Microsoft Corporation

Wireless Headset – BT, Model: 1481

Report No. MCSO1576

Report Prepared By

NORTHWEST EMC

www.nwemc.com
1-888-EMI-CERT

EMC Test Report

Ill roc22975 NW Evergreen Parkway
Suite 400
Hillsboro, Oregon 97124

Certificate of Test

Last Date of Test: August 5, 2011
Microsoft Corporation
Model: 1481

Emissions			
Test Description	**Specification**	**Test Method**	**Pass/Fail**
Spurious Radiated Emissions	FCC 15.247:2011	ANSI C63.10:2009	**Pass**
Occupied Bandwidth	FCC 15.247:2011	ANSI C63.10:2009	**Pass**
Output Power	FCC 15.247:2011	ANSI C63.10:2009	**Pass**
Power Spectral Density	FCC 15.247:2011	ANSI C63.10:2009	**Pass**
Spurious Conducted Emissions	FCC 15.247:2011	ANSI C63.10:2009	**Pass**
Band Edge Compliance	FCC 15.247:2011	ANSI C63.10:2009	**Pass**
Powerline Conducted Emissions	FCC 15.207:2011	ANSI C63.10:2009	**Pass**
Channel Spacing	FCC 15.247:2011	ANSI C63.10:2009	**Pass**
Dwell Time	FCC 15.247:2011	ANSI C63.10:2009	**Pass**
Number of Hopping Frequencies	FCC 15.247:2011	ANSI C63.10:2009	**Pass**

Modifications made to the product
See the Modifications section of this report

Test Facility

The measurement facility used to collect the data is located at:

Northwest EMC, Inc.; 22975 NW Evergreen Parkway, Suite 400;
Hillsboro, OR 97124
Phone: (503) 844-4066 Fax: 844-3826

This site has been fully described in a report filed with and accepted by the FCC (Federal Communications Commission) and Industry Canada (Site filing #2834D-2).

Approved By:

Dean Ghizzone, President

NVLAP Lab Code: 200630-0

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

FCC

Accredited by NVLAP for performance of FCC radio, digital, and ISM device testing. Our Open Area Test Sites, certification chambers, and conducted measurement facilities have been fully described in reports filed with the FCC and accepted by the FCC in letters maintained in our files. Northwest EMC has been accredited by ANSI to ISO / IEC Guide 65 as a product certifier. We have been designated by the FCC as a Telecommunications Certification Body (TCB). This allows Northwest EMC to certify transmitters to FCC specifications in accordance with 47 CFR 2.960 and 2.962.

NVLAP

Northwest EMC, Inc. is accredited under the National Voluntary Laboratory Accreditation Program (NVLAP) for satisfactory compliance with the requirements of ISO/IEC 17025 for Testing Laboratories. NVLAP is administered by the National Institute of Standards and Technology (NIST), an agency of the U.S. Commerce Department. The NVLAP accreditation encompasses Electromagnetic Compatibility Testing in accordance with the European Union EMC Directive 2004/108/EC, and ANSI C63.4. Additionally, Northwest EMC is accredited by NVLAP to perform radio testing in accordance with the European Union R&TTE Directive 1999/5/EEC, the requirements of FCC, and the RSS radio standards for Industry Canada.

Industry Canada

Accredited by NVLAP for performance of Industry Canada RSS and ICES testing. Our Open Area Test Sites and certification chambers comply with RSS-Gen, Issue 2 and have been filed with Industry Canada and accepted. Northwest EMC has been accredited by ANSI to ISO / IEC Guide 65 as a product certifier. We have been designated by NIST and recognized by Industry Canada as a Certification Body (CB) per the APEC Mutual Recognition Arrangement (MRA). This allows Northwest EMC to certify transmitters to Industry Canada technical requirements. (*Site Filing Numbers - Hillsboro: 2834D-1, 2834D-2, Sultan: 2834C-1, Irvine: 2834B-1, 2834B-2, Brooklyn Park: 2834E-1)*

CAB

Designated by NIST and validated by the European Commission as a Conformity Assessment Body (CAB) to conduct tests and approve products to the EMC directive and transmitters to the R&TTE directive, as described in the U.S. - EU Mutual Recognition Agreement.

Australia/New Zealand

The National Association of Testing Authorities (NATA), Australia has been appointed by the ACA as an accreditation body to accredit test laboratories and competent bodies for EMC standards. Accredited test reports or assessments by competent bodies must carry the NATA logo. Test reports made by an overseas laboratory that has been accredited for the relevant standards by an overseas accreditation body that has a Mutual Recognition Agreement (MRA) with NATA are also accepted as technical grounds for product conformity. The report should be endorsed with the respective logo of the accreditation body (NVLAP).

Accreditations and Authorizations

VCCI

Accepted as an Associate Member to the VCCI, Acceptance No. 564. Conducted and radiated measurement facilities have been registered in accordance with Regulations for Voluntary Control Measures, Article 8. *(Registration Numbers. - Hillsboro: C-1071, R-1025, G-84, C-2687, T-1658, and R-2318, Irvine: R-1943, G-85, C-2766, and T-1659, Sultan: R-871, G-83, C-3265, and T-1511, Brooklyn Park: R-3125, G-86, G-141, C-3464, and T-1634).*

BSMI

Northwest EMC has been designated by NIST and validated by C-Taipei (BSMI) as a CAB to conduct tests as described in the APEC Mutual Recognition Agreement (US0017).

GOST

Northwest EMC, Inc. has been assessed and accredited by the Russian Certification bodies Certinform VNIINMASH, CERTINFO, SAMTES, and Federal CHEC, to perform EMC and Hygienic testing for Information Technology Products. As a result of their laboratory assessment, they will accept test results from Northwest EMC, Inc. for product certification

KCC

Northwest EMC, Inc is a CAB designated by MRA partners and recognized by Korea. (*Assigned Lab Numbers: Hillsboro: US0017, Irvine: US0158, Sultan: US0157, Brooklyn Park: US0175)*

VIETNAM

Vietnam MIC has approved Northwest EMC as an accredited test lab. Per Decision No. 194/QD-QLCL (dated December 15, 2009), Northwest EMC test reports can be used for Vietnam approval submissions.

SCOPE

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

Northwest EMC Locations

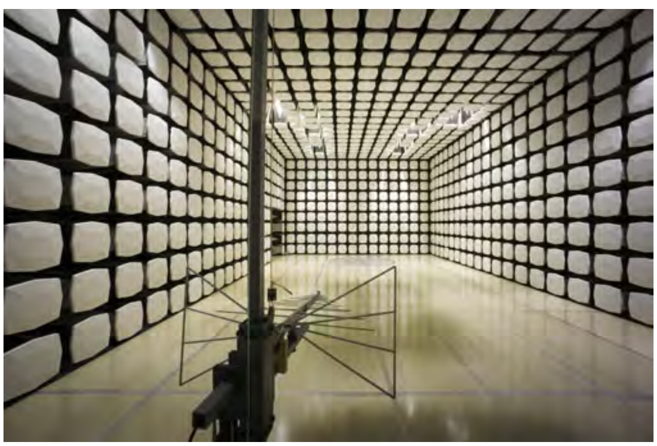
Oregon
Labs EV01-EV12
22975 NW Evergreen Pkwy
Suite 400
Hillsboro, OR 97124
(503) 844-4066

California
Labs OC01-OC13
41 Tesla
Irvine, CA 92618
(949) 861-8918

Minnesota
Labs MN01-MN08
9349 W Broadway Ave.
Brooklyn Park,
MN 55445
(763) 425-2281

Washington
Labs SU01-SU07
14128 339th Ave. SE
Sultan, WA 98294
(360) 793-8675

New York
Labs WA01-WA04
4939 Jordan Rd.
Elbridge, NY 13060
(315) 685-0796



Party Requesting the Test

Company Name:	Microsoft Corporation
Address:	One Microsoft Way
City, State, Zip:	Redmond, WA 98052-6399
Test Requested By:	Kitty Tam
Model:	1481
First Date of Test:	7/11/2011
Last Date of Test:	8/5/2011
Receipt Date of Samples:	5/17/2011
Equipment Design Stage:	Prototype
Equipment Condition:	No Damage

Information Provided by the Party Requesting the Test

Functional Description of the EUT (Equipment Under Test):
Bluetooth Radio

Testing Objective:
To demonstrate compliance to FCC 15.247 requirements.

CONFIGURATION 4 MCSO1576

Software/Firmware Running during test	
Description	**Version**
BlueTest3	BlueTest3

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Headset - Direct Connect BT	Microsoft Corporation	1481	C10

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Programming harness	Microsoft Corporation	None	None

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Computer	Dell	D600	7SLS71

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB	Yes	1.8m	No	Headset	Computer
Programming harness	No	1.8m	No	Headset	USB cable

PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.

CONFIGURATION 7 MCSO1576

Software/Firmware Running during test	
Description	**Version**
BlueTest3	BlueTest3

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Headset - BT	Microsoft Corporation	1481	C12

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Computer	Dell	D600	7SLS71
Cradle	Microsoft Corporation	1502	EV2 B 01
Power Adapter	Dell	PS-1900-0202	CN0U7809-71615-SAO-1A18

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB	Yes	1.8m	No	Computer	Cradle
DC Power	No	1.8m	PA	Computer	Power Adapter
AC Power	No	1.8m	No	Power Adapter	AC Mains

PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.

CONFIGURATION 1 MCSO1579

Software/Firmware Running during test	
Description	**Version**
BlueTest3	BlueTest3

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Headset - Direct Connect BT	Microsoft Corporation	1481	C35

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Computer	Dell	D600	7SLS71
Programming Harness	Microsoft Corporation	None	None
Power Adapter	Dell	PS-1900-0202	CN0U7809-71615-SAO-1A18

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB	Yes	1.8m	No	Computer	Programming Harness
Programming Harness	No	1.8m	No	Headset	USB cable
USB	No	1.0m	No	Headset	Computer
PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.					

CONFIGURATION 1 MCSO1581

Software/Firmware Running during test	
Description	**Version**
BlueTest3	BlueTest3

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Headset - BT	Microsoft Corporation	1481	C31

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Computer	Dell	PP05L	7SLS71
Programming Harness	Microsoft Corporation	None	None
USB-SPI Converter	CSR	USB-SPI Converter	241164
Power Adapter	Dell	PA-1900-02D2	CN0U7809-71615-SAO-1A18

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB	Yes	1.8m	No	Computer	Programming harness
Programming harness	No	1.8m	No	Headset	USB cable
USB	Yes	1.0m	No	Headset	Computer
PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.					

CONFIGURATION 2 MCSO1581

Software/Firmware Running during test	
Description	**Version**
BlueTest3	BlueTest3

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Headset - Direct Connect BT	Microsoft Corporation	1481	C35

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Programming Harness	Microsoft Corporation	None	None
USB-SPI Converter	CSR	USB-SPI Converter	241164

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Computer	Dell	PP05L	7SLS71
Power Adapter	Dell	PA-1900-02D2	CN0U7809-71615-SAO-1A18

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB to Micro USB cable	Yes	1.1m	No	USB Extension cable	Headset - BT
Programming harness	No	1.8m	No	Headset	Ethernet Cable
USB	Yes	2.0m	No	Computer	USB-SPI Converter
Ethernet	Yes	1.0m	No	USB-SPI Converter	Programming harness
DC Power	No	1.8m	Yes	Computer	Power Adapter
AC Power	No	1.8m	No	Power Adapter	AC Mains
PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.					

Equipment modifications					
Item	Date	Test	Modification	Note	Disposition of EUT
1	7/11/2011	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.
2	7/11/2011	Power Spectral Density	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
3	7/11/2011	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.
4	7/19/2011	Powerline Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.
5	7/25/2011	Channel Spacing	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	7/25/2011	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.
7	7/25/2011	Number of Hopping Frequencies	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.
8	7/28/2011	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	8/3/2011	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
10	8/5/2011	Band Edge Compliance	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

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
Spectrum Analyzer	Agilent	E4440A	AFD	7/5/2011	12
40GHz DC Block	Miteq	DCB4000	AMD	8/5/2010	13
Attenuator 20 dB, SMA M/F 26GHz	S.M. Electronics	SA26B-20	AUY	8/6/2010	12
EV06 Direct Connect Cable	ESM Cable Corp.	TT	ECA	NCR	0
MXG Vector Signal Generator	Agilent	N5182A	TIF	NCR	0

MEASUREMENT UNCERTAINTY

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 for radiated emissions measurements is less than +/- 4 dB, and for conducted emissions measurements is less than +/- 2.7 dB. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for measurement uncertainty are available upon request.

TEST DESCRIPTION

This limit is derived from FCC 15.247(a)(1): "Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW."

This was based on the original Bluetooth that had a channel separation of 1 MHz, which results in a 1.5 MHz bandwidth using the information above. Since the 1 MHz represents the worst case for all reports that is what is used, even though the other FHSS radio in this device would actually be larger it still meets. 2/3 * 1.5 MHz = 1 MHz hopping channel.

The 20 dB 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 in a no hop mode at its maximum data rate for each of the three different modulations available.

NORTHWEST
EMC

Occupied Bandwidth

XMit 2011.04.20
PsaTx 2011.07.05

EUT:	**Model: 1481**			**Work Order:**	**MCSO1576**
Serial Number:	**10**			**Date:**	**07/11/11**
Customer:	**Microsoft Corporation**			**Temperature:**	**24°C**
Attendees:	**None**			**Humidity:**	**42%**
Project:	**None**			**Barometric Pres.:**	**29.98 in**
Tested by:	**Rod Peloquin**	**Power:**	**USB**	**Job Site:**	**EV06**

TEST SPECIFICATIONS	TEST METHOD
FCC 15.247:2011	ANSI C63.10:2009

COMMENTS

Transmitting Bluetooth Radio. 0.5 dB added for adapter cable

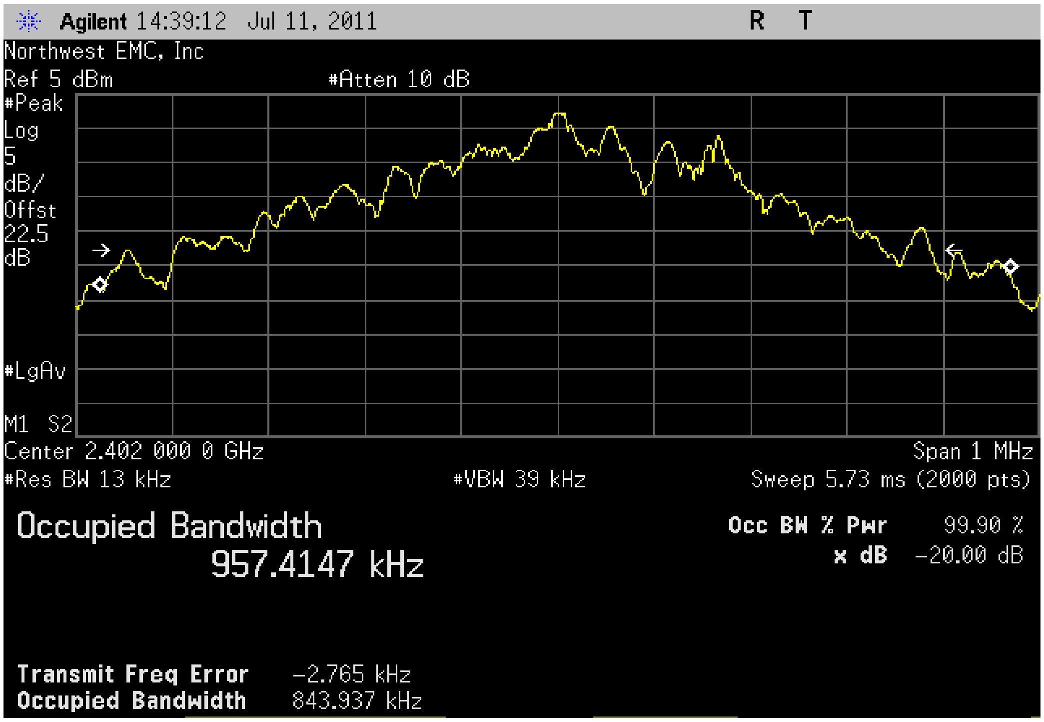
DEVIATIONS FROM TEST STANDARD

Configuration #	**4**	*Signature*

		Value	Limit	Result
DH5, GFSK				
	Low Channel	843.937 kHz	< 1.5 MHz	Pass
	Mid Channel	846.824 kHz	< 1.5 MHz	Pass
	High Channel	882.076 kHz	< 1.5 MHz	Pass
2DH5, 4-DQPSK				
	Low Channel	1.196 MHz	< 1.5 MHz	Pass
	Mid Channel	1.178 MHz	< 1.5 MHz	Pass
	High Channel	1.191 MHz	< 1.5 MHz	Pass
3DH5, 8-DPSK				
	Low Channel	1.226 MHz	< 1.5 MHz	Pass
	Mid Channel	1.218 MHz	< 1.5 MHz	Pass
	High Channel	1.222 MHz	< 1.5 MHz	Pass

