NORTHWEST EMC

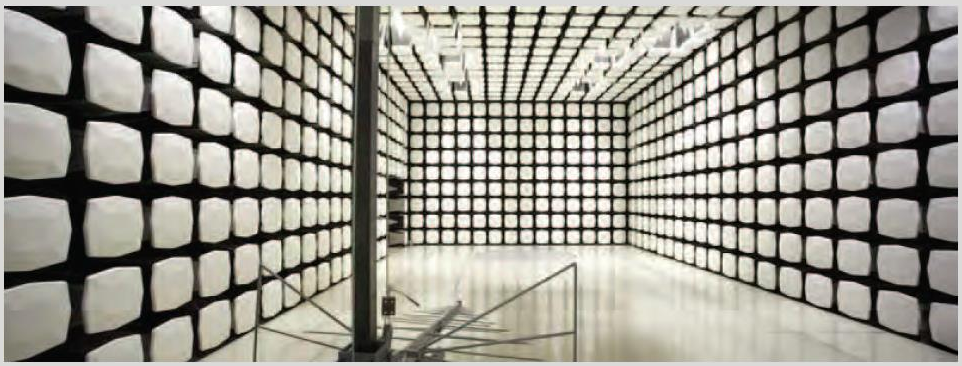
Microsoft Corporation

1790

FCC 15.247:2016

802.11gn SISO Radio

Report # MCSO1761 Rev 01



NVLAP TESTING

NVLAP Lab Code: 200629-0

CERTIFICATE OF TEST

NORTHWEST EMC
2014-12-10

Last Date of Test: December 08, 2016
Microsoft Corporation
Model: 1790

Radio Equipment Testing

Standards

Specification	Method
FCC 15.207:2016	ANSI C63.10:2013
FCC 15.247:2016	KDB 558074

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	AC - Powerline Conducted Emissions	Yes	Pass	
6.5, 6.6, 11.12.1, 11.13.2	Spurious Radiated Emissions	Yes	Pass	
11.6	Duty Cycle	Yes	Pass	
11.8.2	Occupied Bandwidth	Yes	Pass	
11.9.2.2.4	Output Power	Yes	Pass	
11.10.2	Power Spectral Density	Yes	Pass	
11.11	Band Edge Compliance	Yes	Pass	
11.11	Spurious Conducted Emissions	Yes	Pass	

Deviations From Test Standards

None

Approved By:

Rod Munro, Operations Manager

Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information.

REVISION HISTORY

NORTHWEST EMC
REV 2014.10.14

Revision Number	Description	Date	Page Number
01	Revised EUT description	5/22/17	9

ACCREDITATIONS AND AUTHORIZATIONS

REV 2016.7.25

United States

FCC - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

A2LA - Accredited by A2LA to ISO / IEC 17065 as a product certifier. This allows Northwest EMC to certify transmitters to FCC and IC specifications.

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

ISED - Recognized by Innovation, Science and Economic Development Canada as a Certification Body (CB). Certification chambers and Open Area Test Sites are filed with ISED.

European Union

European Commission – Validated by the European Commission as a Notified Body under the R&TTE Directive.

Australia/New Zealand

ACMA - Recognized by ACMA as a CAB for the acceptance of test data.

Korea

MSIP / RRA - Recognized by KCC's RRA as a CAB for the acceptance of test data.

Japan

VCCI - Associate Member of the VCCI. Conducted and radiated measurement facilities are registered.

Taiwan

BSMI – Recognized by BSMI as a CAB for the acceptance of test data.

NCC - Recognized by NCC as a CAB for the acceptance of test data.

Singapore

IDA – Recognized by IDA as a CAB for the acceptance of test data.

Israel

MOC – Recognized by MOC as a CAB for the acceptance of test data.

Hong Kong

OFCA – Recognized by OFCA as a CAB for the acceptance of test data.

Vietnam

MIC – Recognized by MIC as a CAB for the acceptance of test data.

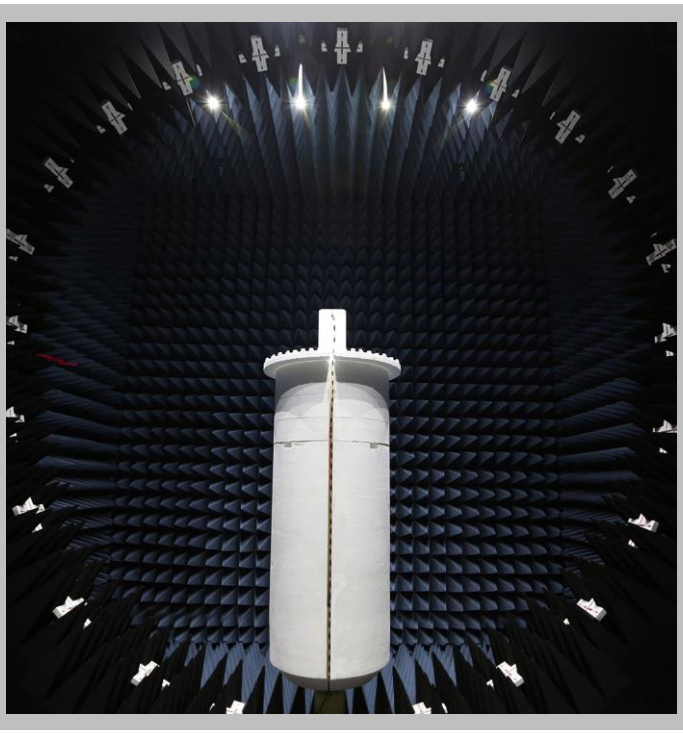
SCOPE

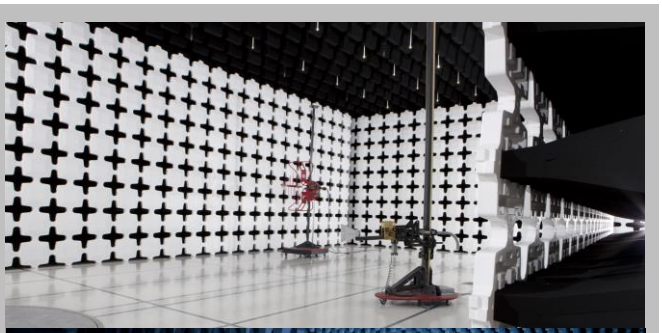
For details on the Scopes of our Accreditations, please visit:
http://www.nwemc.com/accreditations/
http://gsi.nist.gov/global/docs/cabs/designations.html

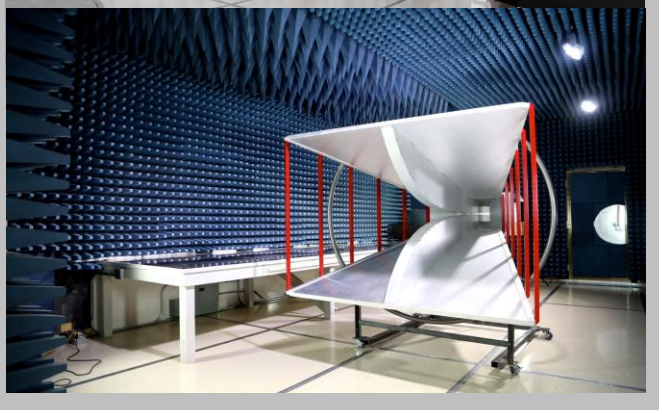
FACILITIES

NORTHWEST EMC
REV 2016.7.25

California	Minnesota	New York	Oregon	Texas	Washington
Labs OC01-13 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-08, MN10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 554-8214	Labs EV01-12 22975 NW Evergreen Pkwy Hillsboro, OR 97124 (503) 844-4066	Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Labs NC01-05 19201 120th Ave NE Bothell, WA 98011 (425)984-6600
NVLAP					
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200761-0	NVLAP Lab Code: 200630-0	NVLAP Lab Code:201049-0	NVLAP Lab Code: 200629-0
Innovation, Science and Economic Development Canada					
2834B-1, 2834B-3	2834E-1	N/A	2834D-1, 2834D-*2*	2834G-1	2834F-1
BSMI					
SL2-IN-E-1154R	SL2-IN-E-1152R	N/A	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI					
A-0029	A-0109	N/A	A-0108	A-0201	A-0110
Recognized Phase I CAB for ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA					
US0158	US0175	N/A	US0017	US0191	US0157







MEASUREMENT UNCERTAINTY

TMU.2015.07.10

Measurement Uncertainty

When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. Measurement uncertainty is a statistical expression of measurement error qualified by a probability distribution.

A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable test description page. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-2 as applicable), and are available upon request.

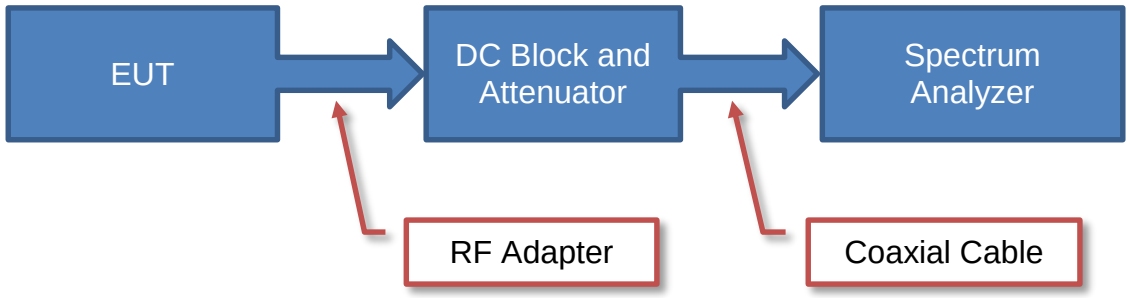
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.0 dB	-5.0 dB
AC Powerline Conducted Emissions (dB)	2.4 dB	-2.4 dB

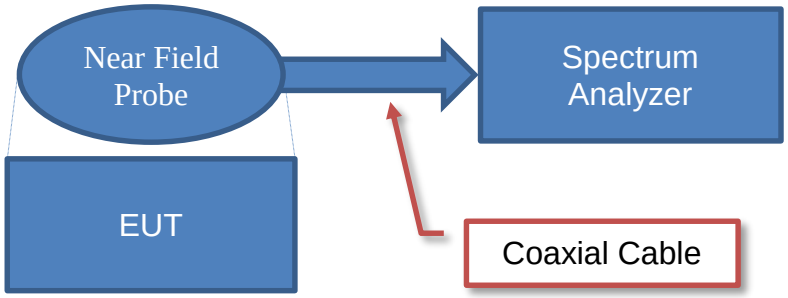
Test Setup Block Diagrams

NORTHWEST EMC
REV 2016.10.04

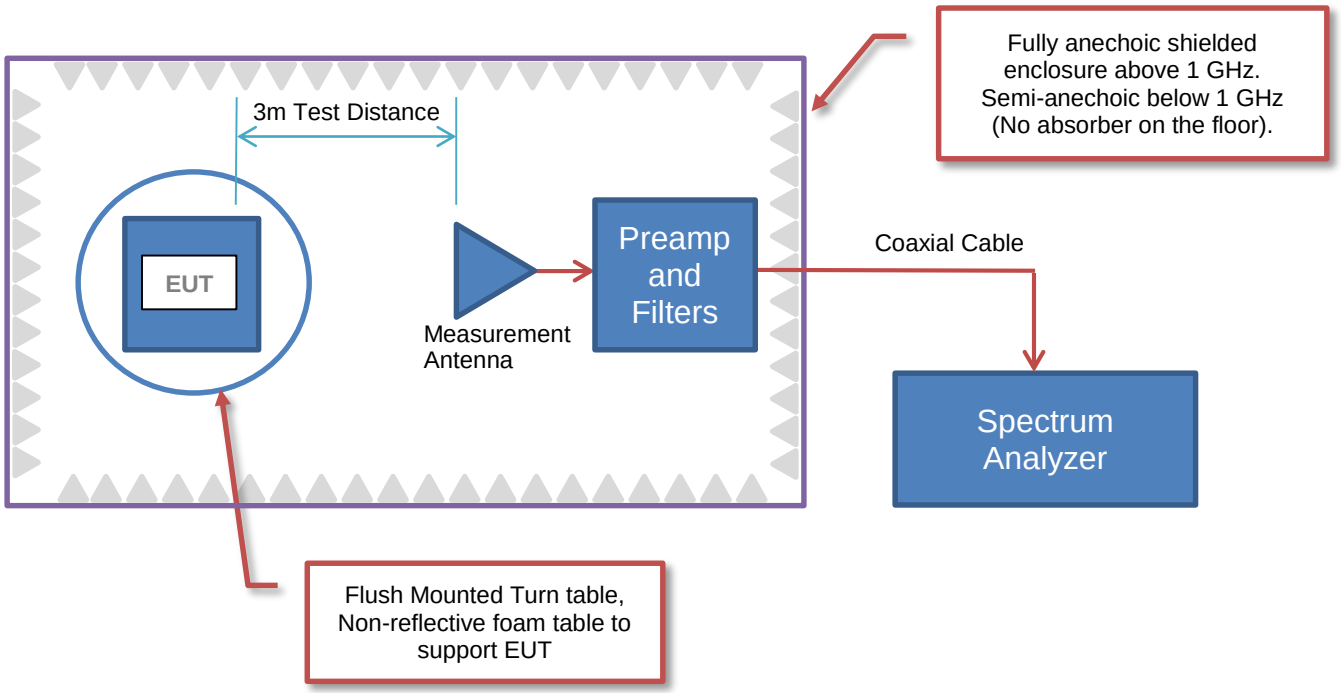
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	Microsoft Corporation
Address:	17760 NE 67th Ct, Redmond
City, State, Zip:	Redmond, WA 98052
Test Requested By:	Chaitrali Limaye
Model:	1790
First Date of Test:	October 28, 2016
Last Date of Test:	December 08, 2016
Receipt Date of Samples:	October 28, 2016
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
USB powered 802.11agn SISO radio with one antenna supporting 20 MHz channel bandwidth only.

Testing Objective:
To demonstrate compliance of the 802.11 radio under FCC 15.247 for operation in the 2.4 GHz band.

CONFIGURATIONS

NORTHWEST EMC 2014-12-10

Configuration MCSO1761- 1

Software/Firmware Running during test	
Description	**Version**
MT7662 QA	V1.0.3.13

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
USB Wireless Device	Microsoft Corporation	1790	DV-1-0546

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop PC	Lenovo	T420S	4054600
AC Adapter (Laptop)	Lenovo	ADLX65NDT2A	None

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB Extension	No	1.2m	No	Laptop PC	USB Wireless Device
AC Power	No	1.0m	No	AC Mains	AC Adapter (Laptop)
DC Power	No	2.0m	Yes	AC Adapter (Laptop)	Laptop PC

Configuration MCSO1761- 4

Software/Firmware Running during test	
Description	**Version**
MT7662 QA	V1.0.3.13

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
USB Wireless Device	Microsoft Corporation	1790	DV-1-0336

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop PC	Lenovo	T420S	4054600
AC Adapter (Laptop)	Lenovo	ADLX65NDT2A	None

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB Extension	No	1.2m	No	Laptop PC	USB Wireless Device
AC Power	No	1.0m	No	AC Mains	AC Adapter (Laptop)
DC Power	No	2.0m	Yes	AC Adapter (Laptop)	Laptop PC

MODIFICATIONS

NORTHWEST EMC
2014-12-10

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	10/28/2016	Duty Cycle	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
2	10/28/2016	Occupied Bandwidth	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
3	10/28/2016	Output Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
4	10/28/2016	Power Spectral Density	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
5	10/28/2016	Band Edge Compliance	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
6	10/28/2016	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
7	11/22/2016	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
8	12/08/2016	AC – Powerline Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

AC - POWERLINE CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2016.09.09

TEST DESCRIPTION

Using the mode of operation and configuration noted within this report, conducted emissions tests were performed. The frequency range investigated (scanned), is also noted in this report. Conducted power line measurements are made, unless otherwise specified, over the frequency range from 150 kHz to 30 MHz to determine the line-to-ground radio-noise voltage that is conducted from the EUT power-input terminals that are directly (or indirectly via separate transformer or power supplies) connected to a public power network. Per the standard, an insulating material was also added to ground plane between the EUT's power and remote I/O cables. Equipment is tested with power cords that are normally used or that have electrical or shielding characteristics that are the same as those cords normally used. Typically those measurements are made using a LISN (Line Impedance Stabilization Network), the 50ohm measuring port is terminated by a 50ohm EMI meter or a 50ohm resistive load. All 50ohm measuring ports of the LISN are terminated by 50ohm. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Receiver	Rohde & Schwarz	ESCI	ARE	8/8/2016	8/8/2017
Cable - Conducted Cable Assembly	Northwest EMC	NC4, HHF, TYL	NC4A	5/6/2016	5/6/2017
LISN	Solar Electronics	9252-50-R-24-BNC	LIM	9/23/2016	9/23/2017

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	2.4 dB	-2.4 dB

CONFIGURATIONS INVESTIGATED

MCSO1761-4

MODES INVESTIGATED

Transmitting 802.11(g), 6Mps, Power Settings at Default. Mid Channel 6, 2437 MHz.

AC - POWERLINE CONDUCTED EMISSIONS

EUT:	1790	Work Order:	MCSO1761
Serial Number:	DV-1-0336	Date:	12/08/2016
Customer:	Microsoft Corporation	Temperature:	22°C
Attendees:	None	Relative Humidity:	23%
Customer Project:	None	Bar. Pressure:	1020 mb
Tested By:	Richard Mellroth	Job Site:	NC05
Power:	USB via 110VAC/60Hz	Configuration:	MCSO1761-4

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2016	ANSI C63.10:2013

TEST PARAMETERS

Run #:	1	Line:	High Line	Add. Ext. Attenuation (dB):	0

COMMENTS

None

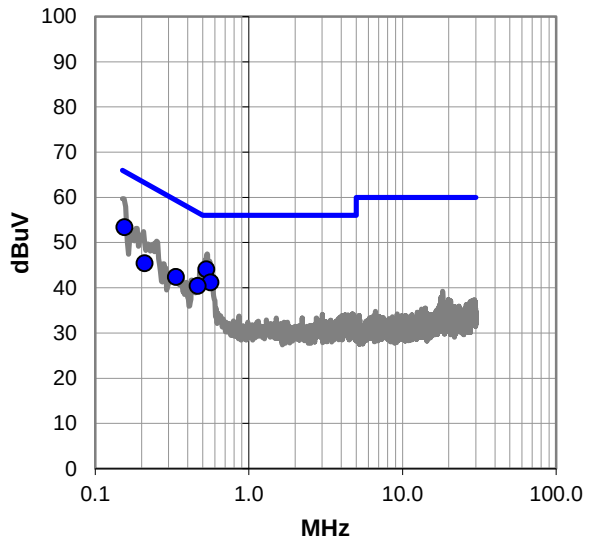
EUT OPERATING MODES

Transmitting 802.11(g), 6Mps, Power Settings at Default. Mid Channel 6, 2437 MHz.

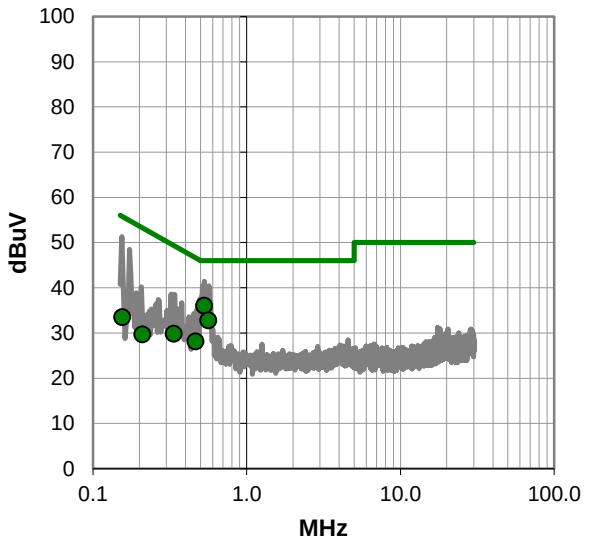
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



AC - POWERLINE CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2016.09.09

RESULTS - Run #1

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.530	23.5	20.6	44.1	56.0	-11.9
0.155	32.6	20.8	53.4	65.7	-12.3
0.564	20.6	20.6	41.2	56.0	-14.8
0.465	19.8	20.6	40.4	56.6	-16.2
0.335	21.8	20.6	42.4	59.3	-16.9
0.210	24.7	20.7	45.4	63.2	-17.8

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.530	15.4	20.6	36.0	46.0	-10.0
0.564	12.2	20.6	32.8	46.0	-13.2
0.465	7.5	20.6	28.1	46.6	-18.5
0.335	9.2	20.6	29.8	49.3	-19.5
0.155	12.7	20.8	33.5	55.7	-22.2
0.210	9.0	20.7	29.7	53.2	-23.5

CONCLUSION

Pass

Tested By

AC - POWERLINE CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2016.09.09

EUT:	1790	Work Order:	MCSO1761
Serial Number:	DV-1-0336	Date:	12/08/2016
Customer:	Microsoft Corporation	Temperature:	22°C
Attendees:	None	Relative Humidity:	23%
Customer Project:	None	Bar. Pressure:	1020 mb
Tested By:	Richard Mellroth	Job Site:	NC05
Power:	USB via 110VAC/60Hz	Configuration:	MCSO1761-4

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2016	ANSI C63.10:2013

TEST PARAMETERS

Run #:	2	Line:	Neutral	Add. Ext. Attenuation (dB):	0

COMMENTS

None

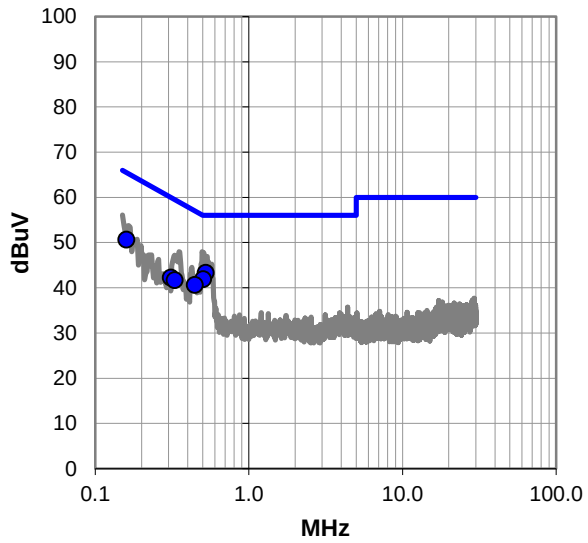
EUT OPERATING MODES

Transmitting 802.11(g), 6Mps, Power Settings at Default. Mid Channel 6, 2437 MHz.

