB)	Avg Test Results (Pass/Fail)	Worst Avg Margin (dB)
7058.6	38.7	30.1	8.4	47.2	83.5	-36.3	PASS		38.5	63.5	-25	PASS	
17955.7	40.4	30.5	20.9	61.3	83.5	-22.2	PASS	-22.2	51.4	63.5	-12.1	PASS	-12.1

Curtis Straus - a Bureau Veritas Company
 Radiated Emissions Electric Field 1m Distance
 6-18GHz Vertical Data
 Operator: CCH
 Notes:
 802.11b 1Mbps Channel 6

Work Order - S1636
 EUT Power Input - 13.8V DC
 Test Site - CH2
 Conditions - 24.1°C; 54%RH; 1006mBar
 Witnessed by - N/A
 EUT Maximum Frequency - 5825MHz

Data Taken at 'October 07, 2018

Frequency (MHz)	Raw Peak Reading (dBμV)	Raw Avg Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_2 09_Peak (dBμV/m)	Peak Margin (dB)	Peak Test Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBμV/m)	Av Lim: FCC_pt15_2 09_Average (dBμV/m)	Avg Margin (dB)	Avg Test Results (Pass/Fail)	Worst Avg Margin (dB)
7899.6	38.9	29.3	8	46.9	83.5	-36.6	PASS		37.3	63.5	-26.2	PASS	
17972.8	38.7	30.7	21.1	59.8	83.5	-23.7	PASS	-23.7	51.8	63.5	-11.7	PASS	-11.7

Curtis Straus - a Bureau Veritas Company
 Radiated Emissions Electric Field 1m Distance
 6-18GHz Horizontal Data
 Operator: CCH
 Notes:
 802.11b 1Mbps Channel 6

Work Order - S1636
 EUT Power Input - 13.8V DC
 Test Site - CH2
 Conditions - 24.1°C; 54%RH; 1006mBar
 Witnessed by - N/A
 EUT Maximum Frequency - 5825MHz

Data Taken at 'October 07, 2018

Frequency (MHz)	Raw Peak Reading (dBμV)	Raw Avg Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_2 09_Peak (dBμV/m)	Peak Margin (dB)	Peak Test Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBμV/m)	Av Lim: FCC_pt15_2 09_Average (dBμV/m)	Avg Margin (dB)	Avg Test Results (Pass/Fail)	Worst Avg Margin (dB)
17300.8	41.3	31.6	19.4	60.7	83.5	-22.8	PASS		51	63.5	-12.5	PASS	
17978.4	40	30.7	21.2	61.2	83.5	-22.3	PASS	-22.3	51.9	63.5	-11.6	PASS	-11.6

Curtis Straus - a Bureau Veritas Company
 Radiated Emissions Electric Field 1m Distance
 6-18GHz Vertical Data
 Operator: CCH
 Notes:
 802.11b 1Mbps Channel 11

Work Order - S1636
 EUT Power Input - 13.8V DC
 Test Site - CH2
 Conditions - 24.1°C; 54%RH; 1006mBar
 Witnessed by - N/A
 EUT Maximum Frequency - 5825MHz

Data Taken at 'October 07, 2018

Frequency (MHz)	Raw Peak Reading (dBμV)	Raw Avg Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_2 09_Peak (dBμV/m)	Peak Margin (dB)	Peak Test Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBμV/m)	Av Lim: FCC_pt15_2 09_Average (dBμV/m)	Avg Margin (dB)	Avg Test Results (Pass/Fail)	Worst Avg Margin (dB)
17964.7	38.7	30.6	21	59.7	83.5	-23.8	PASS	-23.8	51.6	63.5	-11.9	PASS	-11.9



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Curtis Straus - a Bureau Veritas Company
 Radiated Emissions Electric Field 1m Distance
 6-18GHz Horizontal Data
 Operator: CCH
 Notes:
 802.11b 1Mbps Channel 11

Work Order - S1636
 EUT Power Input - 13.8V DC
 Test Site - CH2
 Conditions - 24.1°C; 54%RH; 1006mBar
 Witnessed by - N/A
 EUT Maximum Frequency - 5825MHz

Data Taken at 'October 07, 2018

Frequency (MHz)	Raw Peak Reading (dBμV)	Raw Avg Reading (dBμV)	Correction Factor (dB/m)	Adjusted Peak Amplitude (dBμV/m)	Pk Lim: FCC_pt15_2 09_Peak (dBμV/m)	Peak Margin (dB)	Peak Test Results (Pass/Fail)	Worst Peak Margin (dB)	Adjusted Avg Amplitude (dBμV/m)	Av Lim: FCC_pt15_2 09_Average (dBμV/m)	Avg Margin (dB)	Avg Test Results (Pass/Fail)	Worst Avg Margin (dB)
17992.4	39.7	30.7	21.4	61.1	83.5	-22.4	PASS	-22.4	52	63.5	-11.5	PASS	-11.5

6-18GHz

Radiated Emissions Table

Date: 07-Oct-18				Company: Harman International					Work Order: S1636					
Engineer: Chris Hamel				EUT Desc: GM MY20					EUT Operating Voltage/Frequency: 13.8V DC					
Temp: 24.1°C				Humidity: 54%					Pressure: 1006mBar					
Frequency Range: 18-26.5GHz									Measurement Distance: 0.1 m					
Notes: No Emissions Found 802.11b 1Mbps Channels 1, 6, and 11									EUT Max Freq: 5825MHz					
Antenna Polarization (H / V)	Frequency (MHz)	Peak Reading (dBμV)	Average Reading (dBμV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Peak Reading (dBμV/m)	Adjusted Avg Reading (dBμV/m)	FCC Class B High Frequency - Peak			FCC Class B High Frequency - Average		
									Limit (dBμV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBμV/m)	Margin (dB)	Result (Pass/Fail)
				---	---	---	---	---	---	---	---	---	---	---
Table Result:				Pass by N/A dB					Worst Freq: N/A MHz					
Test Site: EMI Chamber 2				Cable 1: Asset #2323					Cable 2: ---			Cable 3: ---		
Analyzer: Gold				Preamp: 18-26.5GHz					Antenna: 18-26.5GHz Horn			Preselector: ---		
CSsoft Radiated Emissions Calculator v 1.017.208														Copyright Curtis-Straus LLC 2000
Adjusted Reading = Reading - Preamp Factor + Antenna Factor + Cable Factor														

18-26.5GHz

Rev. 10/8/2018

Spectrum Analyzers / Receivers/Preselectors		Range	MN	Mfr	SN	Asset	Cat	Calibration Due
2093 MXE EMI Receiver		20Hz-26.5GHz	N9038A	Agilent	MY51210181	2093	I	11/16/2018
Gold		100Hz-26.5 GHz	E4407B	Agilent	MY45113816	1284	I	3/19/2019
Radiated Emissions Sites		FCC Code	IC Code	VCCI Code	Range	Asset	Cat	Calibration Due
EMI Chamber 2		719150	2762A-7	A-0015	30-1000MHz	1686	I	12/21/2018
EMI Chamber 2		719150	2762A-7	A-0015	1-18GHz	1686	I	12/21/2018
Preamps/Couplers Attenuators / Filters		Range	MN	Mfr	SN	Asset	Cat	Calibration Due
2311 PA		1-1000MHz	PAM-103	COM-POWER	441174	2311	II	10/29/2018
2111 HF Preamp		0.5-18GHz	PAM-118A	COM-POWER	551063	2111	II	11/19/2018
HF (Yellow)		18-26.5GHz	AFS4-18002650-60-8P-4	CS	467559	1266	II	10/16/2018
Antennas		Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Red-White Bilog		30-2000MHz	JB1	Sunol	A091604-1	1105	I	8/21/2019
HF (White) Horn		18-26.5GHz	801-WLM	Waveline	758	758	III	Verify before Use
Blue Horn		1-18GHz	3117	ETS	157647	1861	I	2/14/2019
Meteorological Meters/Chambers			MN	Mfr	SN	Asset	Cat	Calibration Due
Weather Clock (Pressure Only)			BA928	Oregon Scientific	C3166-1	831	I	5/15/2020
TH A#2082			HTC-1	HDE		2082	II	3/22/2019
Cables		Range		Mfr			Cat	Calibration Due
Asset #2051		9kHz - 18GHz		Florida RF			II	3/7/2019
Asset #2054		9kHz - 18GHz		Florida RF			II	10/31/2018
Asset #2466		9KHz-18GHz		MegaPhase			II	10/29/2018
Asset #2323		1-26.5GHz	TM26-S1S1-120	MEGAPHASE	17139101 002	2323	II	8/9/2019

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

TEU



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Radiated Band Edge

Radiated Band Edges														
Date: 10-Oct-18				Company: Harman International					Work Order: S1636					
Engineer: Chris Hamel				EUT Desc: GM MY20					EUT Operating Voltage/Frequency: 13.8V DC					
Temp: 24.0°C				Humidity: 51%					Pressure: 1012mBar					
Frequency Range: 2.3-2.5GHz									Measurement Distance: 1 m					
Notes: Worst case antenna polarization: V														
Antenna Polarization (H/ V)	Frequency (MHz)	Peak Reading (dBμV)	Average Reading (dBμV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Peak Reading (dBμV/m)	Adjusted Avg Reading (dBμV/m)	FCC Class B High Frequency - Peak			FCC Class B High Frequency - Average		
									Limit (dBμV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBμV/m)	Margin (dB)	Result (Pass/Fail)
802.11b 1Mbps				---	---	---	---	---	---	---	---	---	---	---
Low V	2390.0	16.6	16.6	0.0	32.6	4.2	53.4	53.4	83.5	-30.1	Pass	63.5	-10.1	Pass
High V	2483.5	14.7	14.7	0.0	32.8	4.0	51.5	51.5	83.5	-32.0	Pass	63.5	-12.0	Pass
V	2486.7	16.5	16.5	0.0	32.8	4.0	53.3	53.3	83.5	-30.2	Pass	63.5	-10.2	Pass
802.11g 6Mbps				---	---	---	---	---	---	---	---	---	---	---
Low V	2390.0	24.7	13.7	0.0	32.6	4.2	61.5	50.5	83.5	-22.0	Pass	63.5	-13.0	Pass
V	2381.4	21.2	9.7	0.0	32.5	4.2	57.9	46.4	83.5	-25.6	Pass	63.5	-17.1	Pass
High V	2483.5	20.1	13.5	0.0	32.8	4.0	56.9	50.3	83.5	-26.6	Pass	63.5	-13.2	Pass
V	2490.1	18.4	9.5	0.0	32.8	4.0	55.2	46.3	83.5	-28.3	Pass	63.5	-17.2	Pass
802.11n MCS 1 power reduced to 12				---	---	---	---	---	---	---	---	---	---	---
Low V	2390.0	26.4	15.4	0.0	32.6	4.2	63.2	52.2	83.5	-20.3	Pass	63.5	-11.3	Pass
V	2387.5	27.9	14.8	0.0	32.5	4.2	64.6	51.5	83.5	-18.9	Pass	63.5	-12.0	Pass
High V	2483.5	21.8	14.1	0.0	32.8	4.0	58.6	50.9	83.5	-24.9	Pass	63.5	-12.6	Pass
V	2484.3	22.9	14.7	0.0	32.8	4.0	59.7	51.5	83.5	-23.8	Pass	63.5	-12.0	Pass
Table Result:				Pass		by		-10.1 dB		Worst Freq: 2390.0 MHz				
Test Site: EMI Chamber 2				Cable 1: Asset #2051				Cable 2: Asset #2054				Cable 3: ---		
Analyzer: Rental SA#4				Preamp: None				Antenna: Blue Horn				Preselector: ---		
CSsoft Radiated Emissions Calculator v 1.017.208														
Adjusted Reading = Reading - Preamp Factor + Antenna Factor + Cable Factor														
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Spectrum Analyzers / Receivers / Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
2093 MXE EMI Receiver	20Hz-26.5GHz	N9038A	Agilent	MY51210181	2093	I	11/16/2018
Radiated Emissions Sites	FCC Code	IC Code	VCCI Code	Range	Asset	Cat	Calibration Due
EMI Chamber 2	719150	2762A-7	A-0015	1-18GHz	1686	I	12/21/2018
Antennas	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Blue Horn	1-18GHz	3117	ETS	157647	1861	I	2/14/2019
Meteorological Meters/Chambers		MN	Mfr	SN	Asset	Cat	Calibration Due
Weather Clock (Pressure Only)		BA928	Oregon Scientific	C3166-1	831	I	5/15/2020
TH A#2082		HTC-1	HDE		2082	II	3/22/2019
Cables	Range		Mfr			Cat	Calibration Due
Asset #2051	9kHz - 18GHz		Florida RF			II	3/7/2019
Asset #2054	9kHz - 18GHz		Florida RF			II	10/31/2018

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AC Line Conducted Emissions LIMITS

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

*Decreases with the logarithm of the frequency.

[47 CFR 15.207(a)]

MEASUREMENTS / RESULTS

Not applicable. EUT is vehicle battery powered only.

Measurement Uncertainty

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

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



Conditions Of Testing

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

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



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

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

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

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

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



Appendix A

ES1636-1 Appendix A
CFR Title 47 FCC Part §15.247 and ISSED Canada RSS-247 Issue 2

DUT Information

Model: INFO3.5 CSM MY20
 Manufacturer: Harman International Industries, Inc.
 Serial Number: 01

Channels available:

802.11b, 802.11g, 802.11n (HT20):

Channel	Freq. (MHz)	Channel	Freq. (MHz)
1	2412	8	2447
2	2417	9	2452
3	2422	10	2457
4	2427	11	2462
5	2432		
6	2437		
7	2442		

Notes

- The channels which were marked bold were tested.
- Output power measurements were performed at the lowest and highest data rate of each supported 802.11 mode. Worst cases found to be: 802.11b 1Mbps, 802.11g 6Mbps and 802.11n (HT20) MCS0. 6dB BW, 99% OBW, conducted spurious and conducted bandedges were only tested at these worst case data rates.

