NORTHWEST EMC

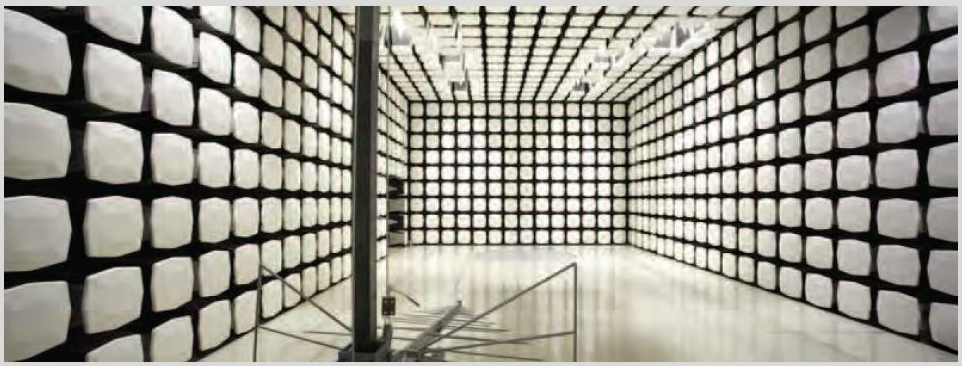
Microsoft Corporation

1790

FCC 15.407:2016

802.11n SISO Radio

Report # MCSO1761.1 Rev 01



NVLAP TESTING

NVLAP Lab Code: 200629-0

CERTIFICATE OF TEST

NORTHWEST EMC
2014-12-10

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

Radio Equipment Testing

Standards

Specification	Method
FCC 15.207:2016	ANSI C63.10:2013
FCC 15.407:2016	KDB 789033

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	AC – Powerline Conducted Emissions	Yes	Pass	
6.5, 6.6, 12.7	Spurious Radiated Emissions	Yes	Pass	
6.8	Frequency Stability	Yes	Pass	
12.2	Duty Cycle	Yes	Pass	
12.3.2.4	Maximum Conducted Output Power	Yes	Pass	
12.4.1	Emission Bandwidth	Yes	Pass	
12.4.2	Occupied Bandwidth	Yes	Pass	
12.4.2	Band Edge	Yes	Pass	
12.5	Maximum Power Spectral Density	Yes	Pass	

Deviations From Test Standards

None

Approved By:

Rod Munro, Operations Manager

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

REVISION HISTORY

NORTHWEST EMC
REV 2014.10.14

Revision Number	Description	Date	Page Number
01	Revised EUT description	5/22/17	9-10

ACCREDITATIONS AND AUTHORIZATIONS

REV 2016.7.25

United States

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

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

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

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

European Union

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

Australia/New Zealand

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

Korea

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

Japan

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

Taiwan

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

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

Singapore

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

Israel

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

Hong Kong

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

Vietnam

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

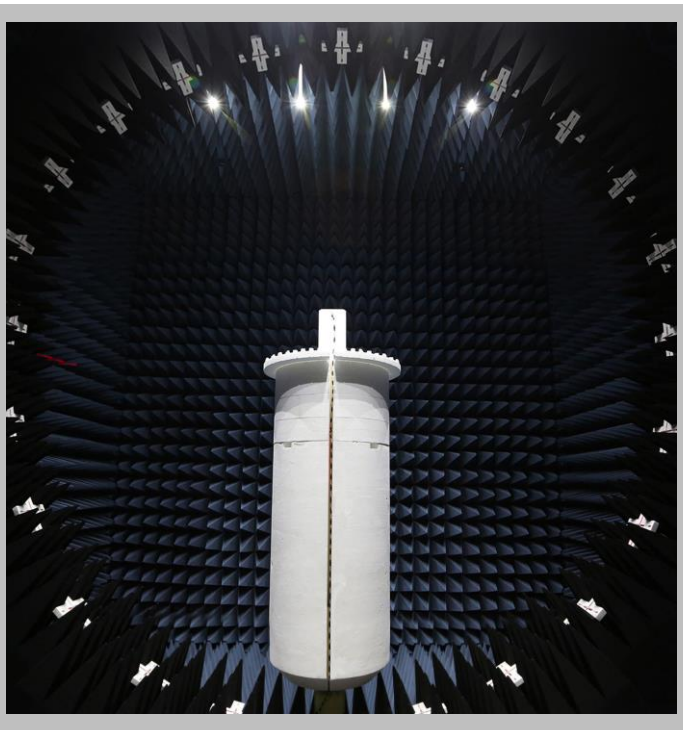
SCOPE

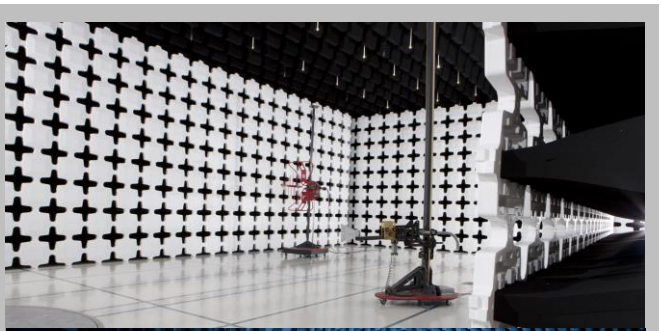
For details on the Scopes of our Accreditations, please visit:
http://www.nwemc.com/accreditations/
http://gsi.nist.gov/global/docs/cabs/designations.html

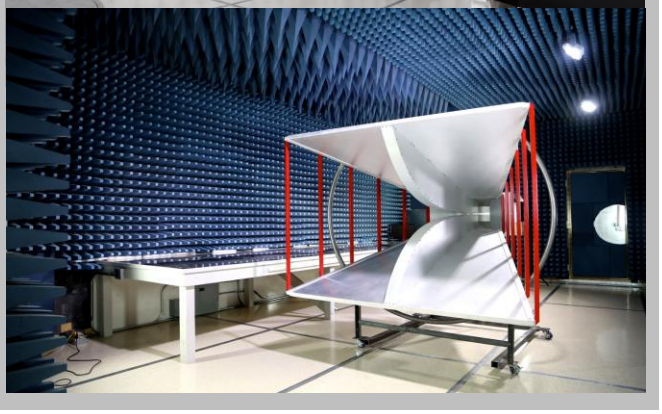
FACILITIES

REV 2016.7.25

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







MEASUREMENT UNCERTAINTY

TMU.2015.07.10

Measurement Uncertainty

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

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

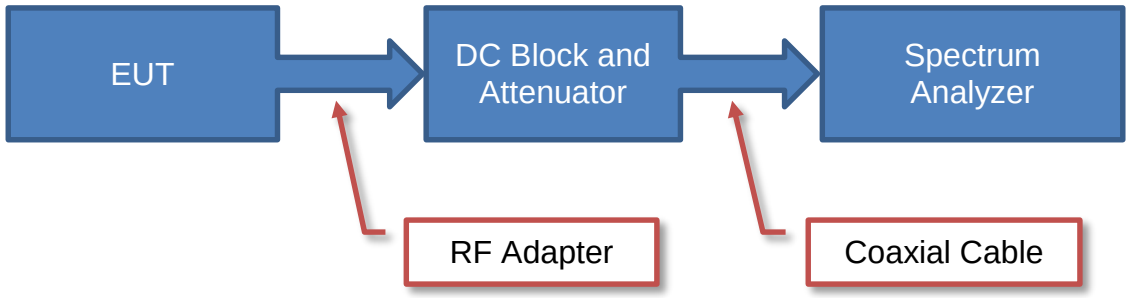
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

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

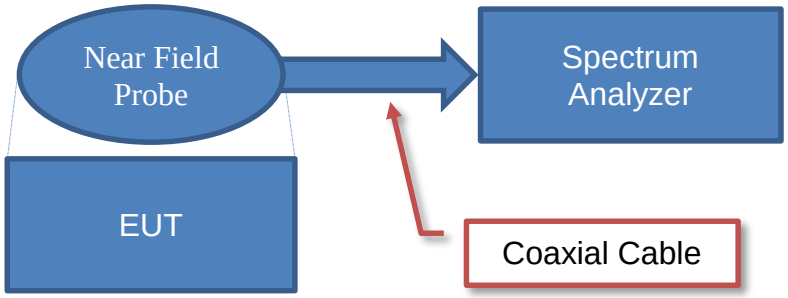
Test Setup Block Diagrams

NORTHWEST EMC
REV 2016.10.04

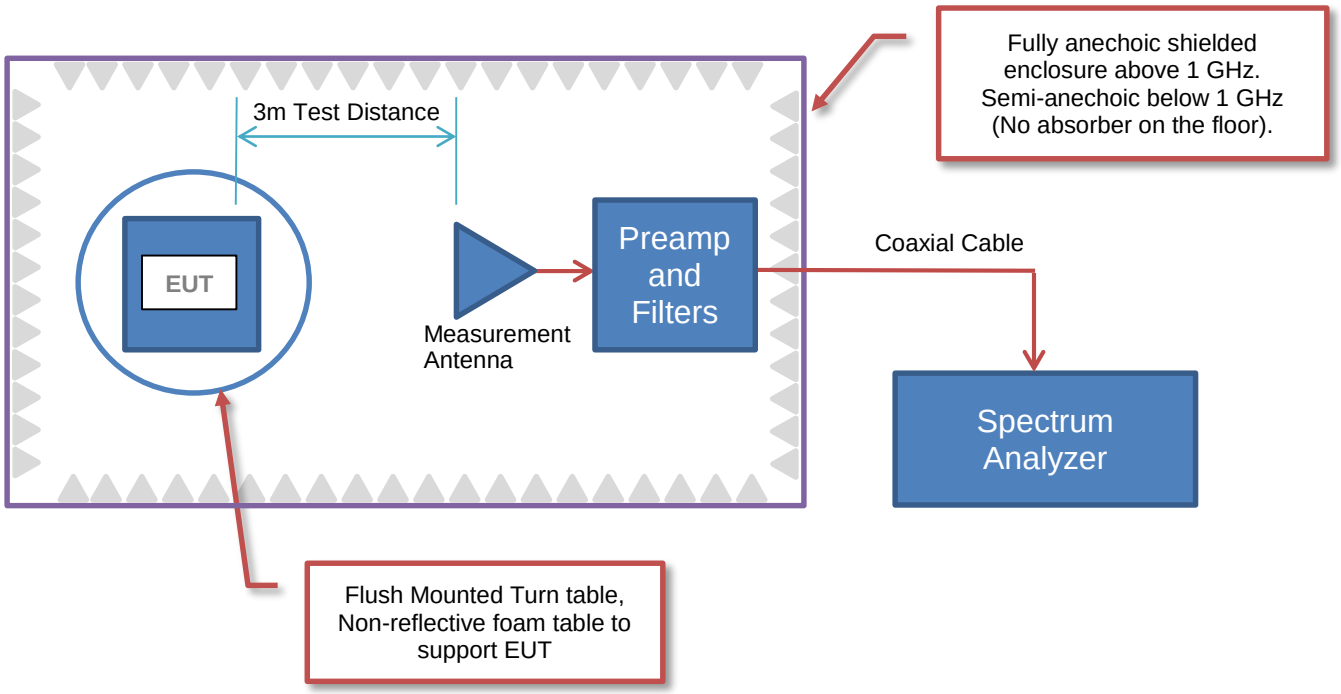
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	Microsoft Corporation
Address:	17760 NE 67th Ct, Redmond
City, State, Zip:	Redmond, WA 98052
Test Requested By:	Chaitrali Limaye
Model:	1790
First Date of Test:	November 02, 2016
Last Date of Test:	December 08, 2016
Receipt Date of Samples:	October 28, 2016
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

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

Testing Objective:
To demonstrate compliance of the 802.11 radio under FCC 15.407 for operation in the 5.2 GHz and 5.8 GHz band(s).

CONFIGURATIONS

NORTHWEST EMC 2014-12-10

Configuration MCSO1761- 1

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

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

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

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

Configuration MCSO1761- 2

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

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

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop PC	Lenovo	T420S	4054600
AC Adapter (Laptop)	Lenovo	ADLX65NDT2A	None
DC Power Supply	Kikusui	PWC 0620	1930492
USB Switch	Elite Electronics, Inc	USB Testing	None

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
AC Power	No	1.0m	No	AC Mains	AC Adapter (Laptop)
DC Power	No	2.0m	Yes	AC Adapter (Laptop)	Laptop PC
DC Leads	No	1.0m	No	DC Power Supply	USB Switch
USB	No	0.15m	No	Laptop PC	USB Switch
USB Extension	No	1.2m	No	USB Switch	USB Wireless Device

CONFIGURATIONS

NORTHWEST EMC 2014-12-10

Configuration MCSO1761- 4

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

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

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

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

MODIFICATIONS

NORTHWEST EMC
2014-12-10

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	11/02/2016	Duty Cycle	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
2	11/08/2016	Emission Bandwidth	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
3	11/08/2016	Occupied Bandwidth	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
4	11/08/2016	Maximum Conducted 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.
5	11/08/2016	Maximum 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.
6	11/08/2016	Frequency Stability	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
7	11/08/2016	Band Edge	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
8	12/07/2016	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
9	12/08/2016	AC – Powerline Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

AC – POWERLINE CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2016.09.09

TEST DESCRIPTION

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

TEST EQUIPMENT

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

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	2.4 dB	-2.4 dB

CONFIGURATIONS INVESTIGATED

MCSO1761-4

MODES INVESTIGATED

Transmitting 802.11(n), MCS0, Power Settings at Default. Mid Channel 40, 5200 MHz.
Transmitting 802.11(n), MCS0, Power Settings at Default. Mid Channel 157, 5785 MHz.

