Microsoft Corporation

1631

FHSS

FCC 15.207:2014

FCC 15.247:2014

Report #: MCSO1702

Report Prepared By Northwest EMC Inc.

NORTHWEST EMC – (888) 364-2378 – www.nwemc.com

California – Minnesota – Oregon – New York – Washington

CERTIFICATE OF TEST

WTD 12.5.23

Last Date of Test: March 07, 2014
Microsoft Corporation
Model: 1631

Emissions

Test Description	Specification	Test Method	Pass/Fail
Duty Cycle	FCC 15.247:2014	ANSI C63.10:2009	Pass
Occupied Bandwidth	FCC 15.247:2014	ANSI C63.10:2009	Pass
Output Power	FCC 15.247:2014	ANSI C63.10:2009	Pass
Spurious Conducted Emissions	FCC 15.247:2014	ANSI C63.10:2009	Pass
Band Edge Compliance	FCC 15.247:2014	ANSI C63.10:2009	Pass
Band Edge Compliance- Hopping Mode	FCC 15.247:2014	ANSI C63.10:2009	Pass
Channel Separation	FCC 15.247:2014	ANSI C63.10:2009	Pass
Number of Hopping Channels	FCC 15.247:2014	ANSI C63.10:2009	Pass
Dwell Time	FCC 15.247:2014	ANSI C63.10:2009	Pass
Spurious Radiated Emissions	FCC 15.247:2014	ANSI C63.10:2009	Pass
AC Powerline Conducted Emissions	FCC 15.207:2014	ANSI C63.10:2009	Pass

Deviations From Test Standards

None

Approved By:

Rod Munro, Operations Manager

NVLAP Lab Code: 200629-0

This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government of the United States of America.

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. This Report may only be duplicated in its entirety. 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.

REVISION HISTORY

Revision Number	Description	Date	Page Number
00	None		

Barometric Pressure

The recorded barometric pressure has been normalized to sea level.

ACCREDITATIONS AND AUTHORIZATIONS

REV 2012.05.24

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 Guide 65 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

IC - Recognized by Industry Canada as a Certification Body (CB). Certification chambers and Open Area Test Sites are filed with IC.

European Union

European Commission – Validated by the European Commission as a Conformity Assessment Body (CAB) under the EMC directive and 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

KCC / 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.

Hong Kong

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

Vietnam

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

Russia

GOST – Accredited by Certinform VNIINMASH, CERTINFO, SAMTES, and Federal CHEC to perform EMC and Hygienic testing for Information Technology products to GOST standards.

SCOPE

For details on the Scopes of our Accreditations, please visit:
http://www.nwemc.com/accreditations/

MEASUREMENT UNCERTAINTY

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 WP 342. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) for each test is listed below. 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 16-4-1 as applicable), and are available upon request.

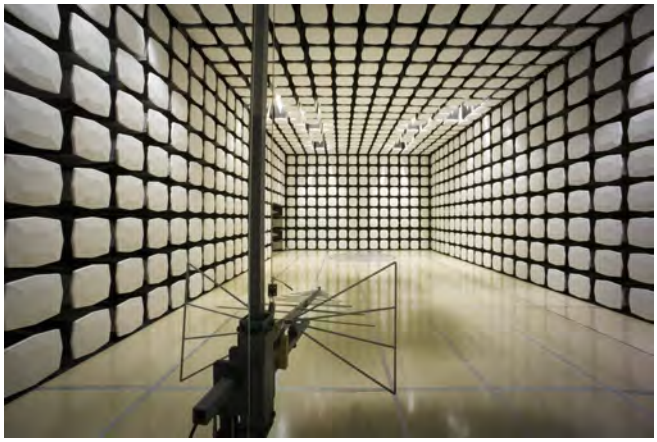
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

Test	+ MU	- MU
Frequency Accuracy (Hz)	0.12	-0.01
Amplitude Accuracy (dB)	0.49	-0.49
Conducted Power (dB)	0.41	-0.41
Radiated Power via Substitution (dB)	0.69	-0.68
Temperature (degrees C)	0.81	-0.81
Humidity (% RH)	2.89	-2.89
Field Strength (dB)	3.80	-3.80
AC Powerline Conducted Emissions (dB)	2.94	-2.94

FACILITIES

REV 2013.06.28

Oregon	**California**	**New York**	**Minnesota**	**Washington**
Labs EV01-12 22975 NW Evergreen Pkwy Hillsboro, OR 97124 (503) 844-4066	Labs OC01-13 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 685-0796	Labs MN01-08 9349 W Broadway Ave. Brooklyn Park, MN 55445 (763) 425-2281	Labs NC01-05,SU02,SU07 19201 120th Ave. NE Bothell, WA 98011 (425) 984-6600
VCCI				
A-0108	A-0029		A-0109	A-0110
Industry Canada				
2834D-1, 2834D-2	2834B-1, 2834B-2, 2834B-3		2834E-1	2834C-1
NVLAP				
NVLAP Lab Code: 200630-0	NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200761-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200629-0



PRODUCT DESCRIPTION

WTD 12.5.23

Client and Equipment Under Test (EUT) Information

Company Name:	Microsoft Corporation
Address:	One Microsoft Way
City, State, Zip:	Redmond, WA 98052-6399
Test Requested By:	Mike Boucher
Model:	1631
First Date of Test:	March 06, 2012
Last Date of Test:	March 07, 2014
Receipt Date of Samples:	March 06, 2012
Equipment Design Stage:	Production
Equipment Condition:	No Damage

Information Provided by the Party Requesting the Test

Functional Description of the EUT (Equipment Under Test):
Handheld computing device with Bluetooth radio module with 1 antenna(s).

Testing Objective:
To demonstrate compliance to FCC 15.247 requirements for Bluetooth FHSS.

CONFIGURATIONS

Configuration MCSO1702- 1

Software/Firmware Running during test	
Description	**Version**
Wi-Fi Tool	V2.3

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Handheld Computing Device	Microsoft Corporation	1631	041152140753

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop Computer	Lenovo	ThinkPad 4174BB4	R9-PMLAF
USB Ethernet Adapter	Cisco	Linksys USB300M	CU906M715225
Detachable Keyboard	Microsoft Corporation	X889242-BBH	000596140354
AC Adapter (1)	Microsoft Corporation	X891182-003	0D130C1VPC42
AC Adapter (2)	Lenovo	42T4430	36200147

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
Ethernet	No	1.5m	No	USB Ethernet Adapter	Laptop Computer
AC Power	No	0.5m	No	AC Mains	AC Adapter (1)
DC Power	No	1.8m	No	AC Adapter (1)	Handheld Computing Device
AC Power	No	0.85m	No	AC Mains	AC Adapter (2)
DC Power	No	1.8m	No	AC Adapter (2)	Laptop Computer
USB	Yes	0.1m	No	Handheld Computing Device	USB Ethernet Adapter
PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.					

Configuration MCSO1702- 2

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Handheld Computing Device	Microsoft Corporation	1631	041152140753

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
USB Ethernet Adapter	Cisco	Linksys USB300M	CU906M715225
Detachable Keyboard	Microsoft Corporation	X889242-BBH	000596140354
AC Adapter (1)	Microsoft Corporation	X891182-003	0D130C1VPC42
Headphones	Unknown	None	None

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
AC Power	No	0.5m	No	AC Mains	AC Adapter (1)
DC Power	No	1.8m	No	AC Adapter (1)	Handheld Computing Device
Audio Cable	No	1.1m	No	Handheld Computing Device	Headphones
Display Port	Yes	1.8m	No	Handheld Computing Device	Unterminated
USB	Yes	0.1m	No	Handheld Computing Device	USB Ethernet Adapter
Ethernet	No	1.5m	No	USB Ethernet Adapter	Unterminated
PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.					

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	3/6/2014	AC Powerline 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.
2	3/6/2014	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.
3	3/6/2014	Band Edge Compliance-Hopping Mode	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	3/6/2014	Channel Separation	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	3/6/2014	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.
6	3/6/2014	Number Hopping Channels	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	3/6/2014	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.
8	3/6/2014	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.
9	3/6/2014	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.
10	3/6/2014	Dwell Time	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.
11	3/7/2014	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

DUTY CYCLE

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.	Interval
Signal Generator	Agilent	N5183A	TIA	1/27/2012	36
NC02 Cable	ESM Cable Corp.	TTBJ-141 KMKM-72	NC5	7/3/2013	12
Attenuator	Fairview Microwave	SA4014-20	TKE	2/13/2014	12
Spectrum Analyzer	Agilent	E4446A	AAT	6/28/2012	24
40GHz DC Block	Fairview Microwave	SD3379	AMJ	7/3/2013	12

TEST DESCRIPTION

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 and transmit channels..

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. A direct connection was made between the RF output of the EUT and a spectrum analyzer. Attenuation and a DC block were used.

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 was used during some of the other tests in this report to only measure during the burst duration.

DUTY CYCLE

EUT:	1631	Work Order:	MCSO1702
Serial Number:	041152140753	Date:	03/06/14
Customer:	Microsoft Corporation	Temperature:	23°C
Attendees:	None	Humidity:	40%
Project:	None	Barometric Pres.:	1001
Tested by:	Richard Mellroth	Power: 110 VAC / 60Hz	Job Site: NC06

TEST SPECIFICATIONS	Test Method
FCC 15.247:2014	ANSI C63.10:2009

COMMENTS

Adapter cable loss of 0.75dB added to analyzer reference level offset. EUT power settings in control software were set to Power Class: 1.5, and Power Level: 8 (dBm).

DEVIATIONS FROM TEST STANDARD

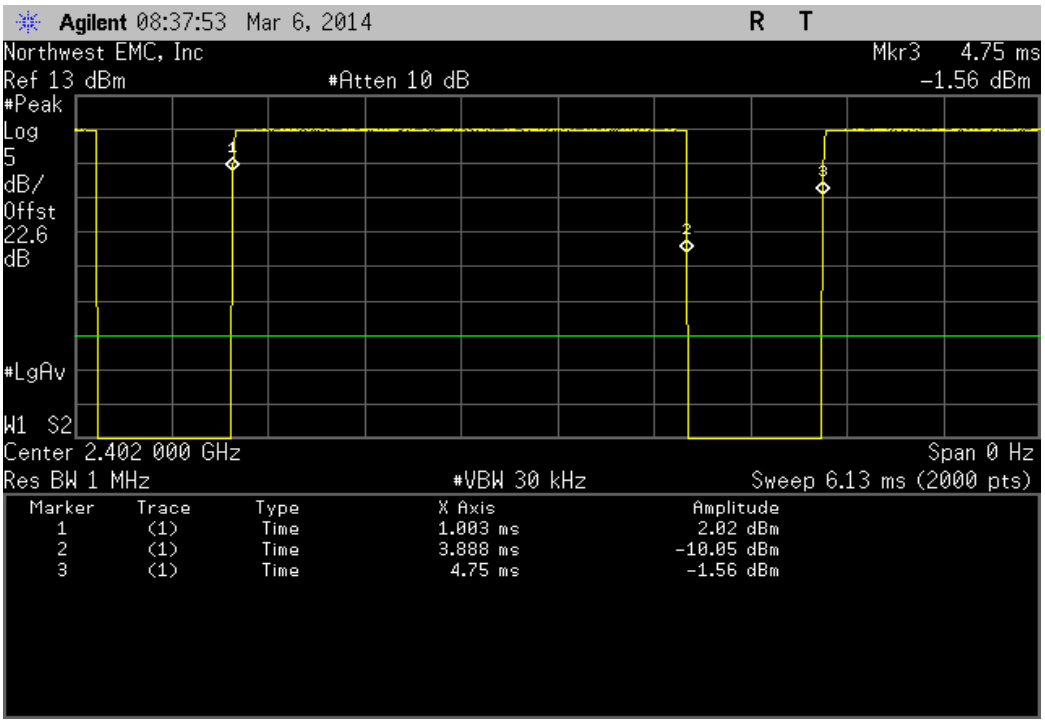
None

Configuration #	1	Signature

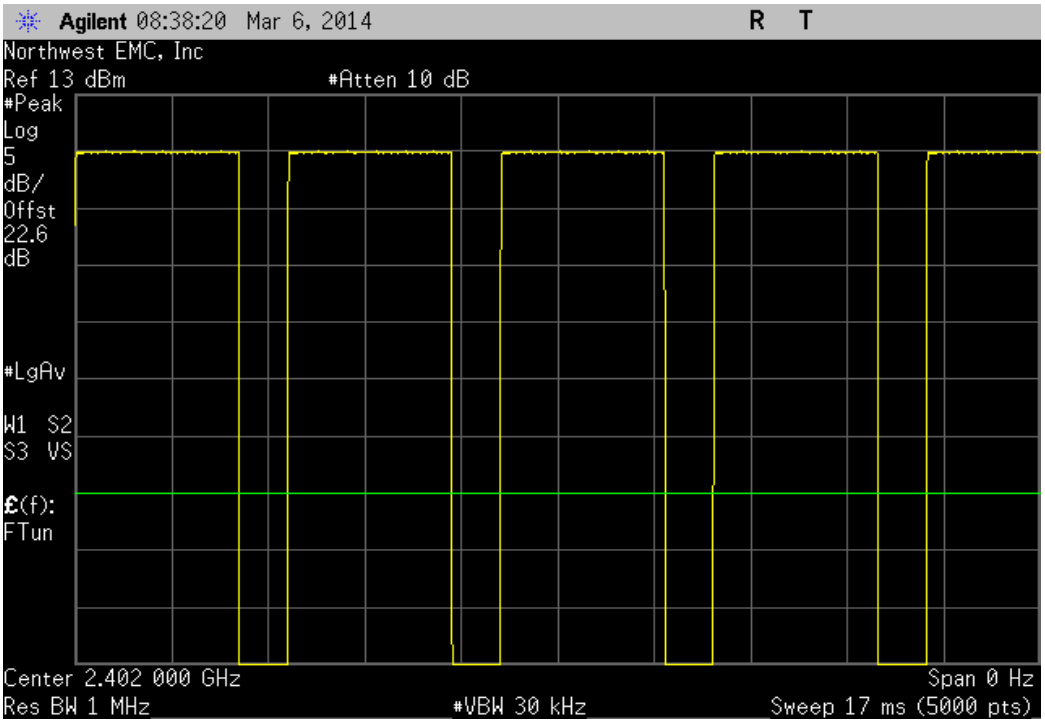
		Pulse Width	Period	Number of Pulses	Value (%)	Limit	Result
DH5							
	Low Channel 0, 2402 MHz	2.886 mS	3.748 mS	1	77	N/A	N/A
	Low Channel 0, 2402 MHz	N/A	N/A	5	N/A	N/A	N/A
	Mid Channel 39, 2441 MHz	2.889 mS	3.751 mS	1	77	N/A	N/A
	Mid Channel 39, 2441 MHz	N/A	N/A	5	N/A	N/A	N/A
	High Channel 78, 2480 MHz	2.886 mS	3.751 mS	1	76.9	N/A	N/A
	High Channel 78, 2480 MHz	N/A	N/A	5	N/A	N/A	N/A
2DH5							
	Low Channel 0, 2402 MHz	2.883 mS	3.748 mS	1	76.9	N/A	N/A
	Low Channel 0, 2402 MHz	N/A	N/A	5	N/A	N/A	N/A
	Mid Channel 39, 2441 MHz	2.886 mS	3.751 mS	1	76.9	N/A	N/A
	Mid Channel 39, 2441 MHz	N/A	N/A	5	N/A	N/A	N/A
	High Channel 78, 2480 MHz	2.886 mS	3.751 mS	1	76.9	N/A	N/A
	High Channel 78, 2480 MHz	N/A	N/A	5	N/A	N/A	N/A
3DH5							
	Low Channel 0, 2402 MHz	2.886 mS	3.751 mS	1	76.9	N/A	N/A
	Low Channel 0, 2402 MHz	N/A	N/A	5	N/A	N/A	N/A
	Mid Channel 39, 2441 MHz	2.886 mS	3.751 mS	1	76.9	N/A	N/A
	Mid Channel 39, 2441 MHz	N/A	N/A	5	N/A	N/A	N/A
	High Channel 78, 2480 MHz	2.886 mS	3.748 mS	1	77	N/A	N/A
	High Channel 78, 2480 MHz	N/A	N/A	5	N/A	N/A	N/A

DUTY CYCLE

DH5, Low Channel 0, 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit	Result
	2.886 mS	3.748 mS	1	77	N/A	N/A

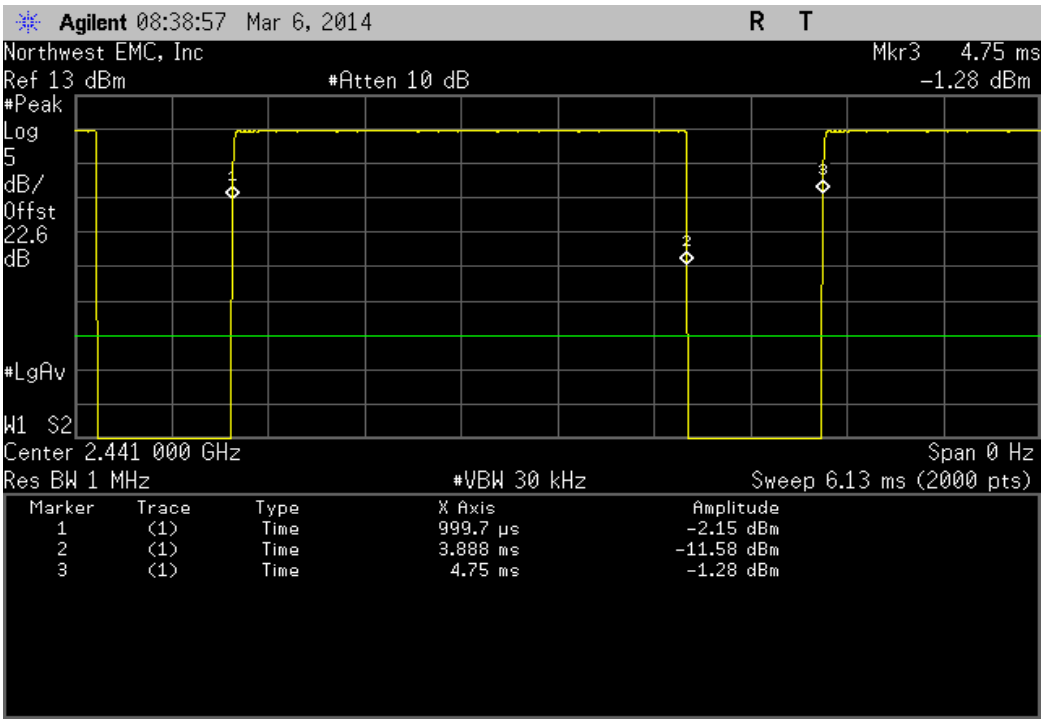


DH5, Low Channel 0, 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit	Result
	N/A	N/A	5	N/A	N/A	N/A

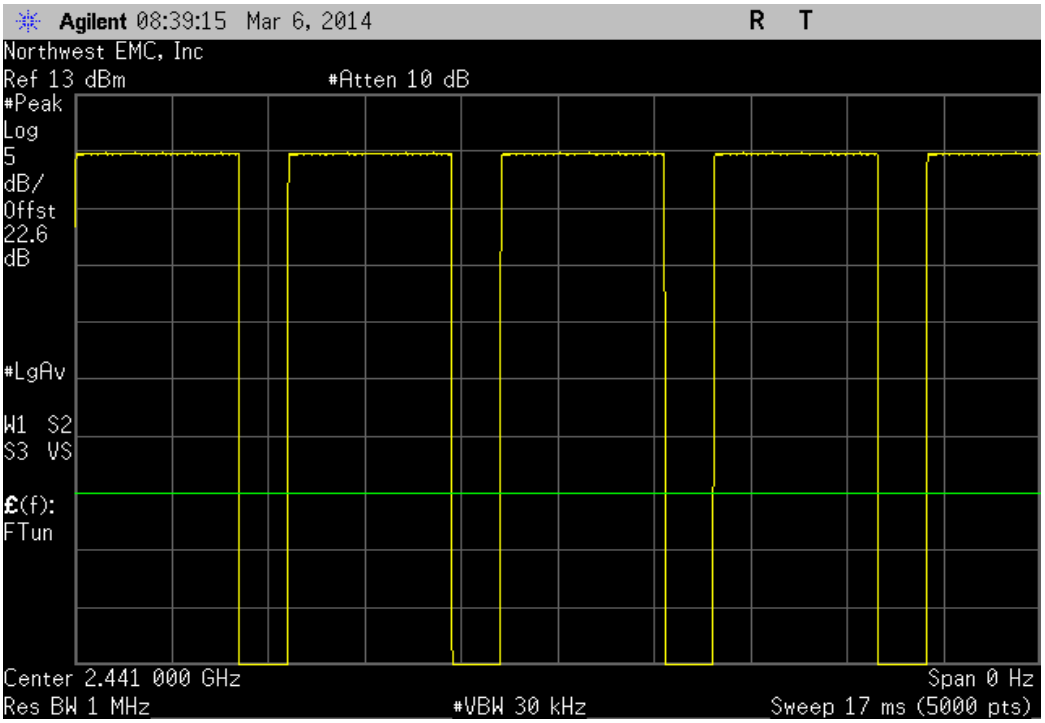


DUTY CYCLE

DH5, Mid Channel 39, 2441 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit	Result
	2.889 mS	3.751 mS	1	77	N/A	N/A

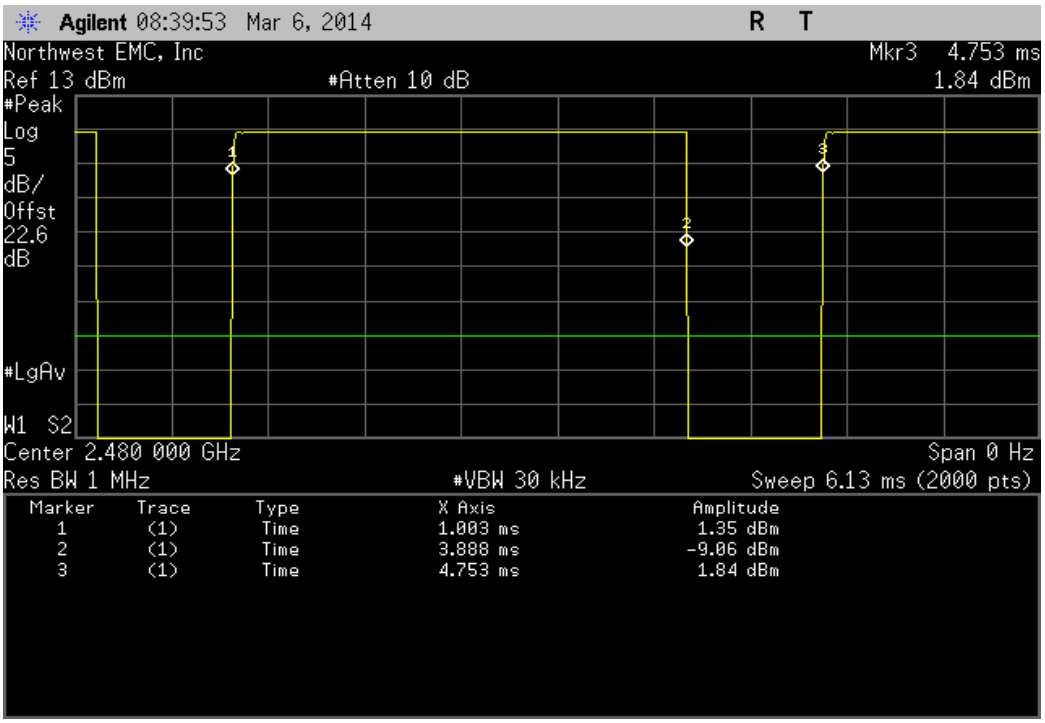


DH5, Mid Channel 39, 2441 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit	Result
	N/A	N/A	5	N/A	N/A	N/A

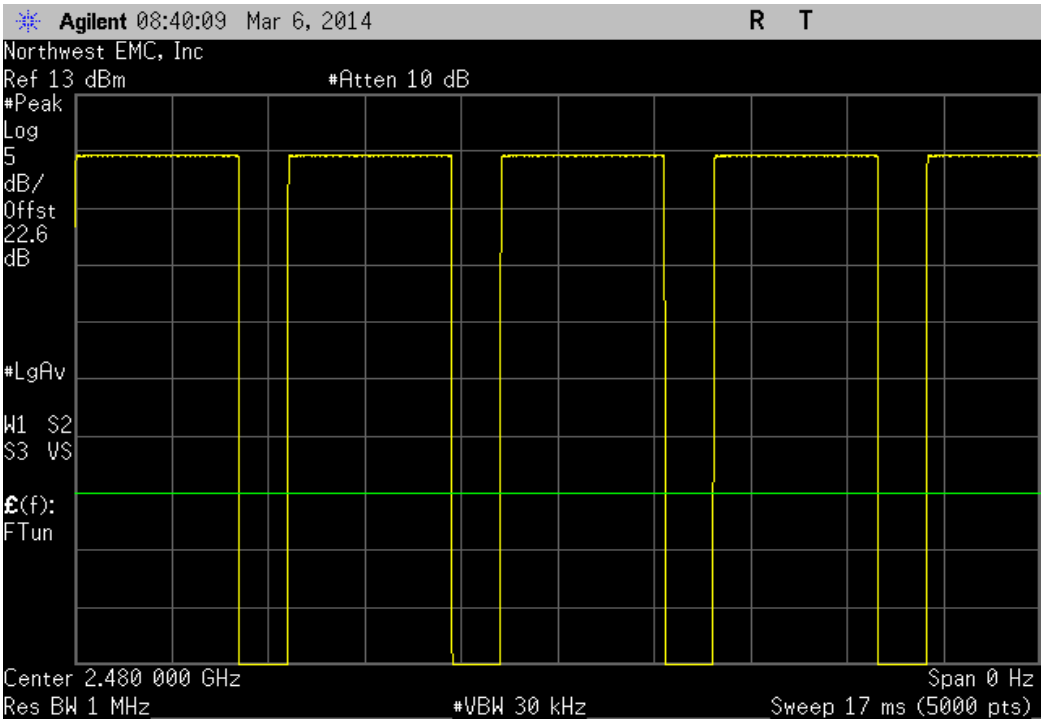


DUTY CYCLE

DH5, High Channel 78, 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit	Result
	2.886 mS	3.751 mS	1	76.9	N/A	N/A

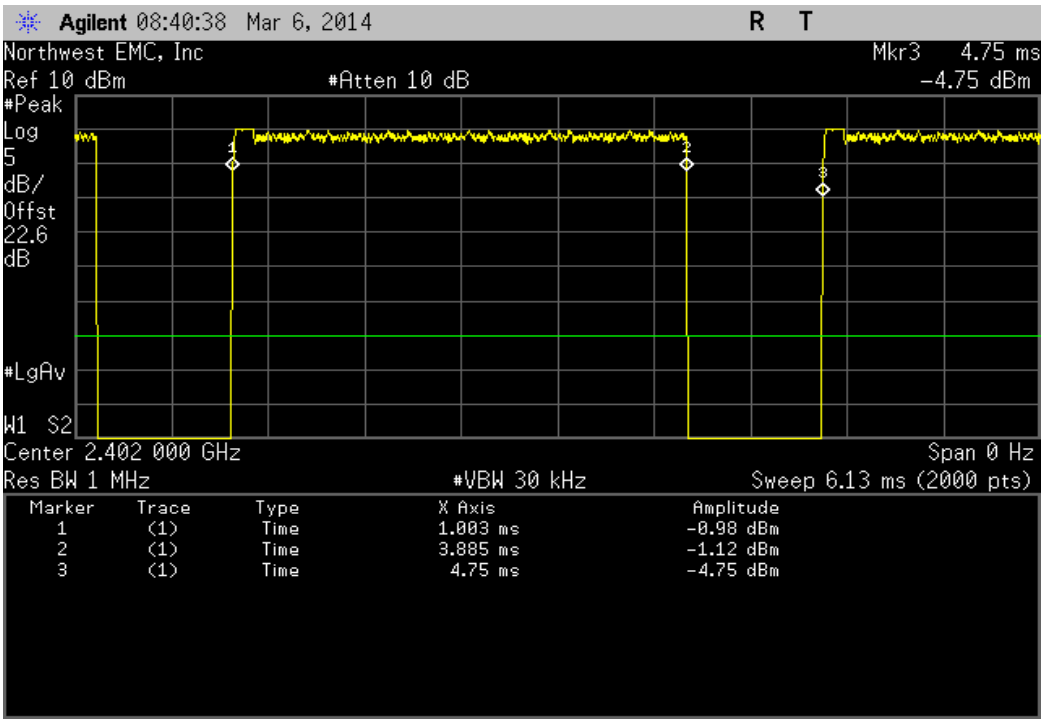


DH5, High Channel 78, 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit	Result
	N/A	N/A	5	N/A	N/A	N/A

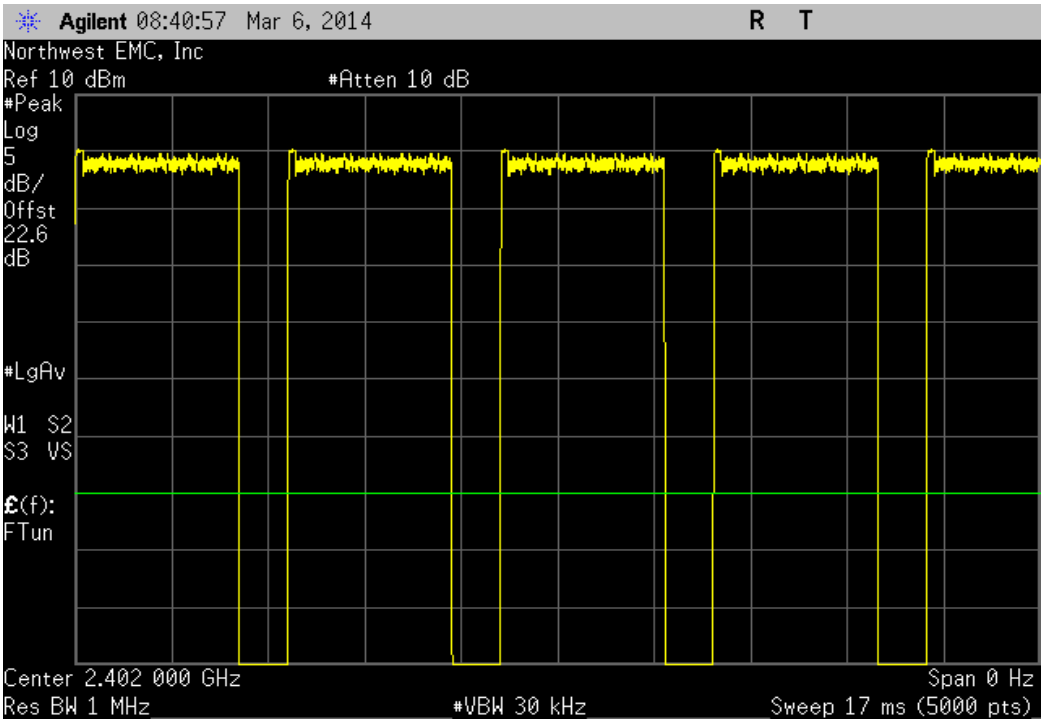


DUTY CYCLE

2DH5, Low Channel 0, 2402 MHz					
	Pulse Width	Period	Number of Pulses	Value (%)	Limit	Result
	2.883 mS	3.748 mS	1	76.9	N/A	N/A

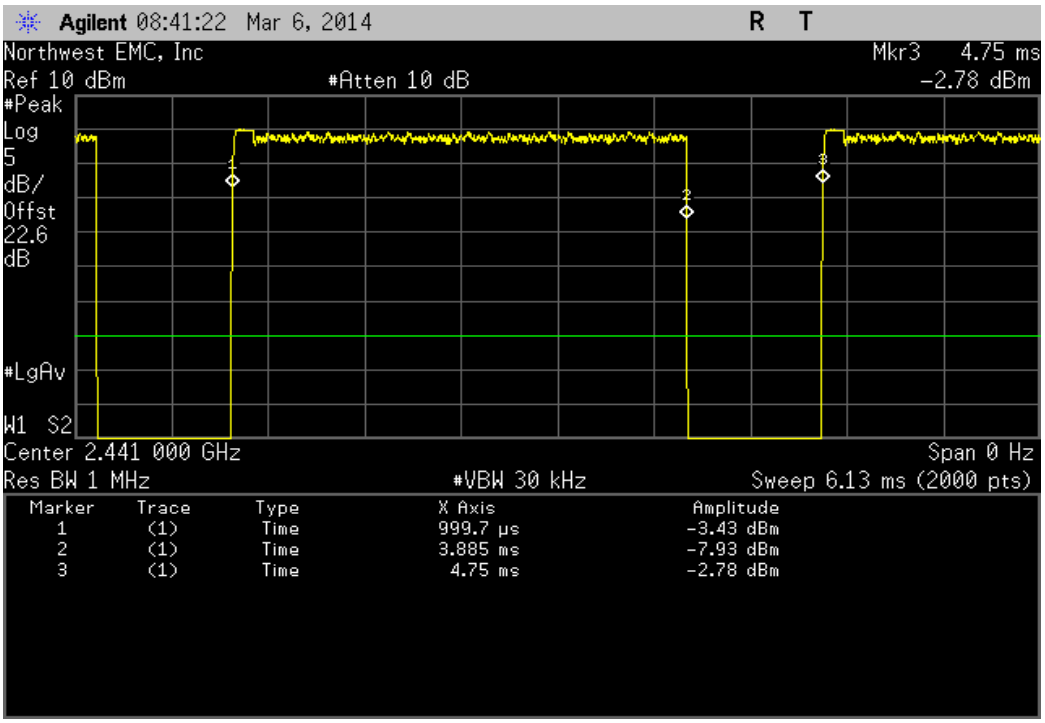


2DH5, Low Channel 0, 2402 MHz					
	Pulse Width	Period	Number of Pulses	Value (%)	Limit	Result
	N/A	N/A	5	N/A	N/A	N/A

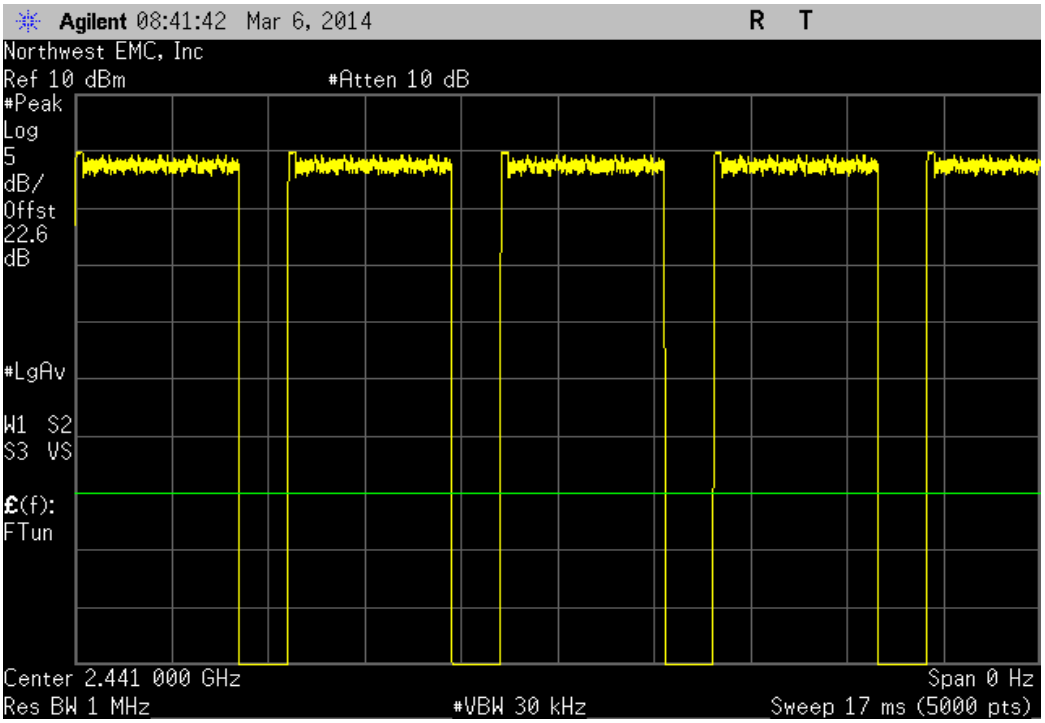


DUTY CYCLE

2DH5, Mid Channel 39, 2441 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit	Result
	2.886 mS	3.751 mS	1	76.9	N/A	N/A