Antenna Gain	1.3 dBi
Number of transmit chains	1
Equipment Type	Digital Transmission System

Power Settings

802.11b		802.11g	
Channel	Power Setting	Channel	Power Setting
1	Default	1	Default
6	Default	6	Default
11	Default	11	Default
802.11n (HT20)			
Channel	Power Setting		
1	12		
6	12		
11	12		



Test Equipment Used

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



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Test Results Summary

Test	Frequency (MHz)	802.11b	802.11g	802.11n (HT20)
Average Output Power	2412.000	PASS	PASS	PASS
Peak Power Spectral Density	2412.000	PASS	PASS	PASS
DTS Bandwidth (6dB)	2412.000	PASS	PASS	PASS
Occupied Channel Bandwidth 99%	2412.000	PASS	PASS	PASS
Conducted Band Edges	2412.000	PASS	PASS	PASS
Conducted Spurious Emissions	2412.000	PASS	PASS	PASS
Average Output Power	2437.000	PASS	PASS	PASS
Peak Power Spectral Density	2437.000	PASS	PASS	PASS
DTS Bandwidth (6dB)	2437.000	PASS	PASS	PASS
Occupied Channel Bandwidth 99%	2437.000	PASS	PASS	PASS
Conducted Band Edges	2437.000	PASS	PASS	PASS
Conducted Spurious Emissions	2437.000	PASS	PASS	PASS
Average Output Power	2462.000	PASS	PASS	PASS
Peak Power Spectral Density	2462.000	PASS	PASS	PASS
DTS Bandwidth (6dB)	2462.000	PASS	PASS	PASS
Occupied Channel Bandwidth 99%	2462.000	PASS	PASS	PASS
Conducted Band Edges	2462.000	PASS	PASS	PASS
Conducted Spurious Emissions	2462.000	PASS	PASS	PASS



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Testing Cert. No. 1627-01

Average Output Power (Gated)

Test according to FCC KDB 558074 D01 15.247 Meas Guidance v05 Section 8.3.2.3.

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

802.11b

Data Rate	Gated RMS (dBm) 2412 MHz	Gated RMS (dBm) 2437 MHz	Gated RMS (dBm) 2462 MHz	Limit (dBm)	Duty Cycle (%)
1 Mbps	10.622	11.204	11.348	30	99.814
11 Mbps	10.591	10.955	11.063	30	98.117

802.11g

Data Rate	Gated RMS (dBm) 2412 MHz	Gated RMS (dBm) 2437 MHz	Gated RMS (dBm) 2462 MHz	Limit (dBm)	Duty Cycle (%)
6 Mbps	11.616	12.032	12.229	30	98.550
54 Mbps	11.252	11.563	11.669	30	89.213

802.11n(HT20)

Data Rate	Gated RMS (dBm) 2412 MHz	Gated RMS (dBm) 2437 MHz	Gated RMS (dBm) 2462 MHz	Limit (dBm)	Duty Cycle (%)
MCS0	9.621	10.084	11.054	30	98.449
MCS7	9.324	9.780	10.557	30	88.383



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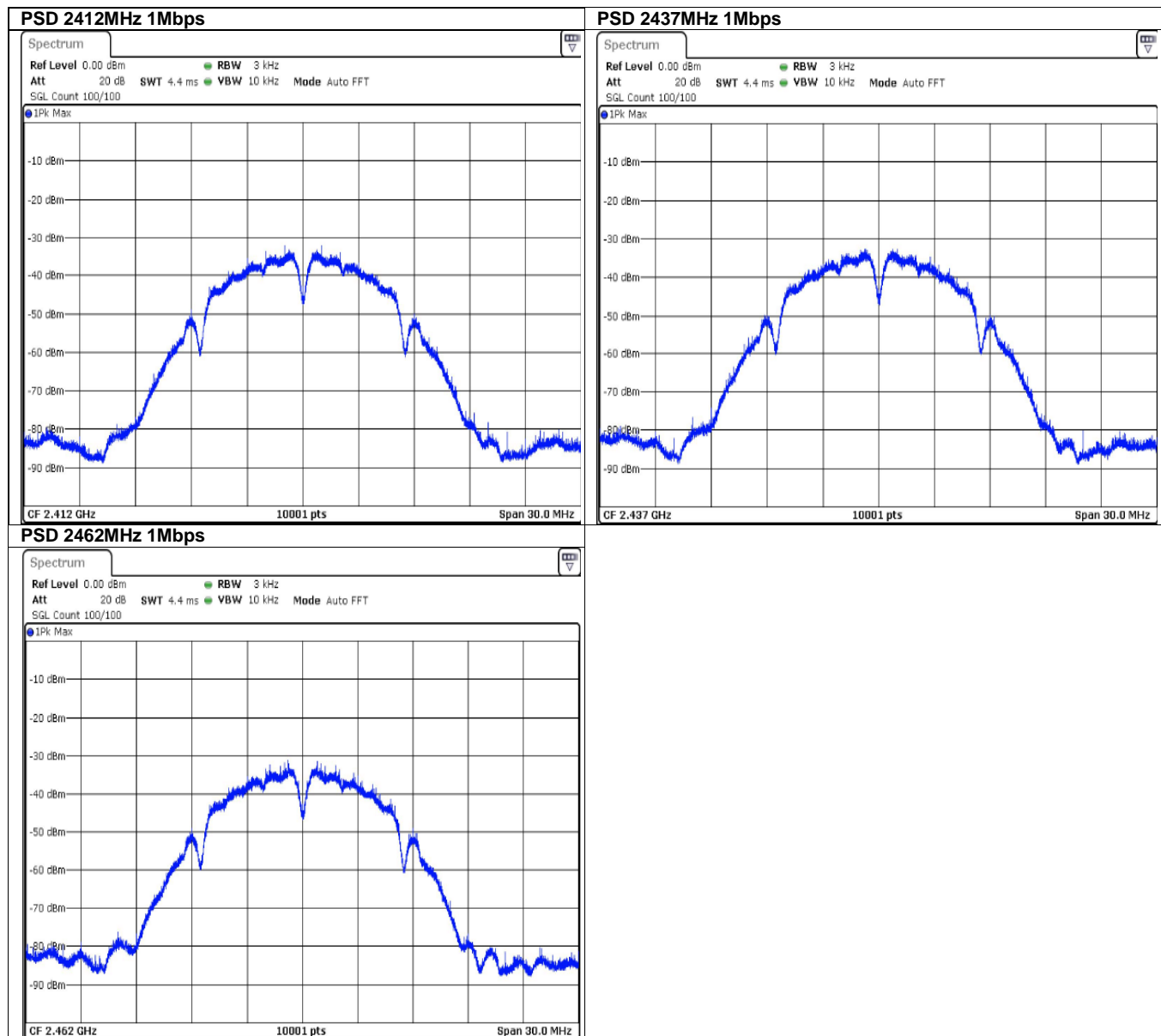
Peak Power Spectral Density

Test according to FCC KDB 558074 D01 15.247 Meas Guidance v05 Section 8.4

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1. Expanded Uncertainty (K=2) < 1.3 dB

802.11b

Data Rate	Peak PSD (dBm) 2412 MHz	Peak PSD (dBm) 2437 MHz	Peak PSD (dBm) 2462 MHz	Limit (dBm)
1 Mbps	-10.414	-10.882	-9.383	8
11 Mbps	-11.172	-11.081	-10.959	8



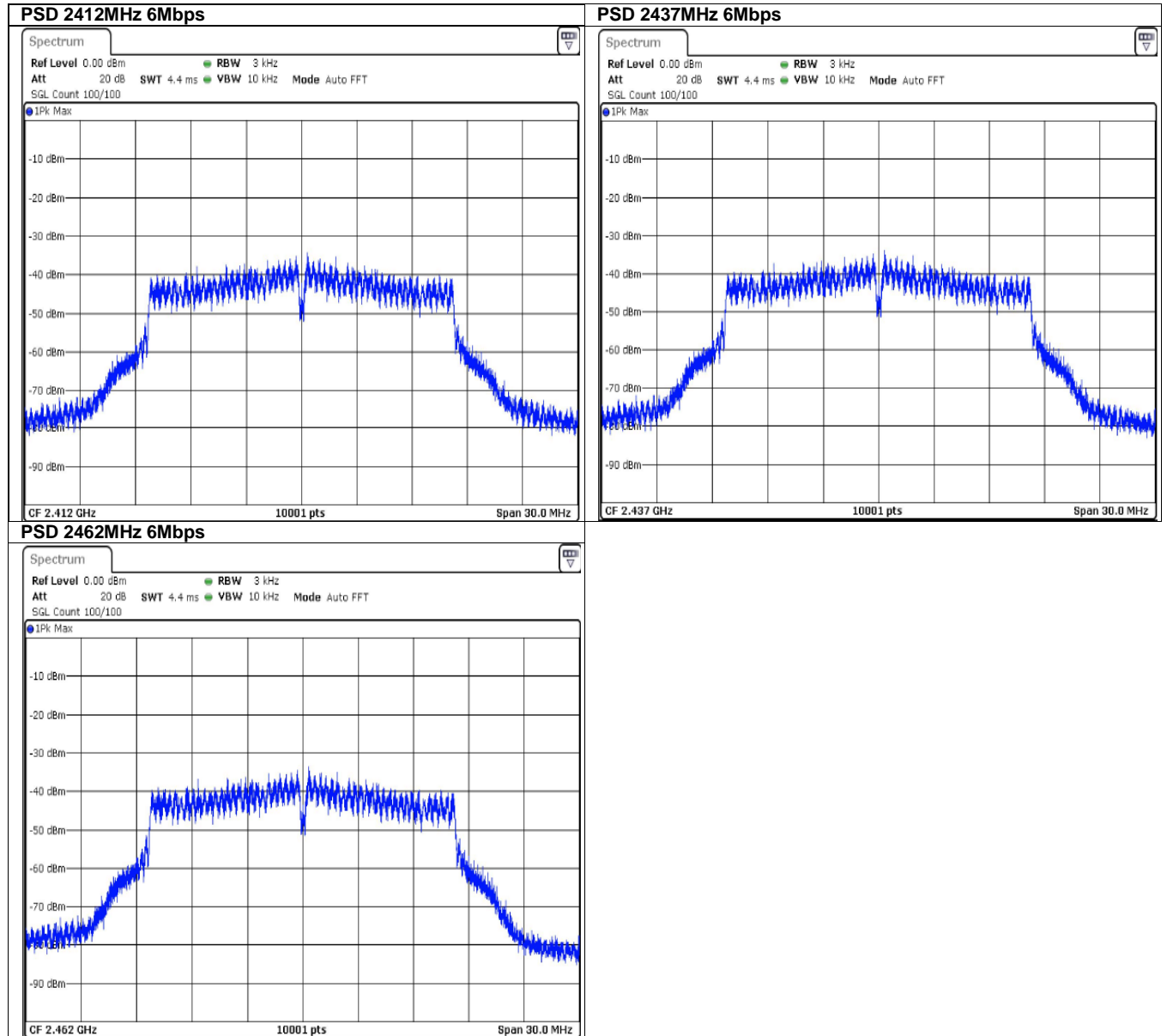
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802.11g

Data Rate	Peak PSD (dBm) 2412 MHz	Peak PSD (dBm) 2437 MHz	Peak PSD (dBm) 2462 MHz	Limit (dBm)
6 Mbps	-12.956	-12.124	-11.874	8
54 Mbps	-16.089	-15.680	-15.587	8



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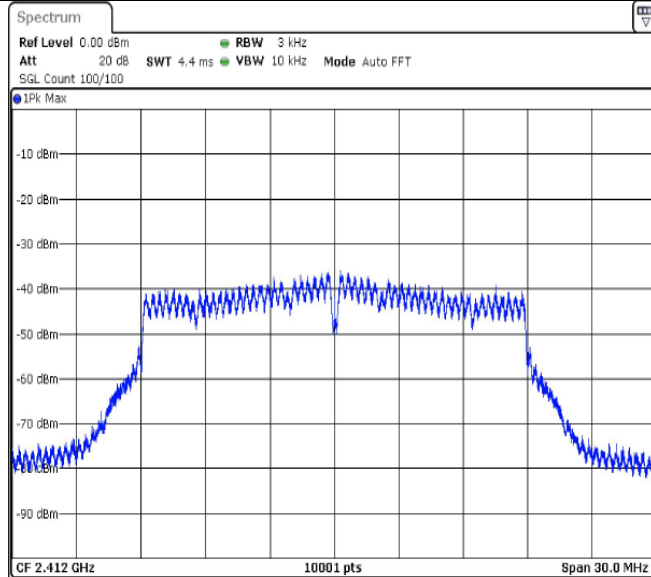
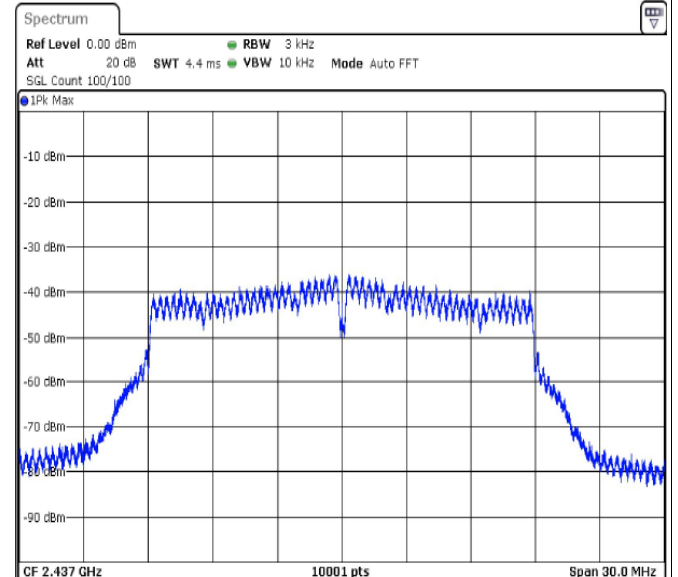
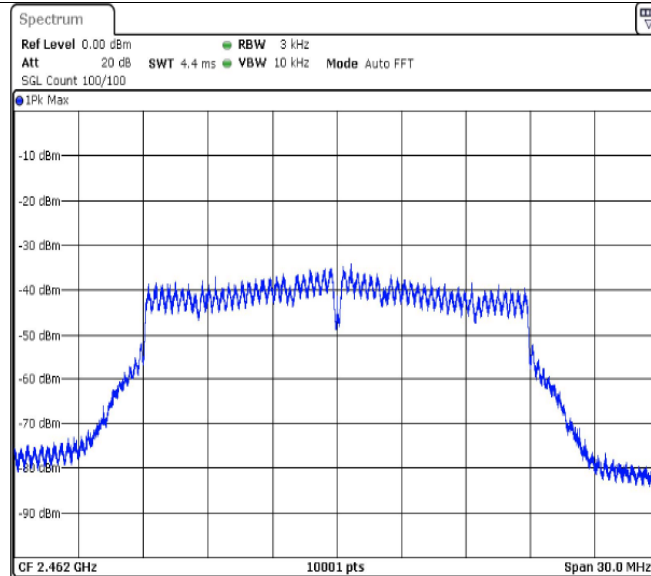
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802.11n (HT20)