AC – POWERLINE CONDUCTED EMISSIONS

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

TEST SPECIFICATIONS

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

TEST PARAMETERS

Run #:	3	Line:	High Line	Add. Ext. Attenuation (dB):	0

COMMENTS

None

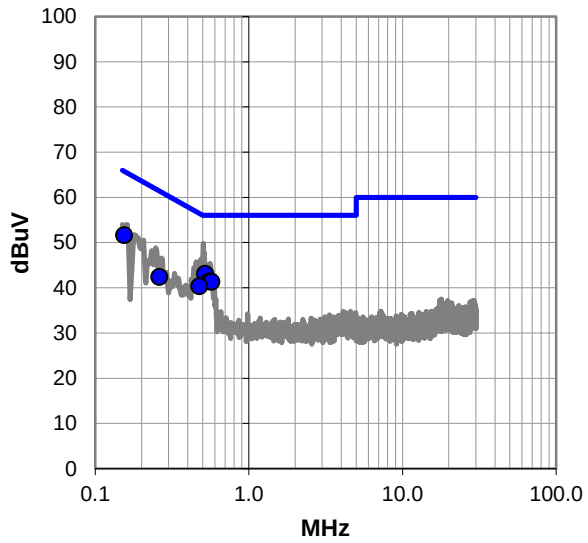
EUT OPERATING MODES

Transmitting 802.11(n), MCS0, Power Settings at Default. Mid Channel 40, 5200 MHz.

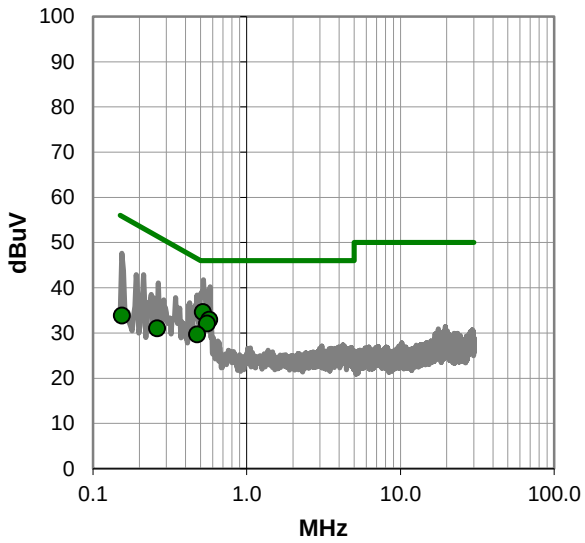
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



AC – POWERLINE CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2016.09.09

RESULTS - Run #3

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.518	22.5	20.6	43.1	56.0	-12.9
0.155	30.8	20.8	51.6	65.7	-14.1
0.552	20.8	20.6	41.4	56.0	-14.6
0.571	20.7	20.6	41.3	56.0	-14.7
0.477	19.7	20.6	40.3	56.4	-16.1
0.261	21.8	20.6	42.4	61.4	-19.0

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.518	14.0	20.6	34.6	46.0	-11.4
0.571	12.3	20.6	32.9	46.0	-13.1
0.552	11.5	20.6	32.1	46.0	-13.9
0.477	9.1	20.6	29.7	46.4	-16.7
0.261	10.4	20.6	31.0	51.4	-20.4
0.155	13.0	20.8	33.8	55.7	-21.9

CONCLUSION

Pass

Tested By

AC – POWERLINE CONDUCTED EMISSIONS

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

TEST SPECIFICATIONS

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

TEST PARAMETERS

Run #:	4	Line:	Neutral	Add. Ext. Attenuation (dB):	0

COMMENTS

None

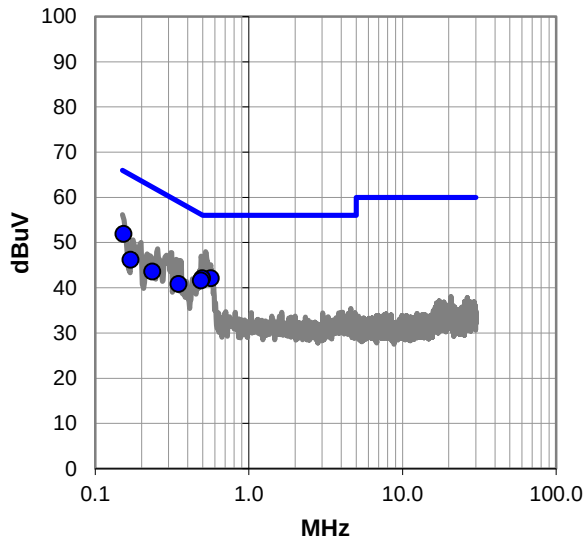
EUT OPERATING MODES

Transmitting 802.11(n), MCS0, Power Settings at Default. Mid Channel 40, 5200 MHz.

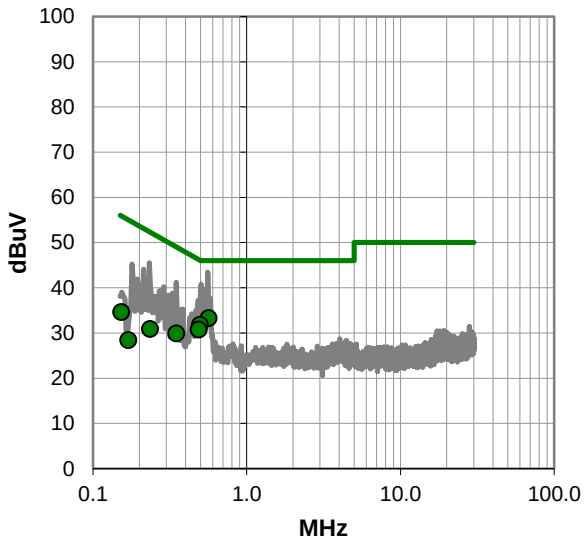
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



AC – POWERLINE CONDUCTED EMISSIONS

WTD.2016.09.09

RESULTS - Run #4

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.153	31.1	20.8	51.9	65.8	-13.9
0.565	21.5	20.6	42.1	56.0	-13.9
0.497	21.5	20.6	42.1	56.1	-14.0
0.488	21.0	20.6	41.6	56.2	-14.6
0.349	20.2	20.6	40.8	59.0	-18.2
0.235	23.0	20.6	43.6	62.3	-18.7
0.170	25.4	20.8	46.2	65.0	-18.8

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.565	12.7	20.6	33.3	46.0	-12.7
0.497	11.2	20.6	31.8	46.1	-14.3
0.488	10.1	20.6	30.7	46.2	-15.5
0.349	9.3	20.6	29.9	49.0	-19.1
0.153	13.8	20.8	34.6	55.8	-21.2
0.235	10.3	20.6	30.9	52.3	-21.4
0.170	7.6	20.8	28.4	55.0	-26.6

CONCLUSION

Pass

Tested By

AC – POWERLINE CONDUCTED EMISSIONS

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

TEST SPECIFICATIONS

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

TEST PARAMETERS

Run #:	5	Line:	High Line	Add. Ext. Attenuation (dB):	0

COMMENTS

None

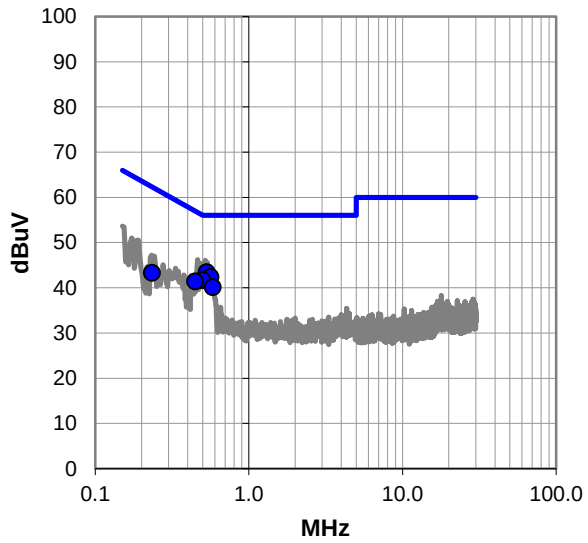
EUT OPERATING MODES

Transmitting 802.11(n), MCS0, Power Settings at Default. Mid Channel 157, 5785 MHz.

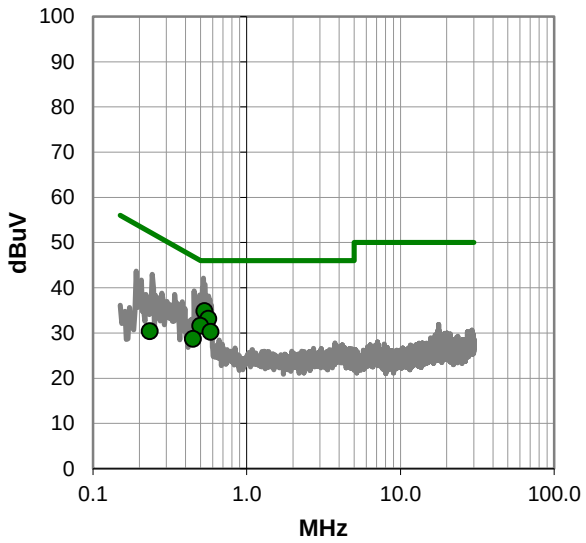
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



AC – POWERLINE CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2016.09.09

RESULTS - Run #5

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.531	22.8	20.6	43.4	56.0	-12.6
0.563	21.8	20.6	42.4	56.0	-13.6
0.500	21.1	20.6	41.7	56.0	-14.3
0.447	20.8	20.6	41.4	56.9	-15.5
0.582	19.5	20.6	40.1	56.0	-15.9
0.235	22.7	20.6	43.3	62.3	-19.0

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.531	14.2	20.6	34.8	46.0	-11.2
0.563	12.5	20.6	33.1	46.0	-12.9
0.500	11.0	20.6	31.6	46.0	-14.4
0.582	9.6	20.6	30.2	46.0	-15.8
0.447	8.1	20.6	28.7	46.9	-18.2
0.235	9.8	20.6	30.4	52.3	-21.9

CONCLUSION

Pass

Tested By

AC – POWERLINE CONDUCTED EMISSIONS

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

TEST SPECIFICATIONS

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

TEST PARAMETERS

Run #:	6	Line:	Neutral	Add. Ext. Attenuation (dB):	0

COMMENTS

None

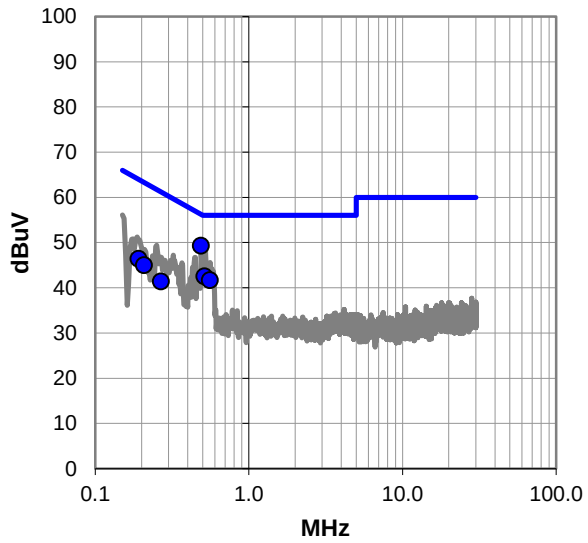
EUT OPERATING MODES

Transmitting 802.11(n), MCS0, Power Settings at Default. Mid Channel 157, 5785 MHz.