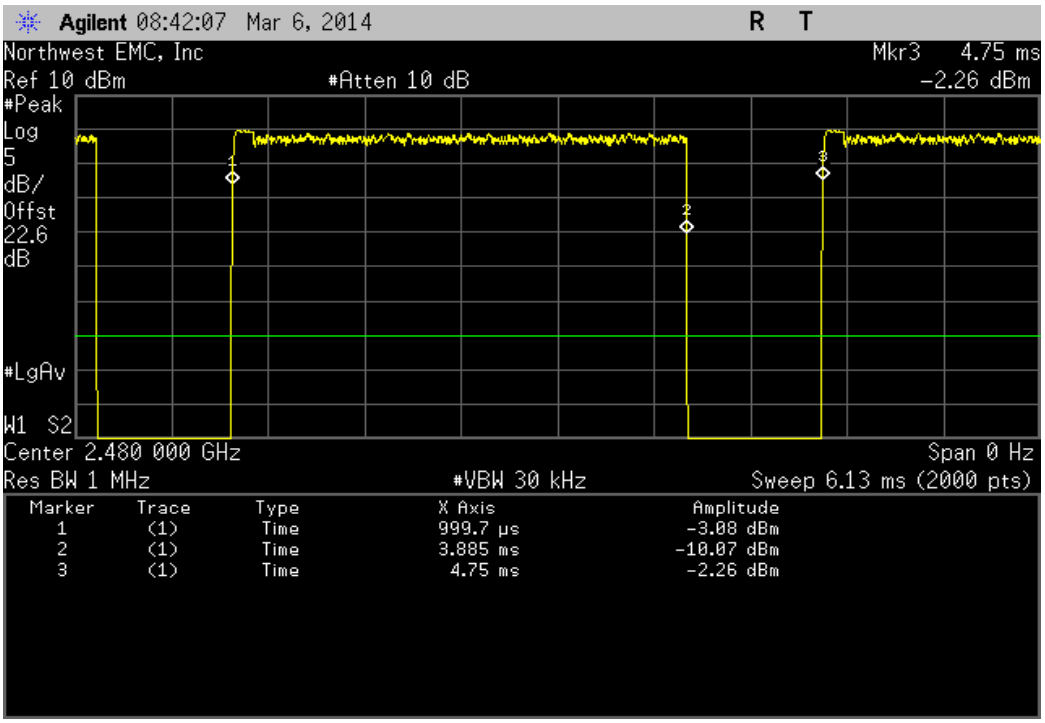


2DH5, Mid Channel 39, 2441 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit	Result
	N/A	N/A	5	N/A	N/A	N/A

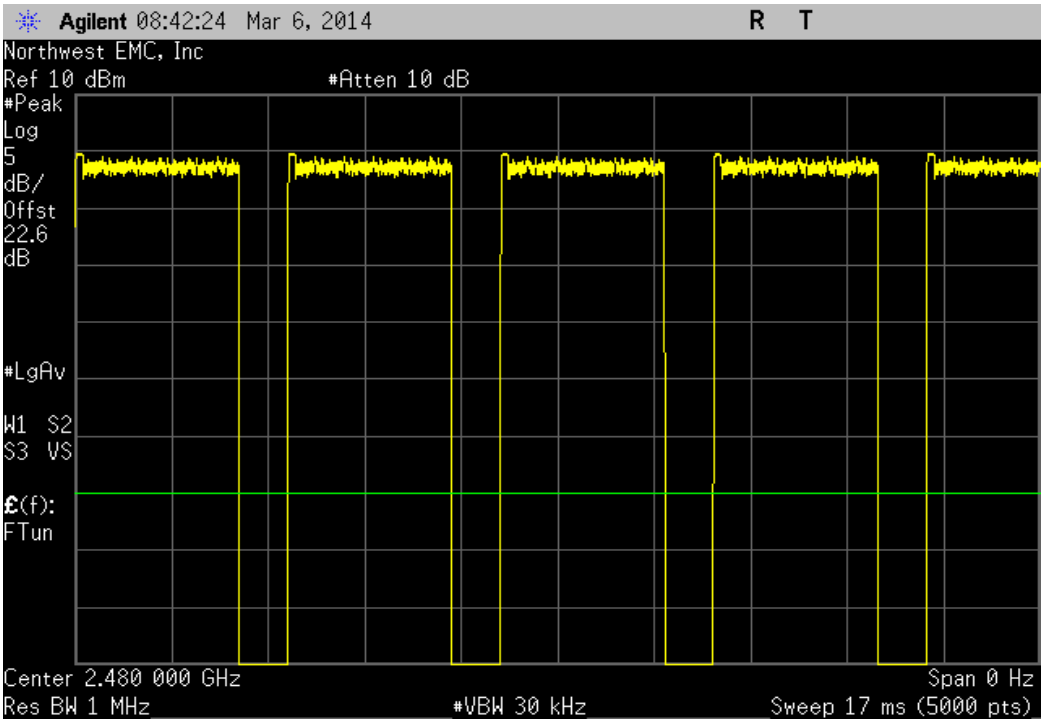


DUTY CYCLE

2DH5, High Channel 78, 2480 MHz					
	Pulse Width	Period	Number of Pulses	Value (%)	Limit	Result
	2.886 mS	3.751 mS	1	76.9	N/A	N/A

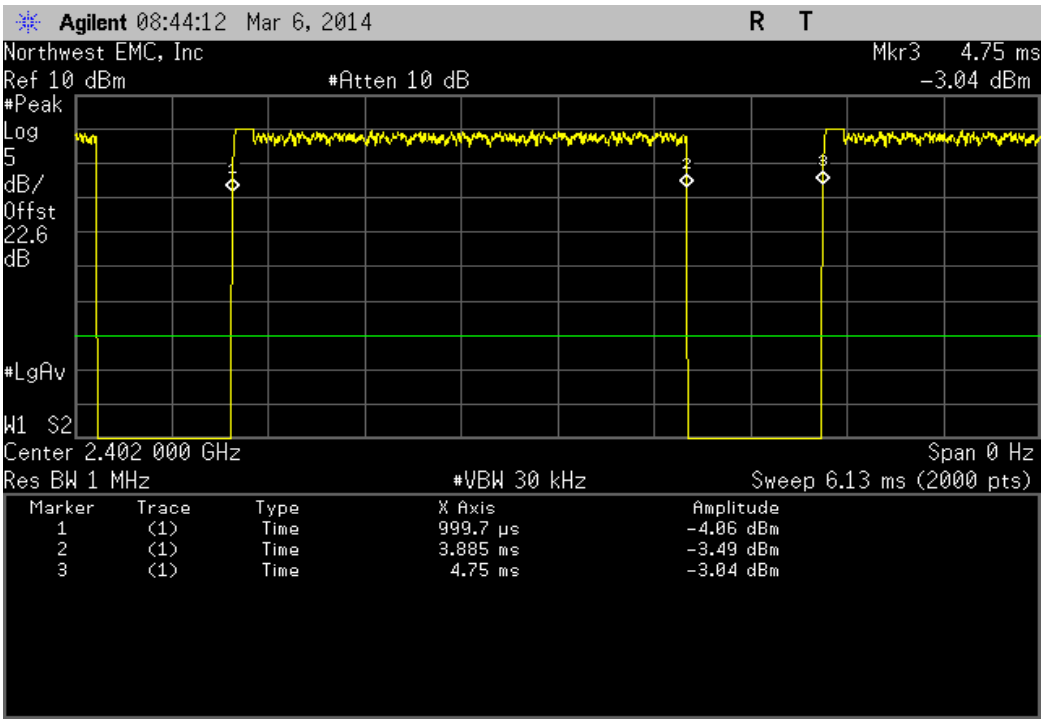


2DH5, High Channel 78, 2480 MHz					
	Pulse Width	Period	Number of Pulses	Value (%)	Limit	Result
	N/A	N/A	5	N/A	N/A	N/A

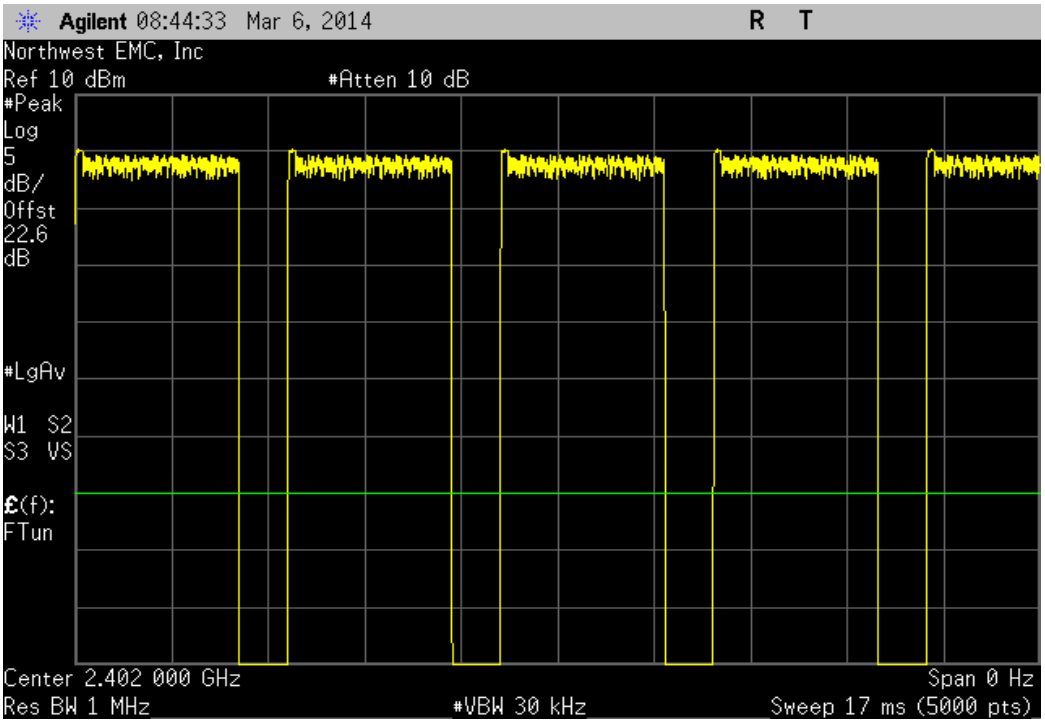


DUTY CYCLE

3DH5, Low Channel 0, 2402 MHz					
	Pulse Width	Period	Number of Pulses	Value (%)	Limit	Result
	2.886 mS	3.751 mS	1	76.9	N/A	N/A

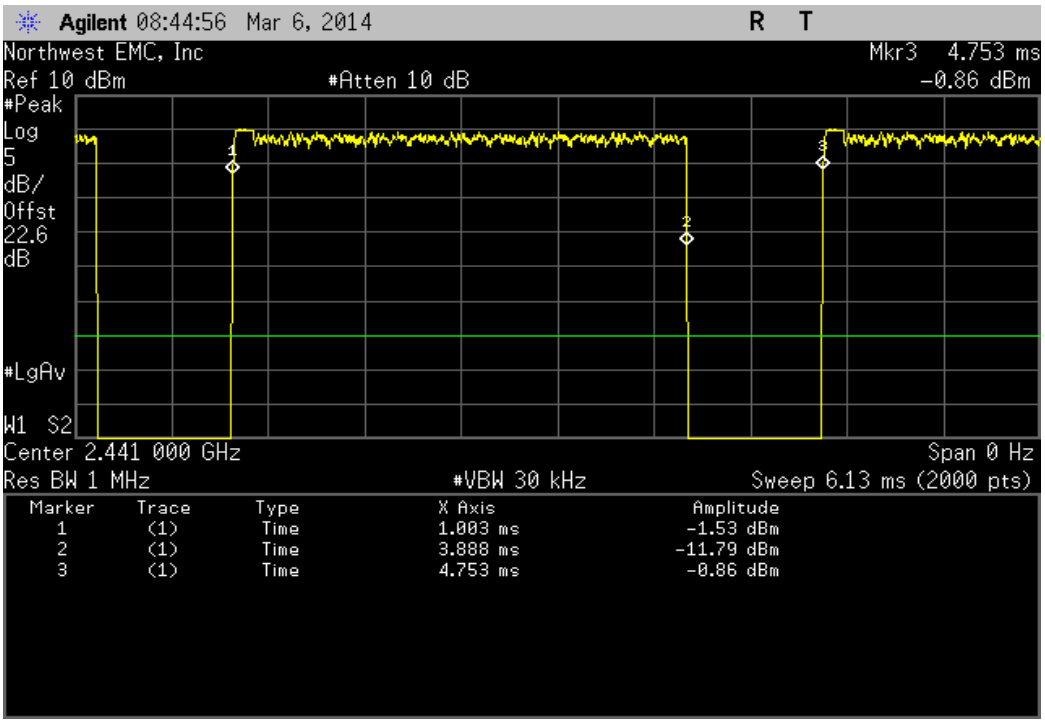


3DH5, Low Channel 0, 2402 MHz					
	Pulse Width	Period	Number of Pulses	Value (%)	Limit	Result
	N/A	N/A	5	N/A	N/A	N/A

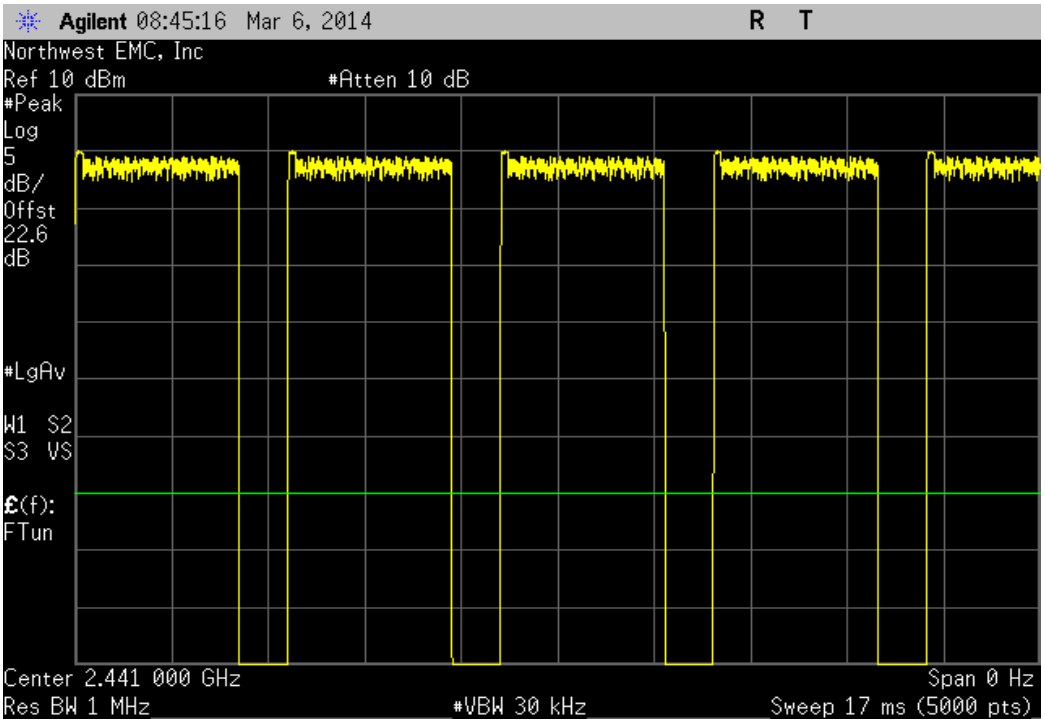


DUTY CYCLE

3DH5, Mid Channel 39, 2441 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit	Result
	2.886 mS	3.751 mS	1	76.9	N/A	N/A

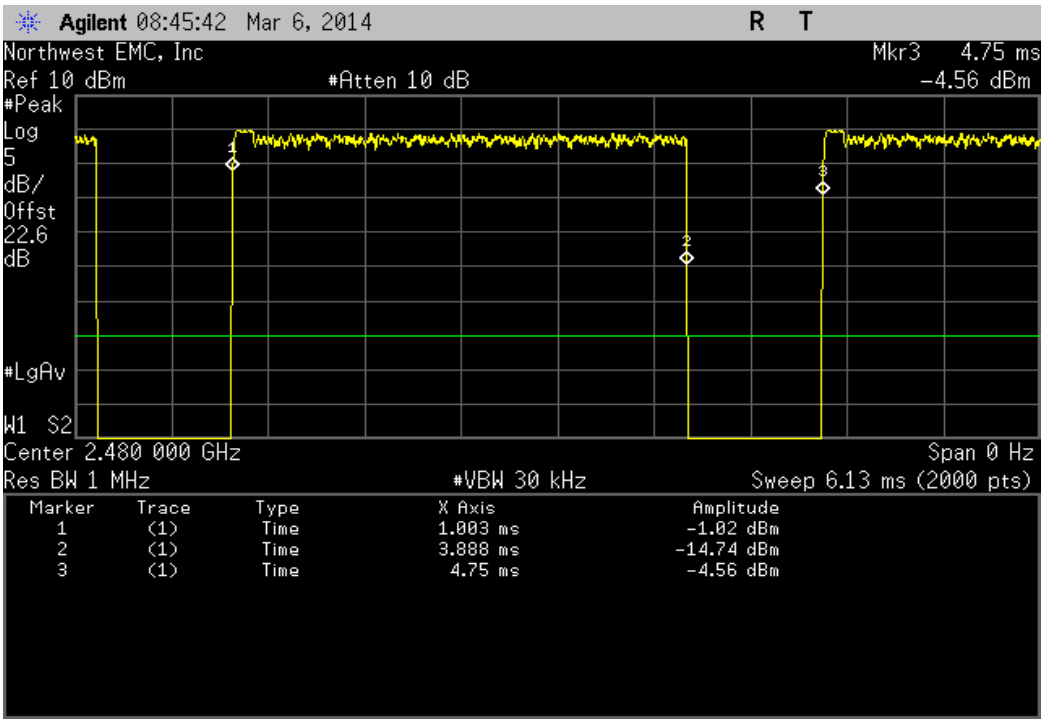


3DH5, Mid Channel 39, 2441 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit	Result
	N/A	N/A	5	N/A	N/A	N/A

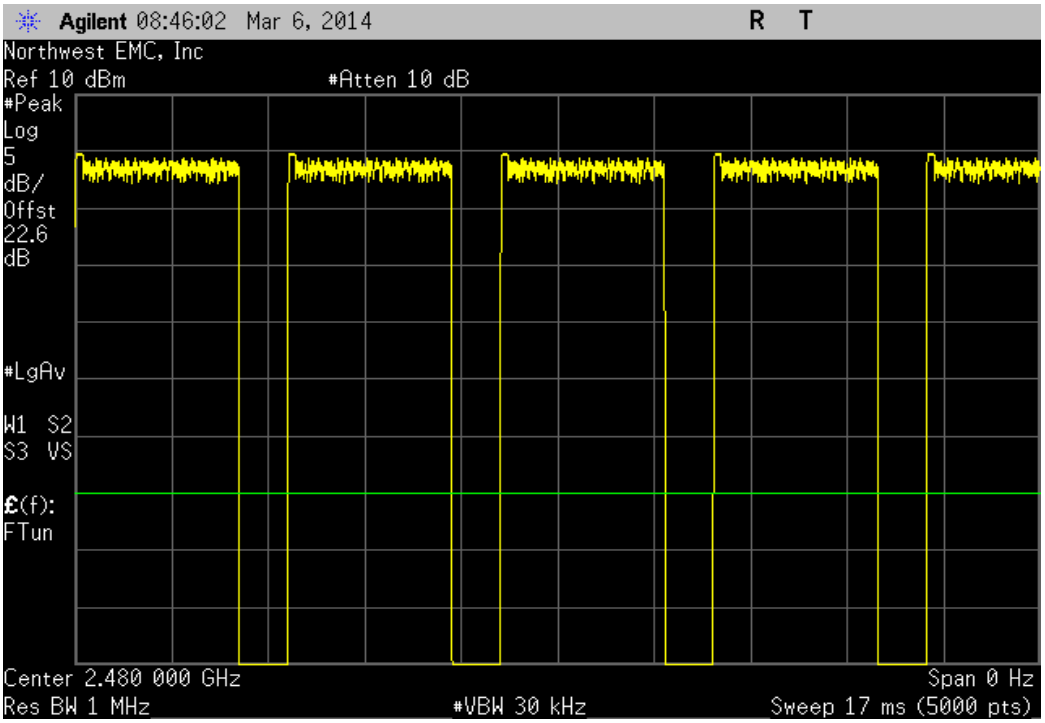


DUTY CYCLE

3DH5, High Channel 78, 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit	Result
	2.886 mS	3.748 mS	1	77	N/A	N/A



3DH5, High Channel 78, 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit	Result
	N/A	N/A	5	N/A	N/A	N/A



OCCUPIED BANDWIDTH

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.	Interval
Signal Generator	Agilent	N5183A	TIA	1/27/2012	36
NC02 Cable	ESM Cable Corp.	TTBJ-141 KMKM-72	NC5	7/3/2013	12
Attenuator	Fairview Microwave	SA4014-20	TKE	2/13/2014	12
40GHz DC Block	Fairview Microwave	SD3379	AMJ	7/3/2013	12
Spectrum Analyzer	Agilent	E4446A	AAT	6/28/2012	24

TEST DESCRIPTION

The occupied bandwidth was measured with the EUT set to low, medium and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at the data rate(s) listed in the datasheet in a no-hop mode.

OCCUPIED BANDWIDTH

EUT:	1631	Work Order:	MCSO1702
Serial Number:	041152140753	Date:	03/06/14
Customer:	Microsoft Corporation	Temperature:	23°C
Attendees:	None	Humidity:	40%
Project:	None	Barometric Pres.:	1001
Tested by:	Richard Mellroth	Power: 110 VAC / 60Hz	Job Site: NC06

TEST SPECIFICATIONS	Test Method
FCC 15.247:2014	ANSI C63.10:2009

COMMENTS

Adapter cable loss of 0.75dB added to analyzer reference level offset. EUT power settings in control software were set to Power Class: 1.5, and Power Level: 8 (dBm).

DEVIATIONS FROM TEST STANDARD

None

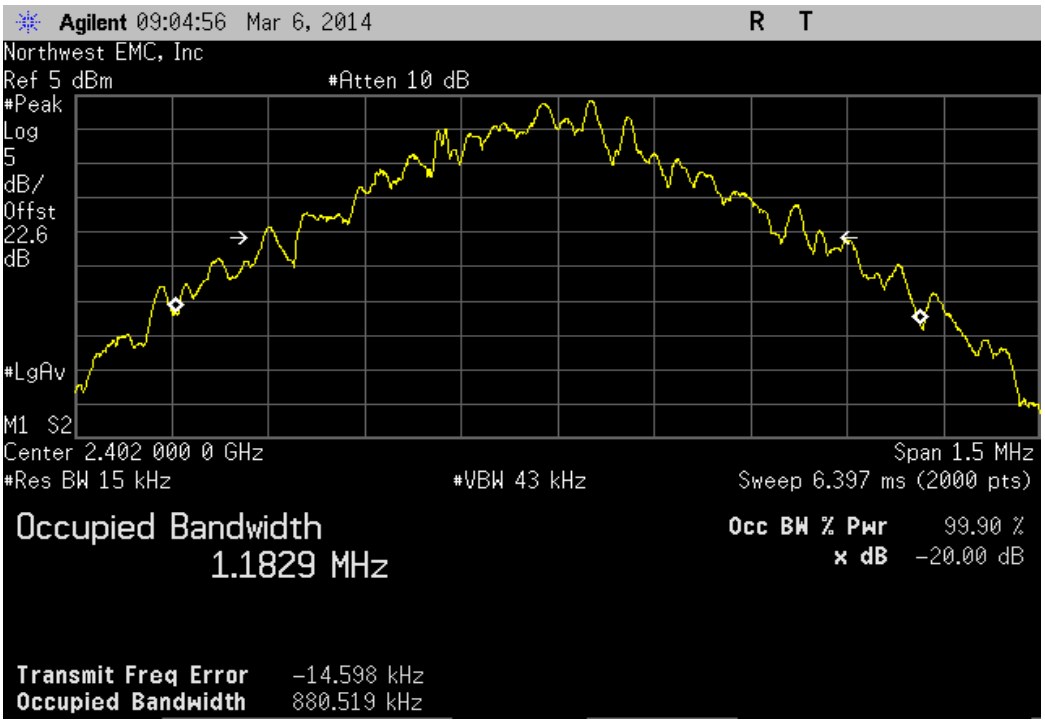
Configuration #	1	Signature

		Value	Limit	Result
DH5				
	Low Channel 0, 2402 MHz	880.519 kHz	< 1.5 MHz	Pass
	Mid Channel 39, 2441 MHz	911.616 kHz	< 1.5 MHz	Pass
	High Channel 78, 2480 MHz	924.779 kHz	< 1.5 MHz	Pass
2DH5				
	Low Channel 0, 2402 MHz	1.323 MHz	< 1.5 MHz	Pass
	Mid Channel 39, 2441 MHz	1.323 MHz	< 1.5 MHz	Pass
	High Channel 78, 2480 MHz	1.325 MHz	< 1.5 MHz	Pass
3DH5				
	Low Channel 0, 2402 MHz	1.304 MHz	< 1.5 MHz	Pass
	Mid Channel 39, 2441 MHz	1.292 MHz	< 1.5 MHz	Pass
	High Channel 78, 2480 MHz	1.29 MHz	< 1.5 MHz	Pass

OCCUPIED BANDWIDTH

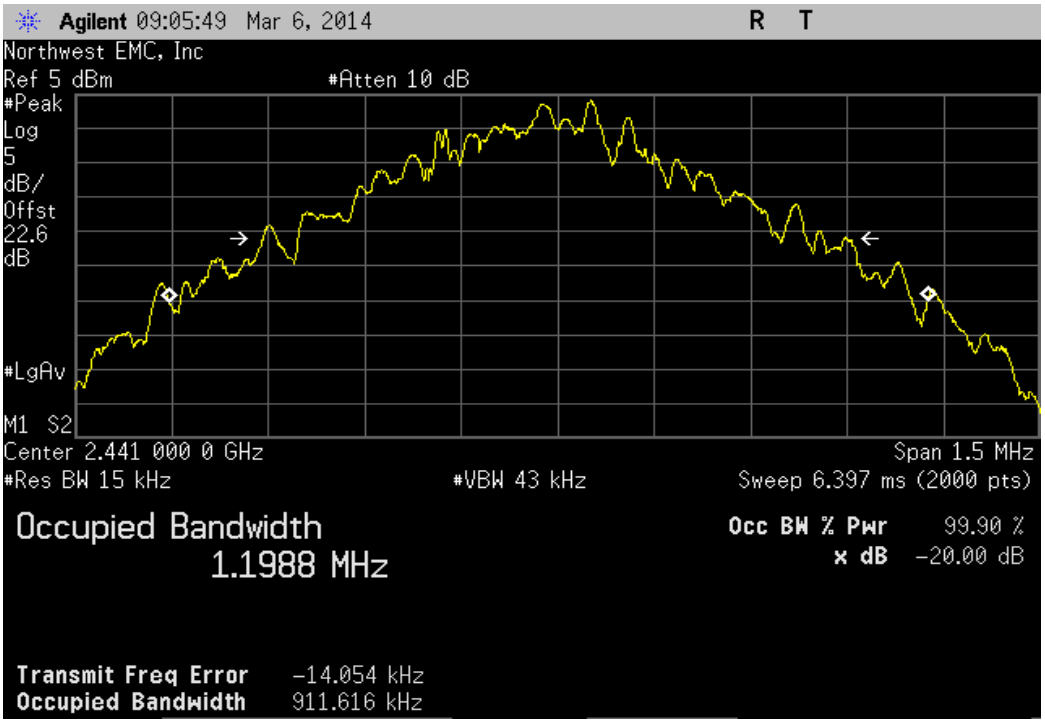
DH5, Low Channel 0, 2402 MHz

				Value	Limit	Result
				880.519 kHz	< 1.5 MHz	Pass



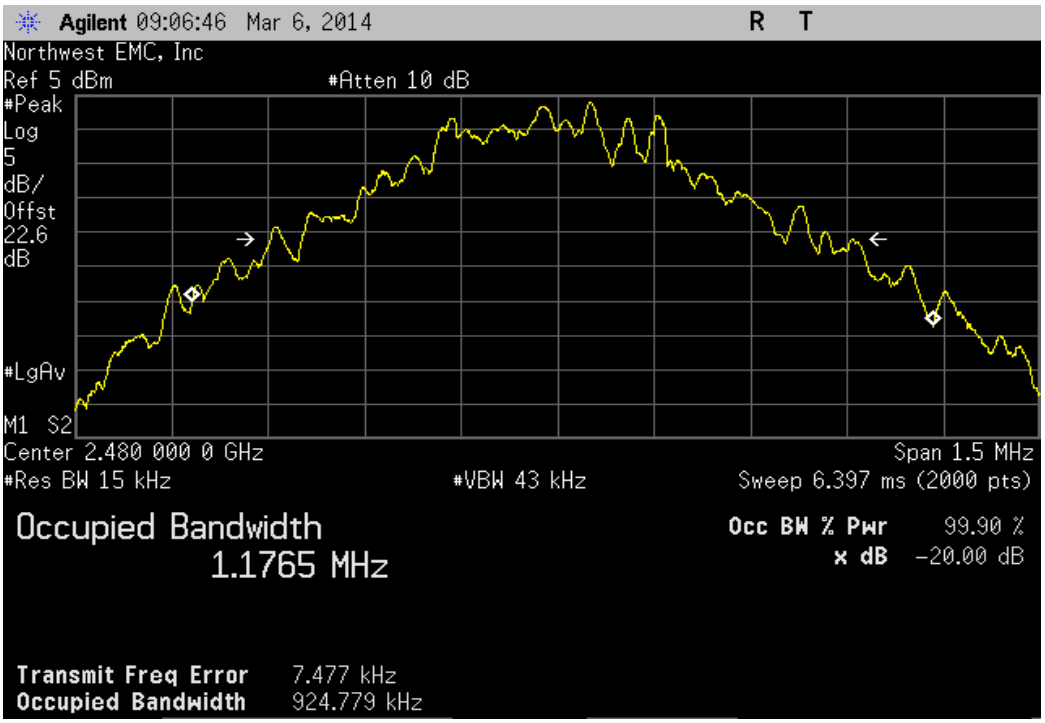
DH5, Mid Channel 39, 2441 MHz

				Value	Limit	Result
				911.616 kHz	< 1.5 MHz	Pass

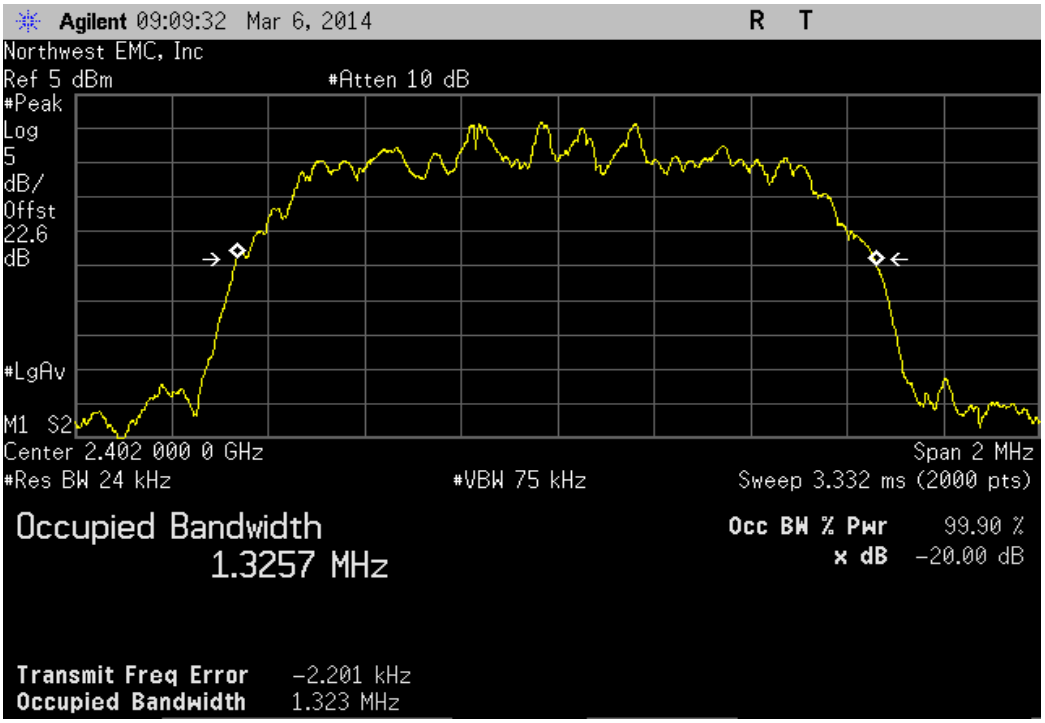


OCCUPIED BANDWIDTH

DH5, High Channel 78, 2480 MHz						
				Value	Limit	Result
				924.779 kHz	< 1.5 MHz	Pass

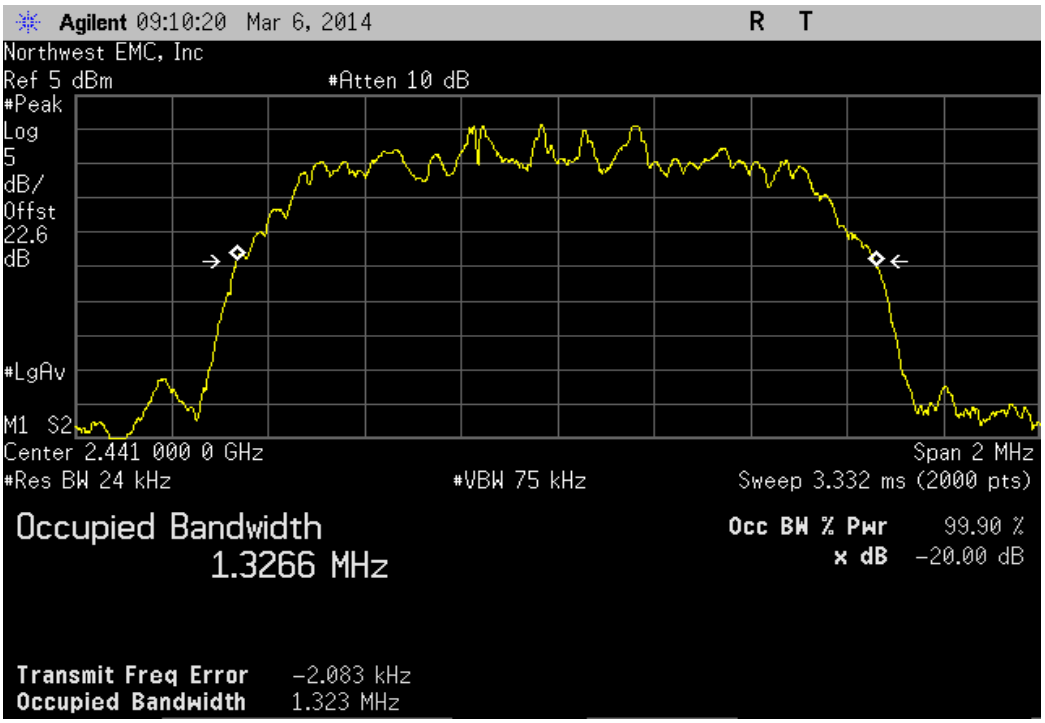


2DH5, Low Channel 0, 2402 MHz						
				Value	Limit	Result
				1.323 MHz	< 1.5 MHz	Pass