Data Rate	Peak PSD (dBm) 2412 MHz	Peak PSD (dBm) 2437 MHz	Peak PSD (dBm) 2462 MHz	Limit (dBm)
MCS0	-14.045	-14.341	-12.340	8
MCS7	-16.290	-15.613	-15.452	8

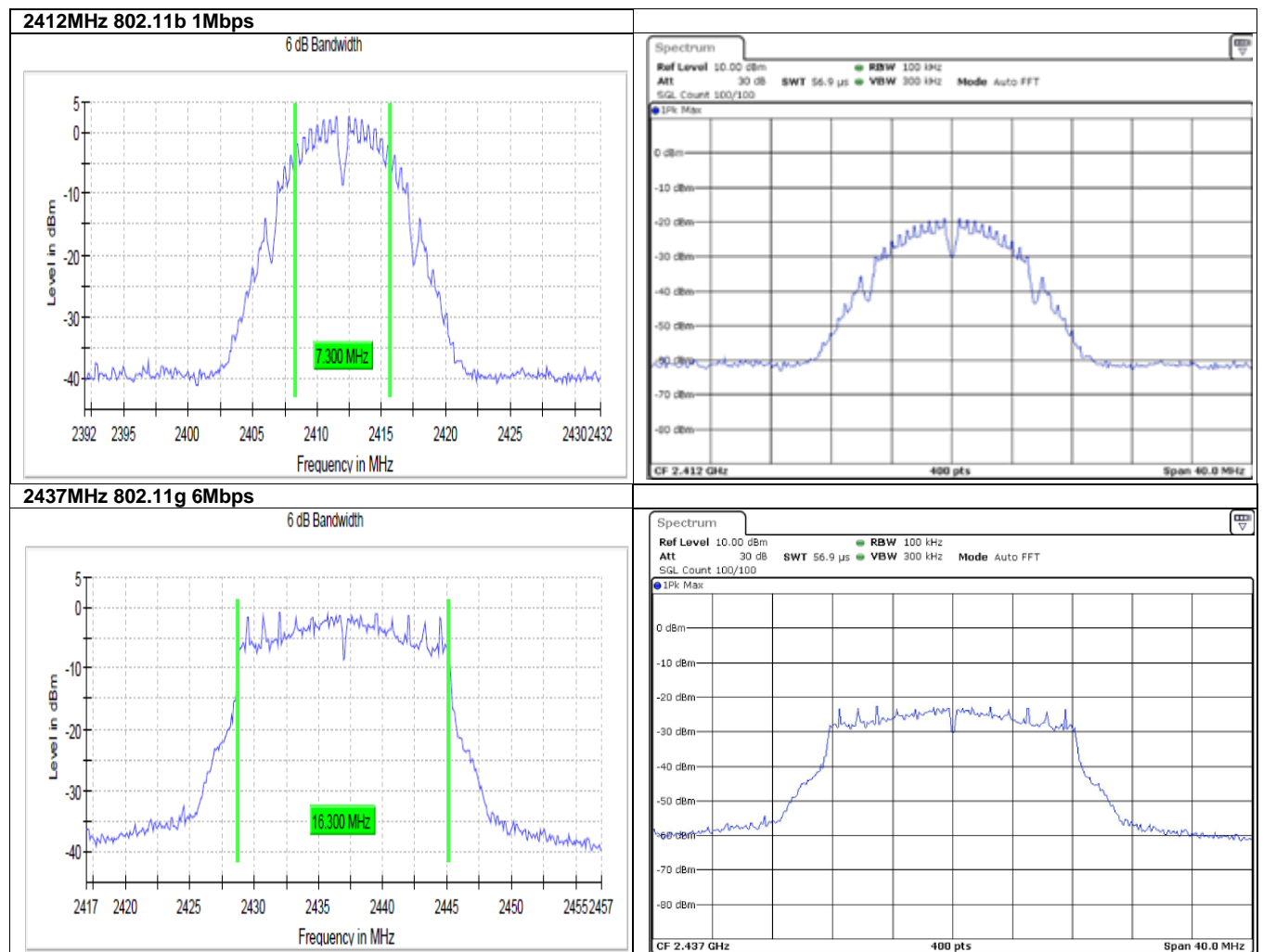
PSD 2412MHz MCS0**PSD 2437MHz MCS0****PSD 2462MHz MCS0**

DTS Bandwidth (6dB)

Test according to FCC KDB 558074 D01 15.247 Meas Guidance v05 Section 8.3.1.1

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

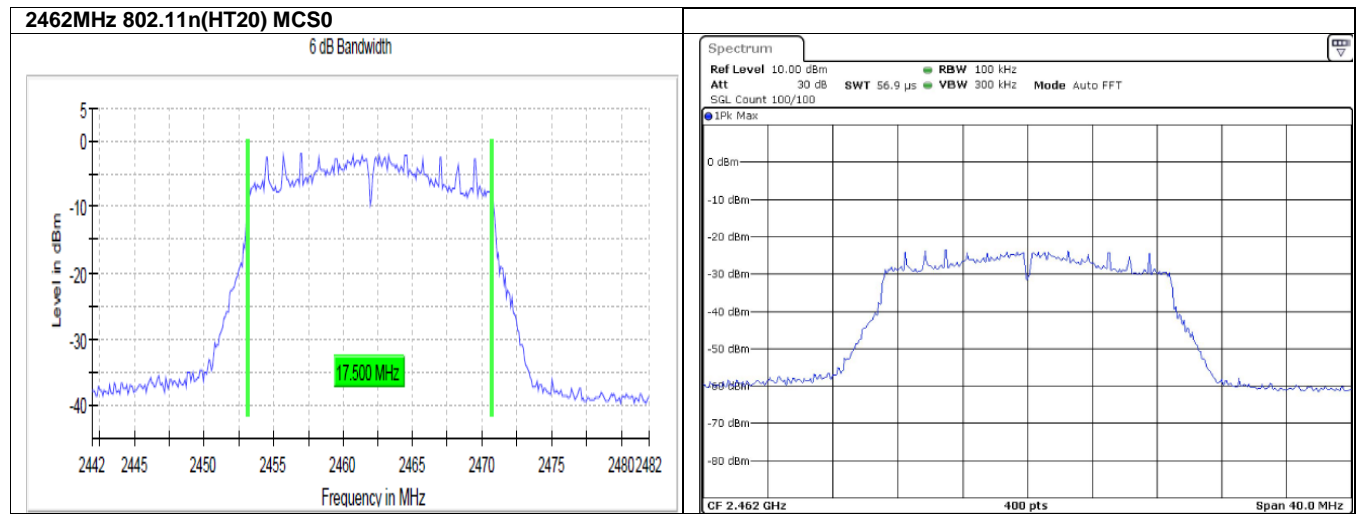
Data Rate	DUT Frequency (MHz)	Bandwidth (MHz)	Minimum Limit (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
802.11b 1 Mbps	2412.000	7.300000	0.5	2408.350000	2415.650000
802.11g 6 Mbps	2412.000	16.500000	0.5	2403.750000	2420.250000
802.11n(HT20) MCS0	2412.000	17.700000	0.5	2403.150000	2420.850000
802.11b 1 Mbps	2437.000	7.300000	0.5	2433.350000	2440.650000
802.11g 6 Mbps	2437.000	16.300000	0.5	2428.750000	2445.050000
802.11n(HT20) MCS0	2437.000	17.500000	0.5	2428.150000	2445.650000
802.11b 1 Mbps	2462.000	7.300000	0.5	2458.350000	2465.650000
802.11g 6 Mbps	2462.000	16.500000	0.5	2453.750000	2470.250000
802.11n(HT20) MCS0	2462.000	17.500000	0.5	2453.150000	2470.650000

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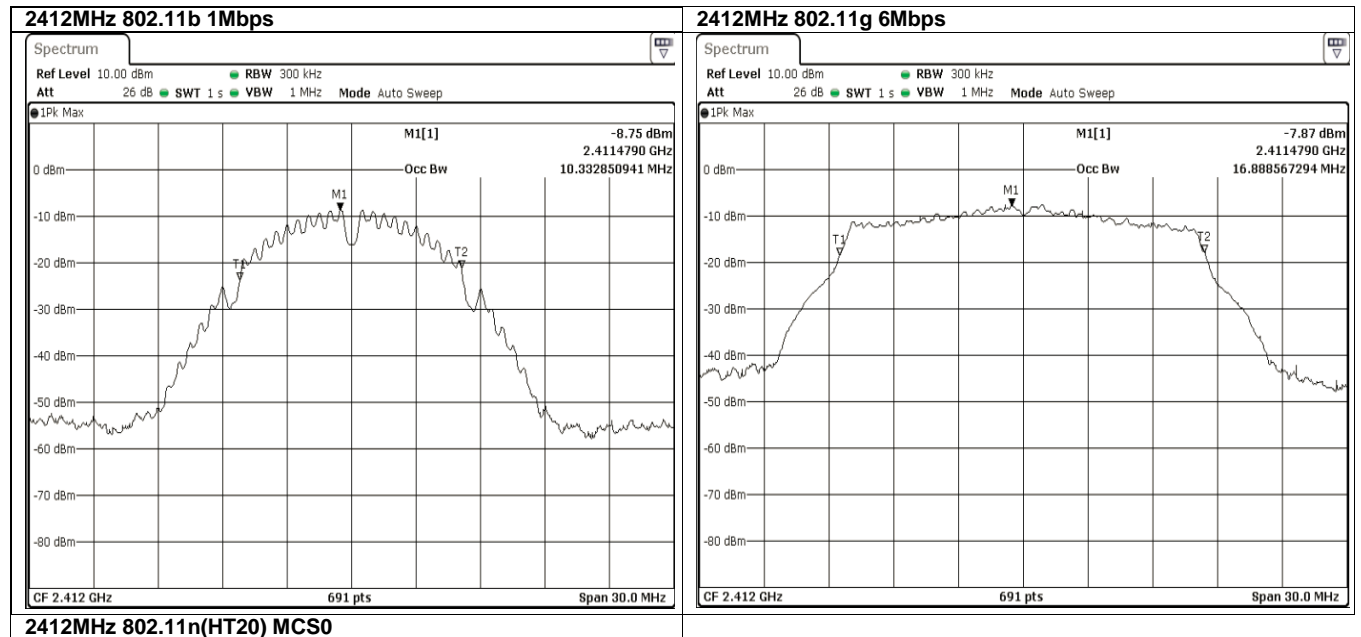


Occupied Channel Bandwidth 99%

Test according to ISED Canada RSS-Gen Issues 5 Section 6.7

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

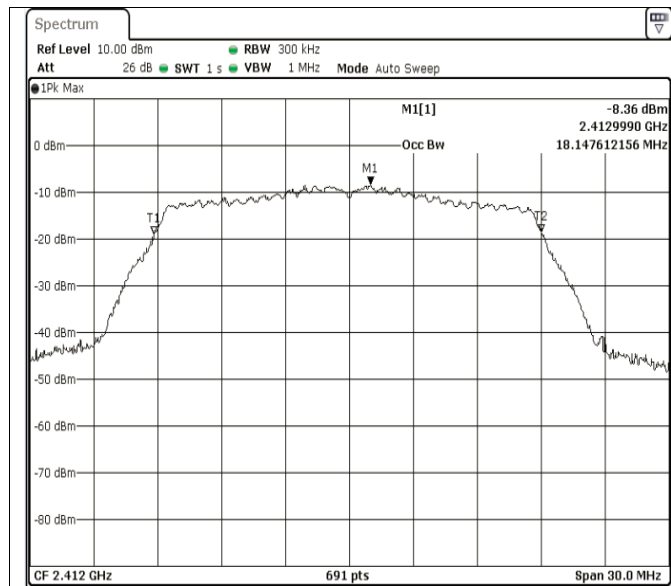
Data Rate	DUT Frequency (MHz)	Bandwidth (MHz)
802.11b 1 Mbps	2412.000	10.332850
802.11g 6 Mbps	2412.000	16.888567
802.11n(HT20) MCS0	2412.000	18.147612
802.11b 1 Mbps	2437.000	10.549927
802.11g 6 Mbps	2437.000	16.931982
802.11n(HT20) MCS0	2437.000	18.104196
802.11b 1 Mbps	2462.000	10.419681
802.11g 6 Mbps	2462.000	16.888567
802.11n(HT20) MCS0	2462.000	18.147612