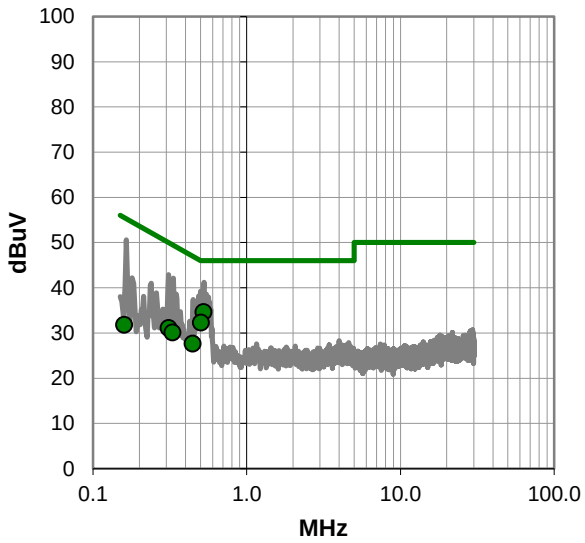
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



AC - POWERLINE CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2016.09.09

RESULTS - Run #2

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.524	22.7	20.6	43.3	56.0	-12.7
0.504	21.3	20.6	41.9	56.0	-14.1
0.160	29.8	20.8	50.6	65.5	-14.9
0.445	20.0	20.6	40.6	57.0	-16.4
0.312	21.6	20.6	42.2	59.9	-17.7
0.330	21.1	20.6	41.7	59.5	-17.8

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.524	14.0	20.6	34.6	46.0	-11.4
0.504	11.7	20.6	32.3	46.0	-13.7
0.312	10.5	20.6	31.1	49.9	-18.8
0.330	9.5	20.6	30.1	49.5	-19.4
0.445	7.0	20.6	27.6	47.0	-19.4
0.160	11.0	20.8	31.8	55.5	-23.7

CONCLUSION

Pass

Tested By

DUTY CYCLE

XMit 2016.05.06

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFO	6/8/2016	6/8/2017
Generator - Signal	Agilent	N5183A	TIA	4/6/2016	4/6/2018
Cable	Micro-Coax	UFD150A-1-0720-200200	NCS	6/7/2016	6/7/2017
Attenuator	Fairview Microwave	SA4014-20	TKV	3/4/2016	3/4/2017
Block - DC	Fairview Microwave	SD3379	AMU	5/6/2016	5/6/2017

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The Duty Cycle (x) of the single channel operation of the radio as controlled by the provided test software was measured for each of the EUT operating modes.

There is no compliance requirement to be met by this test, so therefore no Pass / Fail criteria.

The measurements were made using a zero span on the spectrum analyzer to see the pulses in the time domain. The transmit power was set to its default maximum.

The duty cycle was calculated by dividing the transmission pulse duration (T) by the total period of a single on and total off time.

If the transmit duty cycle < 98 percent, burst gating may have been used during some of the other tests in this report to only take the measurement during the burst duration.

DUTY CYCLE

NORTHWEST EMC

XMit 2016.05.06

EUT:	1790			**Work Order:**	MCSO1761
Serial Number:	DV-1-0546			**Date:**	10/28/16
Customer:	Microsoft Corporation			**Temperature:**	23 °C
Attendees:	Chaitrali Limaye			**Humidity:**	45% RH
Project:	None			**Barometric Pres.:**	1015 mbar
Tested by:	Richard Mellroth	**Power:**	USB	**Job Site:**	NC02

TEST SPECIFICATIONS	Test Method
FCC 15.247:2016	ANSI C63.10:2013

COMMENTS

Power Setting at Default. Client provided adapter cable loss of 0.7dB included in reference level offset.

DEVIATIONS FROM TEST STANDARD

None

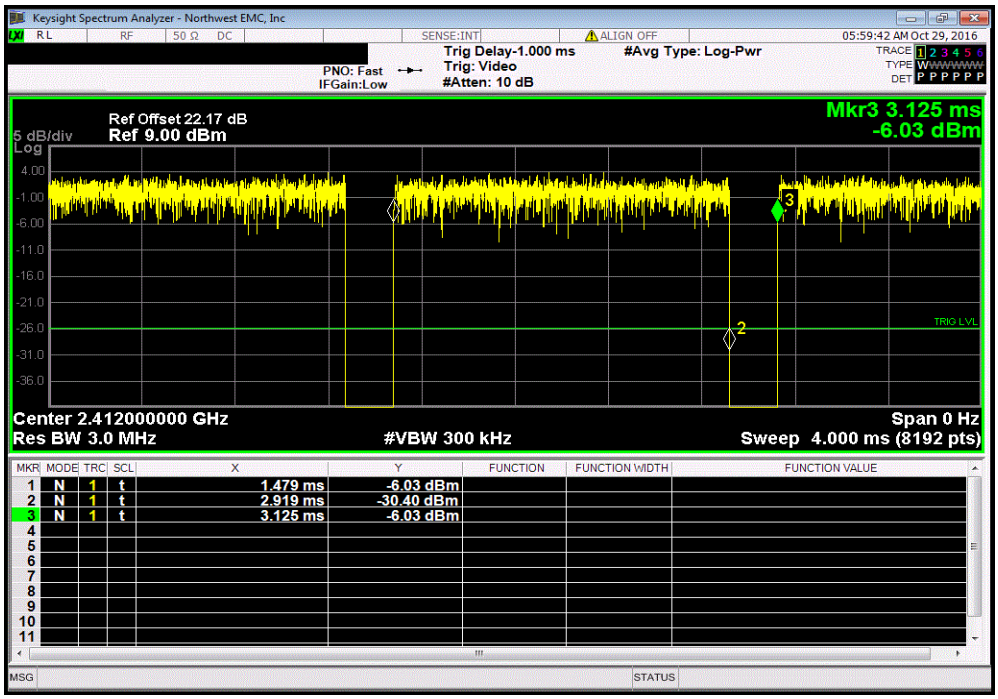
Configuration #	1	Signature

	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
Low Channel 1, 2412 MHz						
802.11(g) 6 Mbps	1.44 ms	1.646 ms	1	87.5	N/A	N/A
802.11(g) 6 Mbps	N/A	N/A	6	N/A	N/A	N/A
802.11(g) 36 Mbps	259.8 us	465.7 us	1	55.8	N/A	N/A
802.11(g) 36 Mbps	N/A	N/A	5	N/A	N/A	N/A
802.11(g) 54 Mbps	179.7 us	385.6 us	1	46.6	N/A	N/A
802.11(g) 54 Mbps	N/A	N/A	5	N/A	N/A	N/A
802.11(n) MCS0	1.348 ms	1.554 ms	1	86.8	N/A	N/A
802.11(n) MCS0	N/A	N/A	6	N/A	N/A	N/A
802.11(n) MCS7	168 us	373.6 us	1	45	N/A	N/A
802.11(n) MCS7	N/A	N/A	5	N/A	N/A	N/A
Mid Channel 6, 2437 MHz						
802.11(g) 6 Mbps	1.44 ms	1.646 ms	1	87.5	N/A	N/A
802.11(g) 6 Mbps	N/A	N/A	6	N/A	N/A	N/A
802.11(g) 36 Mbps	259.8 us	465.7 us	1	55.8	N/A	N/A
802.11(g) 36 Mbps	N/A	N/A	5	N/A	N/A	N/A
802.11(g) 54 Mbps	179.7 us	385.5 us	1	46.6	N/A	N/A
802.11(g) 54 Mbps	N/A	N/A	5	N/A	N/A	N/A
802.11(n) MCS0	1.348 ms	1.554 ms	1	86.7	N/A	N/A
802.11(n) MCS0	N/A	N/A	6	N/A	N/A	N/A
802.11(n) MCS7	168 us	373.6 us	1	45	N/A	N/A
802.11(n) MCS7	N/A	N/A	5	N/A	N/A	N/A
High Channel 11, 2462 MHz						
802.11(g) 6 Mbps	1.44 ms	1.646 ms	1	87.5	N/A	N/A
802.11(g) 6 Mbps	N/A	N/A	6	N/A	N/A	N/A
802.11(g) 36 Mbps	259.6 us	465.7 us	1	55.7	N/A	N/A
802.11(g) 36 Mbps	N/A	N/A	6	N/A	N/A	N/A
802.11(g) 54 Mbps	179.5 us	385.5 us	1	46.6	N/A	N/A
802.11(g) 54 Mbps	N/A	N/A	5	N/A	N/A	N/A
802.11(n) MCS0	1.348 ms	1.553 ms	1	86.8	N/A	N/A
802.11(n) MCS0	N/A	N/A	5	N/A	N/A	N/A
802.11(n) MCS7	168 us	373.6 us	1	45	N/A	N/A
802.11(n) MCS7	N/A	N/A	5	N/A	N/A	N/A

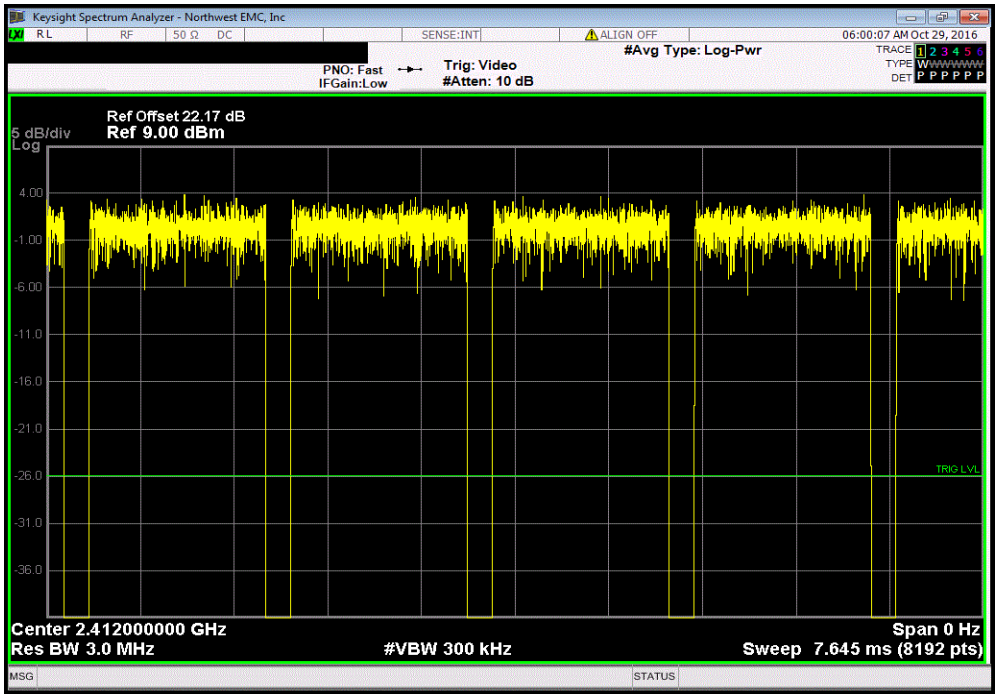
DUTY CYCLE

XMit 2016.05.06

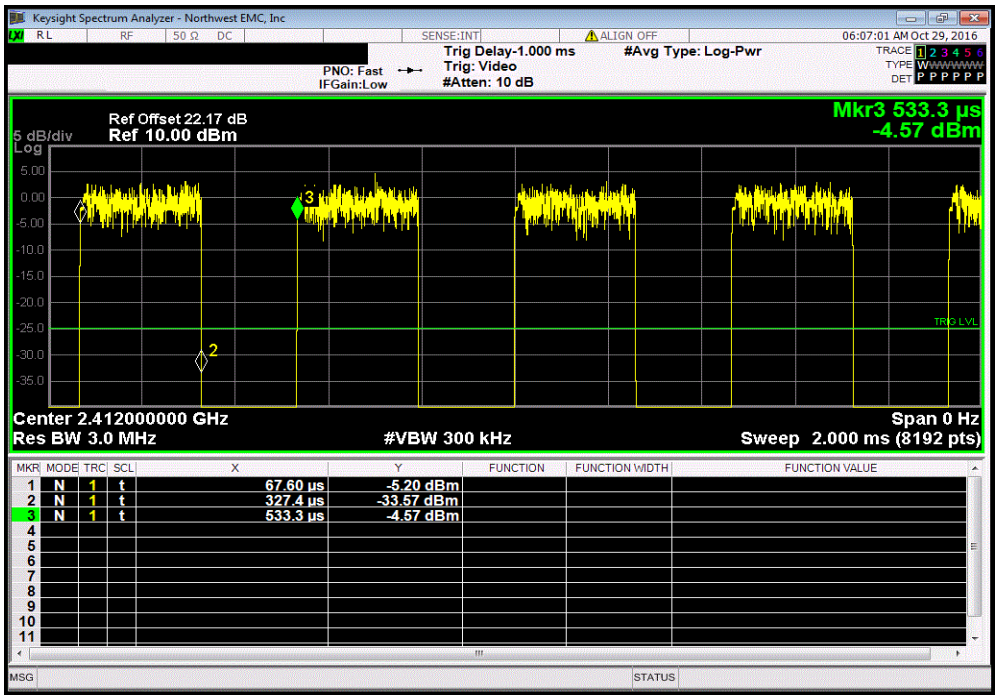
Low Channel 1, 2412 MHz, 802.11(g) 6 Mbps						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	1.44 ms	1.646 ms	1	87.5	N/A	N/A



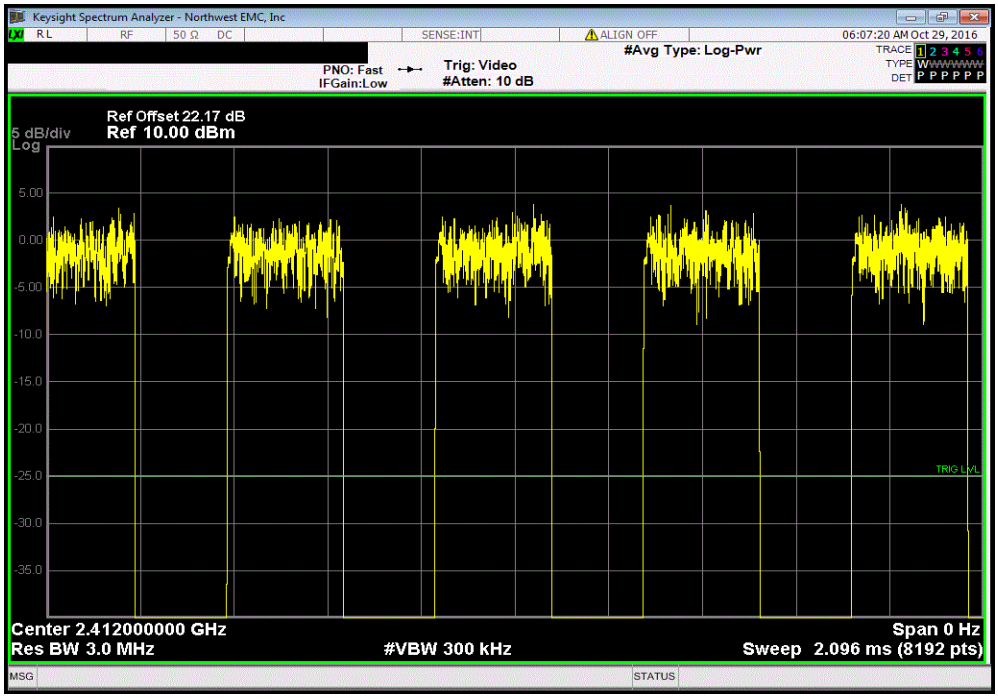
Low Channel 1, 2412 MHz, 802.11(g) 6 Mbps						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	6	N/A	N/A	N/A



Low Channel 1, 2412 MHz, 802.11(g) 36 Mbps						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	259.8 us	465.7 us	1	55.8	N/A	N/A



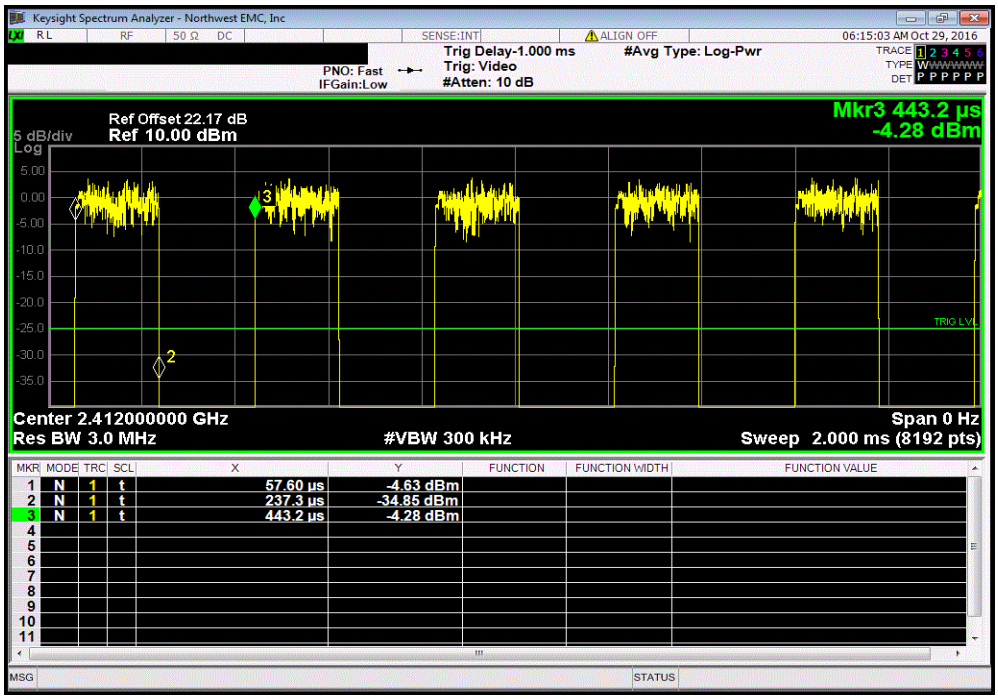
Low Channel 1, 2412 MHz, 802.11(g) 36 Mbps						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



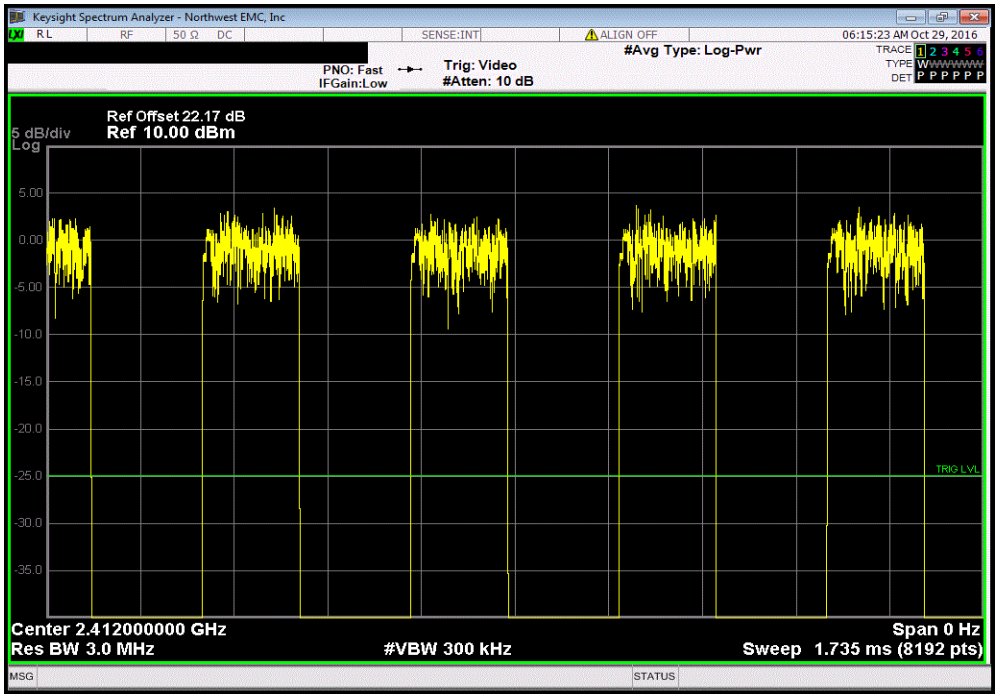
DUTY CYCLE

XMit 2016.05.06

Low Channel 1, 2412 MHz, 802.11(g) 54 Mbps						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	179.7 us	385.6 us	1	46.6	N/A	N/A