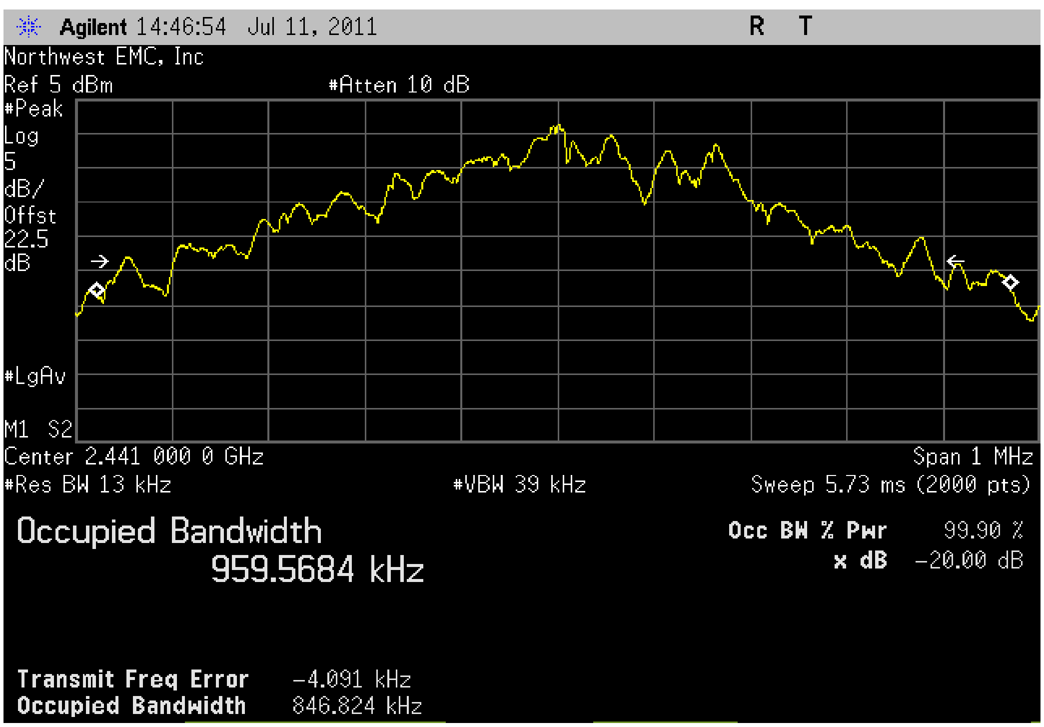
DH5, GFSK, Low Channel

				Value	Limit	Result
				843.937 kHz	< 1.5 MHz	Pass



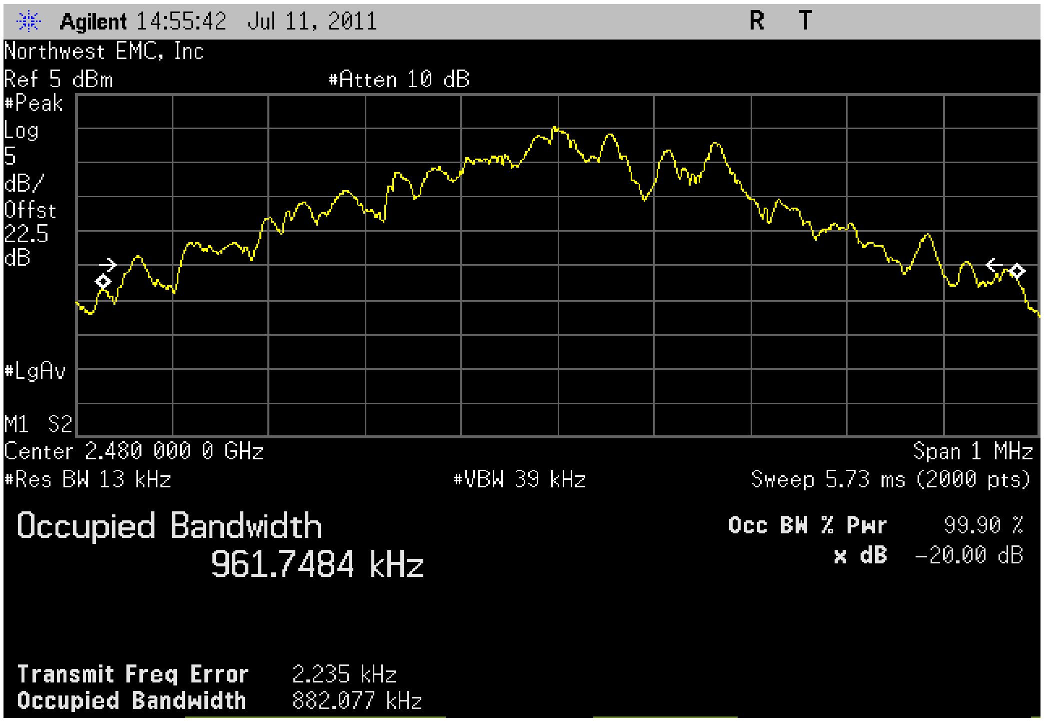
DH5, GFSK, Mid Channel

				Value	Limit	Result
				846.824 kHz	< 1.5 MHz	Pass



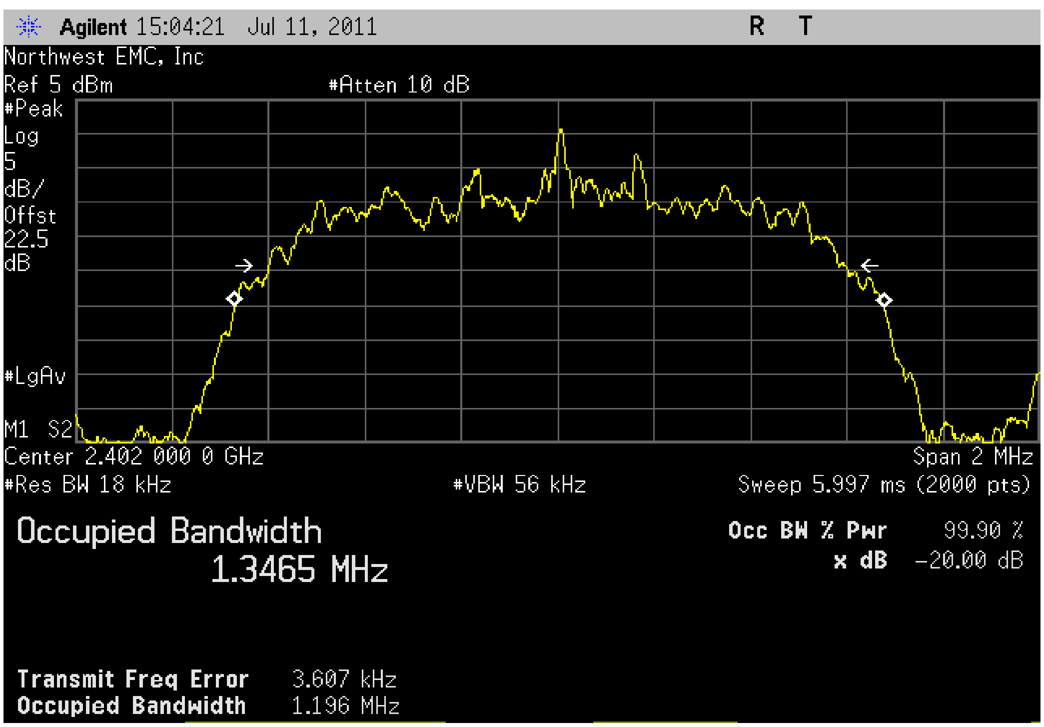
DH5, GFSK, High Channel

				Value	Limit	Result
				882.076 kHz	< 1.5 MHz	Pass



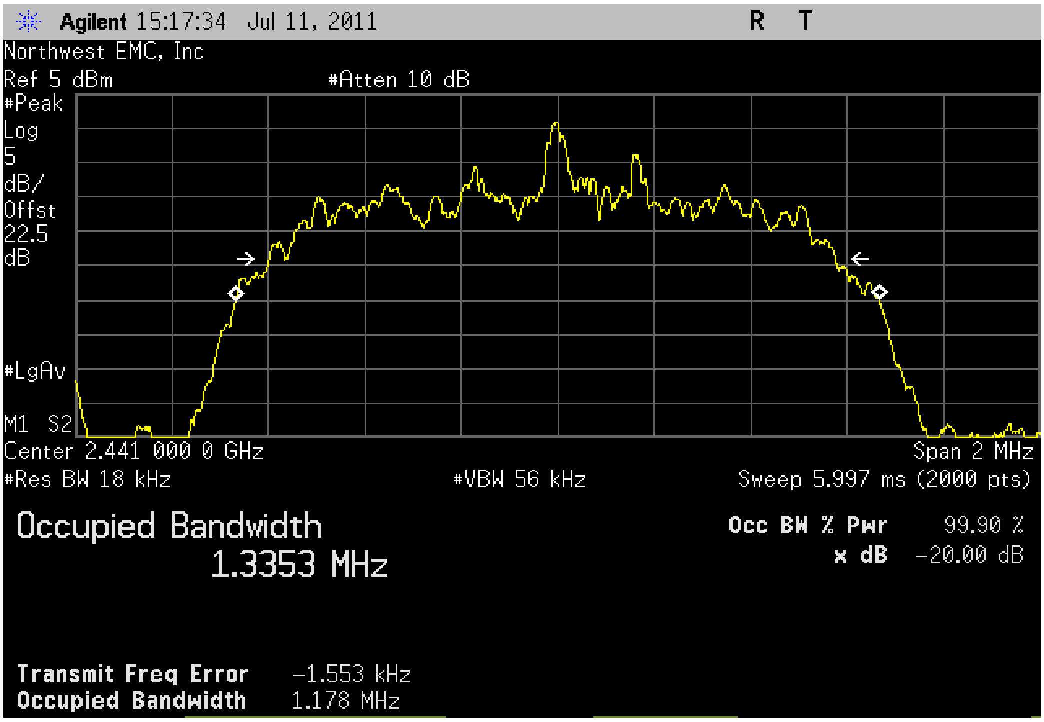
2DH5, 4-DQPSK, Low Channel

				Value	Limit	Result
				1.196 MHz	< 1.5 MHz	Pass



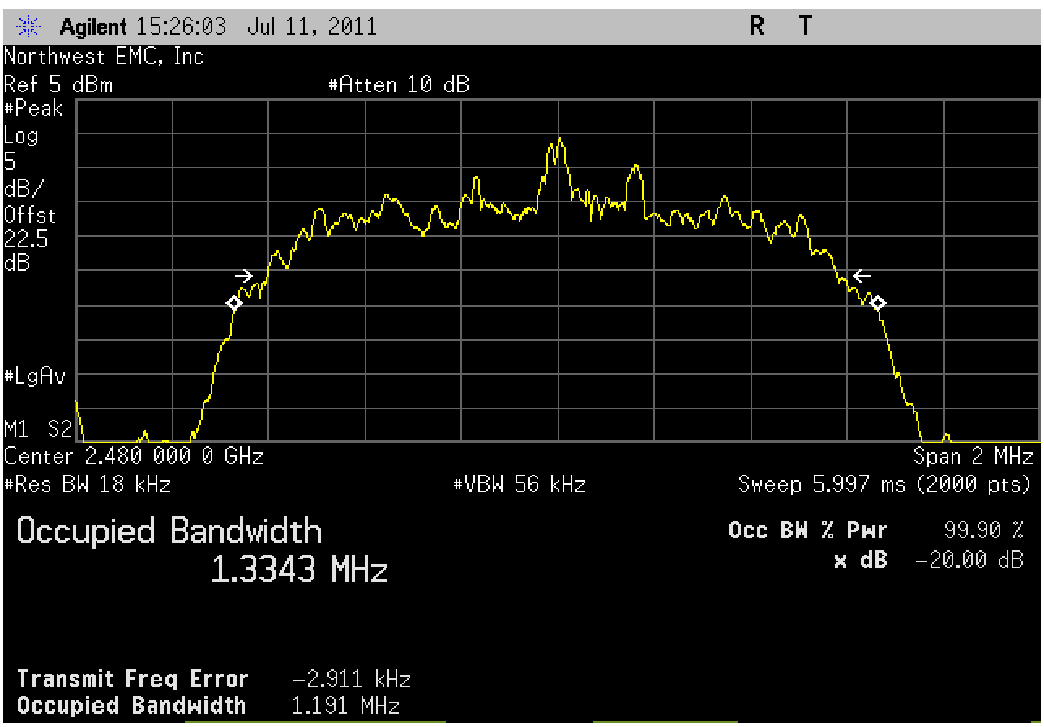
2DH5, 4-DQPSK, Mid Channel

				Value	Limit	Result
				1.178 MHz	< 1.5 MHz	Pass



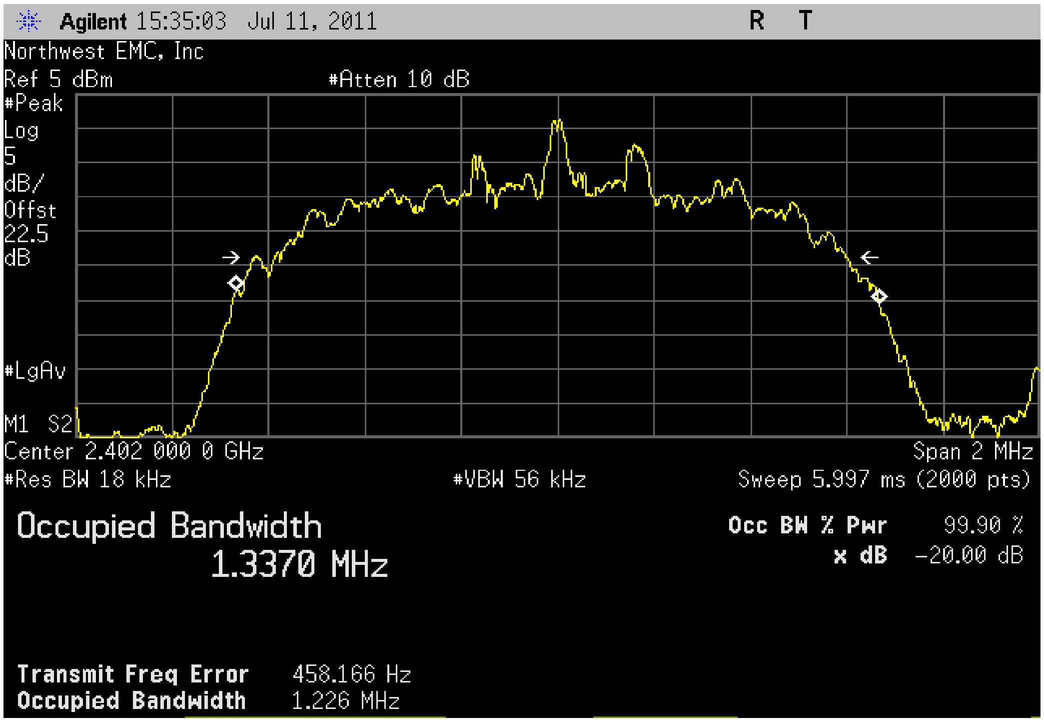
2DH5, 4-DQPSK, High Channel

				Value	Limit	Result
				1.191 MHz	< 1.5 MHz	Pass



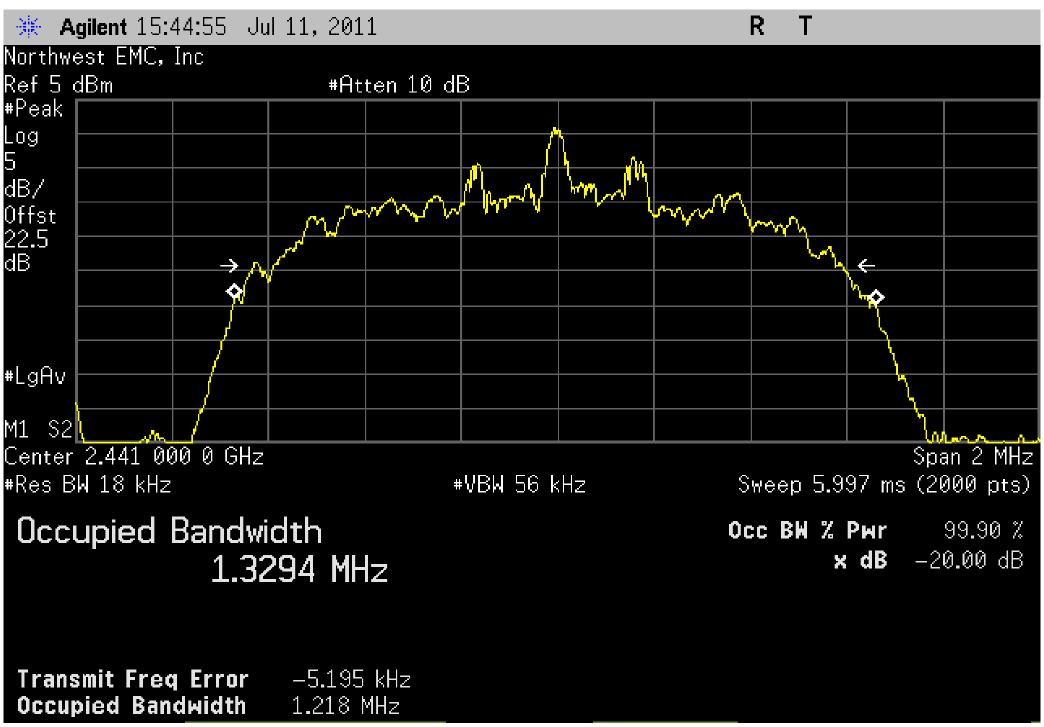
3DH5, 8-DPSK, Low Channel

				Value	Limit	Result
				1.226 MHz	< 1.5 MHz	Pass



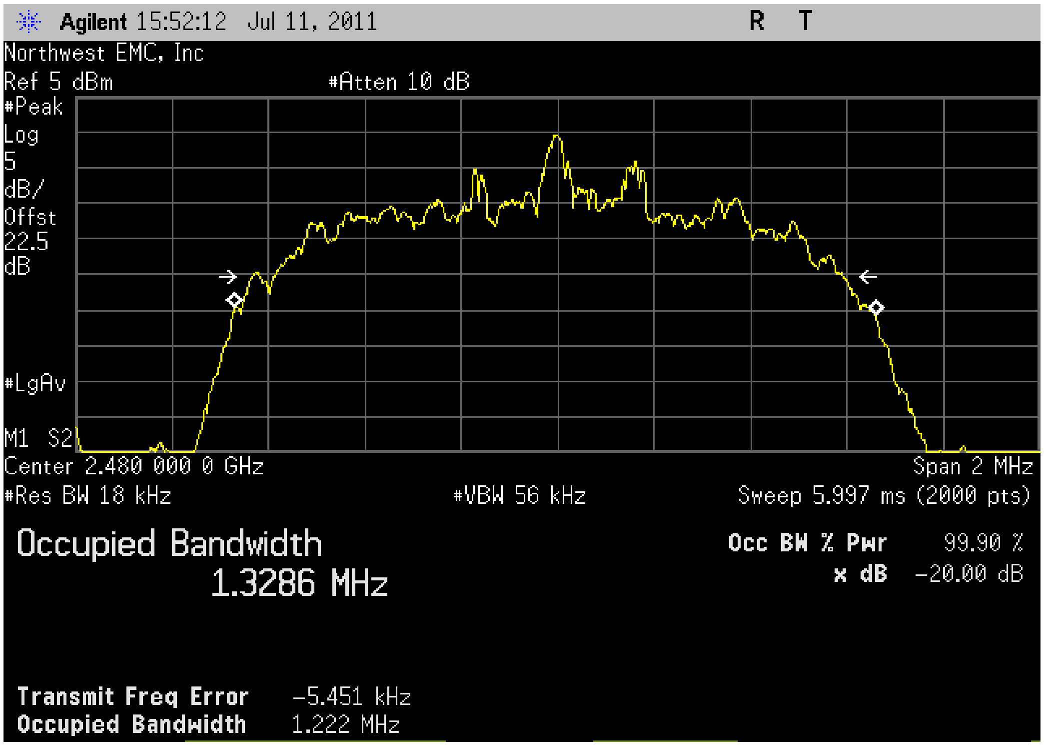
3DH5, 8-DPSK, Mid Channel

				Value	Limit	Result
				1.218 MHz	< 1.5 MHz	Pass



3DH5, 8-DPSK, High Channel

				Value	Limit	Result
				1.222 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
Spectrum Analyzer	Agilent	E4440A	AFD	7/5/2011	12
40GHz DC Block	Miteq	DCB4000	AMD	8/5/2010	13
Attenuator 20 dB, SMA M/F 26GHz	S.M. Electronics	SA26B-20	AUY	8/6/2010	12
EV06 Direct Connect Cable	ESM Cable Corp.	TT	ECA	NCR	0
MXG Vector Signal Generator	Agilent	N5182A	TIF	NCR	0

MEASUREMENT UNCERTAINTY

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 for radiated emissions measurements is less than +/- 4 dB, and for conducted emissions measurements is less than +/- 2.7 dB. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for measurement uncertainty are available upon request.

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 at its maximum data rate in a no hop mode.

De Facto EIRP Limit: Per 47 CFR 15.247 (b)(1-3), the EUT meets the de facto EIRP limit of +36dBm.

NORTHWEST

EMC

Output Power

XMit 2011.04.20
PsaTx 2011.07.25

EUT:	**Model: 1481**			**Work Order:**	**MCSO1579**
Serial Number:	**C35**			**Date:**	**07/28/11**
Customer:	**Microsoft Corporation**			**Temperature:**	**24°C**
Attendees:	**None**			**Humidity:**	**45%**
Project:	**None**			**Barometric Pres.:**	**30.13 in**
Tested by:	**Rod Peloquin**	**Power:**	**USB**	**Job Site:**	**EV06**

TEST SPECIFICATIONS	TEST METHOD
FCC 15.247:2011	ANSI C63.10:2009

COMMENTS

0.5 dB added for adapter cable loss. Power settings of 255, 63 per original instructions.

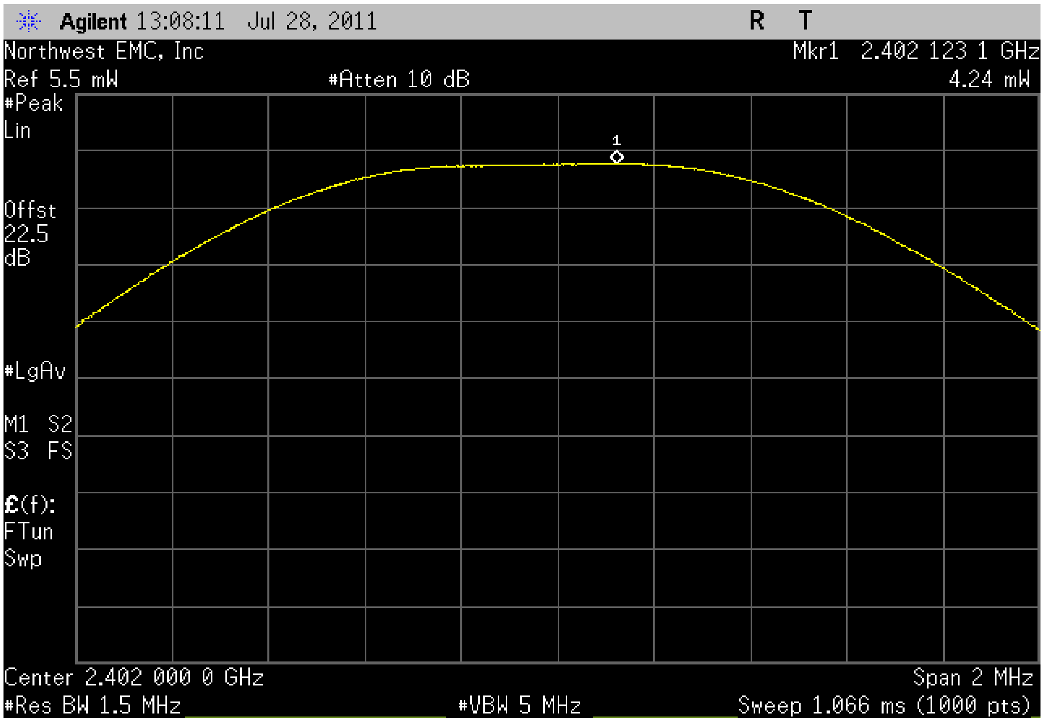
DEVIATIONS FROM TEST STANDARD

Configuration #	**1**	*Signature*

		Value	Limit	Result
DH5, GFSK				
	Low Channel	4.236 mW	< 125 mW	Pass
	Mid Channel	4.051 mW	< 125 mW	Pass
	High Channel	3.605 mW	< 125 mW	Pass
2DH5, 4-DQPSK				
	Low Channel	2.208 mW	< 125 mW	Pass
	Mid Channel	1.918 mW	< 125 mW	Pass
	High Channel	1.573 mW	< 125 mW	Pass
3DH5, 8-DPSK				
	Low Channel	2.41 mW	< 125 mW	Pass
	Mid Channel	2.113 mW	< 125 mW	Pass
	High Channel	1.714 mW	< 125 mW	Pass

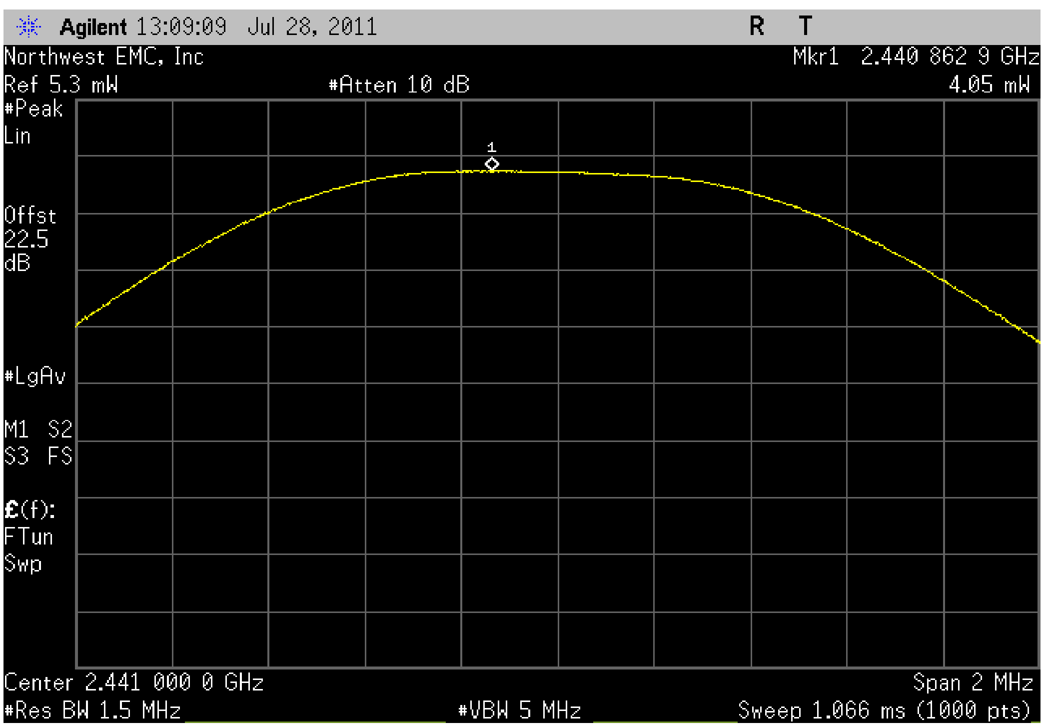
DH5, GFSK, Low Channel

				Value	Limit	Result
				4.236 mW	< 125 mW	Pass



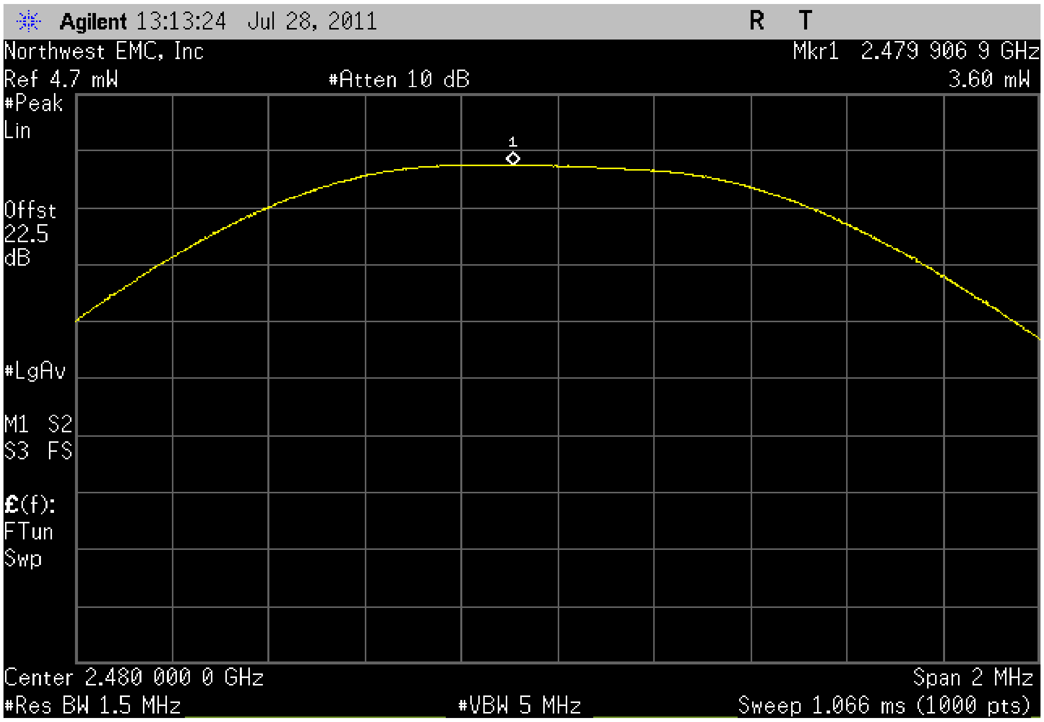
DH5, GFSK, Mid Channel

				Value	Limit	Result
				4.051 mW	< 125 mW	Pass



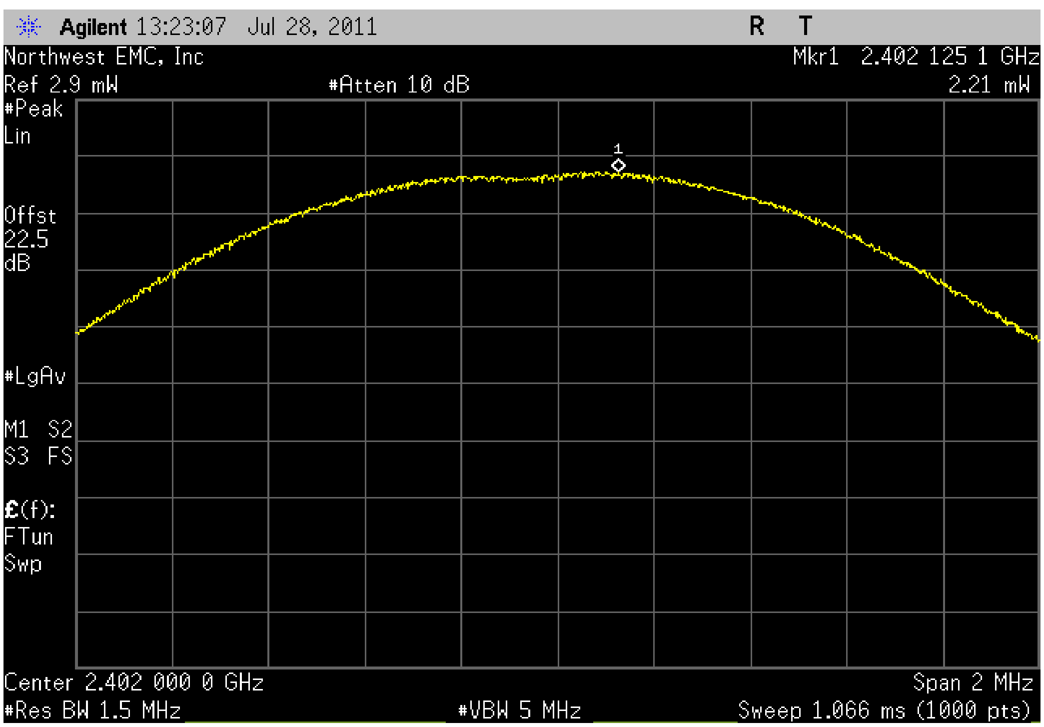
DH5, GFSK, High Channel

				Value	Limit	Result
				3.605 mW	< 125 mW	Pass



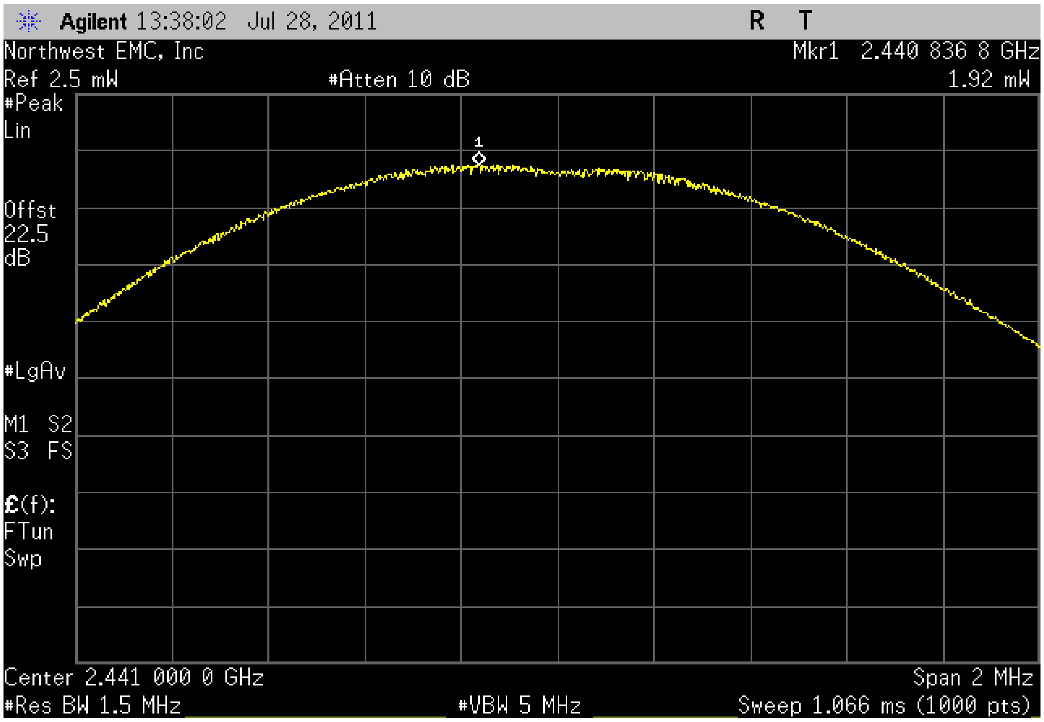
2DH5, 4-DQPSK, Low Channel

				Value	Limit	Result
				2.208 mW	< 125 mW	Pass



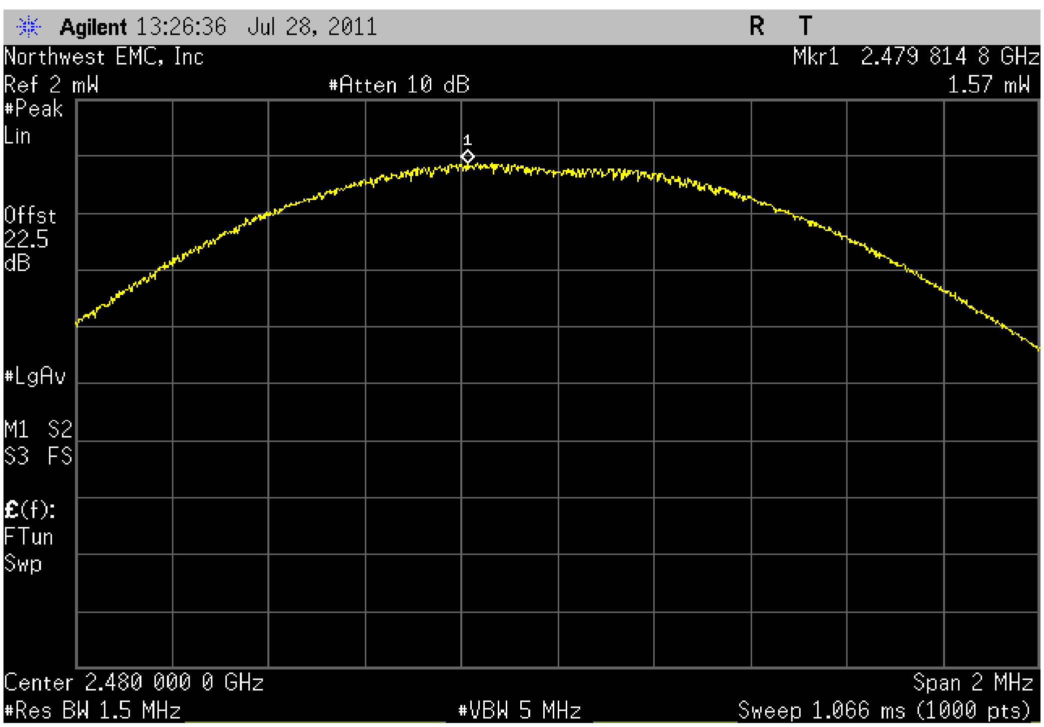
2DH5, 4-DQPSK, Mid Channel

				Value	Limit	Result
				1.918 mW	< 125 mW	Pass



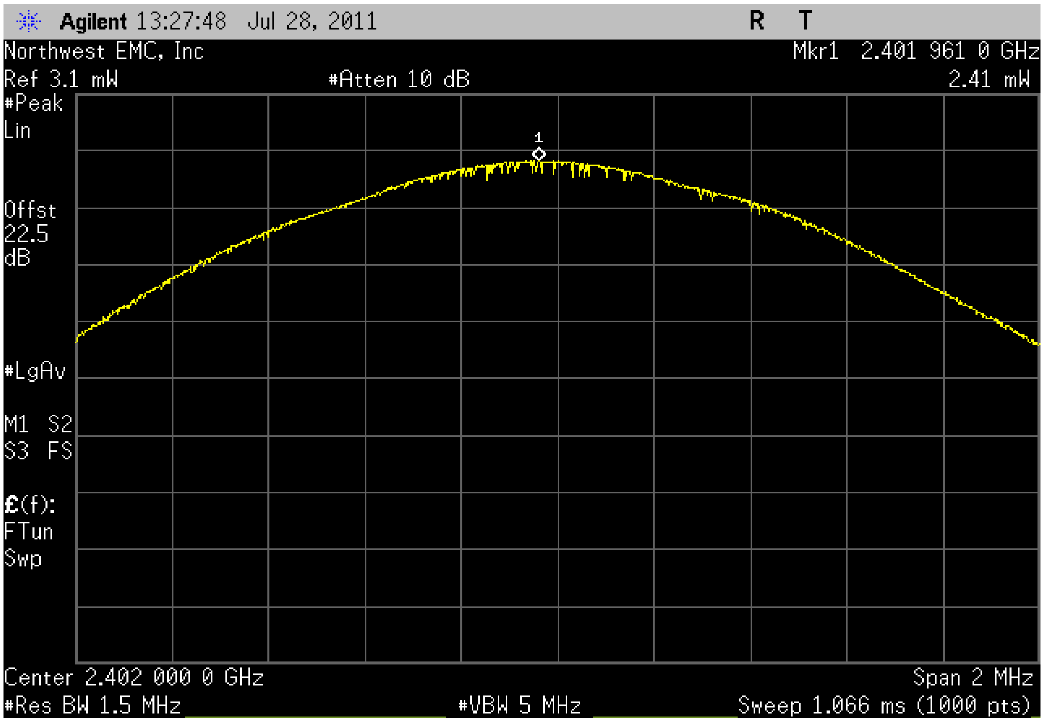
2DH5, 4-DQPSK, High Channel

				Value	Limit	Result
				1.573 mW	< 125 mW	Pass



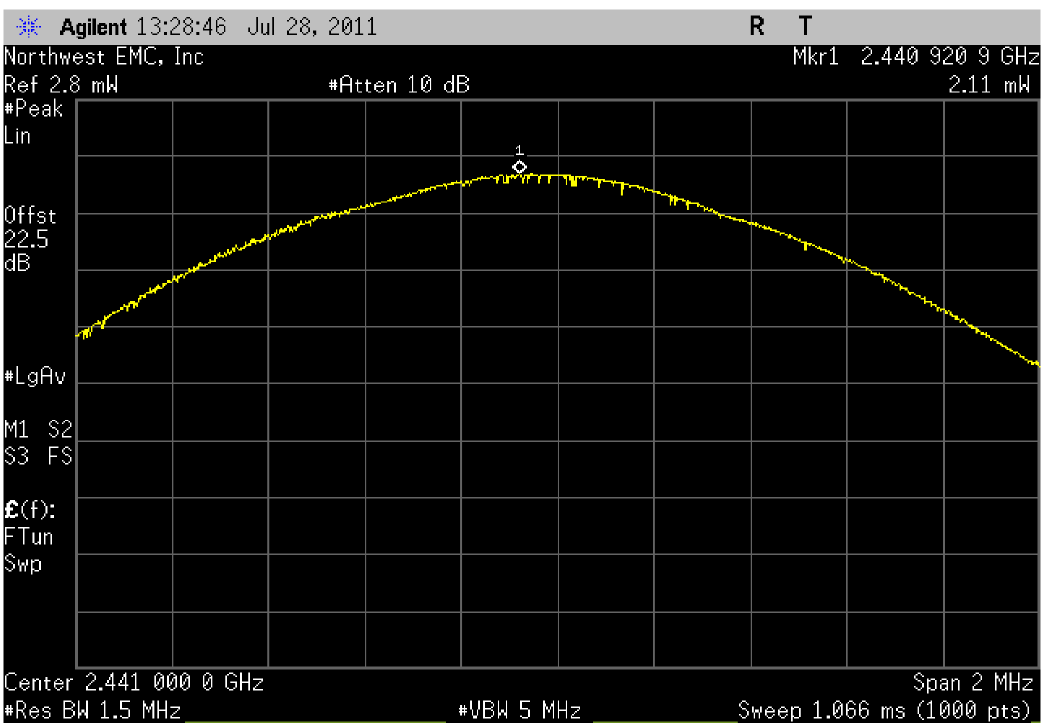
3DH5, 8-DPSK, Low Channel

				Value	Limit	Result
				2.41 mW	< 125 mW	Pass

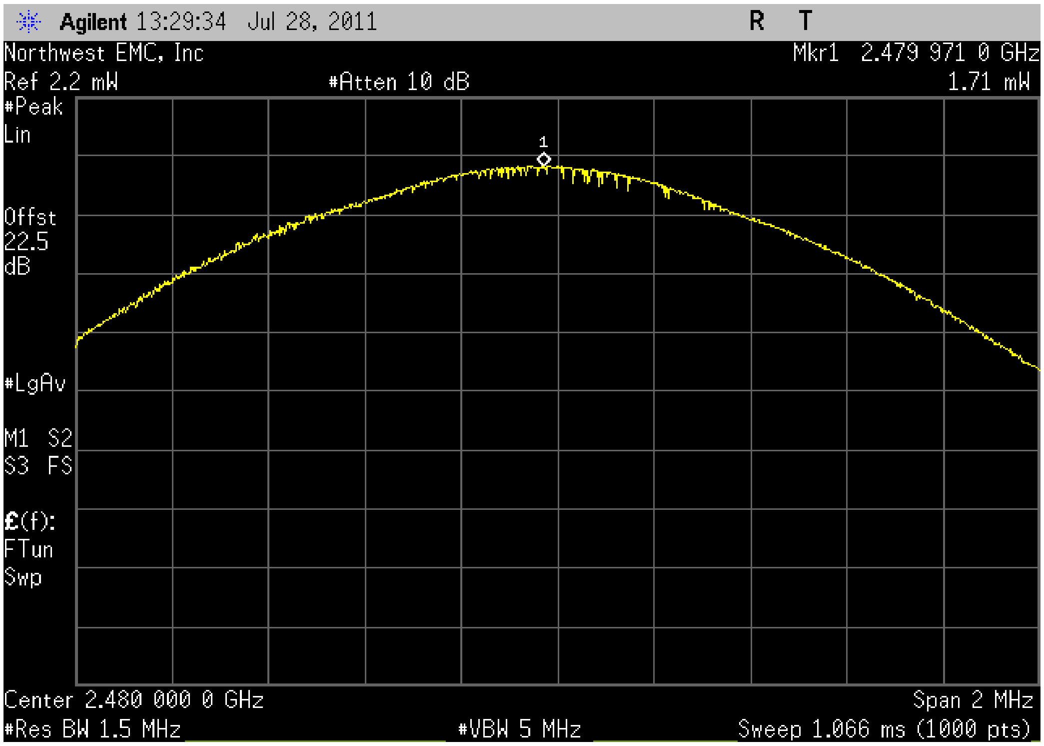


3DH5, 8-DPSK, Mid Channel

				Value	Limit	Result
				2.113 mW	< 125 mW	Pass



3DH5, 8-DPSK, High Channel						
				Value	Limit	Result
				1.714 mW	< 125 mW	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
Spectrum Analyzer	Agilent	E4440A	AFD	7/5/2011	12
40GHz DC Block	Miteq	DCB4000	AMD	8/5/2010	13
Attenuator 20 dB, SMA M/F 26GHz	S.M. Electronics	SA26B-20	AUY	8/2/2011	12
EV06 Direct Connect Cable	ESM Cable Corp.	TT	ECA	NCR	0

MEASUREMENT UNCERTAINTY

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 for radiated emissions measurements is less than +/- 4 dB, and for conducted emissions measurements is less than +/- 2.7 dB. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for measurement uncertainty are available upon request.