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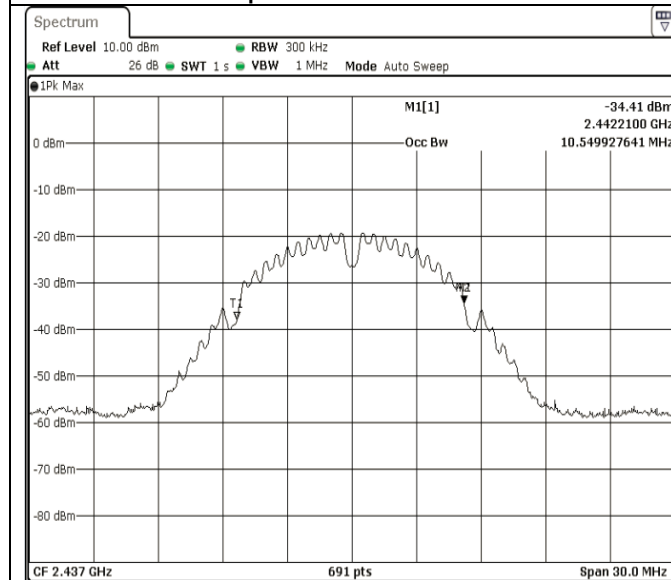
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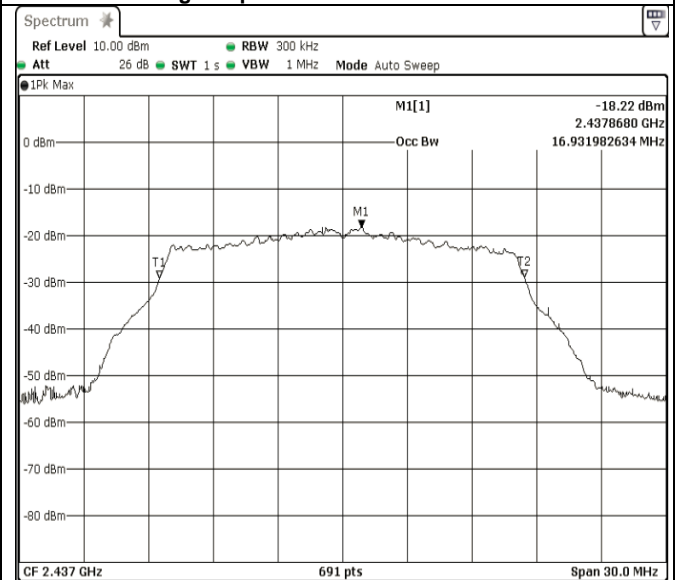


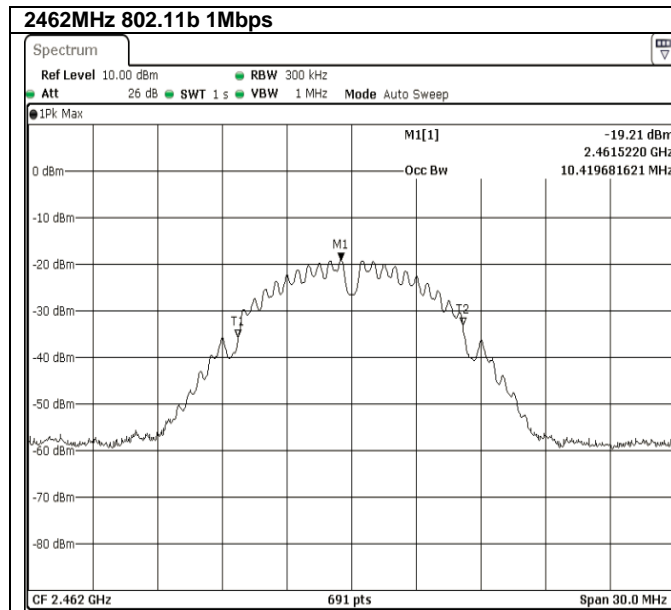
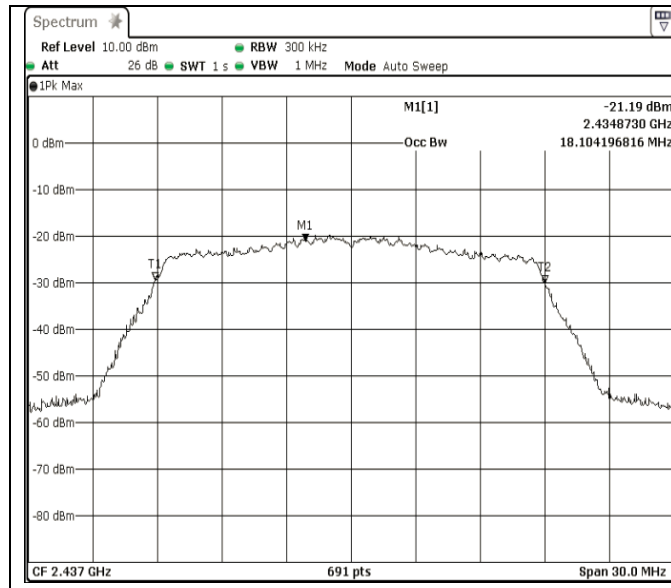
2437MHz 802.11b 1Mbps