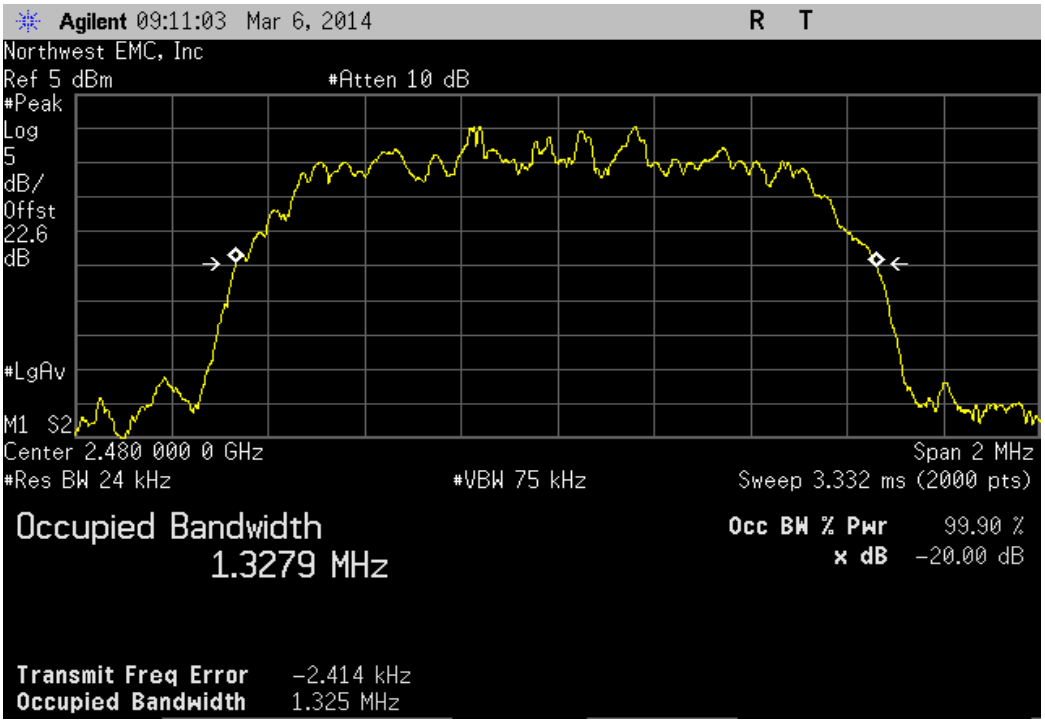


OCCUPIED BANDWIDTH

2DH5, Mid Channel 39, 2441 MHz						
				Value	Limit	Result
				1.323 MHz	< 1.5 MHz	Pass

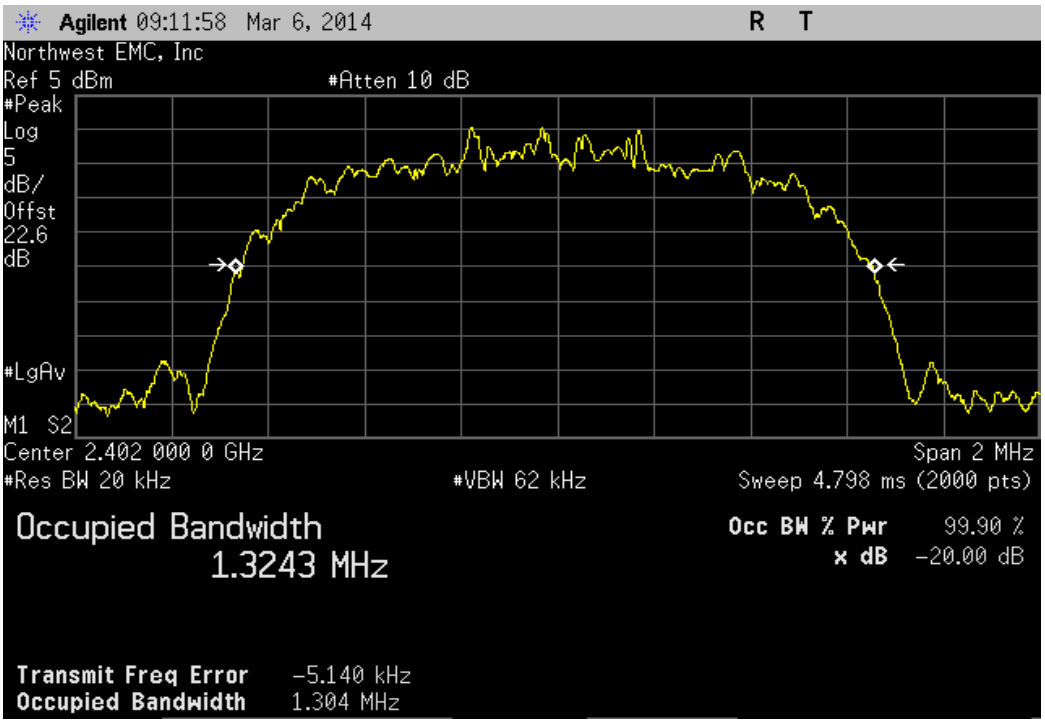


2DH5, High Channel 78, 2480 MHz						
				Value	Limit	Result
				1.325 MHz	< 1.5 MHz	Pass

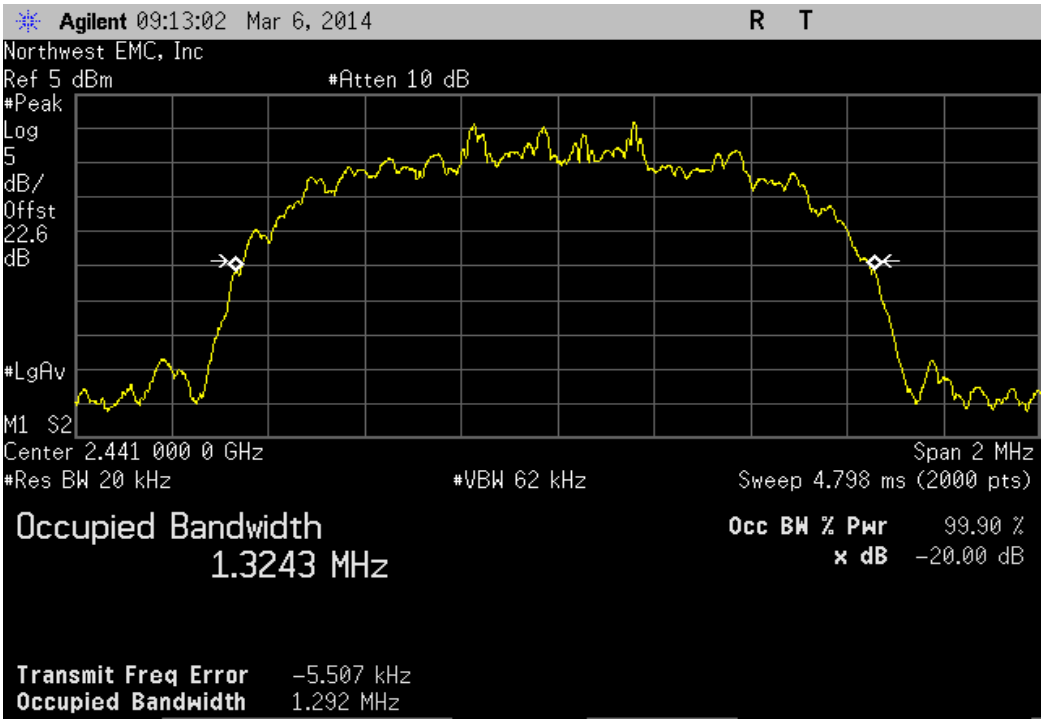


OCCUPIED BANDWIDTH

3DH5, Low Channel 0, 2402 MHz						
				Value	Limit	Result
				1.304 MHz	< 1.5 MHz	Pass

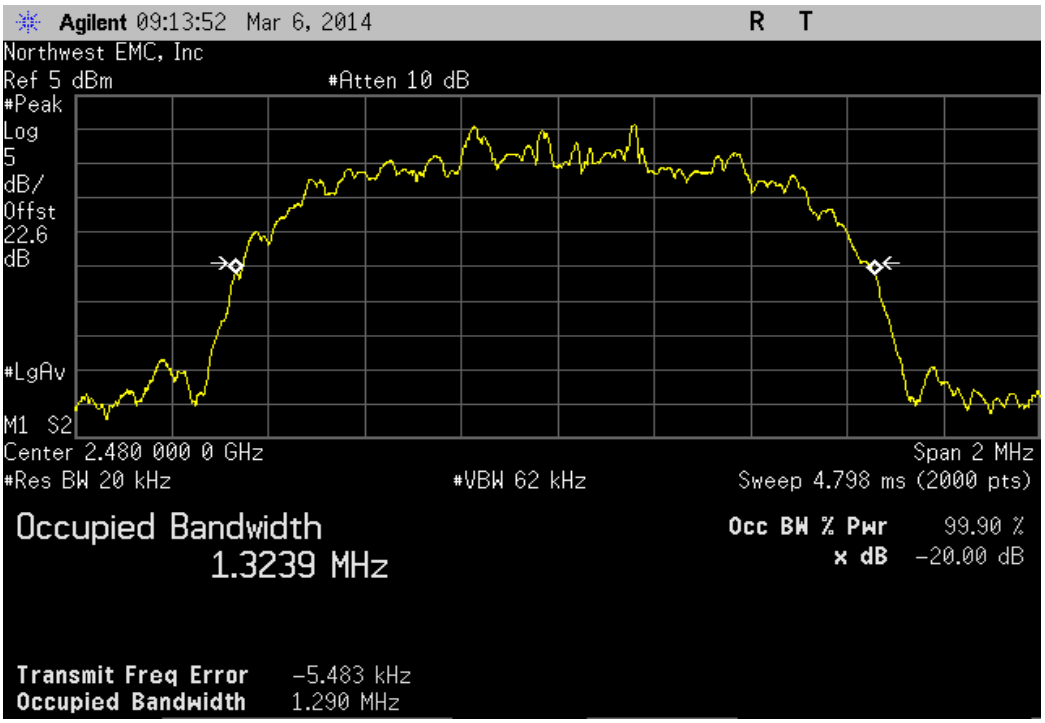


3DH5, Mid Channel 39, 2441 MHz						
				Value	Limit	Result
				1.292 MHz	< 1.5 MHz	Pass



OCCUPIED BANDWIDTH

3DH5, High Channel 78, 2480 MHz						
				Value	Limit	Result
				1.29 MHz	< 1.5 MHz	Pass



OUTPUT POWER

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.	Interval
Signal Generator	Agilent	N5183A	TIA	1/27/2012	36
NC02 Cable	ESM Cable Corp.	TTBJ-141 KMKM-72	NC5	7/3/2013	12
Attenuator	Fairview Microwave	SA4014-20	TKE	2/13/2014	12
Spectrum Analyzer	Agilent	E4446A	AAT	6/28/2012	24
40GHz DC Block	Fairview Microwave	SD3379	AMJ	7/3/2013	12

TEST DESCRIPTION

The peak output power was measured with the EUT set to low, medium and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The EUT was transmitting in a no hop mode at the data rate(s) listed in the datasheet.

De Facto EIRP Limit: Per 47 CFR 15.247 (b)(1-3), the EUT meets the de facto EIRP limit of +27dBm.

OUTPUT POWER

EUT:	1631	Work Order:	MCS01702
Serial Number:	041152140753	Date:	03/06/14
Customer:	Microsoft Corporation	Temperature:	23°C
Attendees:	None	Humidity:	40%
Project:	None	Barometric Pres.:	1001
Tested by:	Richard Mellroth	Power: 110 VAC / 60Hz	Job Site: NC06

TEST SPECIFICATIONS	Test Method
FCC 15.247:2014	ANSI C63.10:2009

COMMENTS

Adapter cable loss of 0.75dB added to analyzer reference level offset. EUT power settings in control software were set to Power Class: 1.5, and Power Level: 8 (dBm).

DEVIATIONS FROM TEST STANDARD

None

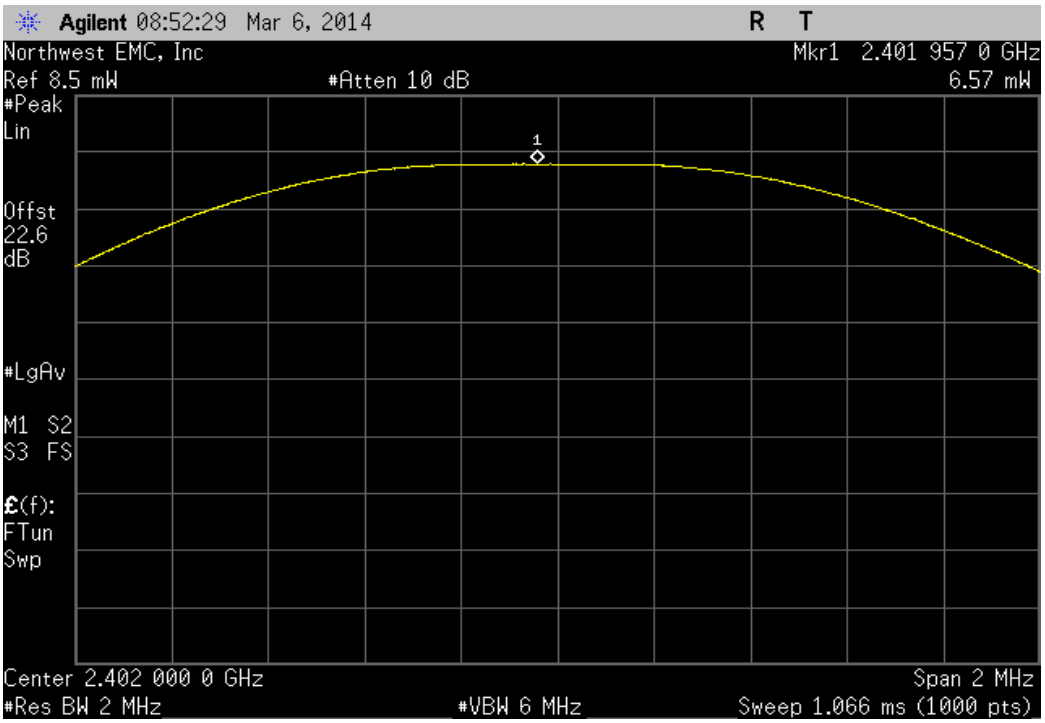
Configuration #	1	Signature

		Value	Limit	Result
DH5				
	Low Channel 0, 2402 MHz	6.566 mW	< 125 mW	Pass
	Mid Channel 39, 2441 MHz	6.362 mW	< 125 mW	Pass
	High Channel 78, 2480 MHz	6.136 mW	< 125 mW	Pass
2DH5				
	Low Channel 0, 2402 MHz	5.8 mW	< 125 mW	Pass
	Mid Channel 39, 2441 MHz	5.629 mW	< 125 mW	Pass
	High Channel 78, 2480 MHz	5.435 mW	< 125 mW	Pass
3DH5				
	Low Channel 0, 2402 MHz	6.279 mW	< 125 mW	Pass
	Mid Channel 39, 2441 MHz	6.1 mW	< 125 mW	Pass
	High Channel 78, 2480 MHz	5.897 mW	< 125 mW	Pass

OUTPUT POWER

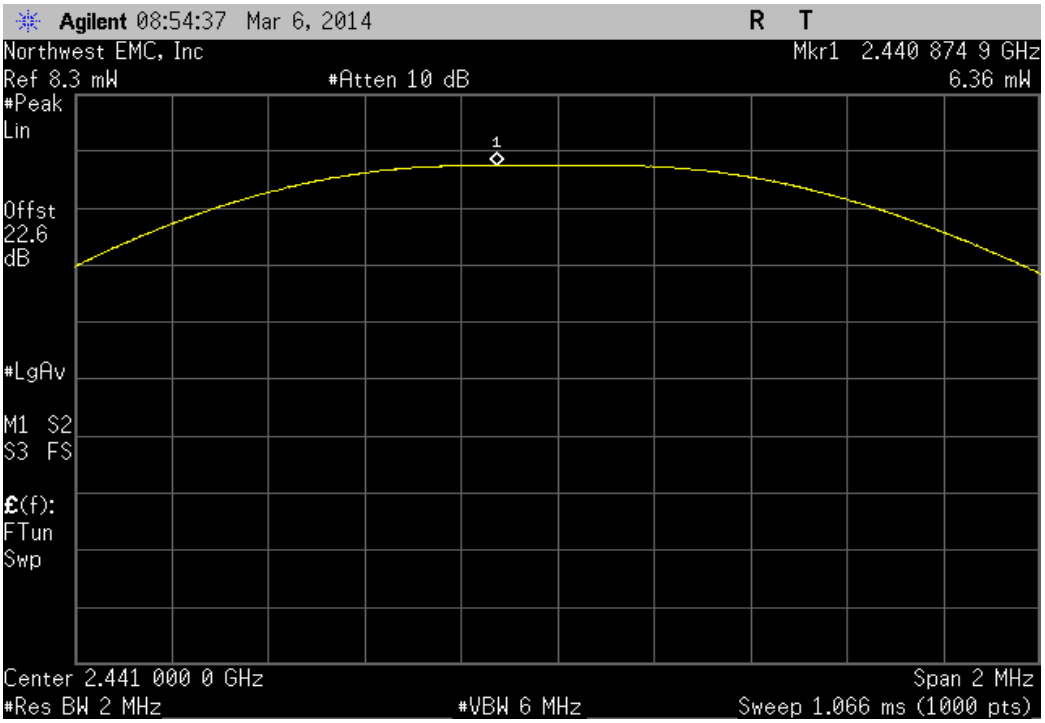
DH5, Low Channel 0, 2402 MHz

				Value	Limit	Result
				6.566 mW	< 125 mW	Pass



DH5, Mid Channel 39, 2441 MHz

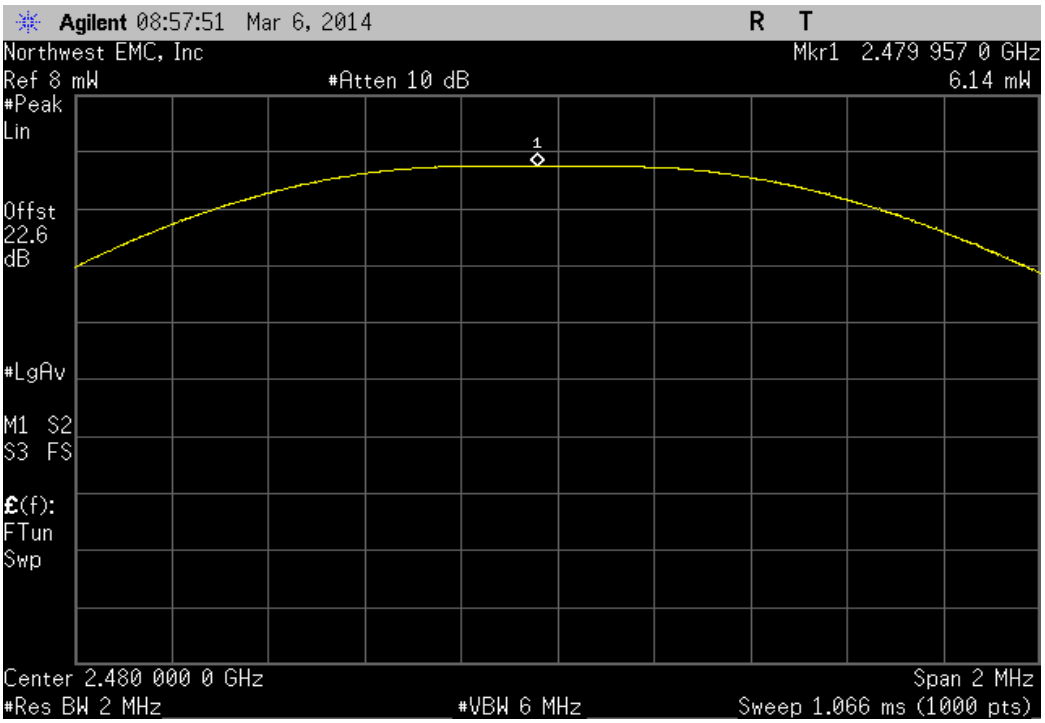
				Value	Limit	Result
				6.362 mW	< 125 mW	Pass



OUTPUT POWER

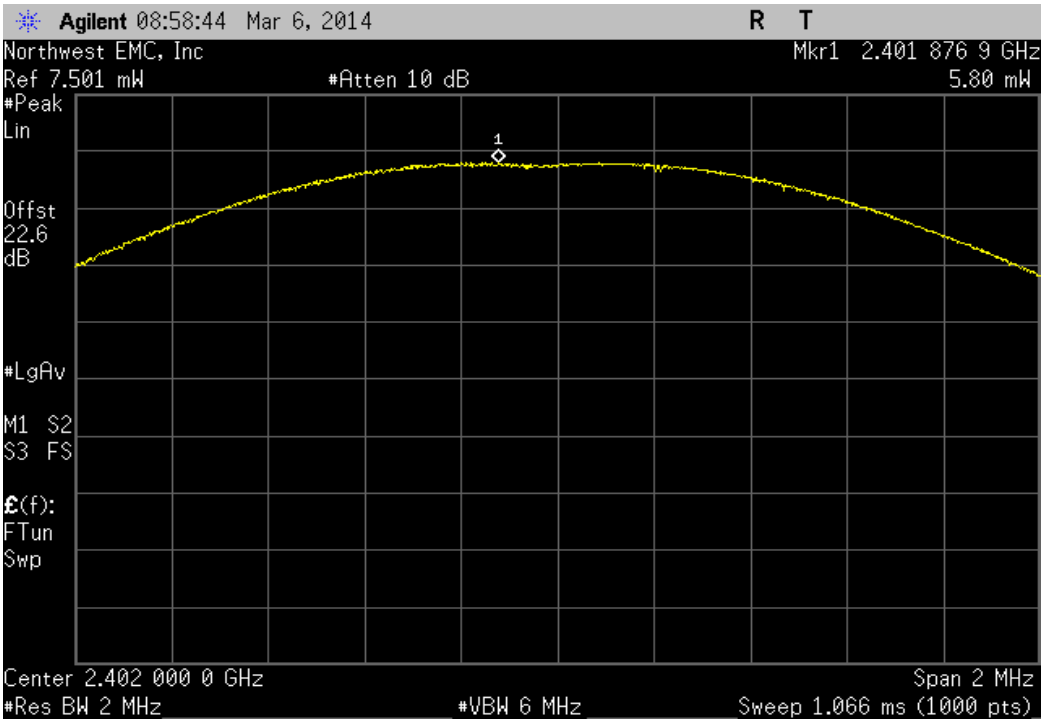
DH5, High Channel 78, 2480 MHz

				Value	Limit	Result
				6.136 mW	< 125 mW	Pass



2DH5, Low Channel 0, 2402 MHz

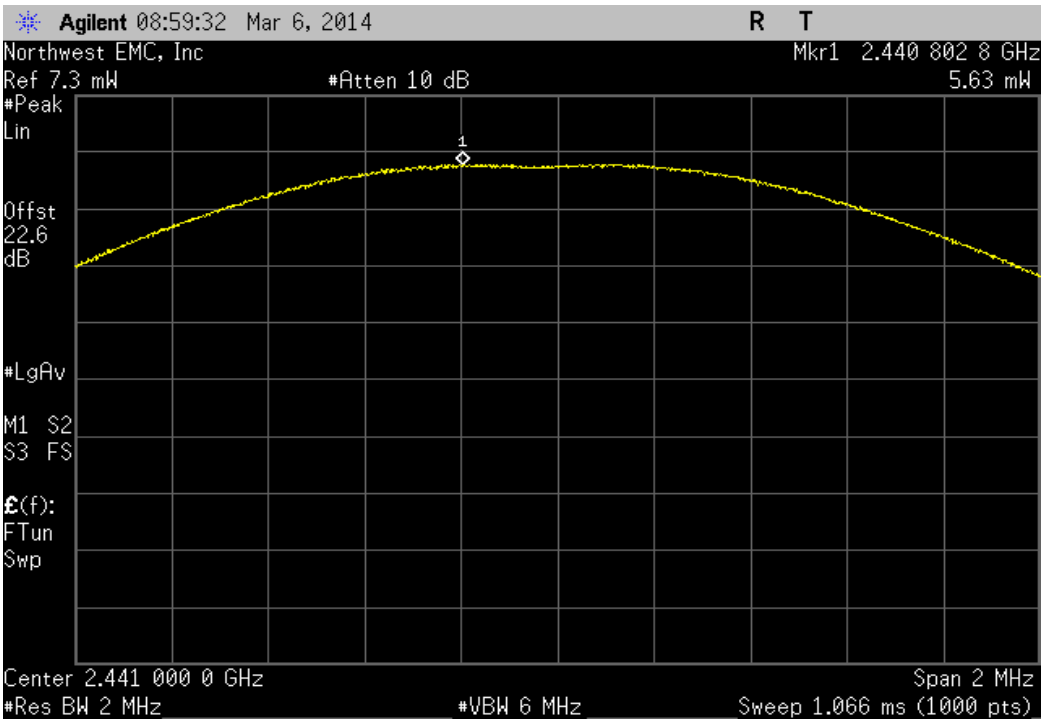
				Value	Limit	Result
				5.8 mW	< 125 mW	Pass



OUTPUT POWER

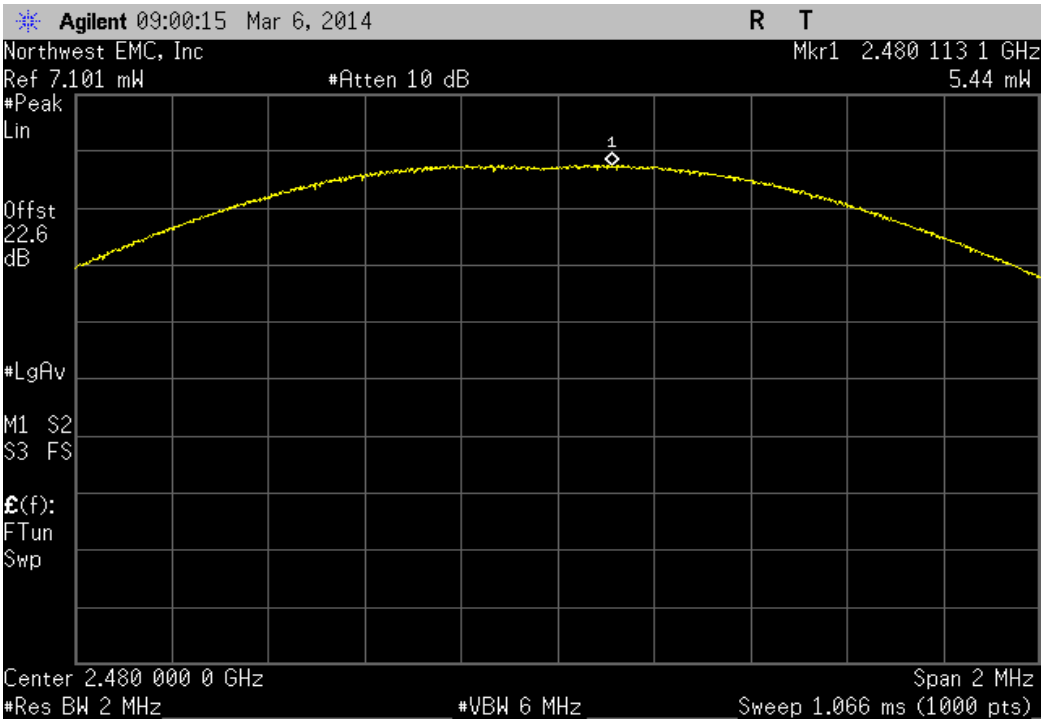
2DH5, Mid Channel 39, 2441 MHz

				Value	Limit	Result
				5.629 mW	< 125 mW	Pass



2DH5, High Channel 78, 2480 MHz

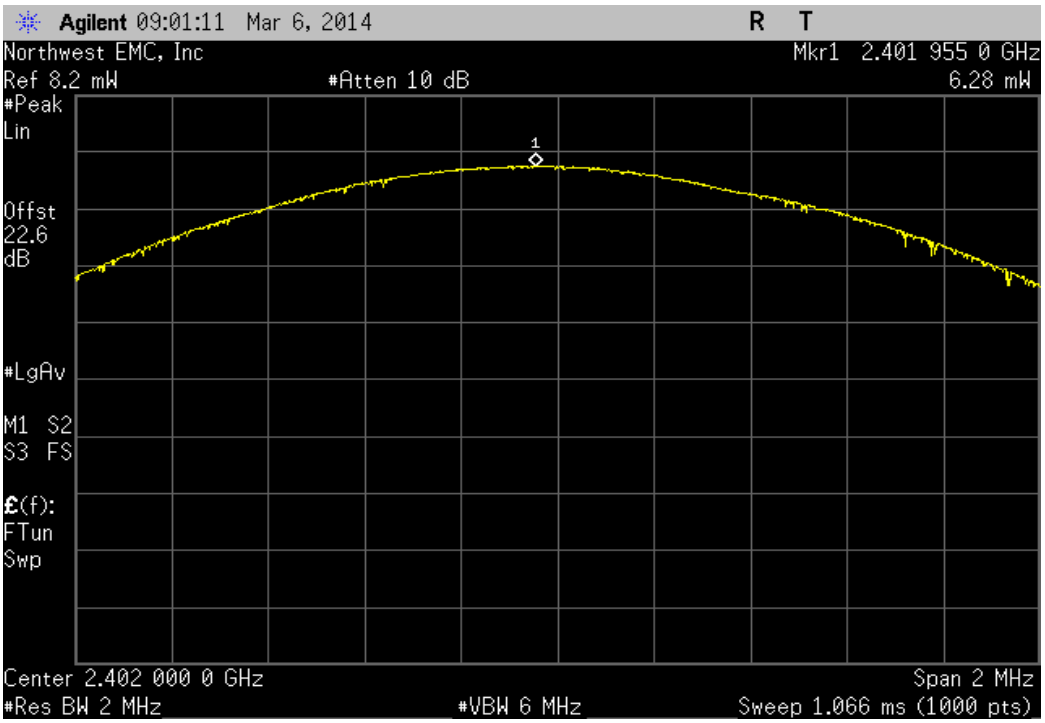
				Value	Limit	Result
				5.435 mW	< 125 mW	Pass



OUTPUT POWER

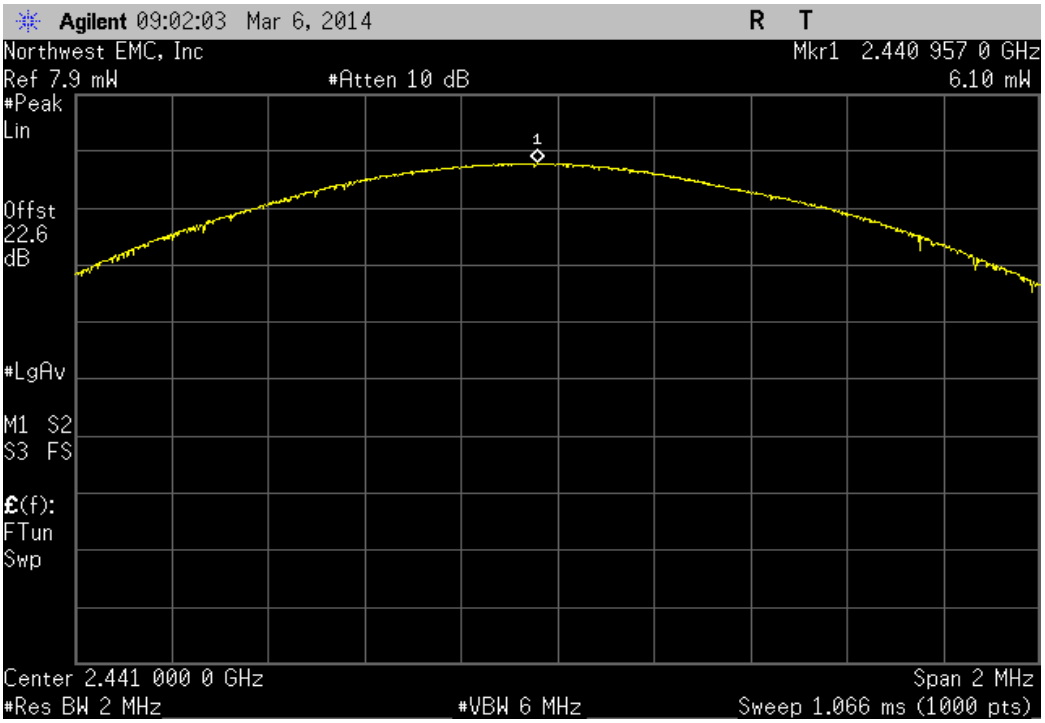
3DH5, Low Channel 0, 2402 MHz

				Value	Limit	Result
				6.279 mW	< 125 mW	Pass



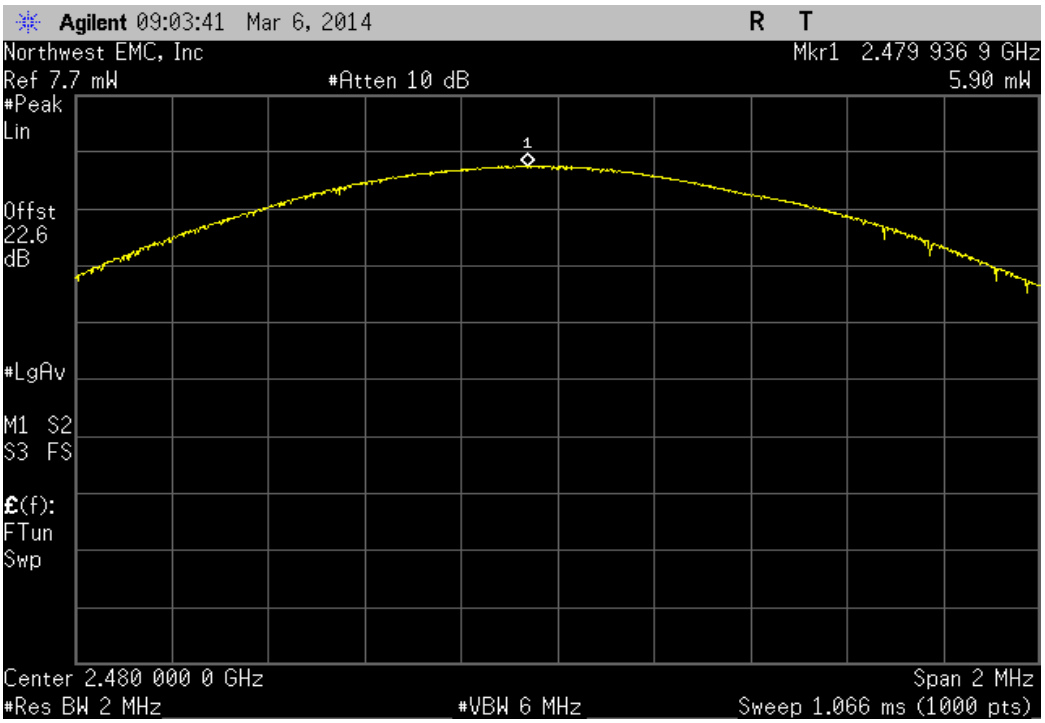
3DH5, Mid Channel 39, 2441 MHz

				Value	Limit	Result
				6.1 mW	< 125 mW	Pass



OUTPUT POWER

3DH5, High Channel 78, 2480 MHz						
				Value	Limit	Result
				5.897 mW	< 125 mW	Pass



SPURIOUS CONDUCTED EMISSIONS

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.	Interval
Signal Generator	Agilent	N5183A	TIA	1/27/2012	36
NC02 Cable	ESM Cable Corp.	TTBJ-141 KMKM-72	NC5	7/3/2013	12
Attenuator	Fairview Microwave	SA4014-20	TKE	2/13/2014	12
Spectrum Analyzer	Agilent	E4446A	AAT	6/28/2012	24
40GHz DC Block	Fairview Microwave	SD3379	AMJ	7/3/2013	12

TEST DESCRIPTION

The spurious RF conducted emissions were measured with the EUT set to low, medium and high transmit frequencies. The measurements were made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at the data rate(s) listed in the datasheet in a no-hop mode. For each transmit frequency, the spectrum was scanned throughout the specified frequency range.

SPURIOUS CONDUCTED EMISSIONS

EUT:	1631	**Work Order:**	MCSO1702
Serial Number:	041152140753	**Date:**	03/06/14
Customer:	Microsoft Corporation	**Temperature:**	23°C
Attendees:	None	**Humidity:**	40%
Project:	None	**Barometric Pres.:**	1001
Tested by:	Richard Mellroth	**Power:** 110 VAC / 60Hz	**Job Site:** NC06

TEST SPECIFICATIONS	Test Method
FCC 15.247:2014	ANSI C63.10:2009

COMMENTS

Adapter cable loss of 0.75dB added to analyzer reference level offset. EUT power settings in control software were set to Power Class: 1.5, and Power Level: 8 (dBm).