TEST DESCRIPTION

The requirements of FCC 15.247(d) for emissions at least 20dB below the carrier in any 100kHz bandwidth outside the allowable band was measured with the EUT set to low and high transmit frequencies while in a no-hop mode, and at the low and high band edge with frequency hopping enabled. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The channels closest to the band edges were selected. The spectrum was scanned across each band edge from 5 MHz below the band edge to 5 MHz above the band edge.

The EUT was transmitting at its maximum data rate using all three types of modulations available in Bluetooth EDR.

NORTHWEST **EMC**

Band Edge Compliance

XMit 2010.11.03

EUT:	**Model: 1481**			**Work Order:**	**MCSO1581**
Serial Number:	**C35**			**Date:**	**08/05/11**
Customer:	**Microsoft Corporation**			**Temperature:**	**23.3°C**
Attendees:	**None**			**Humidity:**	**42%**
Project:	**None**			**Barometric Pres.:**	**29.95**
Tested by:	**Rod Peloquin**	**Power:**	**USB**	**Job Site:**	**EV06**

TEST SPECIFICATIONS	**TEST METHOD**
FCC 15.247:2011	**ANSI C63.10:2009**

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

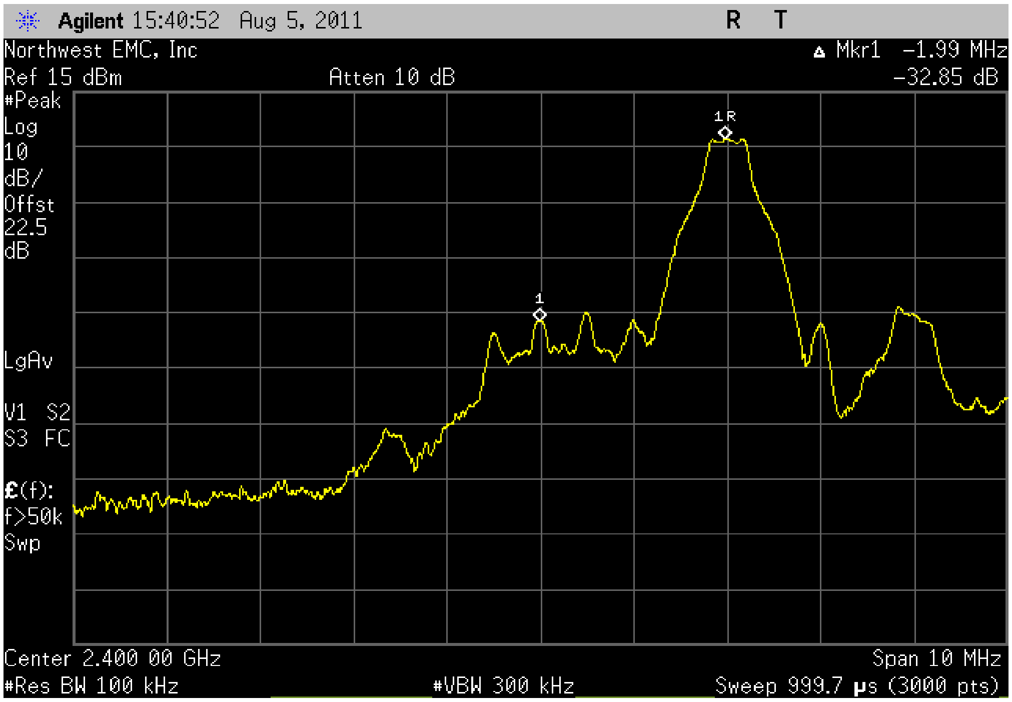
None

Configuration #	**2**	*Signature* Rodney L. Peloquin

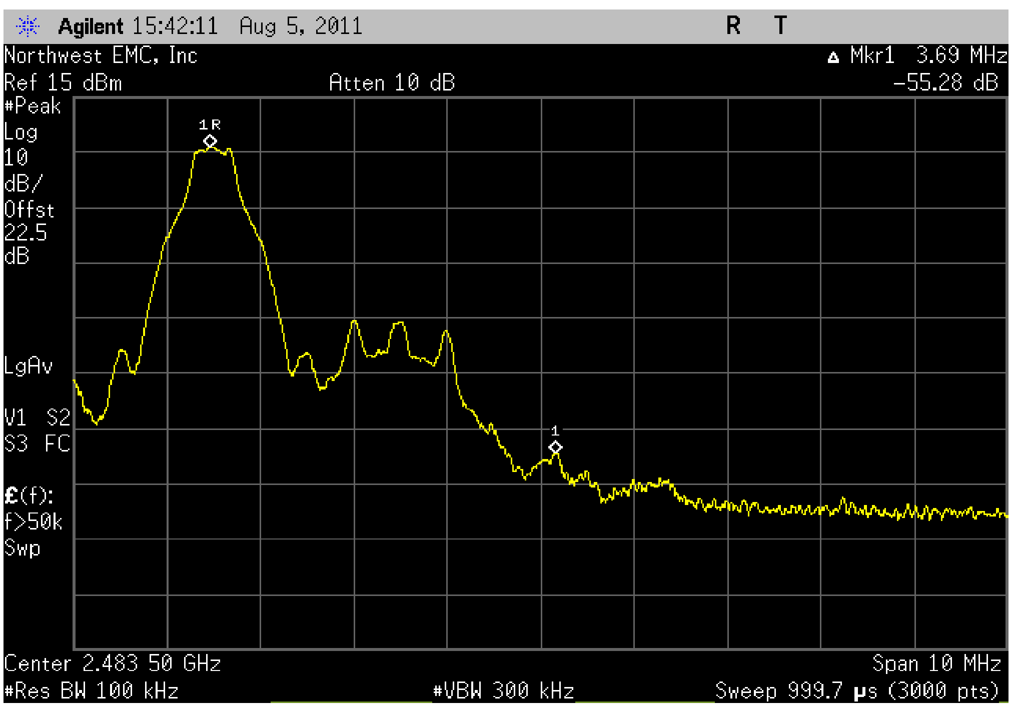
			Value	**Limit**	**Results**
Single Channel					
	GFSK, DH5				
		Low Band Edge	-32.9 dBc	≤ -20dBc	Pass
		High Band Edge	-55.3 dBc	≤ -20dBc	Pass
	pi/4-DQPSK, 2DH5				
		Low Band Edge	-45.3 dBc	≤ -20dBc	Pass
		High Band Edge	-55.7 dBc	≤ -20dBc	Pass
	8-DPSK, 3DH5				
		Low Band Edge	-45.7 dBc	≤ -20dBc	Pass
		High Band Edge	-57.5 dBc	≤ -20dBc	Pass
Frequency Hopping					
	GFSK, DH5				
		Low Band Edge	-37.7 dBc	≤ -20dBc	Pass
		High Band Edge	-56.0 dBc	≤ -20dBc	Pass
	pi/4-DQPSK, 2DH5				
		Low Band Edge	-47.4 dBc	≤ -20dBc	Pass
		High Band Edge	-56.5 dBc	≤ -20dBc	Pass
	8-DPSK, 3DH5				
		Low Band Edge	-47.2 dBc	≤ -20dBc	Pass
		High Band Edge	-59.5 dBc	≤ -20dBc	Pass

Band Edge Compliance

Single Channel, GFSK, DH5, Low Band Edge					
Result:	Pass	**Value:**	-32.9 dBc	**Limit:**	≤ -20dBc

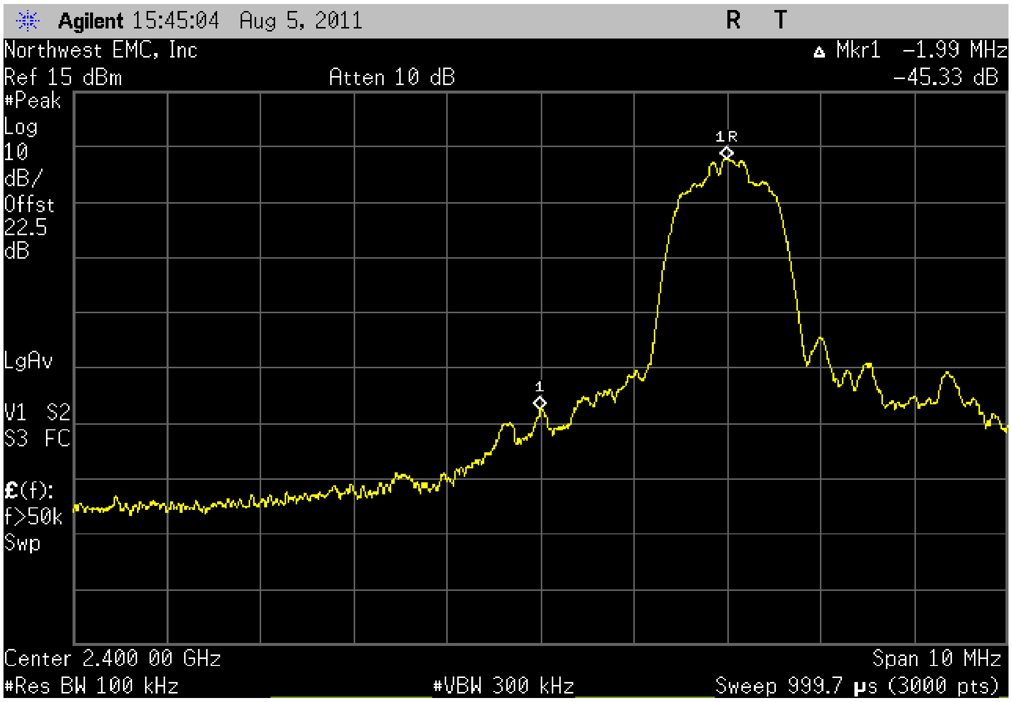


Single Channel, GFSK, DH5, High Band Edge					
Result:	Pass	**Value:**	-55.3 dBc	**Limit:**	≤ -20dBc

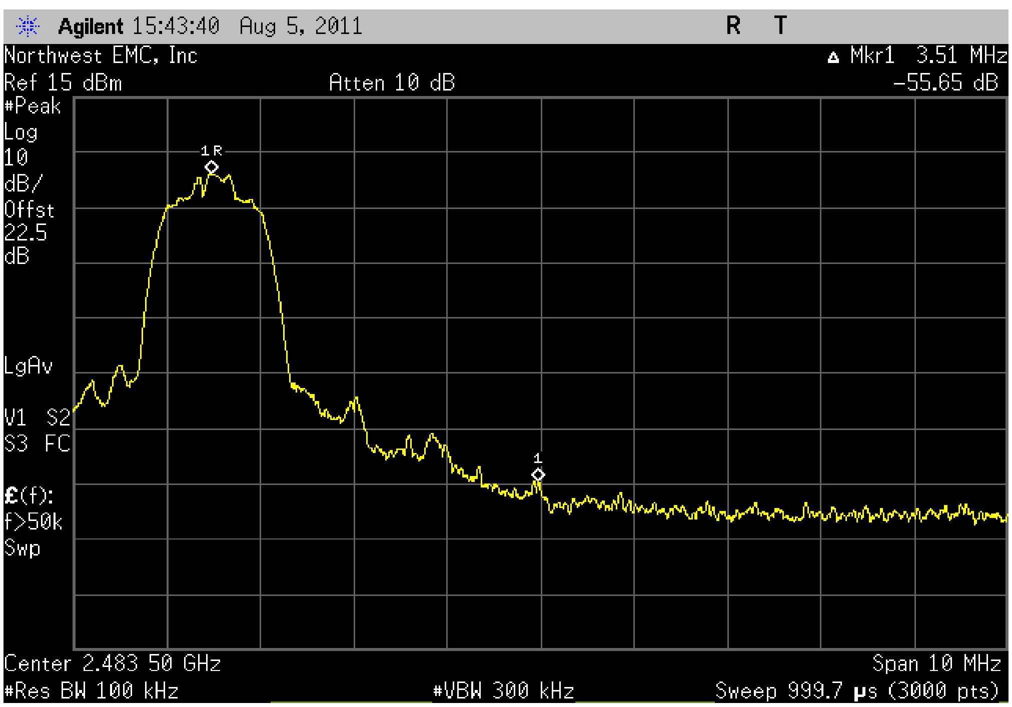


Band Edge Compliance

Single Channel, pi/4-DQPSK, 2DH5, Low Band Edge					
Result:	Pass	**Value:**	-45.3 dBc	**Limit:**	≤ -20dBc

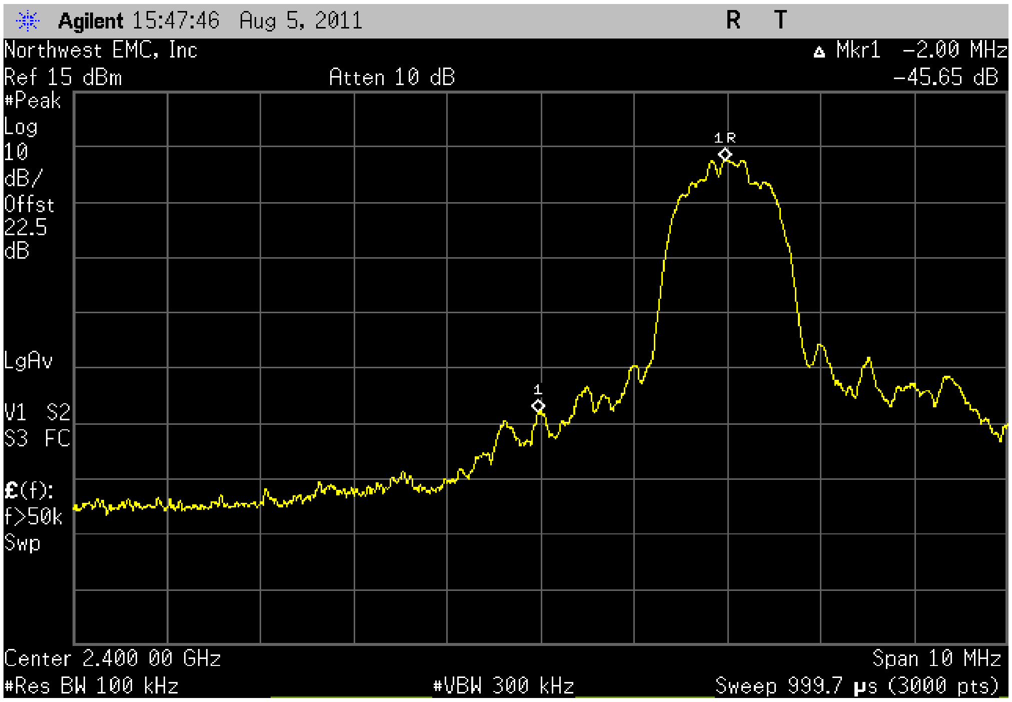


Single Channel, pi/4-DQPSK, 2DH5, High Band Edge					
Result:	Pass	**Value:**	-55.7 dBc	**Limit:**	≤ -20dBc

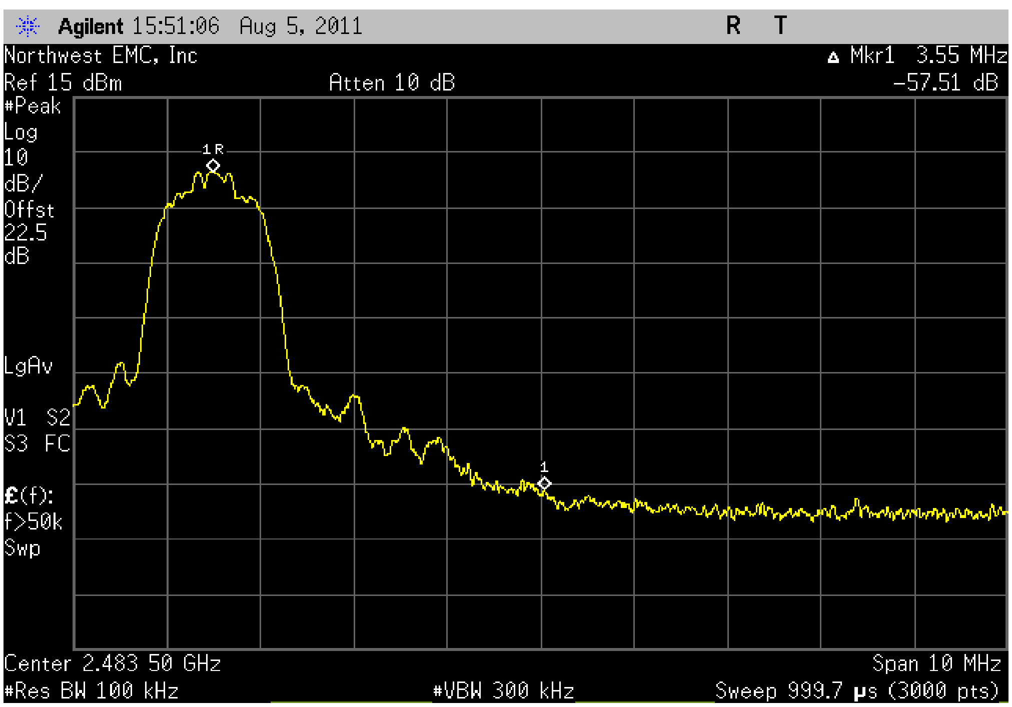


Band Edge Compliance

Single Channel, 8-DPSK, 3DH5, Low Band Edge					
Result:	Pass	**Value:**	-45.7 dBc	**Limit:**	≤ -20dBc

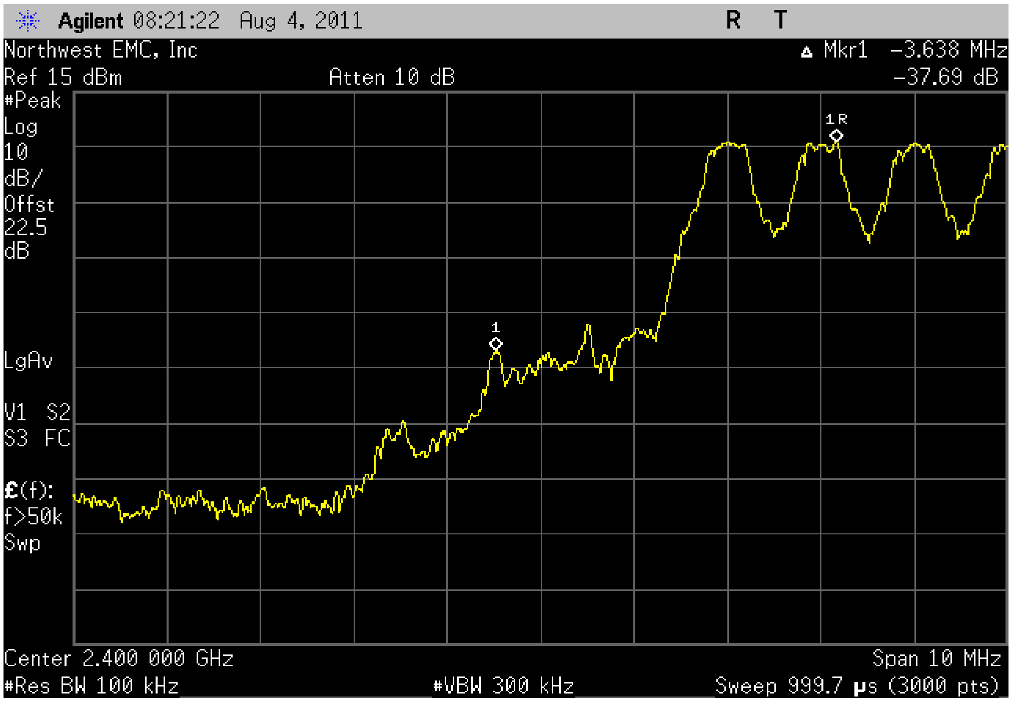


Single Channel, 8-DPSK, 3DH5, High Band Edge					
Result:	Pass	**Value:**	-57.5 dBc	**Limit:**	≤ -20dBc

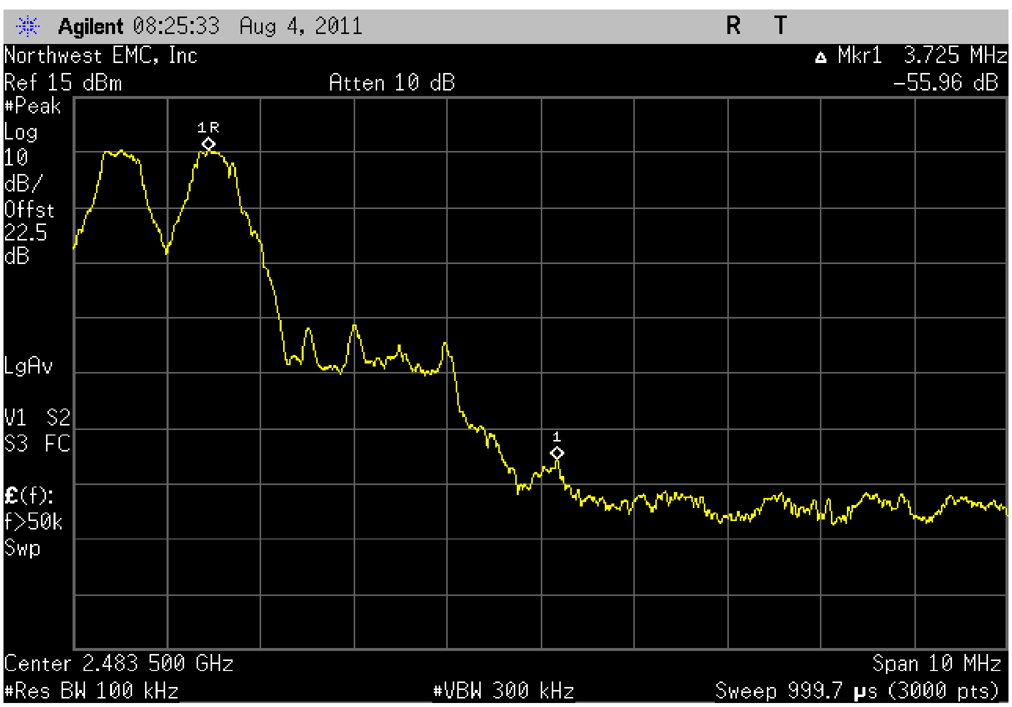


Band Edge Compliance

Frequency Hopping, GFSK, DH5, Low Band Edge					
Result:	Pass	**Value:**	-37.7 dBc	**Limit:**	≤ -20dBc

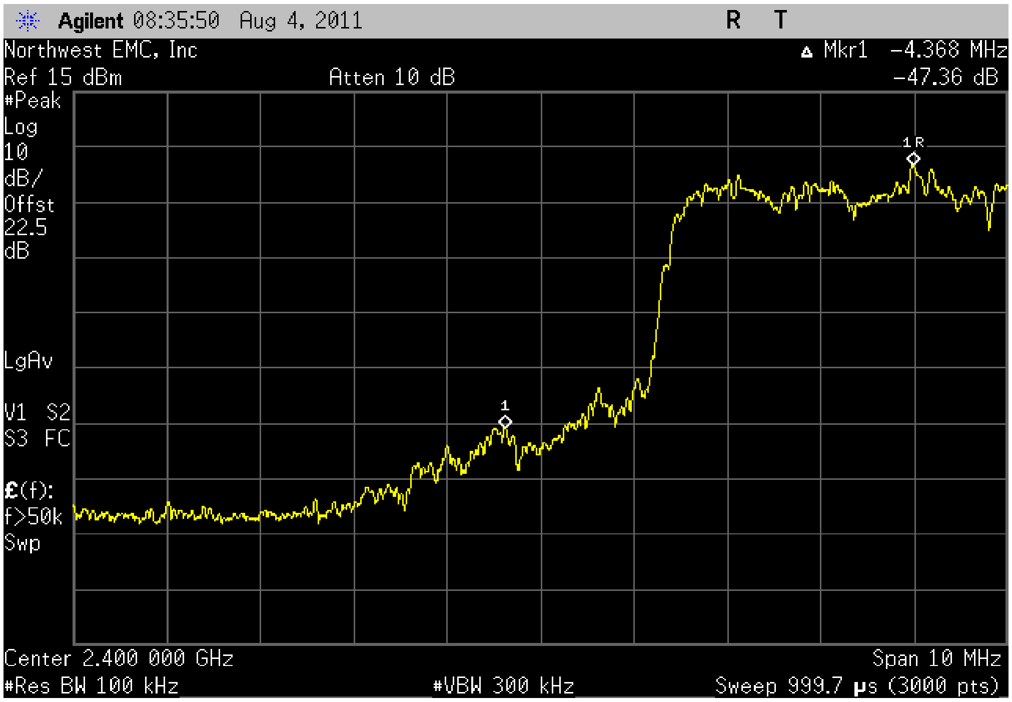


Frequency Hopping, GFSK, DH5, High Band Edge					
Result:	Pass	**Value:**	-56.0 dBc	**Limit:**	≤ -20dBc

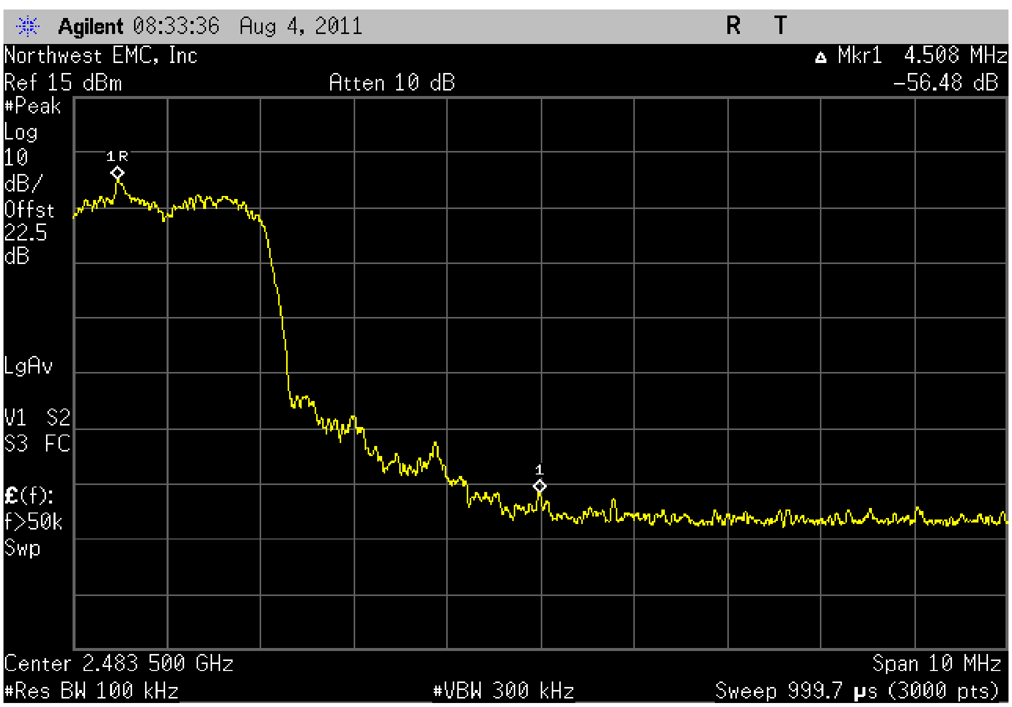


Band Edge Compliance

Frequency Hopping, pi/4-DQPSK, 2DH5, Low Band Edge					
Result:	Pass	**Value:**	-47.4 dBc	**Limit:**	≤ -20dBc

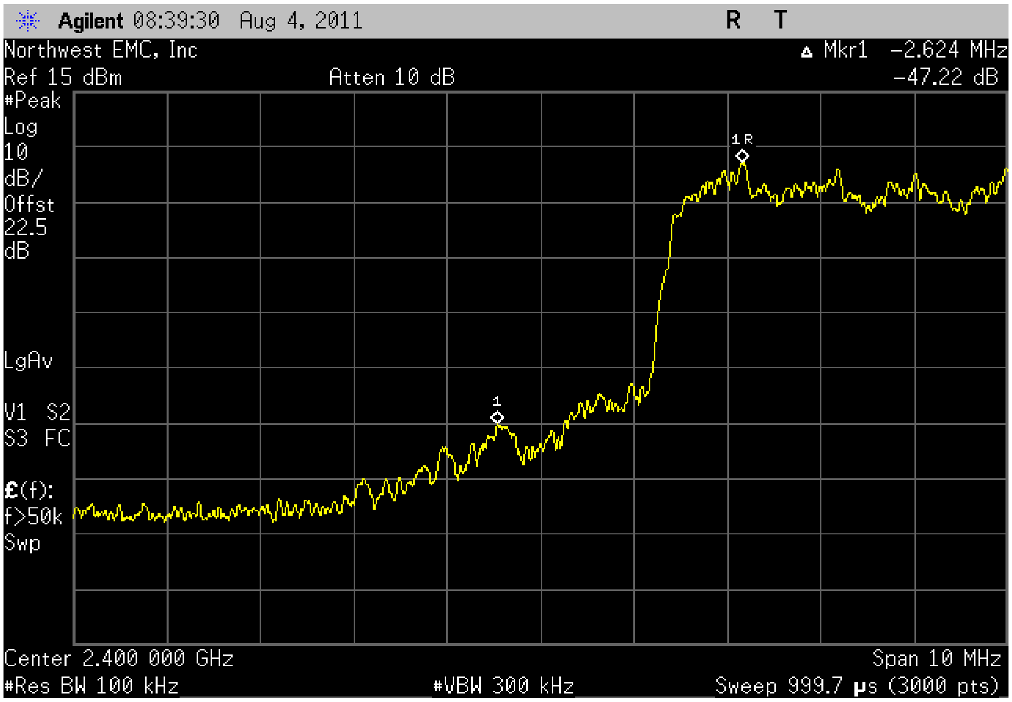


Frequency Hopping, pi/4-DQPSK, 2DH5, High Band Edge					
Result:	Pass	**Value:**	-56.5 dBc	**Limit:**	≤ -20dBc

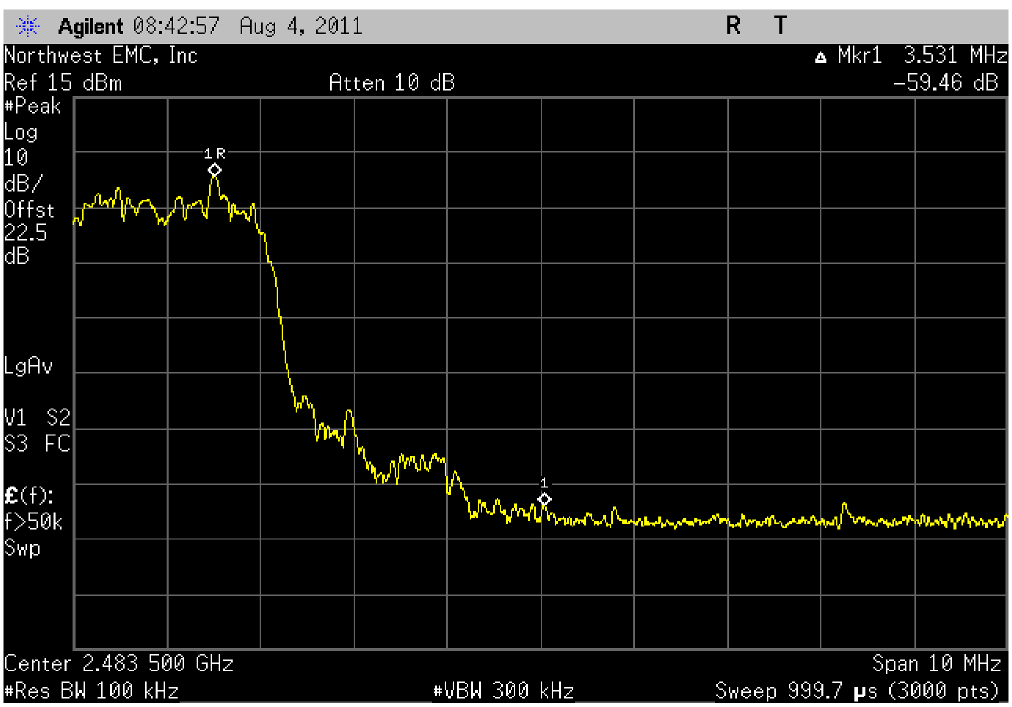


Band Edge Compliance

Frequency Hopping, 8-DPSK, 3DH5, Low Band Edge					
Result:	Pass	**Value:**	-47.2 dBc	**Limit:**	≤ -20dBc



Frequency Hopping, 8-DPSK, 3DH5, High Band Edge					
Result:	Pass	**Value:**	-59.5 dBc	**Limit:**	≤ -20dBc



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
Spectrum Analyzer	Agilent	E4440A	AFD	7/5/2011	12
40GHz DC Block	Miteq	DCB4000	AMD	8/5/2010	13
Attenuator 20 dB, SMA M/F 26GHz	S.M. Electronics	SA26B-20	AUY	8/6/2010	12
Antenna, Passive Rod	EMCO	3303	ACA	NCR	0
MXG Vector Signal Generator	Agilent	N5182A	TIF	NCR	0

MEASUREMENT UNCERTAINTY

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 for radiated emissions measurements is less than +/- 4 dB, and for conducted emissions measurements is less than +/- 2.7 dB. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for measurement uncertainty are available upon request.