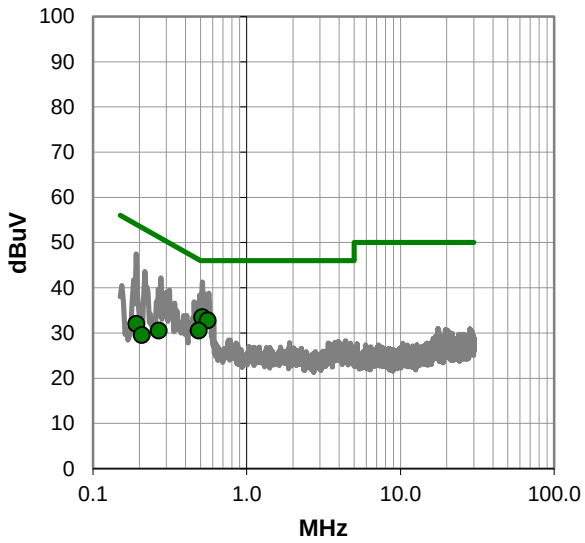
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



AC – POWERLINE CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2016.09.09

RESULTS - Run #6

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.487	28.7	20.6	49.3	56.2	-6.9
0.515	21.9	20.6	42.5	56.0	-13.5
0.559	21.1	20.6	41.7	56.0	-14.3
0.191	25.7	20.7	46.4	64.0	-17.6
0.208	24.3	20.7	45.0	63.3	-18.3
0.268	20.8	20.6	41.4	61.2	-19.8

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.515	12.9	20.6	33.5	46.0	-12.5
0.559	12.2	20.6	32.8	46.0	-13.2
0.487	9.9	20.6	30.5	46.2	-15.7
0.268	9.9	20.6	30.5	51.2	-20.7
0.191	11.3	20.7	32.0	54.0	-22.0
0.208	8.8	20.7	29.5	53.3	-23.8

CONCLUSION

Pass

Tested By

SPURIOUS RADIATED EMISSIONS

PSA-ESCI 2016.07.22

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 802.11(n), MCS0
Transmitting 802.11(n), MCS7

CHANNELS TESTED

Low Channel 36, 5180 MHz
High Channel 48, 5240 MHz
Low Channel 149, 5745 MHz
Mid Channel 157, 5785 MHz
High Channel 161, 5805 MHz

POWER SETTINGS INVESTIGATED

USB

CONFIGURATIONS INVESTIGATED

MCSO1761 - 4

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	40 GHz

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
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAT	6/15/2016	12 mo
Filter - Band Pass/Notch	Micro-Tronics	BRC50705	HHM	1/21/2016	12 mo
Filter - Band Pass/Notch	Micro-Tronics	BRC50703	HHK	1/21/2016	12 mo
Filter - Low Pass	Micro-Tronics	LPM50004	LFF	1/21/2016	12 mo
Antenna - Biconilog	Teseq	CBL 6141B	AYL	7/30/2015	24 mo
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	PAB	7/15/2016	12 mo
Cable	Northwest EMC	Bilog Cables	NC1	8/3/2016	12 mo
Antenna - Double Ridge	EMCO	3115	AHM	6/10/2016	24 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVZ	6/6/2016	12 mo
Cable	ESM Cable Corp	TBJ141 KMKM-72	NCT	9/27/2016	12 mo
Cable	Northwest EMC	3115 Horn Cable	NC2	5/23/2016	12 mo
Antenna - Standard Gain	EMCO	3160-07	AHP	NCR	0 mo
Antenna - Standard Gain	EMCO	3160-08	AHO	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AOJ	9/20/2016	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AOK	9/20/2016	12 mo
Cable	Northwest EMC	Standard Gain Horn Cable	NC3	5/23/2016	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-09	AIY	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-18002650-25-10P	AOD	5/10/2016	12 mo
Cable	Northwest EMC	N/A	NC8	5/10/2016	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-10	AIX	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	JSW45-26004000-40-5P	AVQ	1/6/2016	12 mo
Cable	ESM Cable Corp.	KMKM-72	OC1	1/6/2016	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

TEST DESCRIPTION

The highest gain antenna of each type to be used with the EUT was tested. The EUT was configured for the required transmit frequencies in each operational band and the modes as showed in the data sheets.

For each configuration, the spectrum was scanned throughout the specified range as part of the exploratory investigation of the emissions. These “pre-scans” are not included in the report. Final measurements on individual emissions were then made and included in this test report.

The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis if required, and adjusting the measurement antenna height and polarization (per ANSI C63.10). A preamp and high pass filter (and notch filter) were used for this test in order to provide sufficient measurement sensitivity.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector
PK = Peak Detector
AV = RMS Detector

Measurements were made to satisfy the specific requirements of the test specification for out of band emissions as well as the restricted band requirements.

If there are no detectable emissions above the noise floor, the data included may show noise floor measurements for reference only.

SPURIOUS RADIATED EMISSIONS

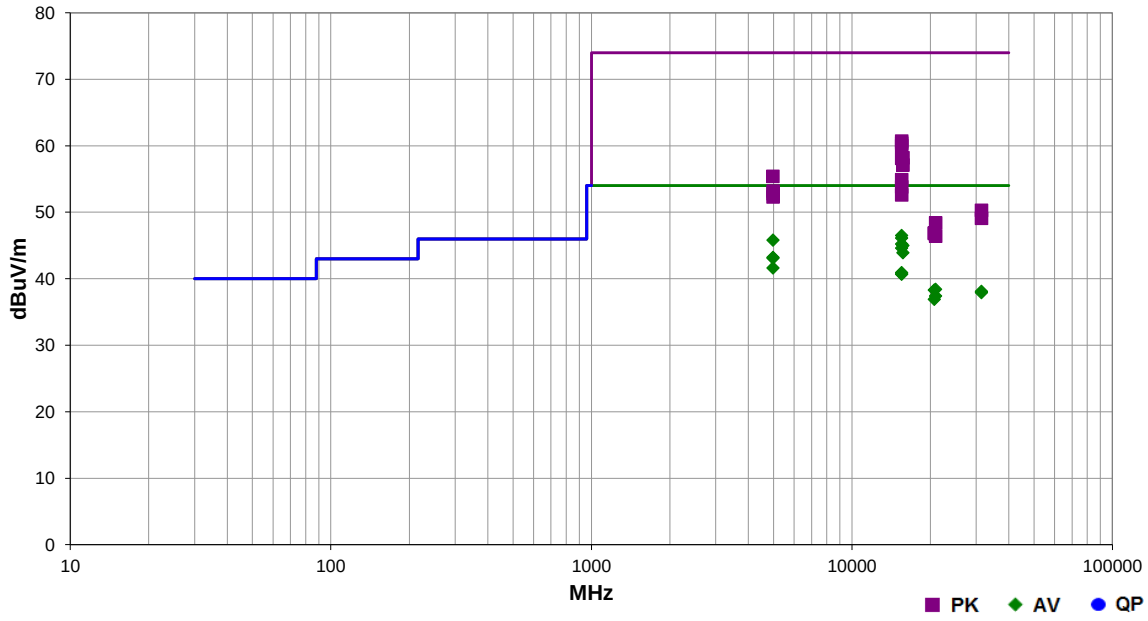
NORTHWEST EMC

PSA-ESCI 2016.07.22
EmiR5 2016.08.26

Work Order:	MCSO1761	**Date:**	12/07/16		
Project:	None	**Temperature:**	23 °C		
Job Site:	NC01	**Humidity:**	35% RH		
Serial Number:	DV-1-0336	**Barometric Pres.:**	1013 mbar	**Tested by:**	Richard Mellroth
EUT:	1790				
Configuration:	4				
Customer:	Microsoft Corporation				
Attendees:	None				
EUT Power:	USB				
Operating Mode:	Transmitting 802.11(n), Power Setting at Default. See comments next to data points for EUT channel, data rate, and orientation.				
Deviations:	None				
Comments:	None				

Test Specifications	**Test Method**
FCC 15.407:2016	ANSI C63.10:2013

Run #	50,55,123,130	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**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
15541.990	38.6	7.9	2.3	165.0	3.0	0.0	Horz	AV	0.0	46.5	54.0	-7.5	Low Ch 36, MCS0, EUT Vert
15539.830	38.2	7.9	2.7	137.0	3.0	0.0	Horz	AV	0.0	46.1	54.0	-7.9	Low Ch 36, MCS7, EUT Vert
4978.975	36.7	9.1	2.9	26.0	3.0	0.0	Vert	AV	0.0	45.8	54.0	-8.2	High Ch 48, MCS0, EUT Vert
15539.330	37.3	7.9	2.4	60.0	3.0	0.0	Vert	AV	0.0	45.2	54.0	-8.8	Low Ch 36, MCS0, EUT on Side
15722.090	37.0	8.0	2.7	143.0	3.0	0.0	Horz	AV	0.0	45.0	54.0	-9.0	High Ch 48, MCS0, EUT Vert
15539.310	36.7	7.9	2.0	358.0	3.0	0.0	Horz	AV	0.0	44.6	54.0	-9.4	Low Ch 36, MCS0, EUT Flat
15722.130	35.9	8.0	1.9	60.0	3.0	0.0	Vert	AV	0.0	43.9	54.0	-10.1	High Ch 48, MCS0, EUT on Side
4979.017	34.1	9.1	3.5	70.0	3.0	0.0	Horz	AV	0.0	43.2	54.0	-10.8	Low Ch 36, MCS0, EUT on Side
4979.067	34.0	9.1	2.3	153.0	3.0	0.0	Vert	AV	0.0	43.1	54.0	-10.9	Low Ch 36, MCS0, EUT Vert
4978.983	32.5	9.1	1.7	214.0	3.0	0.0	Horz	AV	0.0	41.6	54.0	-12.4	High Ch 48, MCS0, EUT on Side
15537.990	33.0	7.9	2.4	360.0	3.0	0.0	Horz	AV	0.0	40.9	54.0	-13.1	Low Ch 36, MCS0, EUT on Side
15538.900	32.8	7.9	1.6	95.0	3.0	0.0	Vert	AV	0.0	40.7	54.0	-13.3	Low Ch 36, MCS0, EUT Flat
15540.090	52.8	7.9	2.3	165.0	3.0	0.0	Horz	PK	0.0	60.7	74.0	-13.3	Low Ch 36, MCS0, EUT Vert
15542.310	32.8	7.9	2.0	256.0	3.0	0.0	Vert	AV	0.0	40.7	54.0	-13.3	Low Ch 36, MCS0, EUT Vert
15538.850	52.5	7.9	2.7	137.0	3.0	0.0	Horz	PK	0.0	60.4	74.0	-13.6	Low Ch 36, MCS7, EUT Vert
15540.220	52.1	7.9	2.4	60.0	3.0	0.0	Vert	PK	0.0	60.0	74.0	-14.0	Low Ch 36, MCS0, EUT on Side
20960.320	38.9	-0.5	1.5	29.0	3.0	0.0	Horz	AV	0.0	38.4	54.0	-15.6	High Ch 48, MCS0, EUT Vert
20720.760	39.5	-1.2	1.5	180.0	3.0	0.0	Vert	AV	0.0	38.3	54.0	-15.7	Low Ch 36, MCS0, EUT Flat
15720.190	50.2	8.0	2.7	143.0	3.0	0.0	Horz	PK	0.0	58.2	74.0	-15.8	High Ch 48, MCS0, EUT Vert
15542.320	50.2	7.9	2.0	358.0	3.0	0.0	Horz	PK	0.0	58.1	74.0	-15.9	Low Ch 36, MCS0, EUT Flat
31438.770	55.6	-17.5	1.5	92.0	3.0	0.0	Vert	AV	0.0	38.1	54.0	-15.9	High Ch 48, MCS0, EUT Flat
31440.590	55.4	-17.5	1.5	179.0	3.0	0.0	Horz	AV	0.0	37.9	54.0	-16.1	High Ch 48, MCS0, EUT Vert

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
20960.580	37.9	-0.5	1.5	180.0	3.0	0.0	Vert	AV	0.0	37.4	54.0	-16.6	High Ch 48, MCS0, EUT Flat
15720.660	49.1	8.0	1.9	60.0	3.0	0.0	Vert	PK	0.0	57.1	74.0	-16.9	High Ch 48, MCS0, EUT on Side
20720.990	38.1	-1.2	1.5	56.0	3.0	0.0	Horz	AV	0.0	36.9	54.0	-17.1	Low Ch 36, MCS0, EUT Vert
4978.708	46.3	9.1	2.9	26.0	3.0	0.0	Vert	PK	0.0	55.4	74.0	-18.6	High Ch 48, MCS0, EUT Vert
15541.670	47.0	7.9	2.4	360.0	3.0	0.0	Horz	PK	0.0	54.9	74.0	-19.1	Low Ch 36, MCS0, EUT on Side
15542.060	45.9	7.9	2.0	256.0	3.0	0.0	Vert	PK	0.0	53.8	74.0	-20.2	Low Ch 36, MCS0, EUT Vert
4979.133	44.1	9.1	3.5	70.0	3.0	0.0	Horz	PK	0.0	53.2	74.0	-20.8	Low Ch 36, MCS0, EUT on Side
4978.808	43.7	9.1	2.3	153.0	3.0	0.0	Vert	PK	0.0	52.8	74.0	-21.2	Low Ch 36, MCS0, EUT Vert
15541.800	44.7	7.9	1.6	95.0	3.0	0.0	Vert	PK	0.0	52.6	74.0	-21.4	Low Ch 36, MCS0, EUT Flat
4979.525	43.2	9.1	1.7	214.0	3.0	0.0	Horz	PK	0.0	52.3	74.0	-21.7	High Ch 48, MCS0, EUT on Side
31439.290	67.8	-17.5	1.5	92.0	3.0	0.0	Vert	PK	0.0	50.3	74.0	-23.7	High Ch 48, MCS0, EUT Flat
31439.740	66.6	-17.5	1.5	179.0	3.0	0.0	Horz	PK	0.0	49.1	74.0	-24.9	High Ch 48, MCS0, EUT Vert
20959.920	48.9	-0.5	1.5	29.0	3.0	0.0	Horz	PK	0.0	48.4	74.0	-25.6	High Ch 48, MCS0, EUT Vert
20720.240	48.1	-1.2	1.5	180.0	3.0	0.0	Vert	PK	0.0	46.9	74.0	-27.1	Low Ch 36, MCS0, EUT Flat
20718.550	47.9	-1.1	1.5	56.0	3.0	0.0	Horz	PK	0.0	46.8	74.0	-27.2	Low Ch 36, MCS0, EUT Vert
20961.130	46.9	-0.5	1.5	180.0	3.0	0.0	Vert	PK	0.0	46.4	74.0	-27.6	High Ch 48, MCS0, EUT Flat