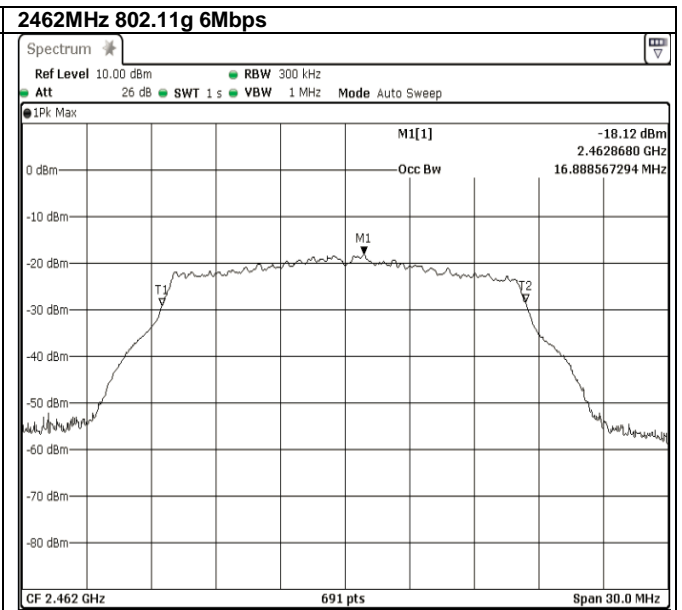
2437MHz 802.11n(HT20) MCS0

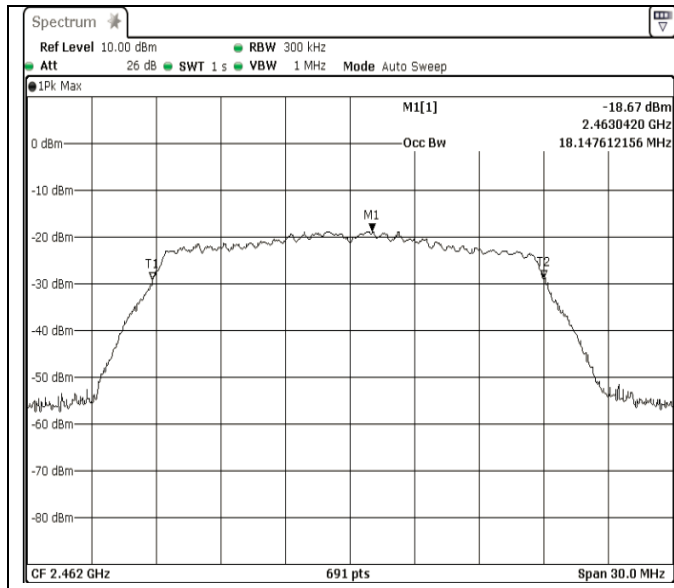
2437MHz 802.11g 6Mbps





2462MHz 802.11n(HT20) MCS0

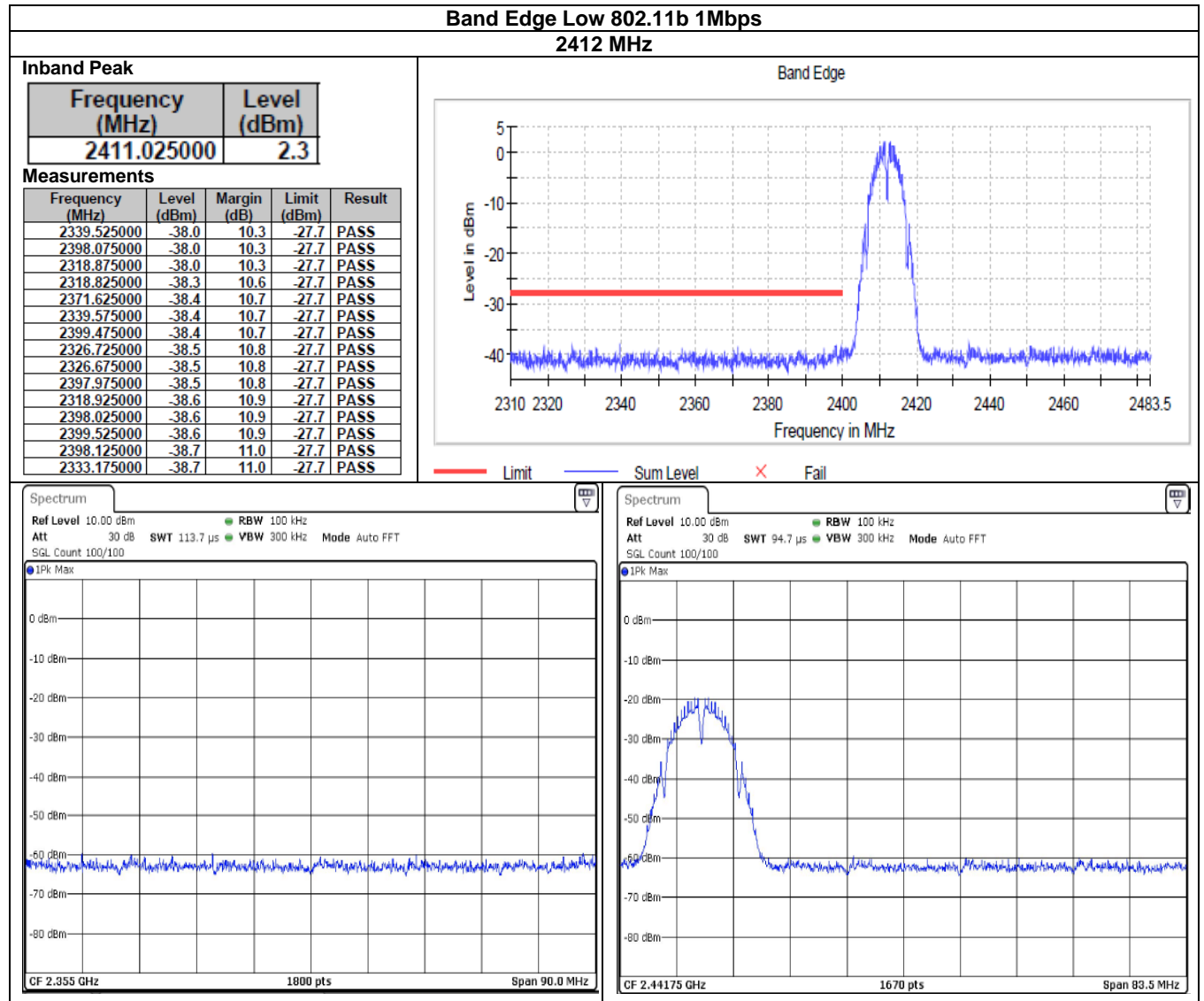




Conducted Band Edge

Test according to FCC KDB 558074 D01 15.247 Meas Guidance v05 Section 8.7

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

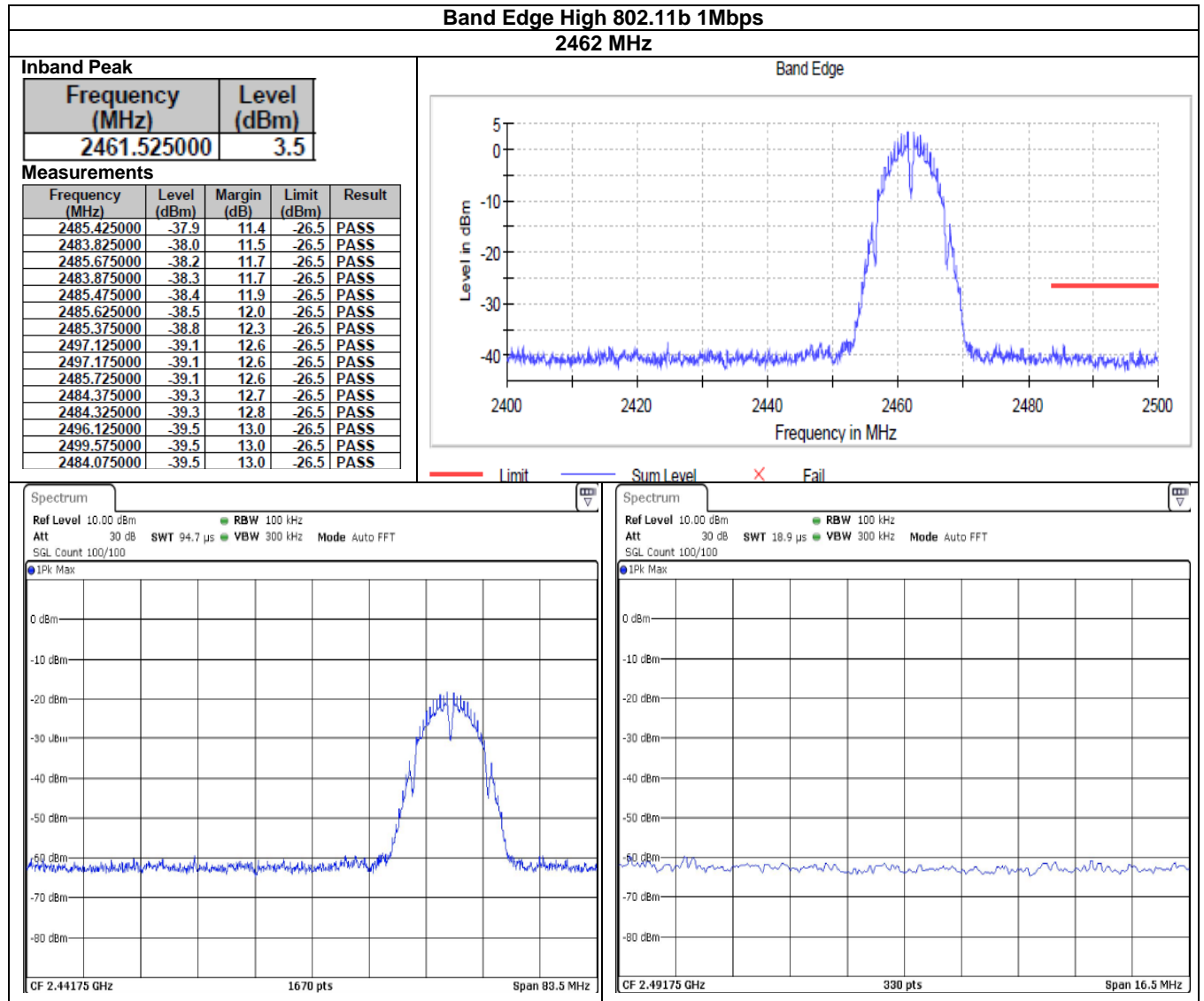


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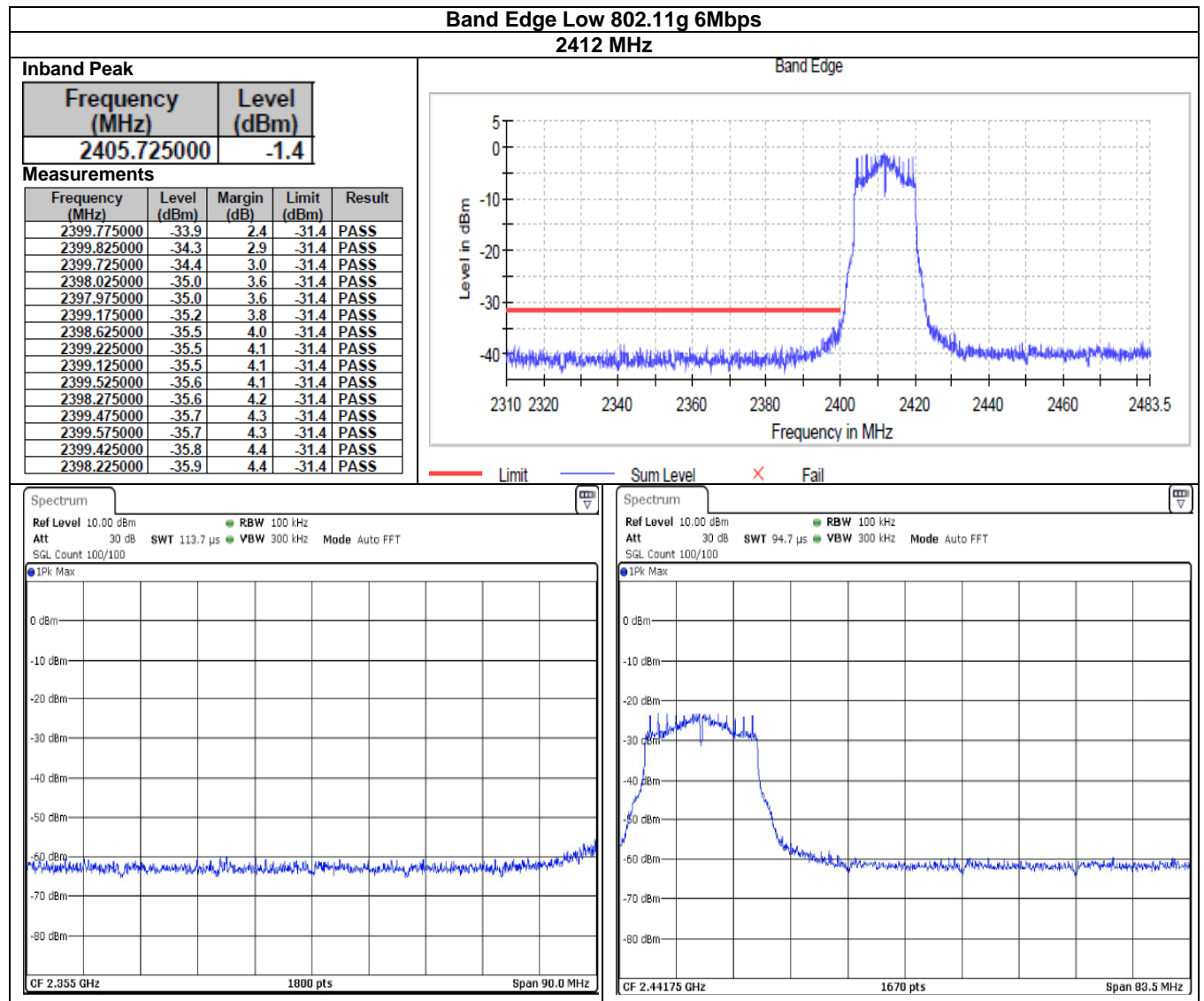




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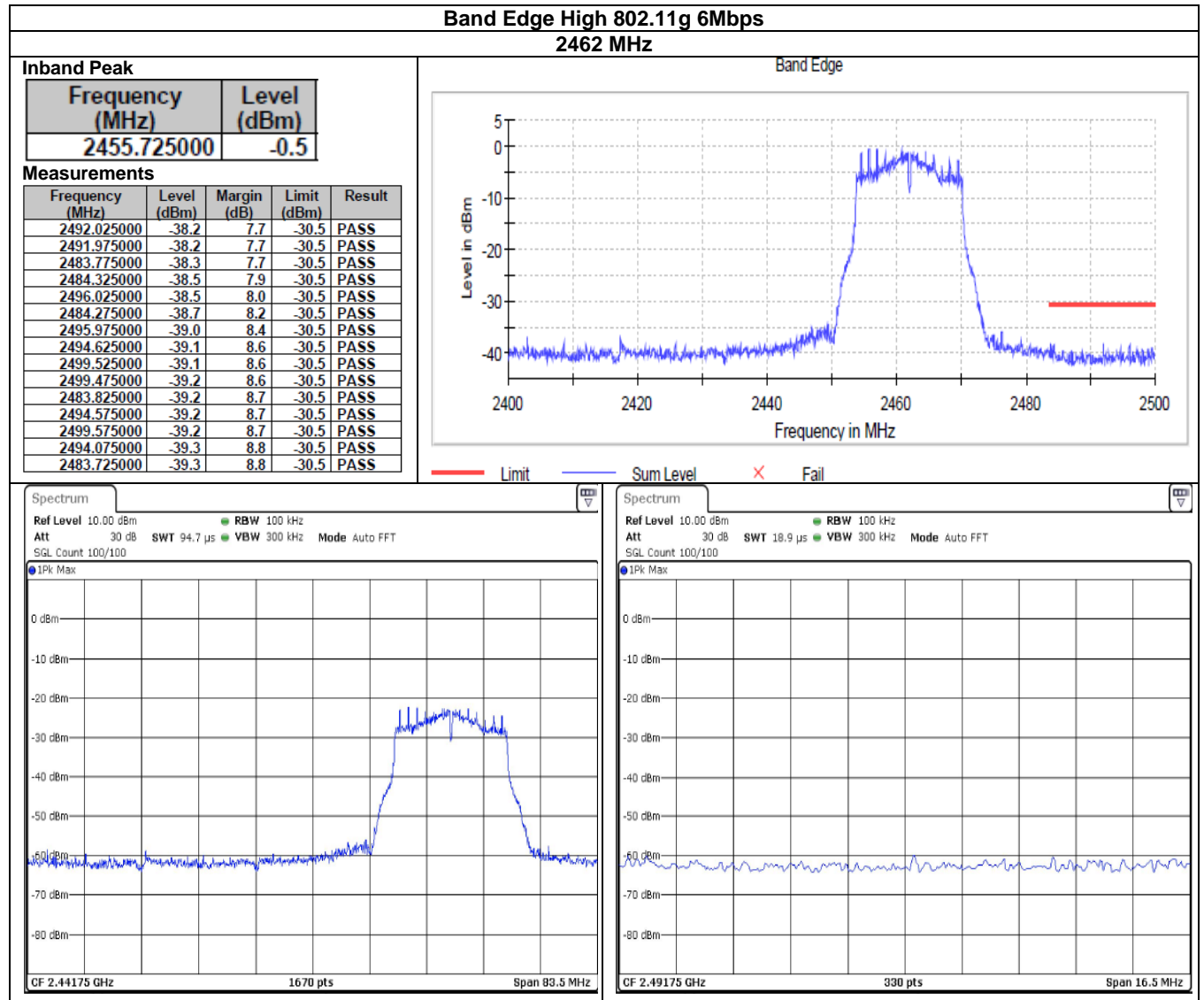


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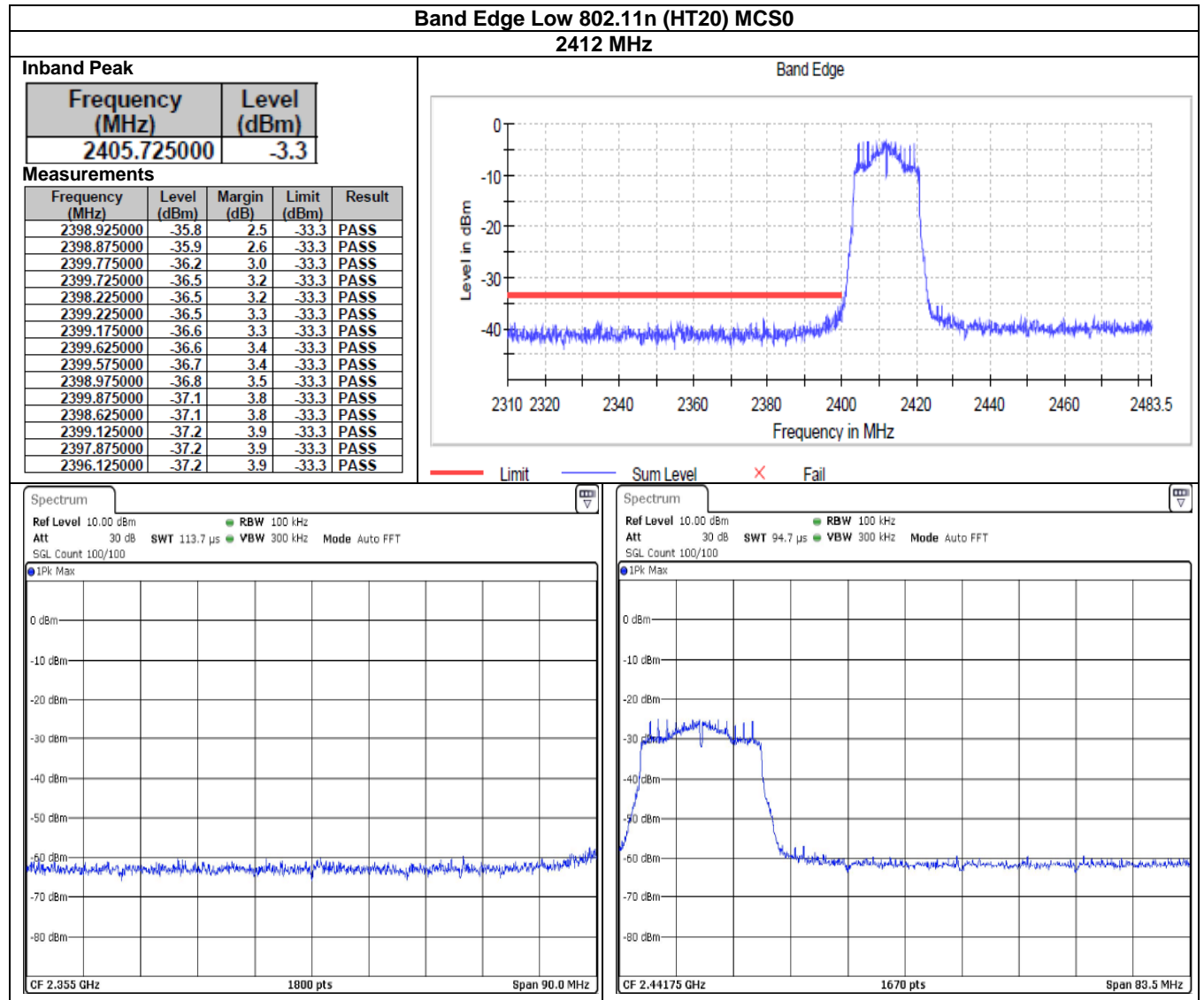