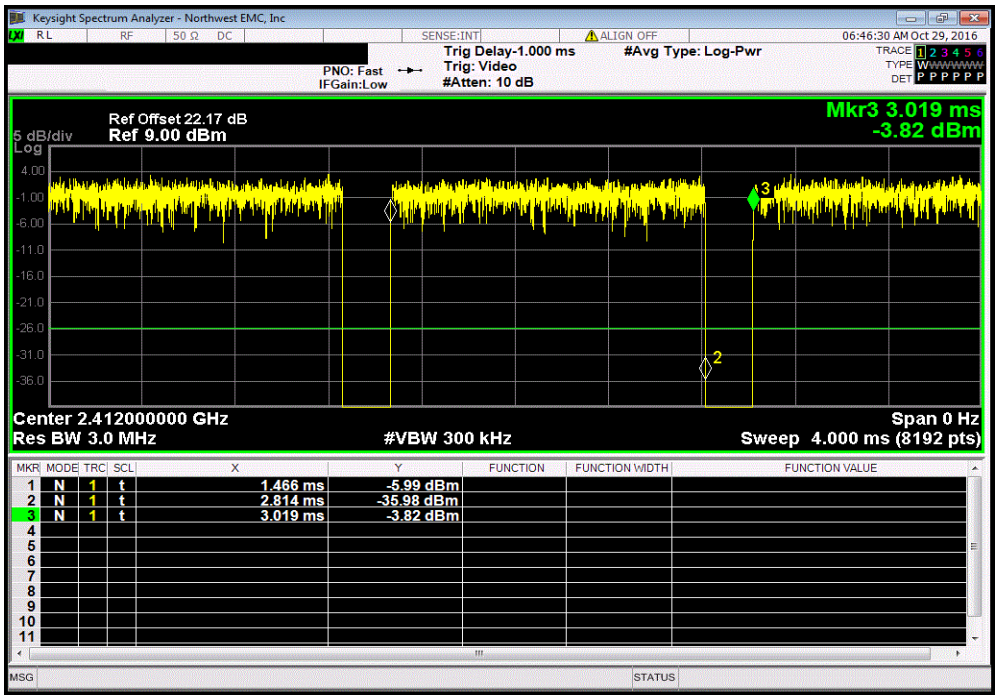
Low Channel 1, 2412 MHz, 802.11(g) 54 Mbps						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



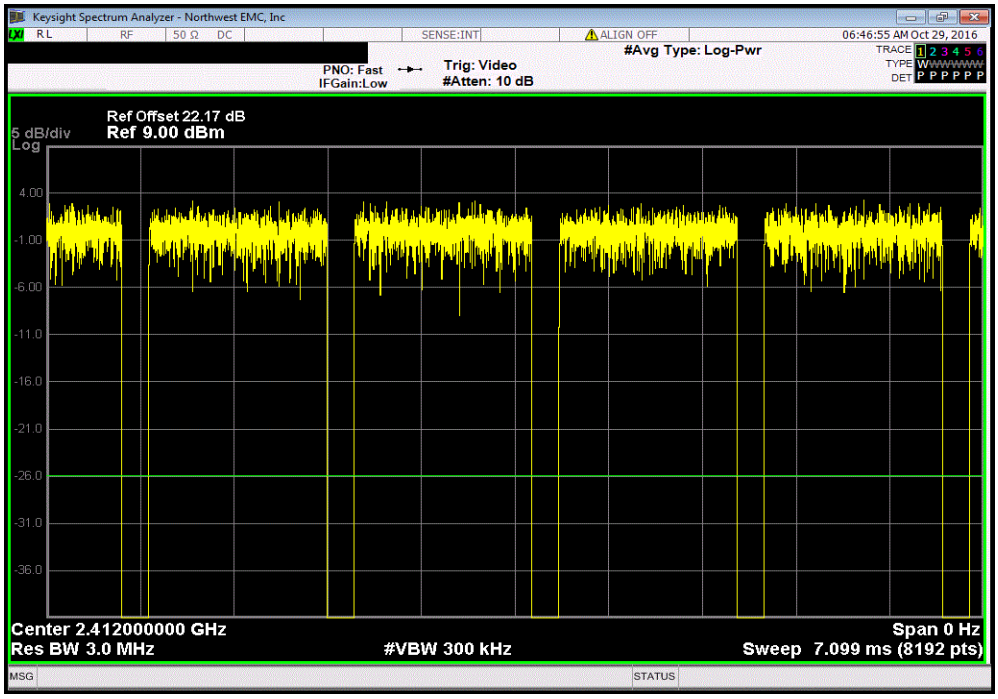
DUTY CYCLE

XMit 2016.05.06

Low Channel 1, 2412 MHz, 802.11(n) MCS0						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	1.348 ms	1.554 ms	1	86.8	N/A	N/A



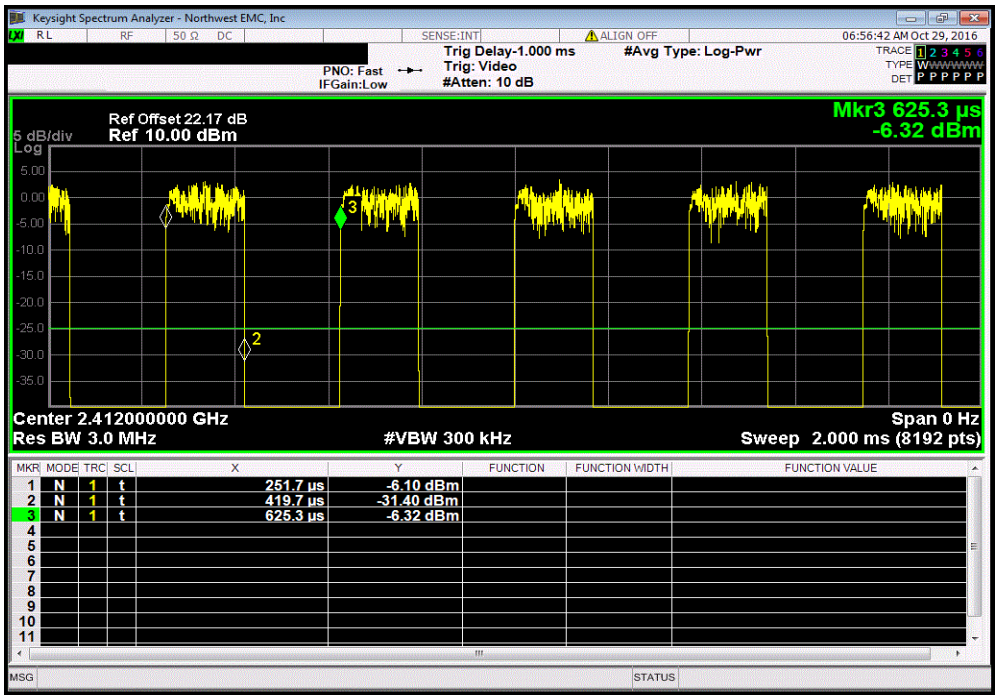
Low Channel 1, 2412 MHz, 802.11(n) MCS0						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	6	N/A	N/A	N/A



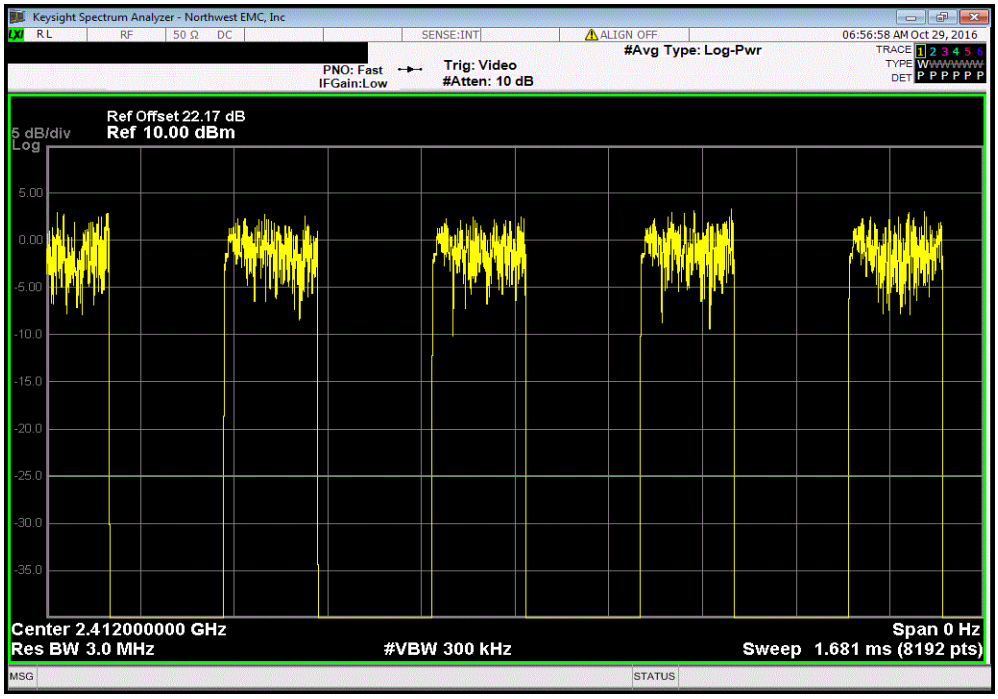
DUTY CYCLE

XMit 2016.05.06

Low Channel 1, 2412 MHz, 802.11(n) MCS7						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	168 us	373.6 us	1	45	N/A	N/A



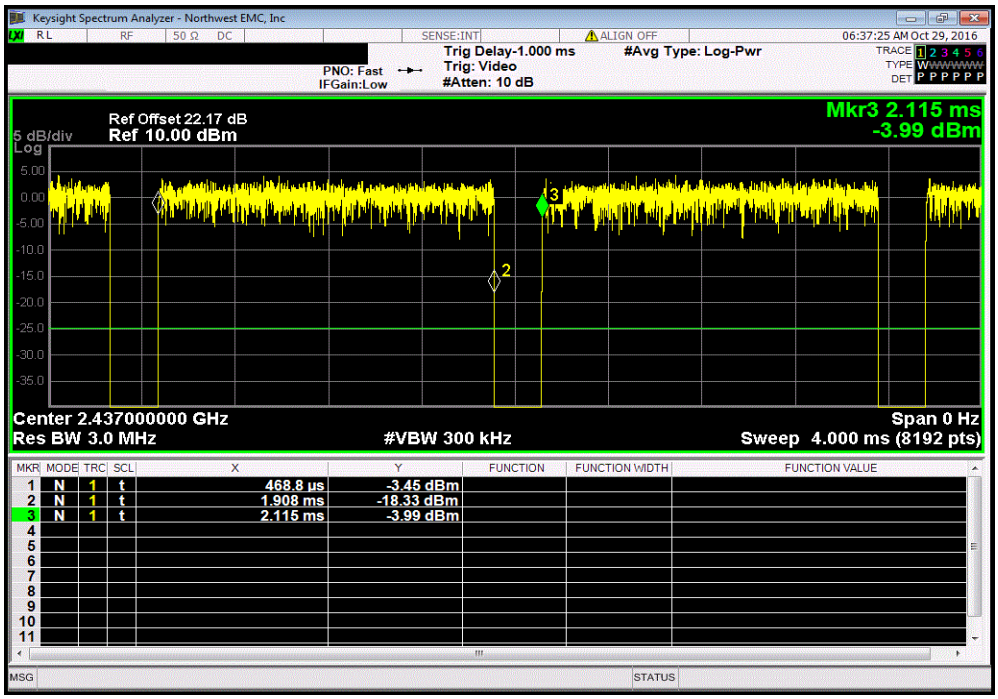
Low Channel 1, 2412 MHz, 802.11(n) MCS7						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



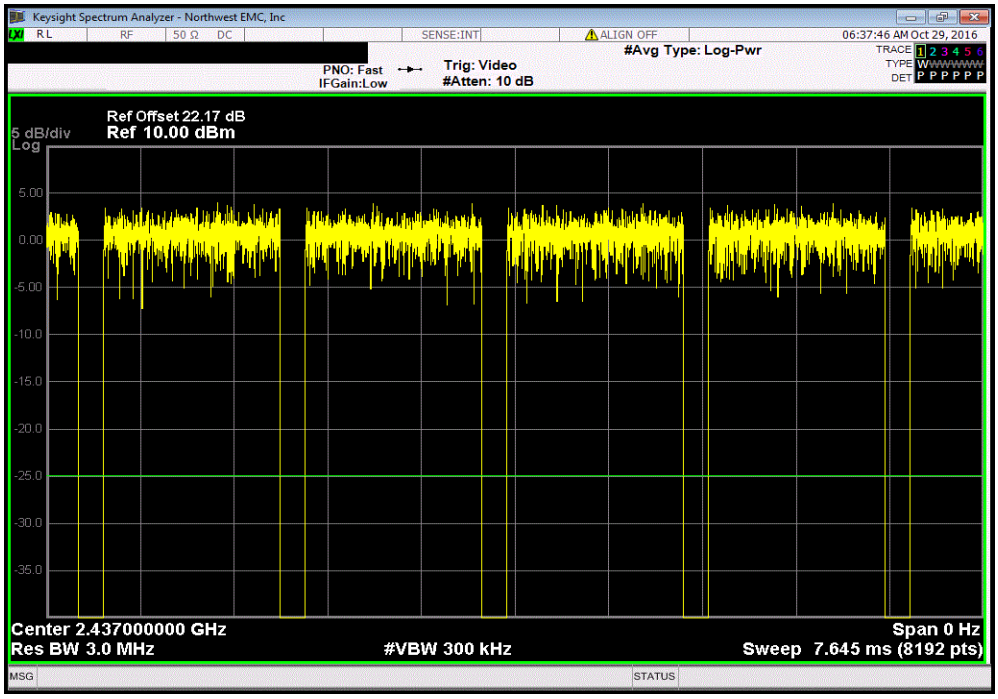
DUTY CYCLE

XMit 2016.05.06

Mid Channel 6, 2437 MHz, 802.11(g) 6 Mbps						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	1.44 ms	1.646 ms	1	87.5	N/A	N/A



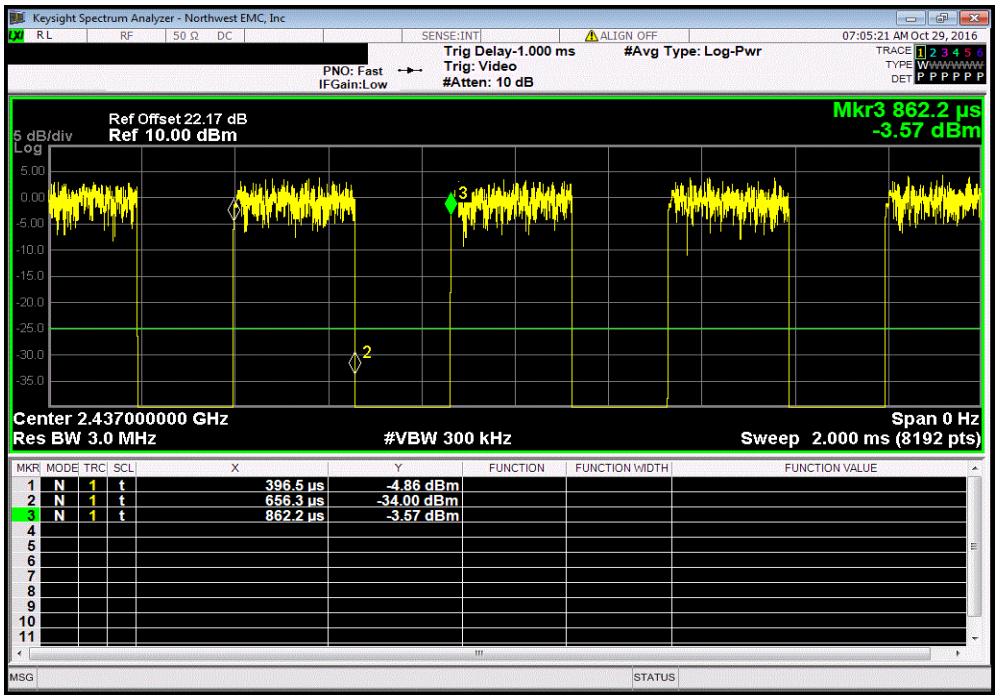
Mid Channel 6, 2437 MHz, 802.11(g) 6 Mbps						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	6	N/A	N/A	N/A



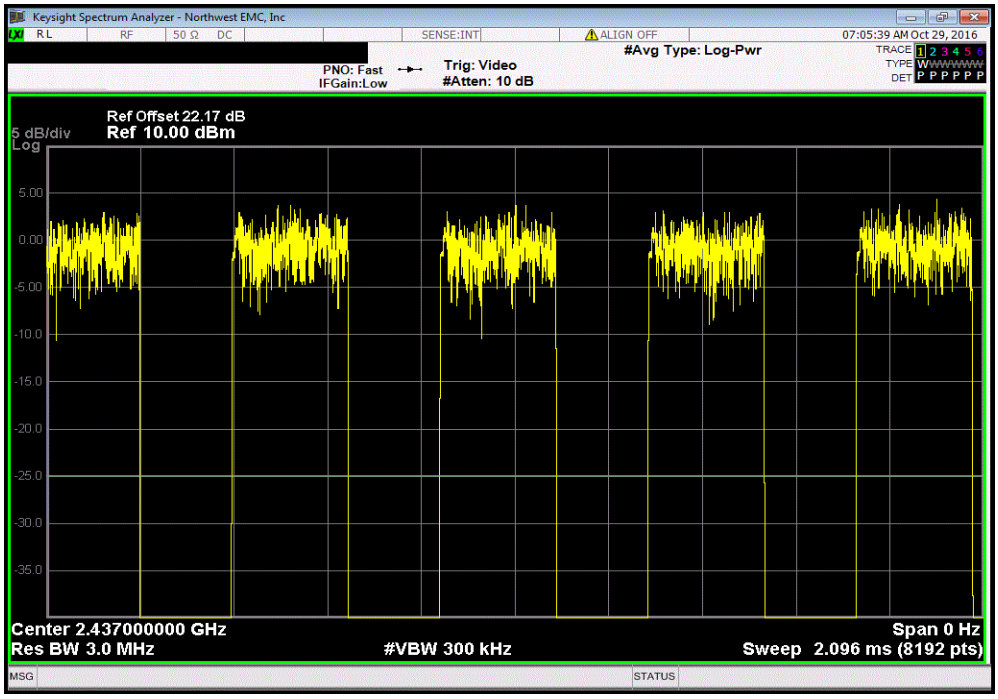
DUTY CYCLE

XMit 2016.05.06

Mid Channel 6, 2437 MHz, 802.11(g) 36 Mbps						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	259.8 us	465.7 us	1	55.8	N/A	N/A



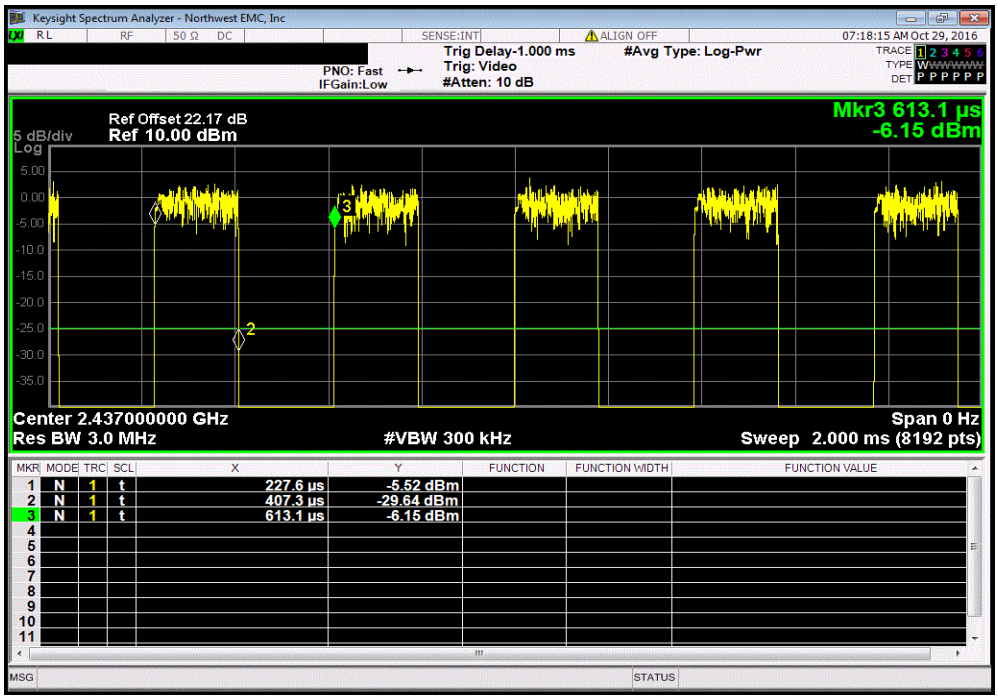
Mid Channel 6, 2437 MHz, 802.11(g) 36 Mbps						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