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 its maximum data rate in a no hop mode. For each transmit frequency, the spectrum was scanned throughout the specified frequency.

NORTHWEST
EMC

Spurious Conducted Emissions

XMit 2011.04.20
PsaTx 2011.07.05

EUT:	**Model: 1481**			**Work Order:**	**MCSO1576**
Serial Number:	**10**			**Date:**	**07/11/11**
Customer:	**Microsoft Corporation**			**Temperature:**	**24°C**
Attendees:	**None**			**Humidity:**	**42%**
Project:	**None**			**Barometric Pres.:**	**29.98 in**
Tested by:	**Rod Peloquin**	**Power:**	**USB**	**Job Site:**	**EV06**

TEST SPECIFICATIONS	TEST METHOD
FCC 15.247:2011	ANSI C63.10:2009

COMMENTS

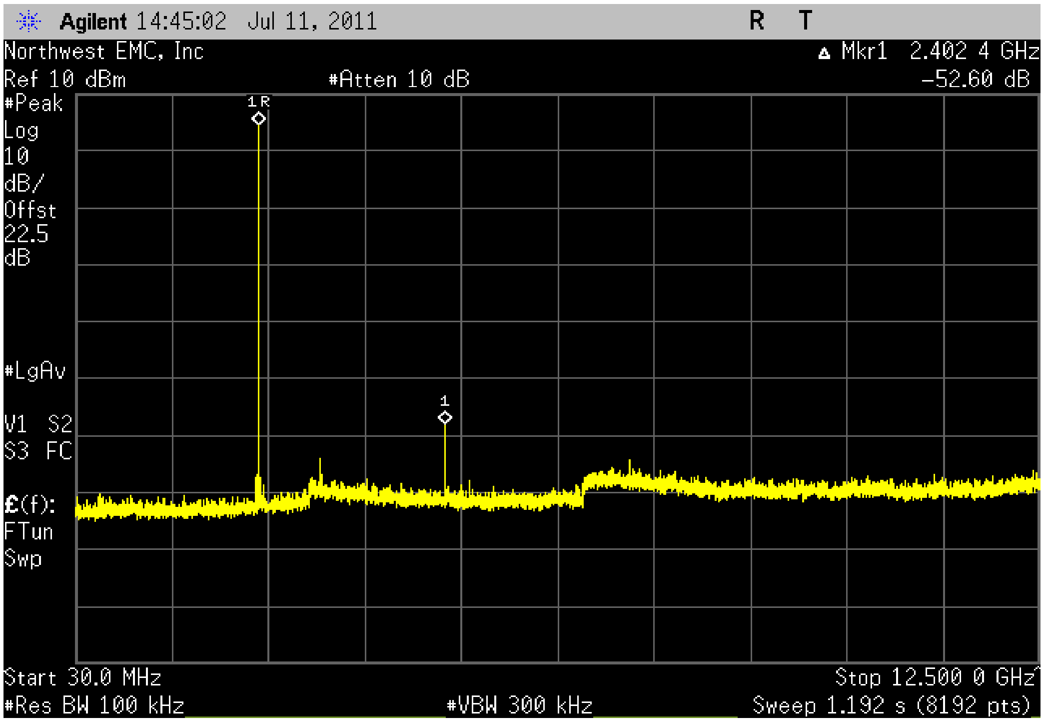
Transmitting Bluetooth Radio. 0.5 dB added for adapter cable

DEVIATIONS FROM TEST STANDARD

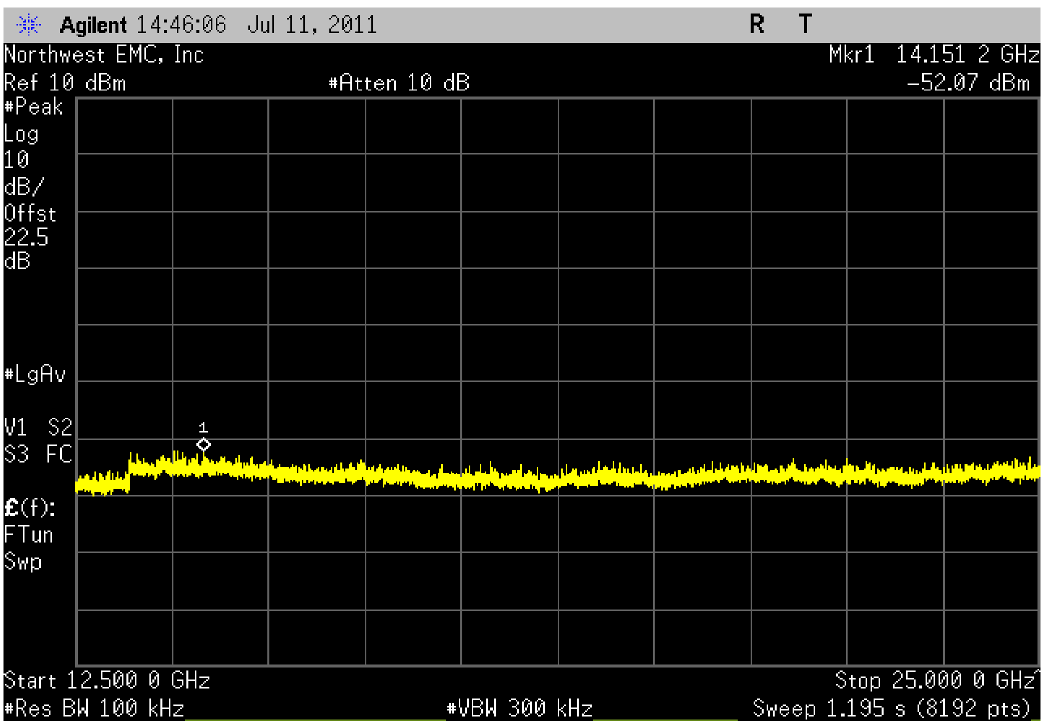
Configuration #	**4**	*Signature*

		Frequency Range	Value	Limit	Result
DH5, GFSK					
	Low Channel	30 MHz - 12.5 GHz	-52.6 dBc	≤ -20 dBc	Pass
	Low Channel	12.5 GHz - 25 GHz	-56.61 dBc	≤ -20 dBc	Pass
	Mid Channel	30 MHz - 12.5 GHz	-53.28 dBc	≤ -20 dBc	Pass
	Mid Channel	12.5 GHz - 25 GHz	-56.42 dBc	≤ -20 dBc	Pass
	High Channel	30 MHz - 12.5 GHz	-55.92 dBc	≤ -20 dBc	Pass
	High Channel	12.5 GHz - 25 GHz	-54.91 dBc	≤ -20 dBc	Pass
2DH5, 4-DQPSK					
	Low Channel	30 MHz - 12.5 GHz	-52 dBc	≤ -20 dBc	Pass
	Low Channel	12.5 GHz - 25 GHz	-50.57 dBc	≤ -20 dBc	Pass
	Mid Channel	30 MHz - 12.5 GHz	-53.73 dBc	≤ -20 dBc	Pass
	Mid Channel	12.5 GHz - 25 GHz	-52.51 dBc	≤ -20 dBc	Pass
	High Channel	30 MHz - 12.5 GHz	-50.79 dBc	≤ -20 dBc	Pass
	High Channel	12.5 GHz - 25 GHz	-50.72 dBc	≤ -20 dBc	Pass
3DH5, 8-DPSK					
	Low Channel	30 MHz - 12.5 GHz	-54.61 dBc	≤ -20 dBc	Pass
	Low Channel	12.5 GHz - 25 GHz	-54.41 dBc	≤ -20 dBc	Pass
	Mid Channel	30 MHz - 12.5 GHz	-55.39 dBc	≤ -20 dBc	Pass
	Mid Channel	12.5 GHz - 25 GHz	-53.9 dBc	≤ -20 dBc	Pass
	High Channel	30 MHz - 12.5 GHz	-51.66 dBc	≤ -20 dBc	Pass
	High Channel	12.5 GHz - 25 GHz	-50.41 dBc	≤ -20 dBc	Pass

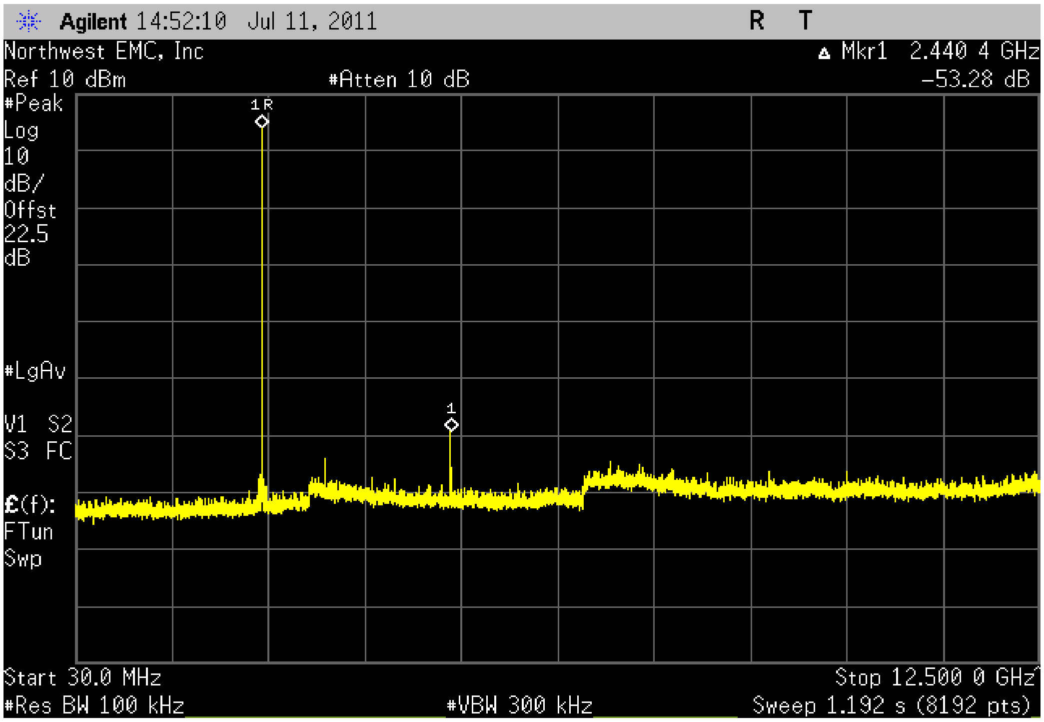
DH5, GFSK, Low Channel				
Frequency Range		**Value**	**Limit**	**Result**
30 MHz - 12.5 GHz		-52.6 dBc	≤ -20 dBc	Pass



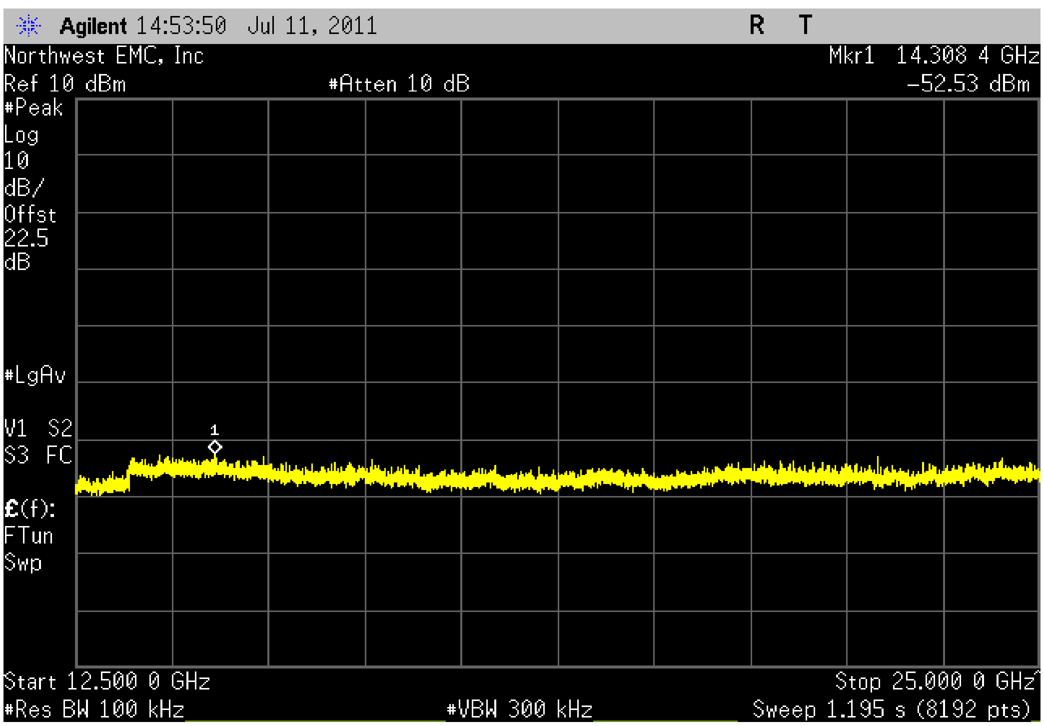
DH5, GFSK, Low Channel				
Frequency Range		**Value**	**Limit**	**Result**
12.5 GHz - 25 GHz		-56.61 dBc	≤ -20 dBc	Pass



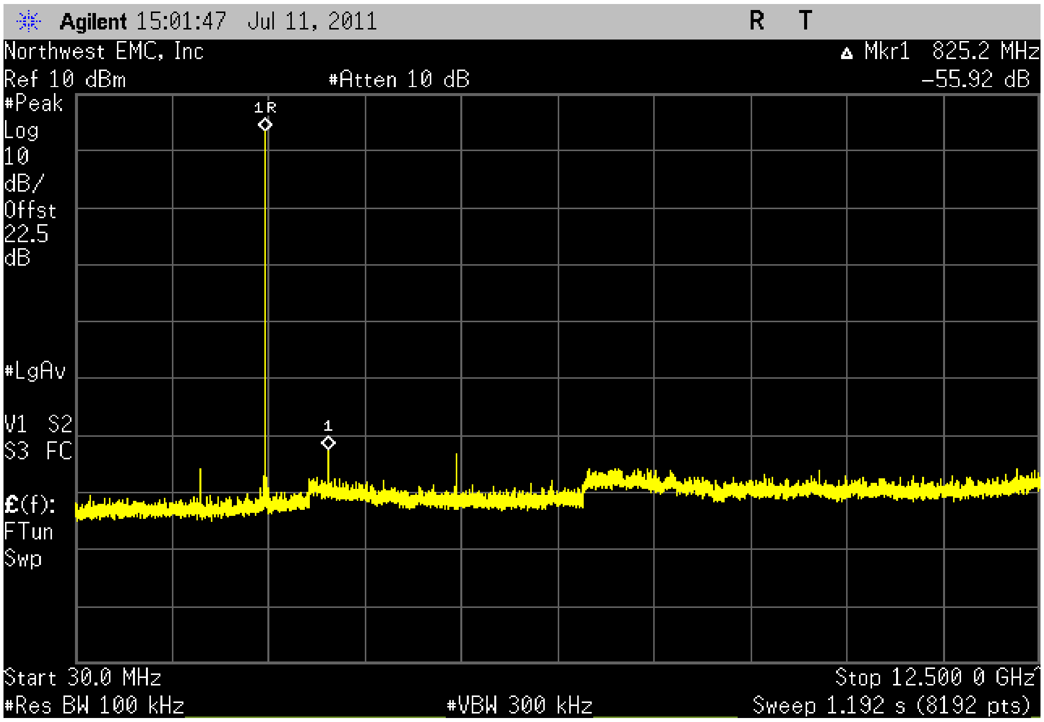
DH5, GFSK, Mid Channel				
Frequency Range		Value	Limit	Result
30 MHz - 12.5 GHz		-53.28 dBc	≤ -20 dBc	Pass



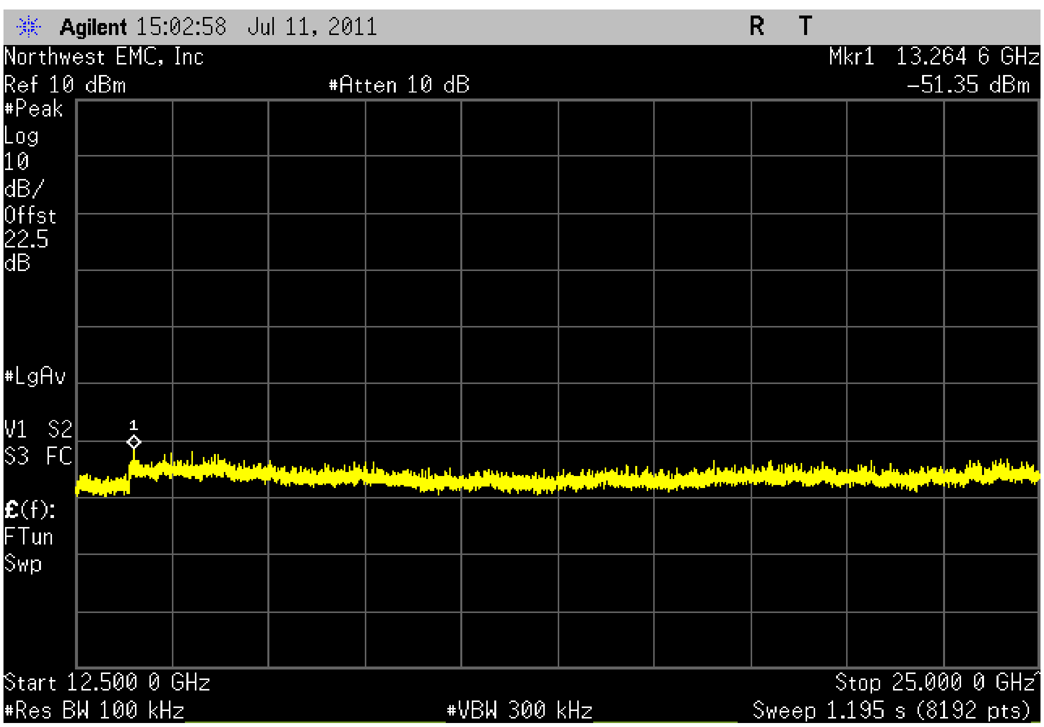
DH5, GFSK, Mid Channel				
Frequency Range		Value	Limit	Result
12.5 GHz - 25 GHz		-56.42 dBc	≤ -20 dBc	Pass



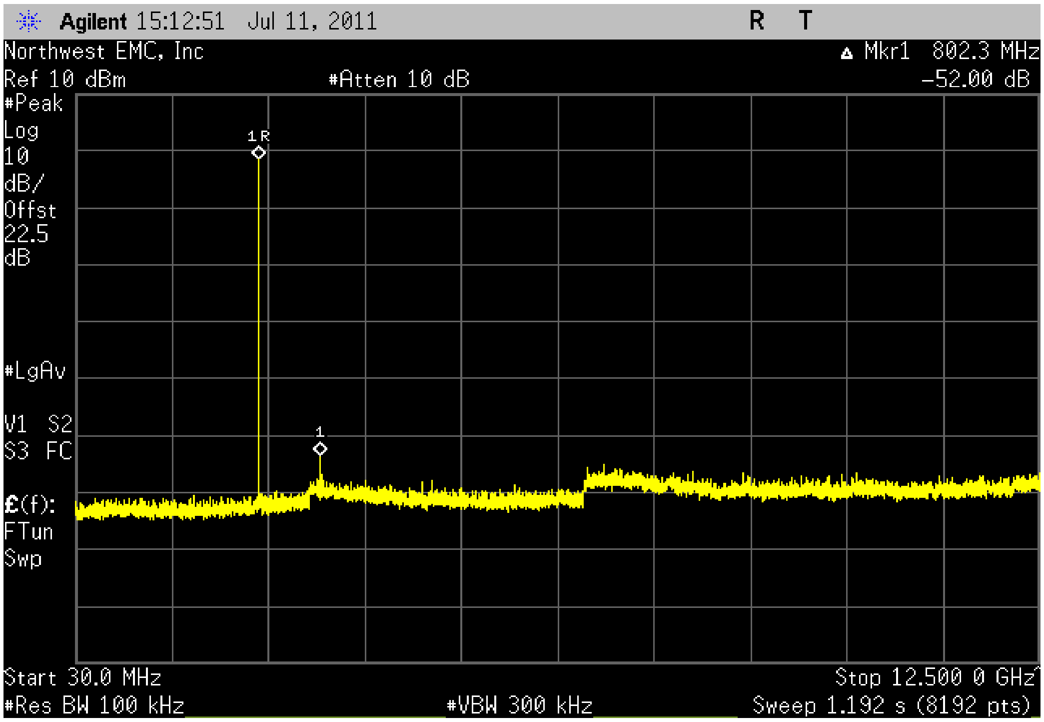
DH5, GFSK, High Channel				
Frequency Range		Value	Limit	Result
30 MHz - 12.5 GHz		-55.92 dBc	≤ -20 dBc	Pass



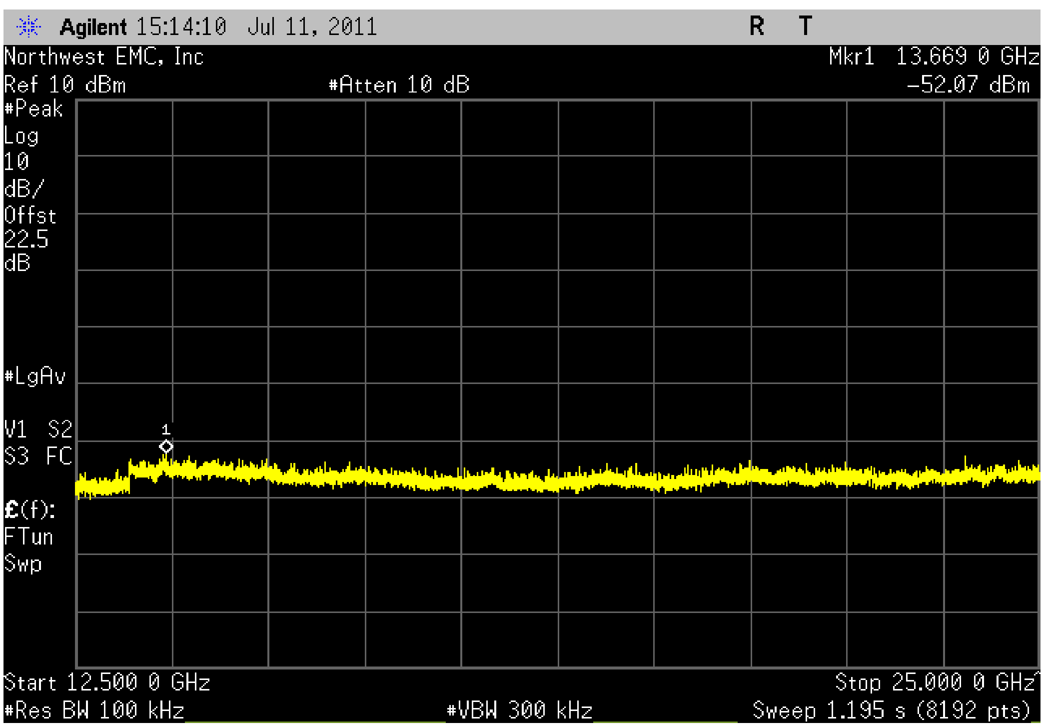
DH5, GFSK, High Channel				
Frequency Range		Value	Limit	Result
12.5 GHz - 25 GHz		-54.91 dBc	≤ -20 dBc	Pass



2DH5, 4-DQPSK, Low Channel				
Frequency Range		Value	Limit	Result
30 MHz - 12.5 GHz		-52 dBc	≤ -20 dBc	Pass

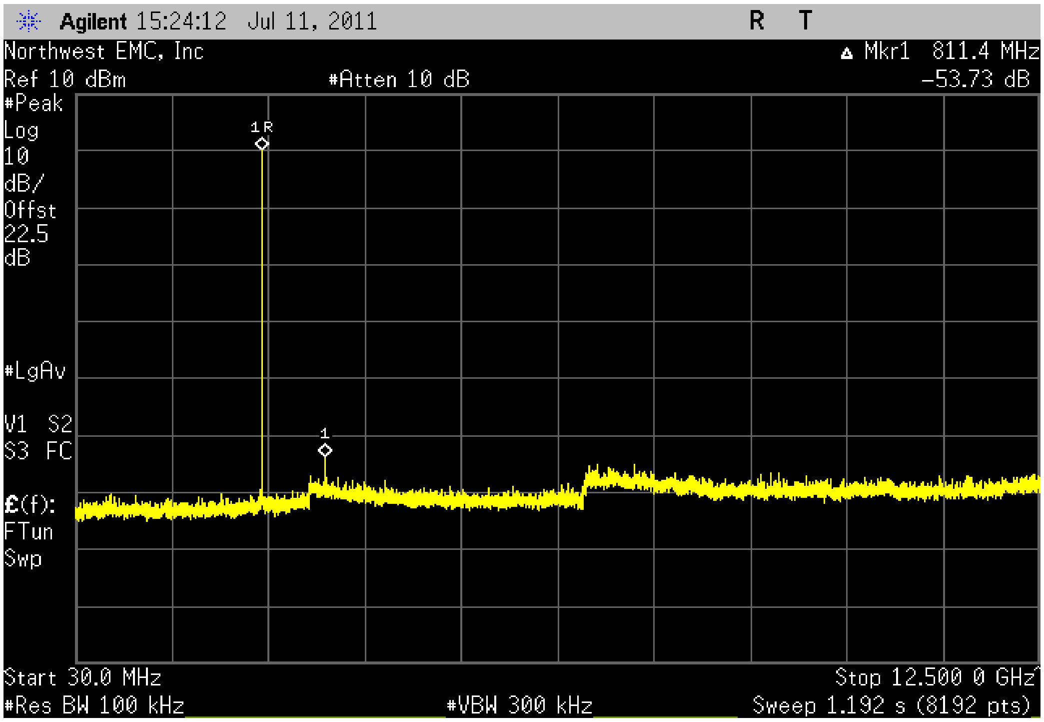


2DH5, 4-DQPSK, Low Channel				
Frequency Range		Value	Limit	Result
12.5 GHz - 25 GHz		-50.57 dBc	≤ -20 dBc	Pass