DEVIATIONS FROM TEST STANDARD

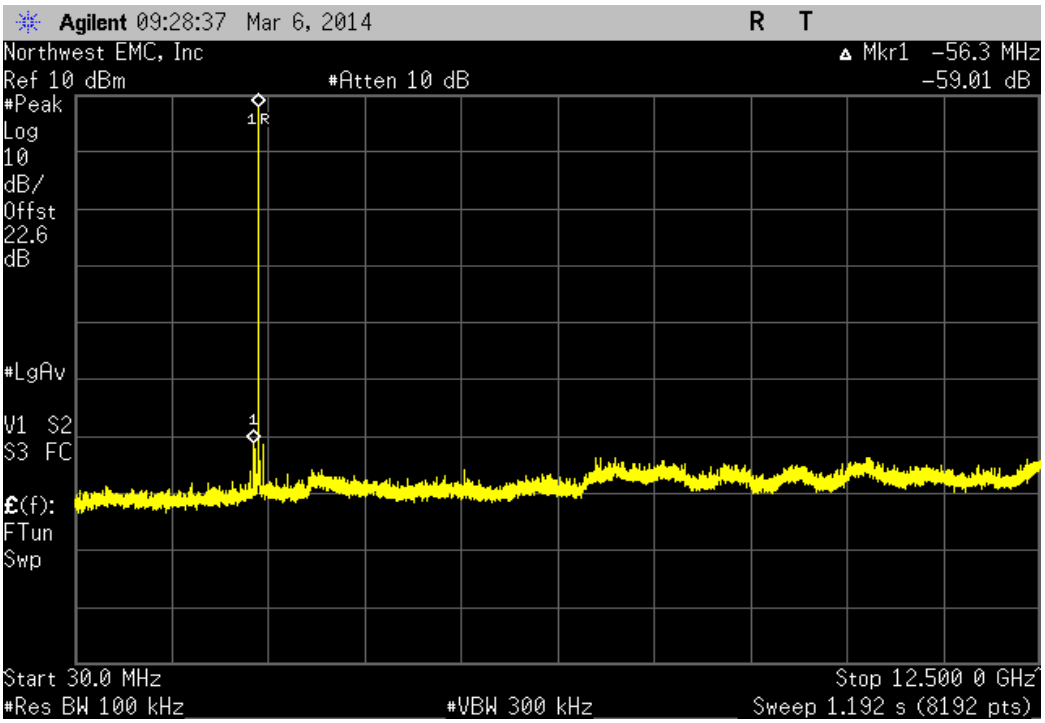
None

Configuration #	1	Signature

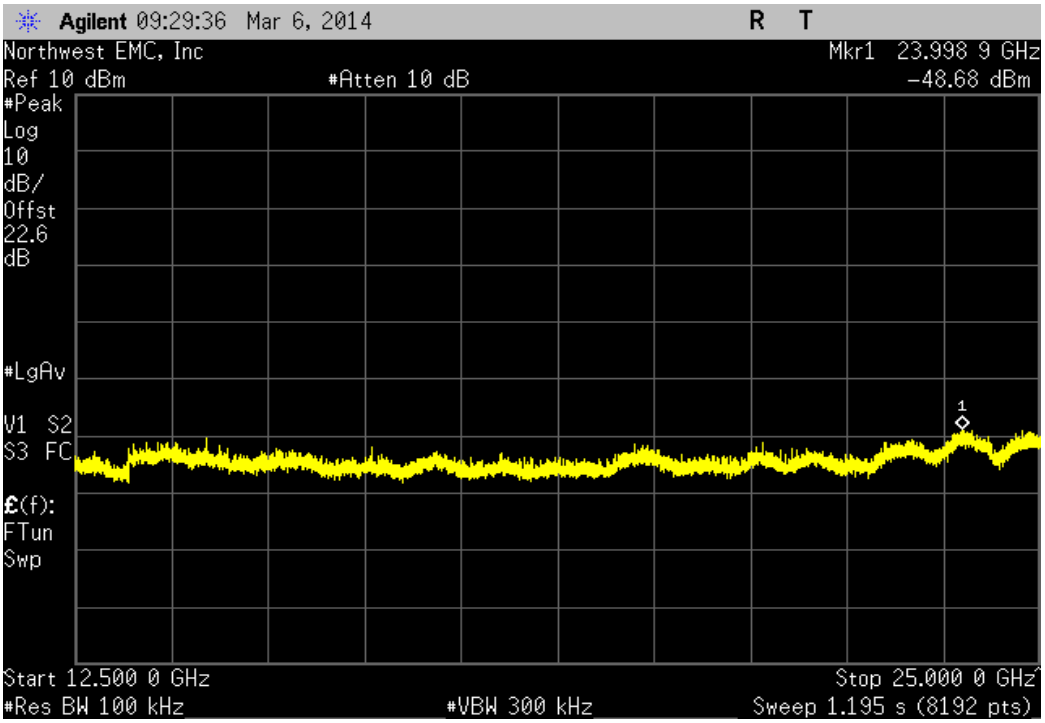
		Frequency Range	Value	Limit	Result
DH5					
	Low Channel 0, 2402 MHz	30 MHz - 12.5 GHz	-59.01 dBc	≤ -20 dBc	Pass
	Low Channel 0, 2402 MHz	12.5 GHz - 25 GHz	-56.55 dBc	≤ -20 dBc	Pass
	Mid Channel 39, 2441 MHz	30 MHz - 12.5 GHz	-61.06 dBc	≤ -20 dBc	Pass
	Mid Channel 39, 2441 MHz	12.5 GHz - 25 GHz	-56.71 dBc	≤ -20 dBc	Pass
	High Channel 78, 2480 MHz	30 MHz - 12.5 GHz	-57.7 dBc	≤ -20 dBc	Pass
	High Channel 78, 2480 MHz	12.5 GHz - 25 GHz	-55.87 dBc	≤ -20 dBc	Pass
2DH5					
	Low Channel 0, 2402 MHz	30 MHz - 12.5 GHz	-51.82 dBc	≤ -20 dBc	Pass
	Low Channel 0, 2402 MHz	12.5 GHz - 25 GHz	-53.25 dBc	≤ -20 dBc	Pass
	Mid Channel 39, 2441 MHz	30 MHz - 12.5 GHz	-52.49 dBc	≤ -20 dBc	Pass
	Mid Channel 39, 2441 MHz	12.5 GHz - 25 GHz	-50.98 dBc	≤ -20 dBc	Pass
	High Channel 78, 2480 MHz	30 MHz - 12.5 GHz	-53.36 dBc	≤ -20 dBc	Pass
	High Channel 78, 2480 MHz	12.5 GHz - 25 GHz	-52.15 dBc	≤ -20 dBc	Pass
3DH5					
	Low Channel 0, 2402 MHz	30 MHz - 12.5 GHz	-51.41 dBc	≤ -20 dBc	Pass
	Low Channel 0, 2402 MHz	12.5 GHz - 25 GHz	-52.17 dBc	≤ -20 dBc	Pass
	Mid Channel 39, 2441 MHz	30 MHz - 12.5 GHz	-53.51 dBc	≤ -20 dBc	Pass
	Mid Channel 39, 2441 MHz	12.5 GHz - 25 GHz	-52.37 dBc	≤ -20 dBc	Pass
	High Channel 78, 2480 MHz	30 MHz - 12.5 GHz	-54.87 dBc	≤ -20 dBc	Pass
	High Channel 78, 2480 MHz	12.5 GHz - 25 GHz	-52.9 dBc	≤ -20 dBc	Pass

SPURIOUS CONDUCTED EMISSIONS

DH5, Low Channel 0, 2402 MHz				
Frequency Range		Value	Limit	Result
30 MHz - 12.5 GHz		-59.01 dBc	≤ -20 dBc	Pass

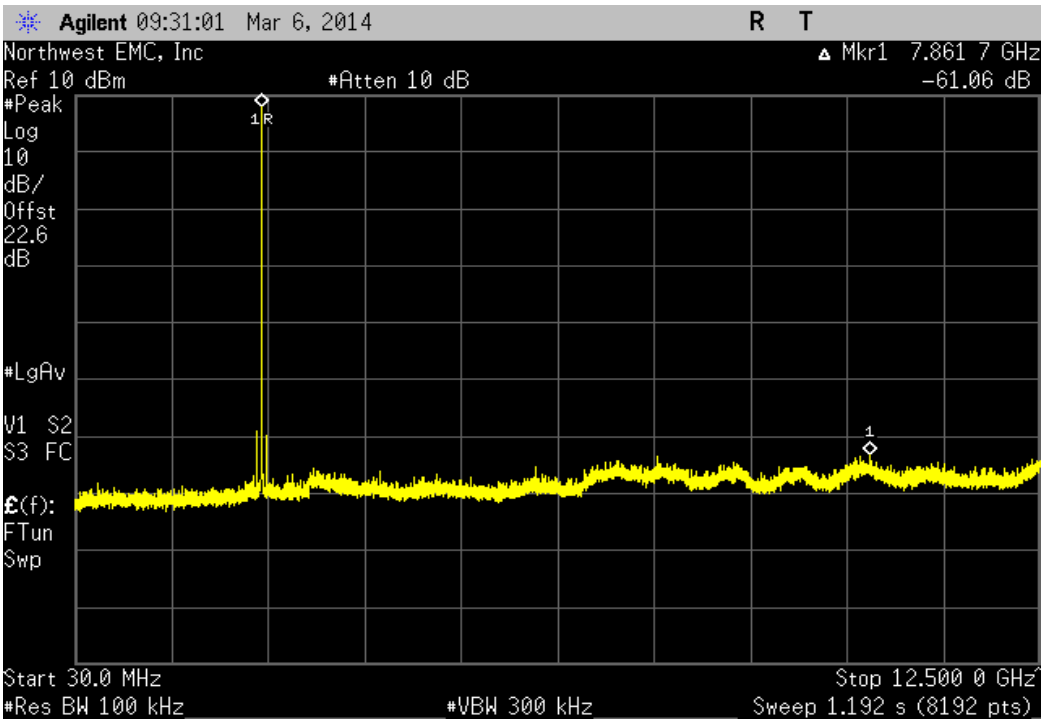


DH5, Low Channel 0, 2402 MHz				
Frequency Range		Value	Limit	Result
12.5 GHz - 25 GHz		-56.55 dBc	≤ -20 dBc	Pass

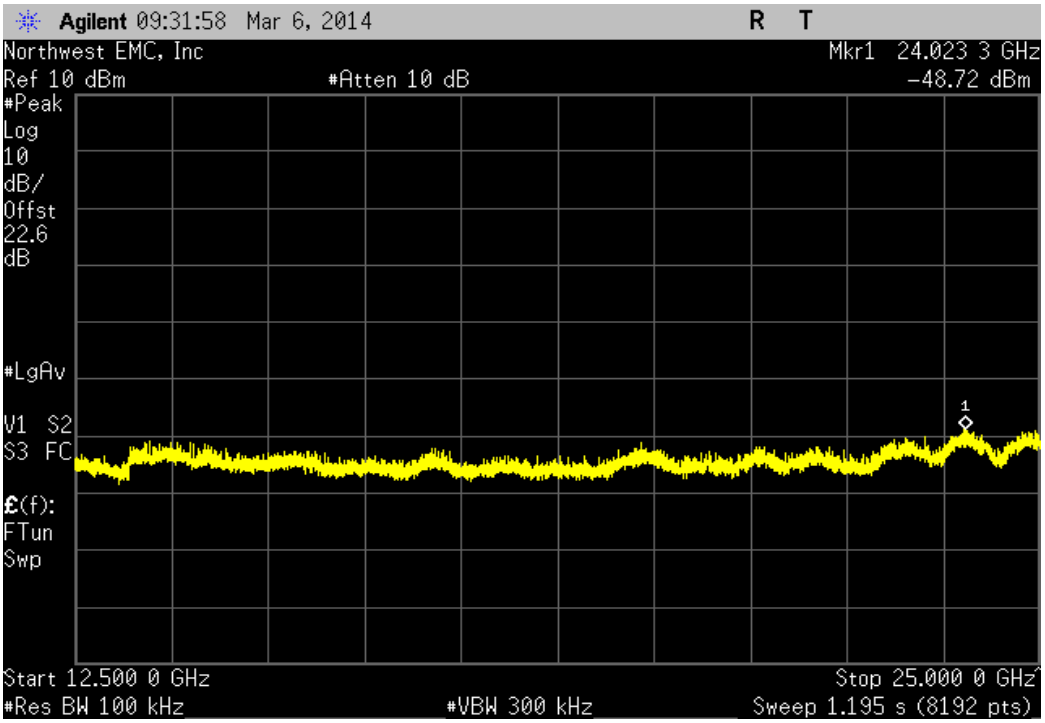


SPURIOUS CONDUCTED EMISSIONS

DH5, Mid Channel 39, 2441 MHz				
Frequency Range		Value	Limit	Result
30 MHz - 12.5 GHz		-61.06 dBc	≤ -20 dBc	Pass

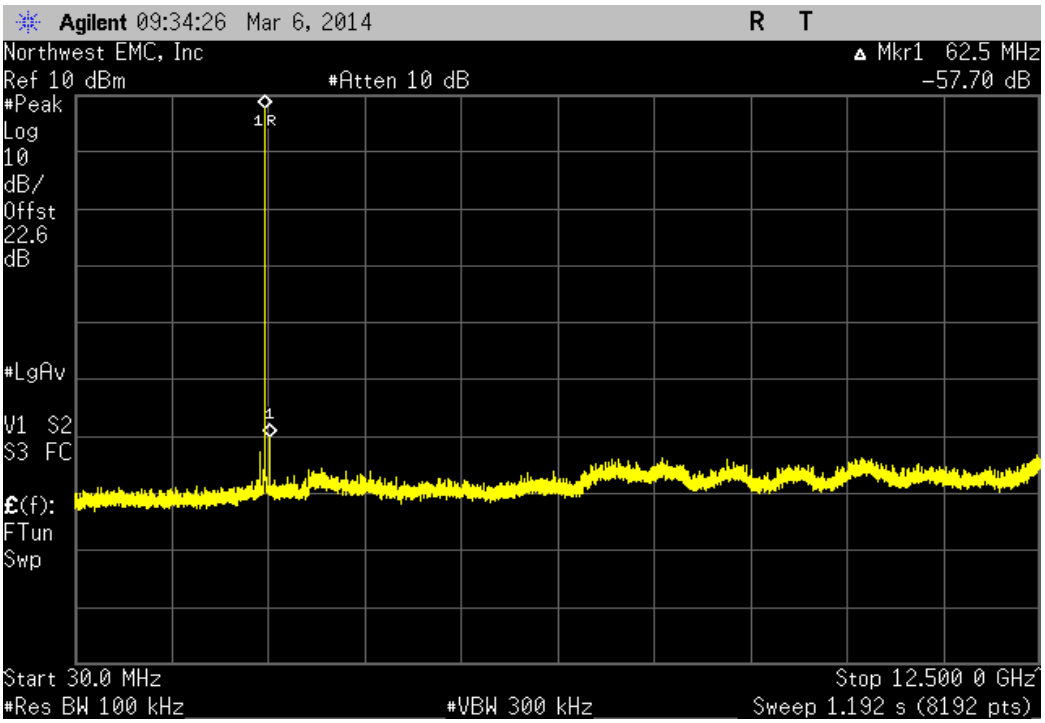


DH5, Mid Channel 39, 2441 MHz				
Frequency Range		Value	Limit	Result
12.5 GHz - 25 GHz		-56.71 dBc	≤ -20 dBc	Pass

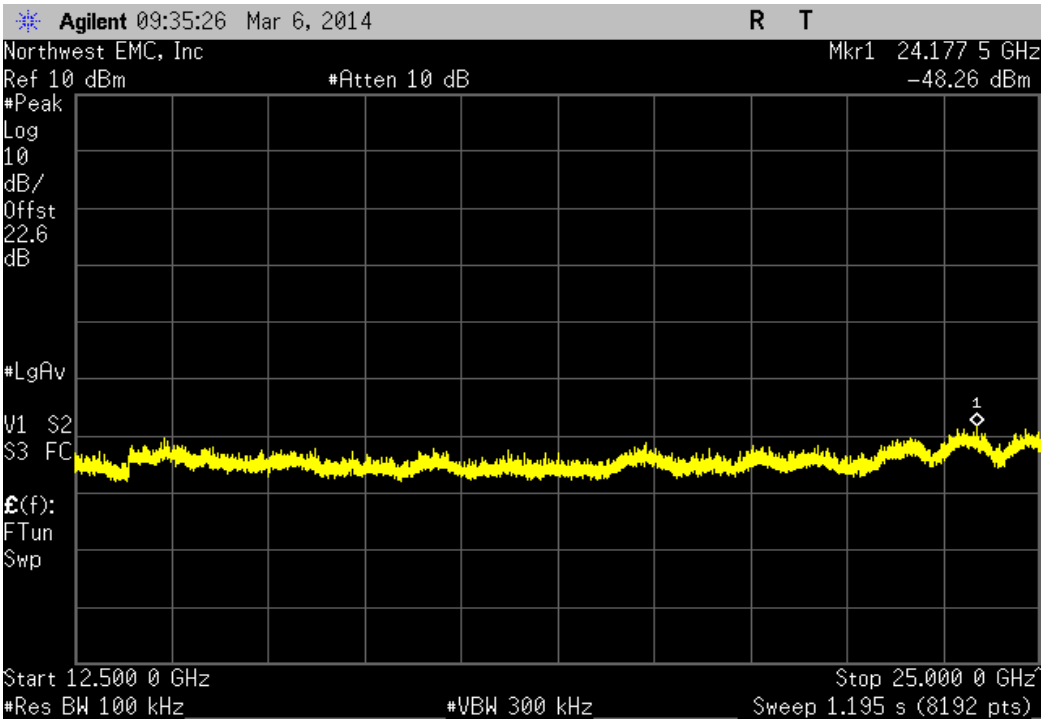


SPURIOUS CONDUCTED EMISSIONS

DH5, High Channel 78, 2480 MHz				
Frequency Range		Value	Limit	Result
30 MHz - 12.5 GHz		-57.7 dBc	≤ -20 dBc	Pass

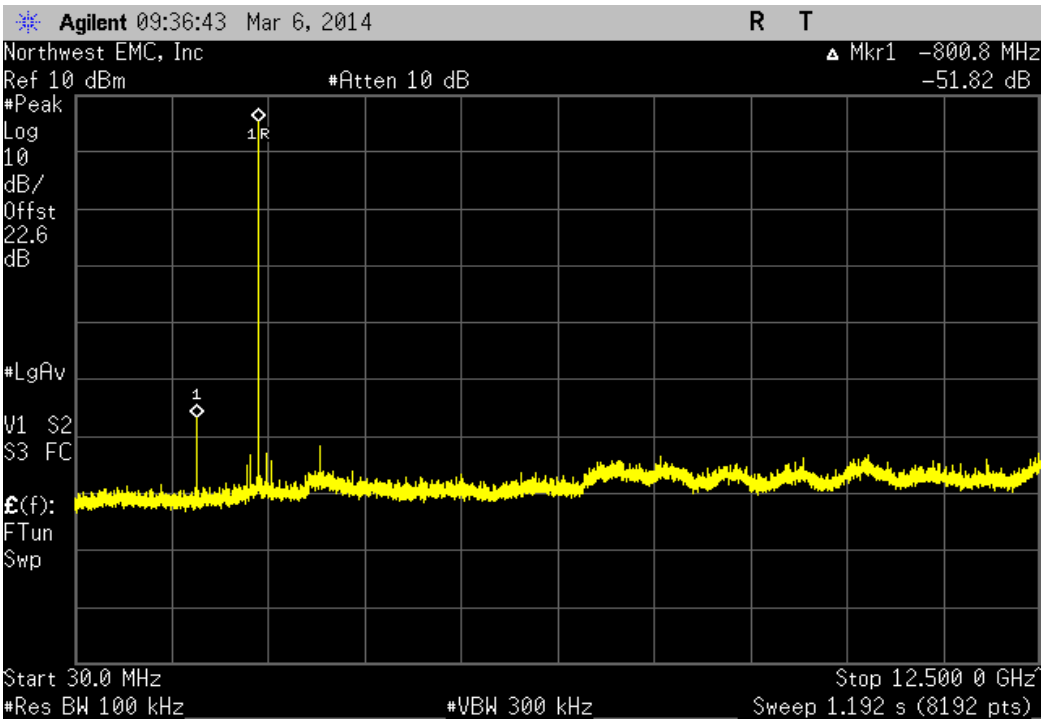


DH5, High Channel 78, 2480 MHz				
Frequency Range		Value	Limit	Result
12.5 GHz - 25 GHz		-55.87 dBc	≤ -20 dBc	Pass

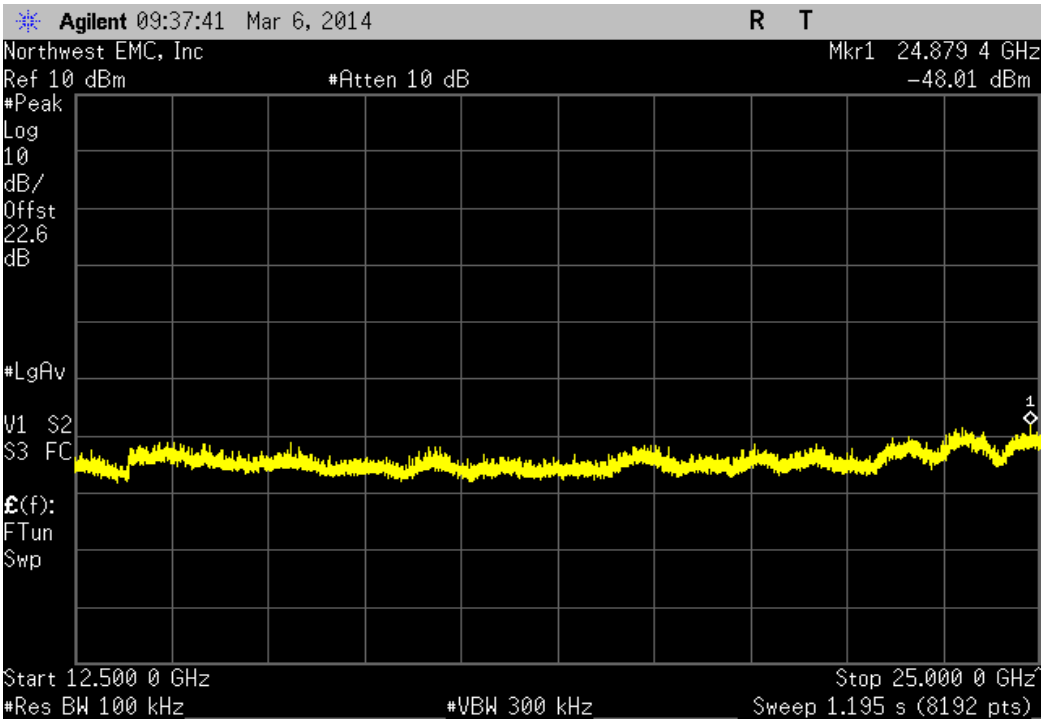


SPURIOUS CONDUCTED EMISSIONS

2DH5, Low Channel 0, 2402 MHz				
Frequency Range		Value	Limit	Result
30 MHz - 12.5 GHz		-51.82 dBc	≤ -20 dBc	Pass

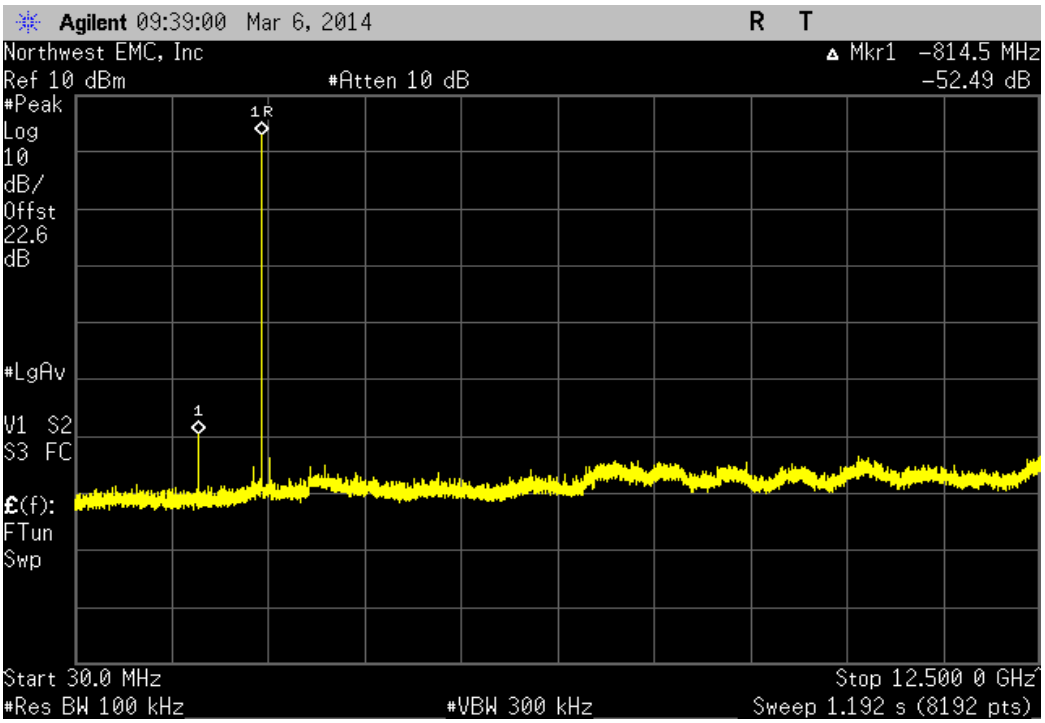


2DH5, Low Channel 0, 2402 MHz				
Frequency Range		Value	Limit	Result
12.5 GHz - 25 GHz		-53.25 dBc	≤ -20 dBc	Pass

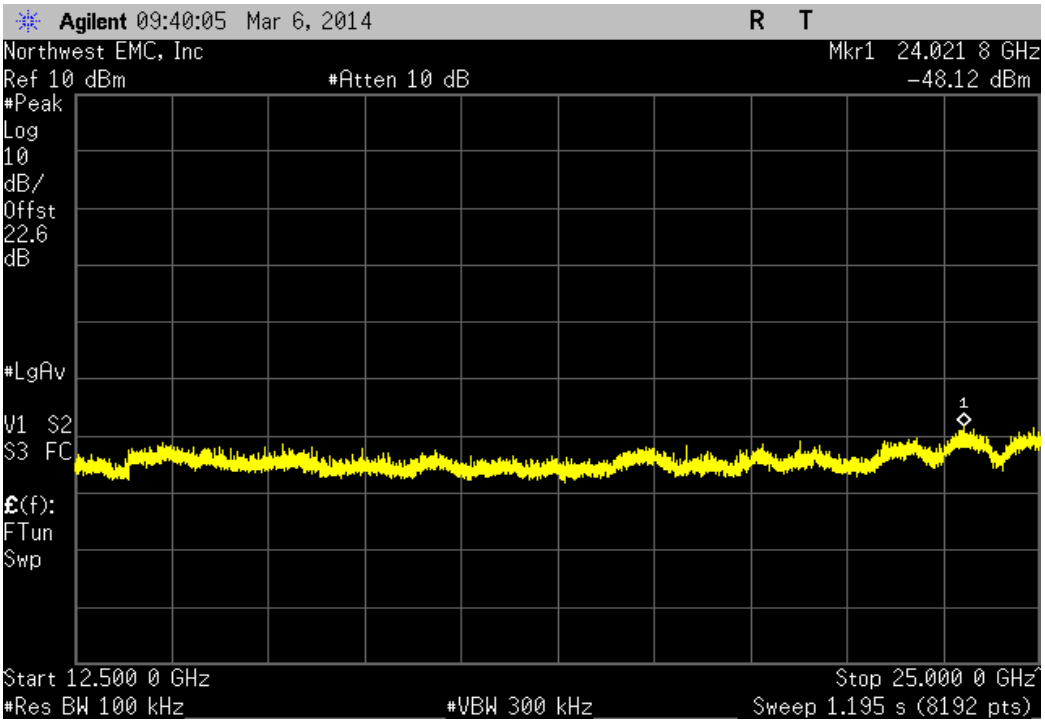


SPURIOUS CONDUCTED EMISSIONS

2DH5, Mid Channel 39, 2441 MHz				
Frequency Range		Value	Limit	Result
30 MHz - 12.5 GHz		-52.49 dBc	≤ -20 dBc	Pass

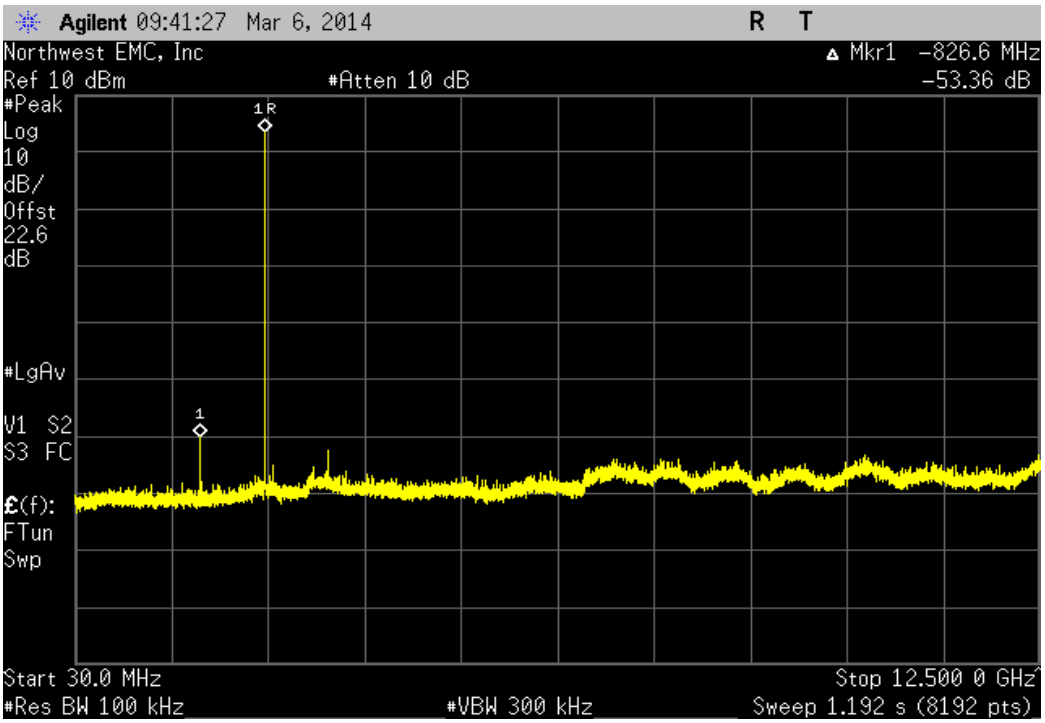


2DH5, Mid Channel 39, 2441 MHz				
Frequency Range		Value	Limit	Result
12.5 GHz - 25 GHz		-50.98 dBc	≤ -20 dBc	Pass

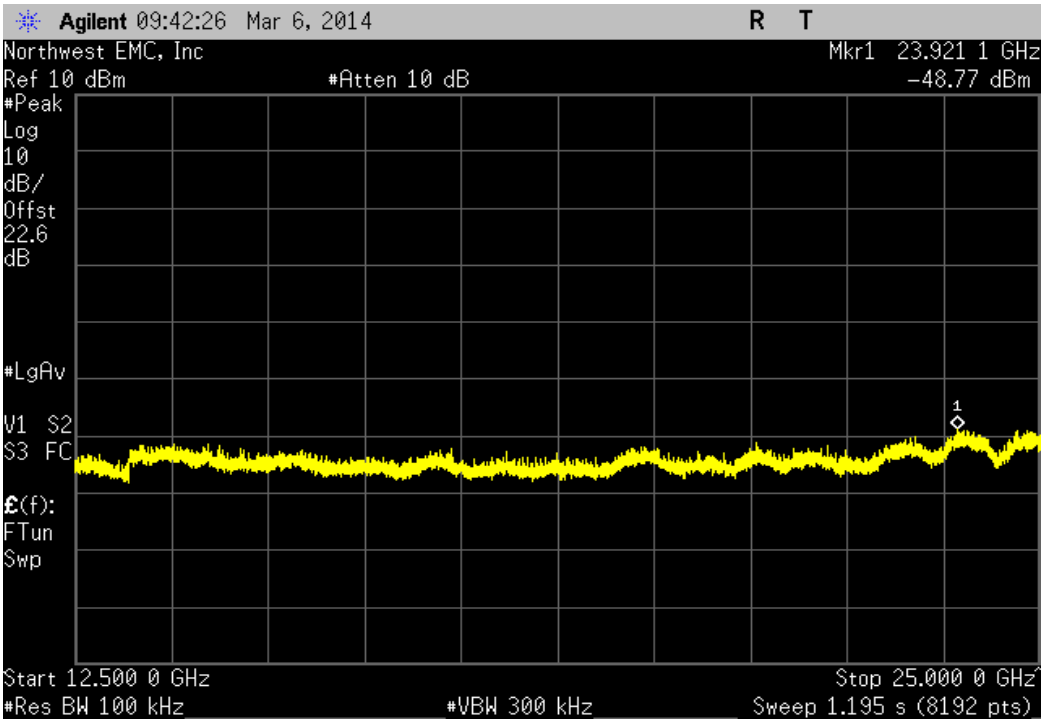


SPURIOUS CONDUCTED EMISSIONS

2DH5, High Channel 78, 2480 MHz				
Frequency Range		Value	Limit	Result
30 MHz - 12.5 GHz		-53.36 dBc	≤ -20 dBc	Pass

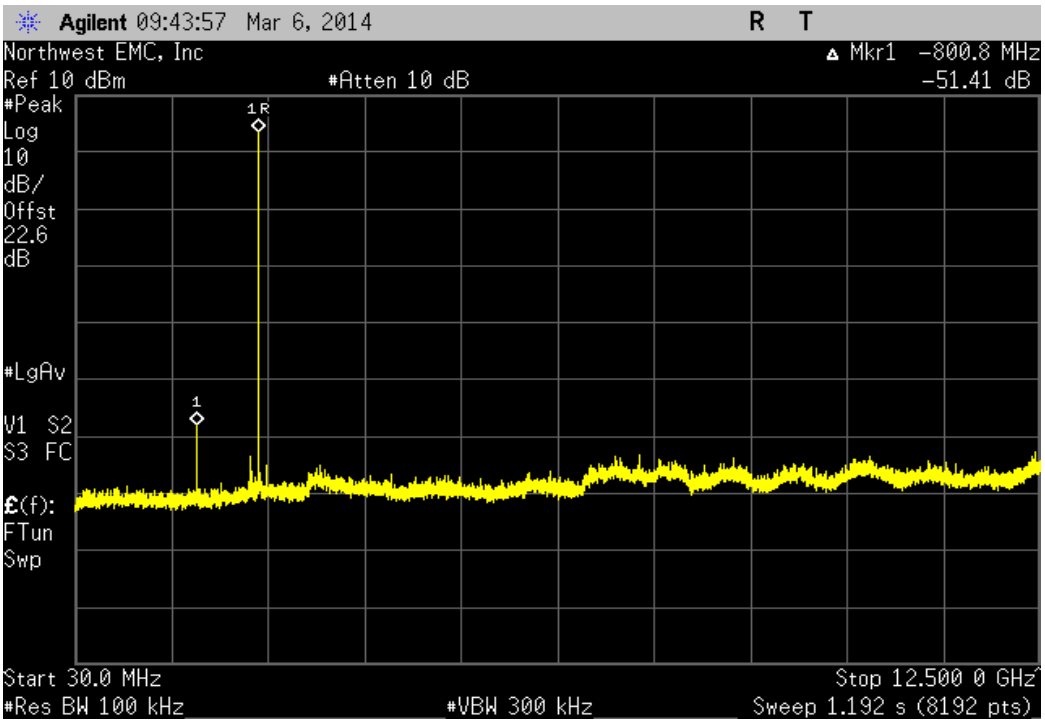


2DH5, High Channel 78, 2480 MHz				
Frequency Range		Value	Limit	Result
12.5 GHz - 25 GHz		-52.15 dBc	≤ -20 dBc	Pass