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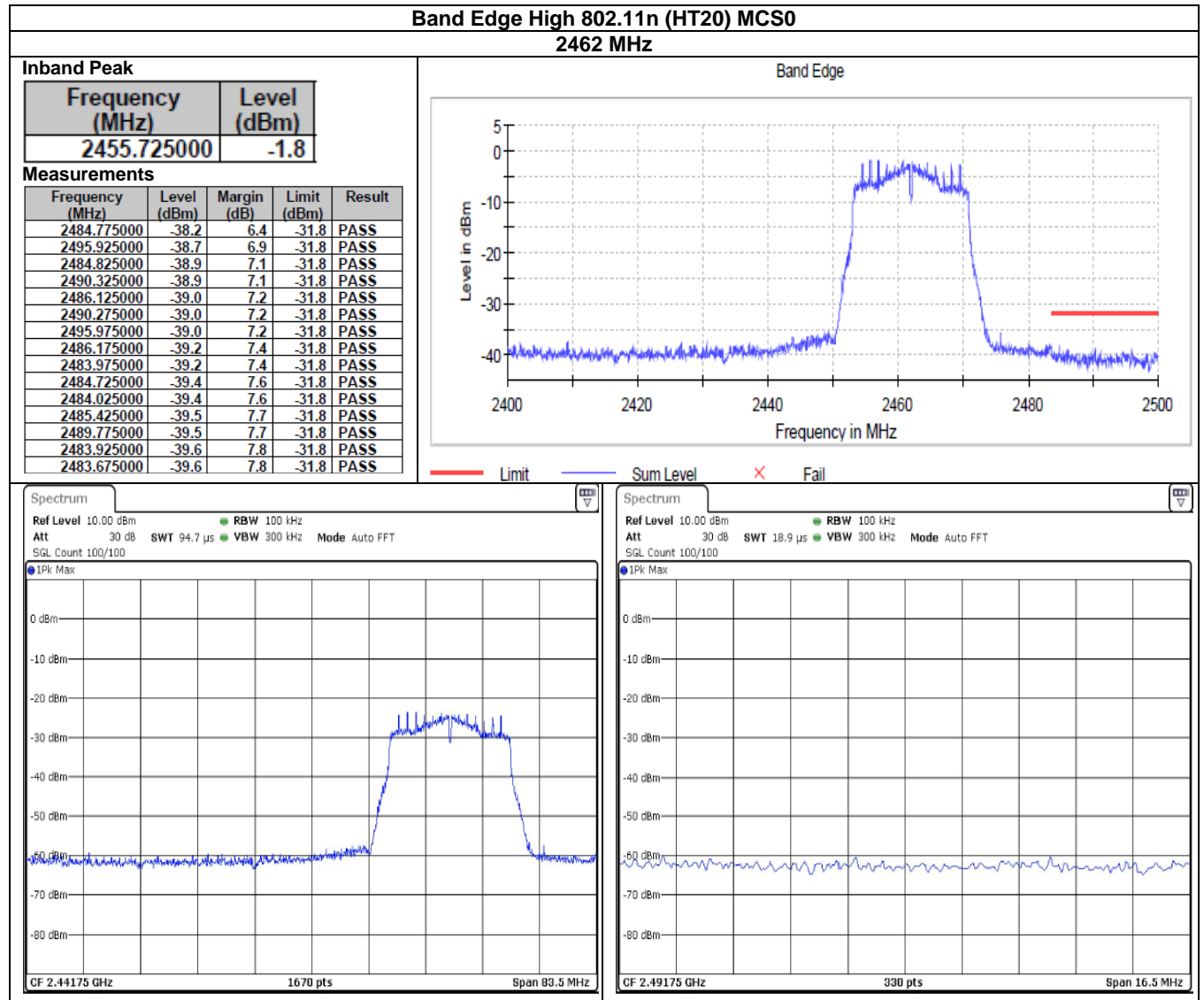


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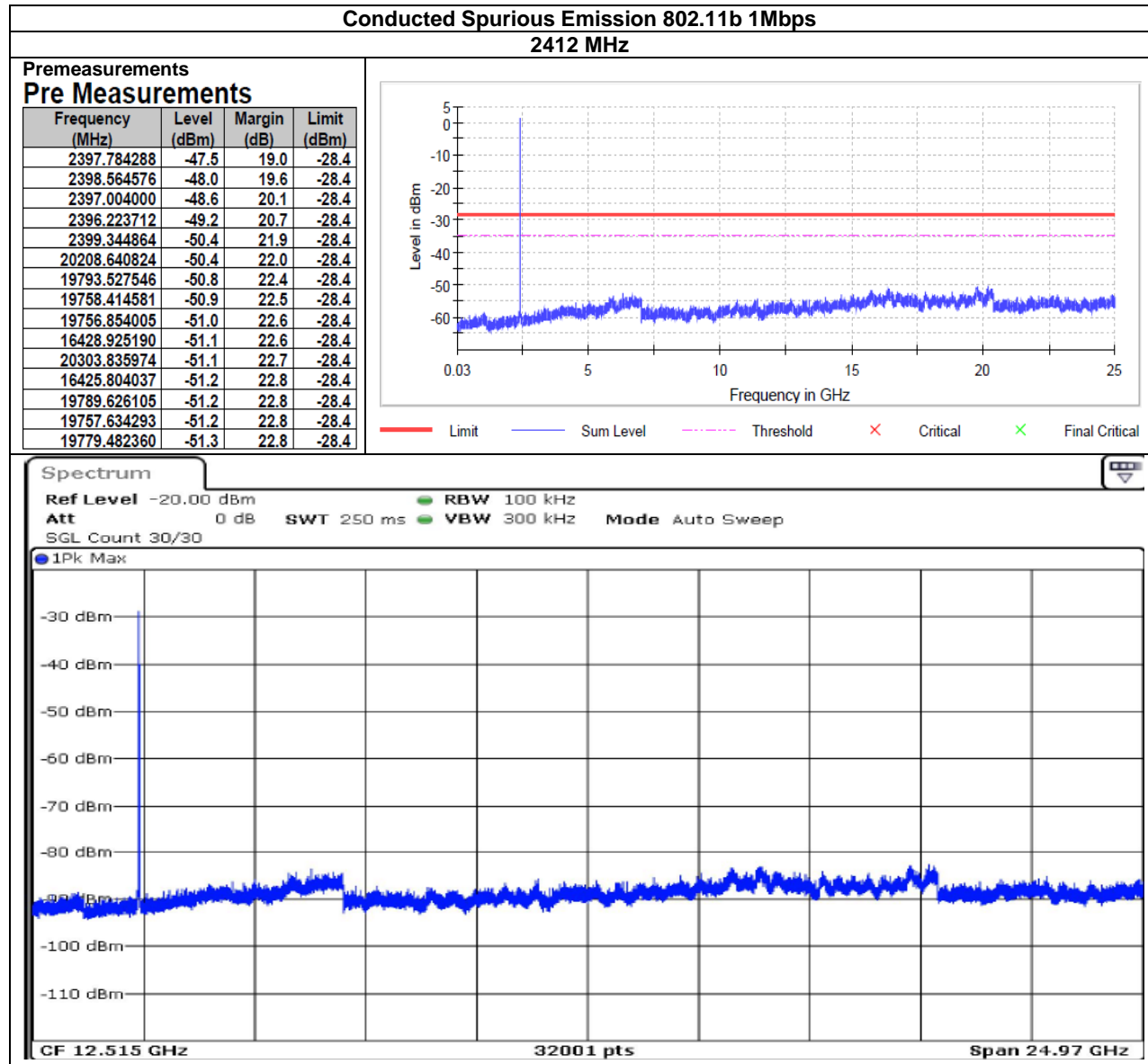
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Conducted Spurious Emissions

Test according to FCC KDB 558074 D01 15.247 Meas Guidance v05 Section 8.5

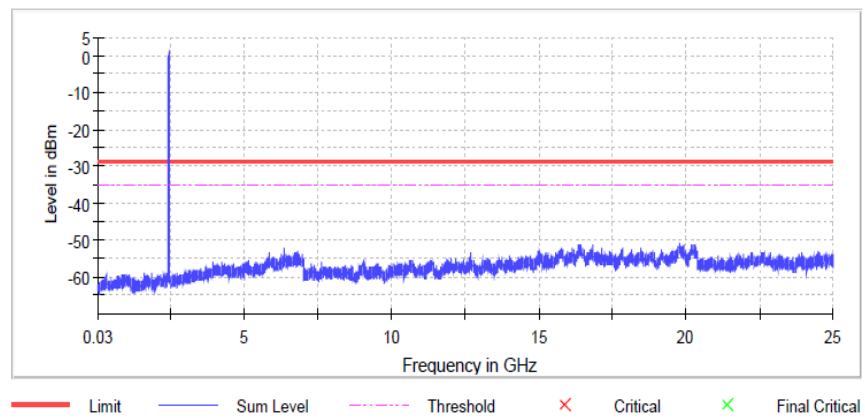
Measurement uncertainty calculated in accordance with ETSI TR 100 028-1. Expanded Uncertainty (K=2) < 1.8 dB



Conducted Spurious Emission 802.11b 1Mbps 2437 MHz

Premeasurements

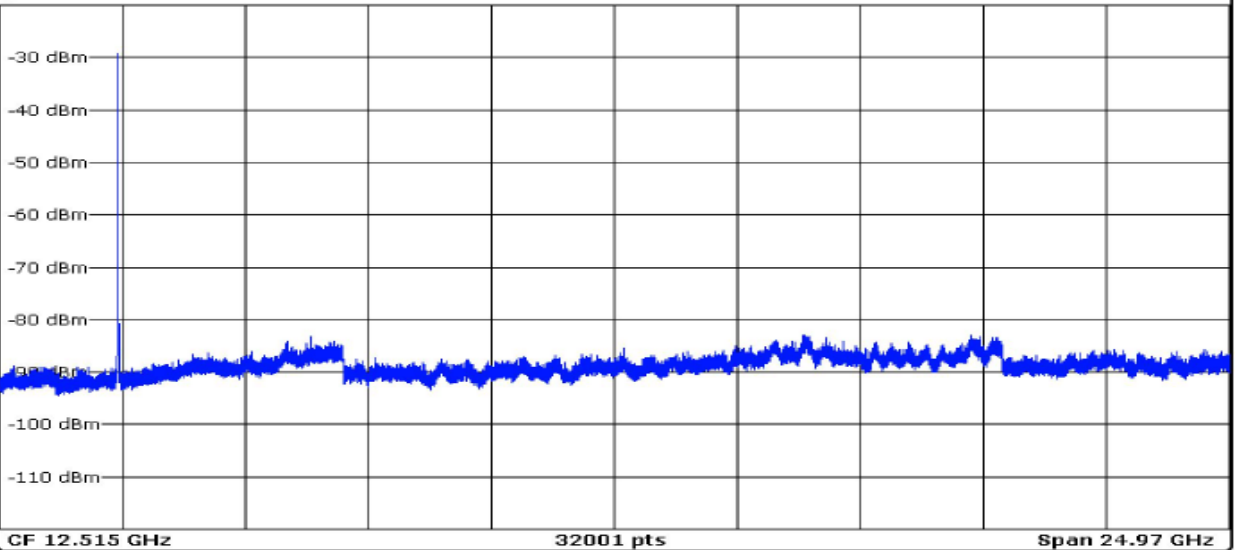
Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)
19765.437174	-51.0	22.1	-28.9
19760.755445	-51.0	22.2	-28.9
16398.493953	-51.1	22.3	-28.9
16344.654073	-51.1	22.3	-28.9
16408.637699	-51.1	22.3	-28.9
20187.573045	-51.2	22.3	-28.9
20245.314365	-51.2	22.3	-28.9
16372.744445	-51.2	22.3	-28.9
16455.454986	-51.2	22.4	-28.9
19941.002000	-51.2	22.4	-28.9
20207.860536	-51.3	22.4	-28.9
16407.857411	-51.3	22.5	-28.9
16422.682885	-51.3	22.5	-28.9
20289.790788	-51.3	22.5	-28.9
20290.571076	-51.4	22.5	-28.9



Spectrum

Ref Level -20.00 dBm
Att 0 dB
SGL Count 30/30
RBW 100 kHz
VBW 300 kHz
Mode Auto Sweep