SPURIOUS RADIATED EMISSIONS

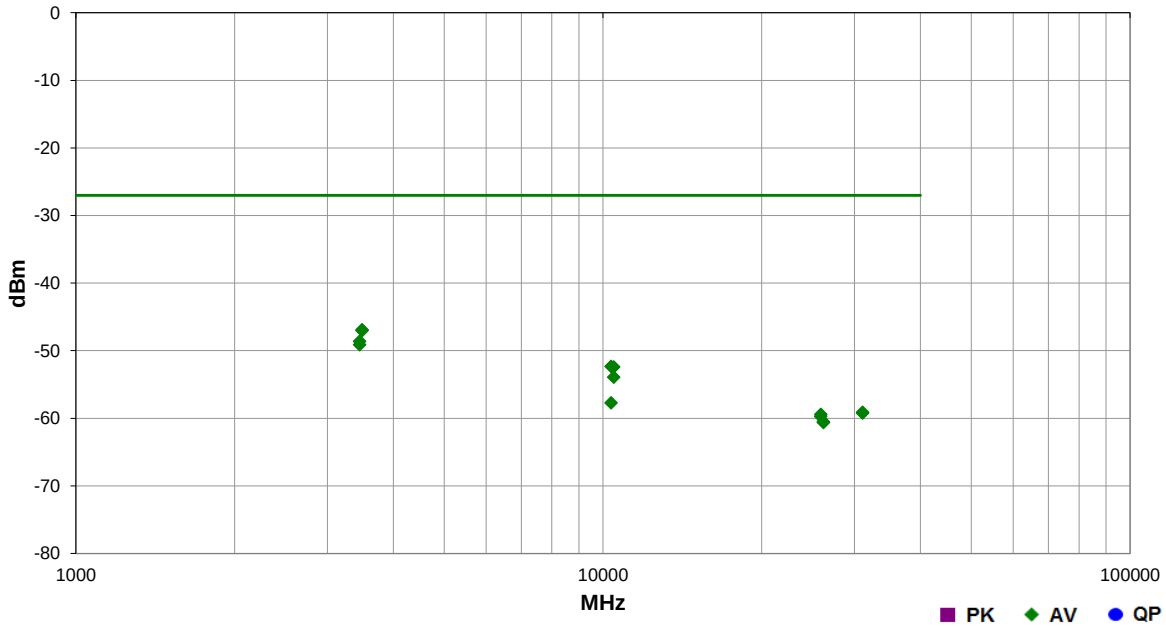
NORTHWEST EMC

PSA-ESCI 2016.07.22
EmiR5 2016.08.26

Work Order:	MCSO1761	**Date:**	12/07/16		
Project:	None	**Temperature:**	23 °C		
Job Site:	NC01	**Humidity:**	35% RH		
Serial Number:	DV-1-0336	**Barometric Pres.:**	1013 mbar	**Tested by:**	Richard Mellroth
EUT:	1790				
Configuration:	4				
Customer:	Microsoft Corporation				
Attendees:	None				
EUT Power:	USB				
Operating Mode:	Transmitting 802.11(n), Power Setting at Default. See comments next to data points for EUT channel, data rate, and orientation.				
Deviations:	None				
Comments:	None				

Test Specifications	**Test Method**
FCC 15.407:2016	ANSI C63.10:2013

Run #	53,54,123,130	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



	Freq (MHz)	Antenna Height (meters)	Azimuth (degrees)	Polarity/ Transducer Type	Detector	EIRP (Watts)	EIRP (dBm)	Spec. Limit (dBm)	Compared to Spec. (dB)	Comments
	3493.450	1.0	243.0	Horz	AV	2.03E-08	-46.9	-27.0	-19.9	High Ch 48, MCS0, EUT on Side
	3493.358	2.9	340.0	Vert	AV	1.98E-08	-47.0	-27.0	-20.0	High Ch 48, MCS0, EUT Vert
	3453.417	1.6	242.0	Horz	AV	1.37E-08	-48.6	-27.0	-21.6	Low Ch 36, MCS0, EUT on Side
	3453.492	2.5	0.0	Vert	AV	1.22E-08	-49.1	-27.0	-22.1	Low Ch 36, MCS0, EUT Vert
	10360.580	1.2	240.0	Vert	AV	5.85E-09	-52.3	-27.0	-25.3	Low Ch 36, MCS0, EUT on Side
	10480.710	1.5	234.0	Vert	AV	5.72E-09	-52.4	-27.0	-25.4	High Ch 48, MCS0, EUT on Side
	10480.380	2.9	237.0	Horz	AV	4.05E-09	-53.9	-27.0	-26.9	High Ch 48, MCS0, EUT Vert
	10360.230	1.6	206.0	Horz	AV	1.69E-09	-57.7	-27.0	-30.7	Low Ch 36, MCS0, EUT Vert
	31080.740	1.5	7.0	Vert	AV	1.22E-09	-59.1	-27.0	-32.1	Low Ch 36, MCS0, EUT Flat
	31081.130	1.5	119.0	Horz	AV	1.19E-09	-59.2	-27.0	-32.2	Low Ch 36, MCS0, EUT Vert
	25901.810	1.5	256.0	Vert	AV	1.14E-09	-59.4	-27.0	-32.4	Low Ch 36, MCS0, EUT Flat
	25897.880	1.5	46.0	Horz	AV	1.06E-09	-59.7	-27.0	-32.7	Low Ch 36, MCS0, EUT Vert
	26198.100	1.5	306.0	Vert	AV	8.85E-10	-60.5	-27.0	-33.5	High Ch 48, MCS0, EUT Flat
	26201.440	1.5	184.0	Horz	AV	8.65E-10	-60.6	-27.0	-33.6	High Ch 48, MCS0, EUT Vert

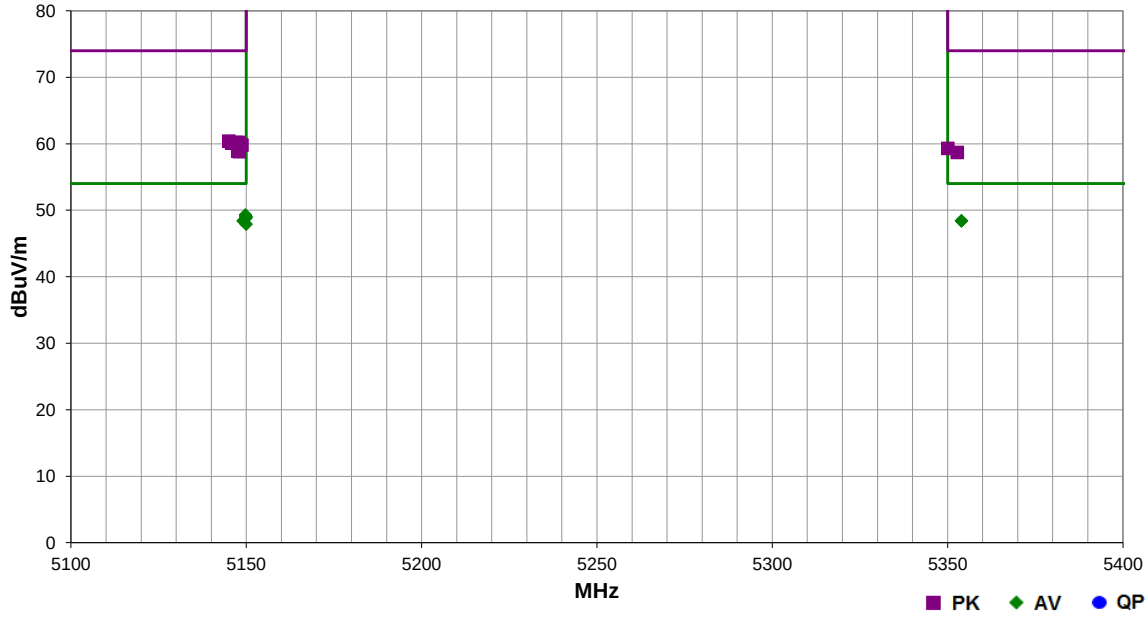
SPURIOUS RADIATED EMISSIONS

PSA-ESCI 2016.09.30
EmiR5 2016.08.26

Work Order:	MCSO1761	**Date:**	12/07/16		
Project:	None	**Temperature:**	23 °C		
Job Site:	NC01	**Humidity:**	35% RH		
Serial Number:	DV-1-0336	**Barometric Pres.:**	1013 mbar	**Tested by:**	Richard Mellroth
EUT:	1790				
Configuration:	4				
Customer:	Microsoft Corporation				
Attendees:	None				
EUT Power:	USB				
Operating Mode:	Transmitting 802.11(n), Power Setting at Default. See comments next to data points for EUT channel, data rate, and orientation.				
Deviations:	None				
Comments:	None				

Test Specifications	**Test Method**
FCC 15.407:2016	ANSI C63.10:2013

Run #	136	**Test Distance (m)**	1	**Antenna Height(s)**	1(m)	**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
5149.742	23.2	35.6	1.0	285.0	1.0	0.0	Vert	AV	-9.5	49.3	54.0	-4.7	Low Ch 36, MCS0, EUT Vert
5149.883	23.0	35.6	1.0	209.0	1.0	0.0	Vert	AV	-9.5	49.1	54.0	-4.9	Low Ch 36, MCS0, EUT on Side
5149.975	22.9	35.6	1.0	298.0	1.0	0.0	Horz	AV	-9.5	49.0	54.0	-5.0	Low Ch 36, MCS0, EUT Flat
5149.858	22.8	35.6	1.0	15.0	1.0	0.0	Horz	AV	-9.5	48.9	54.0	-5.1	Low Ch 36, MCS0, EUT Vert
5149.933	22.7	35.6	1.0	229.0	1.0	0.0	Horz	AV	-9.5	48.8	54.0	-5.2	Low Ch 36, MCS0, EUT on Side
5149.050	22.3	35.6	1.0	286.0	1.0	0.0	Vert	AV	-9.5	48.4	54.0	-5.6	Low Ch 36, MCS7, EUT Vert
5353.958	22.1	35.8	1.0	303.0	1.0	0.0	Vert	AV	-9.5	48.4	54.0	-5.6	High Ch 48, MCS0, EUT Vert
5353.958	22.1	35.8	1.0	348.0	1.0	0.0	Horz	AV	-9.5	48.4	54.0	-5.6	High Ch 48, MCS0, EUT Flat
5149.992	21.8	35.6	1.0	337.0	1.0	0.0	Vert	AV	-9.5	47.9	54.0	-6.1	Low Ch 36, MCS0, EUT Flat
5145.025	34.3	35.6	1.0	286.0	1.0	0.0	Vert	PK	-9.5	60.4	74.0	-13.6	Low Ch 36, MCS7, EUT Vert
5147.667	34.1	35.6	1.0	298.0	1.0	0.0	Horz	PK	-9.5	60.2	74.0	-13.8	Low Ch 36, MCS0, EUT Flat
5147.042	34.1	35.6	1.0	209.0	1.0	0.0	Vert	PK	-9.5	60.2	74.0	-13.8	Low Ch 36, MCS0, EUT on Side
5145.775	34.0	35.6	1.0	285.0	1.0	0.0	Vert	PK	-9.5	60.1	74.0	-13.9	Low Ch 36, MCS0, EUT Vert
5148.758	33.7	35.6	1.0	229.0	1.0	0.0	Horz	PK	-9.5	59.8	74.0	-14.2	Low Ch 36, MCS0, EUT on Side
5350.075	33.0	35.8	1.0	348.0	1.0	0.0	Horz	PK	-9.5	59.3	74.0	-14.7	High Ch 48, MCS0, EUT Flat
5147.550	32.8	35.6	1.0	15.0	1.0	0.0	Horz	PK	-9.5	58.9	74.0	-15.1	Low Ch 36, MCS0, EUT Vert
5148.008	32.7	35.6	1.0	337.0	1.0	0.0	Vert	PK	-9.5	58.8	74.0	-15.2	Low Ch 36, MCS0, EUT Flat
5352.742	32.4	35.8	1.0	303.0	1.0	0.0	Vert	PK	-9.5	58.7	74.0	-15.3	High Ch 48, MCS0, EUT Vert