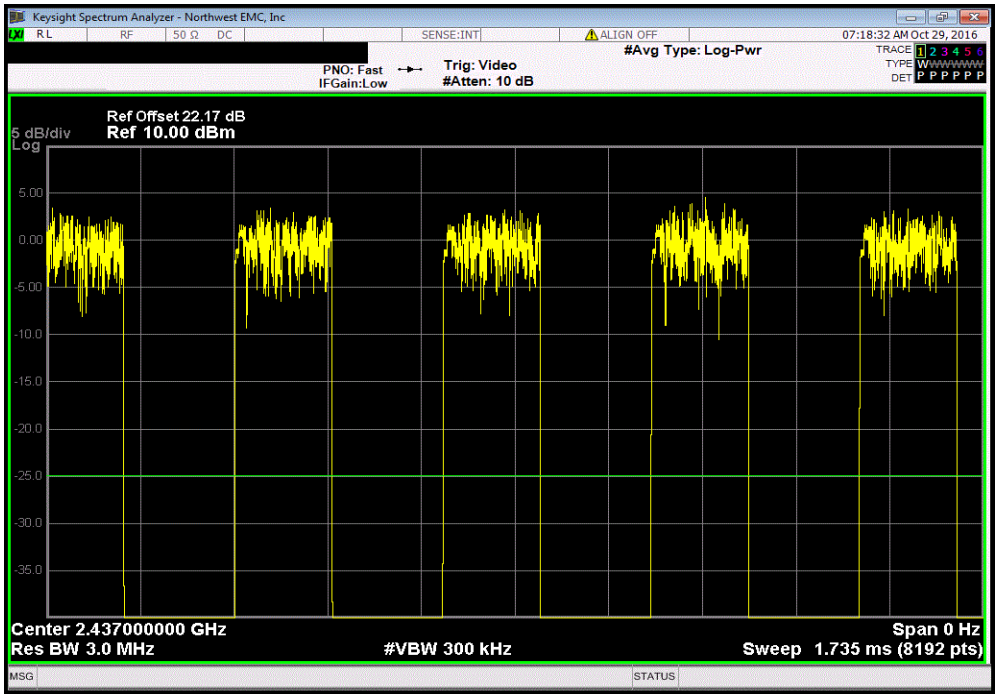
DUTY CYCLE

XMit 2016.05.06

Mid Channel 6, 2437 MHz, 802.11(g) 54 Mbps						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	179.7 us	385.5 us	1	46.6	N/A	N/A



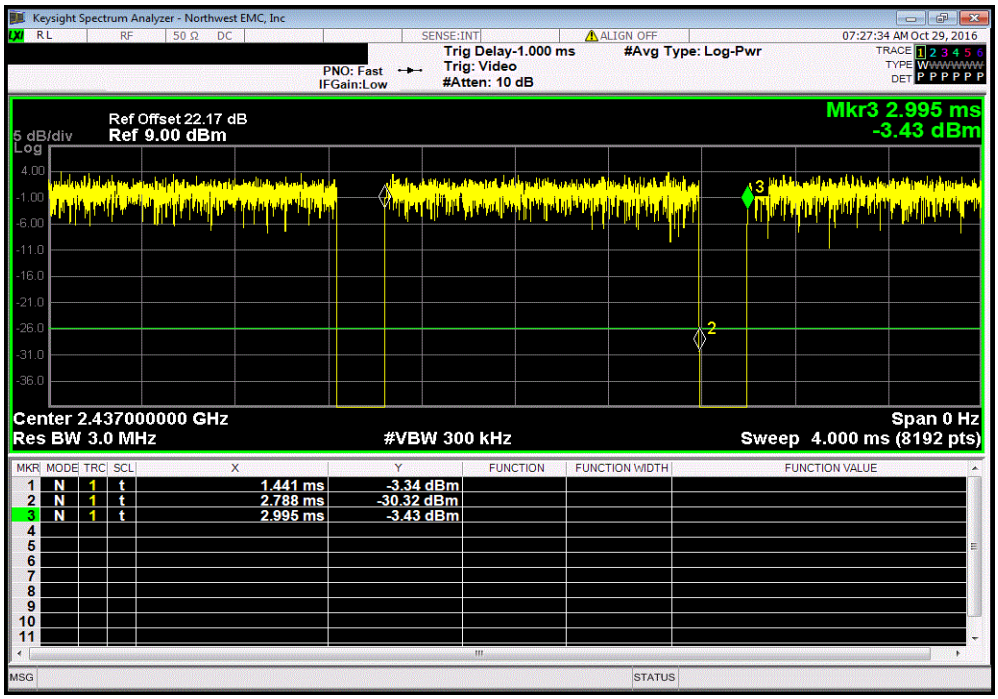
Mid Channel 6, 2437 MHz, 802.11(g) 54 Mbps						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



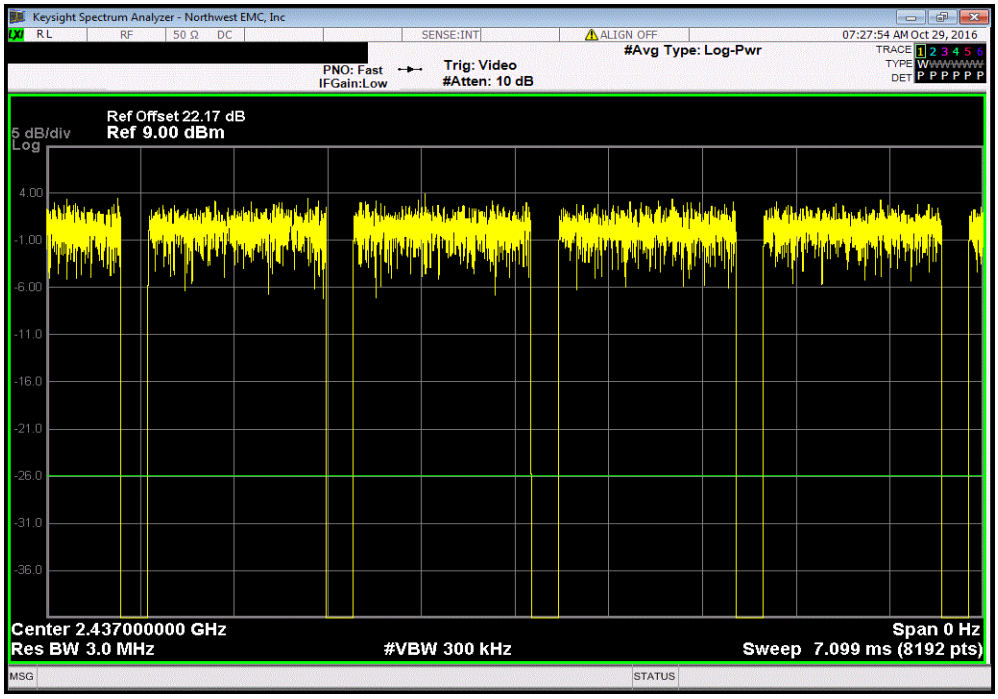
DUTY CYCLE

XMit 2016.05.06

Mid Channel 6, 2437 MHz, 802.11(n) MCS0						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	1.348 ms	1.554 ms	1	86.7	N/A	N/A



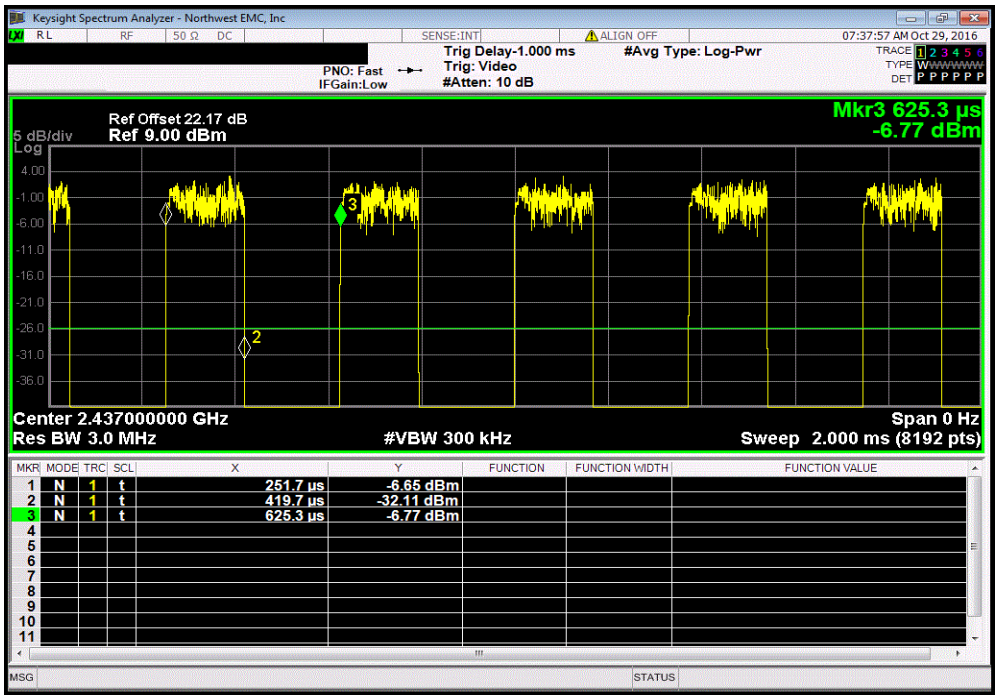
Mid Channel 6, 2437 MHz, 802.11(n) MCS0						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	6	N/A	N/A	N/A



DUTY CYCLE

XMit 2016.05.06

Mid Channel 6, 2437 MHz, 802.11(n) MCS7						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	168 us	373.6 us	1	45	N/A	N/A

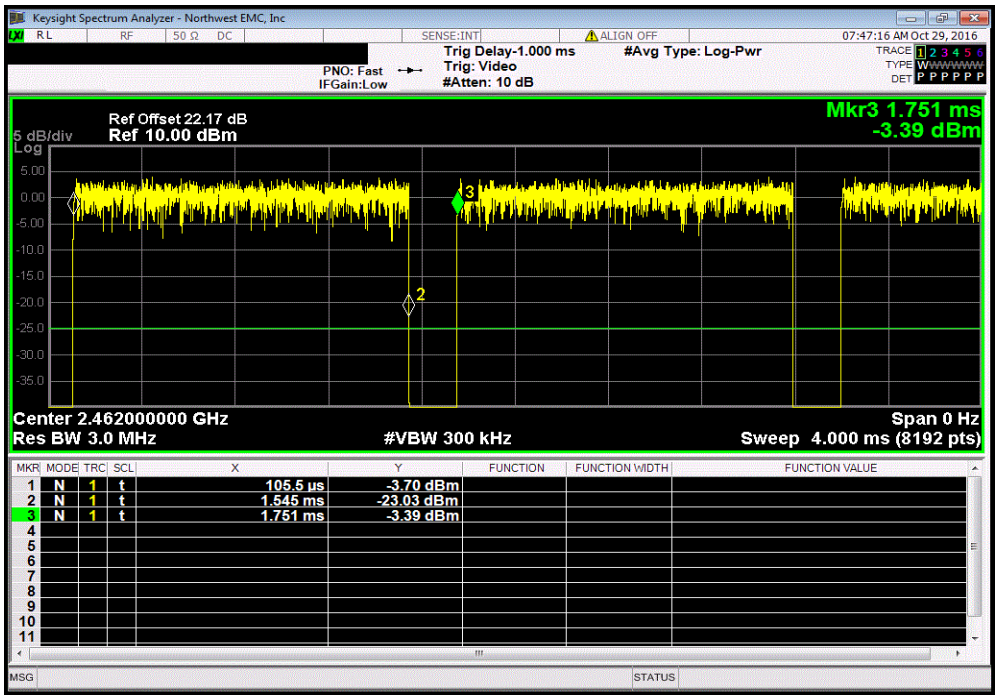


Mid Channel 6, 2437 MHz, 802.11(n) MCS7						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

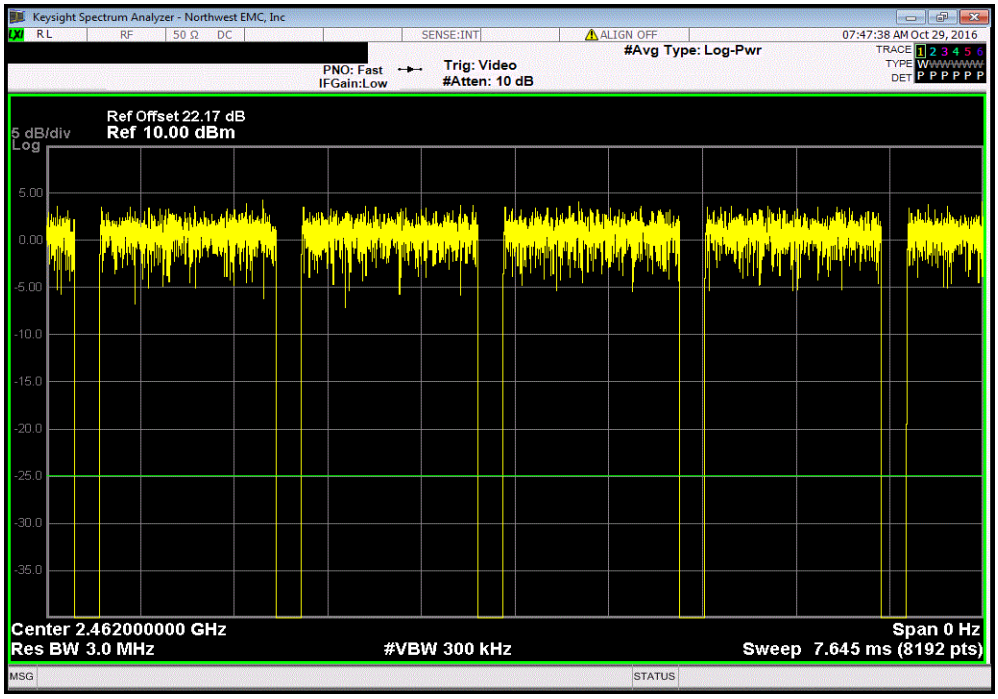
DUTY CYCLE

XMit 2016.05.06

High Channel 11, 2462 MHz , 802.11(g) 6 Mbps						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	1.44 ms	1.646 ms	1	87.5	N/A	N/A



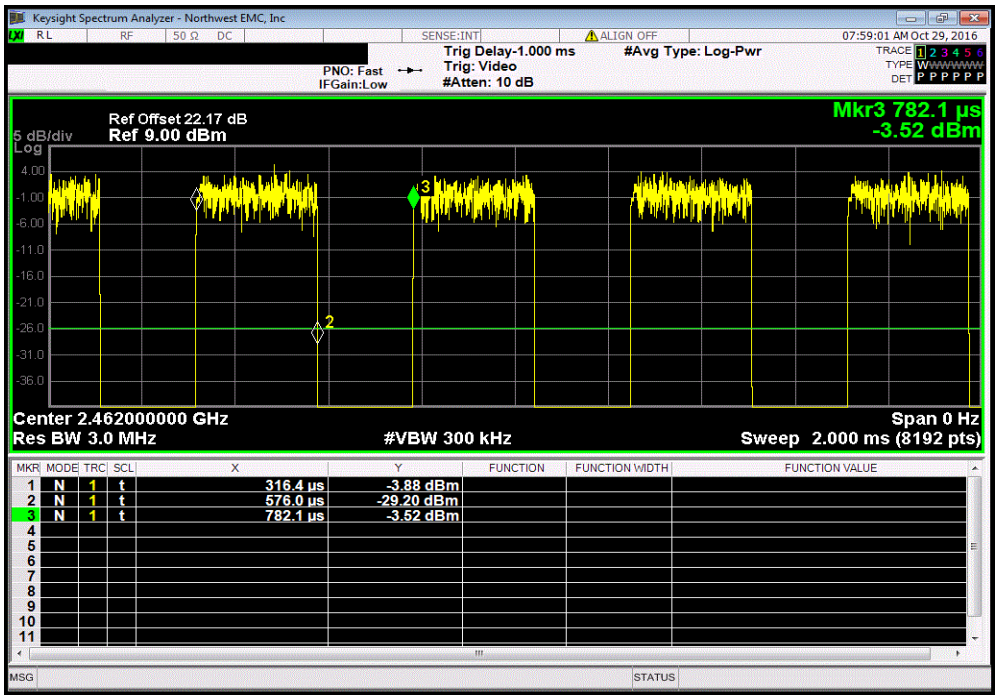
High Channel 11, 2462 MHz , 802.11(g) 6 Mbps						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	6	N/A	N/A	N/A



DUTY CYCLE

XMit 2016.05.06

High Channel 11, 2462 MHz , 802.11(g) 36 Mbps						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	259.6 us	465.7 us	1	55.7	N/A	N/A

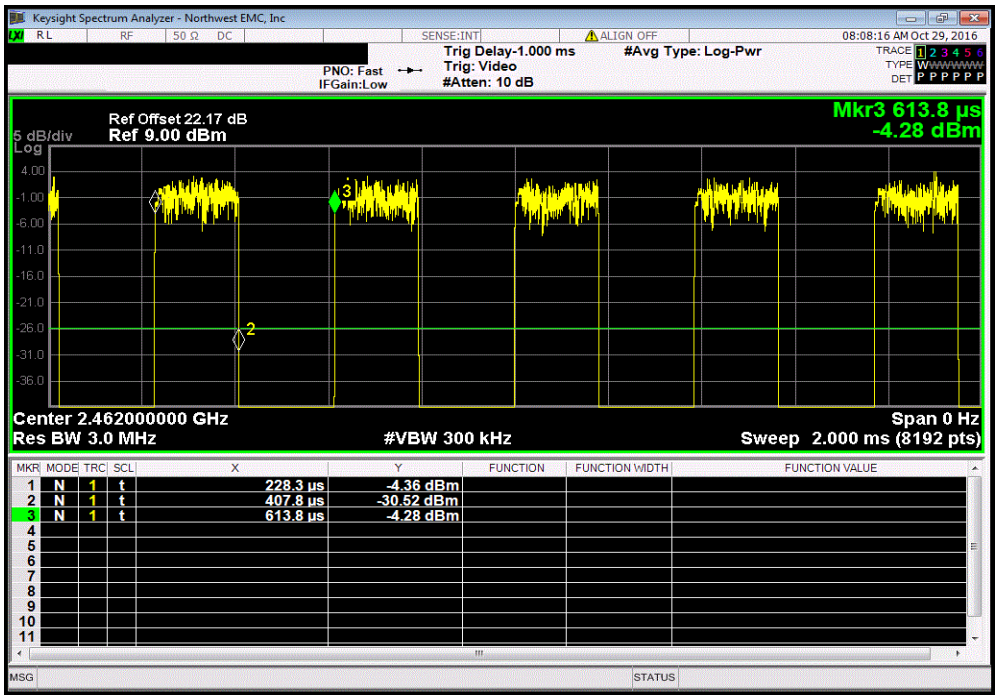


High Channel 11, 2462 MHz , 802.11(g) 36 Mbps						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	6	N/A	N/A	N/A

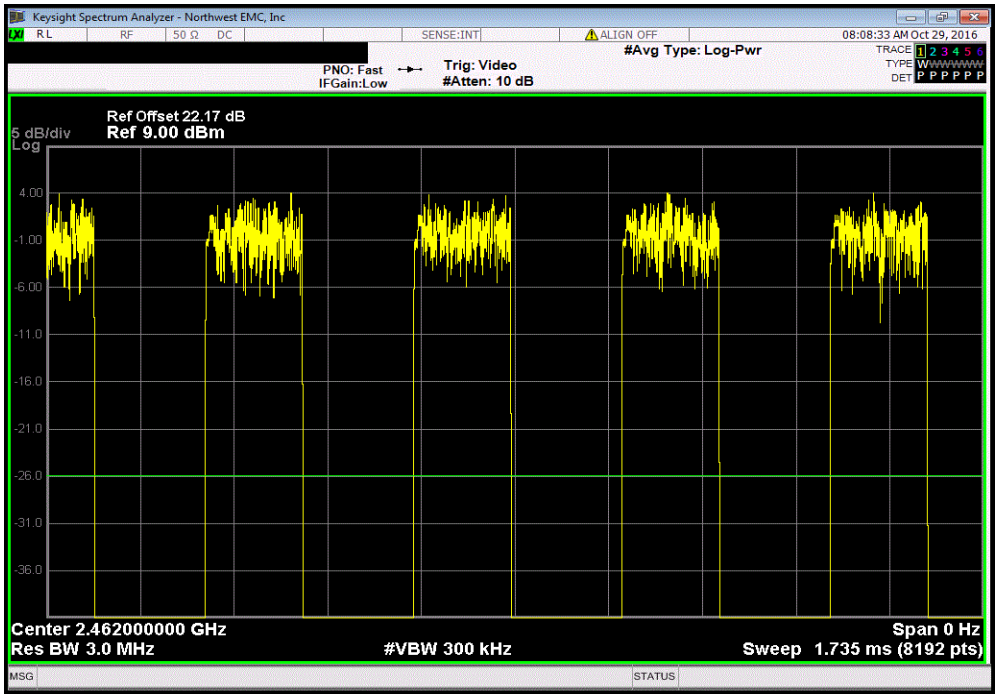
DUTY CYCLE

XMit 2016.05.06

High Channel 11, 2462 MHz , 802.11(g) 54 Mbps						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	179.5 us	385.5 us	1	46.6	N/A	N/A