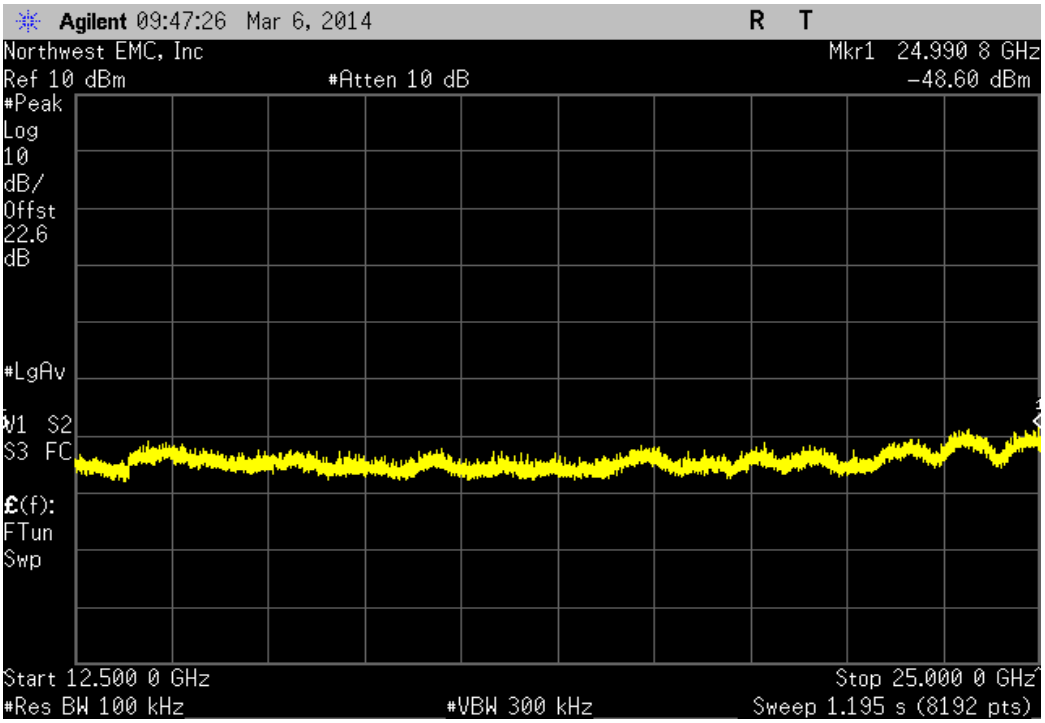


SPURIOUS CONDUCTED EMISSIONS

3DH5, Low Channel 0, 2402 MHz				
Frequency Range		Value	Limit	Result
30 MHz - 12.5 GHz		-51.41 dBc	≤ -20 dBc	Pass

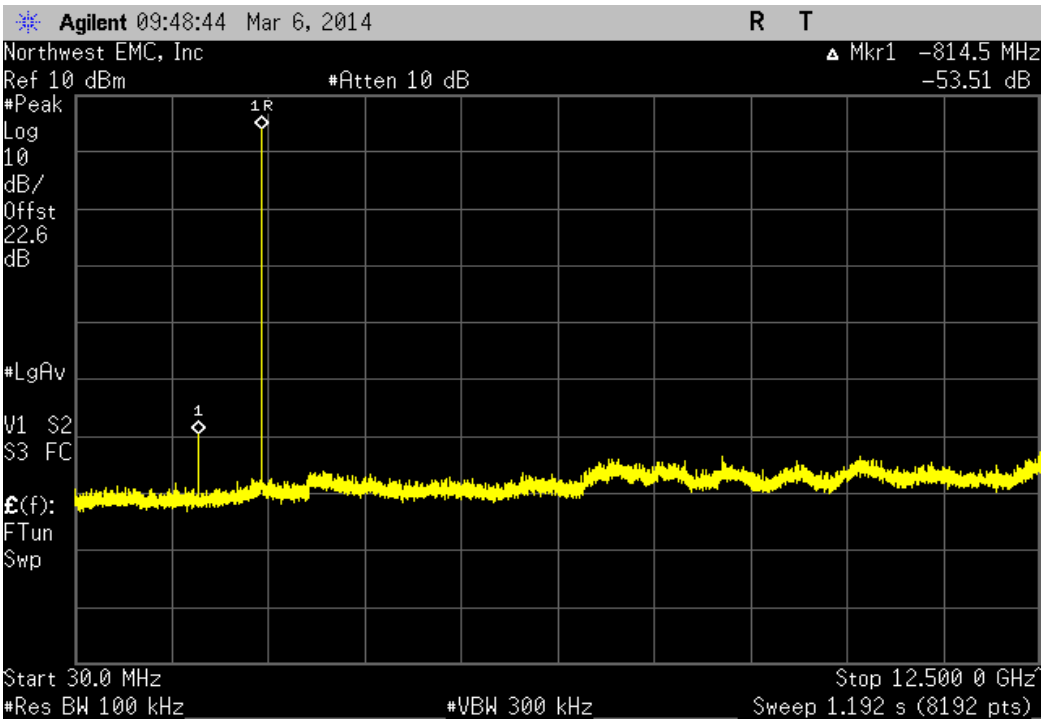


3DH5, Low Channel 0, 2402 MHz				
Frequency Range		Value	Limit	Result
12.5 GHz - 25 GHz		-52.17 dBc	≤ -20 dBc	Pass

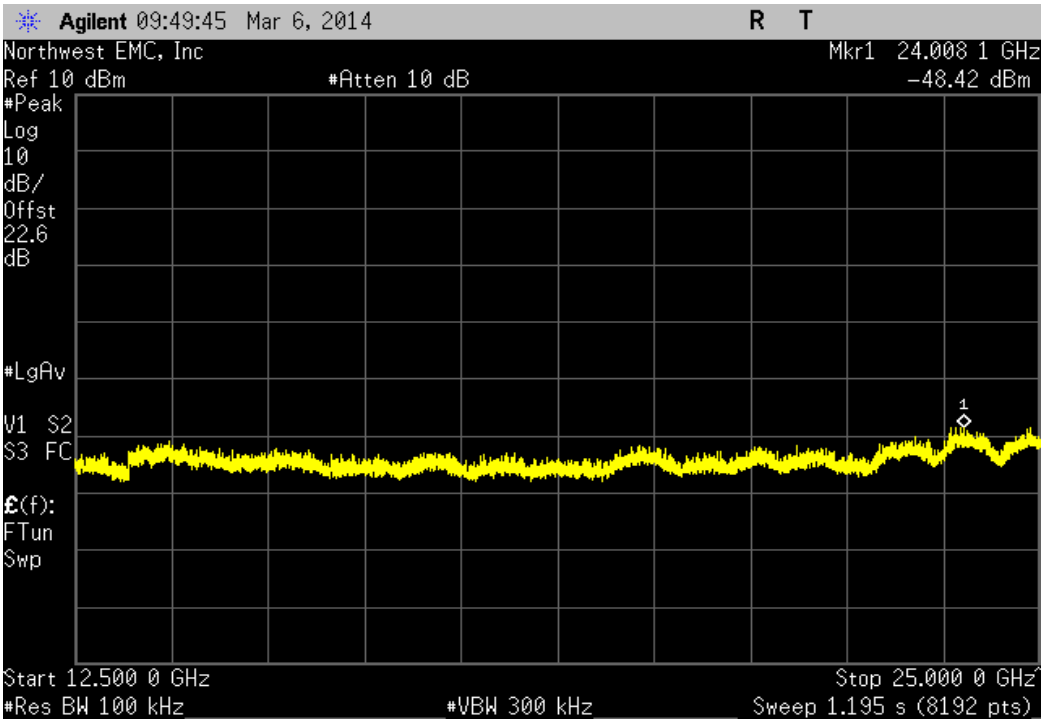


SPURIOUS CONDUCTED EMISSIONS

3DH5, Mid Channel 39, 2441 MHz				
Frequency Range		Value	Limit	Result
30 MHz - 12.5 GHz		-53.51 dBc	≤ -20 dBc	Pass

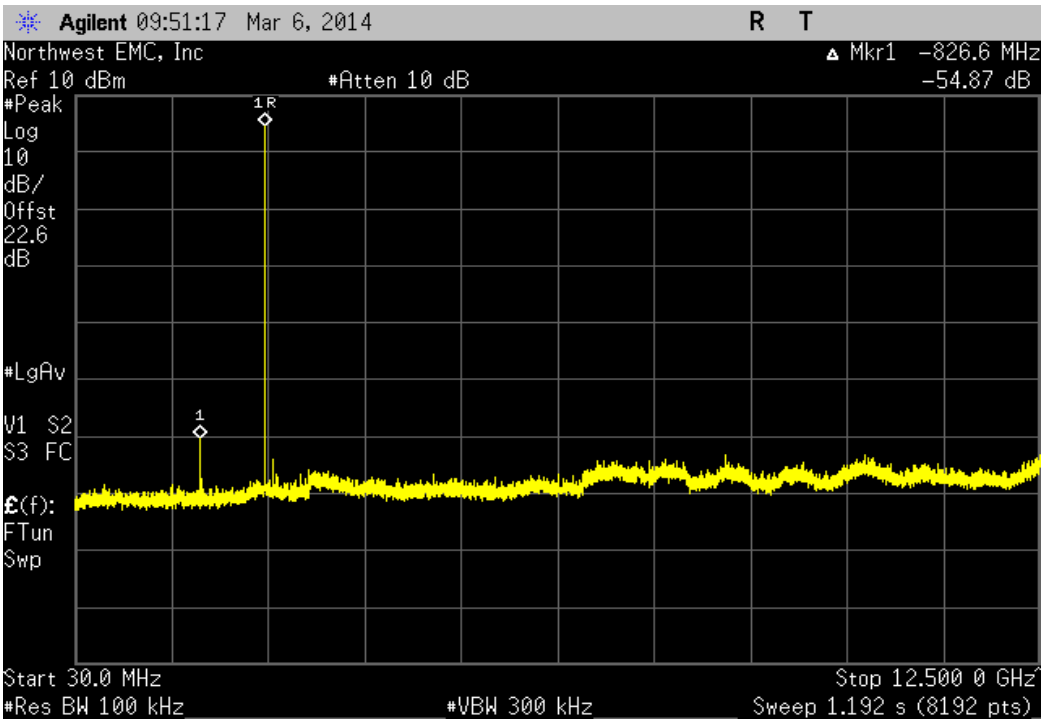


3DH5, Mid Channel 39, 2441 MHz				
Frequency Range		Value	Limit	Result
12.5 GHz - 25 GHz		-52.37 dBc	≤ -20 dBc	Pass

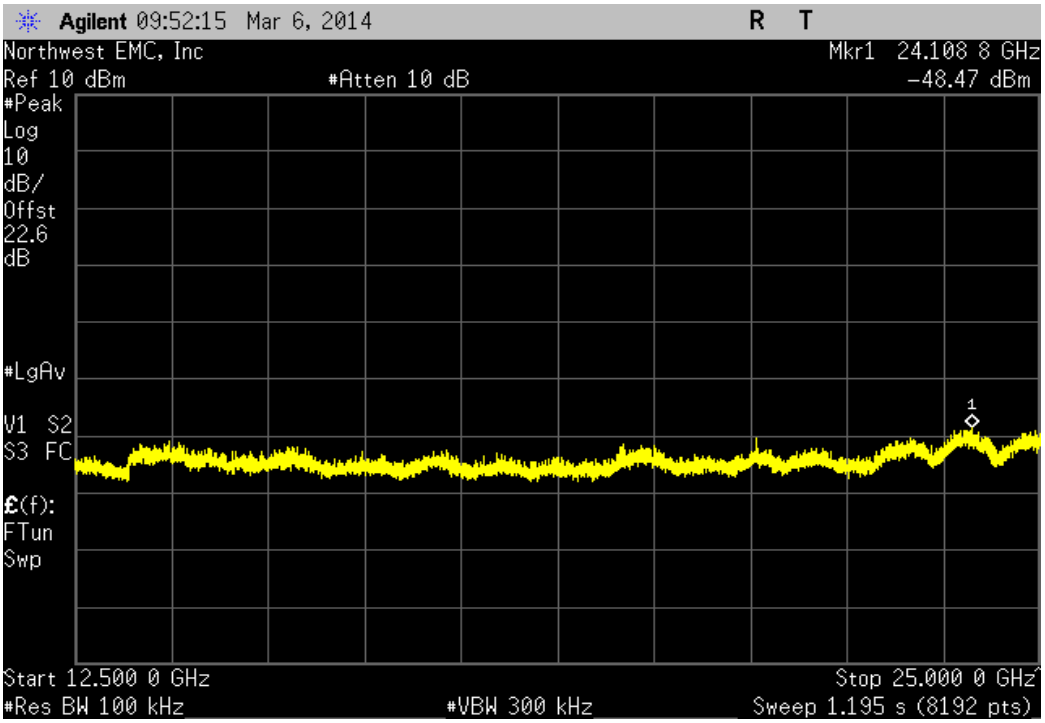


SPURIOUS CONDUCTED EMISSIONS

3DH5, High Channel 78, 2480 MHz				
Frequency Range		Value	Limit	Result
30 MHz - 12.5 GHz		-54.87 dBc	≤ -20 dBc	Pass



3DH5, High Channel 78, 2480 MHz				
Frequency Range		Value	Limit	Result
12.5 GHz - 25 GHz		-52.9 dBc	≤ -20 dBc	Pass



BAND EDGE COMPLIANCE - HOPPING MODE

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.	Interval
Signal Generator	Agilent	N5183A	TIA	1/27/2012	36
NC02 Cable	ESM Cable Corp.	TTBJ-141 KMKM-72	NC5	7/3/2013	12
40GHz DC Block	Fairview Microwave	SD3379	AMJ	7/3/2013	12
Attenuator	Fairview Microwave	SA4014-20	TKE	2/13/2014	12
Spectrum Analyzer	Agilent	E4446A	AAT	6/28/2012	24

TEST DESCRIPTION

The spurious RF conducted emissions at the edges of the authorized band were measured with the EUT set to its normal pseudo-random hopping sequence. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at the data rate(s) listed in the datasheet.

The spectrum was scanned below the lower band edge and above the higher band edge.

BAND EDGE COMPLIANCE - HOPPING MODE

EUT:	1631			**Work Order:**	MCSO1702
Serial Number:	041152140753			**Date:**	03/06/14
Customer:	Microsoft Corporation			**Temperature:**	23°C
Attendees:	None			**Humidity:**	40%
Project:	None			**Barometric Pres.:**	1001
Tested by:	Richard Mellroth	**Power:**	110 VAC / 60Hz	**Job Site:**	NC06

TEST SPECIFICATIONS	Test Method
FCC 15.247:2014	ANSI C63.10:2009

COMMENTS

Adapter cable loss of 0.75dB added to analyzer reference level offset. EUT power settings in control software were set to Power Class: 1.5, and Power Level: 8 (dBm).

DEVIATIONS FROM TEST STANDARD

None

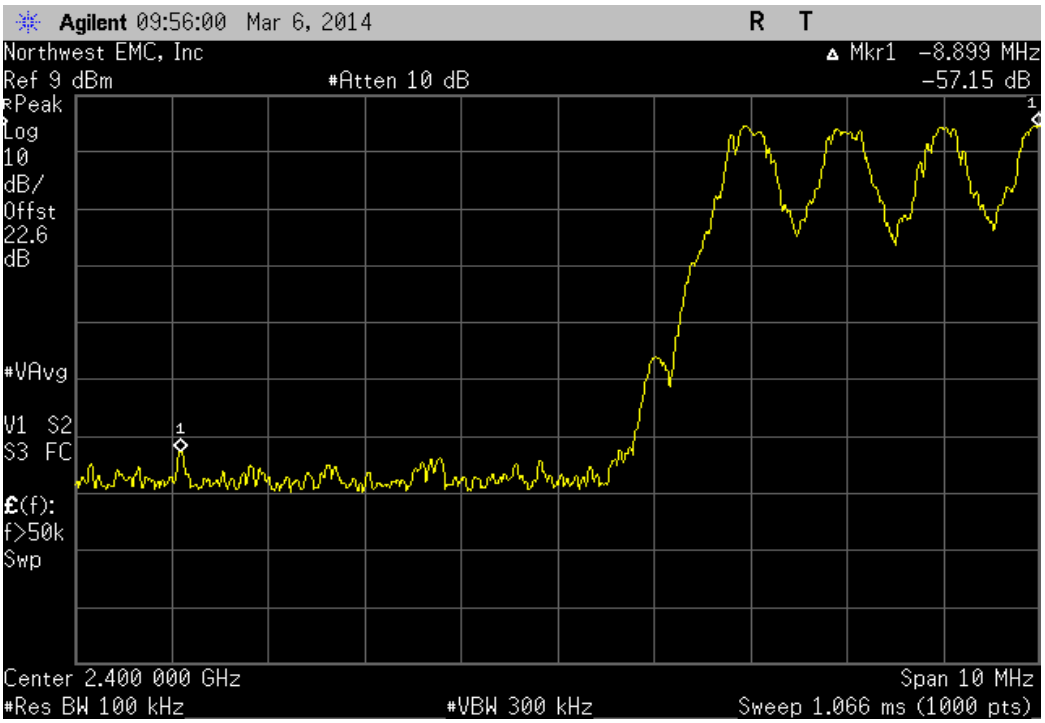
Configuration #	1	Signature

		Value	Limit	Result
DH5				
	Low Channel 0, 2402 MHz	-57.15 dBc	≤ -20 dBc	Pass
	High Channel 78, 2480 MHz	-56.74 dBc	≤ -20 dBc	Pass
2DH5				
	Low Channel 0, 2402 MHz	-51.18 dBc	≤ -20 dBc	Pass
	High Channel 78, 2480 MHz	-55.27 dBc	≤ -20 dBc	Pass
3DH5				
	Low Channel 0, 2402 MHz	-46.9 dBc	≤ -20 dBc	Pass
	High Channel 78, 2480 MHz	-55.5 dBc	≤ -20 dBc	Pass

BAND EDGE COMPLIANCE - HOPPING MODE

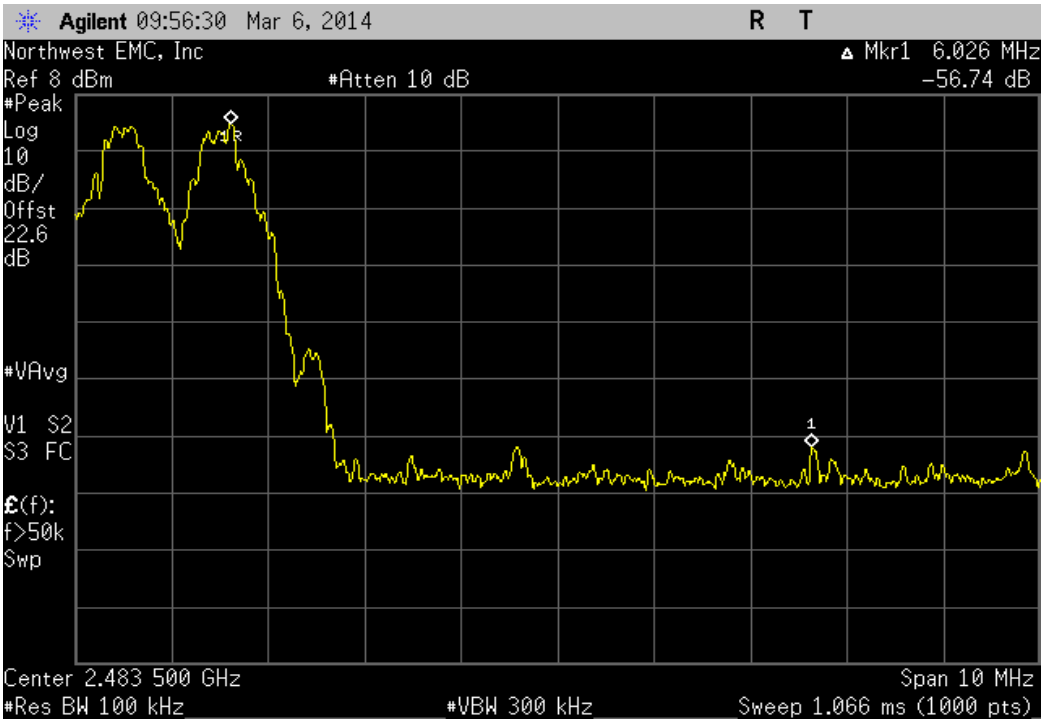
DH5, Low Channel 0, 2402 MHz

				Value	Limit	Result
				-57.15 dBc	≤ -20 dBc	Pass



DH5, High Channel 78, 2480 MHz

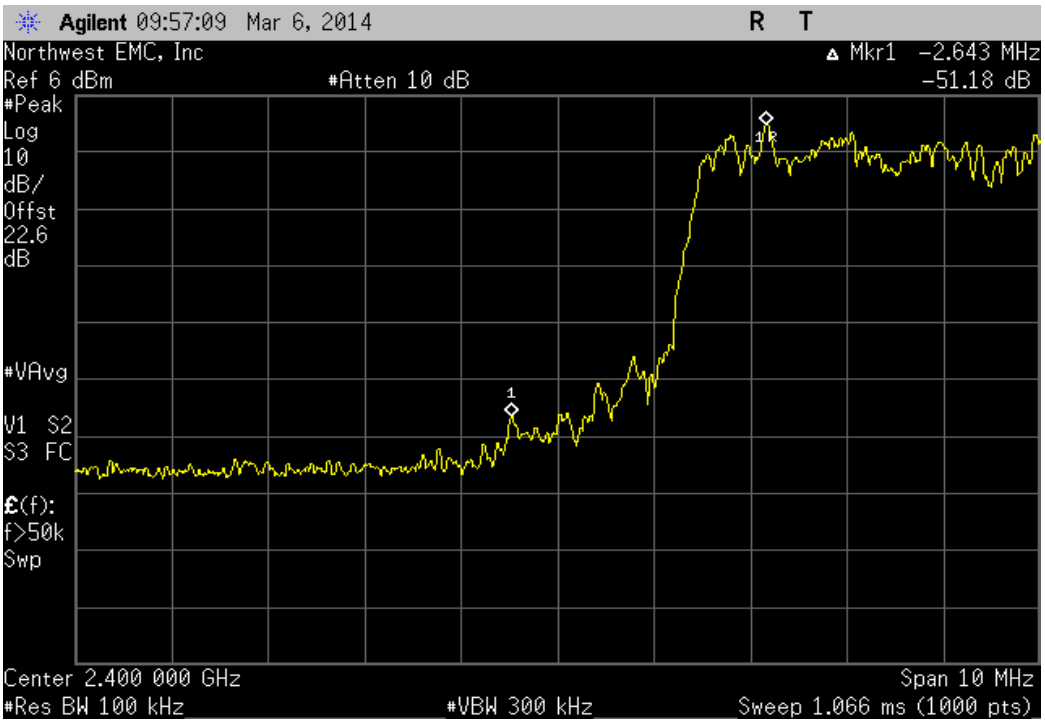
				Value	Limit	Result
				-56.74 dBc	≤ -20 dBc	Pass



BAND EDGE COMPLIANCE - HOPPING MODE

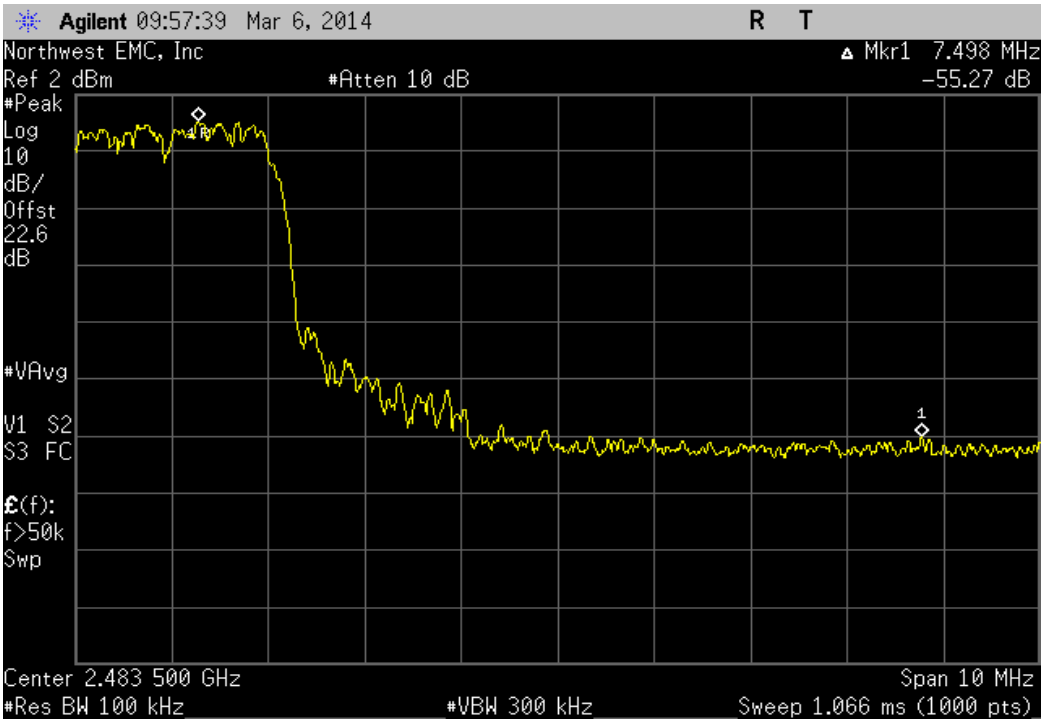
2DH5, Low Channel 0, 2402 MHz

				Value	Limit	Result
				-51.18 dBc	≤ -20 dBc	Pass



2DH5, High Channel 78, 2480 MHz

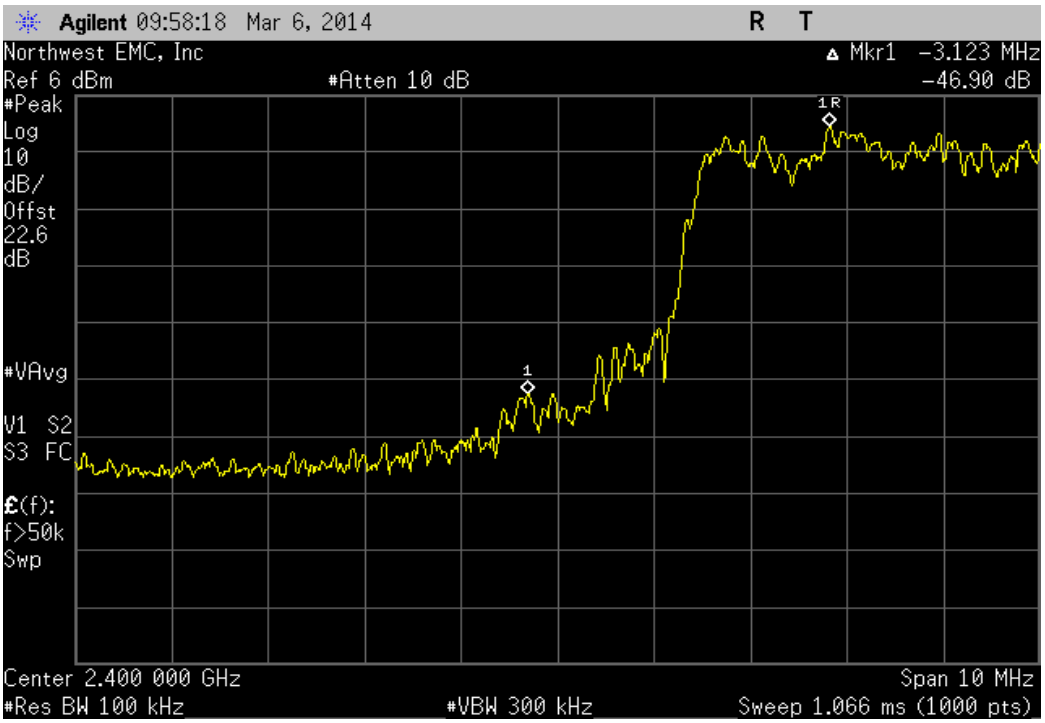
				Value	Limit	Result
				-55.27 dBc	≤ -20 dBc	Pass



BAND EDGE COMPLIANCE - HOPPING MODE

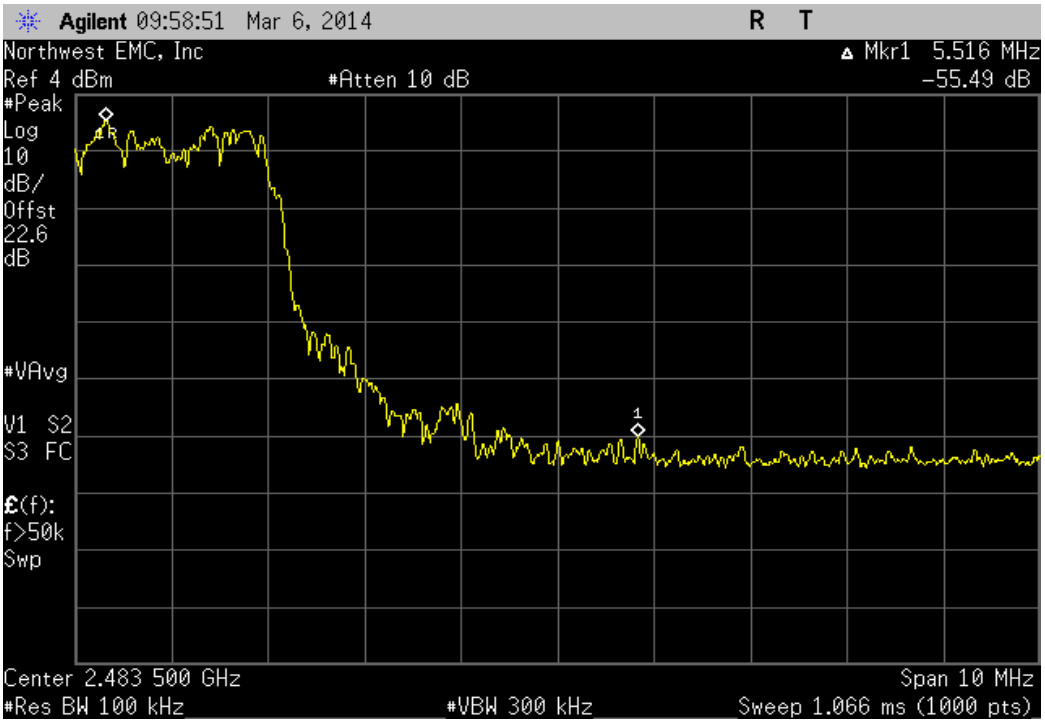
3DH5, Low Channel 0, 2402 MHz

				Value	Limit	Result
				-46.9 dBc	≤ -20 dBc	Pass



3DH5, High Channel 78, 2480 MHz

				Value	Limit	Result
				-55.5 dBc	≤ -20 dBc	Pass



BAND EDGE COMPLIANCE

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.	Interval
Signal Generator	Agilent	N5183A	TIA	1/27/2012	36
NC02 Cable	ESM Cable Corp.	TTBJ-141 KMKM-72	NC5	7/3/2013	12
40GHz DC Block	Fairview Microwave	SD3379	AMJ	7/3/2013	12
Attenuator	Fairview Microwave	SA4014-20	TKE	2/13/2014	12
Spectrum Analyzer	Agilent	E4446A	AAT	6/28/2012	24

TEST DESCRIPTION

The spurious RF conducted emissions at the edges of the authorized band were measured with the EUT set to low and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at the data rate(s) listed in the datasheet in a no hop mode. The channels closest to the band edges were selected.

The spectrum was scanned below the lower band edge and above the higher band edge.

BAND EDGE COMPLIANCE

EUT:	1631			Work Order:	MCSO1702
Serial Number:	041152140753			Date:	03/06/14
Customer:	Microsoft Corporation			Temperature:	23°C
Attendees:	None			Humidity:	40%
Project:	None			Barometric Pres.:	1001
Tested by:	Richard Mellroth	Power:	110 VAC / 60Hz	Job Site:	NC06

TEST SPECIFICATIONS	Test Method
FCC 15.247:2014	ANSI C63.10:2009

COMMENTS

Adapter cable loss of 0.75dB added to analyzer reference level offset. EUT power settings in control software were set to Power Class: 1.5, and Power Level: 8 (dBm).