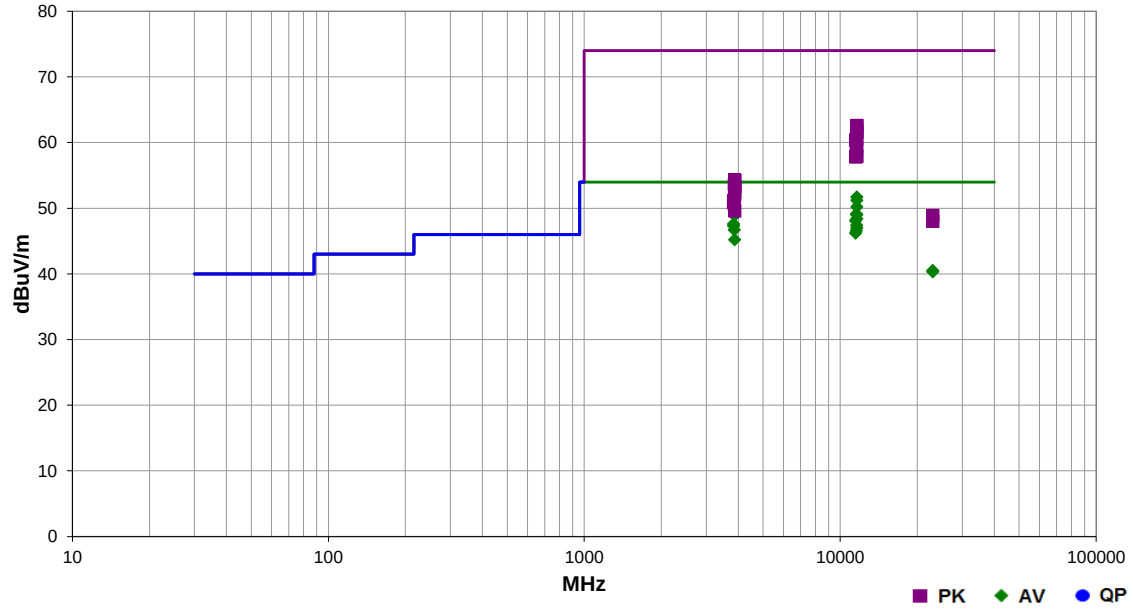
SPURIOUS RADIATED EMISSIONS

PSA-ESCI 2016.07.22
EmiR5 2016.08.26

Work Order:	MCSO1761	**Date:**	12/07/16		
Project:	None	**Temperature:**	23 °C		
Job Site:	NC01	**Humidity:**	35% RH		
Serial Number:	DV-1-0336	**Barometric Pres.:**	1013 mbar	**Tested by:**	Richard Mellroth
EUT:	1790				
Configuration:	4				
Customer:	Microsoft Corporation				
Attendees:	None				
EUT Power:	USB				
Operating Mode:	Transmitting 802.11(n), Power Setting at Default. See comments next to data points for EUT channel, data rate, and orientation.				
Deviations:	None				
Comments:	None				

Test Specifications	**Test Method**
FCC 15.407:2016	ANSI C63.10:2013

Run #	68,70,127	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**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
11611.080	54.0	-2.3	2.1	48.0	3.0	0.0	Horz	AV	0.0	51.7	54.0	-2.3	High Ch 161, MCS0, EUT Flat
3870.050	46.5	5.2	3.5	330.0	3.0	0.0	Vert	AV	0.0	51.7	54.0	-2.3	High Ch 161, MCS7, EUT Vert
3870.125	46.1	5.2	3.7	5.0	3.0	0.0	Vert	AV	0.0	51.3	54.0	-2.7	High Ch 161, MCS0, EUT Vert
11610.610	53.5	-2.3	2.2	283.0	3.0	0.0	Horz	AV	0.0	51.2	54.0	-2.8	High Ch 161, MCS0, EUT on Side
3870.192	45.4	5.2	4.0	126.0	3.0	0.0	Horz	AV	0.0	50.6	54.0	-3.4	High Ch 161, MCS0, EUT Flat
3856.808	45.3	5.2	4.0	170.0	3.0	0.0	Vert	AV	0.0	50.5	54.0	-3.5	Mid Ch 157, MCS0, EUT Flat
3870.083	45.1	5.2	2.1	145.0	3.0	0.0	Horz	AV	0.0	50.3	54.0	-3.7	High Ch 161, MCS0, EUT on Side
11610.390	52.5	-2.3	2.9	174.0	3.0	0.0	Vert	AV	0.0	50.2	54.0	-3.8	High Ch 161, MCS0, EUT Flat
3870.200	44.2	5.2	1.8	181.0	3.0	0.0	Vert	AV	0.0	49.4	54.0	-4.6	High Ch 161, MCS0, EUT Flat
11570.360	51.4	-2.3	3.0	170.0	3.0	0.0	Vert	AV	0.0	49.1	54.0	-4.9	Mid Ch 157, MCS0, EUT Flat
11610.050	51.3	-2.3	1.0	161.0	3.0	0.0	Vert	AV	0.0	49.0	54.0	-5.0	High Ch 161, MCS0, EUT on Side
3870.150	43.7	5.2	2.4	51.0	3.0	0.0	Horz	AV	0.0	48.9	54.0	-5.1	High Ch 161, MCS0, EUT Vert
11610.670	50.7	-2.3	2.2	360.0	3.0	0.0	Horz	AV	0.0	48.4	54.0	-5.6	High Ch 161, MCS0, EUT Vert
11490.820	50.3	-2.2	2.0	161.0	3.0	0.0	Horz	AV	0.0	48.1	54.0	-5.9	Low Ch 149, MCS0, EUT Flat
3830.142	42.6	5.0	1.7	170.0	3.0	0.0	Vert	AV	0.0	47.6	54.0	-6.4	Low Ch 149, MCS0, EUT Flat
11608.790	49.7	-2.3	2.0	162.0	3.0	0.0	Horz	AV	0.0	47.4	54.0	-6.6	High Ch 161, MCS7, EUT Flat
3830.125	42.3	5.0	2.9	235.0	3.0	0.0	Horz	AV	0.0	47.3	54.0	-6.7	Low Ch 149, MCS0, EUT Flat
11610.430	49.3	-2.3	2.2	212.0	3.0	0.0	Vert	AV	0.0	47.0	54.0	-7.0	High Ch 161, MCS0, EUT Vert
3856.775	41.5	5.2	1.7	220.0	3.0	0.0	Horz	AV	0.0	46.7	54.0	-7.3	Mid Ch 157, MCS0, EUT Flat
11569.170	48.9	-2.3	2.2	164.0	3.0	0.0	Horz	AV	0.0	46.6	54.0	-7.4	Mid Ch 157, MCS0, EUT Flat
11490.390	48.4	-2.2	1.9	351.0	3.0	0.0	Vert	AV	0.0	46.2	54.0	-7.8	Low Ch 149, MCS0, EUT Flat
3870.158	40.0	5.2	1.5	88.0	3.0	0.0	Vert	AV	0.0	45.2	54.0	-8.8	High Ch 161, MCS0, EUT on Side
11607.560	64.9	-2.3	1.0	161.0	3.0	0.0	Vert	PK	0.0	62.6	74.0	-11.4	High Ch 161, MCS0, EUT on Side

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
11611.500	64.9	-2.3	2.1	48.0	3.0	0.0	Horz	PK	0.0	62.6	74.0	-11.4	High Ch 161, MCS0, EUT Flat
11609.860	64.1	-2.3	2.2	283.0	3.0	0.0	Horz	PK	0.0	61.8	74.0	-12.2	High Ch 161, MCS0, EUT on Side
11610.030	63.8	-2.3	2.9	174.0	3.0	0.0	Vert	PK	0.0	61.5	74.0	-12.5	High Ch 161, MCS0, EUT Flat
11570.100	62.8	-2.3	3.0	170.0	3.0	0.0	Vert	PK	0.0	60.5	74.0	-13.5	Mid Ch 157, MCS0, EUT Flat
11609.860	62.8	-2.3	2.0	162.0	3.0	0.0	Horz	PK	0.0	60.5	74.0	-13.5	High Ch 161, MCS7, EUT Flat
22980.910	42.2	-1.7	1.5	17.0	3.0	0.0	Horz	AV	0.0	40.5	54.0	-13.5	Low Ch 149, MCS0, EUT Vert
11490.790	62.6	-2.2	2.0	161.0	3.0	0.0	Horz	PK	0.0	60.4	74.0	-13.6	Low Ch 149, MCS0, EUT Flat
22980.980	42.0	-1.7	1.5	240.0	3.0	0.0	Vert	AV	0.0	40.3	54.0	-13.7	Low Ch 149, MCS0, EUT Flat
11609.320	61.7	-2.3	2.2	360.0	3.0	0.0	Horz	PK	0.0	59.4	74.0	-14.6	High Ch 161, MCS0, EUT Vert
11569.740	60.9	-2.3	2.2	164.0	3.0	0.0	Horz	PK	0.0	58.6	74.0	-15.4	Mid Ch 157, MCS0, EUT Flat
11611.260	60.2	-2.3	2.2	212.0	3.0	0.0	Vert	PK	0.0	57.9	74.0	-16.1	High Ch 161, MCS0, EUT Vert
11491.850	60.0	-2.2	1.9	351.0	3.0	0.0	Vert	PK	0.0	57.8	74.0	-16.2	Low Ch 149, MCS0, EUT Flat
3870.167	49.1	5.2	3.5	330.0	3.0	0.0	Vert	PK	0.0	54.3	74.0	-19.7	High Ch 161, MCS7, EUT Vert
3869.867	49.0	5.2	3.7	5.0	3.0	0.0	Vert	PK	0.0	54.2	74.0	-19.8	High Ch 161, MCS0, EUT Vert
3856.783	48.4	5.2	4.0	170.0	3.0	0.0	Vert	PK	0.0	53.6	74.0	-20.4	Mid Ch 157, MCS0, EUT Flat
3870.258	48.1	5.2	4.0	126.0	3.0	0.0	Horz	PK	0.0	53.3	74.0	-20.7	High Ch 161, MCS0, EUT Flat
3869.933	48.1	5.2	2.1	145.0	3.0	0.0	Horz	PK	0.0	53.3	74.0	-20.7	High Ch 161, MCS0, EUT on Side
3870.183	47.3	5.2	1.8	181.0	3.0	0.0	Vert	PK	0.0	52.5	74.0	-21.5	High Ch 161, MCS0, EUT Flat
3870.142	46.9	5.2	2.4	51.0	3.0	0.0	Horz	PK	0.0	52.1	74.0	-21.9	High Ch 161, MCS0, EUT Vert
3830.175	46.2	5.0	1.7	170.0	3.0	0.0	Vert	PK	0.0	51.2	74.0	-22.8	Low Ch 149, MCS0, EUT Flat
3830.267	45.9	5.0	2.9	235.0	3.0	0.0	Horz	PK	0.0	50.9	74.0	-23.1	Low Ch 149, MCS0, EUT Flat
3856.892	45.4	5.2	1.7	220.0	3.0	0.0	Horz	PK	0.0	50.6	74.0	-23.4	Mid Ch 157, MCS0, EUT Flat
3870.125	44.4	5.2	1.5	88.0	3.0	0.0	Vert	PK	0.0	49.6	74.0	-24.4	High Ch 161, MCS0, EUT on Side
22980.680	50.6	-1.7	1.5	240.0	3.0	0.0	Vert	PK	0.0	48.9	74.0	-25.1	Low Ch 149, MCS0, EUT Flat
22980.870	49.7	-1.7	1.5	17.0	3.0	0.0	Horz	PK	0.0	48.0	74.0	-26.0	Low Ch 149, MCS0, EUT Vert