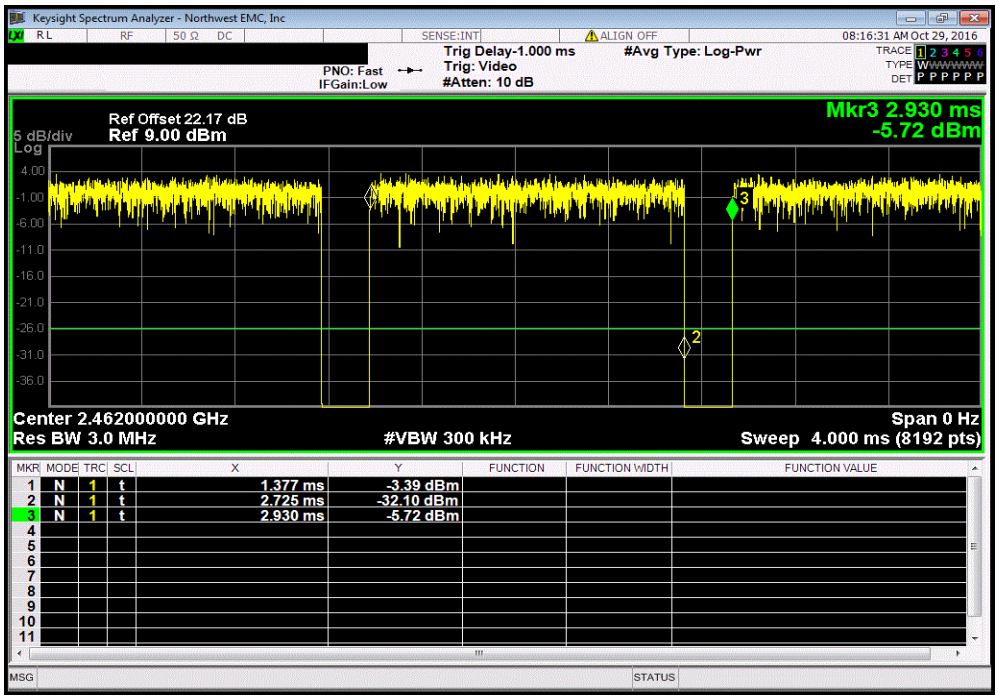
High Channel 11, 2462 MHz , 802.11(g) 54 Mbps						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



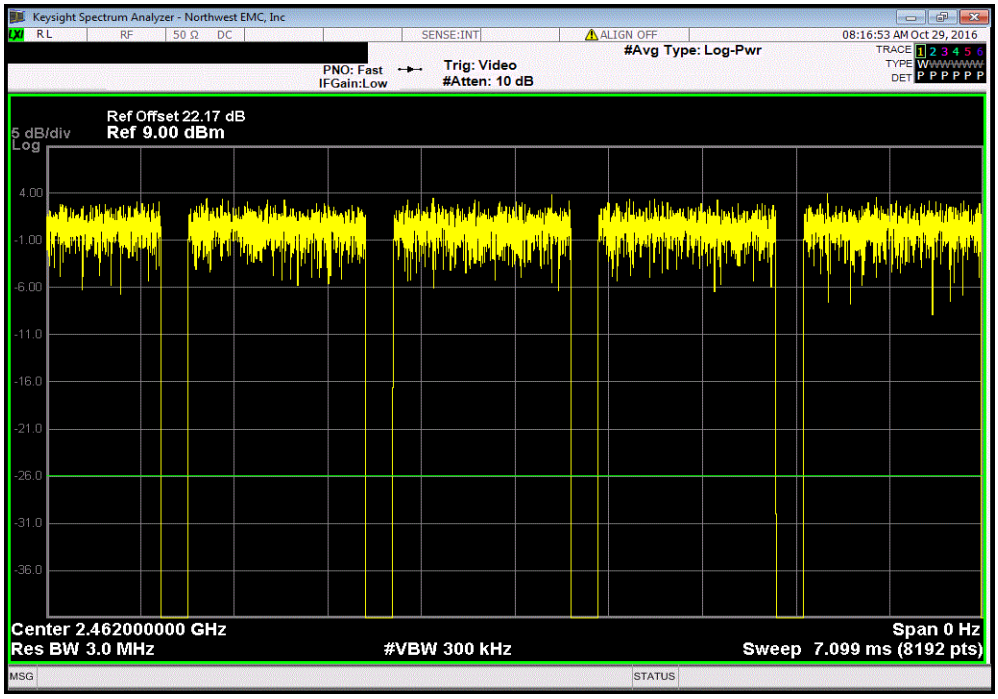
DUTY CYCLE

XMit 2016.05.06

High Channel 11, 2462 MHz , 802.11(n) MCS0						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	1.348 ms	1.553 ms	1	86.8	N/A	N/A



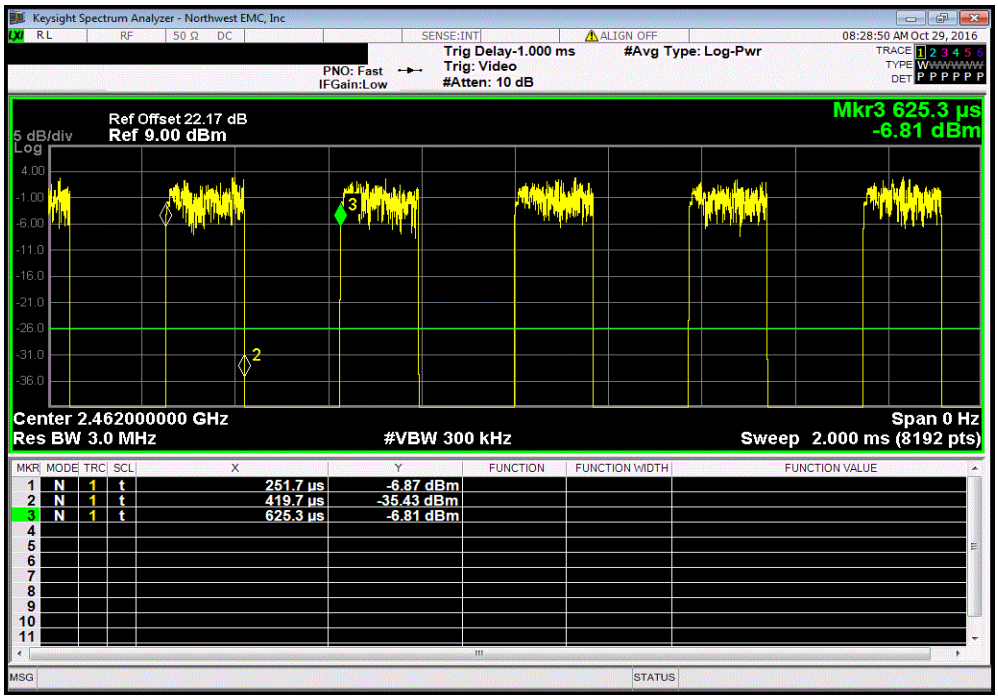
High Channel 11, 2462 MHz , 802.11(n) MCS0						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



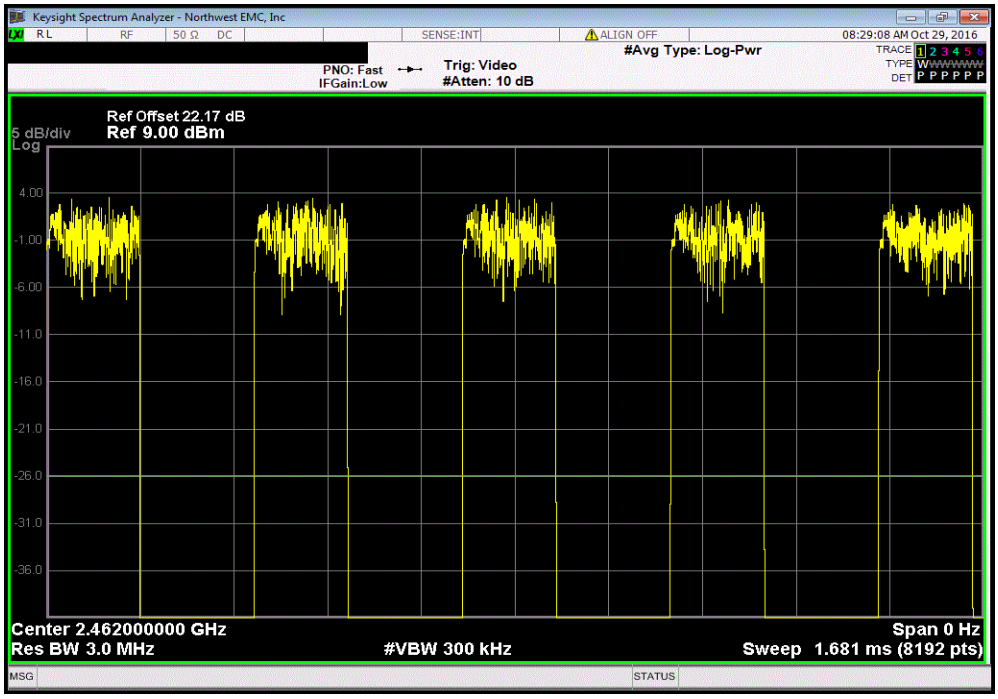
DUTY CYCLE

XMit 2016.05.06

High Channel 11, 2462 MHz , 802.11(n) MCS7						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	168 us	373.6 us	1	45	N/A	N/A



High Channel 11, 2462 MHz , 802.11(n) MCS7						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



OCCUPIED BANDWIDTH

XMit 2016.05.06

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFO	6/8/2016	6/8/2017
Generator - Signal	Agilent	N5183A	TIA	4/6/2016	4/6/2018
Cable	Micro-Coax	UFD150A-1-0720-200200	NCS	6/7/2016	6/7/2017
Attenuator	Fairview Microwave	SA4014-20	TKV	3/4/2016	3/4/2017
Block - DC	Fairview Microwave	SD3379	AMU	5/6/2016	5/6/2017

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The EUT was set to the channels and modes listed in the datasheet.

The 6dB occupied bandwidth was measured using 100 kHz resolution bandwidth and 300 kHz video bandwidth. The 99.0% occupied bandwidth was also measured at the same time which can be needed during Output Power depending on the applicable method.

OCCUPIED BANDWIDTH

NORTHWEST EMC

XMit 2016.05.06

EUT:	1790			**Work Order:**	MCSO1761
Serial Number:	DV-1-0546			**Date:**	10/28/16
Customer:	Microsoft Corporation			**Temperature:**	23 °C
Attendees:	Chaitrali Limaye			**Humidity:**	45% RH
Project:	None			**Barometric Pres.:**	1015 mbar
Tested by:	Richard Mellroth	**Power:**	USB	**Job Site:**	NC02

TEST SPECIFICATIONS	Test Method
FCC 15.247:2016	ANSI C63.10:2013

COMMENTS

Power Setting at Default. Client provided adapter cable loss of 0.7dB included in reference level offset.

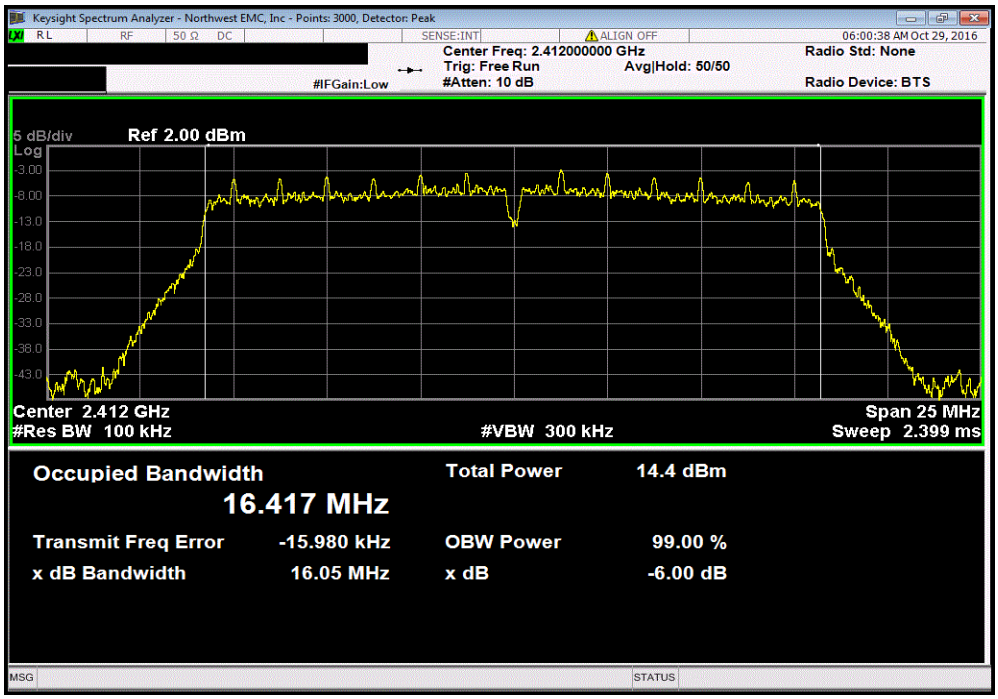
DEVIATIONS FROM TEST STANDARD

None

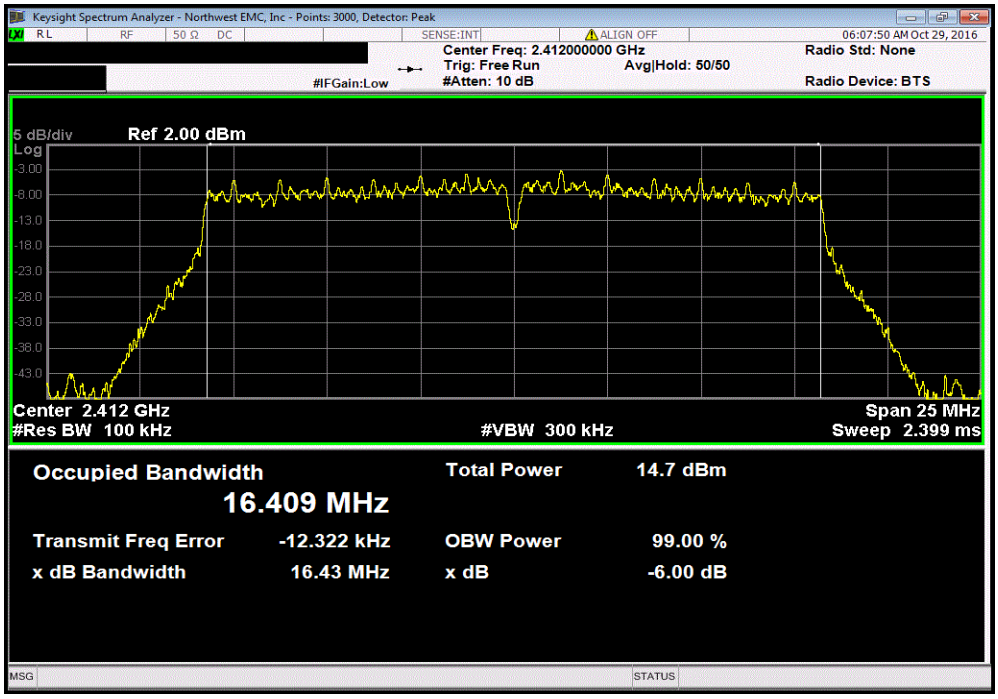
Configuration #	1	Signature

	Value	Limit (>)	Result
Low Channel 1, 2412 MHz			
802.11(g) 6 Mbps	16.053 MHz	500 kHz	Pass
802.11(g) 36 Mbps	16.433 MHz	500 kHz	Pass
802.11(g) 54 Mbps	16.359 MHz	500 kHz	Pass
802.11(n) MCS0	16.944 MHz	500 kHz	Pass
802.11(n) MCS7	16.862 MHz	500 kHz	Pass
Mid Channel 6, 2437 MHz			
802.11(g) 6 Mbps	16.083 MHz	500 kHz	Pass
802.11(g) 36 Mbps	16.421 MHz	500 kHz	Pass
802.11(g) 54 Mbps	16.375 MHz	500 kHz	Pass
802.11(n) MCS0	16.919 MHz	500 kHz	Pass
802.11(n) MCS7	17.217 MHz	500 kHz	Pass
High Channel 11, 2462 MHz			
802.11(g) 6 Mbps	16.275 MHz	500 kHz	Pass
802.11(g) 36 Mbps	16.392 MHz	500 kHz	Pass
802.11(g) 54 Mbps	16.38 MHz	500 kHz	Pass
802.11(n) MCS0	16.929 MHz	500 kHz	Pass
802.11(n) MCS7	16.677 MHz	500 kHz	Pass

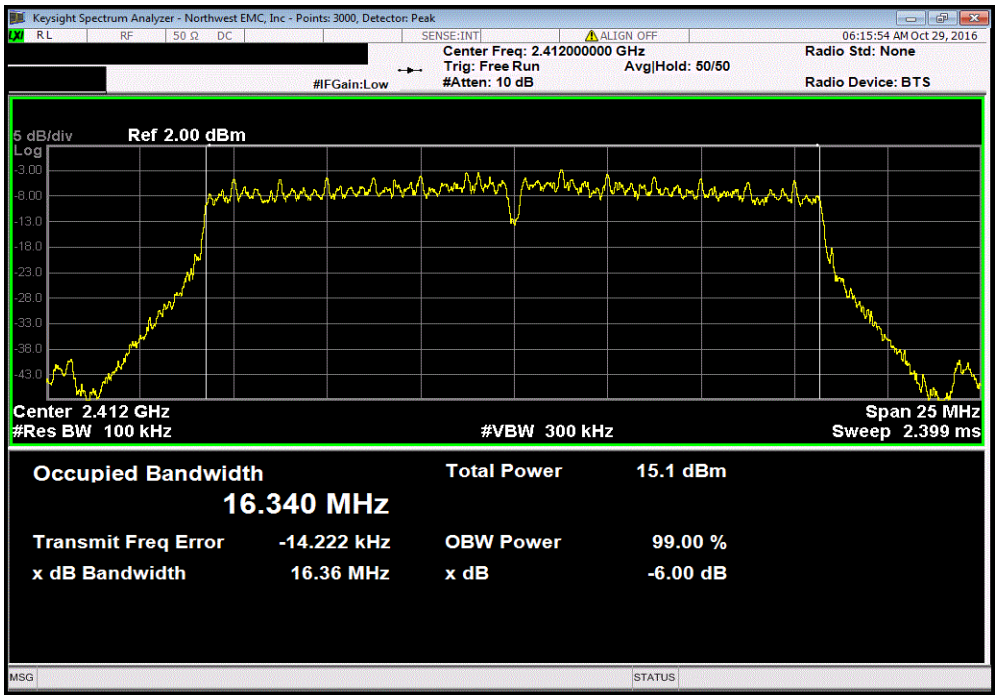
Low Channel 1, 2412 MHz, 802.11(g) 6 Mbps						
				Value	Limit (>)	Result
				16.053 MHz	500 kHz	Pass



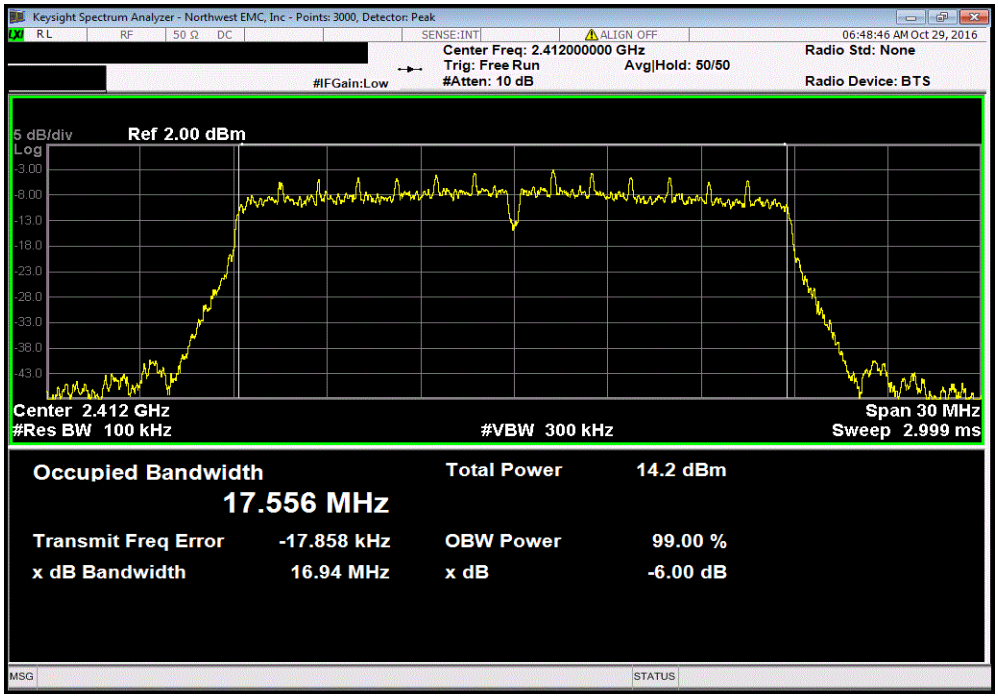
Low Channel 1, 2412 MHz, 802.11(g) 36 Mbps						
				Value	Limit (>)	Result
				16.433 MHz	500 kHz	Pass