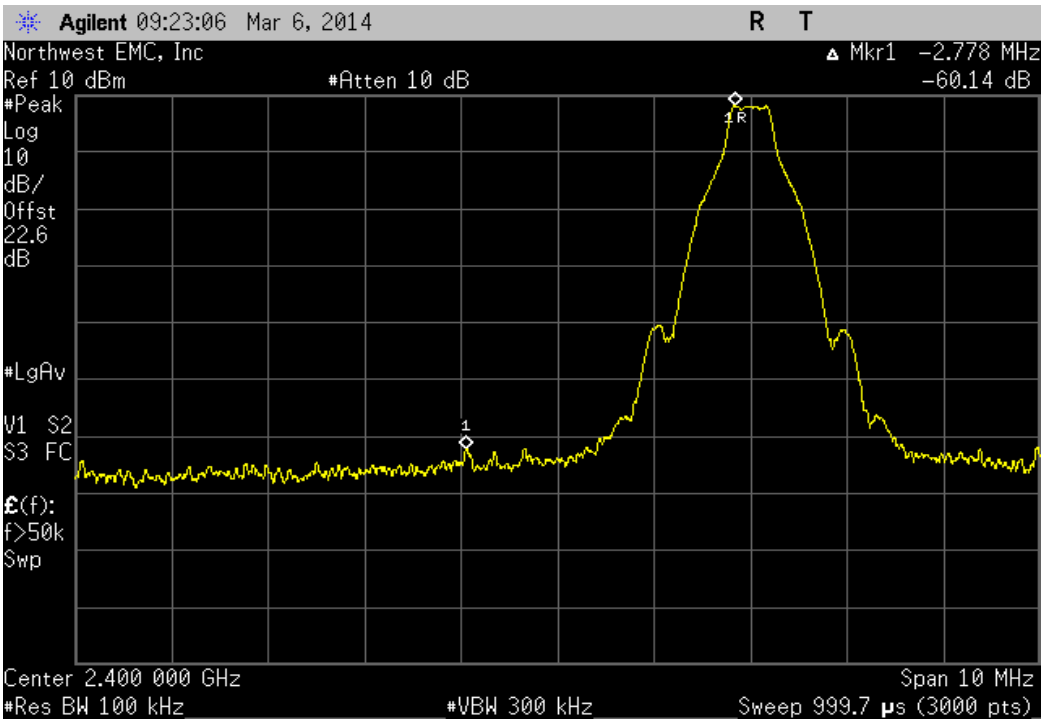
DEVIATIONS FROM TEST STANDARD

None

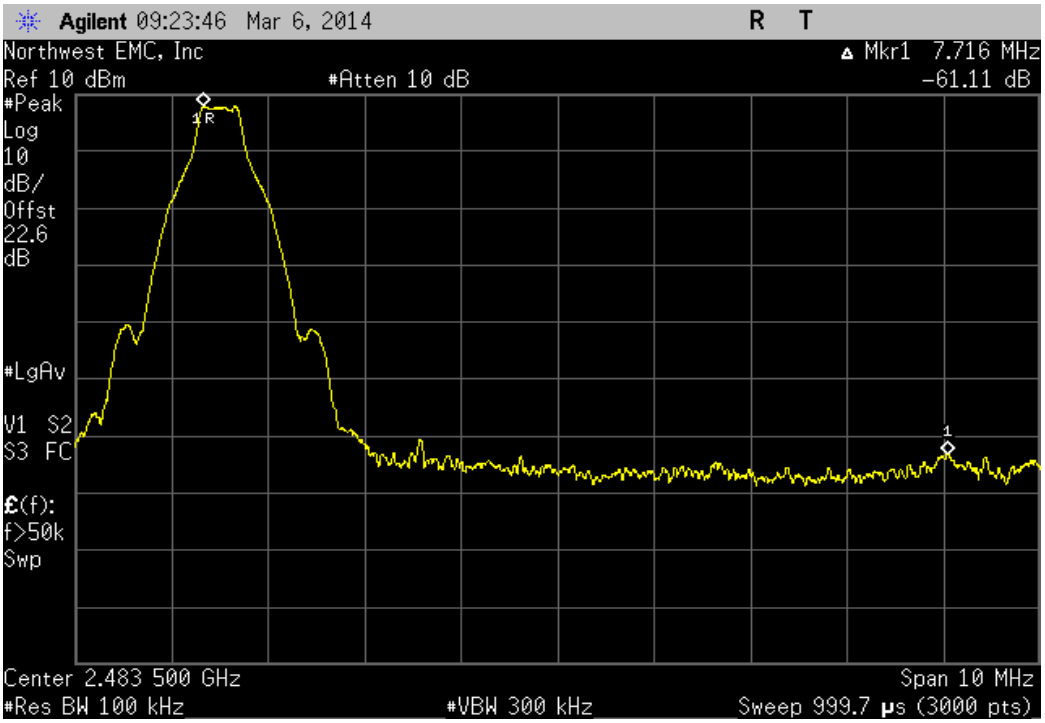
Configuration #	1	Signature

		Value	Limit	Result
DH5				
	Low Channel 0, 2402 MHz	-60.14 dBc	≤ -20 dBc	Pass
	High Channel 78, 2480 MHz	-61.11 dBc	≤ -20 dBc	Pass
2DH5				
	Low Channel 0, 2402 MHz	-51.83 dBc	≤ -20 dBc	Pass
	High Channel 78, 2480 MHz	-59.6 dBc	≤ -20 dBc	Pass
3DH5				
	Low Channel 0, 2402 MHz	-49.09 dBc	≤ -20 dBc	Pass
	High Channel 78, 2480 MHz	-56.85 dBc	≤ -20 dBc	Pass

DH5, Low Channel 0, 2402 MHz						
				Value	Limit	Result
				-60.14 dBc	≤ -20 dBc	Pass



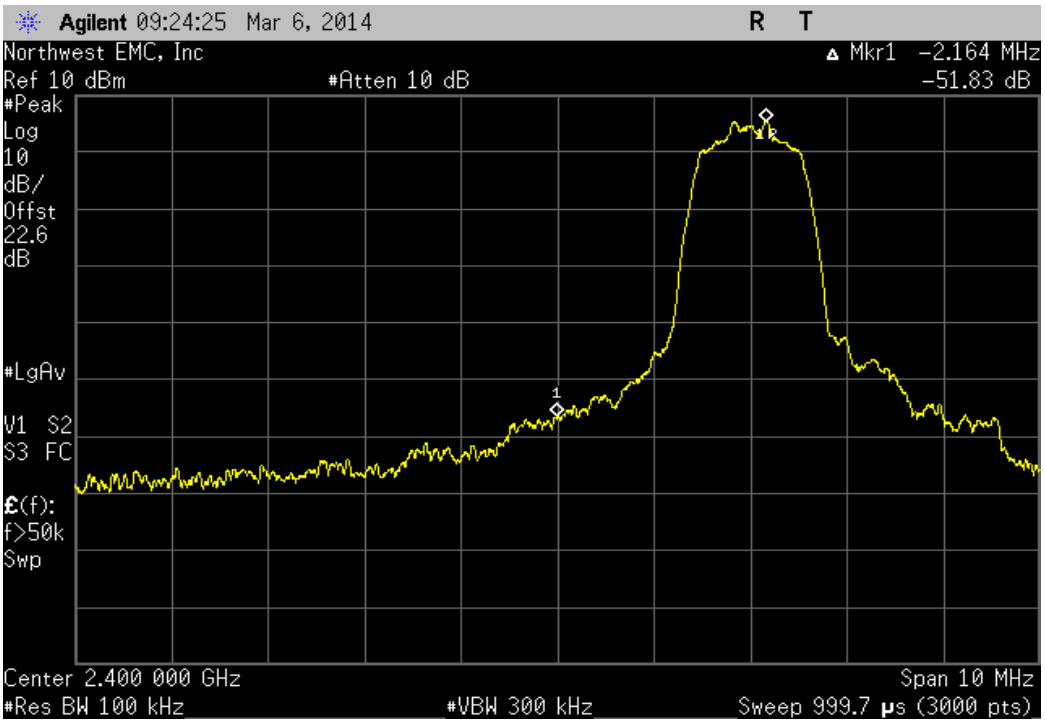
DH5, High Channel 78, 2480 MHz						
				Value	Limit	Result
				-61.11 dBc	≤ -20 dBc	Pass



BAND EDGE COMPLIANCE

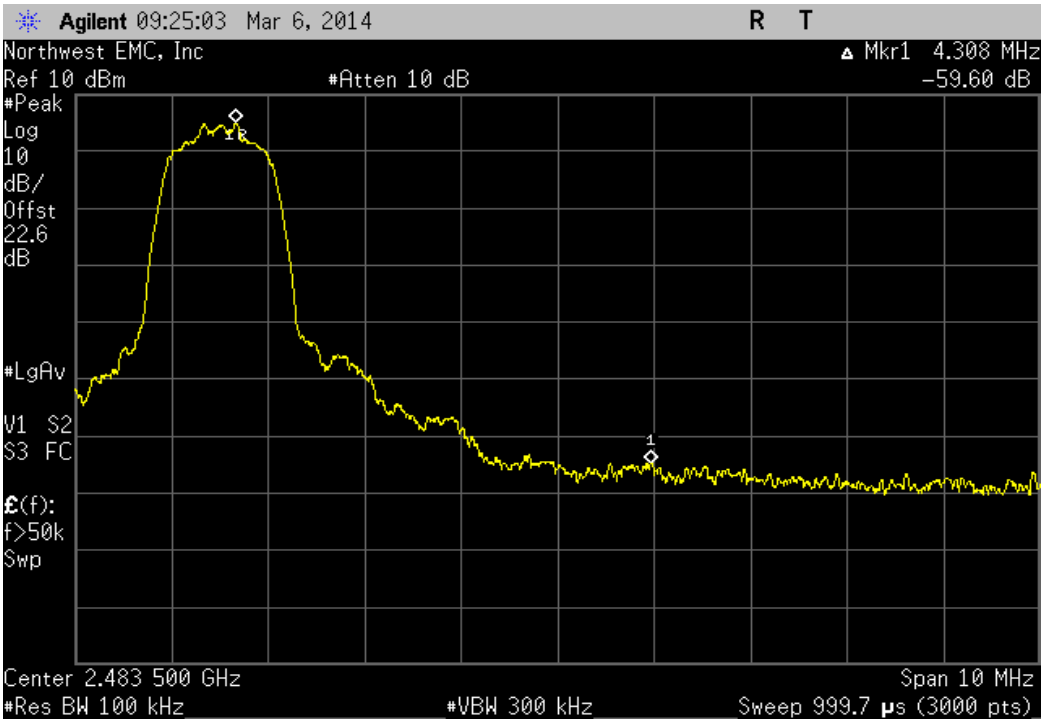
2DH5, Low Channel 0, 2402 MHz

				Value	Limit	Result
				-51.83 dBc	≤ -20 dBc	Pass



2DH5, High Channel 78, 2480 MHz

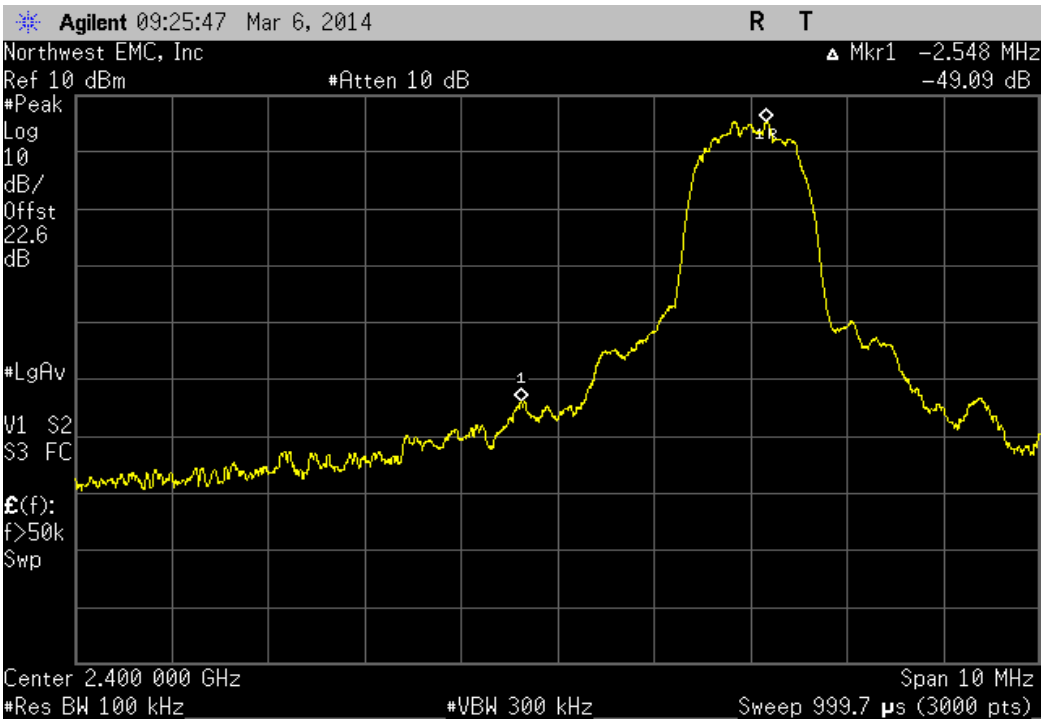
				Value	Limit	Result
				-59.6 dBc	≤ -20 dBc	Pass



BAND EDGE COMPLIANCE

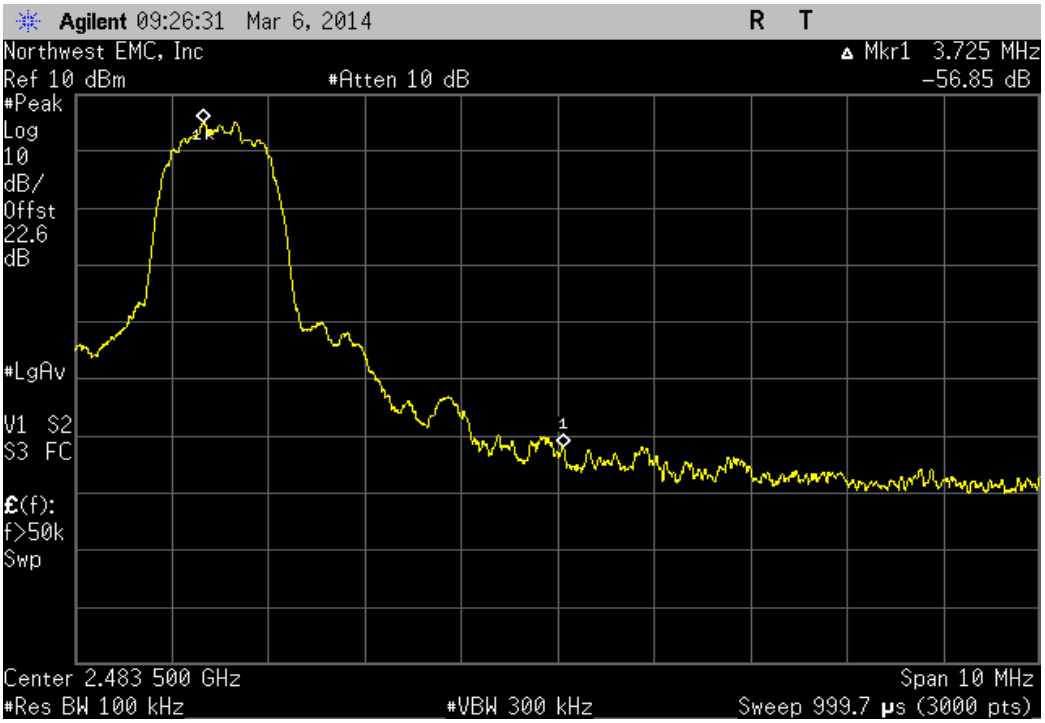
3DH5, Low Channel 0, 2402 MHz

				Value	Limit	Result
				-49.09 dBc	≤ -20 dBc	Pass



3DH5, High Channel 78, 2480 MHz

				Value	Limit	Result
				-56.85 dBc	≤ -20 dBc	Pass



CHANNEL SEPARATION

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.	Interval
Signal Generator	Agilent	N5183A	TIA	1/27/2012	36
NC02 Cable	ESM Cable Corp.	TTBJ-141 KMKM-72	NC5	7/3/2013	12
Attenuator	Fairview Microwave	SA4014-20	TKE	2/13/2014	12
40GHz DC Block	Fairview Microwave	SD3379	AMJ	7/3/2013	12
Spectrum Analyzer	Agilent	E4446A	AAT	6/28/2012	24

TEST DESCRIPTION

The channel carrier frequencies in the 2400-2483.5MHz band must be separated by 25 kHz or the 20dB bandwidth of the hopping channel, whichever is greater. Or, if the output power is less than 125 mW, the channel separation can be 25 kHz or 2/3 of the 20dB bandwidth. The EUT was operated in pseudorandom hopping mode. The spectrum was scanned across two adjacent peaks. The separation between the peaks of these channels was measured.

CHANNEL SEPARATION

EUT:	1631			Work Order:	MCSO1702
Serial Number:	041152140753			Date:	03/06/14
Customer:	Microsoft Corporation			Temperature:	23°C
Attendees:	None			Humidity:	40%
Project:	None			Barometric Pres.:	1001
Tested by:	Richard Mellroth	Power:	110 VAC / 60Hz	Job Site:	NC06

TEST SPECIFICATIONS	Test Method
FCC 15.247:2014	ANSI C63.10:2009

COMMENTS

Adapter cable loss of 0.75dB added to analyzer reference level offset. EUT power settings in control software were set to Power Class: 1.5, and Power Level: 8 (dBm).

DEVIATIONS FROM TEST STANDARD

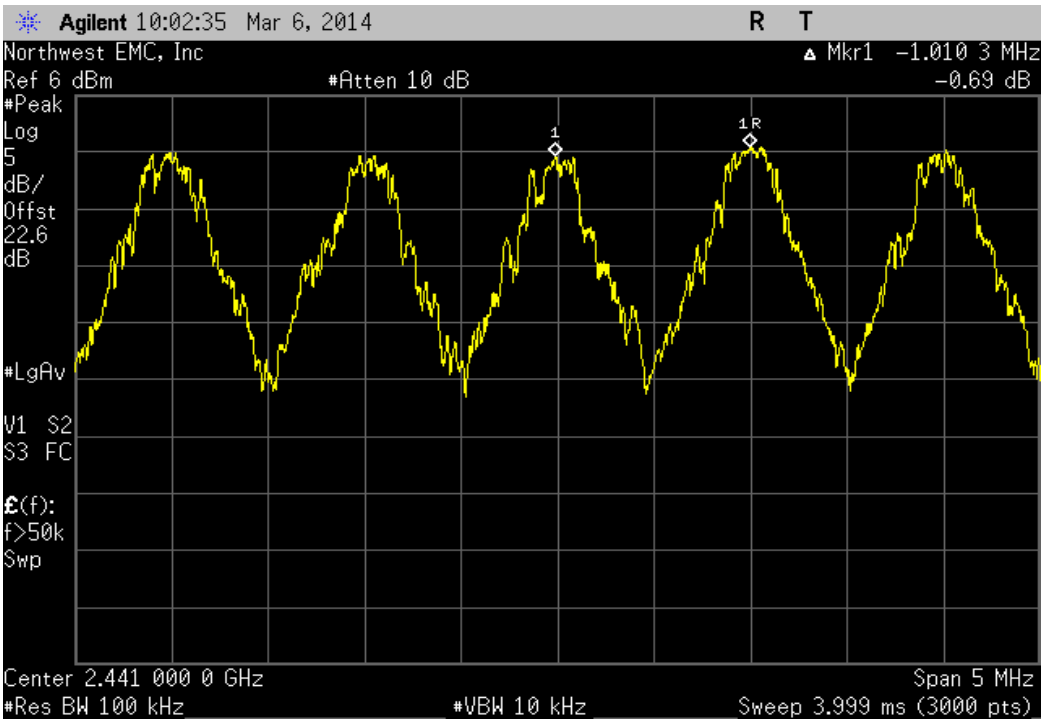
None

Configuration #	1	Signature

	Value	Limit	Result
DH5			
Mid Channel 39, 2441 MHz	1.0 MHz	≥ 1 MHz	Pass

CHANNEL SEPARATION

DH5, Mid Channel 39, 2441 MHz						
				Value	Limit	Result
				1.0 MHz	≥ 1 MHz	Pass



NUMBER OF HOPPING CHANNELS

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.	Interval
Signal Generator	Agilent	N5183A	TIA	1/27/2012	36
NC02 Cable	ESM Cable Corp.	TTBJ-141 KMKM-72	NC5	7/3/2013	12
Attenuator	Fairview Microwave	SA4014-20	TKE	2/13/2014	12
40GHz DC Block	Fairview Microwave	SD3379	AMJ	7/3/2013	12
Spectrum Analyzer	Agilent	E4446A	AAT	6/28/2012	24

TEST DESCRIPTION

The number of hopping frequencies was measured across the authorized band. The measurements were made using a direct connection between the RF output of the EUT and the spectrum analyzer. The hopping function of the EUT was enabled.

NUMBER OF HOPPING CHANNELS

EUT:	1631			Work Order:	MCSO1702
Serial Number:	041152140753			Date:	03/06/14
Customer:	Microsoft Corporation			Temperature:	23°C
Attendees:	None			Humidity:	40%
Project:	None			Barometric Pres.:	1001
Tested by:	Richard Mellroth	Power:	110 VAC / 60Hz	Job Site:	NC06

TEST SPECIFICATIONS	Test Method
FCC 15.247:2014	ANSI C63.10:2009

COMMENTS

Adapter cable loss of 0.75dB added to analyzer reference level offset. EUT power settings in control software were set to Power Class: 1.5, and Power Level: 8 (dBm).

DEVIATIONS FROM TEST STANDARD

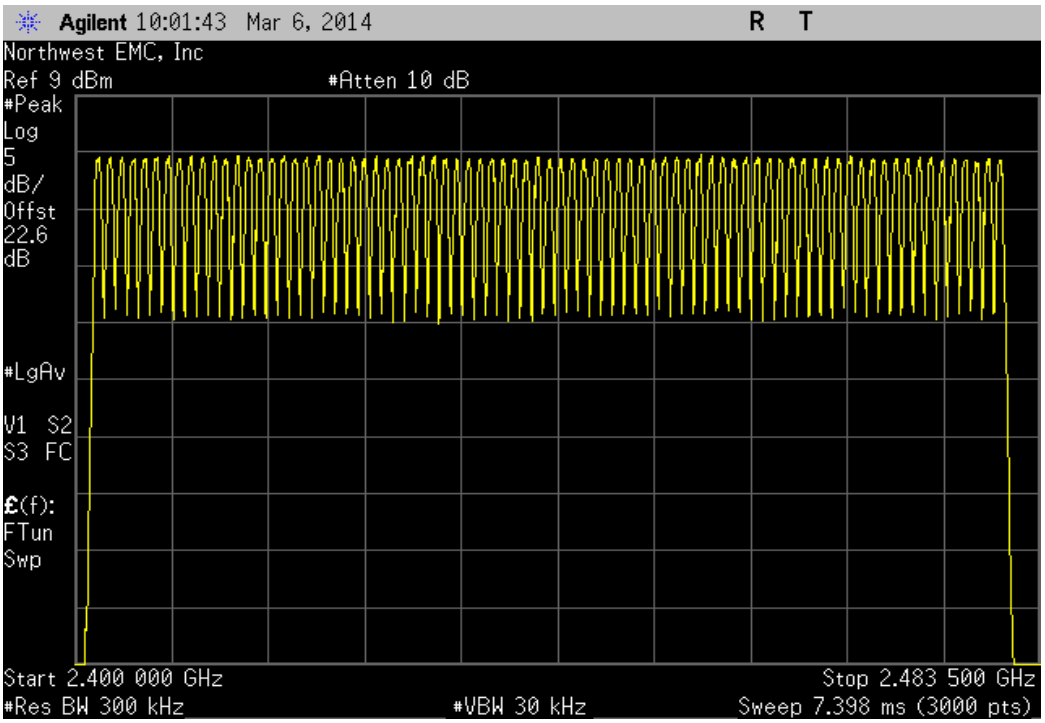
None

Configuration #	1	Signature

	Number of Channels	Limit	Result
DH5			
Hopping Mode	79	≥ 15	Pass

NUMBER OF HOPPING CHANNELS

Hopping Mode						
				Number of Channels	Limit	Result
				79	≥ 15	Pass



DWELL TIME

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.	Interval
Signal Generator	Agilent	N5183A	TIA	1/27/2012	36
NC02 Cable	ESM Cable Corp.	TTBJ-141 KMKM-72	NC5	7/3/2013	12
Attenuator	Fairview Microwave	SA4014-20	TKE	2/13/2014	12
Spectrum Analyzer	Agilent	E4446A	AAT	6/28/2012	24
40GHz DC Block	Fairview Microwave	SD3379	AMJ	7/3/2013	12

TEST DESCRIPTION

The average dwell time per hopping channel was measured at one hopping channel in the middle of the authorized band. The measurements were made using a direct connection between the RF output of the EUT and the spectrum analyzer. The hopping function of the EUT was enabled.

The dwell time limit is based on the Number of Hopping Channels * 400 mS. For Bluetooth this would be 79 Channels * 400mS = 31.6 Sec.

On Time During 31.6 Sec = Pulse Width * Average Number of Pulses * Scale Factor

- Average Number of Pulses is based on 4 samples.

- Scale Factor = 31.6 Sec / Screen Capture Sweep Time = 31.6 Sec / 6.32 Sec = 5

DWELL TIME

EUT:	1631	Work Order:	MCSO1702
Serial Number:	041152140753	Date:	03/06/14
Customer:	Microsoft Corporation	Temperature:	23°C
Attendees:	None	Humidity:	40%
Project:	None	Barometric Pres.:	1001
Tested by:	Richard Mellroth	Power: 110 VAC / 60Hz	Job Site: NC06

TEST SPECIFICATIONS	Test Method
FCC 15.247:2014	ANSI C63.10:2009

COMMENTS

Adapter cable loss of 0.75dB added to analyzer reference level offset. EUT power settings in control software were set to Power Class: 1.5, and Power Level: 8 (dBm).

DEVIATIONS FROM TEST STANDARD

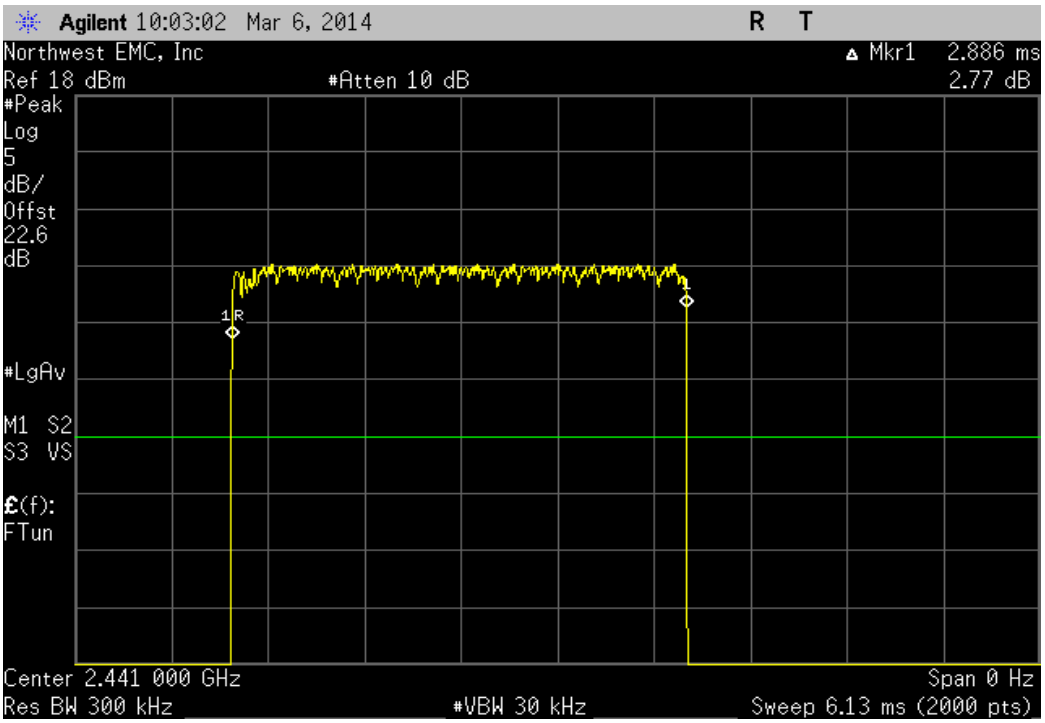
None

Configuration #	1	Signature

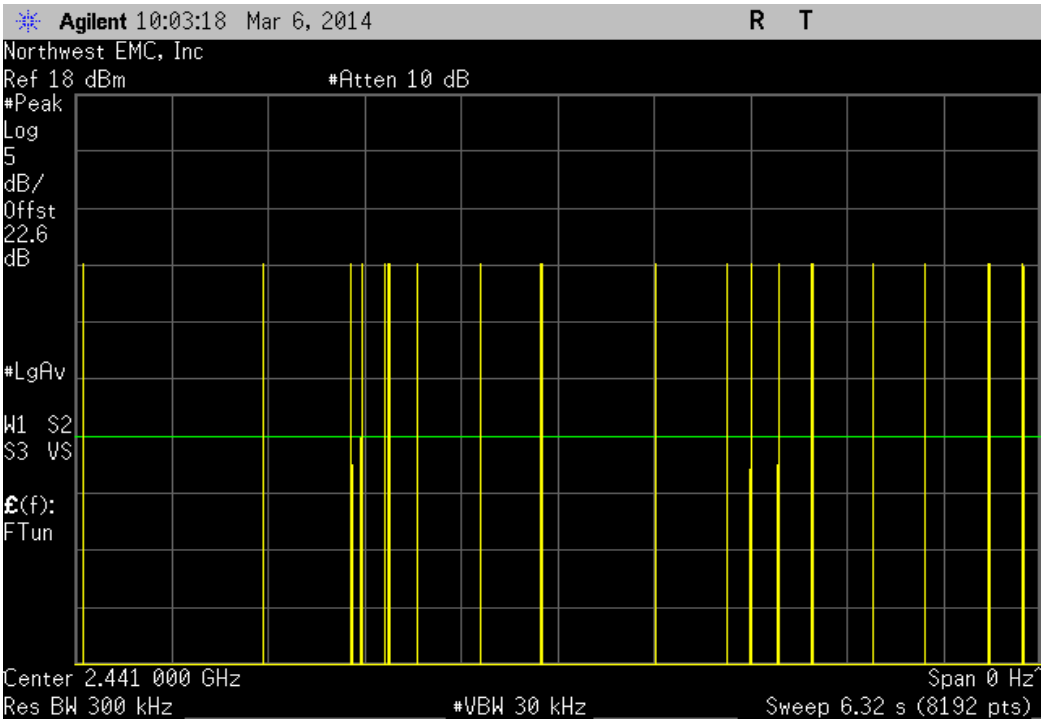
	Pulse Width (mS)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (mS) During 31.6 S	Limit (mS)	Result
DH5							
Mid Channel 39, 2441 MHz	2.886	N/A	N/A	N/A	N/A	N/A	N/A
Mid Channel 39, 2441 MHz	N/A	18	N/A	N/A	N/A	N/A	N/A
Mid Channel 39, 2441 MHz	N/A	22	N/A	N/A	N/A	N/A	N/A
Mid Channel 39, 2441 MHz	N/A	20	N/A	N/A	N/A	N/A	N/A
Mid Channel 39, 2441 MHz	N/A	23	N/A	N/A	N/A	N/A	N/A
Mid Channel 39, 2441 MHz	2.886	N/A	20.75	5	299.42	400	Pass
2DH5							
Mid Channel 39, 2441 MHz	2.886	N/A	N/A	N/A	N/A	N/A	N/A
Mid Channel 39, 2441 MHz	N/A	24	N/A	N/A	N/A	N/A	N/A
Mid Channel 39, 2441 MHz	N/A	19	N/A	N/A	N/A	N/A	N/A
Mid Channel 39, 2441 MHz	N/A	30	N/A	N/A	N/A	N/A	N/A
Mid Channel 39, 2441 MHz	N/A	24	N/A	N/A	N/A	N/A	N/A
Mid Channel 39, 2441 MHz	2.886	N/A	24.25	5	349.93	400	Pass
3DH5							
Mid Channel 39, 2441 MHz	2.889	N/A	N/A	N/A	N/A	N/A	N/A
Mid Channel 39, 2441 MHz	N/A	21	N/A	N/A	N/A	N/A	N/A
Mid Channel 39, 2441 MHz	N/A	25	N/A	N/A	N/A	N/A	N/A
Mid Channel 39, 2441 MHz	N/A	20	N/A	N/A	N/A	N/A	N/A
Mid Channel 39, 2441 MHz	N/A	23	N/A	N/A	N/A	N/A	N/A
Mid Channel 39, 2441 MHz	2.889	N/A	22.25	5	321.4	400	Pass

DWELL TIME

DH5, Mid Channel 39, 2441 MHz						
Pulse Width (mS)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (mS) During 31.6 S	Limit (mS)	Result
2.886	N/A	N/A	N/A	N/A	N/A	N/A

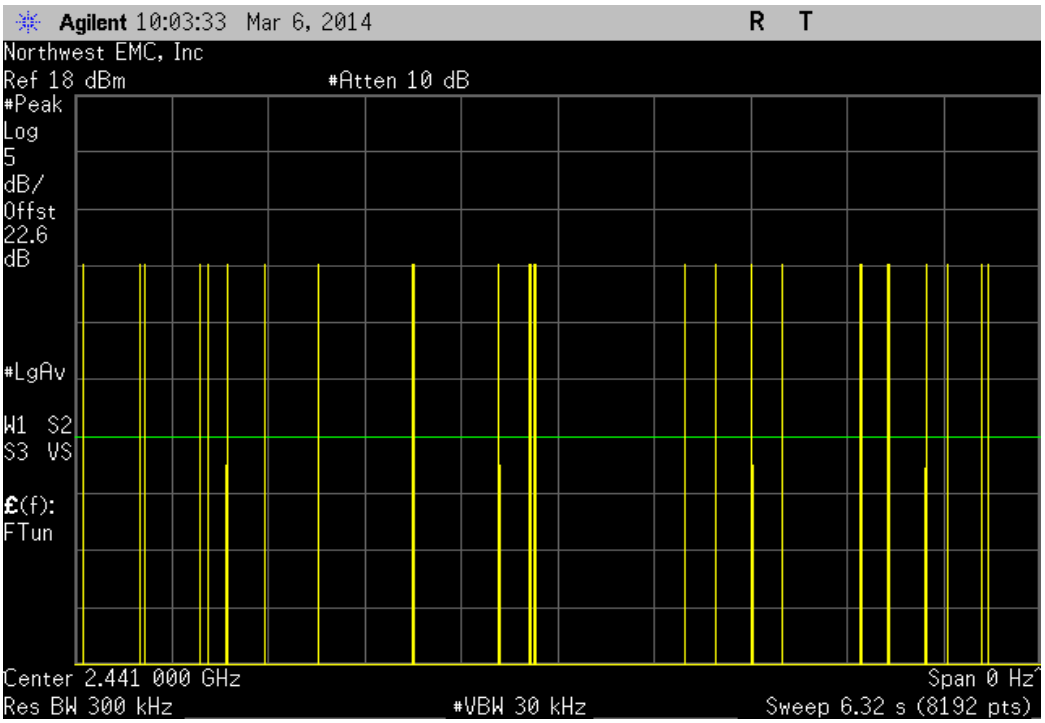


DH5, Mid Channel 39, 2441 MHz						
Pulse Width (mS)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (mS) During 31.6 S	Limit (mS)	Result
N/A	18	N/A	N/A	N/A	N/A	N/A

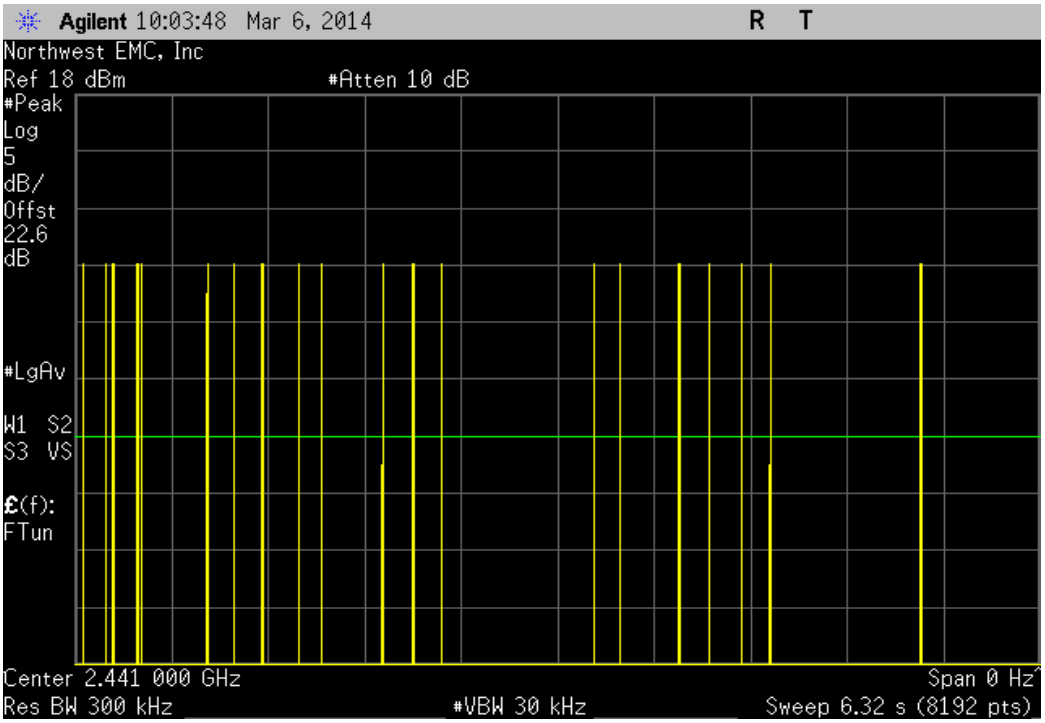


DWELL TIME

DH5, Mid Channel 39, 2441 MHz						
Pulse Width (mS)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (mS) During 31.6 S	Limit (mS)	Result
N/A	22	N/A	N/A	N/A	N/A	N/A

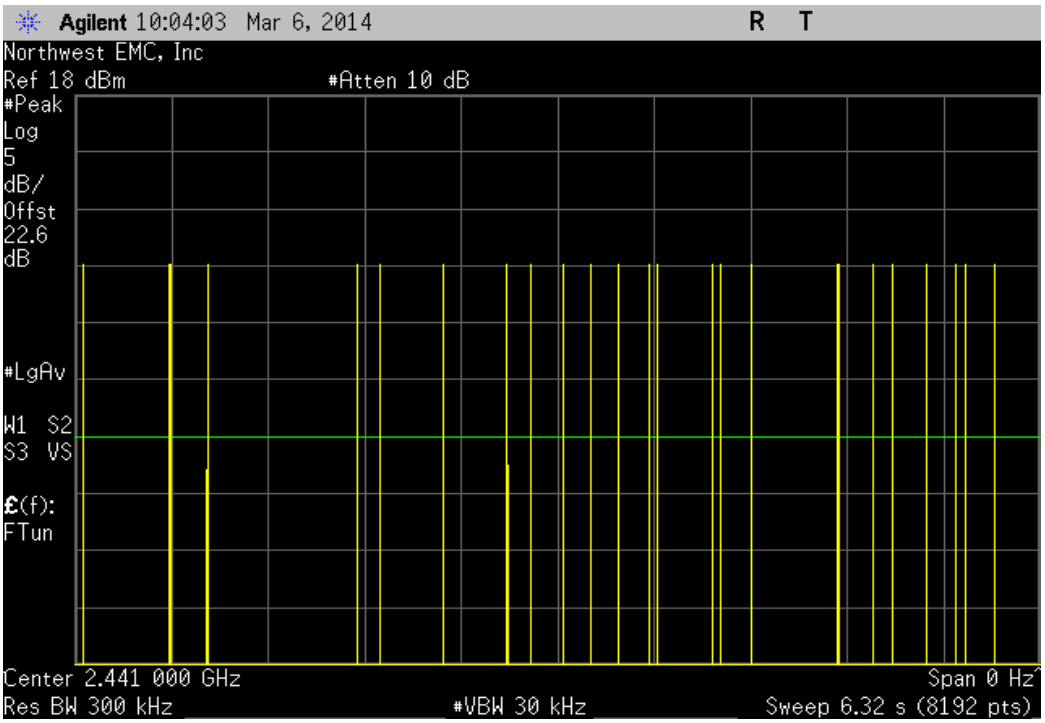


DH5, Mid Channel 39, 2441 MHz						
Pulse Width (mS)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (mS) During 31.6 S	Limit (mS)	Result
N/A	20	N/A	N/A	N/A	N/A	N/A



DWELL TIME

DH5, Mid Channel 39, 2441 MHz						
Pulse Width (mS)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (mS) During 31.6 S	Limit (mS)	Result
N/A	23	N/A	N/A	N/A	N/A	N/A