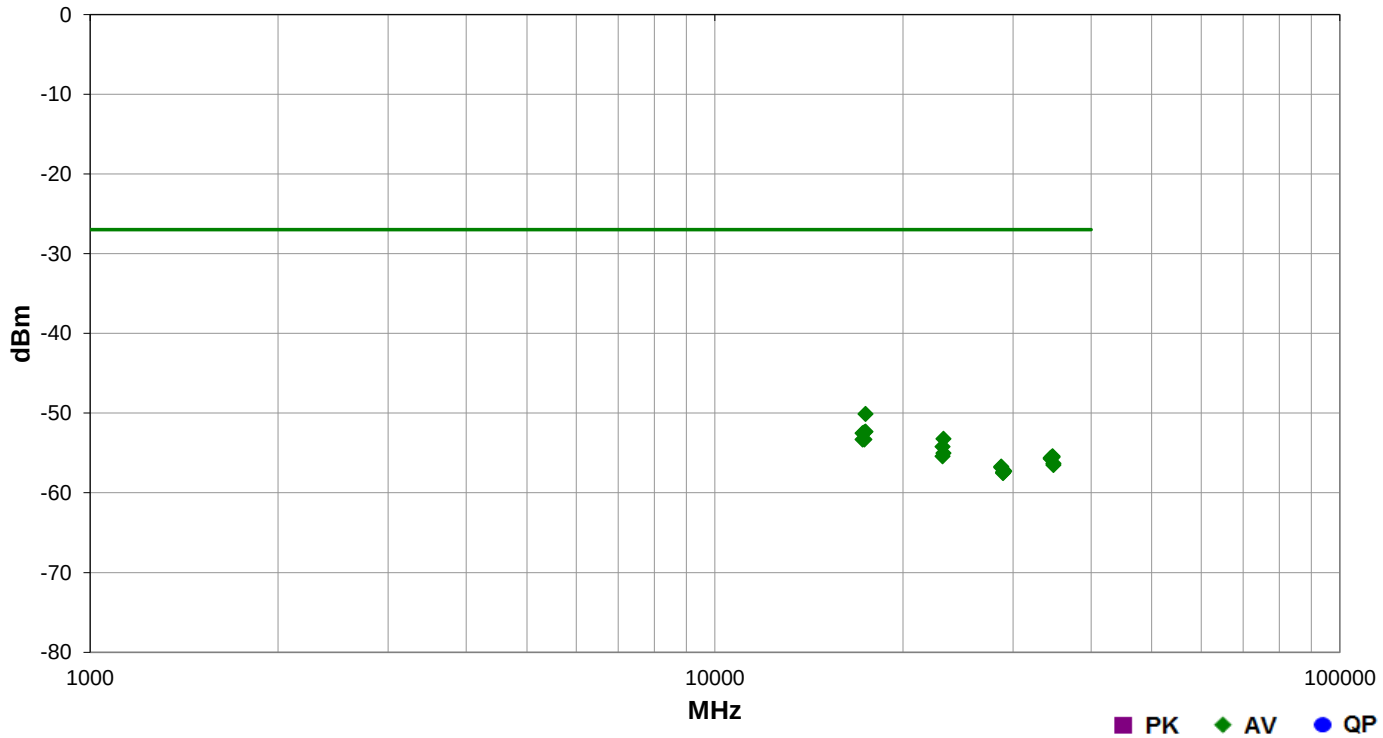
SPURIOUS RADIATED EMISSIONS

PSA-ESCI 2016.07.22
EmiR5 2016.08.26

Work Order:	MCSO1761	**Date:**	12/07/16		
Project:	None	**Temperature:**	23 °C		
Job Site:	NC01	**Humidity:**	35% RH		
Serial Number:	DV-1-0336	**Barometric Pres.:**	1013 mbar	**Tested by:**	Richard Mellroth
EUT:	1790				
Configuration:	4				
Customer:	Microsoft Corporation				
Attendees:	None				
EUT Power:	USB				
Operating Mode:	Transmitting 802.11(n), Power Setting at Default. See comments next to data points for EUT channel, data rate, and orientation.				
Deviations:	None				
Comments:	None				

Test Specifications	**Test Method**
FCC 15.407:2016	ANSI C63.10:2013

Run #	68,127,134	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



	Freq (MHz)	Antenna Height (meters)	Azimuth (degrees)	Polarity/ Transducer Type	Detector	EIRP (Watts)	EIRP (dBm)	Spec. Limit (dBm)	Compared to Spec. (dB)	Comments
	17414.430	2.1	48.0	Vert	AV	9.71E-09	-50.1	-27.0	-23.1	High Ch 161, MCS0, EUT Flat
	17414.600	1.6	354.0	Horz	AV	5.85E-09	-52.3	-27.0	-25.3	High Ch 161, MCS0, EUT Flat
	17355.850	1.7	359.0	Horz	AV	5.72E-09	-52.4	-27.0	-25.4	Mid Ch 157, MCS0, EUT Flat
	17236.060	2.5	41.0	Vert	AV	5.59E-09	-52.5	-27.0	-25.5	Low Ch 149, MCS0, EUT Flat
	23220.840	1.5	239.0	Vert	AV	4.75E-09	-53.2	-27.0	-26.2	High Ch 161, MCS0, EUT Flat

	Freq (MHz)	Antenna Height (meters)	Azimuth (degrees)	Polarity/ Transducer Type	Detector	EIRP (Watts)	EIRP (dBm)	Spec. Limit (dBm)	Compared to Spec. (dB)	Comments
	17235.590	1.6	343.0	Horz	AV	4.65E-09	-53.3	-27.0	-26.3	Low Ch 149, MCS0, EUT Flat
	17355.740	1.9	50.0	Vert	AV	4.65E-09	-53.3	-27.0	-26.3	Mid Ch 157, MCS0, EUT Flat
	23140.860	1.5	207.0	Vert	AV	3.78E-09	-54.2	-27.0	-27.2	Mid Ch 157, MCS0, EUT Flat
	23220.850	1.5	179.0	Horz	AV	3.14E-09	-55.0	-27.0	-28.0	High Ch 161, MCS0, EUT Vert
	23140.950	1.5	17.0	Horz	AV	2.86E-09	-55.4	-27.0	-28.4	Mid Ch 157, MCS0, EUT Vert
	34709.390	1.5	245.0	Horz	AV	2.86E-09	-55.4	-27.0	-28.4	Mid Ch 157, MCS0, EUT Vert
	34711.580	1.5	25.0	Vert	AV	2.80E-09	-55.5	-27.0	-28.5	Mid Ch 157, MCS0, EUT Flat
	34471.880	1.5	234.0	Vert	AV	2.74E-09	-55.6	-27.0	-28.6	Low Ch 149, MCS0, EUT Flat
	34469.100	1.5	111.0	Horz	AV	2.67E-09	-55.7	-27.0	-28.7	Low Ch 149, MCS0, EUT Vert
	34831.270	1.5	305.0	Vert	AV	2.33E-09	-56.3	-27.0	-29.3	High Ch 161, MCS0, EUT Flat
	34831.320	1.5	350.0	Horz	AV	2.22E-09	-56.5	-27.0	-29.5	High Ch 161, MCS0, EUT Vert
	28723.410	1.5	174.0	Horz	AV	2.12E-09	-56.7	-27.0	-29.7	Low Ch 149, MCS0, EUT Vert
	28726.230	1.5	286.0	Vert	AV	2.08E-09	-56.8	-27.0	-29.8	Low Ch 149, MCS0, EUT Flat
	29023.140	1.5	247.0	Horz	AV	1.89E-09	-57.2	-27.0	-30.2	High Ch 161, MCS0, EUT Vert
	29025.150	1.5	188.0	Vert	AV	1.85E-09	-57.3	-27.0	-30.3	High Ch 161, MCS0, EUT Flat
	28923.940	1.5	119.0	Horz	AV	1.81E-09	-57.4	-27.0	-30.4	Mid Ch 157, MCS0, EUT Vert
	28924.220	1.5	94.0	Vert	AV	1.77E-09	-57.5	-27.0	-30.5	Mid Ch 157, MCS0, EUT Flat

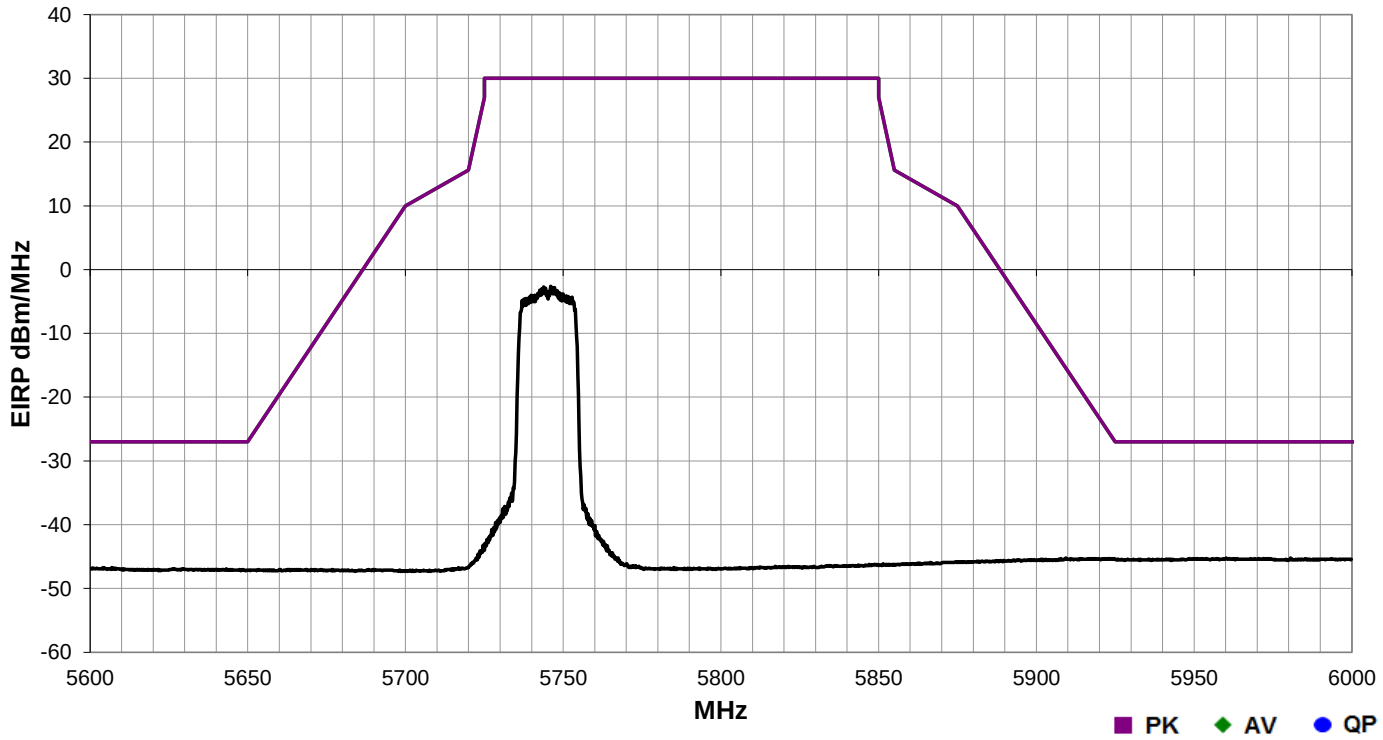
SPURIOUS RADIATED EMISSIONS

PSA-ESCI 2016.09.30
EmiR5 2016.08.26

Work Order:	MCSO1761	**Date:**	12/07/16		
Project:	None	**Temperature:**	23 °C		
Job Site:	NC01	**Humidity:**	35% RH		
Serial Number:	DV-1-0336	**Barometric Pres.:**	1013 mbar	**Tested by:**	Richard Mellroth
EUT:	1790				
Configuration:	4				
Customer:	Microsoft Corporation				
Attendees:	None				
EUT Power:	USB				
Operating Mode:	Transmitting 802.11(n), Power Setting at Default. Low Channel 149, 5745 MHz, MCS0. EUT Vertical				
Deviations:	None				
Comments:	None				

Test Specifications	**Test Method**
FCC 15.407:2016	ANSI C63.10:2013

Run #	139	**Test Distance (m)**	1	**Antenna Height(s)**	1(m)	**Results**	Pass



	Freq (MHz)	Antenna Height (meters)	Transducer (dB)	Polarity/ Transducer Type	Detector	EIRP (Watts/MHz)	EIRP (dBm/MHz)	Spec. Limit (dBm/MHz)	Compared to Spec. (dB)	Comments

All emissions were below the limit (see graph above).