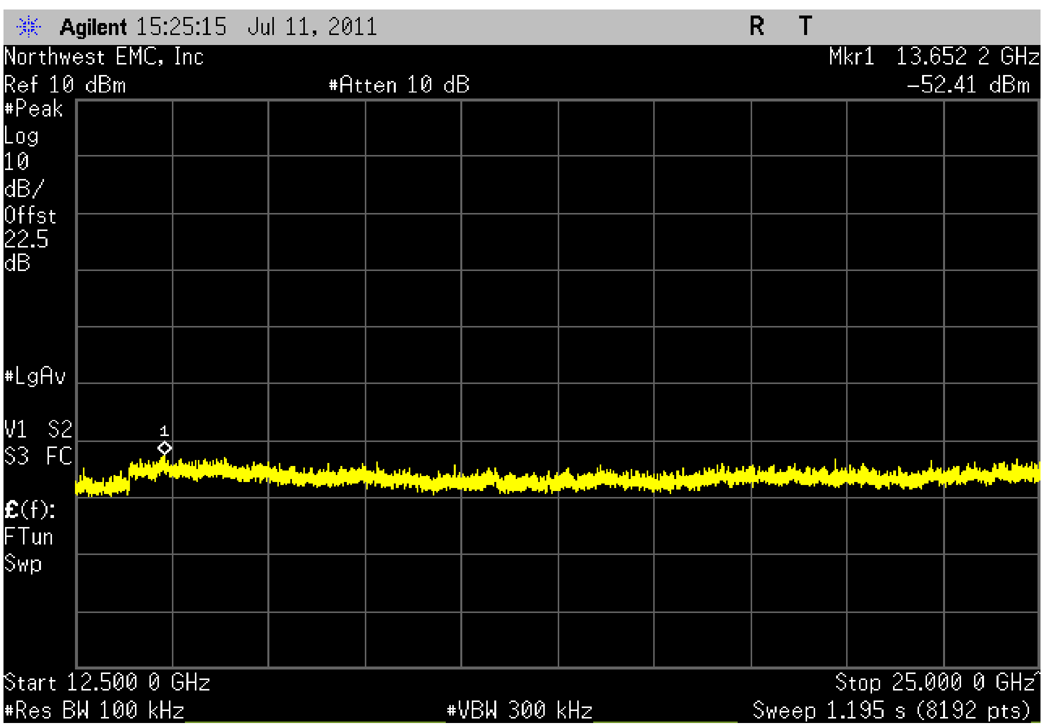
2DH5, 4-DQPSK, Mid Channel

Frequency Range		Value	Limit	Result
30 MHz - 12.5 GHz		-53.73 dBc	≤ -20 dBc	Pass

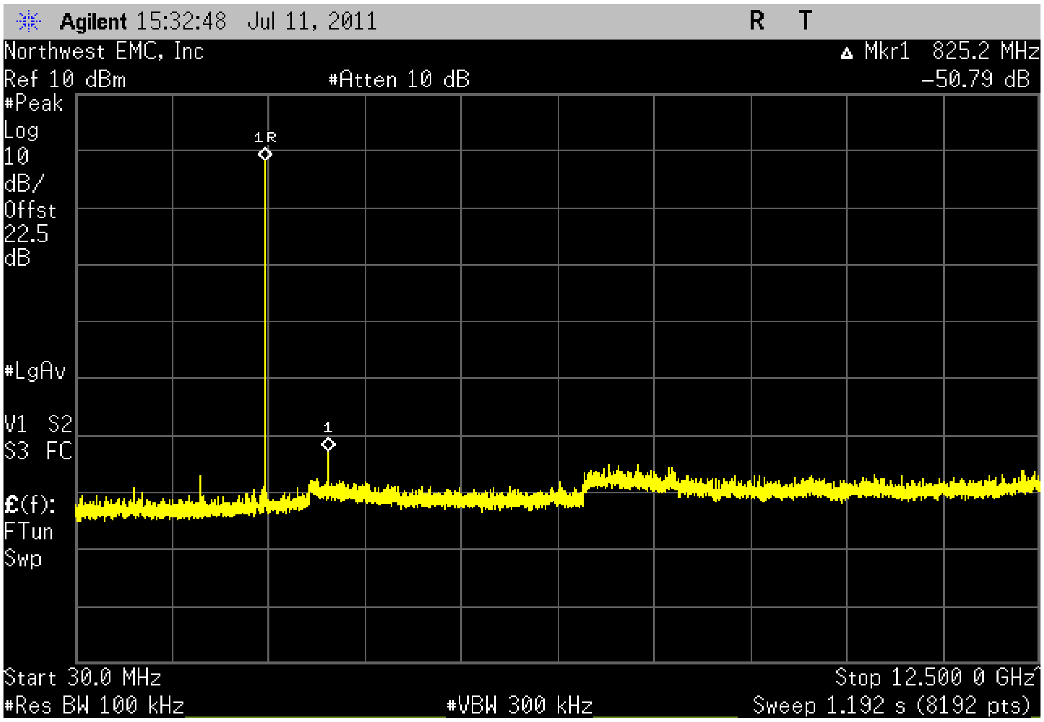


2DH5, 4-DQPSK, Mid Channel

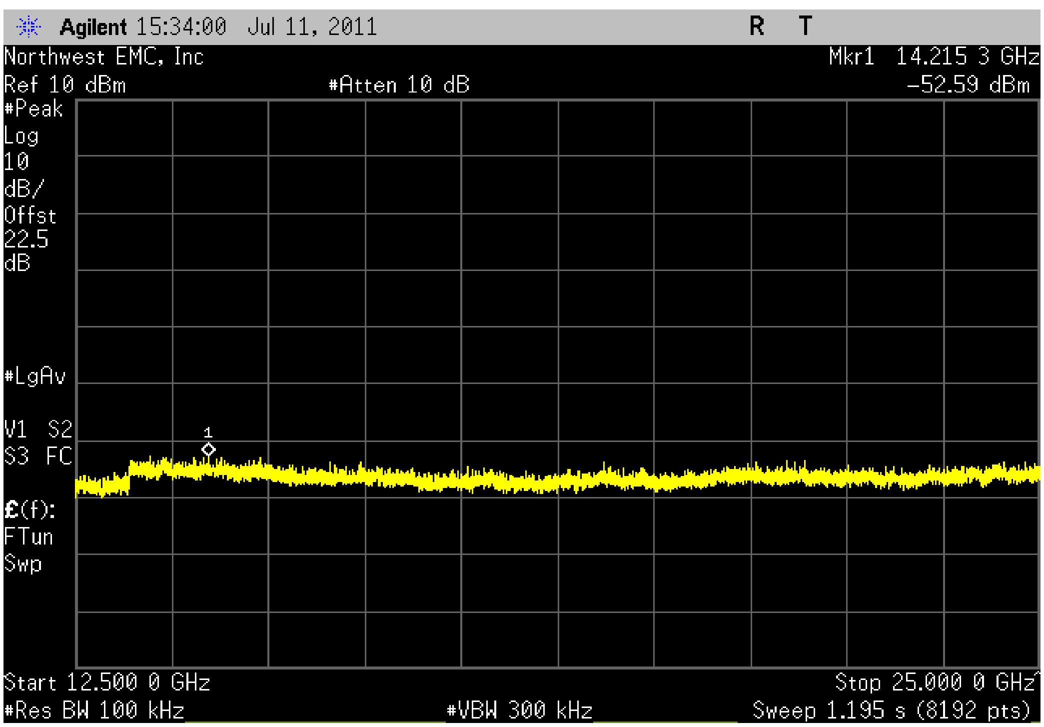
Frequency Range		Value	Limit	Result
12.5 GHz - 25 GHz		-52.51 dBc	≤ -20 dBc	Pass



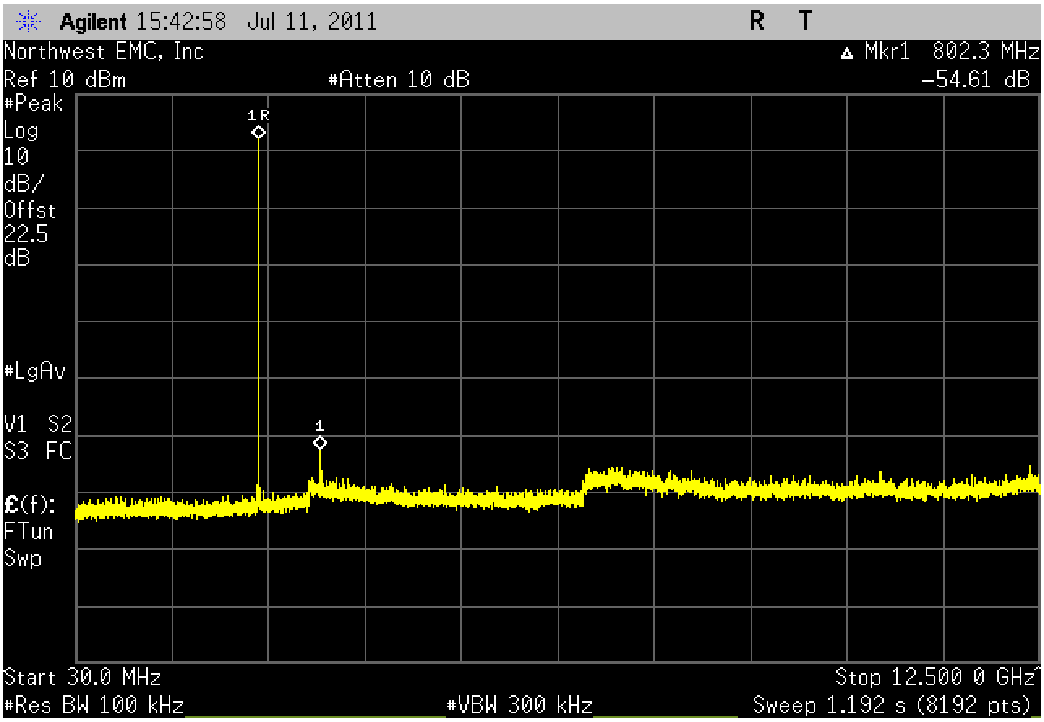
2DH5, 4-DQPSK, High Channel				
Frequency Range		Value	Limit	Result
30 MHz - 12.5 GHz		-50.79 dBc	≤ -20 dBc	Pass



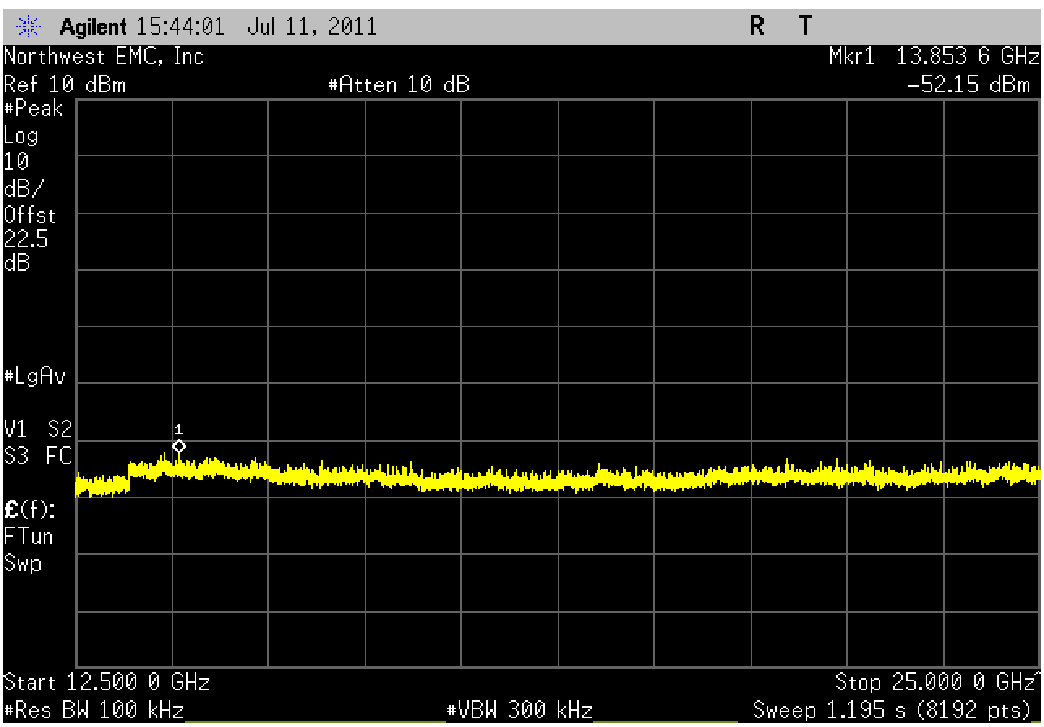
2DH5, 4-DQPSK, High Channel				
Frequency Range		Value	Limit	Result
12.5 GHz - 25 GHz		-50.72 dBc	≤ -20 dBc	Pass



3DH5, 8-DPSK, Low Channel				
Frequency Range		Value	Limit	Result
30 MHz - 12.5 GHz		-54.61 dBc	≤ -20 dBc	Pass

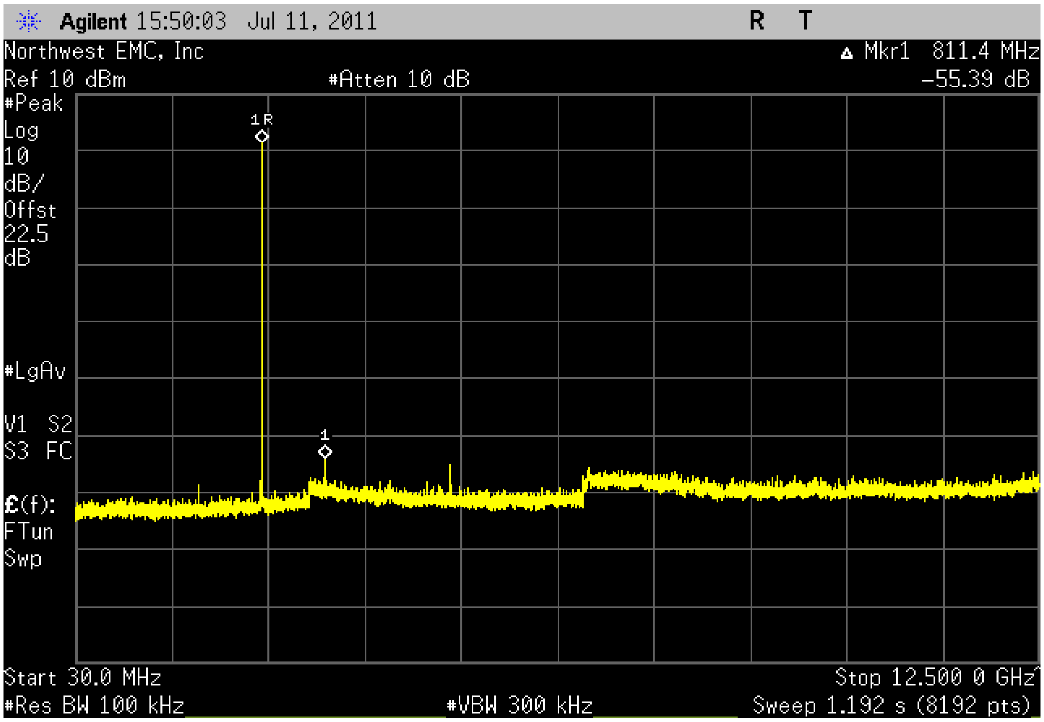


3DH5, 8-DPSK, Low Channel				
Frequency Range		Value	Limit	Result
12.5 GHz - 25 GHz		-54.41 dBc	≤ -20 dBc	Pass



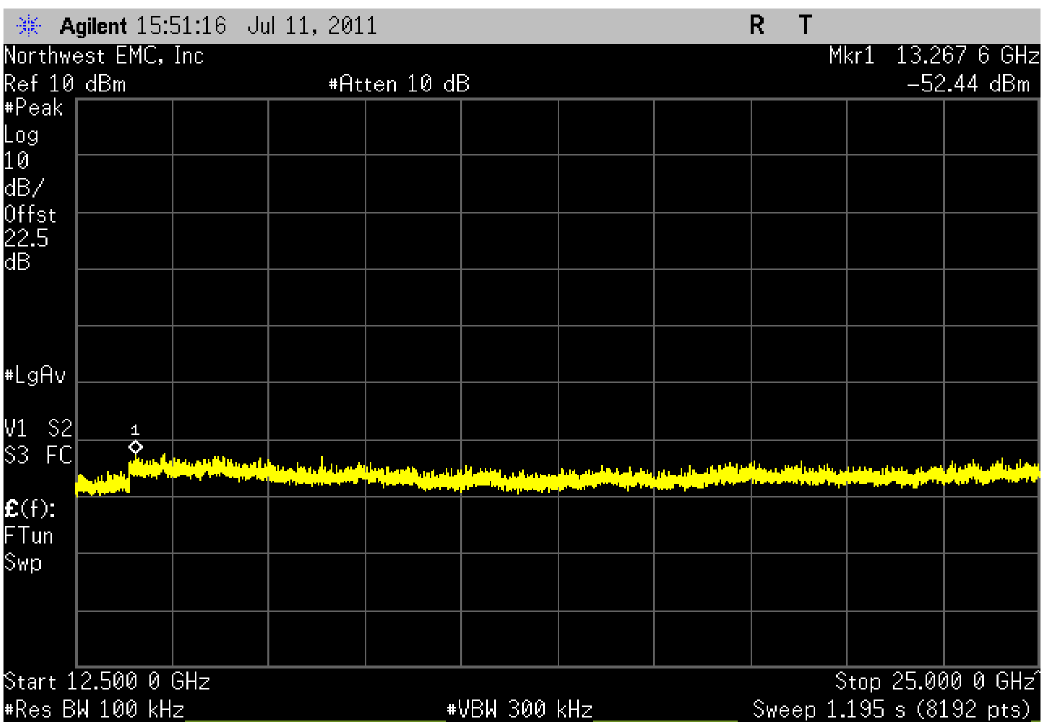
3DH5, 8-DPSK, Mid Channel

Frequency Range		Value	Limit	Result
30 MHz - 12.5 GHz		-55.39 dBc	≤ -20 dBc	Pass

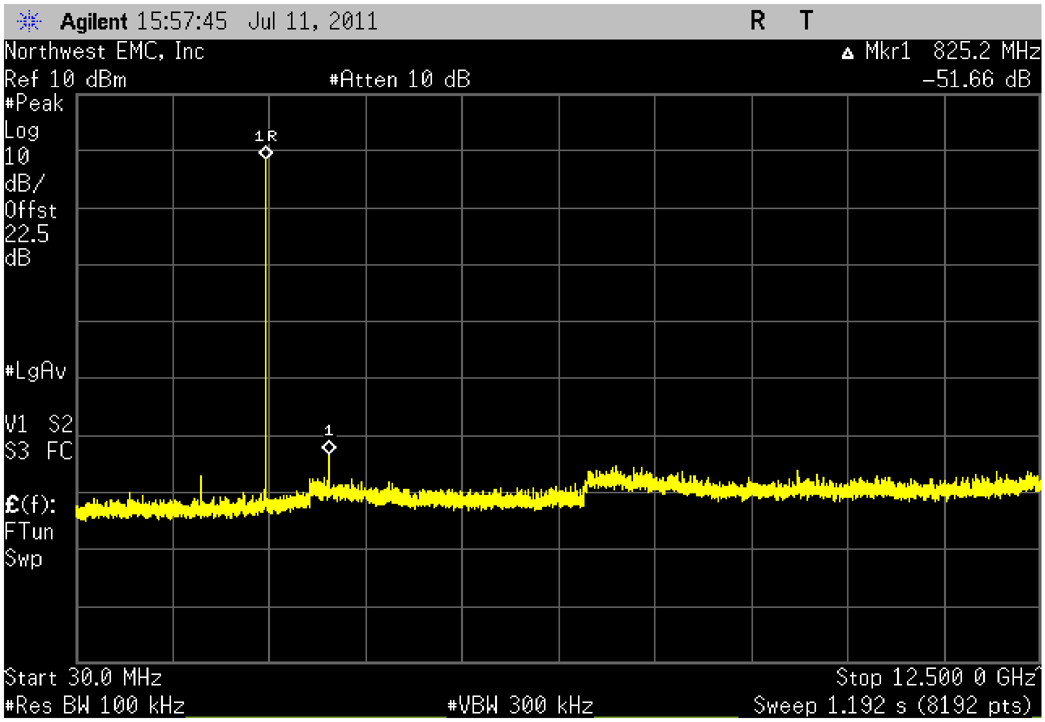


3DH5, 8-DPSK, Mid Channel

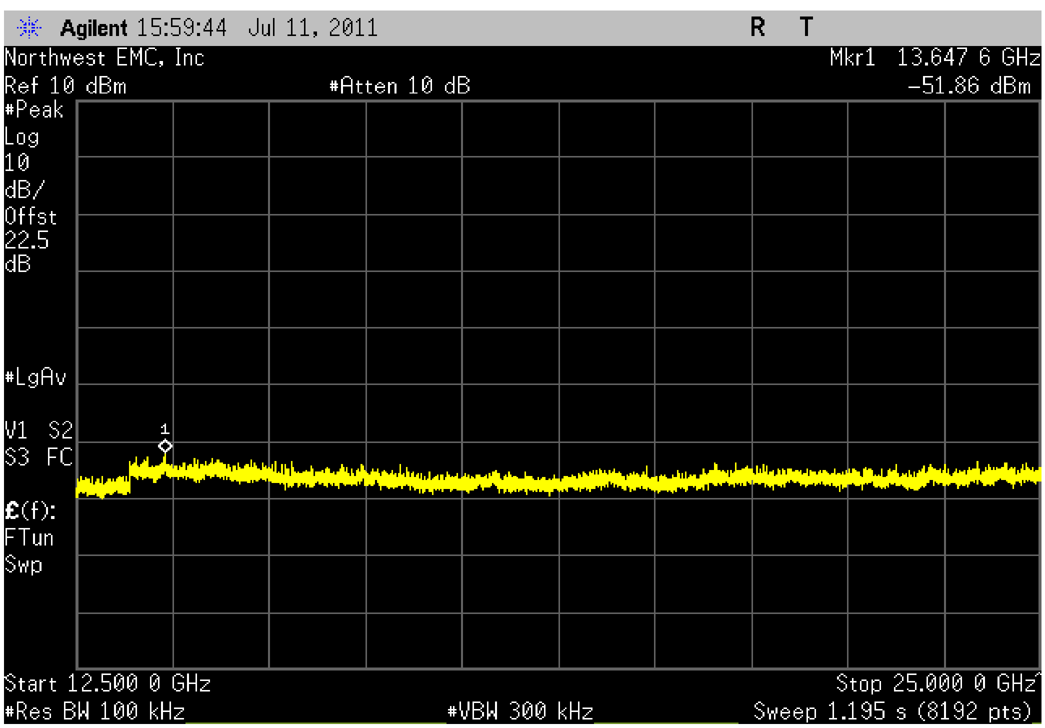
Frequency Range		Value	Limit	Result
12.5 GHz - 25 GHz		-53.9 dBc	≤ -20 dBc	Pass



3DH5, 8-DPSK, High Channel				
Frequency Range		**Value**	**Limit**	**Result**
30 MHz - 12.5 GHz		-51.66 dBc	≤ -20 dBc	Pass



3DH5, 8-DPSK, High Channel				
Frequency Range		**Value**	**Limit**	**Result**
12.5 GHz - 25 GHz		-50.41 dBc	≤ -20 dBc	Pass



Power Spectral Density

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
Spectrum Analyzer	Agilent	E4440A	AFD	7/5/2011	12
40GHz DC Block	Miteq	DCB4000	AMD	8/5/2010	13
Attenuator 20 dB, SMA M/F 26GHz	S.M. Electronics	SA26B-20	AUY	8/6/2010	12
EV06 Direct Connect Cable	ESM Cable Corp.	TT	ECA	NCR	0
MXG Vector Signal Generator	Agilent	N5182A	TIF	NCR	0

MEASUREMENT UNCERTAINTY

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 for radiated emissions measurements is less than +/- 4 dB, and for conducted emissions measurements is less than +/- 2.7 dB. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for measurement uncertainty are available upon request.

TEST DESCRIPTION

The power spectral density measurements were measured with the EUT set to low, mid, 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 its maximum data rate for each modulation type available. ANSI C63.10:2009, Section 6.11.2.3 was followed. The spectrum analyzer was set as follows:

The emission peak was located and zoomed in on within the passband.

a) RBW = 3 kHz

b) VBW = 10 kHz

c) Span = 300 kHz

d) Sweep time = 100s

e) Trace set to MAX

f) The 1 hz Marker Noise function on the analyzer was used. The data was corrected to 3 kHz by adding 34.8 dB to the reading.

NORTHWEST
EMC

XMit 2011.04.20
PsaTx 2011.07.05

Power Spectral Density

EUT:	Model: 1481	Work Order:	MCSO1576
Serial Number:	10	Date:	07/11/11
Customer:	Microsoft Corporation	Temperature:	24°C
Attendees:	None	Humidity:	42%
Project:	None	Barometric Pres.:	29.98 in
Tested by:	Rod Peloquin	Power: USB	Job Site: EV06

TEST SPECIFICATIONS	TEST METHOD
FCC 15.247:2011	ANSI C63.10:2009

COMMENTS

Transmitting Bluetooth Radio. 0.5 dB added for adapter cable

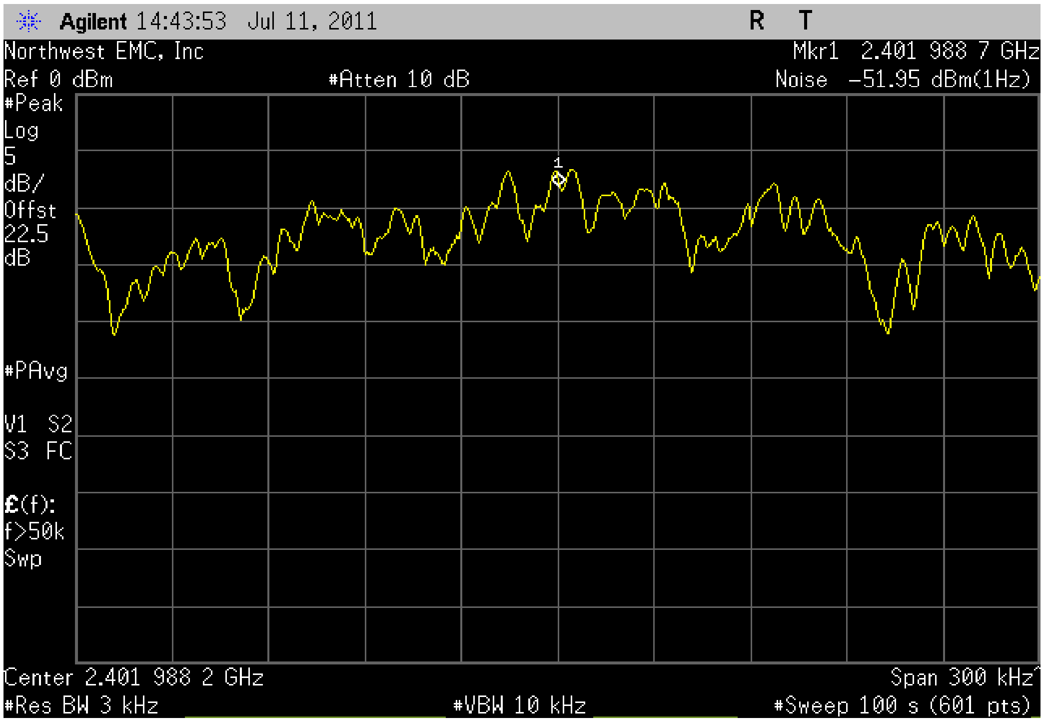
DEVIATIONS FROM TEST STANDARD

Configuration # 4

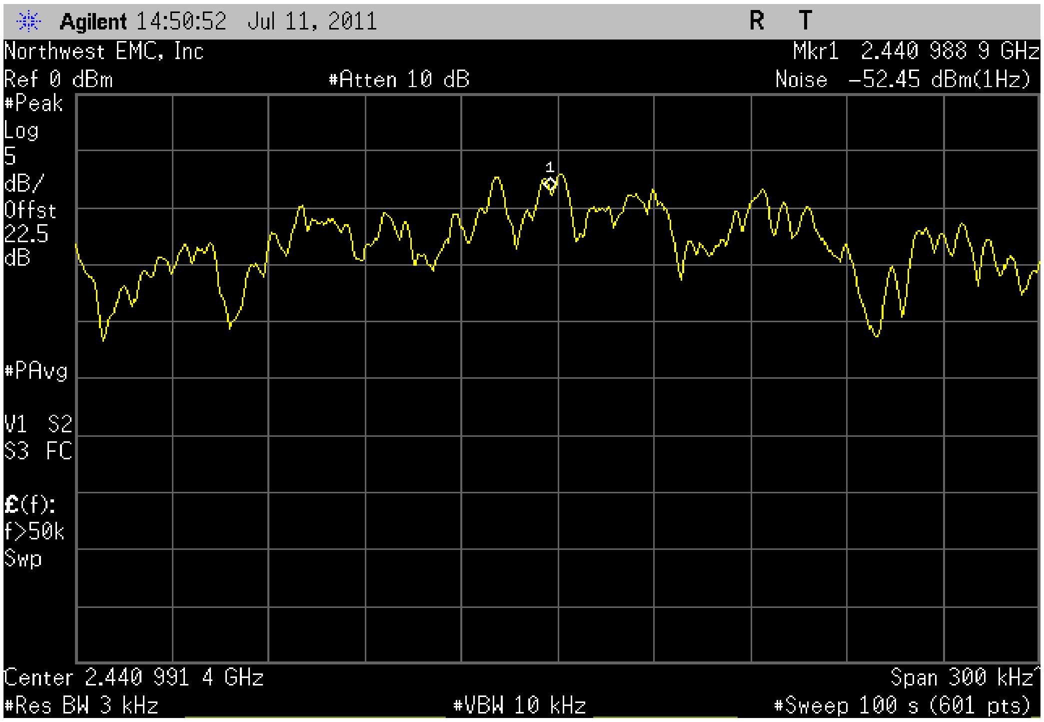
Signature

		Value (dBm / 3 kHz)	Limit (dBm / 3 kHz)	Result
DH5, GFSK				
	Low Channel	-17.152	8	Pass
	Mid Channel	-17.649	8	Pass
	High Channel	-17.942	8	Pass
2DH5, 4-DQPSK				
	Low Channel	-20.211	8	Pass
	Mid Channel	-20.688	8	Pass
	High Channel	-21.85	8	Pass
3DH5, 8-DPSK				
	Low Channel	-20.131	8	Pass
	Mid Channel	-20.837	8	Pass
	High Channel	-21.942	8	Pass