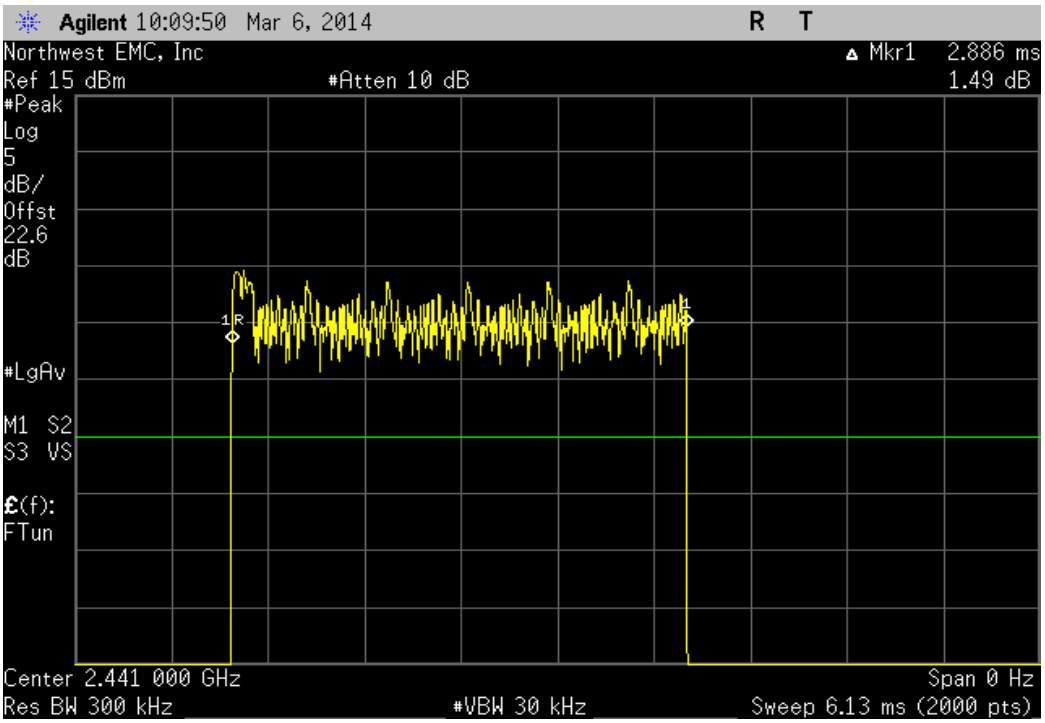
DH5, Mid Channel 39, 2441 MHz						
Pulse Width (mS)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (mS) During 31.6 S	Limit (mS)	Result
2.886	N/A	20.75	5	299.42	400	Pass

Calculation Only

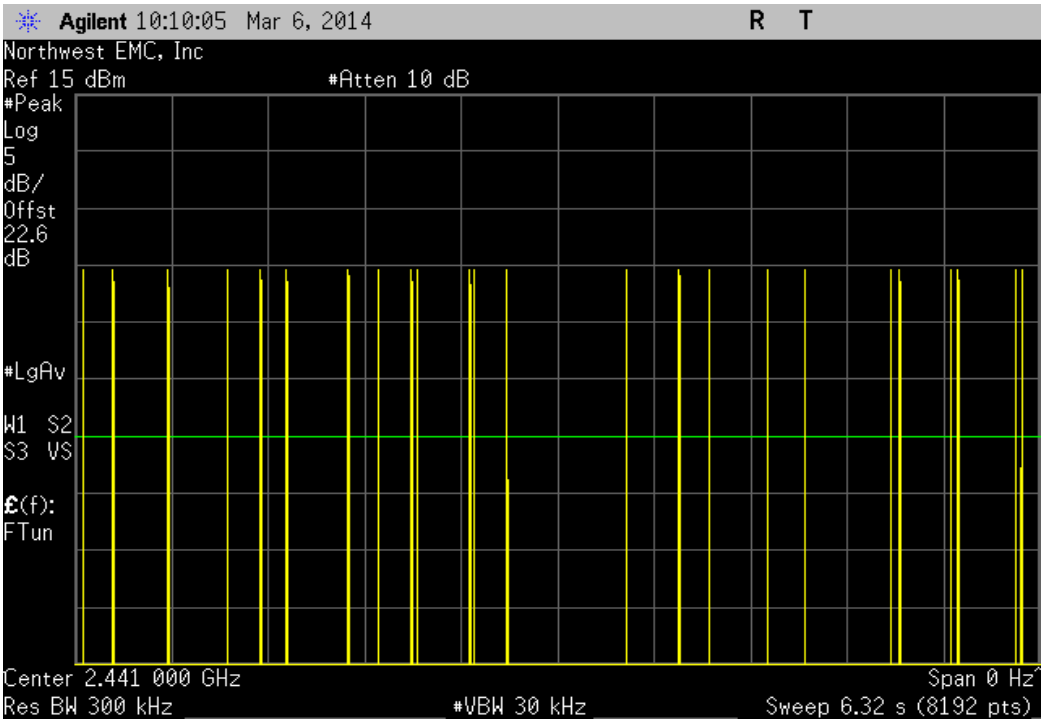
No Screen Capture Required

DWELL TIME

2DH5, Mid Channel 39, 2441 MHz						
Pulse Width (mS)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (mS) During 31.6 S	Limit (mS)	Result
2.886	N/A	N/A	N/A	N/A	N/A	N/A

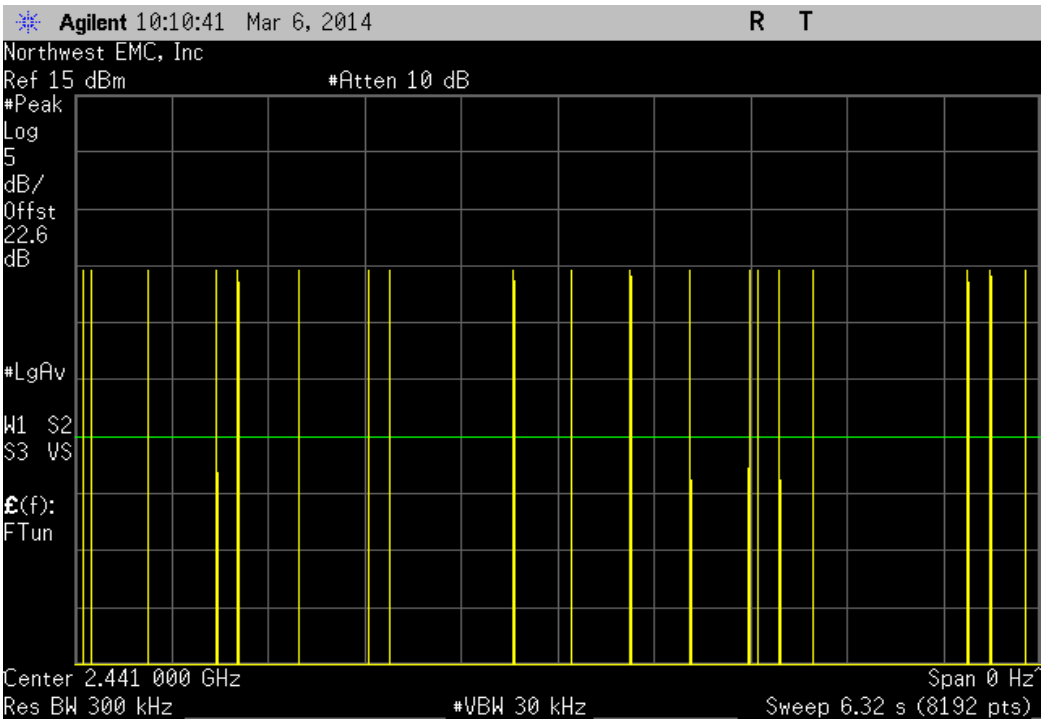


2DH5, Mid Channel 39, 2441 MHz						
Pulse Width (mS)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (mS) During 31.6 S	Limit (mS)	Result
N/A	24	N/A	N/A	N/A	N/A	N/A

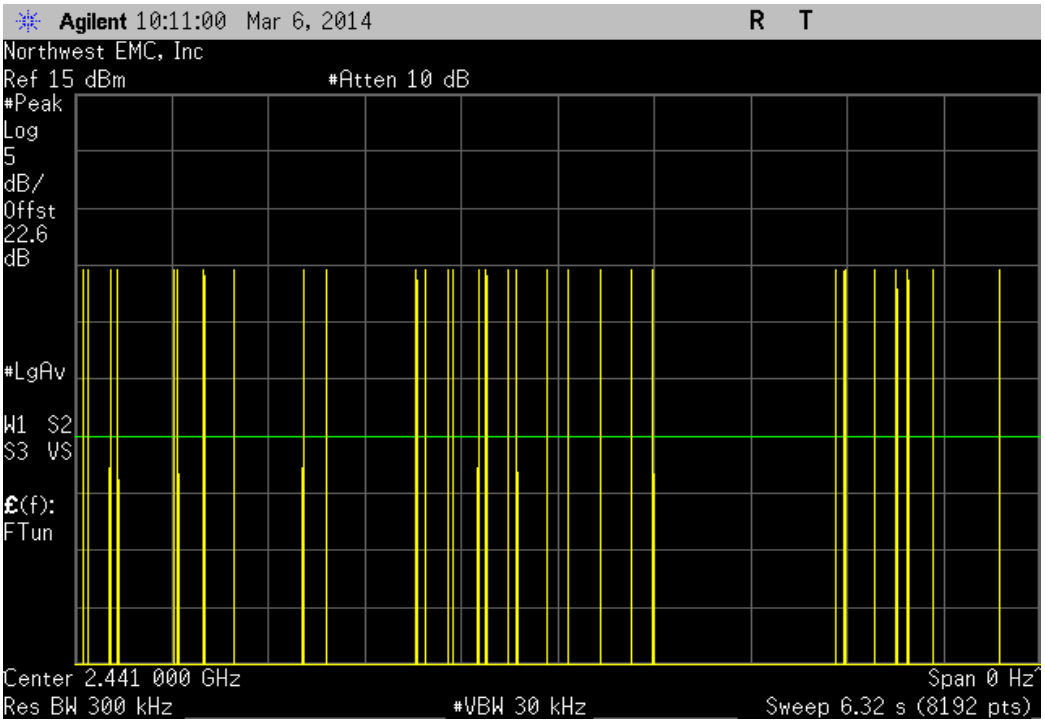


DWELL TIME

2DH5, Mid Channel 39, 2441 MHz						
Pulse Width (mS)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (mS) During 31.6 S	Limit (mS)	Result
N/A	19	N/A	N/A	N/A	N/A	N/A

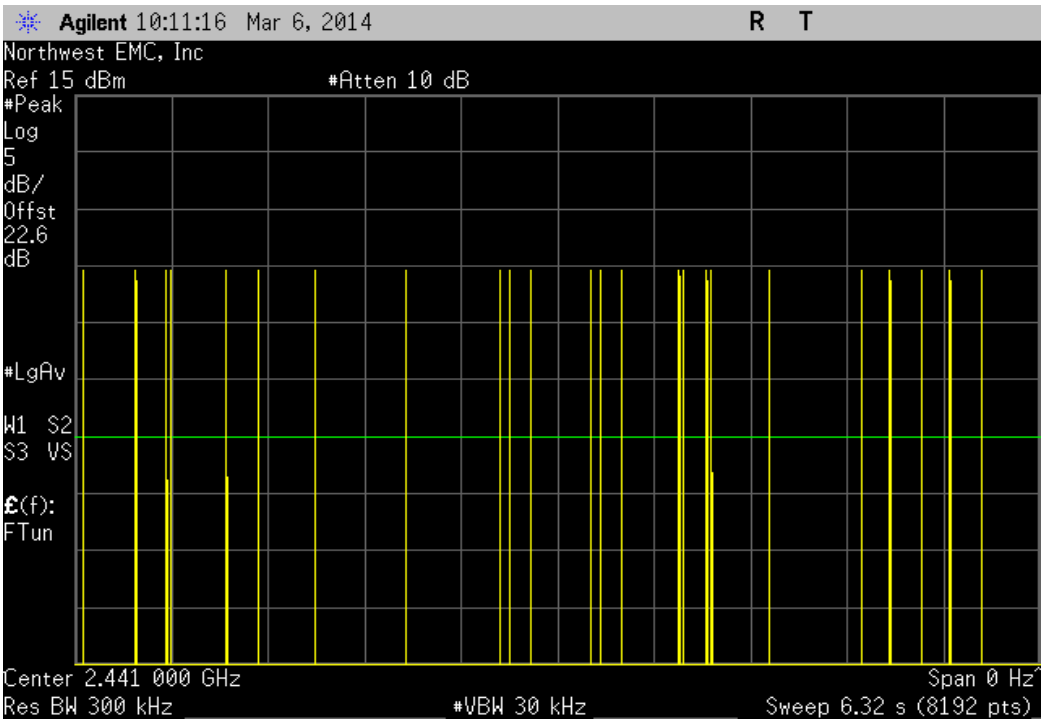


2DH5, Mid Channel 39, 2441 MHz						
Pulse Width (mS)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (mS) During 31.6 S	Limit (mS)	Result
N/A	30	N/A	N/A	N/A	N/A	N/A



DWELL TIME

2DH5, Mid Channel 39, 2441 MHz						
Pulse Width (mS)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (mS) During 31.6 S	Limit (mS)	Result
N/A	24	N/A	N/A	N/A	N/A	N/A



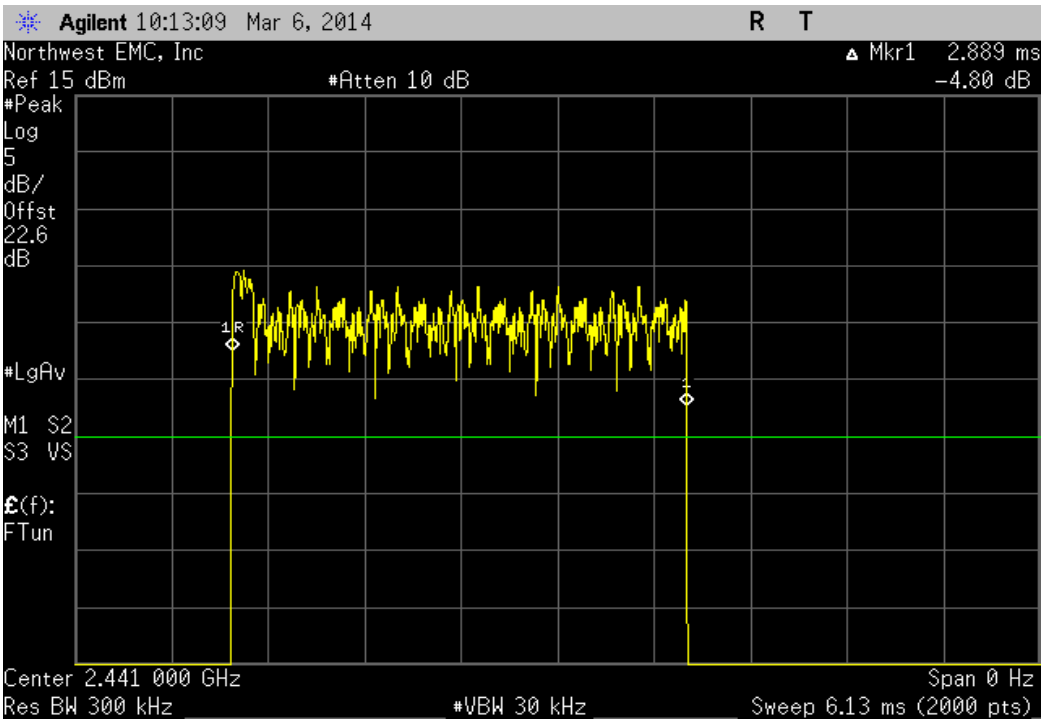
2DH5, Mid Channel 39, 2441 MHz						
Pulse Width (mS)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (mS) During 31.6 S	Limit (mS)	Result
2.886	N/A	24.25	5	349.93	400	Pass

Calculation Only

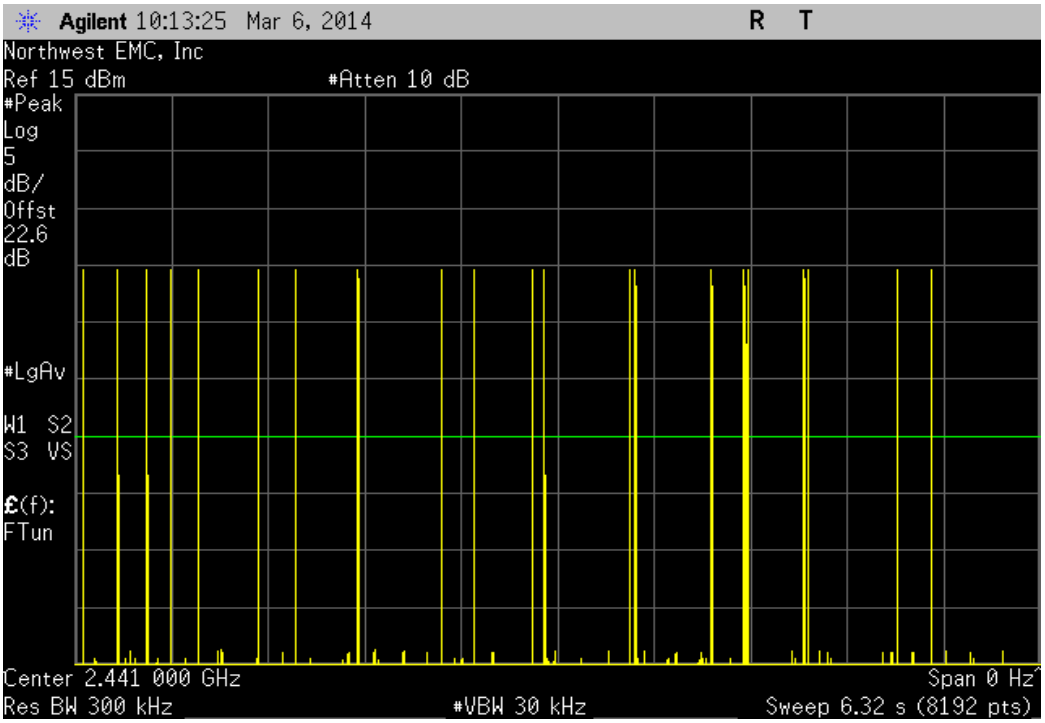
No Screen Capture Required

DWELL TIME

3DH5, Mid Channel 39, 2441 MHz						
Pulse Width (mS)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (mS) During 31.6 S	Limit (mS)	Result
2.889	N/A	N/A	N/A	N/A	N/A	N/A

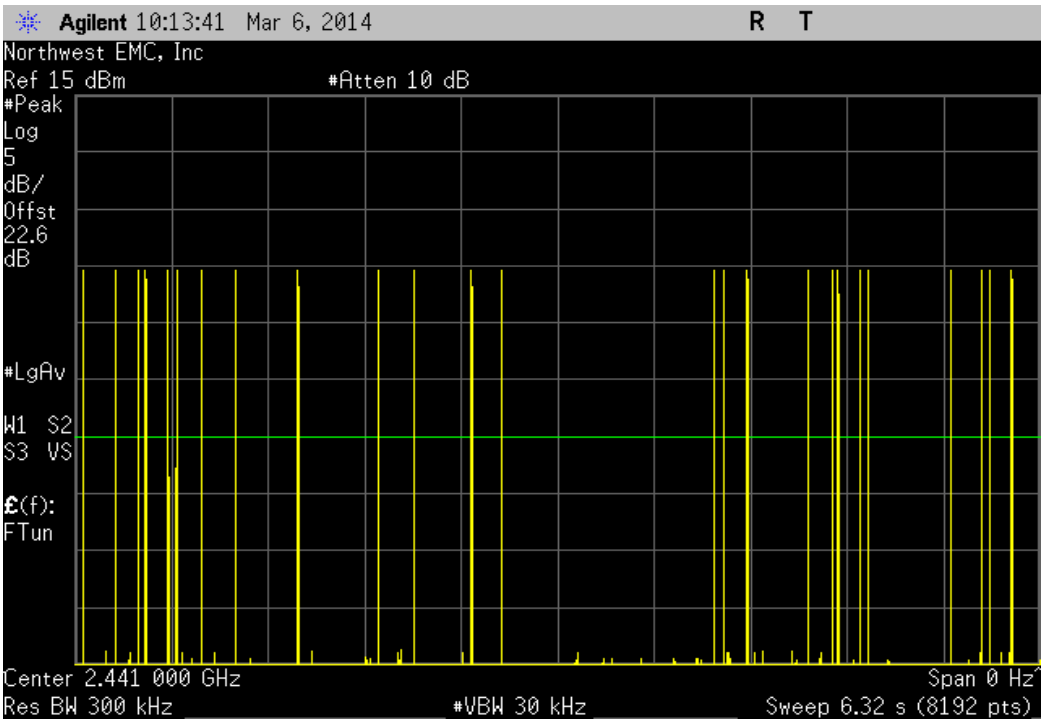


3DH5, Mid Channel 39, 2441 MHz						
Pulse Width (mS)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (mS) During 31.6 S	Limit (mS)	Result
N/A	21	N/A	N/A	N/A	N/A	N/A

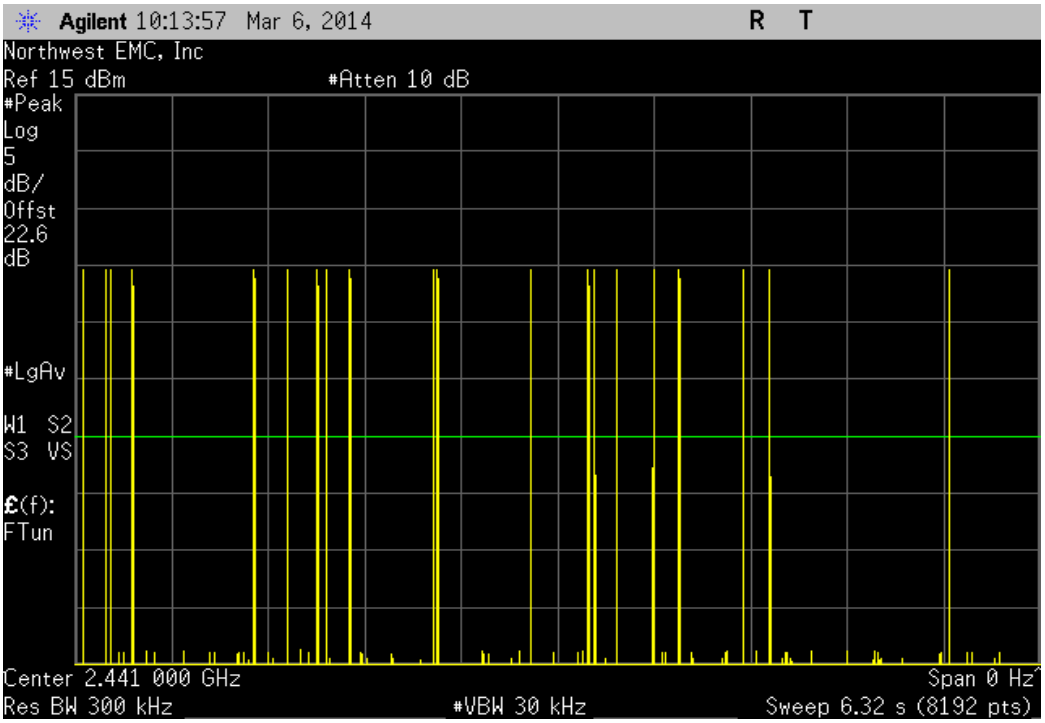


DWELL TIME

3DH5, Mid Channel 39, 2441 MHz						
Pulse Width (mS)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (mS) During 31.6 S	Limit (mS)	Result
N/A	25	N/A	N/A	N/A	N/A	N/A

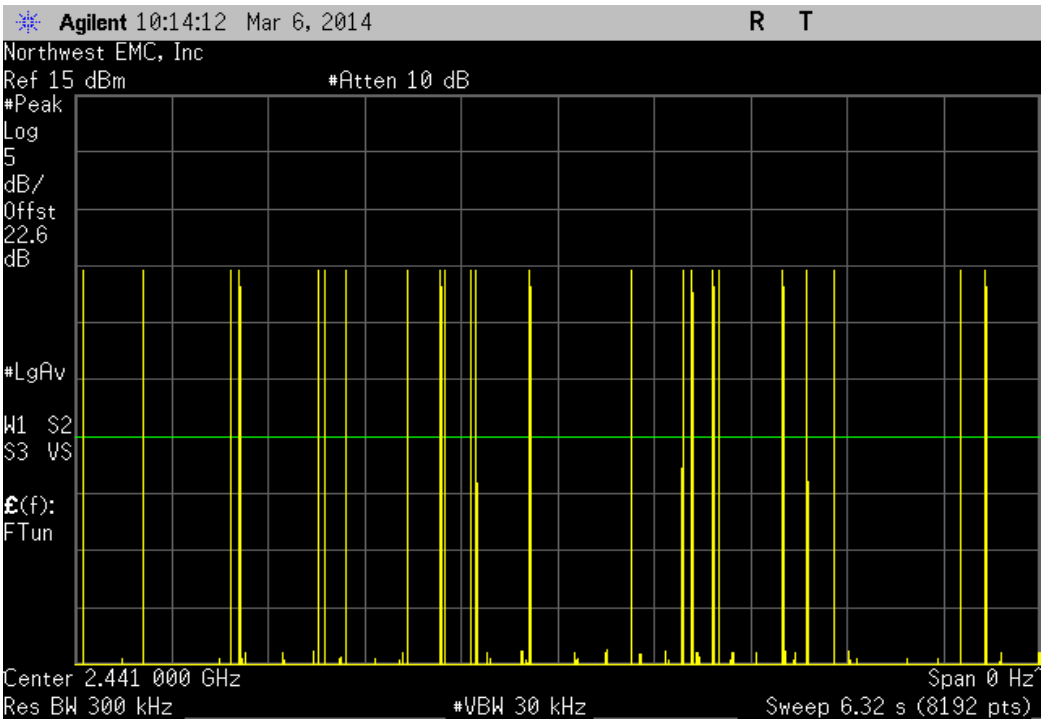


3DH5, Mid Channel 39, 2441 MHz						
Pulse Width (mS)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (mS) During 31.6 S	Limit (mS)	Result
N/A	20	N/A	N/A	N/A	N/A	N/A



DWELL TIME

3DH5, Mid Channel 39, 2441 MHz						
Pulse Width (mS)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (mS) During 31.6 S	Limit (mS)	Result
N/A	23	N/A	N/A	N/A	N/A	N/A



3DH5, Mid Channel 39, 2441 MHz						
Pulse Width (mS)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (mS) During 31.6 S	Limit (mS)	Result
2.889	N/A	22.25	5	321.4	400	Pass

Calculation Only

No Screen Capture Required

SPURIOUS RADIATED EMISSIONS

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. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

Transmitting Bluetooth FHSS, DH5
Transmitting Bluetooth FHSS, 2DH5
Transmitting Bluetooth FHSS, 3DH5

CHANNELS TESTED

Low Channel 0, 2402 MHz
Mid Channel 39, 2441 MHz
High Channel 78, 2480 MHz

POWER SETTINGS INVESTIGATED

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

MCSO1702 - 2

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	26000 MHz

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
HP Filter	Micro-Tronics	HPM50111	HHI	1/18/2013	24 mo
Attenuator	Fairview Microwave	SA18E-20	AQV	12/6/2013	12 mo
LP Filter	Micro-Tronics	LPM50004	LFF	11/14/2013	24 mo
Pre-Amplifier	Miteq	AMF-6F-18002650-25-10P	AOD	7/10/2013	12 mo
Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AOJ	12/6/2013	12 mo
Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AOK	12/6/2013	12 mo
Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVZ	10/24/2013	12 mo
Pre-Amplifier	Miteq	AM-1616-1000	PAB	10/24/2013	12 mo
Antenna, Horn	ETS	3160-09	AIY	NCR	0 mo
Antenna, Horn	EMCO	3160-08	AHO	NCR	0 mo
Antenna, Horn	EMCO	3160-07	AHP	NCR	0 mo
Antenna, Horn	EMCO	3115	AHM	6/19/2012	24 mo
Antenna, Biconilog	EMCO	3142	AXJ	5/16/2012	36 mo
Cable I	N/A	N/A	SUM	7/10/2013	12 mo
NC01 Cables	N/A	Standard Gain Horn Cable	NC3	12/6/2013	12 mo
NC01 Cables	N/A	3115 Horn Cable	NC2	10/24/2013	12 mo
NC01 Cables	N/A	Bilog Cables	NC1	10/24/2013	12 mo
Spectrum Analyzer	Agilent	E4440A	AAW	2/21/2013	24 mo

MEASUREMENT BANDWIDTHS

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

TEST DESCRIPTION

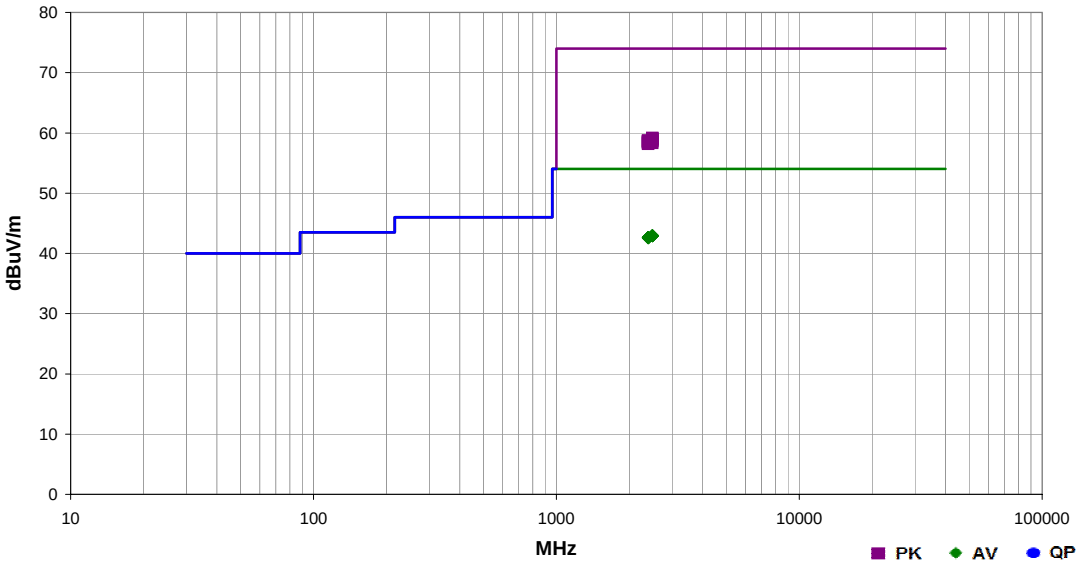
The highest gain of each type of antenna to be used with the EUT was tested. The EUT was configured for low, mid, and high band transmit frequencies. For each configuration, the spectrum was scanned throughout the specified range. In addition, measurements were made in the restricted bands to verify compliance. While scanning, emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and the EUT antenna in three orthogonal axis, and adjusting measurement antenna height and polarization. A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

SPURIOUS RADIATED EMISSIONS

Work Order:	MCSO1702	**Date:**	03/07/14		
Project:	None	**Temperature:**	24 °C		
Job Site:	NC01	**Humidity:**	36% RH		
Serial Number:	41152140753	**Barometric Pres.:**	1023 mbar	**Tested by:**	Richard Mellroth
EUT:	1631				
Configuration:	2				
Customer:	Microsoft Corporation				
Attendees:	None				
EUT Power:	110VAC/60Hz				
Operating Mode:	Transmitting Bluetooth FHSS, See comments next to data points for channel and data rate information.				
Deviations:	None				
Comments:	EUT power settings in control software were set to Power Class: 1.5, and Power Level: 8 (dBm). Measuring emissions at 2483.5 MHz and 2390 MHz restricted band edges.				

Test Specifications	**Test Method**
FCC 15.247:2014	ANSI C63.10:2009

Run #	16	**Test Distance (m)**	3	**Antenna Height(s)**	1-4m	**Results**	Pass



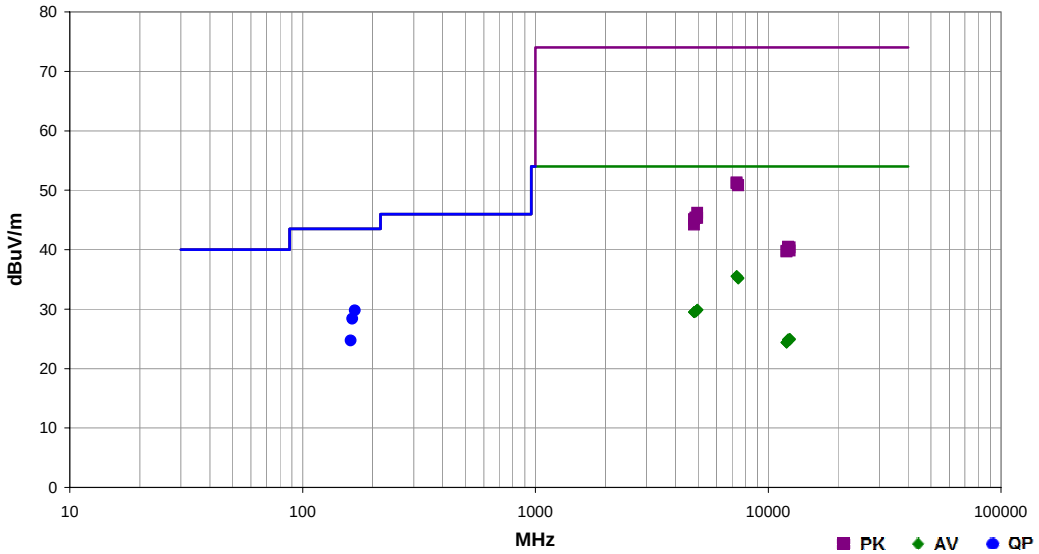
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2485.470	24.9	-2.0	1.2	193.0	3.0	20.0	Vert	AV	0.0	42.9	54.0	-11.1	High Ch 78, 2480 MHz, EUT Horz, 3DH5
2485.430	24.9	-2.0	1.2	238.0	3.0	20.0	Vert	AV	0.0	42.9	54.0	-11.1	High Ch 78, 2480 MHz, EUT Horz, DH5
2485.037	24.9	-2.0	1.8	255.0	3.0	20.0	Vert	AV	0.0	42.9	54.0	-11.1	High Ch 78, 2480 MHz, EUT Flat, DH5
2484.887	24.9	-2.0	1.1	273.0	3.0	20.0	Vert	AV	0.0	42.9	54.0	-11.1	High Ch 78, 2480 MHz, EUT Horz, 2DH5
2484.233	24.9	-2.0	1.2	0.0	3.0	20.0	Horz	AV	0.0	42.9	54.0	-11.1	High Ch 78, 2480 MHz, EUT Vert, DH5
2484.147	24.9	-2.0	1.2	337.0	3.0	20.0	Horz	AV	0.0	42.9	54.0	-11.1	High Ch 78, 2480 MHz, EUT Horz, DH5
2483.807	24.9	-2.0	3.2	298.0	3.0	20.0	Horz	AV	0.0	42.9	54.0	-11.1	High Ch 78, 2480 MHz, EUT Flat, DH5
2483.500	24.9	-2.0	1.2	94.0	3.0	20.0	Vert	AV	0.0	42.9	54.0	-11.1	High Ch 78, 2480 MHz, EUT Vert, DH5
2388.867	24.9	-2.2	1.2	35.0	3.0	20.0	Vert	AV	0.0	42.7	54.0	-11.3	Low Ch 0, 2402 MHz, EUT Horz, DH5
2388.373	24.9	-2.2	2.3	83.0	3.0	20.0	Vert	AV	0.0	42.7	54.0	-11.3	Low Ch 0, 2402 MHz, EUT Vert, DH5
2388.280	24.9	-2.2	1.2	132.0	3.0	20.0	Horz	AV	0.0	42.7	54.0	-11.3	Low Ch 0, 2402 MHz, EUT Vert, DH5
2388.000	24.9	-2.2	1.0	279.0	3.0	20.0	Horz	AV	0.0	42.7	54.0	-11.3	Low Ch 0, 2402 MHz, EUT Horz, DH5
2388.297	24.8	-2.2	1.2	112.0	3.0	20.0	Horz	AV	0.0	42.6	54.0	-11.4	Low Ch 0, 2402 MHz, EUT Flat, DH5
2388.180	24.8	-2.2	1.2	307.0	3.0	20.0	Vert	AV	0.0	42.6	54.0	-11.4	Low Ch 0, 2402 MHz, EUT Horz, 2DH5
2388.130	24.8	-2.2	1.2	348.0	3.0	20.0	Vert	AV	0.0	42.6	54.0	-11.4	Low Ch 0, 2402 MHz, EUT Horz, 3DH5
2388.073	24.8	-2.2	1.2	316.0	3.0	20.0	Vert	AV	0.0	42.6	54.0	-11.4	Low Ch 0, 2402 MHz, EUT Flat, DH5
2484.733	41.1	-2.0	3.2	298.0	3.0	20.0	Horz	PK	0.0	59.1	74.0	-14.9	High Ch 78, 2480 MHz, EUT Flat, DH5
2483.667	41.1	-2.0	1.8	255.0	3.0	20.0	Vert	PK	0.0	59.1	74.0	-14.9	High Ch 78, 2480 MHz, EUT Flat, DH5
2483.590	41.0	-2.0	1.2	238.0	3.0	20.0	Vert	PK	0.0	59.0	74.0	-15.0	High Ch 78, 2480 MHz, EUT Horz, DH5
2485.237	40.9	-2.0	1.1	273.0	3.0	20.0	Vert	PK	0.0	58.9	74.0	-15.1	High Ch 78, 2480 MHz, EUT Horz, 2DH5
2485.103	40.9	-2.0	1.2	337.0	3.0	20.0	Horz	PK	0.0	58.9	74.0	-15.1	High Ch 78, 2480 MHz, EUT Horz, DH5
2485.000	40.7	-2.0	1.2	193.0	3.0	20.0	Vert	PK	0.0	58.7	74.0	-15.3	High Ch 78, 2480 MHz, EUT Horz, 3DH5
2389.890	40.9	-2.2	1.0	279.0	3.0	20.0	Horz	PK	0.0	58.7	74.0	-15.3	Low Ch 0, 2402 MHz, EUT Horz, DH5
2389.367	40.9	-2.2	1.2	35.0	3.0	20.0	Vert	PK	0.0	58.7	74.0	-15.3	Low Ch 0, 2402 MHz, EUT Horz, DH5
2484.420	40.6	-2.0	1.2	94.0	3.0	20.0	Vert	PK	0.0	58.6	74.0	-15.4	High Ch 78, 2480 MHz, EUT Vert, DH5
2389.897	40.8	-2.2	1.2	132.0	3.0	20.0	Horz	PK	0.0	58.6	74.0	-15.4	Low Ch 0, 2402 MHz, EUT Vert, DH5
2389.983	40.7	-2.2	1.2	112.0	3.0	20.0	Horz	PK	0.0	58.5	74.0	-15.5	Low Ch 0, 2402 MHz, EUT Flat, DH5
2389.573	40.7	-2.2	1.2	307.0	3.0	20.0	Vert	PK	0.0	58.5	74.0	-15.5	Low Ch 0, 2402 MHz, EUT Horz, 2DH5
2388.017	40.6	-2.2	1.2	348.0	3.0	20.0	Vert	PK	0.0	58.4	74.0	-15.6	Low Ch 0, 2402 MHz, EUT Horz, 3DH5
2483.743	40.3	-2.0	1.2	0.0	3.0	20.0	Horz	PK	0.0	58.3	74.0	-15.7	High Ch 78, 2480 MHz, EUT Vert, DH5
2389.123	40.5	-2.2	2.3	83.0	3.0	20.0	Vert	PK	0.0	58.3	74.0	-15.7	Low Ch 0, 2402 MHz, EUT Vert, DH5
2389.737	40.4	-2.2	1.2	316.0	3.0	20.0	Vert	PK	0.0	58.2	74.0	-15.8	Low Ch 0, 2402 MHz, EUT Flat, DH5

SPURIOUS RADIATED EMISSIONS

Work Order:	MCSO1702	**Date:**	03/07/14		
Project:	None	**Temperature:**	24 °C		
Job Site:	NC01	**Humidity:**	36% RH		
Serial Number:	41152140753	**Barometric Pres.:**	1023 mbar	**Tested by:**	Richard Mellroth
EUT:	1631				
Configuration:	2				
Customer:	Microsoft Corporation				
Attendees:	None				
EUT Power:	110VAC/60Hz				
Operating Mode:	Transmitting Bluetooth FHSS, See comments next to data points for channel and data rate information.				
Deviations:	None				
Comments:	EUT power settings in control software were set to Power Class: 1.5, and Power Level: 8 (dBm).				