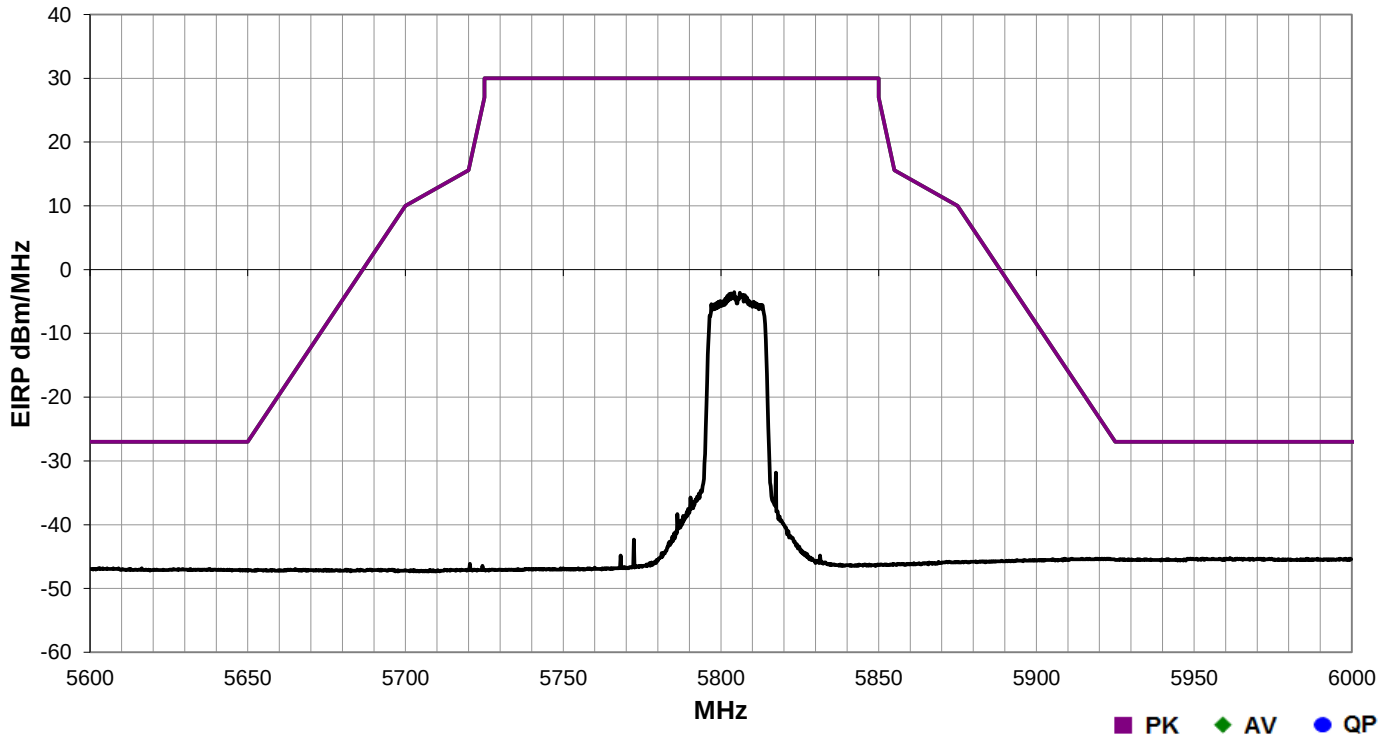
SPURIOUS RADIATED EMISSIONS

PSA-ESCI 2016.09.30
EmiR5 2016.08.26

Work Order:	MCSO1761	**Date:**	12/07/16		
Project:	None	**Temperature:**	23 °C		
Job Site:	NC01	**Humidity:**	35% RH		
Serial Number:	DV-1-0336	**Barometric Pres.:**	1013 mbar	**Tested by:**	Richard Mellroth
EUT:	1790				
Configuration:	4				
Customer:	Microsoft Corporation				
Attendees:	None				
EUT Power:	USB				
Operating Mode:	Transmitting 802.11(n), Power Setting at Default. High Channel 161, 5805 MHz, MCS0. EUT Vertical				
Deviations:	None				
Comments:	None				

Test Specifications	**Test Method**
FCC 15.407:2016	ANSI C63.10:2013

Run #	140	**Test Distance (m)**	1	**Antenna Height(s)**	1(m)	**Results**	Pass



	Freq (MHz)	Antenna Height (meters)	Transducer (dB)	Polarity/ Transducer Type	Detector	EIRP (Watts/MHz)	EIRP (dBm/MHz)	Spec. Limit (dBm/MHz)	Compared to Spec. (dB)	Comments

All emissions were below the limit (see graph above).

FREQUENCY STABILITY

XMit 2016.05.06

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Meter - Multimeter	Fluke	111	MMM	2/18/2016	2/18/2019
Chamber - Temperature/Humidity	Tenney	T6S	TBG	NCR	NCR
Thermometer	Omega Engineering, Inc.	HH311	DUH	4/3/2015	4/3/2018
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFO	6/8/2016	6/8/2017
Cable	Micro-Coax	UFD150A-1-0720-200200	NCS	6/7/2016	6/7/2017
Attenuator	Fairview Microwave	SA4014-20	TKV	3/4/2016	3/4/2017
Block - DC	Fairview Microwave	SD3379	AMU	5/6/2016	5/6/2017
Generator - Signal	Agilent	N5183A	TIA	4/6/2016	4/6/2018

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The spectrum analyzer is equipped with a precision frequency reference that exceeds the stability requirement of the EUT.

Measurements were made at the edges of the main transmit bands as called out on the data sheets. Testing was done with an absence of modulation in a CW mode of operation.

The primary supply voltage was varied from 85 % to 115% of the nominal voltage Using a temperature chamber, the transmit frequency was recorded at the extremes of the specified temperature range (-30 ° to +50° C) and at 10°C intervals.

Where a ppm limit applies: ppm = (Measured Frequency / Measured Nominal Frequency - 1) * 1,000,000

Per the requirements of FCC 15.407:

“Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user’s manual.”

No specific limits are provided in either FCC 15.407, the product specific rule part, or FCC 2.1055, the equipment authorization procedure for testing frequency stability. While there are no limits called out, any results less than 100ppm will still allow the radio to be operating within the band.

FREQUENCY STABILITY

NORTHWEST EMC

XMit 2016.05.06

EUT:	1790			**Work Order:**	MCSO1761
Serial Number:	DV-1-0546			**Date:**	11/08/16
Customer:	Microsoft Corporation			**Temperature:**	21.5 °C
Attendees:	None			**Humidity:**	46.6% RH
Project:	None			**Barometric Pres.:**	1021 mbar
Tested by:	Richard Mellroth	**Power:**	5.0 VDC	**Job Site:**	NC02

TEST SPECIFICATIONS	Test Method
FCC 15.407:2016	ANSI C63.10:2013

COMMENTS

Power Setting at Default. Client provided adapter cable loss of 1.2dB included in reference level offset.

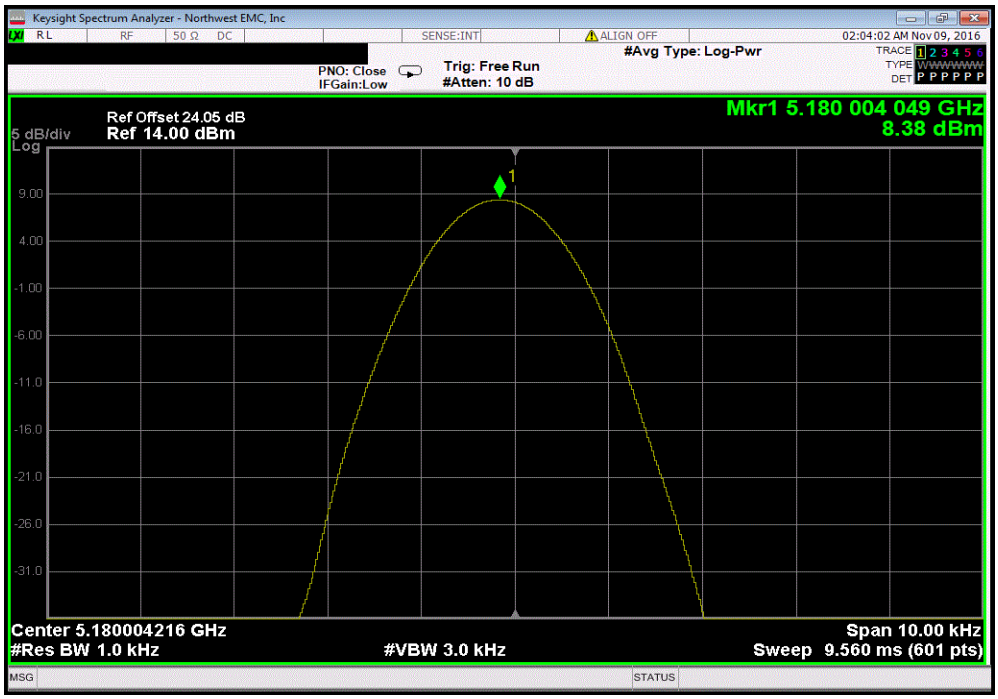
DEVIATIONS FROM TEST STANDARD

None

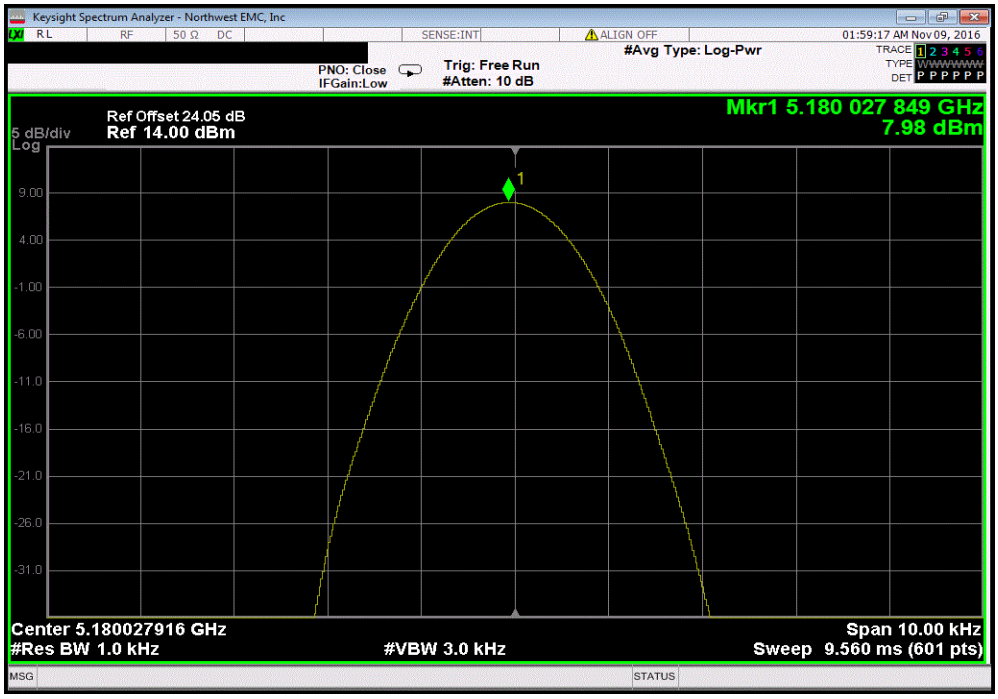
Configuration #	2	Signature

	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
5150 MHz - 5250 MHz Band - Low Channel 36, 5180 MHz					
Voltage: 115%	5180.004049	5180	0.8	100	Pass
Voltage: 100%	5180.027849	5180	5.4	100	Pass
Voltage: 85%	5180.010417	5180	2	100	Pass
Temperature: +50°	5180.021534	5180	4.2	100	Pass
Temperature: +40°	5179.985567	5180	2.8	100	Pass
Temperature: +30°	5179.975051	5180	4.8	100	Pass
Temperature: +20°	5180.038847	5180	7.5	100	Pass
Temperature: +10°	5179.975716	5180	4.7	100	Pass
Temperature: 0°	5179.988682	5180	2.2	100	Pass
Temperature: -10°	5180.0008	5180	0.2	100	Pass
Temperature: -20°	5180.012333	5180	2.4	100	Pass
Temperature: -30°	5180.027749	5180	5.4	100	Pass
5725 MHz - 5850 MHz Band - High Channel 161, 5805 MHz					
Voltage: 115%	5805.036467	5805	6.3	100	Pass
Voltage: 100%	5805.048116	5805	8.3	100	Pass
Voltage: 85%	5805.040934	5805	7.1	100	Pass
Temperature: +50°	5805.084667	5805	14.6	100	Pass
Temperature: +40°	5805.002067	5805	0.4	100	Pass
Temperature: +30°	5804.97855	5805	3.7	100	Pass
Temperature: +20°	5805.043043	5805	7.4	100	Pass
Temperature: +10°	5804.97225	5805	4.8	100	Pass
Temperature: 0°	5804.982883	5805	3	100	Pass
Temperature: -10°	5804.995234	5805	0.8	100	Pass
Temperature: -20°	5805.0064	5805	1.1	100	Pass
Temperature: -30°	5805.0226	5805	3.9	100	Pass

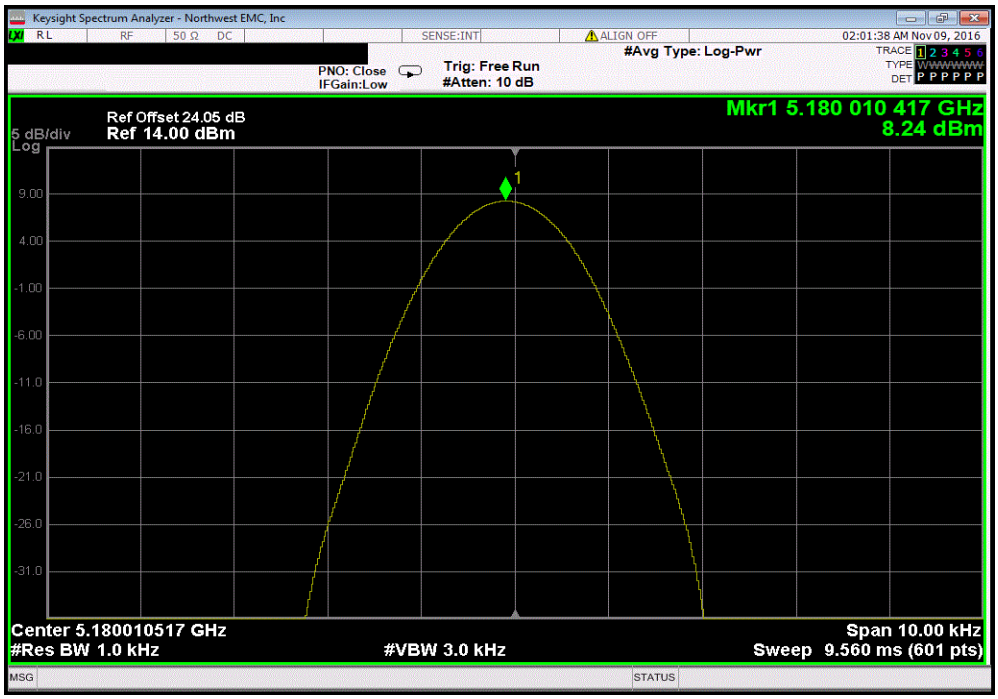
5150 MHz - 5250 MHz Band - Low Channel 36, 5180 MHz, Voltage: 115%						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		5180.004049	5180	0.8	100	Pass