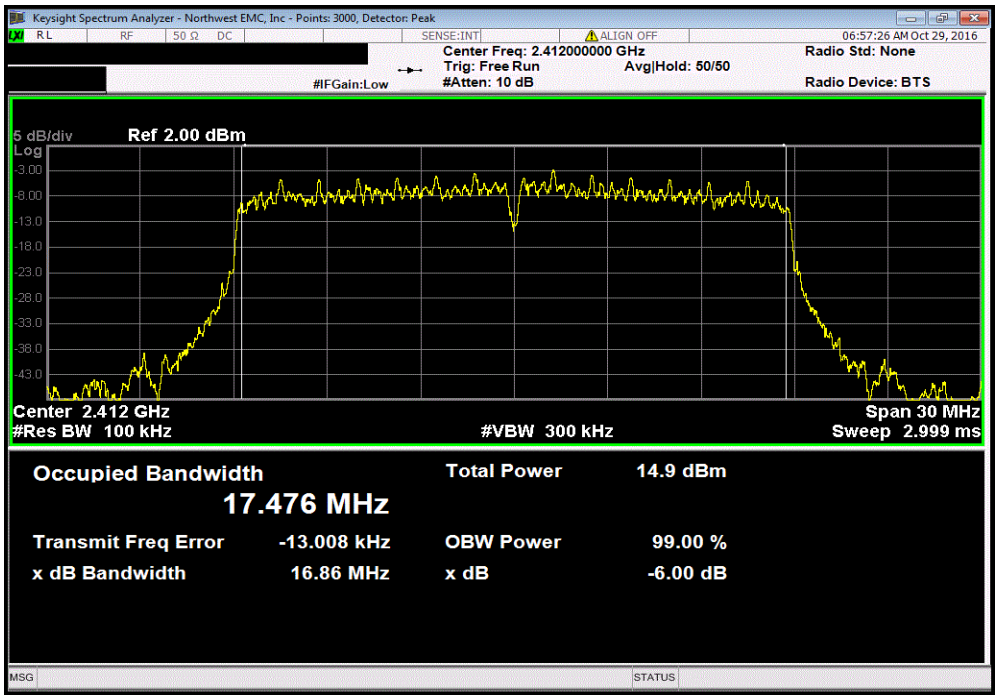
Low Channel 1, 2412 MHz, 802.11(g) 54 Mbps						
				Value	Limit (>)	Result
				16.359 MHz	500 kHz	Pass



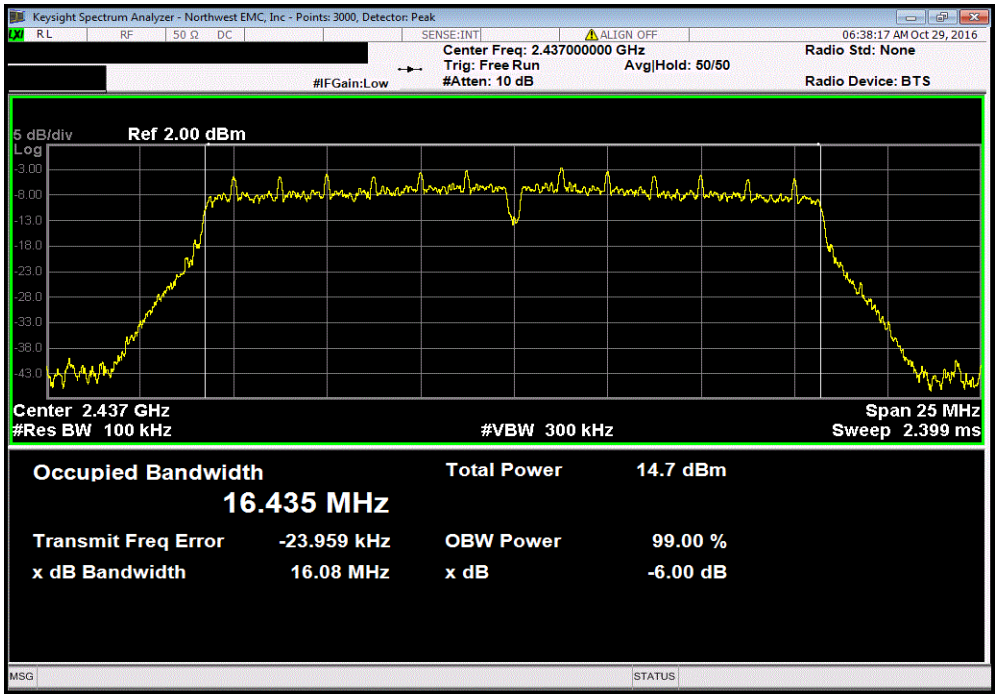
Low Channel 1, 2412 MHz, 802.11(n) MCS0						
				Value	Limit (>)	Result
				16.944 MHz	500 kHz	Pass



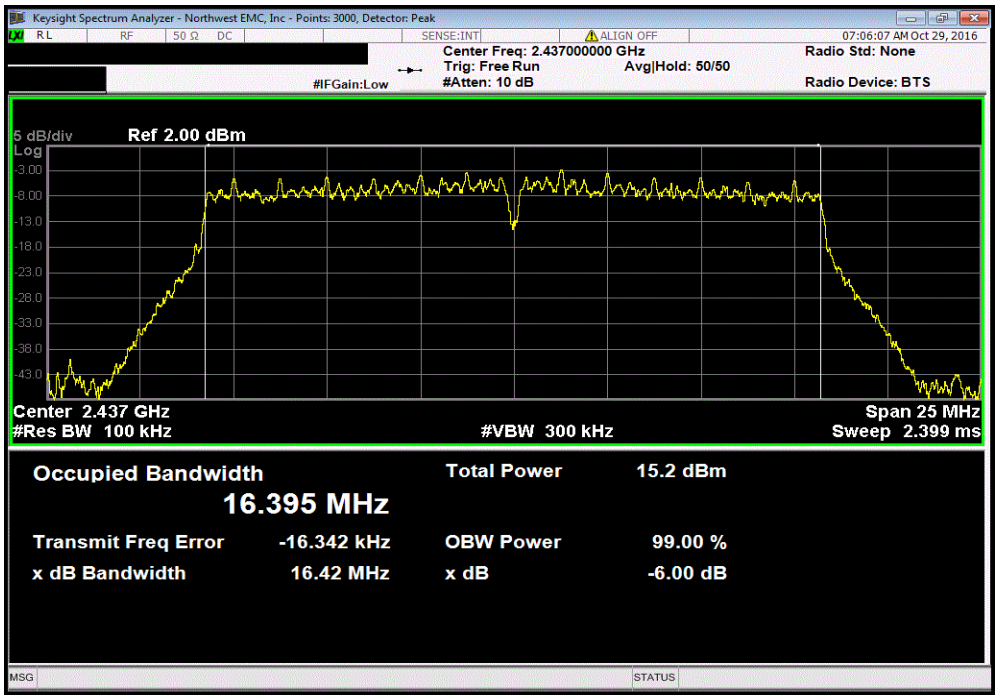
Low Channel 1, 2412 MHz, 802.11(n) MCS7						
				Value	Limit (>)	Result
				16.862 MHz	500 kHz	Pass



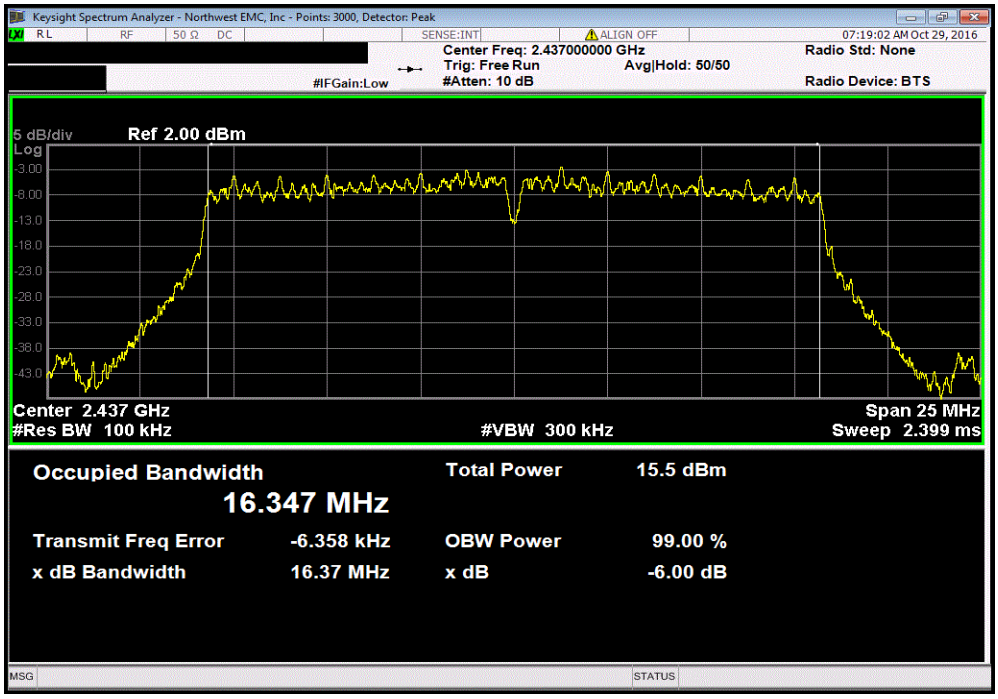
Mid Channel 6, 2437 MHz, 802.11(g) 6 Mbps						
				Value	Limit (>)	Result
				16.083 MHz	500 kHz	Pass



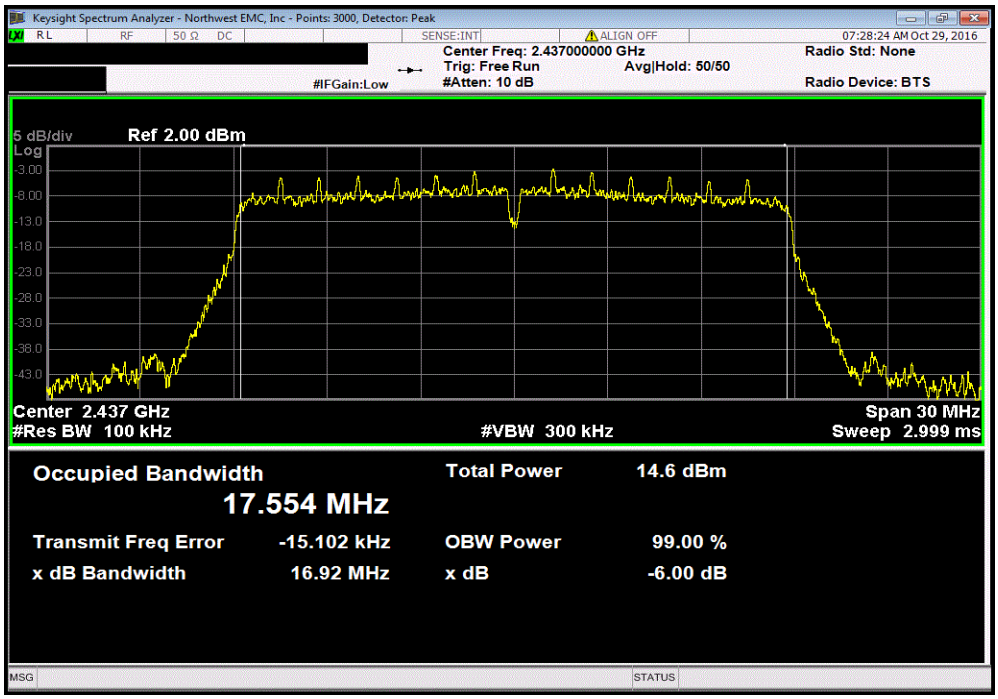
Mid Channel 6, 2437 MHz, 802.11(g) 36 Mbps						
				Value	Limit (>)	Result
				16.421 MHz	500 kHz	Pass



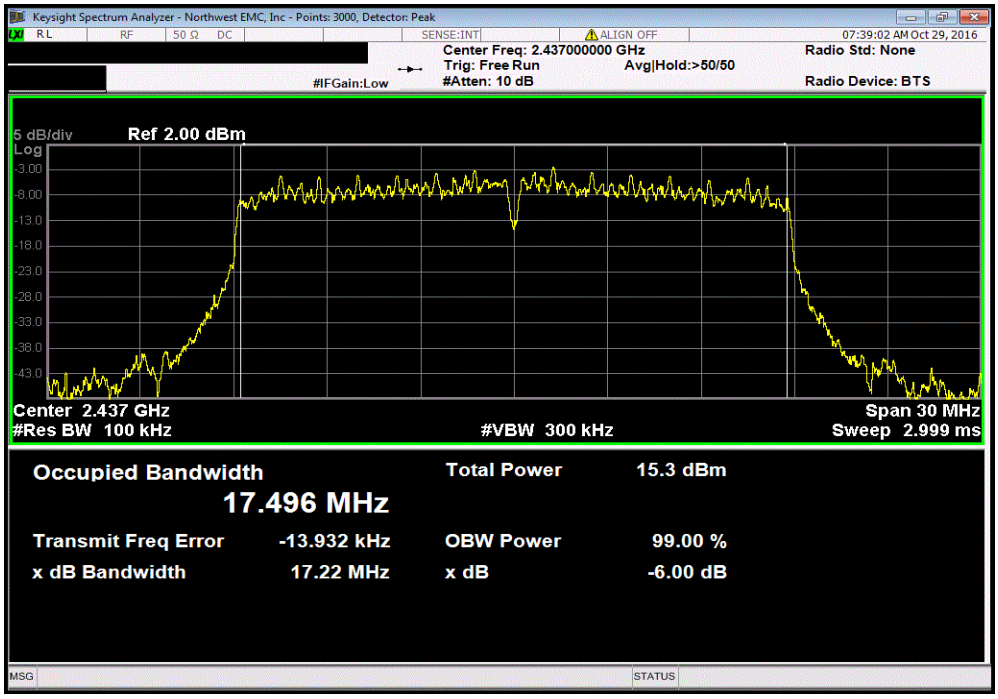
Mid Channel 6, 2437 MHz, 802.11(g) 54 Mbps						
				Value	Limit (>)	Result
				16.375 MHz	500 kHz	Pass



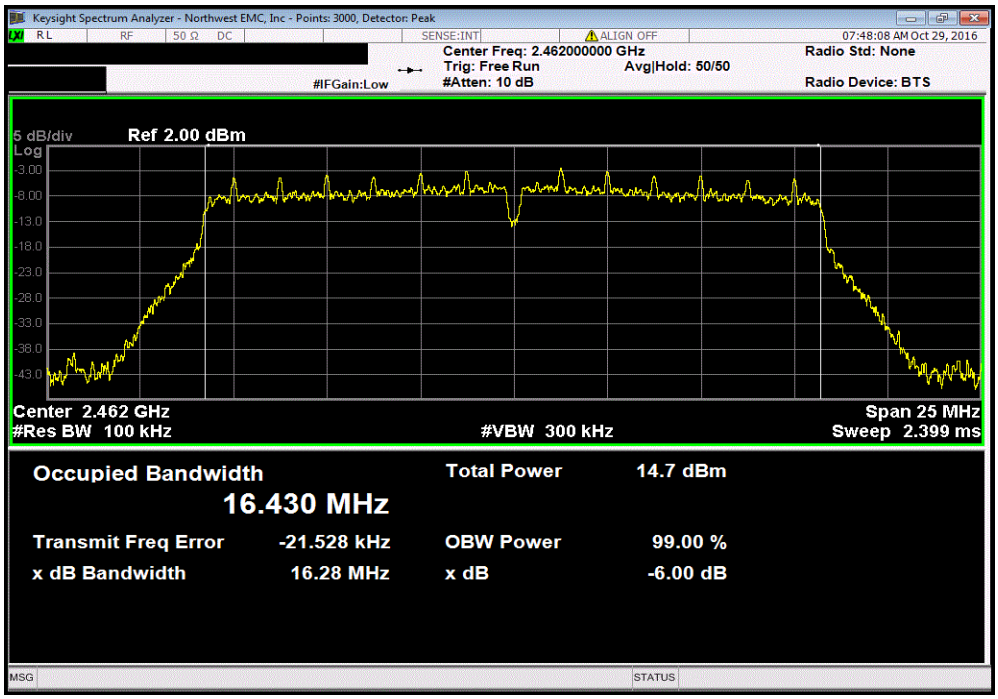
Mid Channel 6, 2437 MHz, 802.11(n) MCS0						
				Value	Limit (>)	Result
				16.919 MHz	500 kHz	Pass



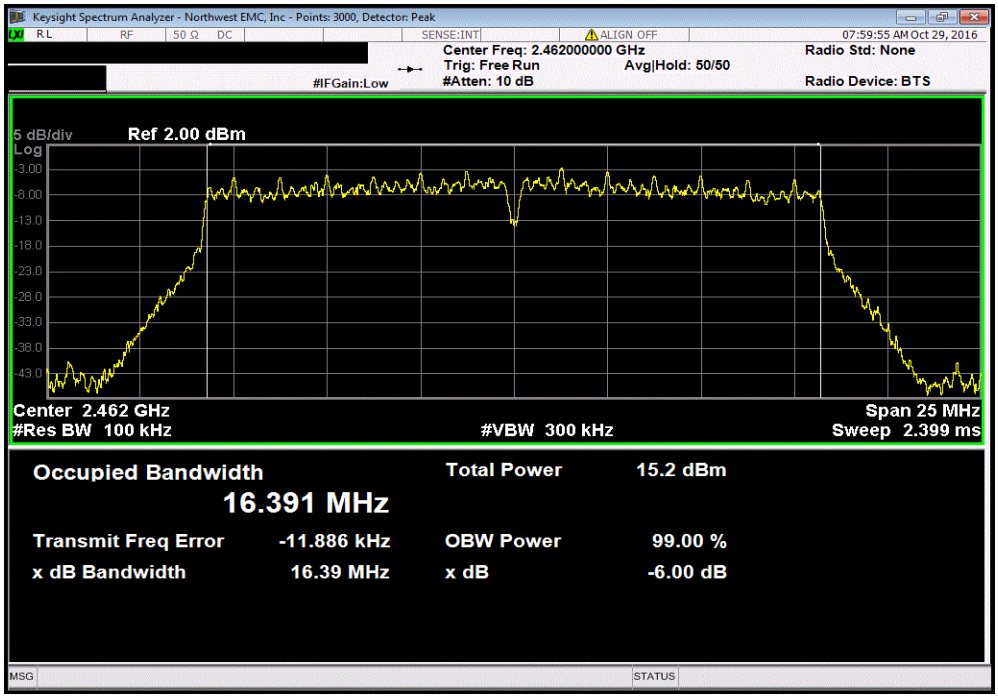
Mid Channel 6, 2437 MHz, 802.11(n) MCS7						
				Value	Limit (>)	Result
				17.217 MHz	500 kHz	Pass



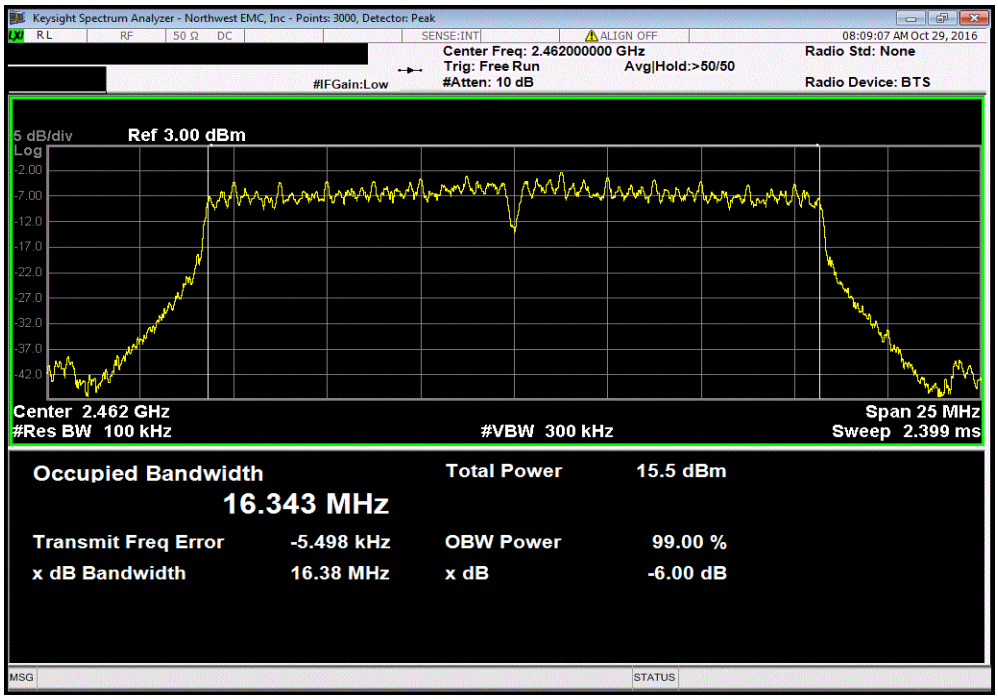
High Channel 11, 2462 MHz , 802.11(g) 6 Mbps							
					Value	Limit (>)	Result
					16.275 MHz	500 kHz	Pass