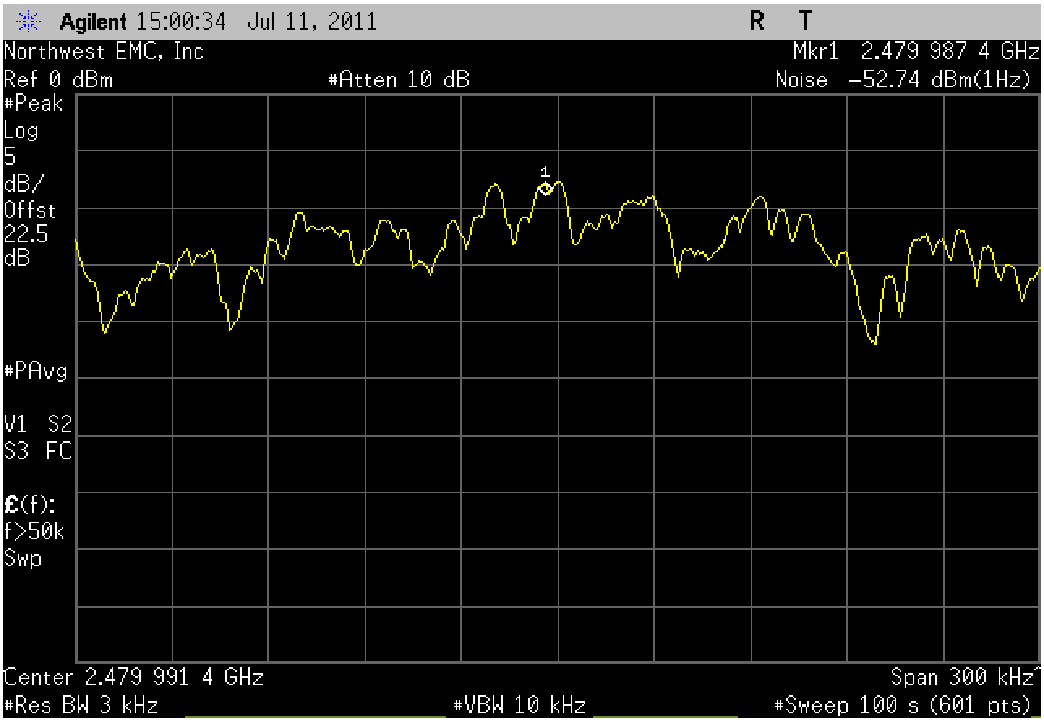
DH5, GFSK, Low Channel							
					Value (dBm / 3 kHz)	Limit (dBm / 3 kHz)	Result
					-17.152	8	Pass



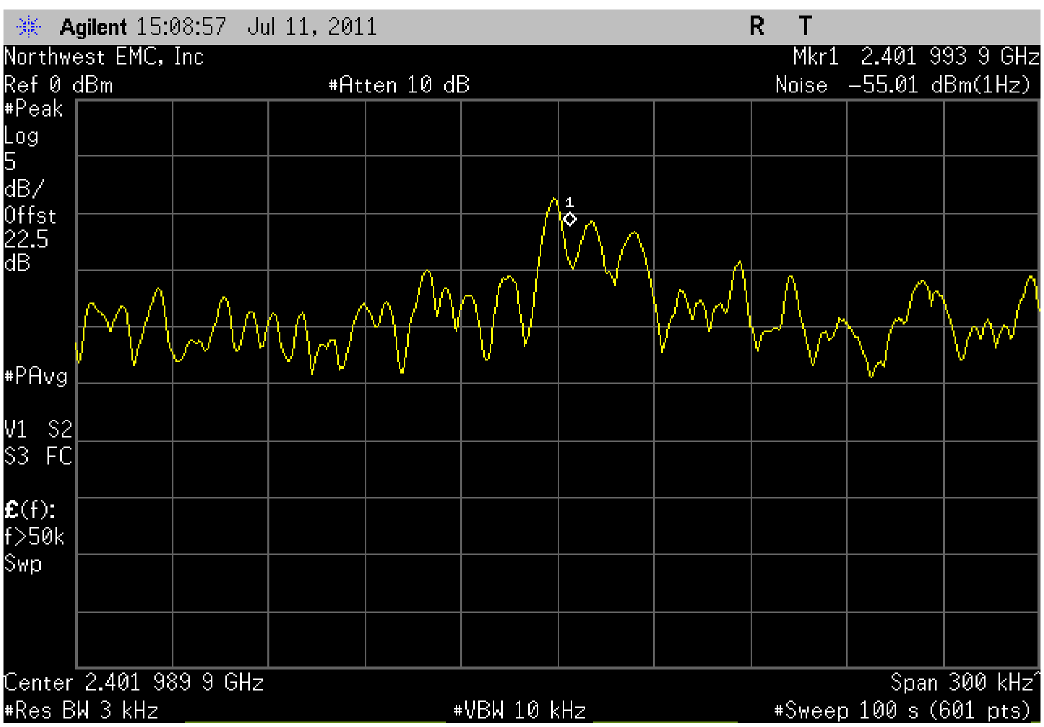
DH5, GFSK, Mid Channel							
					Value (dBm / 3 kHz)	Limit (dBm / 3 kHz)	Result
					-17.649	8	Pass



DH5, GFSK, High Channel		
Value (dBm / 3 kHz)	Limit (dBm / 3 kHz)	Result
-17.942	8	Pass

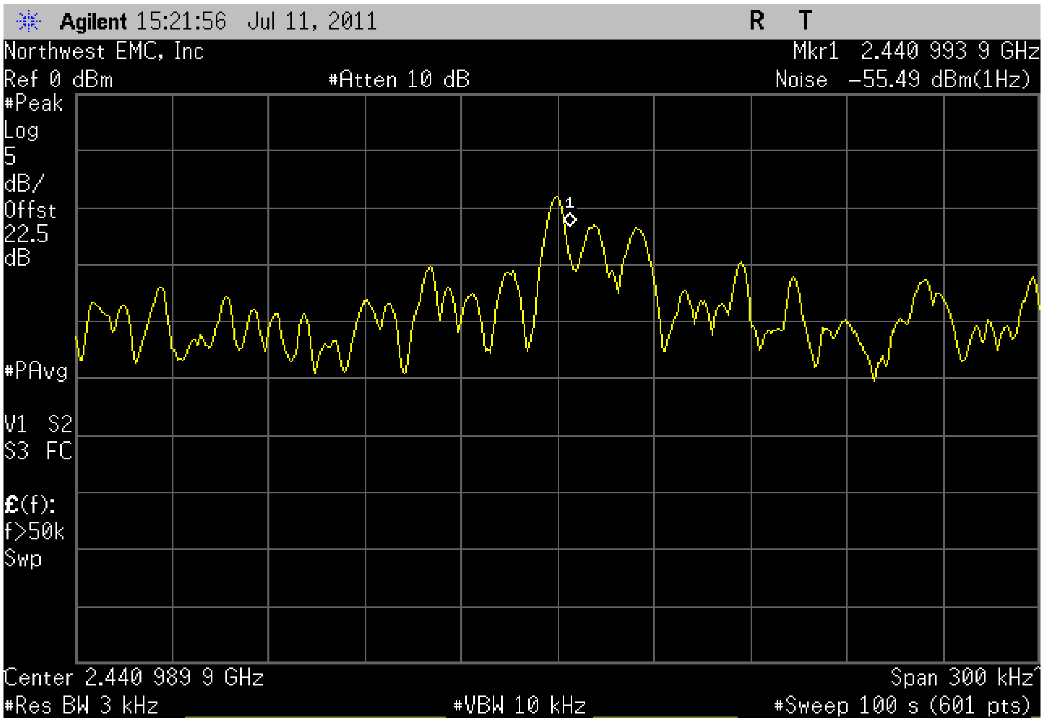


2DH5, 4-DQPSK, Low Channel		
Value (dBm / 3 kHz)	Limit (dBm / 3 kHz)	Result
-20.211	8	Pass



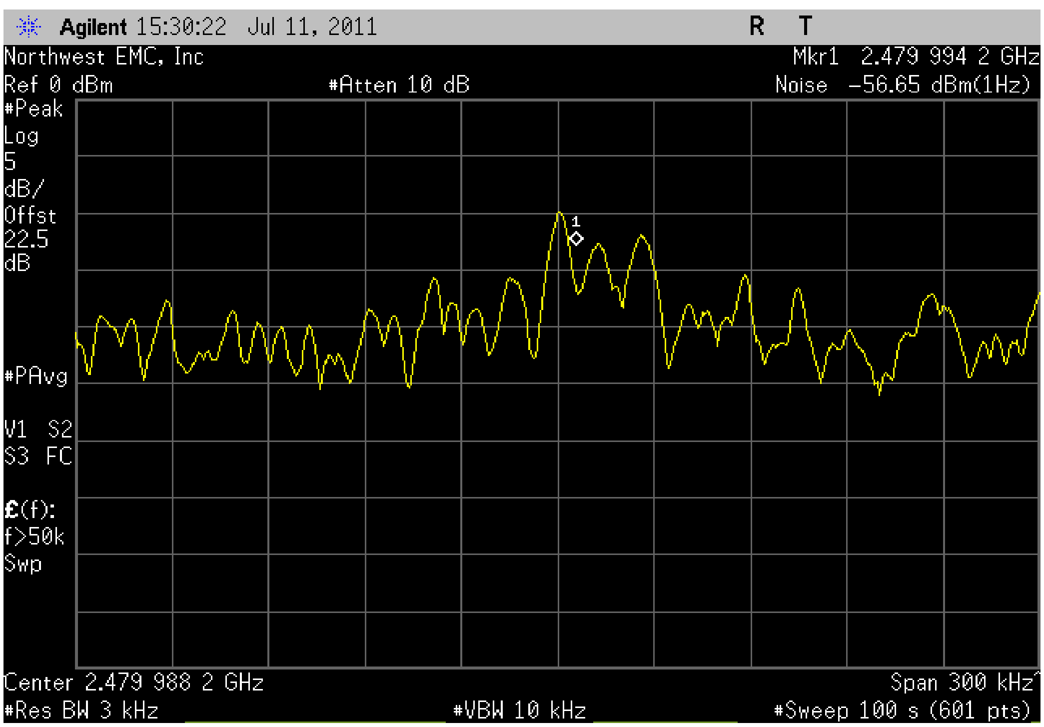
2DH5, 4-DQPSK, Mid Channel

				Value (dBm / 3 kHz)	Limit (dBm / 3 kHz)	Result
				-20.688	8	Pass

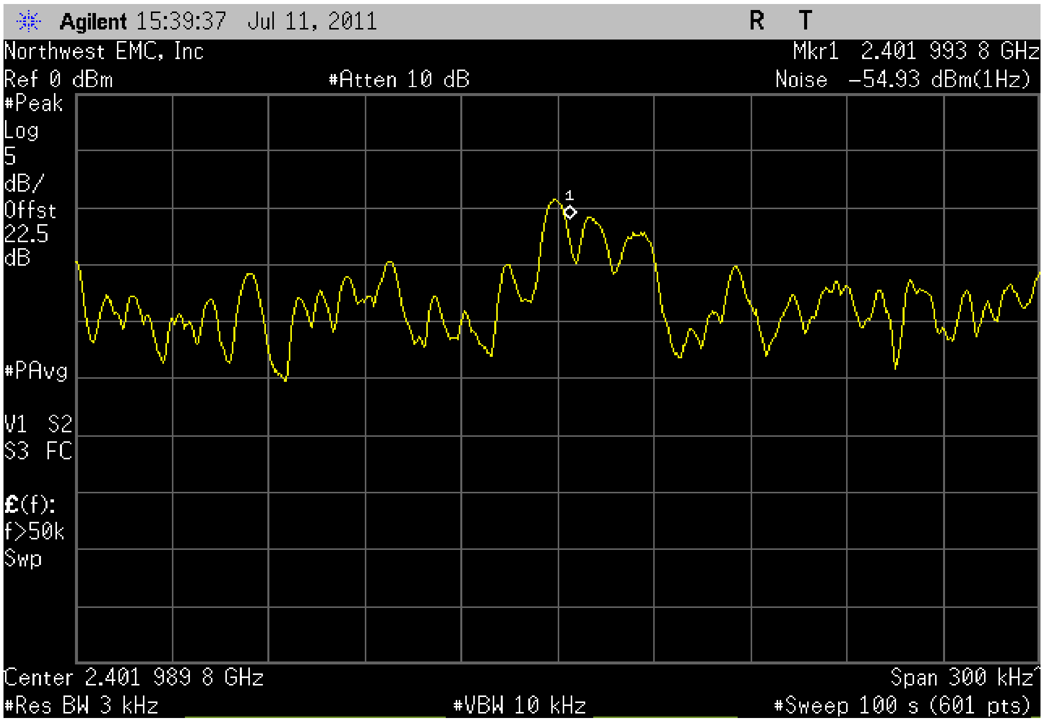


2DH5, 4-DQPSK, High Channel

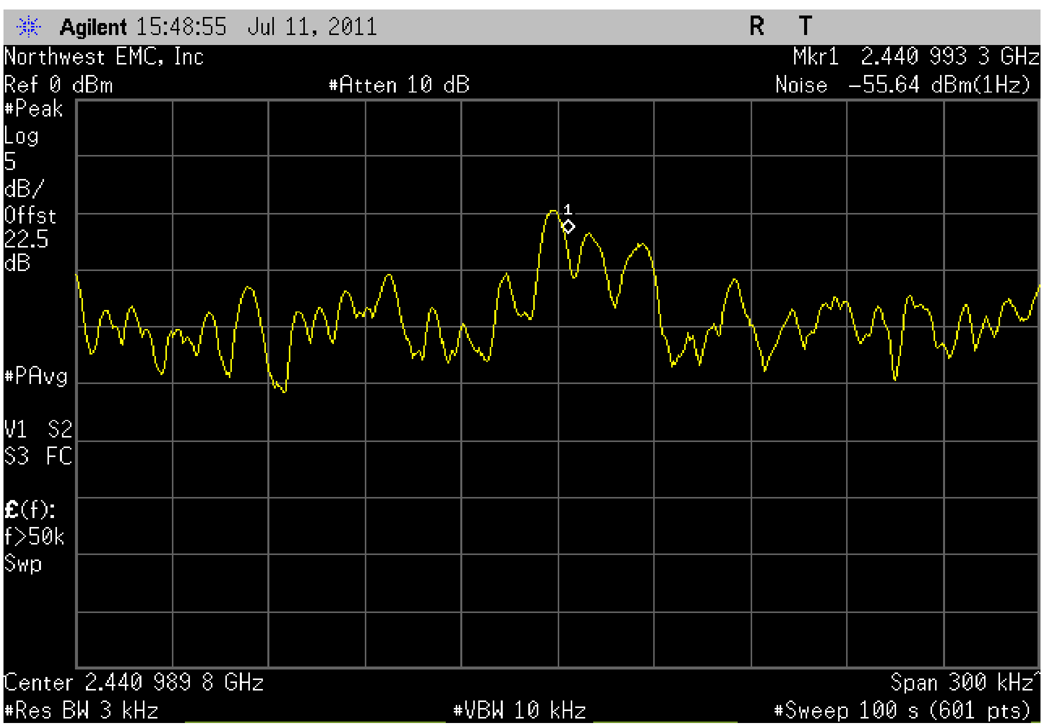
				Value (dBm / 3 kHz)	Limit (dBm / 3 kHz)	Result
				-21.85	8	Pass



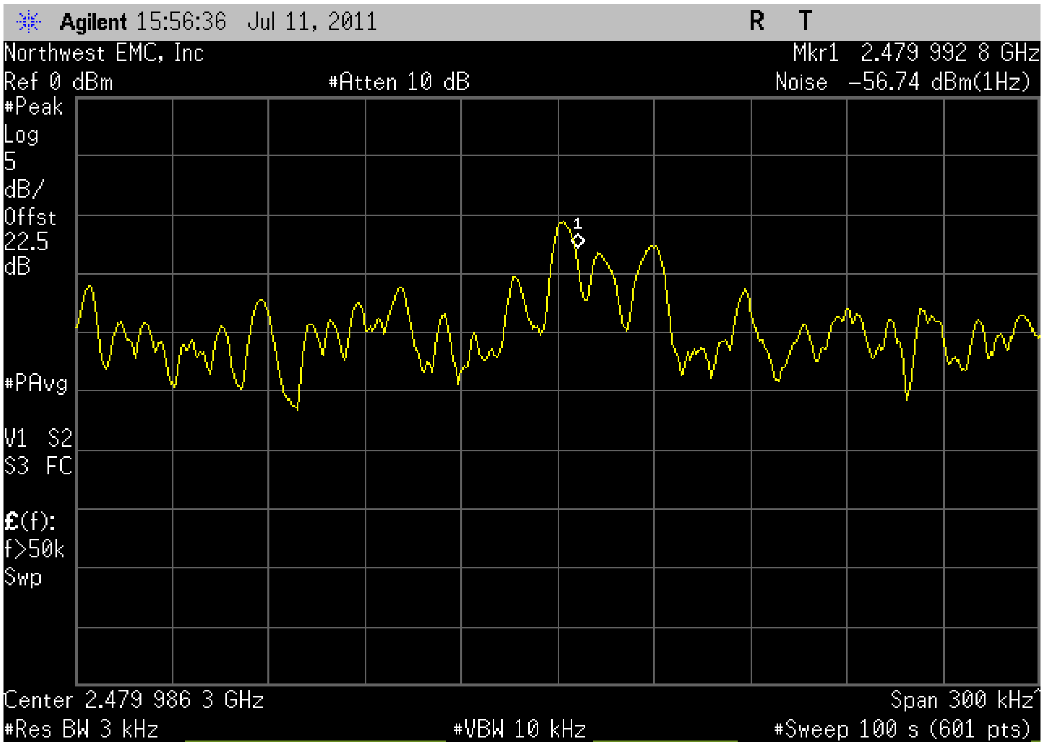
3DH5, 8-DPSK, Low Channel						
				Value (dBm / 3 kHz)	Limit (dBm / 3 kHz)	Result
				-20.131	8	Pass



3DH5, 8-DPSK, Mid Channel						
				Value (dBm / 3 kHz)	Limit (dBm / 3 kHz)	Result
				-20.837	8	Pass



3DH5, 8-DPSK, High Channel							
					Value (dBm / 3 kHz)	Limit (dBm / 3 kHz)	Result
					-21.942	8	Pass



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.

MODES OF OPERATION

Continuous Tx, Bluetooth

POWER SETTINGS INVESTIGATED

5VDC via USB

FREQUENCY RANGE INVESTIGATED

Start Frequency	30MHz	Stop Frequency	25GHz

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
Spectrum Analyzer	Agilent	E4446A	AAQ	6/24/2011	12
High Pass Filter	Micro-Tronics	HPM50111	HFO	8/9/2010	24
Attenuator - 20dB, HF (1000MHz - 18000MHz)	Coaxicom	3910-20	AXZ	6/28/2011	12
EV01 Cables	N/A	Bilog Cables	EVA	6/28/2011	12
EV01 Cables	N/A	Double Ridge Horn Cables	EVB	6/28/2011	12
EV01 Cables	N/A	Standard Gain Horns Cables	EVF	3/2/2011	12
Cable	ESM Cable Corp.	KMKM-72	EVY	9/15/2010	12
Pre-Amplifier	Miteq	AM-1616-1000	AOL	6/28/2011	12
Pre-Amplifier	Miteq	AMF-4D-010100-24-10P	APW	6/28/2011	12
Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVC	3/2/2011	12
Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVD	3/2/2011	12
Pre-Amplifier	Miteq	AMF-6F-18002650-25-10P	AVU	9/15/2010	12
Antenna, Bilog	Teseq	CBL 6141B	AXR	11/29/2010	12
Antenna, Horn	ETS	3115	AIZ	1/24/2011	24
Antenna, Horn	ETS	3160-07	AHU	NCR	0
Antenna, Horn	ETS	3160-08	AHV	NCR	0
Antenna, Horn	ETS Lindgren	3160-09	AIV	NCR	0

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.

MEASUREMENT UNCERTAINTY

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. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4. The measurement uncertainty estimation is available upon request.

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, and manipulating the EUT antenna in 3 orthogonal planes (per ANSI C63.10:2009). A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

NORTHWEST
EMC

Spurious Radiated Emissions

PSA 2011.05.11
EMI 2008.1.9

EUT:	**Model: 1481**			**Work Order:**	**MCSO1581**
Serial Number:	**C31**			**Date:**	**08/03/11**
Customer:	**Microsoft Corporation**			**Temperature:**	**24.8 °C**
Attendees:	**None**			**Humidity:**	**45%**
Project:	**None**			**Barometric Pres.:**	**1013.9 mb**
Tested by:	**Dan Haas**	**Power:**	**5VDC via USB**	**Job Site:**	**EV01**

TEST SPECIFICATIONS	**TEST METHOD**
FCC 15.247:2011	**ANSI C63.10:2009**

TEST PARAMETERS

Antenna Height(s) (m)	1 - 4	**Test Distance (m)**	3

COMMENTS

Powered via USB from remote Laptop PC. See notes for channel, mode, and EUT orientation

EUT OPERATING MODES

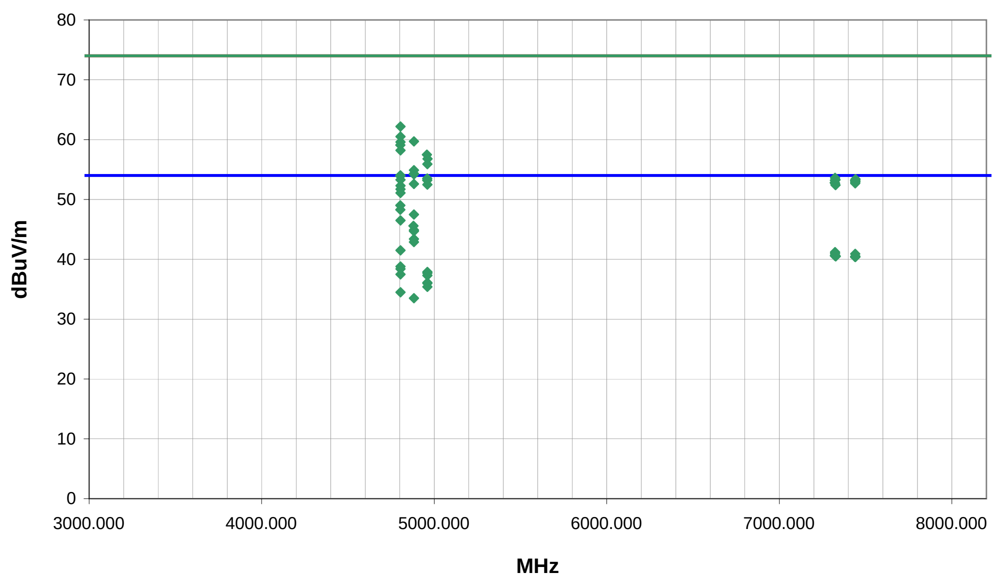
Continuous Tx, Bluetooth

DEVIATIONS FROM TEST STANDARD

No deviations.

Run #	**1**
Configuration #	**1**
Results	**Pass**

Signature



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)	Comments
4804.020	43.9	9.4	206.0	1.0	3.0	0.0	H-Horn	AV	0.0	53.3	54.0	-0.7	Low channel, GFSK/DH5 EUT vertical.
4804.015	42.9	9.4	203.0	1.0	3.0	0.0	V-Horn	AV	0.0	52.3	54.0	-1.7	Low channel, GFSK/DH5 EUT vertical.
4803.960	42.3	9.4	187.0	1.0	3.0	0.0	H-Horn	AV	0.0	51.7	54.0	-2.3	Low channel, GFSK/DH5 EUT on side.
4804.015	41.7	9.4	181.0	1.0	3.0	0.0	H-Horn	AV	0.0	51.1	54.0	-2.9	Low channel, GFSK/DH5 EUT face up.
4882.017	38.1	9.4	360.0	1.2	3.0	0.0	H-Horn	AV	0.0	47.5	54.0	-6.5	Mid channel, GFSK/DH5 EUT vertical
4804.005	37.1	9.4	263.0	1.1	3.0	0.0	V-Horn	AV	0.0	46.5	54.0	-7.5	Low channel, GFSK/DH5 EUT face up.
4882.050	35.5	9.4	202.0	1.2	3.0	0.0	H-Horn	AV	0.0	44.9	54.0	-9.1	Mid channel, GFSK/DH5, EUT face up.
4882.033	35.3	9.4	338.0	1.0	3.0	0.0	V-Horn	AV	0.0	44.7	54.0	-9.3	Mid channel, GFSK/DH5, EUT on side.
4882.033	34.0	9.4	116.0	1.0	3.0	0.0	V-Horn	AV	0.0	43.4	54.0	-10.6	Mid channel, GFSK/DH5 EUT vertical
4882.033	33.5	9.4	171.0	1.2	3.0	0.0	H-Horn	AV	0.0	42.9	54.0	-11.1	Mid channel, GFSK/DH5, EUT on side.
4804.250	52.8	9.4	21.0	1.0	3.0	0.0	H-Horn	PK	0.0	62.2	74.0	-11.8	Low channel, ERD-2/DH5 EUT vertical
4804.030	32.1	9.4	21.0	1.0	3.0	0.0	H-Horn	AV	0.0	41.5	54.0	-12.5	Low channel, ERD-2/DH5 EUT vertical
7323.125	24.6	16.6	256.0	1.0	3.0	0.0	H-Horn	AV	0.0	41.2	54.0	-12.8	Mid channel, GFSK/DH5 EUT vertical
7323.125	24.4	16.6	36.0	2.2	3.0	0.0	V-Horn	AV	0.0	41.0	54.0	-13.0	Mid channel, GFSK/DH5 EUT vertical
7440.033	24.2	16.7	246.0	1.3	3.0	0.0	H-Horn	AV	0.0	40.9	54.0	-13.1	High channel, GFSK/DH5, EUT vertical.
7322.825	24.1	16.6	316.0	2.2	3.0	0.0	V-Horn	AV	0.0	40.7	54.0	-13.3	Mid channel, GFSK/DH5, EUT face up.
7321.958	24.0	16.6	313.0	2.2	3.0	0.0	V-Horn	AV	0.0	40.6	54.0	-13.4	Mid channel, GFSK/DH5, EUT on side.
7326.375	23.9	16.6	127.0	3.3	3.0	0.0	H-Horn	AV	0.0	40.5	54.0	-13.5	Mid channel, GFSK/DH5, EUT on side.
7326.533	23.9	16.6	31.0	3.2	3.0	0.0	H-Horn	AV	0.0	40.5	54.0	-13.5	Mid channel, GFSK/DH5, EUT face up.
7440.408	23.8	16.7	234.0	1.4	3.0	0.0	V-Horn	AV	0.0	40.5	54.0	-13.5	High channel, GFSK/DH5, EUT vertical.
4804.165	51.1	9.4	206.0	1.0	3.0	0.0	H-Horn	PK	0.0	60.5	74.0	-13.5	Low channel, GFSK/DH5 EUT vertical.
7438.492	23.7	16.7	118.0	3.3	3.0	0.0	V-Horn	AV	0.0	40.4	54.0	-13.6	High channel, GFSK/DH5 EUT on side.
7439.800	23.7	16.7	27.0	1.3	3.0	0.0	H-Horn	AV	0.0	40.4	54.0	-13.6	High channel, GFSK/DH5 EUT face up.
7440.508	23.7	16.7	0.0	2.0	3.0	0.0	V-Horn	AV	0.0	40.4	54.0	-13.6	High channel, GFSK/DH5 EUT face up.
7440.775	23.7	16.7	102.0	1.2	3.0	0.0	H-Horn	AV	0.0	40.4	54.0	-13.6	High channel, GFSK/DH5 EUT on side.
4882.533	50.3	9.4	360.0	1.2	3.0	0.0	H-Horn	PK	0.0	59.7	74.0	-14.3	Mid channel, GFSK/DH5 EUT vertical
4804.250	50.2	9.4	203.0	1.0	3.0	0.0	V-Horn	PK	0.0	59.6	74.0	-14.4	Low channel, GFSK/DH5 EUT vertical.
4803.615	49.7	9.4	187.0	1.0	3.0	0.0	H-Horn	PK	0.0	59.1	74.0	-14.9	Low channel, GFSK/DH5 EUT on side.
4804.040	29.4	9.4	360.0	1.8	3.0	0.0	V-Horn	AV	0.0	38.8	54.0	-15.2	Low channel, GFSK/DH5 EUT on side.
4804.005	29.0	9.4	120.0	1.1	3.0	0.0	V-Horn	AV	0.0	38.4	54.0	-15.6	Low channel, ERD-2/DH5 EUT vertical
4804.255	48.8	9.4	181.0	1.0	3.0	0.0	H-Horn	PK	0.0	58.2	74.0	-15.8	Low channel, GFSK/DH5 EUT face up.
4960.000	28.4	9.5	299.0	1.9	3.0	0.0	V-Horn	AV	0.0	37.9	54.0	-16.1	High channel, GFSK/DH5 EUT on side.
4960.017	28.2	9.5	271.0	1.3	3.0	0.0	H-Horn	AV	0.0	37.7	54.0	-16.3	High channel, GFSK/DH5 EUT on side.
4803.990	28.1	9.4	13.0	1.0	3.0	0.0	H-Horn	AV	0.0	37.5	54.0	-16.5	Low channel, ERD3/DH5 EUT vertical
4957.533	48.0	9.5	299.0	1.9	3.0	0.0	V-Horn	PK	0.0	57.5	74.0	-16.5	High channel, GFSK/DH5 EUT on side.
4960.017	27.8	9.5	360.0	1.1	3.0	0.0	H-Horn	AV	0.0	37.3	54.0	-16.7	High channel, GFSK/DH5, EUT vertical.
4960.733	47.3	9.5	271.0	1.3	3.0	0.0	H-Horn	PK	0.0	56.8	74.0	-17.2	High channel, GFSK/DH5 EUT on side.
4960.083	26.6	9.5	29.0	1.9	3.0	0.0	V-Horn	AV	0.0	36.1	54.0	-17.9	High channel, GFSK/DH5, EUT vertical.