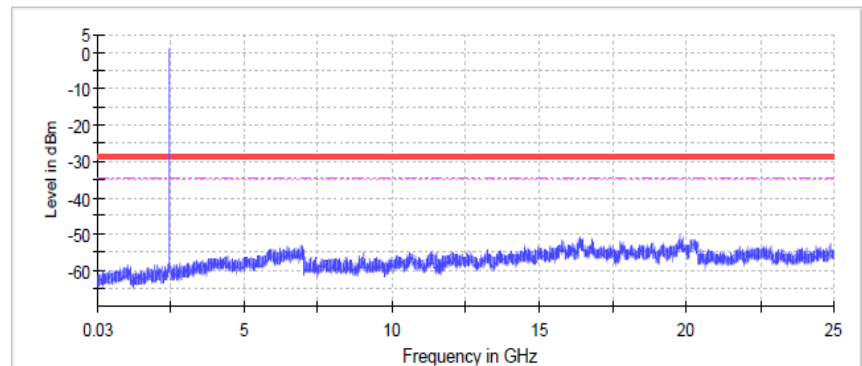
1Pk Max



Conducted Spurious Emission 802.11b 1Mbps 2462 MHz

Premeasurements

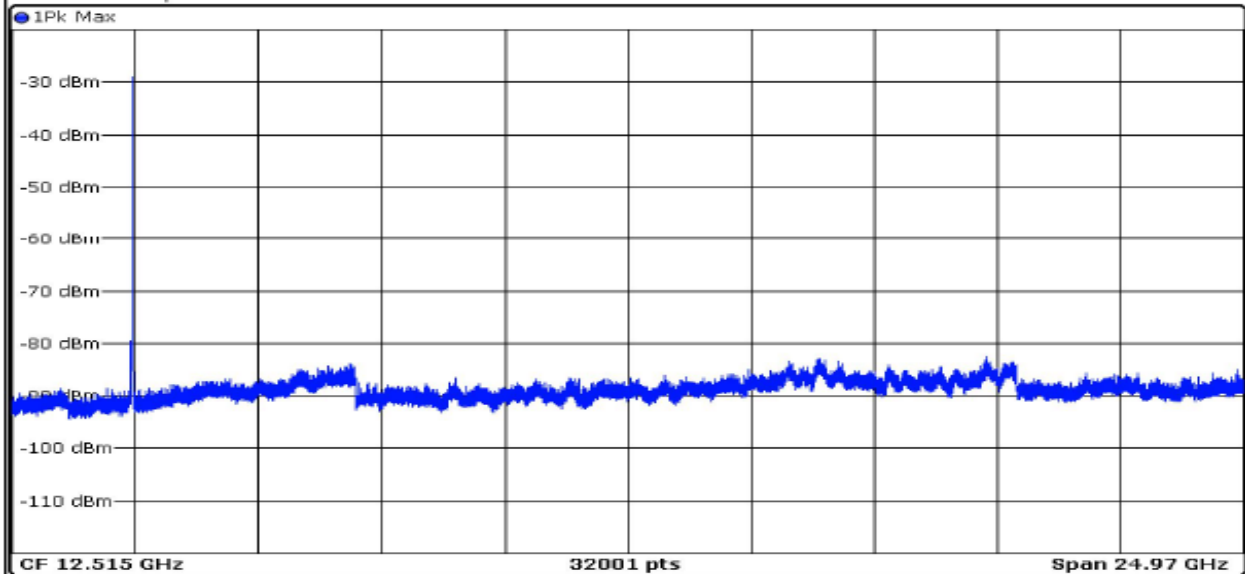
Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)
19781.042936	-50.4	21.7	-28.7
19788.065529	-50.7	21.9	-28.7
19789.626105	-50.8	22.0	-28.7
16398.493953	-51.0	22.3	-28.7
16503.832849	-51.1	22.4	-28.7
19795.088122	-51.2	22.5	-28.7
19770.118903	-51.2	22.5	-28.7
19764.656886	-51.2	22.5	-28.7
16381.327615	-51.3	22.5	-28.7
16393.031937	-51.3	22.5	-28.7
19765.437174	-51.3	22.6	-28.7
16411.758851	-51.3	22.6	-28.7
16361.040124	-51.3	22.6	-28.7
19778.702072	-51.3	22.6	-28.7
16389.910784	-51.3	22.6	-28.7



— Limit — Sum Level - - - Threshold × Critical × Final Critical

Spectrum

Ref Level -20.00 dBm Att 0 dB RBW 100 kHz
SGL Count 30/30 Mode Auto Sweep

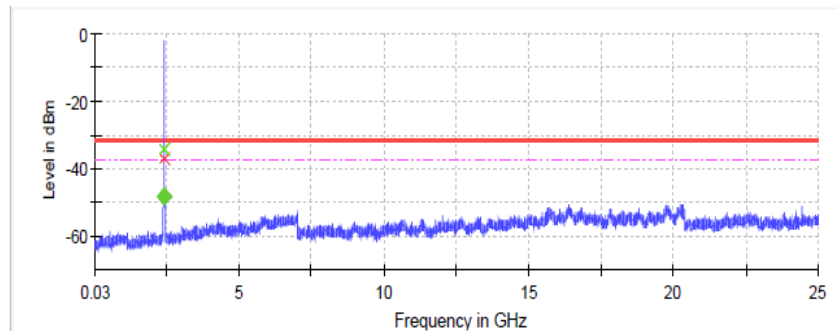


**Conducted Spurious Emission 802.11g 6Mbps
2412 MHz****Final Measurements**

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)
2399.344864	-48.2	16.5	-31.7

Premeasurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)
2399.344864	-34.2	2.5	-31.7
2398.564576	-37.0	5.3	-31.7
2397.784288	-38.5	6.8	-31.7
2396.223712	-38.6	6.9	-31.7
2397.004000	-38.6	7.0	-31.7
2395.443424	-40.8	9.1	-31.7
2394.663136	-42.6	10.9	-31.7
2393.102559	-43.2	11.6	-31.7
2392.322271	-43.2	11.6	-31.7
2393.882847	-43.4	11.7	-31.7
2391.541983	-45.6	13.9	-31.7
2389.981407	-45.8	14.1	-31.7
2390.761695	-45.9	14.2	-31.7
2389.201119	-47.8	16.1	-31.7
2388.420831	-49.7	18.1	-31.7



Limit Final Critical Sum Level Fail Threshold Pass Critical

Spectrum

Ref Level -20.00 dBm

Att 0 dB

SWT 250 ms

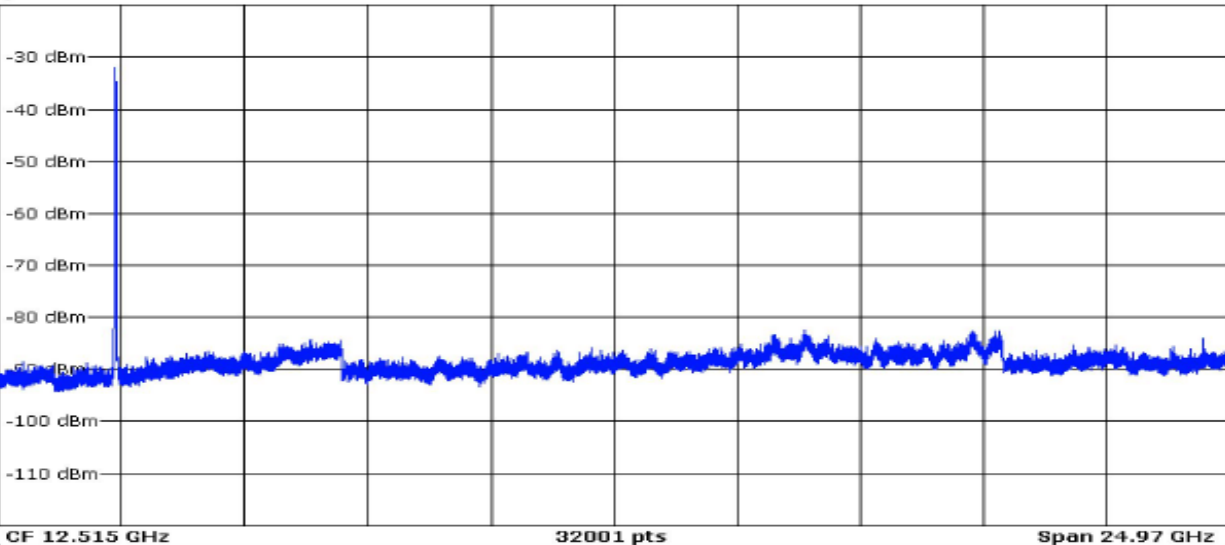
RBW 100 kHz

VBW 300 kHz

Mode Auto Sweep

SGL Count 30/30

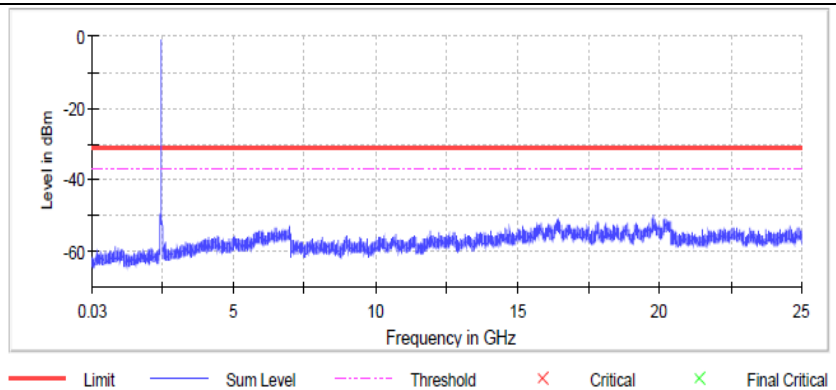
IPk Max



Conducted Spurious Emission 802.11g 6Mbps 2437 MHz

Premeasurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)
16432.826630	-49.8	17.8	-32.0
20208.640824	-49.9	17.9	-32.0
16356.358395	-50.3	18.3	-32.0
19774.020343	-50.6	18.7	-32.0
19790.406394	-50.6	18.7	-32.0
16359.479548	-51.0	19.1	-32.0
16405.516546	-51.1	19.1	-32.0
16439.068935	-51.2	19.2	-32.0
2485.956845	-51.3	19.3	-32.0
16397.713665	-51.3	19.3	-32.0
2485.176557	-51.3	19.4	-32.0
16413.319428	-51.3	19.4	-32.0
20271.844161	-51.3	19.4	-32.0
20233.610043	-51.3	19.4	-32.0
16441.409800	-51.3	19.4	-32.0

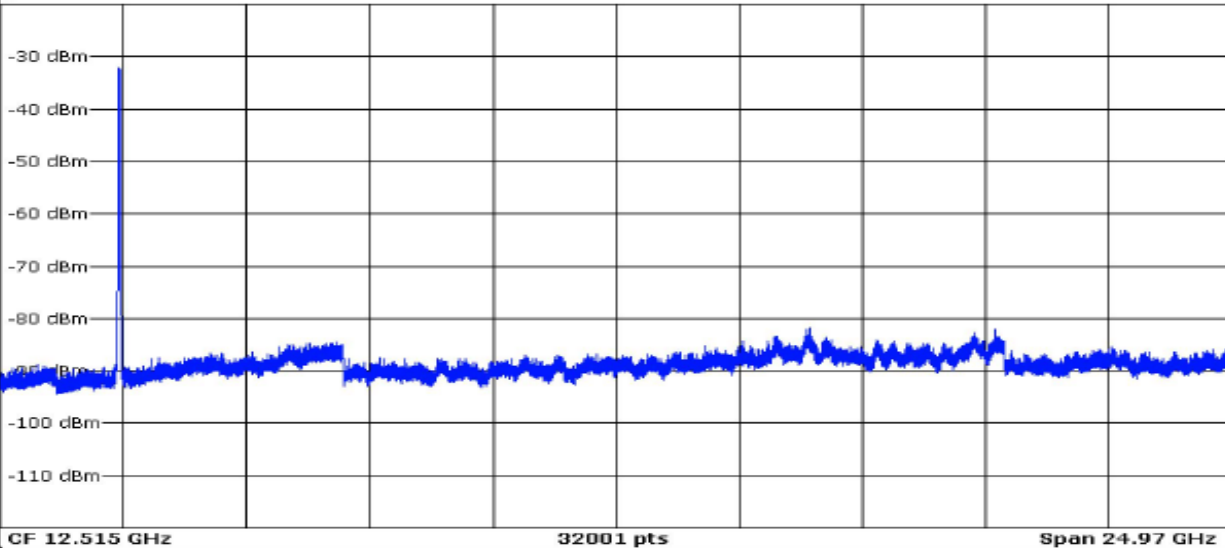


Spectrum

Ref Level -20.00 dBm
Att 0 dB
SGL Count 30/30

RBW 100 kHz
VBW 300 kHz
Mode Auto Sweep
SWT 250 ms

1Pk Max



CF 12.515 GHz

32001 pts

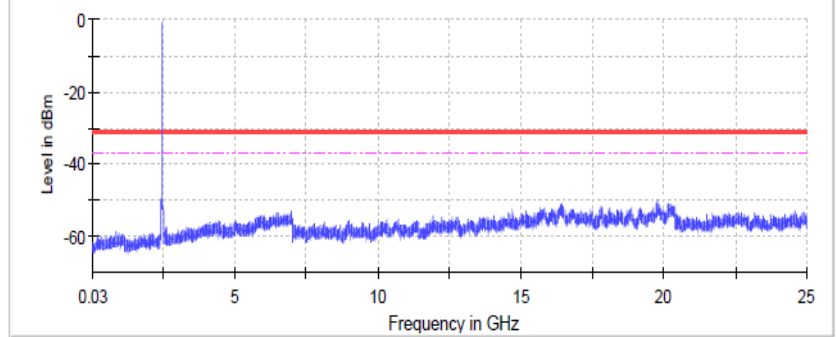
Span 24.97 GHz



Conducted Spurious Emission 802.11g 6Mbps 2462 MHz

Premeasurements

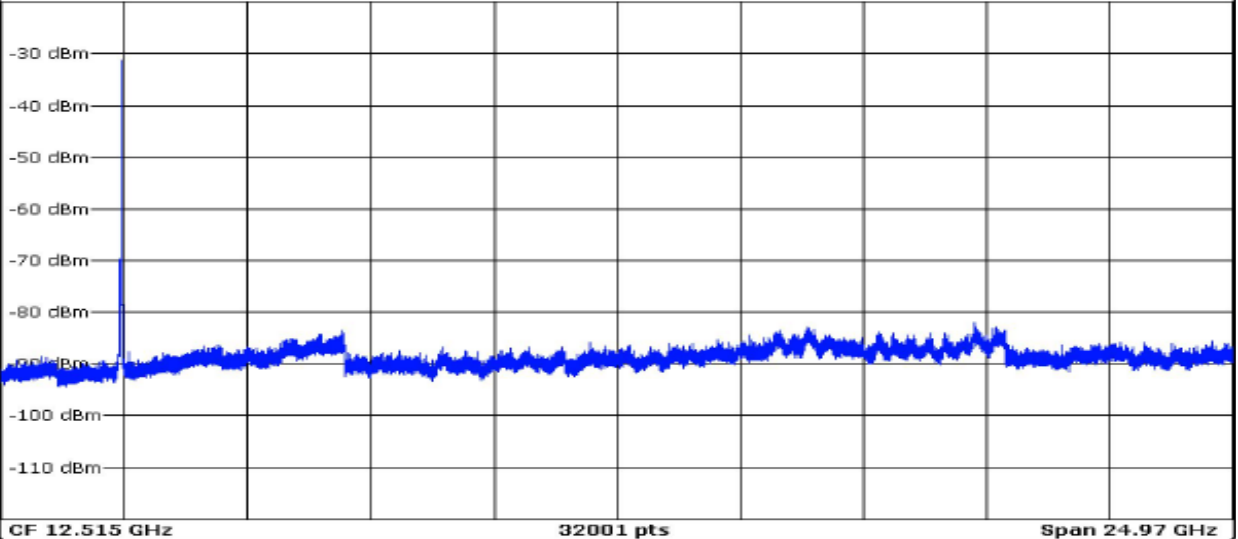
Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)
19765.437174	-50.0	19.1	-30.9
19766.217462	-50.3	19.4	-30.9
19740.467954	-50.5	19.6	-30.9
20195.375926	-50.7	19.8	-30.9
19764.656886	-50.8	19.8	-30.9
2485.956845	-50.9	19.9	-30.9
19795.088122	-50.9	19.9	-30.9
19780.262648	-51.0	20.0	-30.9
16413.319428	-51.0	20.1	-30.9
20139.975470	-51.1	20.2	-30.9
19766.997750	-51.1	20.2	-30.9
19763.096309	-51.2	20.3	-30.9
16368.062717	-51.2	20.3	-30.9
20235.170620	-51.3	20.3	-30.9
19829.420799	-51.3	20.4	-30.9