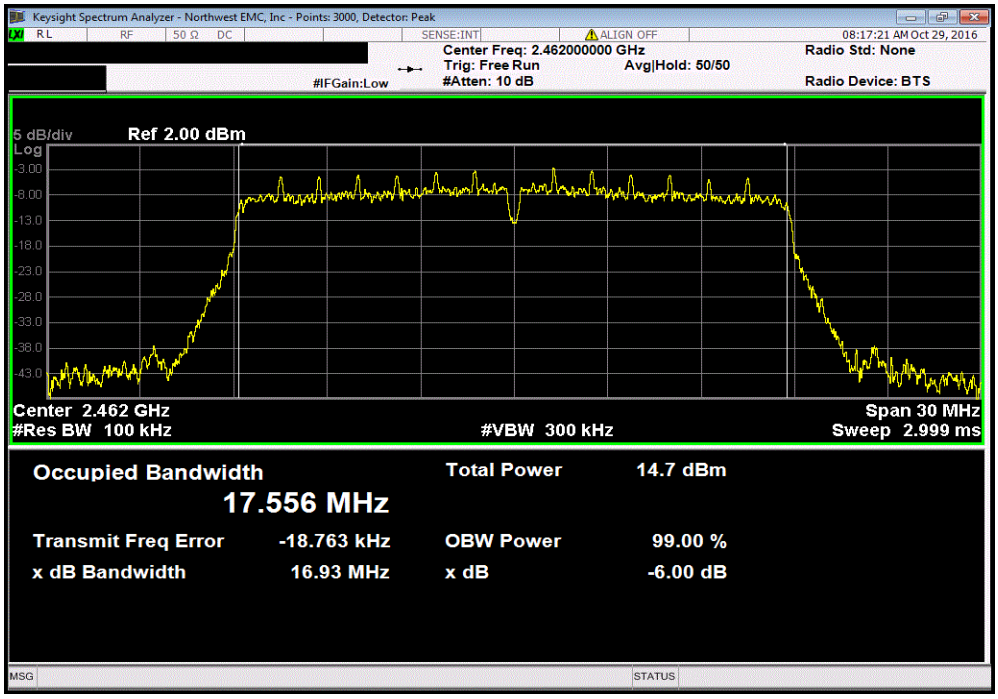
High Channel 11, 2462 MHz , 802.11(g) 36 Mbps							
					Value	Limit (>)	Result
					16.392 MHz	500 kHz	Pass



High Channel 11, 2462 MHz , 802.11(g) 54 Mbps						
				Value	Limit (>)	Result
				16.38 MHz	500 kHz	Pass



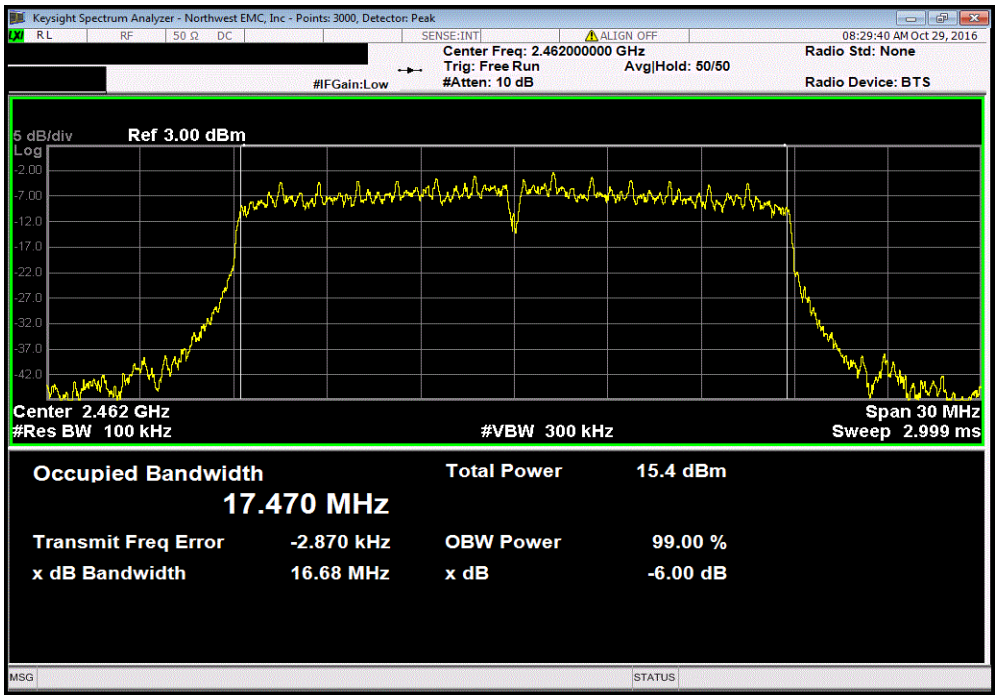
High Channel 11, 2462 MHz , 802.11(n) MCS0						
				Value	Limit (>)	Result
				16.929 MHz	500 kHz	Pass



OCCUPIED BANDWIDTH

XMit 2016.05.06

High Channel 11, 2462 MHz , 802.11(n) MCS7						
				Value	Limit (>)	Result
				16.677 MHz	500 kHz	Pass



OUTPUT POWER

XMit 2016.05.06

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFO	6/8/2016	6/8/2017
Generator - Signal	Agilent	N5183A	TIA	4/6/2016	4/6/2018
Cable	Micro-Coax	UFD150A-1-0720-200200	NCS	6/7/2016	6/7/2017
Attenuator	Fairview Microwave	SA4014-20	TKV	3/4/2016	3/4/2017
Block - DC	Fairview Microwave	SD3379	AMU	5/6/2016	5/6/2017

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The fundamental emission output power (maximum average conducted output power) was measured using the channels and modes as called out on the following data sheets. The transmit power was set to its default maximum.

Prior to measuring output power; the emission bandwidth (B) and the transmission pulse duration (T) were measured. Both are required to determine the method of measuring Maximum Conducted Output Power. The transmission pulse duration (T) was measured using a zero span on the spectrum analyzer to see the pulses in the time domain.

The method AVGSA-2 in section 11.9.2.2.4 of ANSI C63.10:2013 was used to make the measurement. This method uses trace averaging across ON and OFF times of the EUT transmissions in the spectrum analyzer channel power function using an RMS detector. Following the measurement a duty cycle correction was applied by adding [10 log (1 / D)], where D is the duty cycle, to the measured power to compute the average power during the actual transmission times.

De Facto EIRP Limit: The EUT meets the de facto EIRP limit of +36 dBm.

OUTPUT POWER

NORTHWEST EMC

XMit 2016.05.06

EUT:	1790			**Work Order:**	MCSO1761
Serial Number:	DV-1-0546			**Date:**	10/28/16
Customer:	Microsoft Corporation			**Temperature:**	23 °C
Attendees:	Chaitrali Limaye			**Humidity:**	45% RH
Project:	None			**Barometric Pres.:**	1015 mbar
Tested by:	Richard Mellroth	**Power:**	USB	**Job Site:**	NC02

TEST SPECIFICATIONS	Test Method
FCC 15.247:2016	ANSI C63.10:2013

COMMENTS

Power Setting at Default. Client provided adapter cable loss of 0.7dB included in reference level offset.

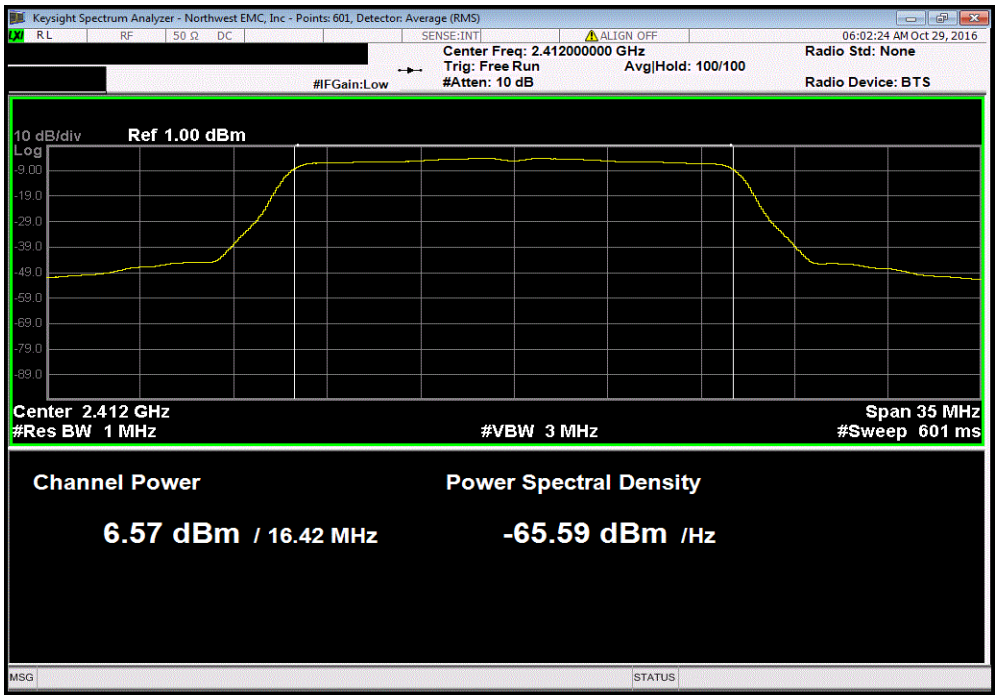
DEVIATIONS FROM TEST STANDARD

None

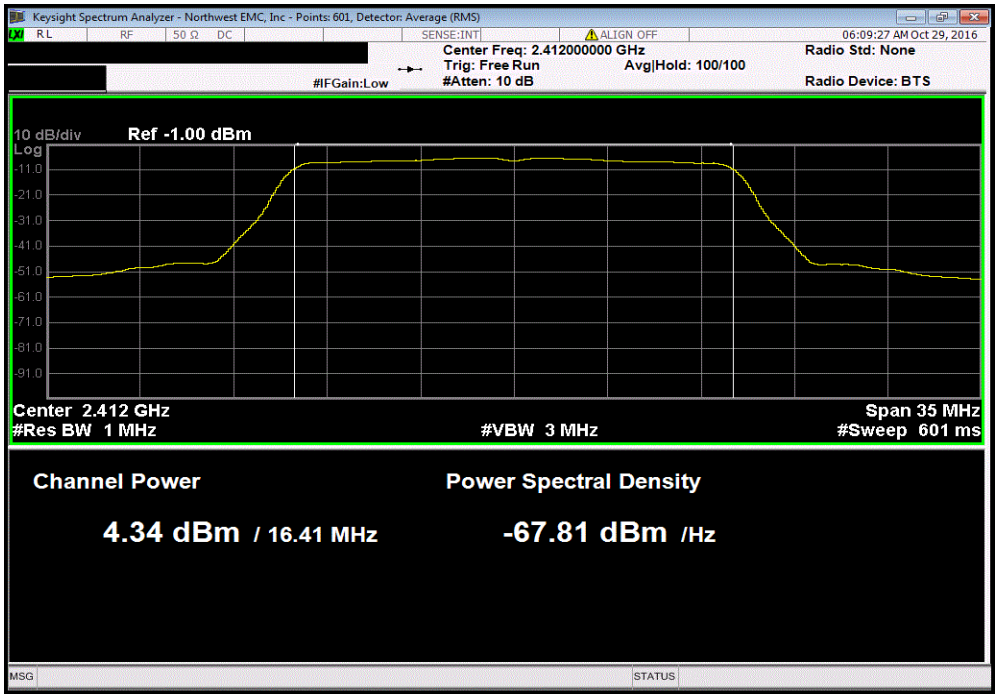
Configuration #	1	*Signature*

	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (dBm)	Results
Low Channel 1, 2412 MHz					
802.11(g) 6 Mbps	6.568	0.6	7.1	30	Pass
802.11(g) 36 Mbps	4.34	2.5	6.9	30	Pass
802.11(g) 54 Mbps	3.854	3.3	7.2	30	Pass
802.11(n) MCS0	6.319	0.6	6.9	30	Pass
802.11(n) MCS7	3.716	3.5	7.2	30	Pass
Mid Channel 6, 2437 MHz					
802.11(g) 6 Mbps	6.83	0.6	7.4	30	Pass
802.11(g) 36 Mbps	4.892	2.5	7.4	30	Pass
802.11(g) 54 Mbps	4.368	3.3	7.7	30	Pass
802.11(n) MCS0	6.877	0.6	7.5	30	Pass
802.11(n) MCS7	4.073	3.5	7.5	30	Pass
High Channel 11, 2462 MHz					
802.11(g) 6 Mbps	7.043	0.6	7.6	30	Pass
802.11(g) 36 Mbps	4.969	2.5	7.5	30	Pass
802.11(g) 54 Mbps	4.413	3.3	7.7	30	Pass
802.11(n) MCS0	6.978	0.6	7.6	30	Pass
802.11(n) MCS7	4.188	3.5	7.7	30	Pass

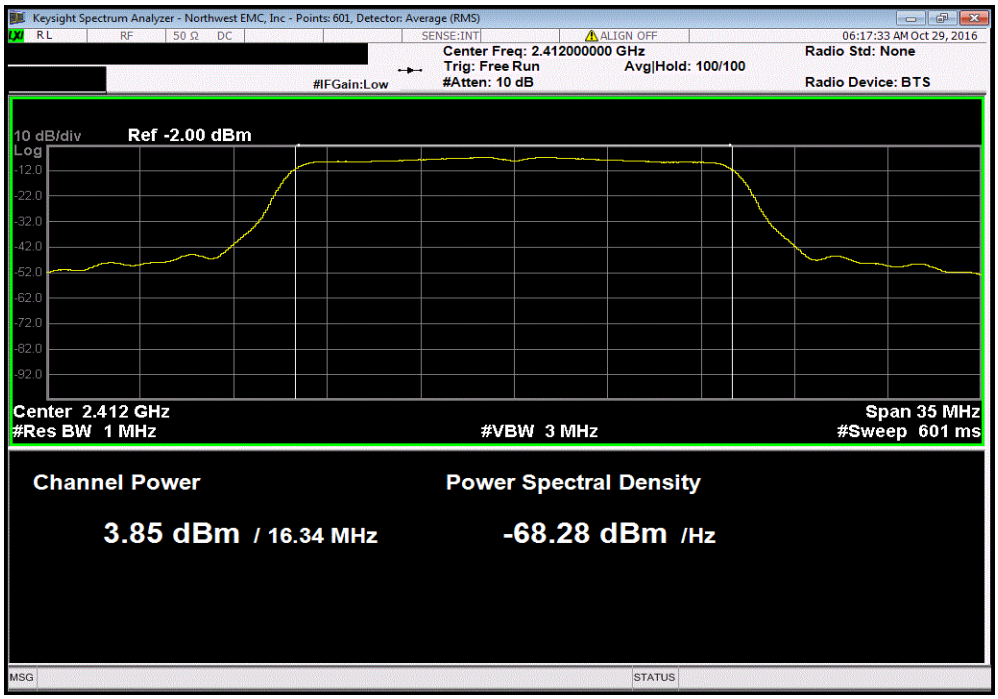
Low Channel 1, 2412 MHz, 802.11(g) 6 Mbps						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	6.568	0.6		7.1	30	Pass



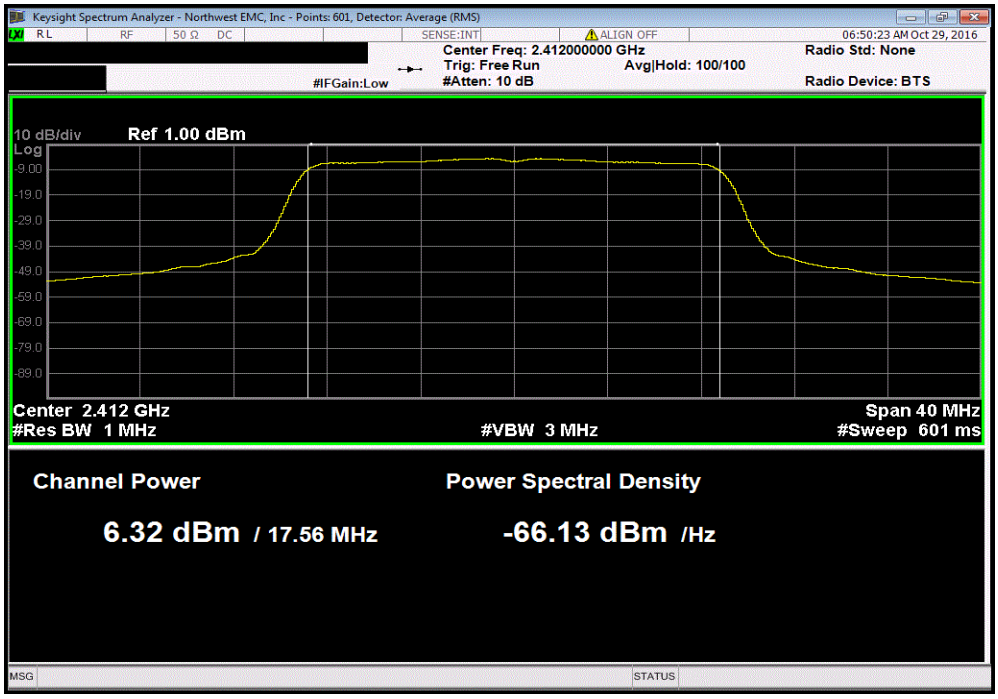
Low Channel 1, 2412 MHz, 802.11(g) 36 Mbps						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	4.34	2.5		6.9	30	Pass



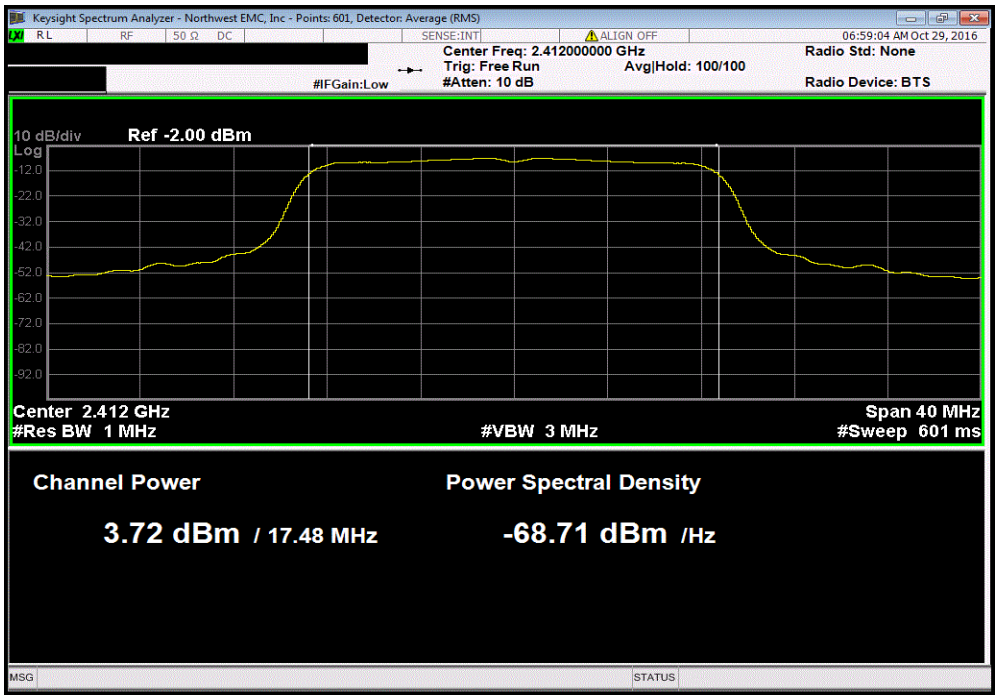
Low Channel 1, 2412 MHz, 802.11(g) 54 Mbps						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	3.854	3.3		7.2	30	Pass