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)	Comments
4960.025	26.5	9.5	159.0	1.0	3.0	0.0	V-Horn	AV	0.0	36.0	54.0	-18.0	High channel, GFSK/DH5 EUT face up.
4959.750	46.4	9.5	360.0	1.1	3.0	0.0	H-Horn	PK	0.0	55.9	74.0	-18.1	High channel, GFSK/DH5, EUT vertical.
4959.975	25.9	9.5	248.0	1.4	3.0	0.0	H-Horn	AV	0.0	35.4	54.0	-18.6	High channel, GFSK/DH5 EUT face up.
4881.867	45.5	9.4	338.0	1.0	3.0	0.0	V-Horn	PK	0.0	54.9	74.0	-19.1	Mid channel, GFSK/DH5, EUT on side.
4804.150	25.1	9.4	108.0	1.1	3.0	0.0	V-Horn	AV	0.0	34.5	54.0	-19.5	Low channel, ERD3/DH5 EUT vertical
4882.142	44.9	9.4	116.0	1.0	3.0	0.0	V-Horn	PK	0.0	54.3	74.0	-19.7	Mid channel, GFSK/DH5 EUT vertical
4882.358	44.8	9.4	202.0	1.2	3.0	0.0	H-Horn	PK	0.0	54.2	74.0	-19.8	Mid channel, GFSK/DH5, EUT face up.
4803.790	44.6	9.4	120.0	1.1	3.0	0.0	V-Horn	PK	0.0	54.0	74.0	-20.0	Low channel, ERD-2/DH5 EUT vertical
4804.040	44.6	9.4	263.0	1.1	3.0	0.0	V-Horn	PK	0.0	54.0	74.0	-20.0	Low channel, GFSK/DH5 EUT face up.
4803.795	44.5	9.4	13.0	1.0	3.0	0.0	H-Horn	PK	0.0	53.9	74.0	-20.1	Low channel, ERD3/DH5 EUT vertical
7322.767	37.0	16.6	256.0	1.0	3.0	0.0	H-Horn	PK	0.0	53.6	74.0	-20.4	Mid channel, GFSK/DH5 EUT vertical
4881.975	24.1	9.4	115.0	1.5	3.0	0.0	V-Horn	AV	0.0	33.5	54.0	-20.5	Mid channel, GFSK/DH5, EUT face up.
4959.308	44.0	9.5	159.0	1.0	3.0	0.0	V-Horn	PK	0.0	53.5	74.0	-20.5	High channel, GFSK/DH5 EUT face up.
7441.783	36.7	16.7	27.0	1.3	3.0	0.0	H-Horn	PK	0.0	53.4	74.0	-20.6	High channel, GFSK/DH5 EUT face up.
7325.392	36.7	16.6	36.0	2.2	3.0	0.0	V-Horn	PK	0.0	53.3	74.0	-20.7	Mid channel, GFSK/DH5 EUT vertical
4959.325	43.7	9.5	29.0	1.9	3.0	0.0	V-Horn	PK	0.0	53.2	74.0	-20.8	High channel, GFSK/DH5, EUT vertical.
7321.683	36.6	16.6	316.0	2.2	3.0	0.0	V-Horn	PK	0.0	53.2	74.0	-20.8	Mid channel, GFSK/DH5, EUT face up.
7439.183	36.5	16.7	0.0	2.0	3.0	0.0	V-Horn	PK	0.0	53.2	74.0	-20.8	High channel, GFSK/DH5 EUT face up.
7440.933	36.4	16.7	246.0	1.3	3.0	0.0	H-Horn	PK	0.0	53.1	74.0	-20.9	High channel, GFSK/DH5, EUT vertical.
7440.875	36.3	16.7	102.0	1.2	3.0	0.0	H-Horn	PK	0.0	53.0	74.0	-21.0	High channel, GFSK/DH5 EUT on side.
7439.400	36.2	16.7	118.0	3.3	3.0	0.0	V-Horn	PK	0.0	52.9	74.0	-21.1	High channel, GFSK/DH5 EUT on side.
7320.942	36.2	16.6	313.0	2.2	3.0	0.0	V-Horn	PK	0.0	52.8	74.0	-21.2	Mid channel, GFSK/DH5, EUT on side.
7323.058	36.1	16.6	31.0	3.2	3.0	0.0	H-Horn	PK	0.0	52.7	74.0	-21.3	Mid channel, GFSK/DH5, EUT face up.
7439.700	36.0	16.7	234.0	1.4	3.0	0.0	V-Horn	PK	0.0	52.7	74.0	-21.3	High channel, GFSK/DH5, EUT vertical.
4881.858	43.2	9.4	171.0	1.2	3.0	0.0	H-Horn	PK	0.0	52.6	74.0	-21.4	Mid channel, GFSK/DH5, EUT on side.
4960.108	43.0	9.5	248.0	1.4	3.0	0.0	H-Horn	PK	0.0	52.5	74.0	-21.5	High channel, GFSK/DH5 EUT face up.
7325.483	35.8	16.6	127.0	3.3	3.0	0.0	H-Horn	PK	0.0	52.4	74.0	-21.6	Mid channel, GFSK/DH5, EUT on side.
4803.675	39.6	9.4	360.0	1.8	3.0	0.0	V-Horn	PK	0.0	49.0	74.0	-25.0	Low channel, GFSK/DH5 EUT on side.
4803.500	38.9	9.4	108.0	1.1	3.0	0.0	V-Horn	PK	0.0	48.3	74.0	-25.7	Low channel, ERD3/DH5 EUT vertical
4879.867	36.2	9.4	115.0	1.5	3.0	0.0	V-Horn	PK	0.0	45.6	74.0	-28.4	Mid channel, GFSK/DH5, EUT face up.

NORTHWEST
EMC

Spurious Radiated Emissions

PSA 2011.05.11
EMI 2008.1.9

EUT:	Model: 1481	Work Order:	MCSO1581
Serial Number:	C31	Date:	08/03/11
Customer:	Microsoft Corporation	Temperature:	24.8 °C
Attendees:	None	Humidity:	45%
Project:	None	Barometric Pres.:	1013.9 mb
Tested by:	Dan Haas Power: 5VDC via USB	Job Site:	EV01

TEST SPECIFICATIONS	TEST METHOD
FCC 15.247:2011	ANSI C63.10:2009

TEST PARAMETERS

Antenna Height(s) (m)	1 - 4	Test Distance (m)	3

COMMENTS

Powered via USB from remote Laptop PC. See notes for mode and EUT orientation.

EUT OPERATING MODES

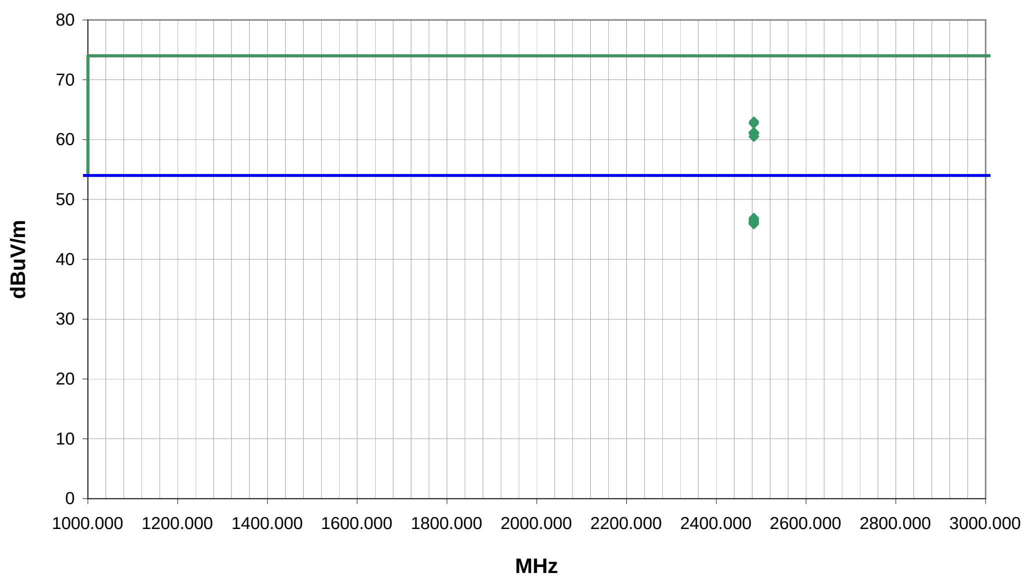
Continuous Tx, Bluetooth, High channel

DEVIATIONS FROM TEST STANDARD

No deviations.

Run #	2
Configuration #	1
Results	Pass

Signature



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)	Comments
2483.507	24.6	2.3	217.0	1.0	3.0	20.0	V-Horn	AV	0.0	46.9	54.0	-7.1	GFSK/DH5, EUT vertical.
2483.500	24.5	2.3	205.0	1.1	3.0	20.0	H-Horn	AV	0.0	46.8	54.0	-7.2	GFSK/DH5, EUT vertical.
2483.500	24.3	2.3	187.0	1.1	3.0	20.0	H-Horn	AV	0.0	46.6	54.0	-7.4	GFSK/DH5, EUT on side.
2483.508	24.1	2.3	301.0	1.0	3.0	20.0	V-Horn	AV	0.0	46.4	54.0	-7.6	GFSK/DH5, EUT on side.
2483.508	23.9	2.3	253.0	1.1	3.0	20.0	H-Horn	AV	0.0	46.2	54.0	-7.8	GFSK/DH5, EUT face up.
2483.500	23.8	2.3	225.0	1.1	3.0	20.0	V-Horn	AV	0.0	46.1	54.0	-7.9	GFSK/DH5, EUT face up.
2483.612	23.8	2.3	220.0	1.1	3.0	20.0	H-Horn	AV	0.0	46.1	54.0	-7.9	ERD-2/DH5, EUT vertical.
2483.505	23.7	2.3	238.0	1.1	3.0	20.0	V-Horn	AV	0.0	46.0	54.0	-8.0	ERD3/DH5, EUT vertical.
2483.520	23.6	2.3	262.0	1.1	3.0	20.0	V-Horn	AV	0.0	45.9	54.0	-8.1	ERD-2/DH5, EUT vertical.
2483.573	23.6	2.3	177.0	1.0	3.0	20.0	H-Horn	AV	0.0	45.9	54.0	-8.1	ERD3/DH5, EUT vertical.
2483.905	40.7	2.3	187.0	1.1	3.0	20.0	H-Horn	PK	0.0	63.0	74.0	-11.0	GFSK/DH5, EUT on side.
2483.603	40.4	2.3	262.0	1.1	3.0	20.0	V-Horn	PK	0.0	62.7	74.0	-11.3	ERD-2/DH5, EUT vertical.
2483.523	38.9	2.3	301.0	1.0	3.0	20.0	V-Horn	PK	0.0	61.2	74.0	-12.8	GFSK/DH5, EUT on side.
2483.638	38.9	2.3	225.0	1.1	3.0	20.0	V-Horn	PK	0.0	61.2	74.0	-12.8	GFSK/DH5, EUT face up.
2483.692	38.8	2.3	238.0	1.1	3.0	20.0	V-Horn	PK	0.0	61.1	74.0	-12.9	ERD3/DH5, EUT vertical.
2483.995	38.8	2.3	253.0	1.1	3.0	20.0	H-Horn	PK	0.0	61.1	74.0	-12.9	GFSK/DH5, EUT face up.
2483.565	38.7	2.3	217.0	1.0	3.0	20.0	V-Horn	PK	0.0	61.0	74.0	-13.0	GFSK/DH5, EUT vertical.
2484.013	38.7	2.3	177.0	1.0	3.0	20.0	H-Horn	PK	0.0	61.0	74.0	-13.0	ERD3/DH5, EUT vertical.
2483.502	38.2	2.3	205.0	1.1	3.0	20.0	H-Horn	PK	0.0	60.5	74.0	-13.5	GFSK/DH5, EUT vertical.
2484.112	38.2	2.3	220.0	1.1	3.0	20.0	H-Horn	PK	0.0	60.5	74.0	-13.5	ERD-2/DH5, EUT vertical.

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

Charging with cradle

POWER SETTINGS INVESTIGATED

USB

CONFIGURATIONS INVESTIGATED

MCSO1576 - 7

SAMPLE CALCULATIONS

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
High Pass Filter	TTE	H97-100K-50-720B	HFX	2/9/2011	24 mo
Attenuator	Coaxicom	66702 2910-20	ATO	8/6/2010	12 mo
Receiver	Rohde & Schwarz	ESCI	ARH	3/30/2011	12 mo
EV07 Cables	N/A	Conducted Cables	EVG	6/17/2011	12 mo
LISN	Solar	9252-50-R-24-BNC	LIR	2/17/2011	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.

MEASUREMENT UNCERTAINTY

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 for radiated emissions measurements is less than +/- 4 dB, and for conducted emissions measurements is less than +/- 2.7 dB. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for measurement uncertainty are available upon request.

TEST DESCRIPTION

Using the mode of operation and configuration noted within this report, conducted emissions tests were performed. The frequency range investigated (scanned), is also noted in this report. Conducted power line measurements are made, unless otherwise specified, over the frequency range from 150 kHz to 30 MHz to determine the line-to-ground radio-noise voltage that is conducted from the EUT power-input terminals that are directly (or indirectly via separate transformer or power supplies) connected to a public power network. Equipment is tested with power cords that are normally used or that have electrical or shielding characteristics that are the same as those cords normally used. Typically those measurements are made using a LISN (Line Impedance Stabilization Network), the 50ohm measuring port is terminated by a 50ohm EMI meter or a 50ohm resistive load. All 50ohm measuring ports of the LISN are terminated by 50ohm.

NORTHWEST
EMC

Powerline Conducted Emissions

PSA-ESCI 2010.04.06
PSA-ESCI Version 2011.05.10

Work Order:	MCSO1576	**Date:**	07/19/11
Project:	None	**Temperature:**	23
Job Site:	EV07	**Humidity:**	45
Serial Number:	C12	**Barometric Pres.:**	29.9

Tested by: Ethan Schoonover

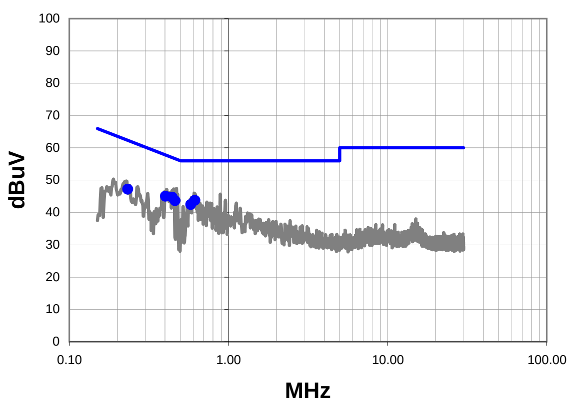
EUT:	Model: 1481
Configuration:	7
Customer:	Microsoft Corporation
Attendees:	None
EUT Power:	USB
Operating Mode:	Charging with cradle
Deviations:	None
Comments:	None

Test Specifications **Class B**
FCC 15.207:2011

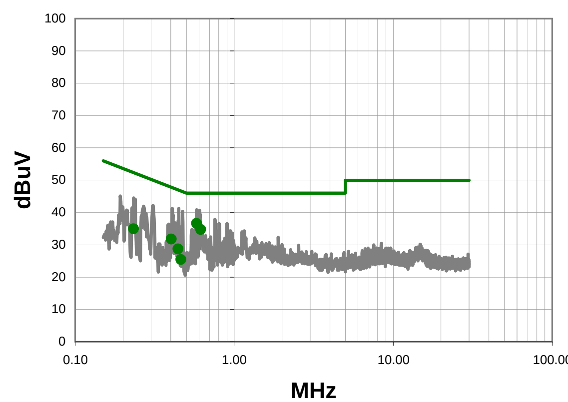
Test Method
ANSI C63.10:2009

Run #	3	**Line:**	Neutral	**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)	Spec. Limit (dBuV)	Compared to Spec. (dB)
0.445	24.6	20.1	44.7	57.0	-12.3
0.618	23.6	20.1	43.7	56.0	-12.3
0.403	24.9	20.1	45.0	57.8	-12.8
0.463	23.5	20.1	43.6	56.6	-13.0
0.580	22.3	20.1	42.4	56.0	-13.6
0.233	27.1	20.1	47.2	62.3	-15.1

Average Data - vs - Average Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
0.580	16.5	20.1	36.6	46.0	-9.4
0.618	14.6	20.1	34.7	46.0	-11.3
0.403	11.7	20.1	31.8	47.8	-16.0
0.233	14.8	20.1	34.9	52.3	-17.4
0.445	8.6	20.1	28.7	47.0	-18.3
0.463	5.3	20.1	25.4	46.6	-21.2

NORTHWEST
EMC
Powerline Conducted Emissions

PSA-ESCI 2010.04.06
PSA-ESCI Version 2011.05.10

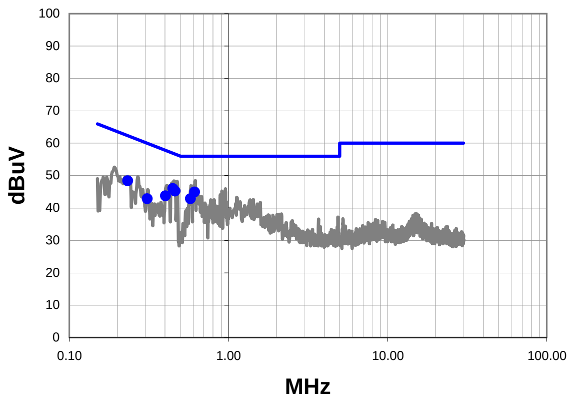
Work Order:	MCSO1576	**Date:**	07/19/11	
Project:	None	**Temperature:**	23	
Job Site:	EV07	**Humidity:**	45	
Serial Number:	C12	**Barometric Pres.:**	29.9	**Tested by:** Ethan Schoonover

EUT:	Model: 1481
Configuration:	7
Customer:	Microsoft Corporation
Attendees:	None
EUT Power:	USB
Operating Mode:	Charging with cradle
Deviations:	None
Comments:	None

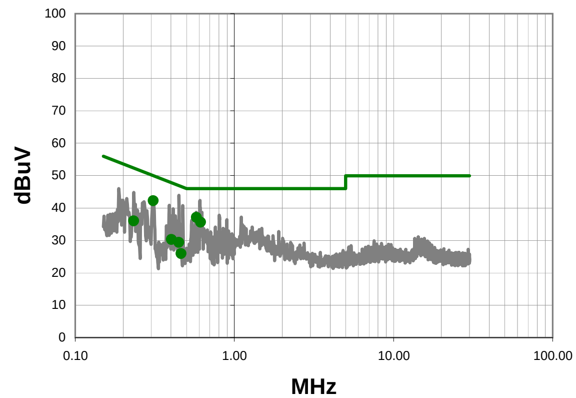
Test Specifications	**Class B**	**Test Method**
FCC 15.207:2011		ANSI C63.10:2009

Run #	4	**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)	Spec. Limit (dBuV)	Compared to Spec. (dB)
0.449	25.9	20.1	46.0	56.9	-10.9
0.615	24.8	20.1	44.9	56.0	-11.1
0.463	25.1	20.1	45.2	56.6	-11.4
0.579	22.7	20.1	42.8	56.0	-13.2
0.233	28.3	20.1	48.4	62.3	-13.9
0.402	23.6	20.1	43.7	57.8	-14.1
0.310	22.7	20.1	42.8	60.0	-17.2

Average Data - vs - Average Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
0.310	22.1	20.1	42.2	50.0	-7.8
0.579	17.0	20.1	37.1	46.0	-8.9
0.615	15.5	20.1	35.6	46.0	-10.4
0.233	15.9	20.1	36.0	52.3	-16.3
0.449	9.3	20.1	29.4	46.9	-17.5
0.402	10.2	20.1	30.3	47.8	-17.5
0.463	5.8	20.1	25.9	46.6	-20.7

Channel Spacing

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
Spectrum Analyzer	Agilent	E4440A	AFD	7/5/2011	12
40GHz DC Block	Miteq	DCB4000	AMD	8/5/2010	13
Attenuator 20 dB, SMA M/F 26GHz	S.M. Electronics	SA26B-20	AUY	8/6/2010	12
EV06 Direct Connect Cable	ESM Cable Corp.	TT	ECA	NCR	0
MXG Vector Signal Generator	Agilent	N5182A	TIF	NCR	0

MEASUREMENT UNCERTAINTY

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 for radiated emissions measurements is less than +/- 4 dB, and for conducted emissions measurements is less than +/- 2.7 dB. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for measurement uncertainty are available upon request.

TEST DESCRIPTION

This limit is derived from FCC 15.247(a)(1): "Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW."

This was based on the original Bluetooth that had a channel separation of 1 MHz, which results in a 1.5 MHz bandwidth using the information above. Since the 1 MHz represents the worst case for all reports that is what is used, even though the other FHSS radio in this device would actually be larger it still meets. 2/3 * 1.5 MHz = 1 MHz hopping channel.

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.

NORTHWEST **EMC**

XMit 2010.11.03

Channel Spacing

EUT:	**Model: 1481**			**Work Order:**	**MCSO1576**
Serial Number:	**10**			**Date:**	**07/25/11**
Customer:	**Microsoft Corporation**			**Temperature:**	**23°C**
Attendees:	**None**			**Humidity:**	**48%**
Project:	**None**			**Barometric Pres.:**	**29.92 in**
Tested by:	**Ethan Schoonover**	**Power:**	**USB**	**Job Site:**	**EV06**

TEST SPECIFICATIONS	TEST METHOD
FCC 15.247:2011	ANSI C63.10:2009

COMMENTS

Transmitting Bluetooth Radio. 0.5 dB added for adapter cable DH5

DEVIATIONS FROM TEST STANDARD

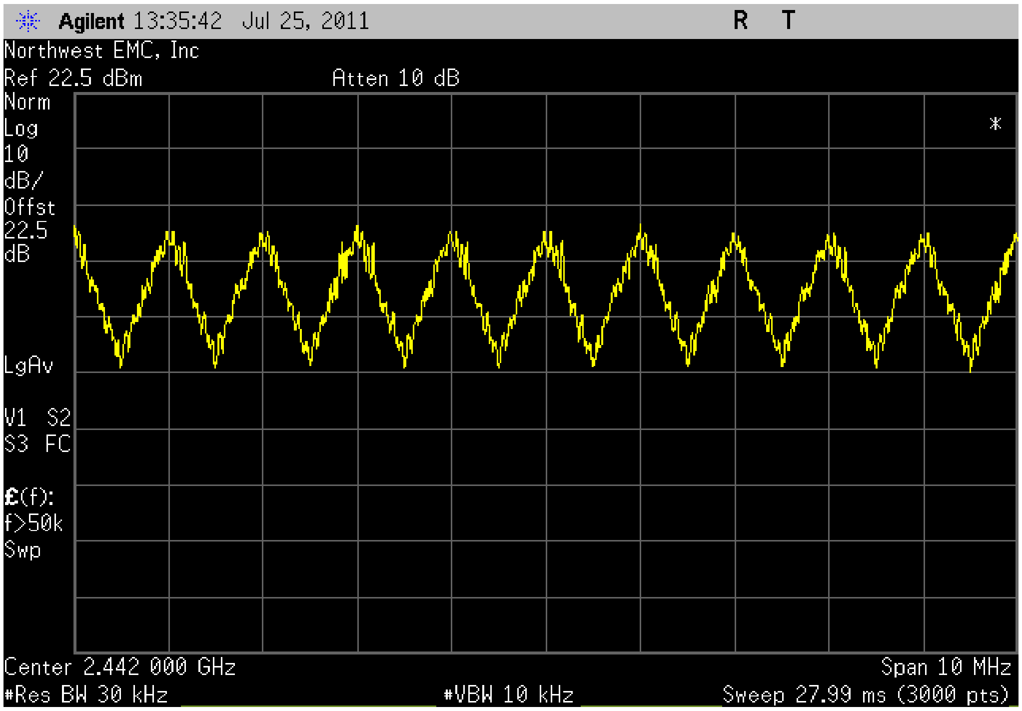
None

Configuration #	**4**	*Signature*

	Value	Limit	Results
Channel Spacing	1 MHz	≥ 1 MHz	Pass

Channel Spacing

Channel Spacing					
Result:	Pass	**Value:**	1 MHz	**Limit:**	≥ 1 MHz



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
Spectrum Analyzer	Agilent	E4440A	AFD	7/5/2011	12
40GHz DC Block	Miteq	DCB4000	AMD	8/5/2010	13
Attenuator 20 dB, SMA M/F 26GHz	S.M. Electronics	SA26B-20	AUY	8/6/2010	12
EV06 Direct Connect Cable	ESM Cable Corp.	TT	ECA	NCR	0

MEASUREMENT UNCERTAINTY

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 for radiated emissions measurements is less than +/- 4 dB, and for conducted emissions measurements is less than +/- 2.7 dB. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for measurement uncertainty are available upon request.

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.

NORTHWEST
EMC

Dwell Time

XMit 2010.11.03

EUT:	**Model: 1481**			**Work Order:**	**MCSO1576**
Serial Number:	**C10**			**Date:**	**07/25/11**
Customer:	**Microsoft Corporation**			**Temperature:**	**24°C**
Attendees:	**None**			**Humidity:**	**48%**
Project:	**None**			**Barometric Pres.:**	**30.09 in**
Tested by:	**Rod Peloquin**	**Power:**	**USB**	**Job Site:**	**EV06**

TEST SPECIFICATIONS	**TEST METHOD**
FCC 15.247:2011	**ANSI C63.10:2009**

COMMENTS

Transmitting on Bluetooth in frequency hopping mode.

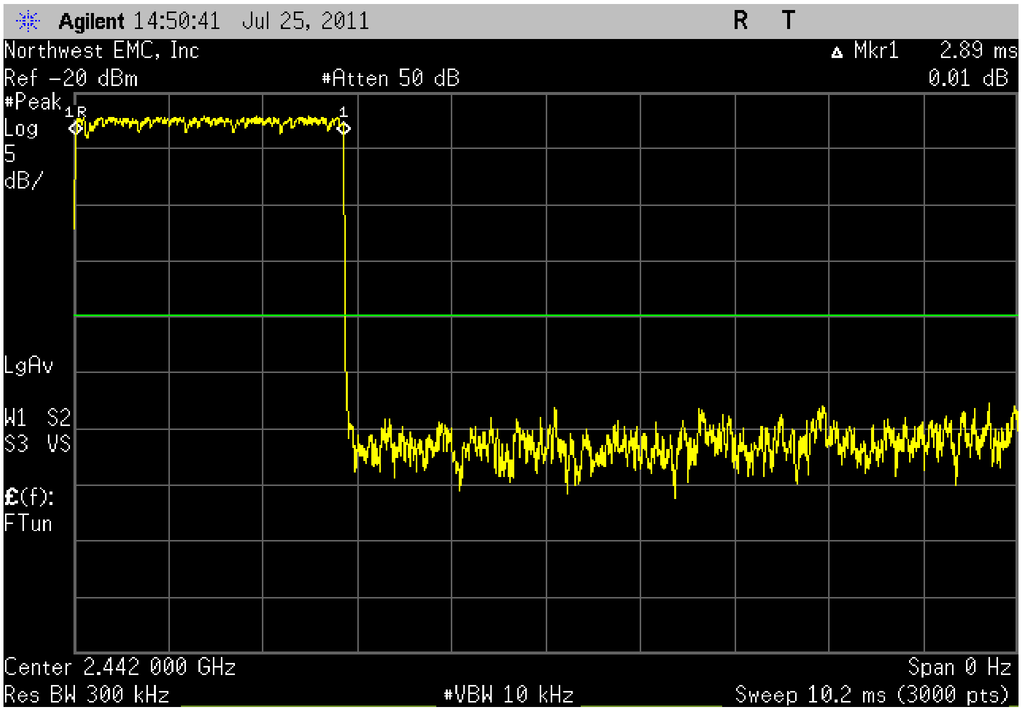
DEVIATIONS FROM TEST STANDARD

Configuration #	**4**	*Signature*

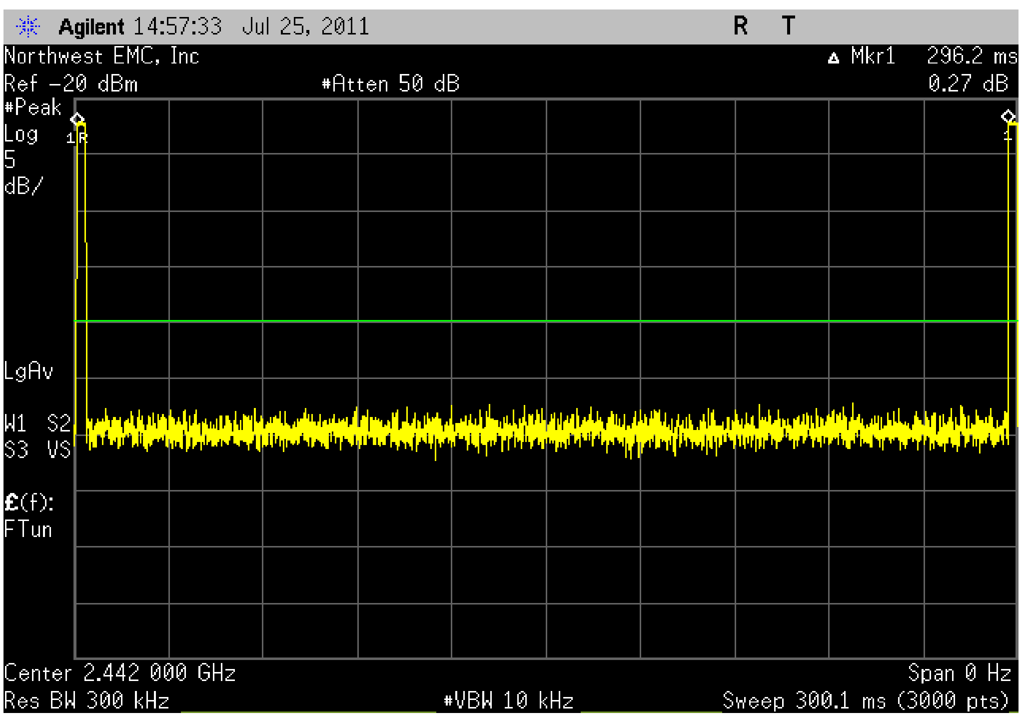
		Value	**Limit**	**Results**
Bluetooth, GFSK, DH5				
	Pulse Width	2.9 ms	N/A	Pass
	Period	296.2 ms	N/A	Pass
	Total Period	304.5 ms in 31.6 s	400 ms in 31.6 s	Pass
Bluetooth, 4-DQPSK, 2DH5				
	Pulse Width	2.9 ms	N/A	Pass
	Period	296.2 ms	N/A	Pass
	Total Period	304.5 ms in 31.6 s	400 ms in 31.6 s	Pass
Bluetooth, 8-DPSK, 3DH5				
	Pulse Width	2.9 ms	N/A	Pass
	Period	296.2 ms	N/A	Pass
	Total Period	304.5 ms in 31.6 s	400 ms in 31.6 s	Pass

Dwell Time

Bluetooth, GFSK, DH5, Pulse Width					
Result:	Pass	**Value:**	2.9 ms	**Limit:**	N/A