Spectrum

Ref Level -20.00 dBm
Att 0 dB
SGL Count 30/30
RBW 100 kHz
VBW 300 kHz
Mode Auto Sweep
SWT 250 ms

1Pk Max

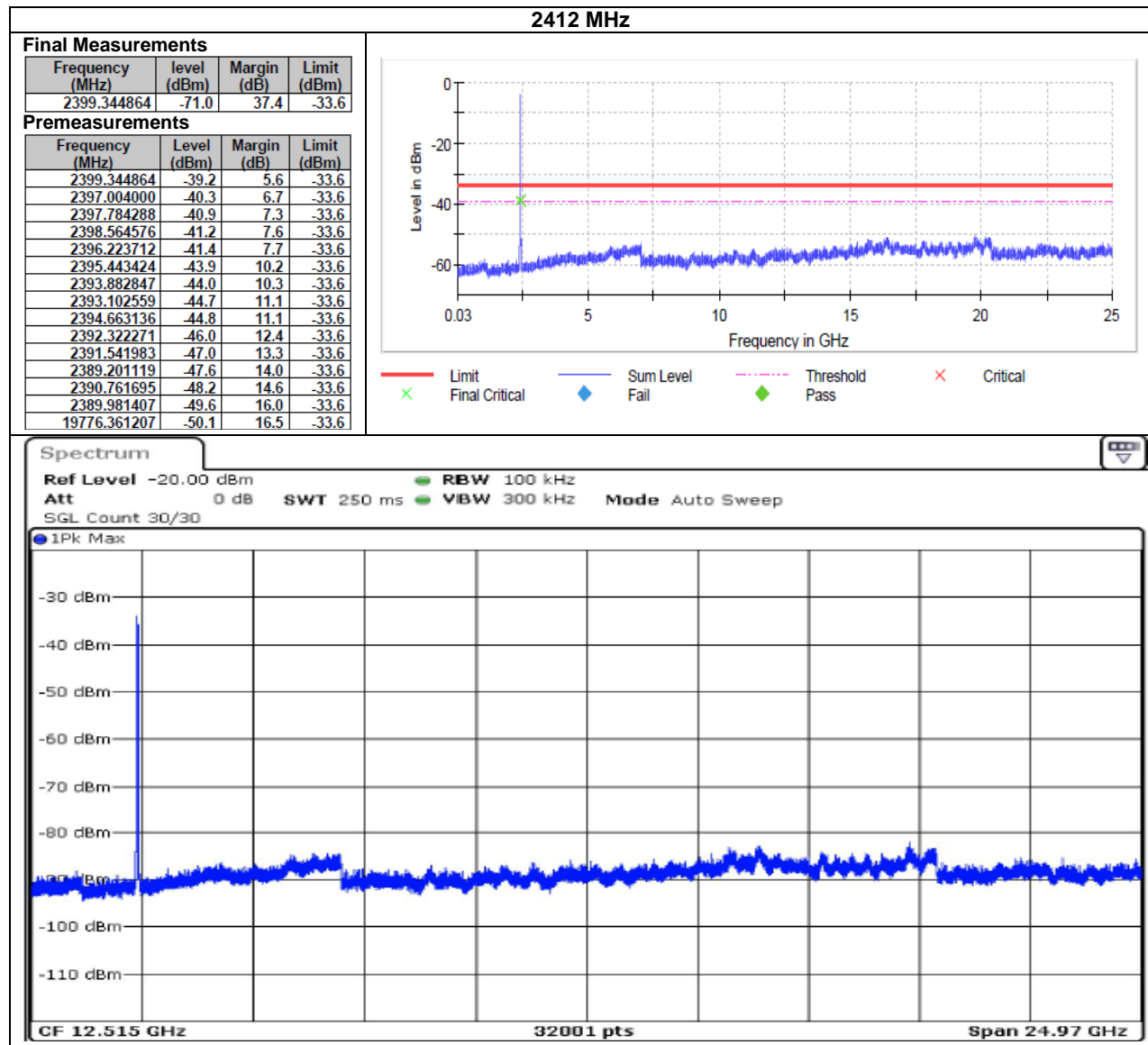


Conducted Spurious Emission 802.11n (HT20) MCS0



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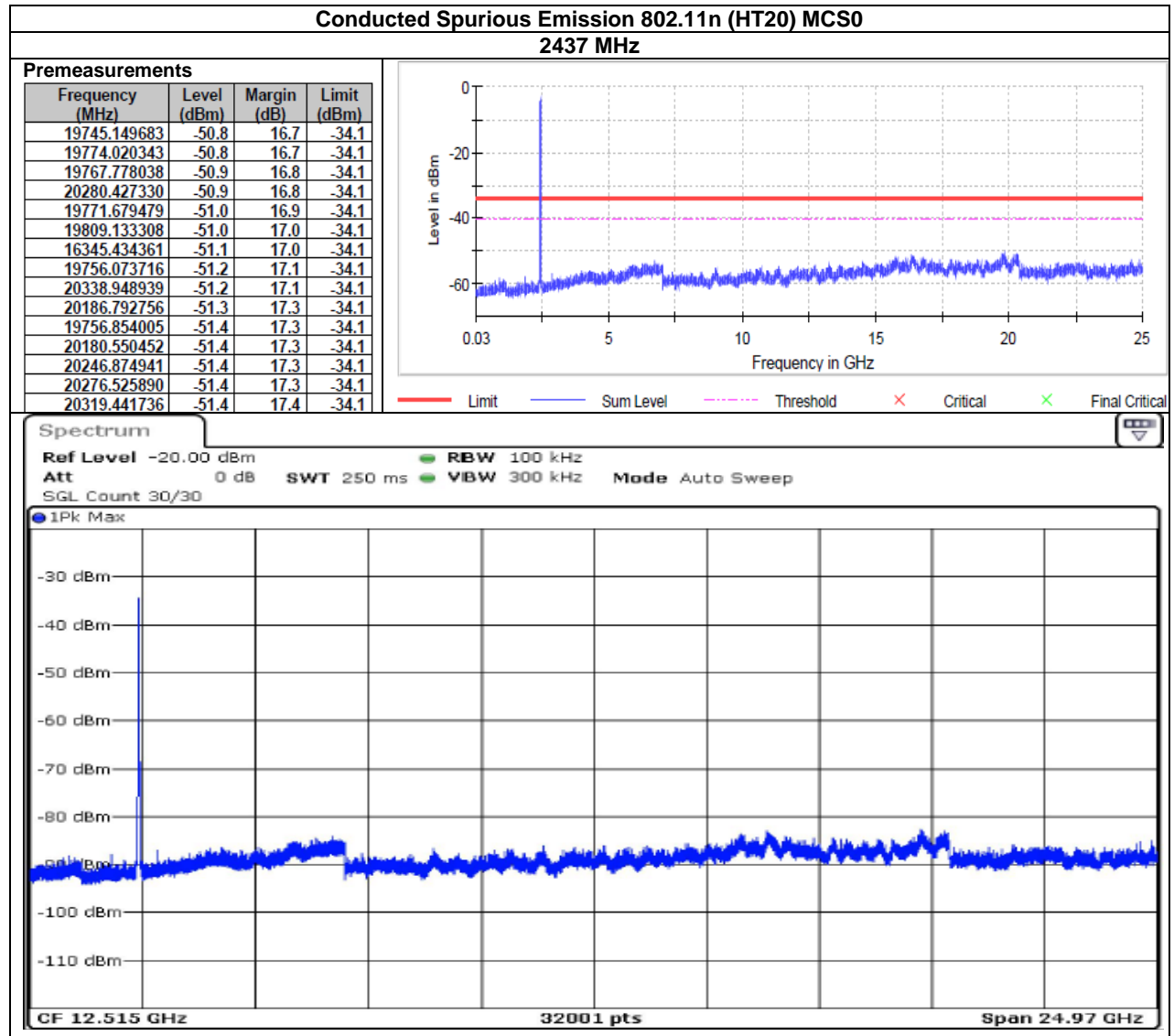


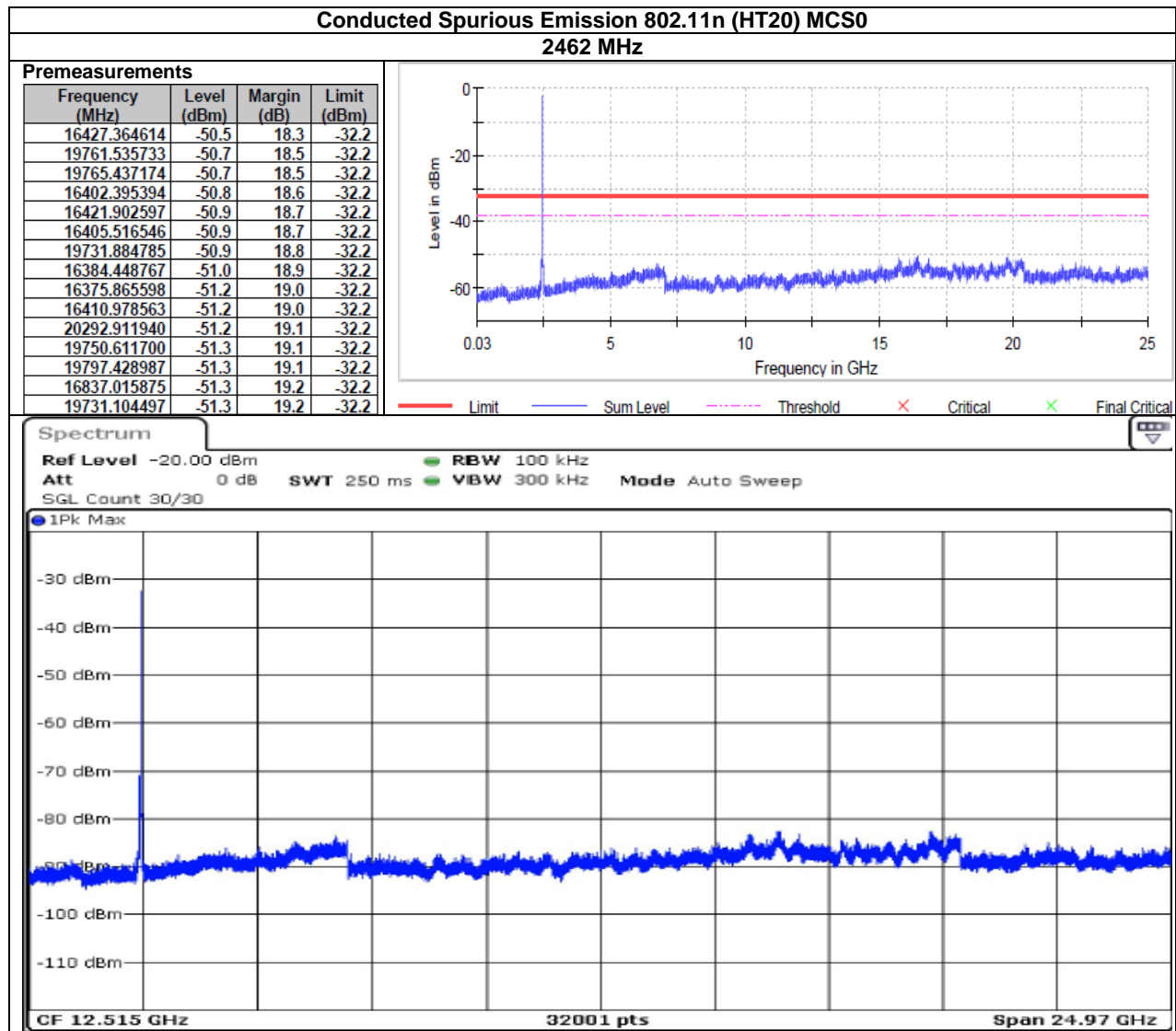
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