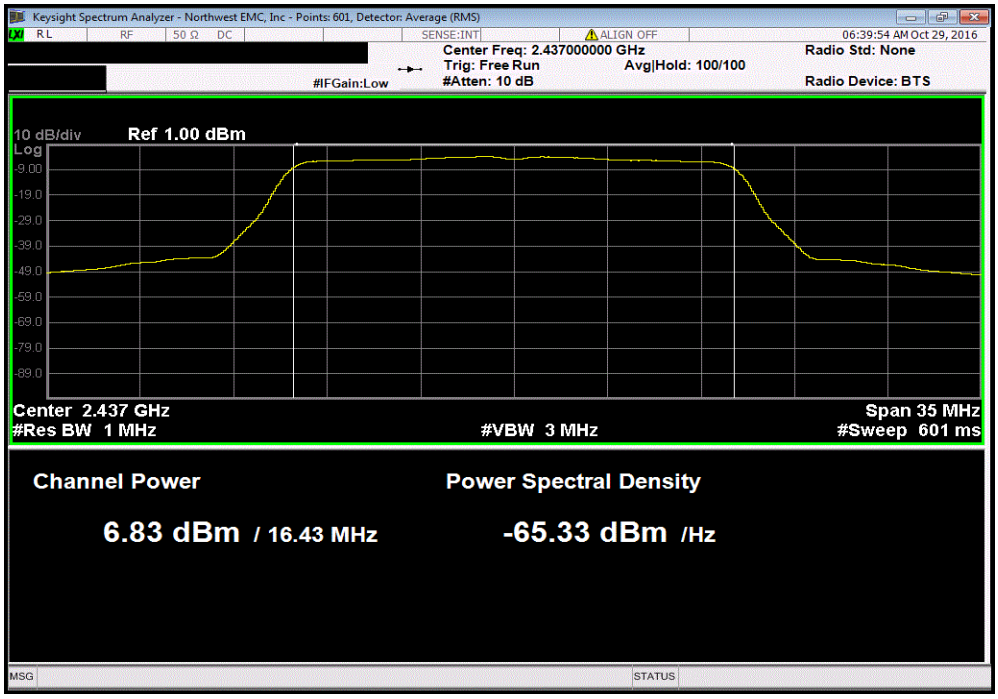
Low Channel 1, 2412 MHz, 802.11(n) MCS0						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	6.319	0.6		6.9	30	Pass



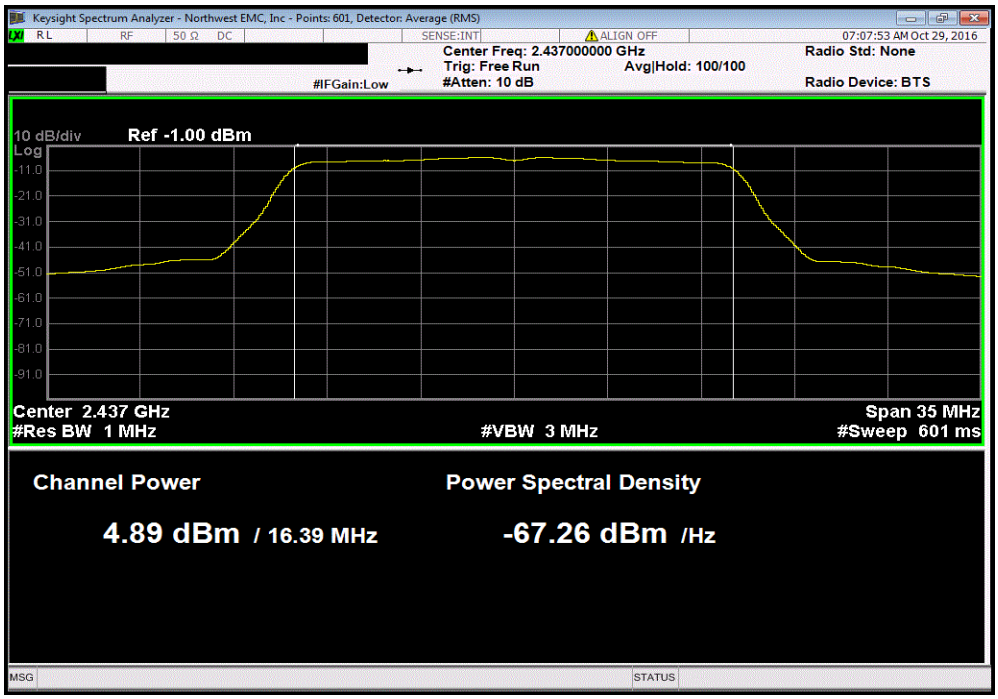
Low Channel 1, 2412 MHz, 802.11(n) MCS7						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	3.716	3.5		7.2	30	Pass



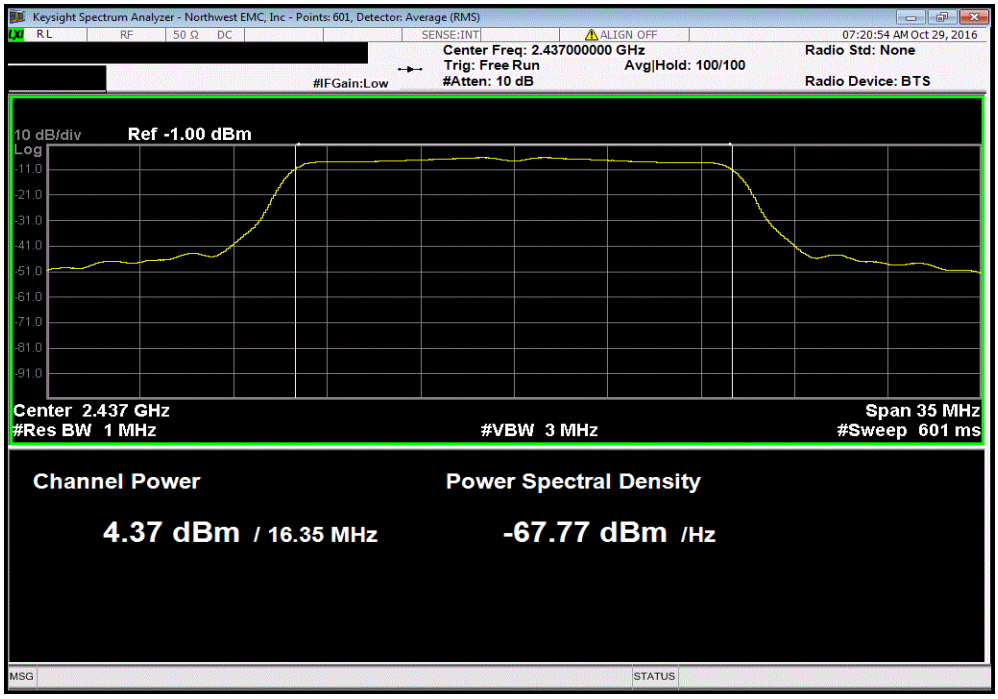
Mid Channel 6, 2437 MHz, 802.11(g) 6 Mbps						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	6.83	0.6		7.4	30	Pass



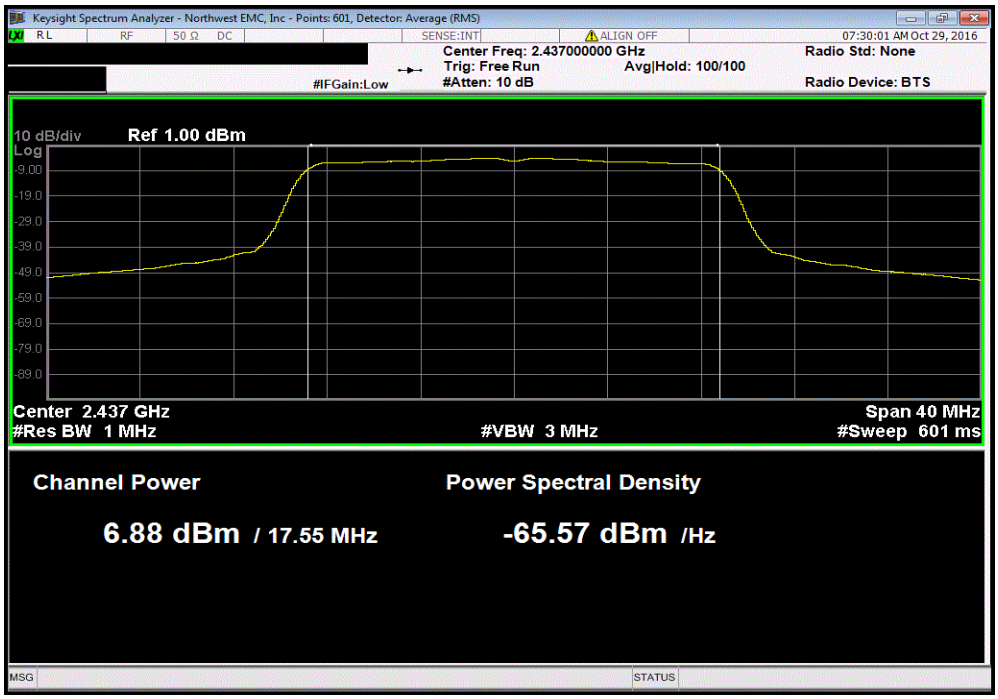
Mid Channel 6, 2437 MHz, 802.11(g) 36 Mbps						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	4.892	2.5		7.4	30	Pass



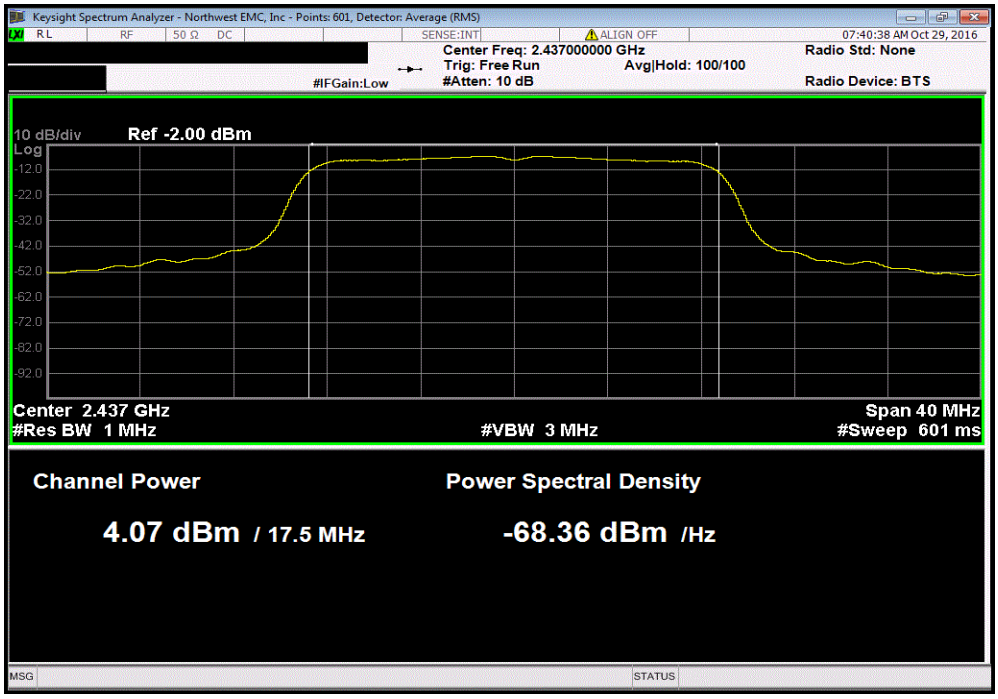
Mid Channel 6, 2437 MHz, 802.11(g) 54 Mbps						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	4.368	3.3		7.7	30	Pass



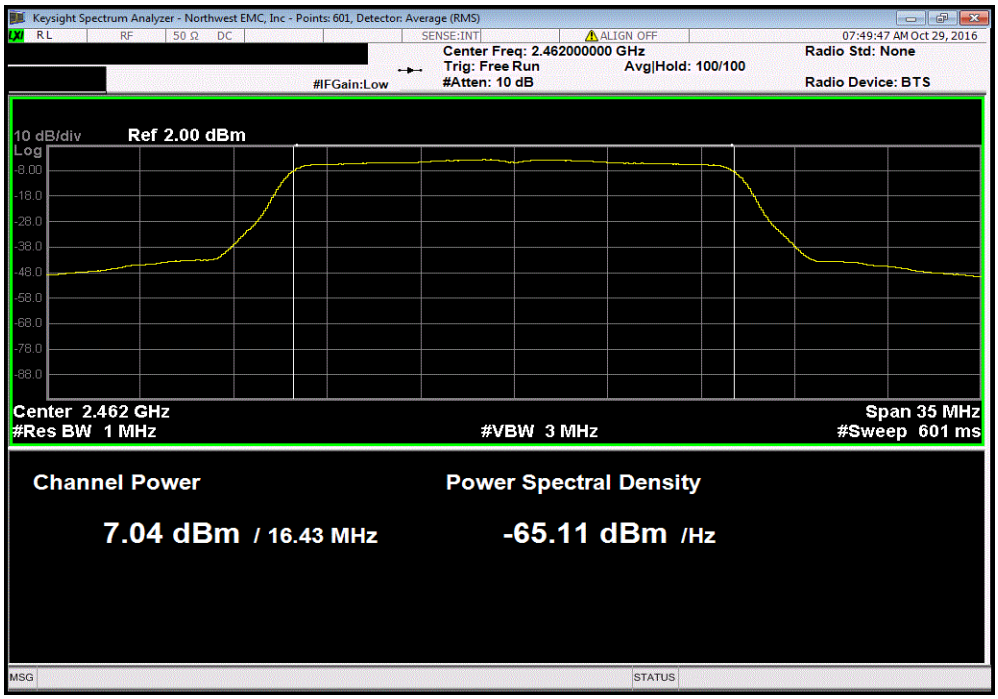
Mid Channel 6, 2437 MHz, 802.11(n) MCS0						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	6.877	0.6		7.5	30	Pass



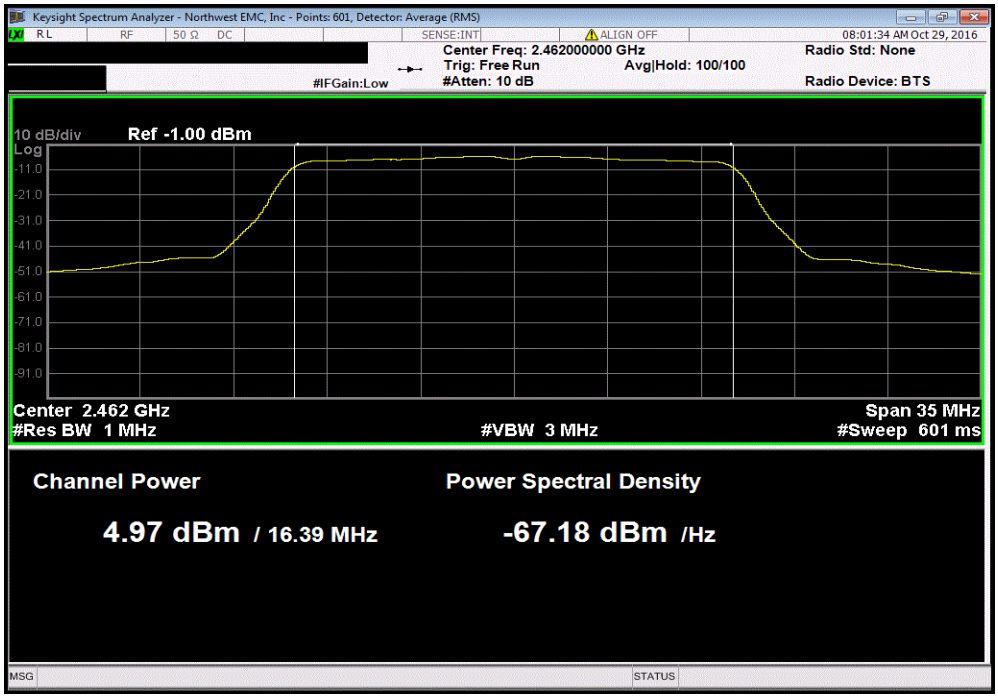
Mid Channel 6, 2437 MHz, 802.11(n) MCS7						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	4.073	3.5		7.5	30	Pass



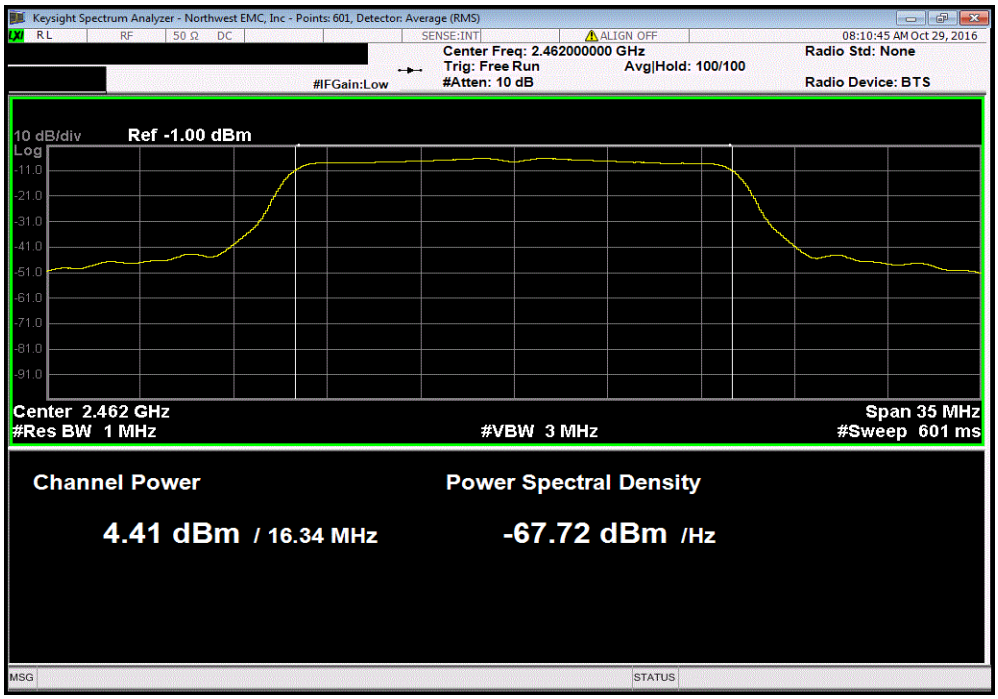
High Channel 11, 2462 MHz , 802.11(g) 6 Mbps						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	7.043	0.6		7.6	30	Pass



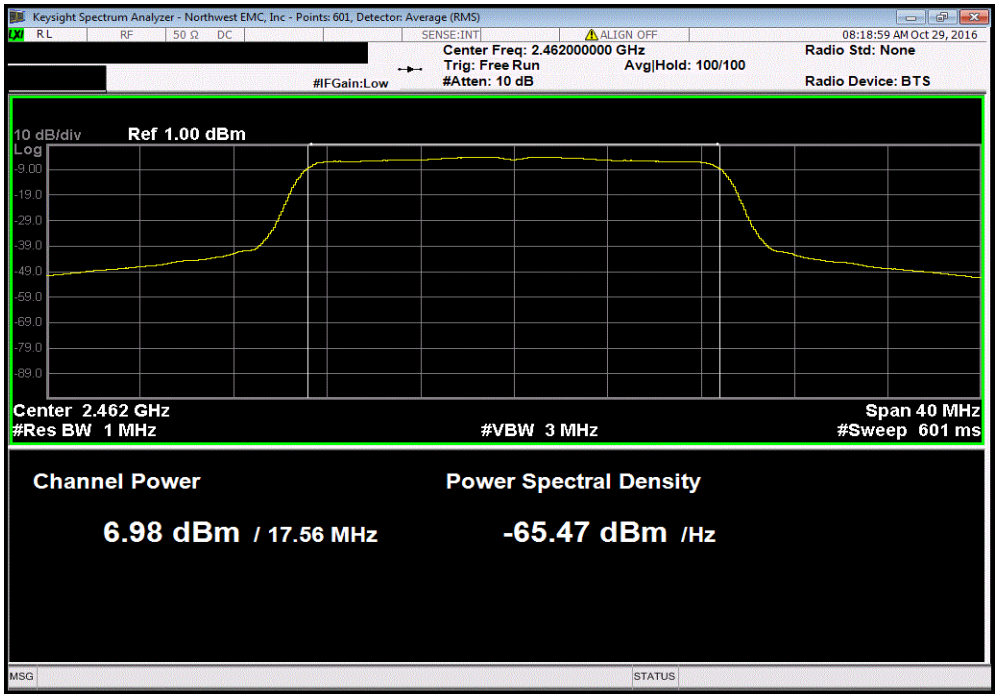
High Channel 11, 2462 MHz , 802.11(g) 36 Mbps						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	4.969	2.5		7.5	30	Pass



High Channel 11, 2462 MHz , 802.11(g) 54 Mbps						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	4.413	3.3		7.7	30	Pass



High Channel 11, 2462 MHz , 802.11(n) MCS0						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	6.978	0.6		7.6	30	Pass



High Channel 11, 2462 MHz , 802.11(n) MCS7						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)		Value (dBm)	Limit (dBm)	Results
	4.188	3.5		7.7	30	Pass