Test Specifications	**Test Method**
FCC 15.247:2014	ANSI C63.10:2009

Run #	17-19	**Test Distance (m)**	3	**Antenna Height(s)**	1-4m	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
168.004	33.8	-4.0	1.9	60.0	3.0	0.0	Horz	QP	0.0	29.8	43.5	-13.7	Low Ch 0, 2402 MHz, EUT Horz, DH5
163.843	32.5	-4.1	2.2	72.0	3.0	0.0	Horz	QP	0.0	28.4	43.5	-15.1	High Ch 78, 2480 MHz, EUT Horz, DH5
7324.260	23.3	12.2	1.2	301.0	3.0	0.0	Vert	AV	0.0	35.5	54.0	-18.5	Mid Ch 39, 2441 MHz, EUT Horz, DH5
7323.990	23.3	12.2	1.2	306.0	3.0	0.0	Horz	AV	0.0	35.5	54.0	-18.5	Mid Ch 39, 2441 MHz, EUT Vert, DH5
7438.660	22.5	12.7	1.8	81.0	3.0	0.0	Horz	AV	0.0	35.2	54.0	-18.8	High Ch 78, 2480 MHz, EUT Vert, DH5
161.206	28.8	-4.1	2.0	25.0	3.0	0.0	Horz	QP	0.0	24.7	43.5	-18.8	Mid Ch 39, 2441 MHz, EUT Horz, DH5
7440.570	22.4	12.7	1.2	76.0	3.0	0.0	Vert	AV	0.0	35.1	54.0	-18.9	High Ch 78, 2480 MHz, EUT Horz, DH5
7323.445	39.1	12.2	1.2	301.0	3.0	0.0	Vert	PK	0.0	51.3	74.0	-22.7	Mid Ch 39, 2441 MHz, EUT Horz, DH5
7323.380	38.9	12.2	1.2	306.0	3.0	0.0	Horz	PK	0.0	51.1	74.0	-22.9	Mid Ch 39, 2441 MHz, EUT Vert, DH5
7441.440	38.1	12.7	1.2	76.0	3.0	0.0	Vert	PK	0.0	50.8	74.0	-23.2	High Ch 78, 2480 MHz, EUT Horz, DH5
7440.250	38.1	12.7	1.8	81.0	3.0	0.0	Horz	PK	0.0	50.8	74.0	-23.2	High Ch 78, 2480 MHz, EUT Vert, DH5
4960.085	22.4	7.5	1.2	4.0	3.0	0.0	Horz	AV	0.0	29.9	54.0	-24.1	High Ch 78, 2480 MHz, EUT Vert, DH5
4960.035	22.4	7.5	1.2	359.0	3.0	0.0	Vert	AV	0.0	29.9	54.0	-24.1	High Ch 78, 2480 MHz, EUT Horz, DH5
4883.495	22.3	7.3	3.6	163.0	3.0	0.0	Horz	AV	0.0	29.6	54.0	-24.4	Mid Ch 39, 2441 MHz, EUT Vert, DH5
4881.730	22.3	7.3	1.2	256.0	3.0	0.0	Vert	AV	0.0	29.6	54.0	-24.4	Mid Ch 39, 2441 MHz, EUT Horz, DH5
4805.080	22.3	7.2	1.2	160.0	3.0	0.0	Horz	AV	0.0	29.5	54.0	-24.5	Low Ch 0, 2402 MHz, EUT Vert, DH5
4804.142	22.3	7.2	1.2	269.0	3.0	0.0	Vert	AV	0.0	29.5	54.0	-24.5	Low Ch 0, 2402 MHz, EUT Horz, DH5
4960.050	38.7	7.5	1.2	4.0	3.0	0.0	Horz	PK	0.0	46.2	74.0	-27.8	High Ch 78, 2480 MHz, EUT Vert, DH5
4882.265	38.1	7.3	3.6	163.0	3.0	0.0	Horz	PK	0.0	45.4	74.0	-28.6	Mid Ch 39, 2441 MHz, EUT Vert, DH5
4883.320	38.0	7.3	1.2	256.0	3.0	0.0	Vert	PK	0.0	45.3	74.0	-28.7	Mid Ch 39, 2441 MHz, EUT Horz, DH5
4961.295	37.8	7.5	1.2	359.0	3.0	0.0	Vert	PK	0.0	45.3	74.0	-28.7	High Ch 78, 2480 MHz, EUT Horz, DH5
4803.760	37.9	7.2	1.2	160.0	3.0	0.0	Horz	PK	0.0	45.1	74.0	-28.9	Low Ch 0, 2402 MHz, EUT Vert, DH5
12399.990	27.0	-2.0	1.2	21.0	3.0	0.0	Horz	AV	0.0	25.0	54.0	-29.0	High Ch 78, 2480 MHz, EUT Vert, DH5
12206.330	27.0	-2.1	1.2	344.0	3.0	0.0	Vert	AV	0.0	24.9	54.0	-29.1	Mid Ch 39, 2441 MHz, EUT Horz, DH5
12206.180	27.0	-2.1	1.2	25.0	3.0	0.0	Horz	AV	0.0	24.9	54.0	-29.1	Mid Ch 39, 2441 MHz, EUT Vert, DH5
12399.900	26.9	-2.0	1.2	97.0	3.0	0.0	Vert	AV	0.0	24.9	54.0	-29.1	High Ch 78, 2480 MHz, EUT Horz, DH5
12011.090	26.6	-2.2	1.2	149.0	3.0	0.0	Horz	AV	0.0	24.4	54.0	-29.6	Low Ch 0, 2402 MHz, EUT Vert, DH5
12010.930	26.6	-2.2	1.2	268.0	3.0	0.0	Vert	AV	0.0	24.4	54.0	-29.6	Low Ch 0, 2402 MHz, EUT Horz, DH5
4804.100	37.0	7.2	1.2	269.0	3.0	0.0	Vert	PK	0.0	44.2	74.0	-29.8	Low Ch 0, 2402 MHz, EUT Horz, DH5
12205.960	42.6	-2.1	1.2	344.0	3.0	0.0	Vert	PK	0.0	40.5	74.0	-33.5	Mid Ch 39, 2441 MHz, EUT Horz, DH5
12205.540	42.5	-2.1	1.2	25.0	3.0	0.0	Horz	PK	0.0	40.4	74.0	-33.6	Mid Ch 39, 2441 MHz, EUT Vert, DH5
12399.680	42.4	-2.0	1.2	21.0	3.0	0.0	Horz	PK	0.0	40.4	74.0	-33.6	High Ch 78, 2480 MHz, EUT Vert, DH5
12399.980	41.9	-2.0	1.2	97.0	3.0	0.0	Vert	PK	0.0	39.9	74.0	-34.1	High Ch 78, 2480 MHz, EUT Horz, DH5
12010.860	42.0	-2.2	1.2	149.0	3.0	0.0	Horz	PK	0.0	39.8	74.0	-34.2	Low Ch 0, 2402 MHz, EUT Vert, DH5
12010.630	41.9	-2.2	1.2	268.0	3.0	0.0	Vert	PK	0.0	39.7	74.0	-34.3	Low Ch 0, 2402 MHz, EUT Horz, DH5

AC POWERLINE CONDUCTED EMISSIONS

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.

MODES OF OPERATION

Transmitting Bluetooth FHSS

CHANNELS TESTED

Low Channel 0, 2402 MHz, DH5
Mid Channel 39, 2441 MHz, DH5
High Channel 78, 2480 MHz, DH5

POWER SETTINGS INVESTIGATED

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

MCSO1702 - 2

SAMPLE CALCULATIONS

Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
LISN	Solar	9252-50-R-24-BNC	LIK	1/8/2014	12 mo
NC05 Cables	N/A	Conducted / NF Probe Cable	NC4	12/12/2013	12 mo
High Pass Filter	TTE	H97-100K-50-720B	HHF	1/22/2014	12 mo
Attenuator	Fairview Microwave	SA03B-20	RKD	12/12/2013	12 mo
Receiver	Rohde & Schwarz	ESCI	ARE	5/30/2013	12 mo

MEASUREMENT BANDWIDTHS

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

Measurements were made using the bandwidths and detectors specified. No video filter was used.

TEST DESCRIPTION

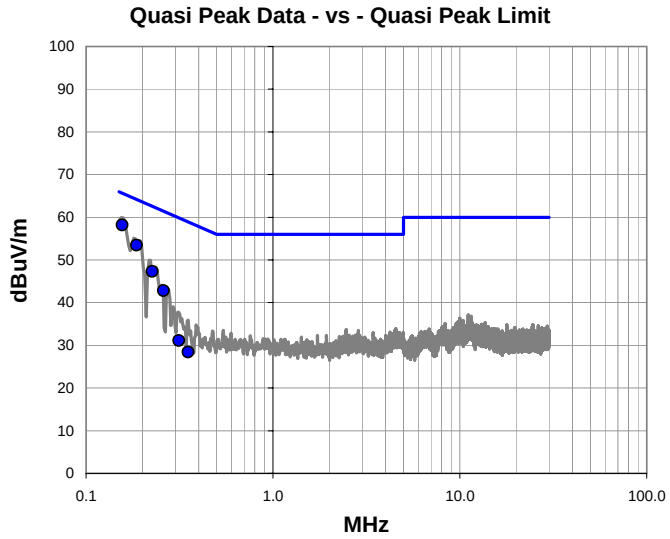
The EUT will be powered either directly or indirectly from the AC power line. Therefore, conducted emissions measurements were made on the AC input of the EUT, or on the AC input of the device used to power the EUT. The AC power line conducted emissions were measured with the EUT operating at the lowest, the highest, and a middle channel in the operational band. The EUT was transmitting at its maximum data rate. For each mode, the spectrum was scanned from 150 kHz to 30 MHz. The test setup and procedures were in accordance with ANSI C63.10-2009.

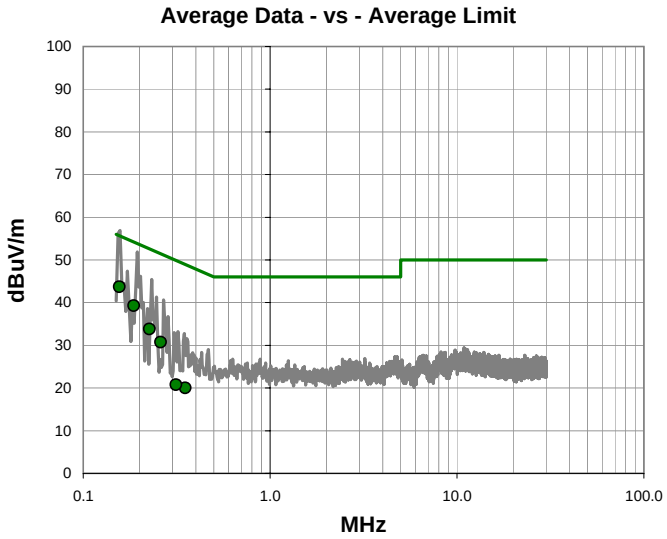
AC POWERLINE CONDUCTED EMISSIONS

Work Order:	MCSO1702	**Date:**	03/06/14		
Project:	None	**Temperature:**	23 °C		
Job Site:	NC05	**Humidity:**	40% RH		
Serial Number:	41152140753	**Barometric Pres.:**	1001 mbar	**Tested by:**	Richard Mellroth
EUT:	1631				
Configuration:	2				
Customer:	Microsoft Corporation				
Attendees:	None				
EUT Power:	110VAC/60Hz				
Operating Mode:	Transmitting Bluetooth FHSS, Low Channel 0, 2402 MHz, DH5.				
Deviations:	None				
Comments:	EUT power settings in control software were set to Power Class: 1.5, and Power Level: 8 (dBm).				

Test Specifications	**Test Method**
FCC 15.207:2014	ANSI C63.10:2009

Run #	1	**Line:**	High Line	**Ext. Attenuation:**	20	**Results**	Pass





Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)
0.156	38.0	20.2	58.2	65.7	-7.5
0.186	33.2	20.3	53.5	64.2	-10.7
0.227	27.1	20.2	47.3	62.6	-15.3
0.260	22.7	20.1	42.8	61.4	-18.6
0.313	10.9	20.2	31.1	59.9	-28.8
0.352	8.2	20.2	28.4	58.9	-30.5

Average Data - vs - Average Limit

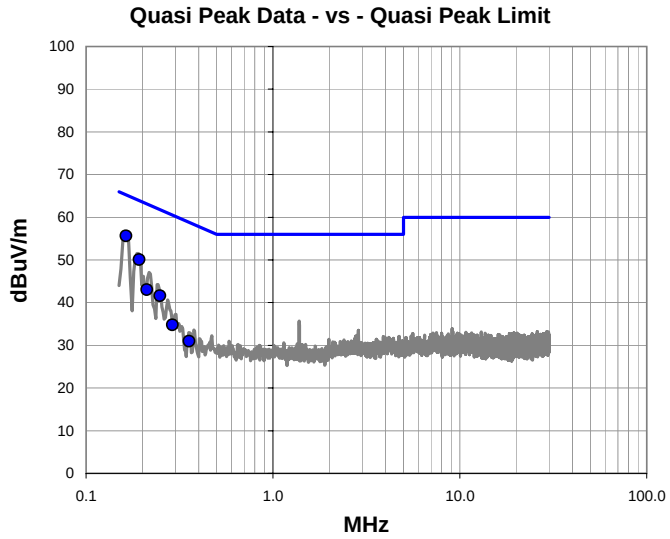
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)
0.156	23.5	20.2	43.7	55.7	-12.0
0.186	19.0	20.3	39.3	54.2	-14.9
0.227	13.6	20.2	33.8	52.6	-18.8
0.260	10.6	20.1	30.7	51.4	-20.7
0.352	-0.2	20.2	20.0	48.9	-28.9
0.313	0.6	20.2	20.8	49.9	-29.1

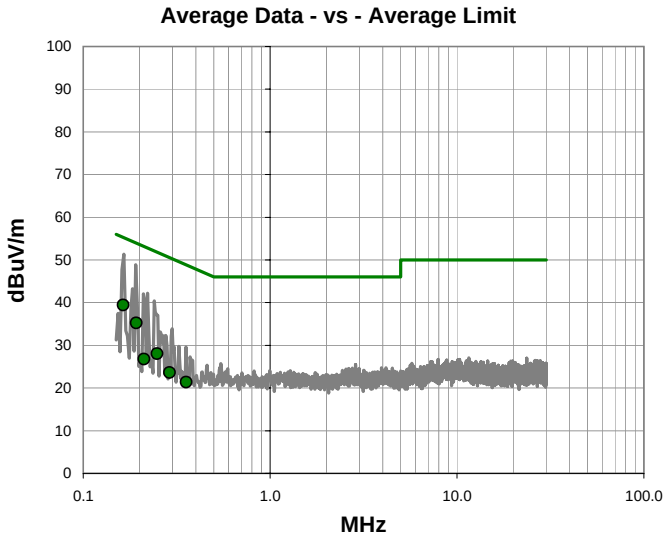
AC POWERLINE CONDUCTED EMISSIONS

Work Order:	MCSO1702	**Date:**	03/06/14		
Project:	None	**Temperature:**	23 °C		
Job Site:	NC05	**Humidity:**	40% RH		
Serial Number:	41152140753	**Barometric Pres.:**	1001 mbar	**Tested by:**	Richard Mellroth
EUT:	1631				
Configuration:	2				
Customer:	Microsoft Corporation				
Attendees:	None				
EUT Power:	110VAC/60Hz				
Operating Mode:	Transmitting Bluetooth FHSS, Low Channel 0, 2402 MHz, DH5.				
Deviations:	None				
Comments:	EUT power settings in control software were set to Power Class: 1.5, and Power Level: 8 (dBm).				

Test Specifications	**Test Method**
FCC 15.207:2014	ANSI C63.10:2009

Run #	2	**Line:**	Neutral	**Ext. Attenuation:**	20	**Results**	Pass





Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)
0.164	35.4	20.2	55.6	65.3	-9.7
0.192	29.8	20.3	50.1	63.9	-13.9
0.212	22.8	20.2	43.0	63.1	-20.1
0.248	21.5	20.1	41.6	61.8	-20.2
0.290	14.6	20.1	34.7	60.5	-25.8
0.356	10.8	20.2	31.0	58.8	-27.8

Average Data - vs - Average Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)
0.164	19.2	20.2	39.4	55.3	-15.9
0.192	15.0	20.3	35.3	53.9	-18.7
0.248	7.9	20.1	28.0	51.8	-23.8
0.212	6.5	20.2	26.7	53.1	-26.4
0.290	3.5	20.1	23.6	50.5	-26.9
0.356	1.2	20.2	21.4	48.8	-27.4

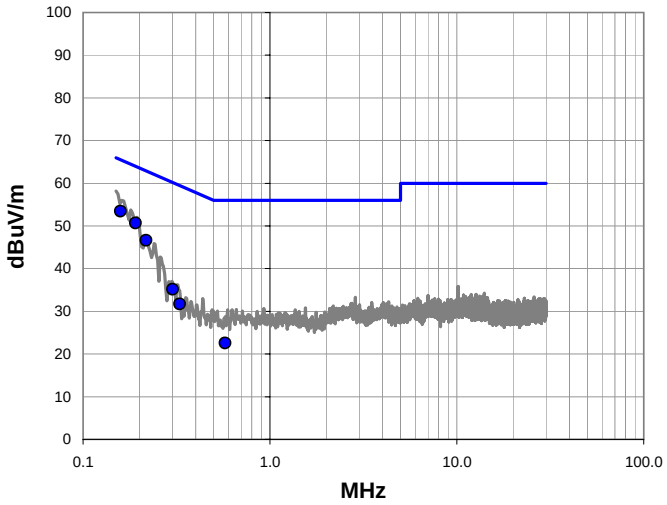
AC POWERLINE CONDUCTED EMISSIONS

Work Order:	MCSO1702	**Date:**	03/06/14		
Project:	None	**Temperature:**	23 °C		
Job Site:	NC05	**Humidity:**	40% RH		
Serial Number:	41152140753	**Barometric Pres.:**	1001 mbar	**Tested by:**	Richard Mellroth
EUT:	1631				
Configuration:	2				
Customer:	Microsoft Corporation				
Attendees:	None				
EUT Power:	110VAC/60Hz				
Operating Mode:	Transmitting Bluetooth FHSS, Mid Channel 39, 2441 MHz, DH5.				
Deviations:	None				
Comments:	EUT power settings in control software were set to Power Class: 1.5, and Power Level: 8 (dBm).				

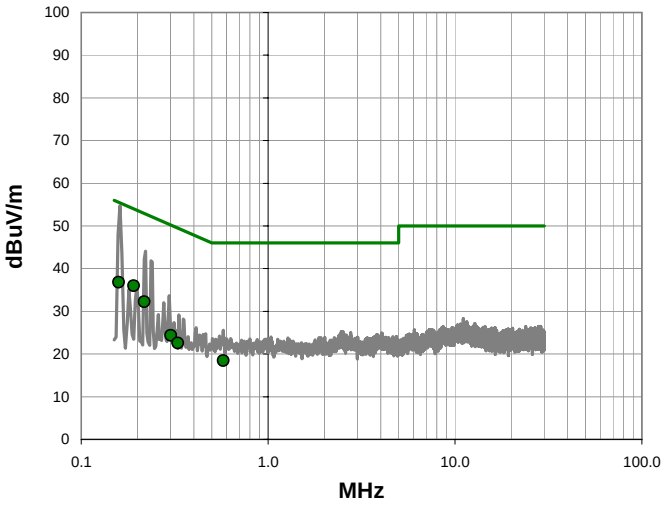
Test Specifications	**Test Method**
FCC 15.207:2014	ANSI C63.10:2009

Run #	3	**Line:**	High Line	**Ext. Attenuation:**	20	**Results**	Pass

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)
0.158	33.2	20.2	53.4	65.6	-12.1
0.191	30.4	20.3	50.7	64.0	-13.3
0.218	26.4	20.2	46.6	62.9	-16.3
0.301	15.0	20.2	35.2	60.2	-25.1
0.329	11.5	20.2	31.7	59.5	-27.8
0.576	2.4	20.1	22.5	56.0	-33.5

Average Data - vs - Average Limit

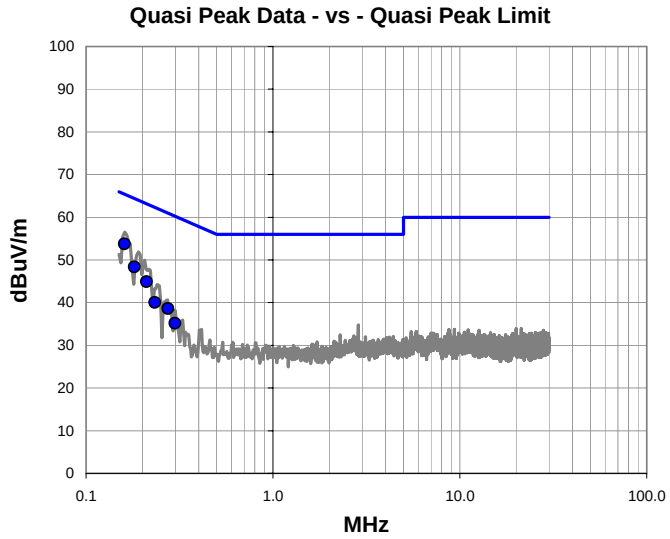
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)
0.191	15.7	20.3	36.0	54.0	-18.0
0.158	16.6	20.2	36.8	55.6	-18.7
0.218	12.0	20.2	32.2	52.9	-20.7
0.301	4.2	20.2	24.4	50.2	-25.9
0.329	2.4	20.2	22.6	49.5	-26.9
0.576	-1.7	20.1	18.4	46.0	-27.6

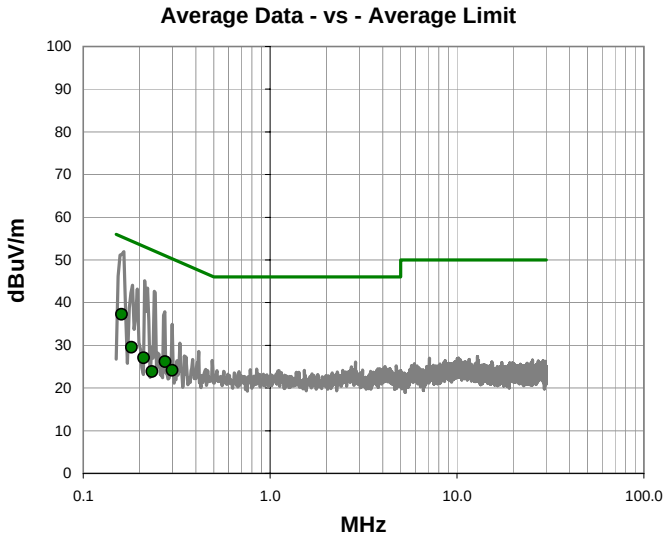
AC POWERLINE CONDUCTED EMISSIONS

Work Order:	MCSO1702	**Date:**	03/06/14		
Project:	None	**Temperature:**	23 °C		
Job Site:	NC05	**Humidity:**	40% RH		
Serial Number:	41152140753	**Barometric Pres.:**	1001 mbar	**Tested by:**	Richard Mellroth
EUT:	1631				
Configuration:	2				
Customer:	Microsoft Corporation				
Attendees:	None				
EUT Power:	110VAC/60Hz				
Operating Mode:	Transmitting Bluetooth FHSS, Mid Channel 39, 2441 MHz, DH5.				
Deviations:	None				
Comments:	EUT power settings in control software were set to Power Class: 1.5, and Power Level: 8 (dBm).				

Test Specifications	**Test Method**
FCC 15.207:2014	ANSI C63.10:2009

Run #	4	**Line:**	Neutral	**Ext. Attenuation:**	20	**Results**	Pass





Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)
0.161	33.5	20.2	53.7	65.4	-11.7
0.181	28.1	20.3	48.4	64.4	-16.1
0.211	24.7	20.2	44.9	63.2	-18.2
0.233	19.9	20.2	40.1	62.3	-22.3
0.274	18.5	20.1	38.6	61.0	-22.4
0.299	15.0	20.2	35.2	60.3	-25.1

Average Data - vs - Average Limit

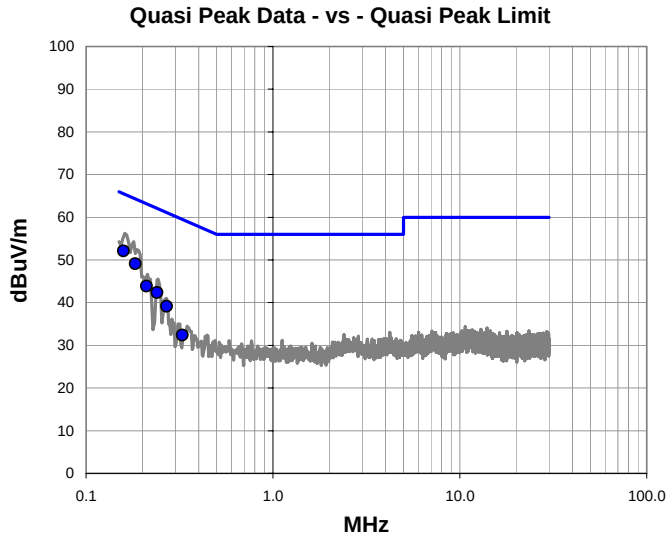
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)
0.161	17.0	20.2	37.2	55.4	-18.2
0.274	6.0	20.1	26.1	51.0	-24.9
0.181	9.3	20.3	29.6	54.4	-24.9
0.299	4.0	20.2	24.2	50.3	-26.1
0.211	6.8	20.2	27.0	53.2	-26.1
0.233	3.7	20.2	23.9	52.3	-28.5

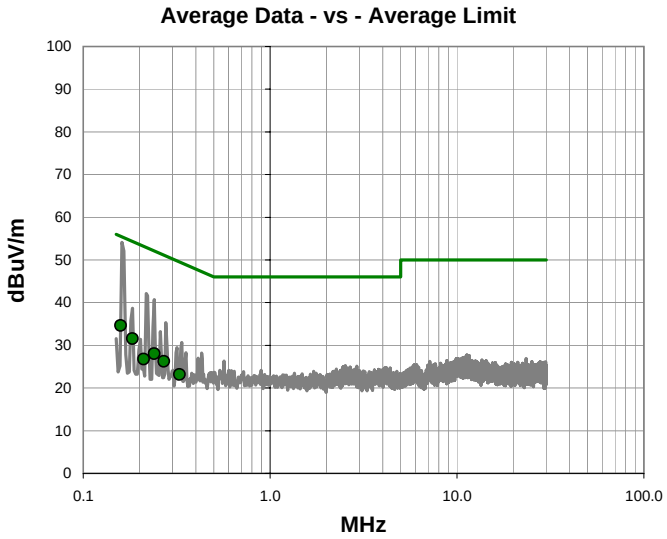
AC POWERLINE CONDUCTED EMISSIONS

Work Order:	MCSO1702	**Date:**	03/06/14		
Project:	None	**Temperature:**	23 °C		
Job Site:	NC05	**Humidity:**	40% RH		
Serial Number:	41152140753	**Barometric Pres.:**	1001 mbar	**Tested by:**	Richard Mellroth
EUT:	1631				
Configuration:	2				
Customer:	Microsoft Corporation				
Attendees:	None				
EUT Power:	110VAC/60Hz				
Operating Mode:	Transmitting Bluetooth FHSS, High Channel 78, 2480 MHz, DH5.				
Deviations:	None				
Comments:	EUT power settings in control software were set to Power Class: 1.5, and Power Level: 8 (dBm).				

Test Specifications	**Test Method**
FCC 15.207:2014	ANSI C63.10:2009

Run #	5	**Line:**	High Line	**Ext. Attenuation:**	20	**Results**	Pass





Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)
0.159	31.9	20.2	52.1	65.5	-13.4
0.183	28.8	20.3	49.1	64.3	-15.3
0.211	23.6	20.2	43.8	63.2	-19.3
0.240	22.2	20.1	42.3	62.1	-19.8
0.271	19.0	20.1	39.1	61.1	-22.0
0.327	12.2	20.2	32.4	59.5	-27.1

Average Data - vs - Average Limit

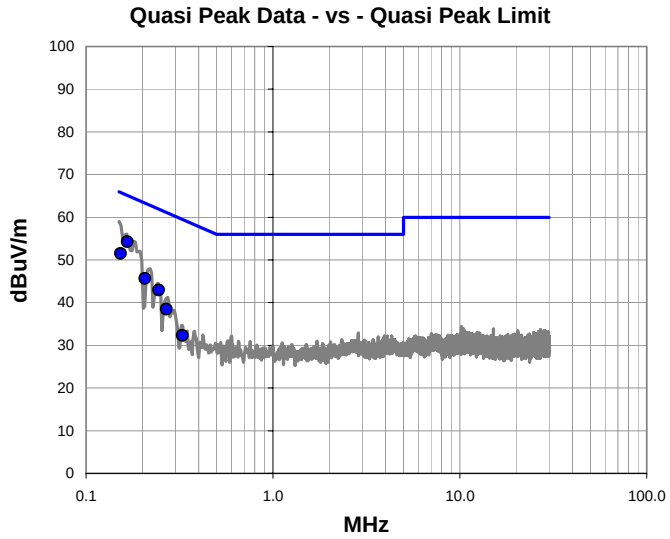
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)
0.159	14.4	20.2	34.6	55.5	-20.9
0.183	11.3	20.3	31.6	54.3	-22.8
0.240	7.9	20.1	28.0	52.1	-24.1
0.271	6.1	20.1	26.2	51.1	-24.9
0.327	3.0	20.2	23.2	49.5	-26.3
0.211	6.5	20.2	26.7	53.2	-26.4

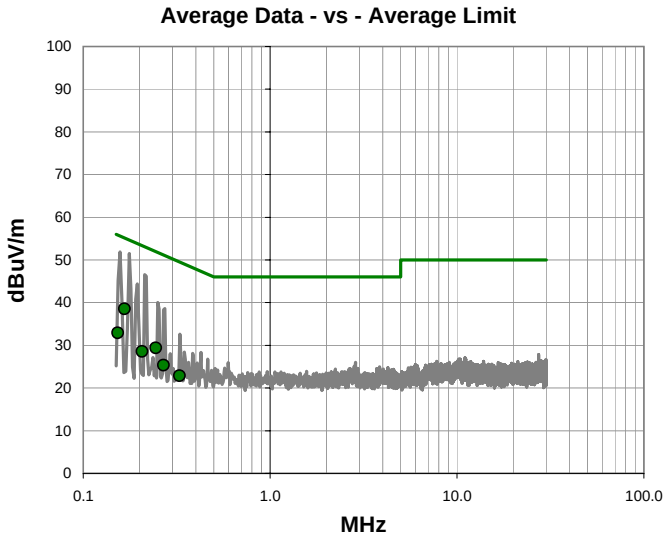
AC POWERLINE CONDUCTED EMISSIONS

Work Order:	MCSO1702	**Date:**	03/06/14		
Project:	None	**Temperature:**	23 °C		
Job Site:	NC05	**Humidity:**	40% RH		
Serial Number:	41152140753	**Barometric Pres.:**	1001 mbar	**Tested by:**	Richard Mellroth
EUT:	1631				
Configuration:	2				
Customer:	Microsoft Corporation				
Attendees:	None				
EUT Power:	110VAC/60Hz				
Operating Mode:	Transmitting Bluetooth FHSS, High Channel 78, 2480 MHz, DH5.				
Deviations:	None				
Comments:	EUT power settings in control software were set to Power Class: 1.5, and Power Level: 8 (dBm).				

Test Specifications	**Test Method**
FCC 15.207:2014	ANSI C63.10:2009

Run #	6	**Line:**	Neutral	**Ext. Attenuation:**	20	**Results**	Pass





Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)
0.167	34.0	20.2	54.2	65.1	-10.9
0.153	31.3	20.2	51.5	65.8	-14.3
0.206	25.4	20.2	45.6	63.3	-17.7
0.245	22.8	20.1	42.9	61.9	-19.0
0.269	18.3	20.1	38.4	61.2	-22.7
0.328	12.1	20.2	32.3	59.5	-27.2

Average Data - vs - Average Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)
0.167	18.3	20.2	38.5	55.1	-16.6
0.245	9.3	20.1	29.4	51.9	-22.5
0.153	12.7	20.2	32.9	55.8	-22.9
0.206	8.3	20.2	28.5	53.3	-24.8
0.269	5.2	20.1	25.3	51.2	-25.8
0.328	2.7	20.2	22.9	49.5	-26.6