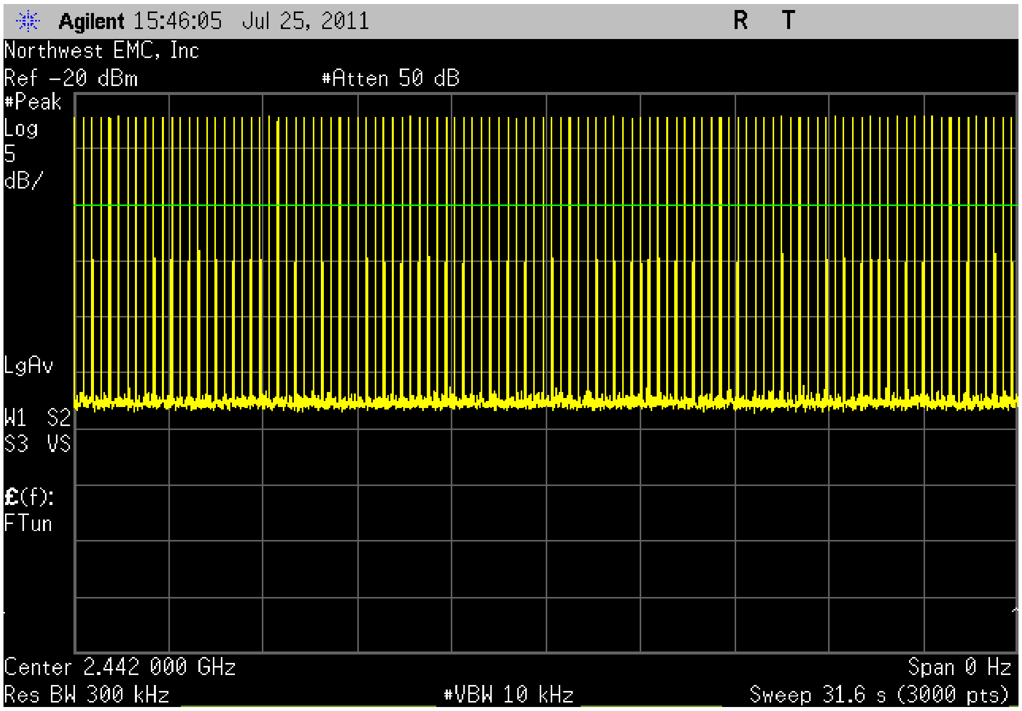


Bluetooth, GFSK, DH5, Period					
Result:	Pass	**Value:**	296.2 ms	**Limit:**	N/A

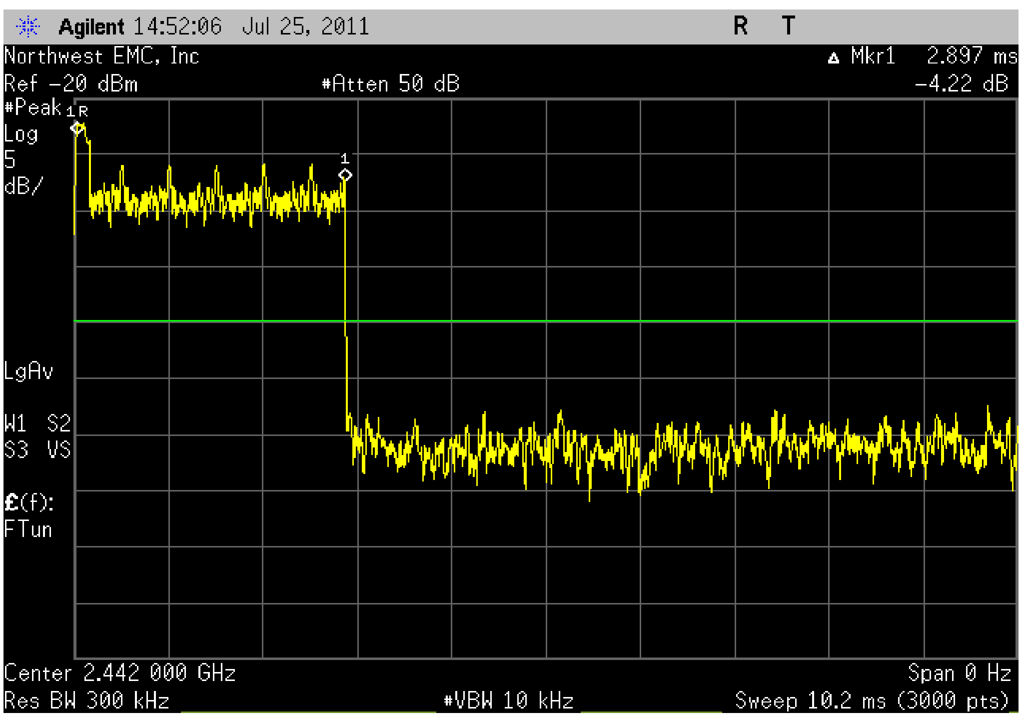


Dwell Time

Bluetooth, GFSK, DH5, Total Period		
Result: Pass	**Value:** 304.5 ms in 31.6 s	**Limit:** 400 ms in 31.6 s

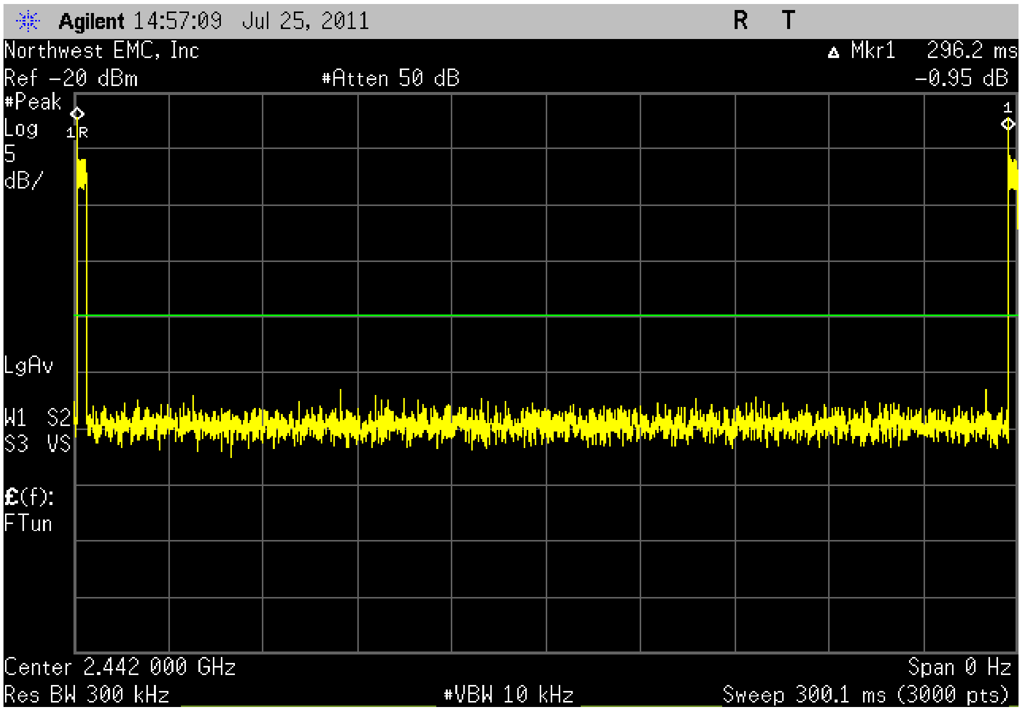


Bluetooth, 4-DQPSK, 2DH5, Pulse Width		
Result: Pass	**Value:** 2.9 ms	**Limit:** N/A

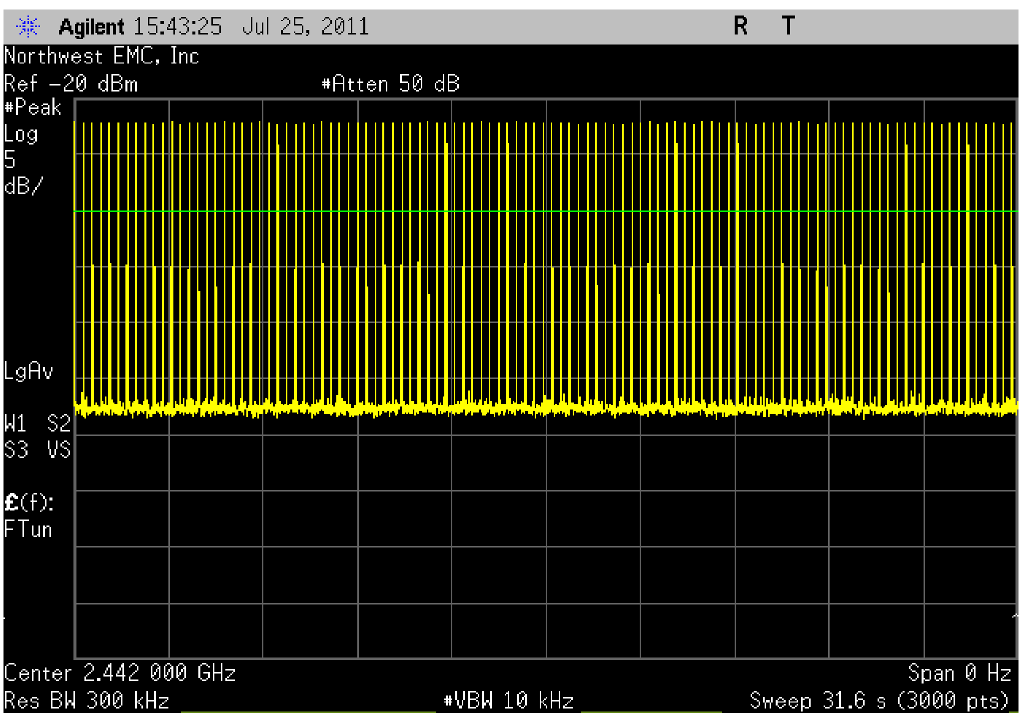


Dwell Time

Bluetooth, 4-DQPSK, 2DH5, Period					
Result:	Pass	**Value:**	296.2 ms	**Limit:**	N/A

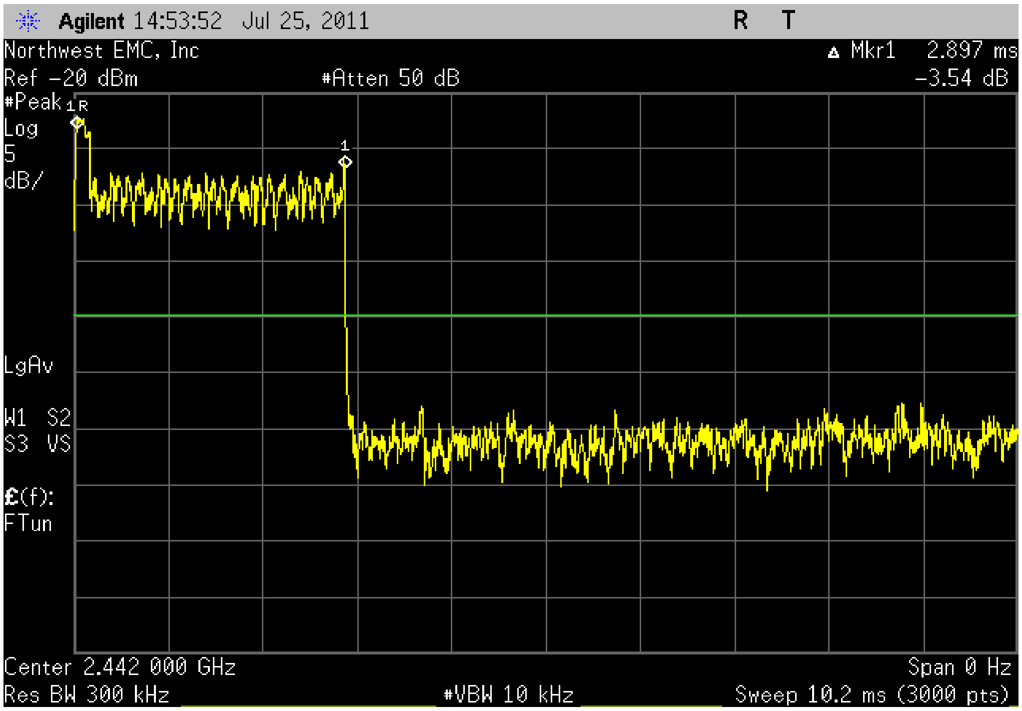


Bluetooth, 4-DQPSK, 2DH5, Total Period					
Result:	Pass	**Value:**	304.5 ms in 31.6 s	**Limit:**	400 ms in 31.6 s

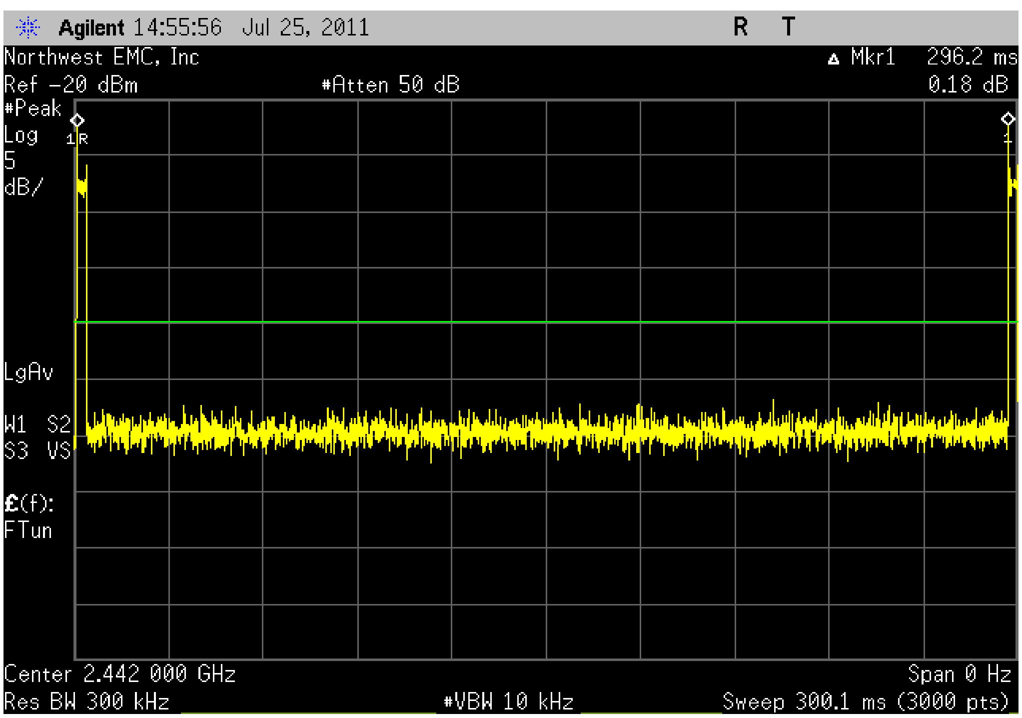


Dwell Time

Bluetooth, 8-DPSK, 3DH5, Pulse Width		
Result: Pass	**Value:** 2.9 ms	**Limit:** N/A

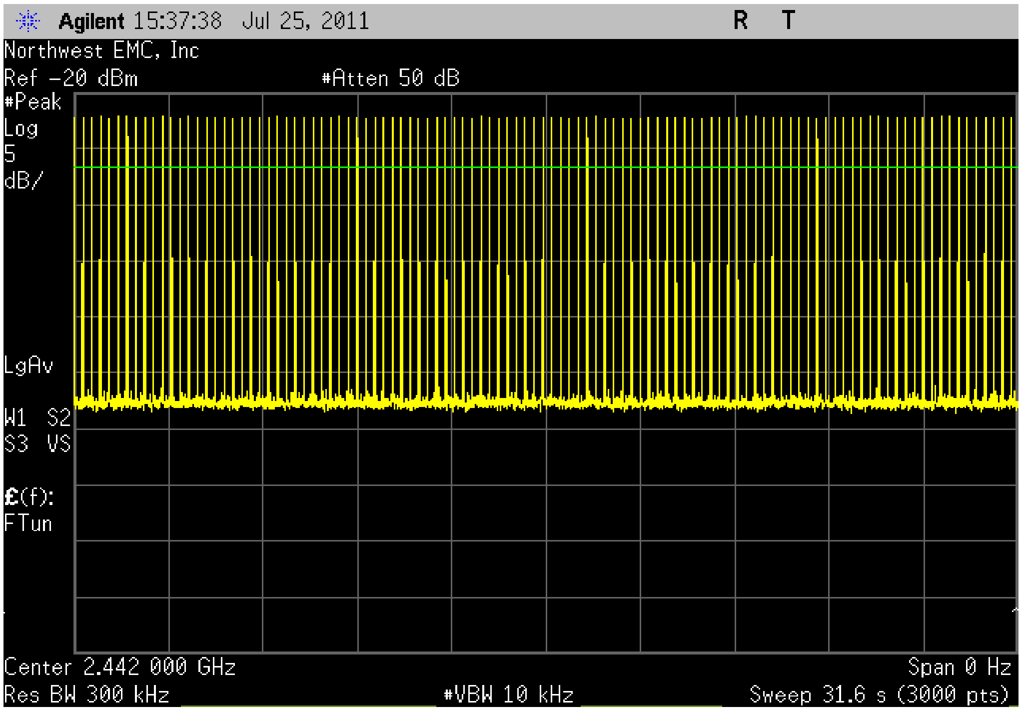


Bluetooth, 8-DPSK, 3DH5, Period		
Result: Pass	**Value:** 296.2 ms	**Limit:** N/A



Dwell Time

Bluetooth, 8-DPSK, 3DH5, Total Period					
Result:	Pass	**Value:**	304.5 ms in 31.6 s	**Limit:**	400 ms in 31.6 s



Number of Hopping Frequencies

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
Spectrum Analyzer	Agilent	E4440A	AFD	7/5/2011	12
40GHz DC Block	Miteq	DCB4000	AMD	8/5/2010	13
Attenuator 20 dB, SMA M/F 26GHz	S.M. Electronics	SA26B-20	AUY	8/6/2010	12
EV06 Direct Connect Cable	ESM Cable Corp.	TT	ECA	NCR	0
MXG Vector Signal Generator	Agilent	N5182A	TIF	NCR	0

MEASUREMENT UNCERTAINTY

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 for radiated emissions measurements is less than +/- 4 dB, and for conducted emissions measurements is less than +/- 2.7 dB. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for measurement uncertainty are available upon request.

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.

NORTHWEST
EMC

XMit 2010.11.03

Number of Hopping Frequencies

EUT:	**Model: 1481**			**Work Order:**	**MCSO1576**
Serial Number:	**10**			**Date:**	**07/25/11**
Customer:	**Microsoft Corporation**			**Temperature:**	**23°C**
Attendees:	**None**			**Humidity:**	**48%**
Project:	**None**			**Barometric Pres.:**	**29.92 in**
Tested by:	**Ethan Schoonover**	**Power:**	**USB**	**Job Site:**	**EV06**

TEST SPECIFICATIONS	**TEST METHOD**
FCC 15.247:2011	**ANSI C63.10:2009**

COMMENTS

Transmitting Bluetooth Radio. 0.5 dB added for adapter cable DH5

DEVIATIONS FROM TEST STANDARD

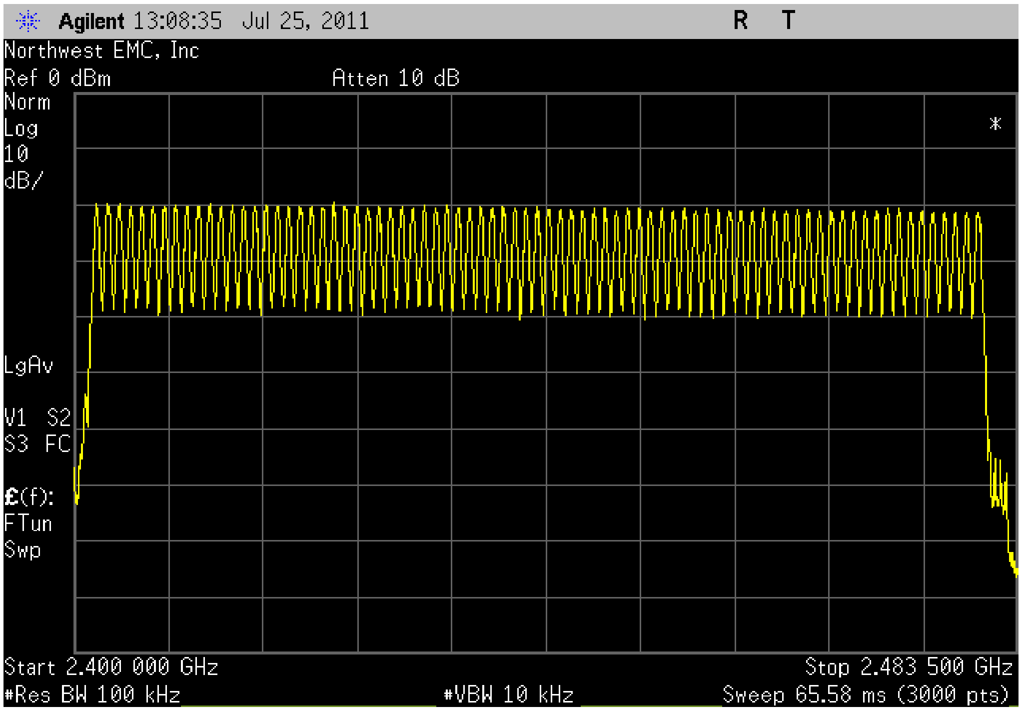
None

Configuration #	**4**	*Signature*

	Value	Limit	Results
Number of Hopping Frequencies	79	>15	Pass

Number of Hopping Frequencies

Number of Hopping Frequencies					
Result:	Pass	**Value:**	79	**Limit:**	>15



BLUETOOTH APPROVALS

FCC Procedure Received from Joe Dichoso on 2-15-02

The following exhibit indicates the FCC Spread Spectrum requirements in Section 15.247 for devices meeting the Bluetooth Specifications in the 2.4 GHz band as of February 2001 operating in the USA. The purpose of this exhibit is to help expedite the approval process for Bluetooth devices. This exhibit provides items that vary for each device and also provides a list of items that are common to Bluetooth devices that explains the remaining requirements. The list of common items can be submitted for each application for equipment authorization. This exhibit only specifies requirements in Section 15.247, requirements in other rule Sections for intentional radiators such as in Section 15.203 or 15.207 must be also be addressed. A Bluetooth device is a FHSS transmitter in the data mode and applies as a Hybrid spread spectrum device in the acquisition mode.

For each individual device, the following items, 1-7 will vary from one device to another and must be submitted.

1) The occupied bandwidth in Section 15.247(a)(1)(ii).
2) Conducted output power specified in Section 15.247(b)(1).
3) EIRP limit in Section 15.247(b)(3).
4) RF safety requirement in Section 15.247(b)(4)
5) Spurious emission limits in Section 15.247(c).
6) Processing gain and requirements for Hybrids in Section 15.247(f) in the acquisition mode.
7) Power spectral density requirement in Section 15.247(f) in the acquisition mode.

For all devices, the following items, 1-12, are common to all Bluetooth devices and will not vary from one device to another. This list can be copied into the filing.

1 Output power and channel separation of a Bluetooth device in the different operating modes:
The different operating modes (data-mode, acquisition-mode) of a Bluetooth device don't influence the output power and the channel spacing. There is only one transmitter which is driven by identical input parameters concerning these two parameters.
Only a different hopping sequence will be used. For this reason, the RF parameters in one op-mode is sufficient.

2 Frequency range of a Bluetooth device:
The maximum frequency of the device is: **2402 – 2480 M**Hz.
This is according the Bluetooth Core Specification V 1.0B (+ critical errata) for devices which will be operated in the USA. Other frequency ranges (e.g. for Spain, France, Japan) which are allowed according the Core Specification must **not be** supported by the device.

3 Co-ordination of the hopping sequence in data mode to avoid simultaneous occupancy by multiple transmitters:
Bluetooth units which want to communicate with other units must be organized in a structure called piconet. This piconet consist of max. 8 Bluetooth units. One unit is the master the other seven are the slaves. The master co-ordinates frequency occupation in this piconet for all units. As the master hop sequence is derived from it's BD address which is unique for every Bluetooth device, additional masters intending to establish new piconets will always use different hop sequences.

4 Example of a hopping sequence in data mode:

Example of a 79 hopping sequence in data mode:
40, 21, 44, 23, 42, 53, 46, 55, 48, 33, 52, 35, 50, 65, 54, 67,
56, 37, 60, 39, 58, 69, 62, 71, 64, 25, 68, 27, 66, 57, 70, 59,
72, 29, 76, 31, 74, 61, 78, 63, 01, 41, 05, 43, 03, 73, 07, 75,
09, 45, 13, 47, 11, 77, 15, 00, 64, 49, 66, 53, 68, 02, 70, 06,
01, 51, 03, 55, 05, 04

5 Equally average use of frequencies in data mode and short transmissions:

The generation of the hopping sequence in connection mode depends essentially on two input values:

1. LAP/UAP of the master of the connection
2. Internal master clock

The LAP (lower address part) are the 24 LSB's of the 48 BD_ADDRESS. The BD_ADDRESS is an unambiguous number of every Bluetooth unit. The UAP (upper address part) are the 24 MSB's of the 48 BD_ADDRESS. The internal clock of a Bluetooth unit is derived from a free running clock which is never adjusted and is never turned off. For synchronization with other units, only the offsets are used. It has no relation to the time of the day. Its resolution is at least half the RX/TX slot length of 312.5 µs. The clock has a cycle of about one day (23h30). In most case it is implemented as 28 bit counter. For the deriving of the hopping sequence the entire LAP (24 bits), 4 LSB's (4 bits) (Input 1) and the 27 MSB's of the clock (Input 2) are used. With this input values different mathematical procedures (permutations, additions, XOR-operations) are performed to generate the sequence. This will be done at the beginning of every new transmission.

Regarding short transmissions, the Bluetooth system has the following behavior:
The first connection between the two devices is established, a hopping sequence is generated. For transmitting the wanted data, the complete hopping sequence is not used and the connection ends. The second connection will be established. A new hopping sequence is generated. Due to the fact that the Bluetooth clock has a different value, because the period between the two transmission is longer (and it cannot be shorter) than the minimum resolution of the clock (312.5 µs). The hopping sequence will always differ from the first one.

6 Receiver input bandwidth, synchronization and repeated single or multiple packets:

The input bandwidth of the receiver is 1 MHz.

In every connection, one Bluetooth device is the master and the other one is the slave. The master determines the hopping sequence (see chapter 5). The slave follows this sequence. Both devices shift between RX and TX time slot according to the clock of the master. Additionally the type of connection (e.g. single or multi-slot packet) is set up at the beginning of the connection. The master adapts its hopping frequency and its TX/RX timing is according to the packet type of the connection. Also, the slave of the connection uses these settings. Repeating of a packet has no influence on the hopping sequence. The hopping sequence generated by the master of the connection will be followed in any case. That means, a repeated packet will not be send on the same frequency, it is send on the next frequency of the hopping sequence

7 Dwell time in data mode

The dwell time of 0.3797s within a 30 second period in data mode is independent from the packet type (packet length). The calculation for a 30 second period is a follows:
Dwell time = time slot length * hop rate / number of hopping channels *30s
Example for a DH1 packet (with a maximum length of one time slot)
Dwell time = 625 µs * 1600 1/s / 79 * 30s = 0.3797s (in a 30s period)

For multi-slot packet the hopping is reduced according to the length of the packet.
Example for a DH5 packet (with a maximum length of five time slots)
Dwell time = 5 * 625 µs * 1600 * 1/5 *1/s / 79 * 30s = 0.3797s (in a 30s period)
This is according the Bluetooth Core Specification V 1.0B (+ critical errata) for all Bluetooth devices. Therefore, all Bluetooth devices **comply** with the FCC dwell time requirement in the data mode.
This was checked during the Bluetooth Qualification tests.
The Dwell time in hybrid mode is approximately 2.6 mS (in a 12.8s period)

8 Channel Separation in hybrid mode

The nominal channel spacing of the Bluetooth system is 1Mhz independent of the operating mode.
The maximum “initial carrier frequency tolerance” which is allowed for Bluetooth is fcenter = 75 kHz.
This was checked during the Bluetooth Qualification tests (Test Case: TRM/CA/07-E) for three frequencies (2402, 2441, 2480 MHz).

9 Derivation and examples for a hopping sequence in hybrid mode

For the generation of the inquiry and page hop sequences the same procedures as described for the data mode are used (see item 5), but this time with different input vectors:
**For the inquiry hop sequence, a predefined fixed address is always used. This results in the same 32 frequencies used by all devices doing an inquiry but every time with a different start frequency and phase in this sequence.
**For the page hop sequence, the device address of the paged unit is used as the input vector. This results in the use of a subset of 32 frequencies which is specific for that initial state of the connection establishment between the two units. A page to different devices would result in a different subset of 32 frequencies.
So it is ensured that also in hybrid mode, the frequency is used equally on average.
Example of a hopping sequence in inquiry mode:
48, 50, 09, 13, 52, 54,41, 45, 56, 58, 11, 15, 60, 62, 43, 47, 00, 02, 64, 68, 04, 06, 17, 21, 08, 10, 66, 70, 12, 14, 19, 23
Example of a hopping sequence in paging mode:
08, 57, 68, 70, 51, 02, 42, 40, 04, 61, 44, 46, 63, 14, 50, 48, 16, 65, 52, 54, 67, 18, 58, 56, 20, 53, 60, 62, 55, 06, 66, 64

10 Receiver input bandwidth and synchronization in hybrid mode:

The receiver input bandwidth is the same as in the data mode (1 MHz). When two Bluetooth devices establish contact for the first time, one device sends an inquiry access code and the other device is scanning for this inquiry access code. If two devices have been connected previously and want to start a new transmission, a similar procedure takes place. The only difference is, instead of the inquiry access code, a special access code, derived from the BD_ADDRESS of the paged device will be, will be sent by the master of this connection. Due to the fact that both units have been connected before (in the inquiry procedure) the paging unit has timing and frequency information about the page scan of the paged unit. For this reason the time to establish the connection is reduced.

11 Spread rate / data rate of the direct sequence signal

The Spread rate / Data rate in inquiry and paging mode can be defined via the access code. The access code is the only criterion for the system to check if there is a valid transmission or not. If you regard the presence of a valid access code as one bit of information, and compare it with the length of the access code of 68 bits, the Spread rate / Data rate will be 68/1.

12 Spurious emission in hybrid mode

The Dwell in hybrid mode is shorter than in data mode. For this reason the spurious emissions average level in data mode is worst case. The spurious emissions peak level is the same for both modes.