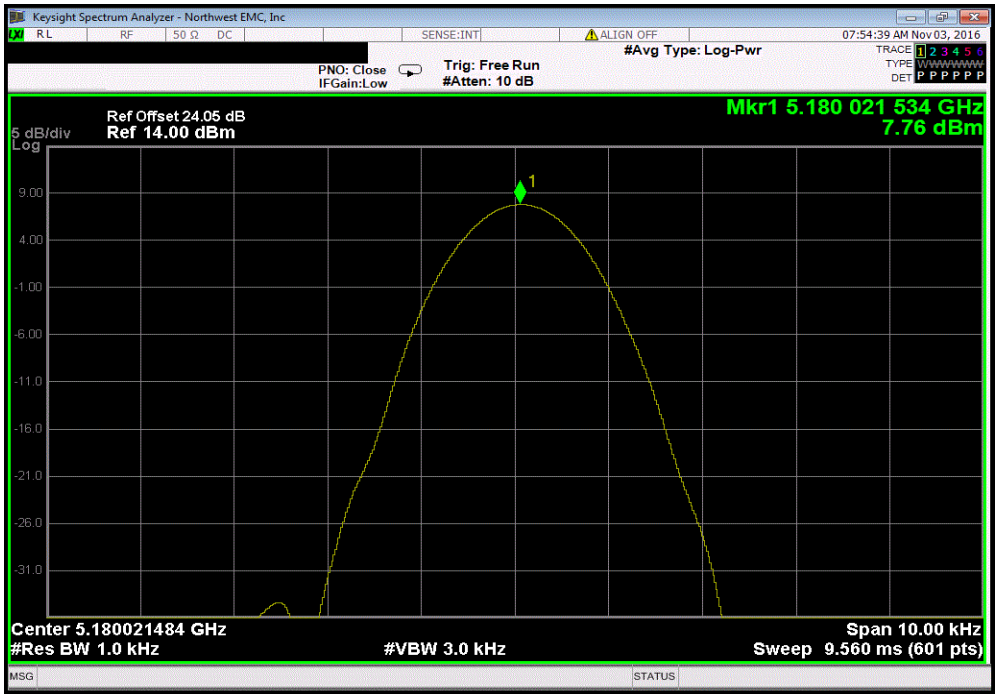
5150 MHz - 5250 MHz Band - Low Channel 36, 5180 MHz, Voltage: 100%						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		5180.027849	5180	5.4	100	Pass



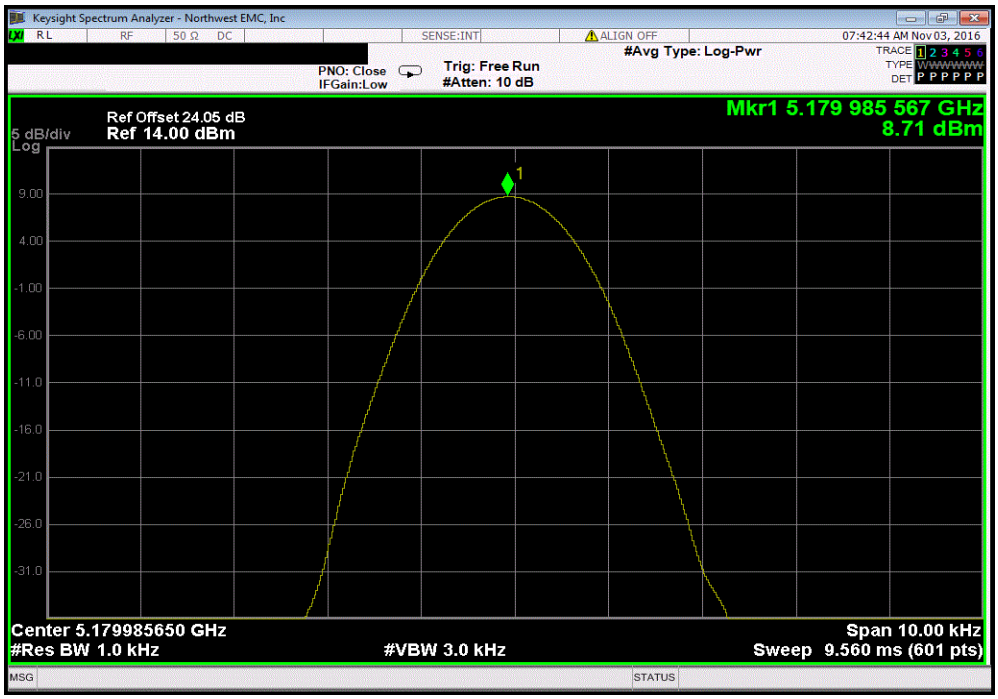
5150 MHz - 5250 MHz Band - Low Channel 36, 5180 MHz, Voltage: 85%						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		5180.010417	5180	2	100	Pass



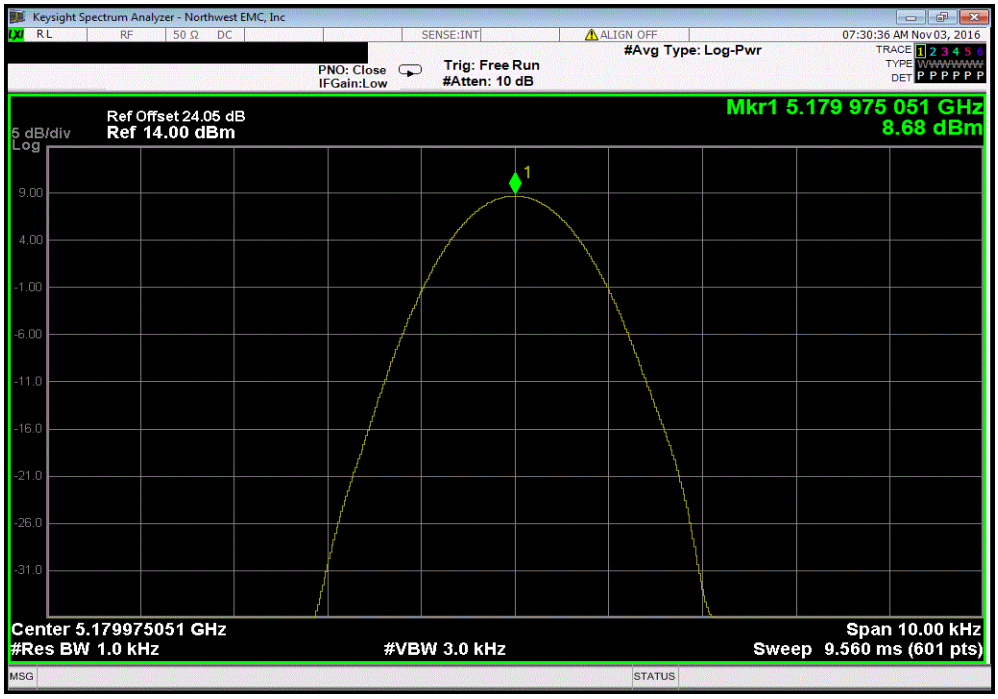
5150 MHz - 5250 MHz Band - Low Channel 36, 5180 MHz, Temperature: +50°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		5180.021534	5180	4.2	100	Pass



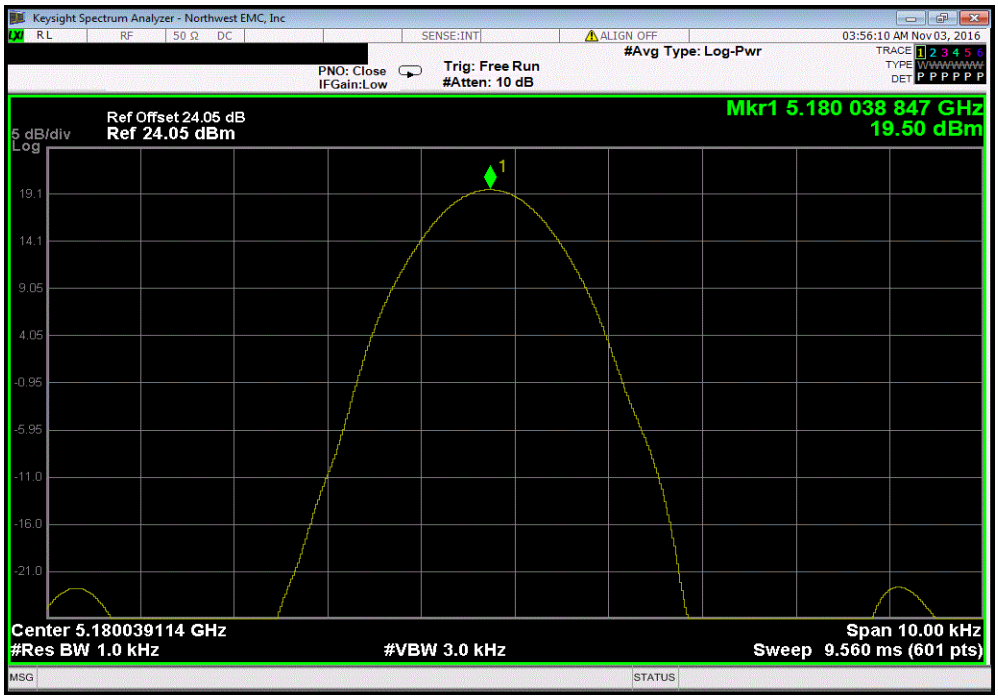
5150 MHz - 5250 MHz Band - Low Channel 36, 5180 MHz, Temperature: +40°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		5179.985567	5180	2.8	100	Pass



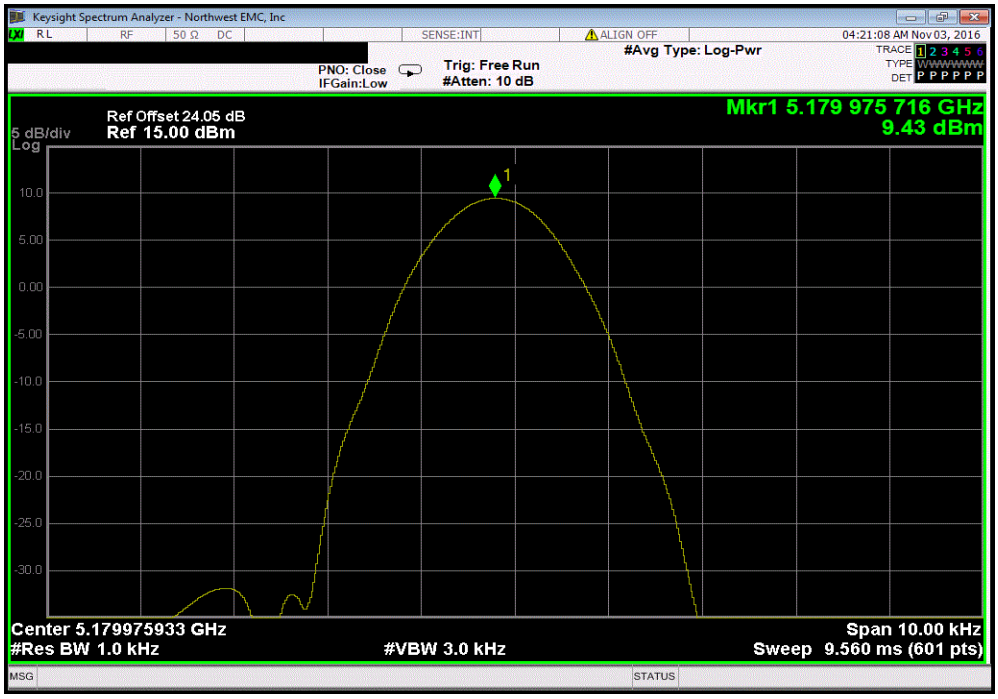
5150 MHz - 5250 MHz Band - Low Channel 36, 5180 MHz, Temperature: +30°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		5179.975051	5180	4.8	100	Pass



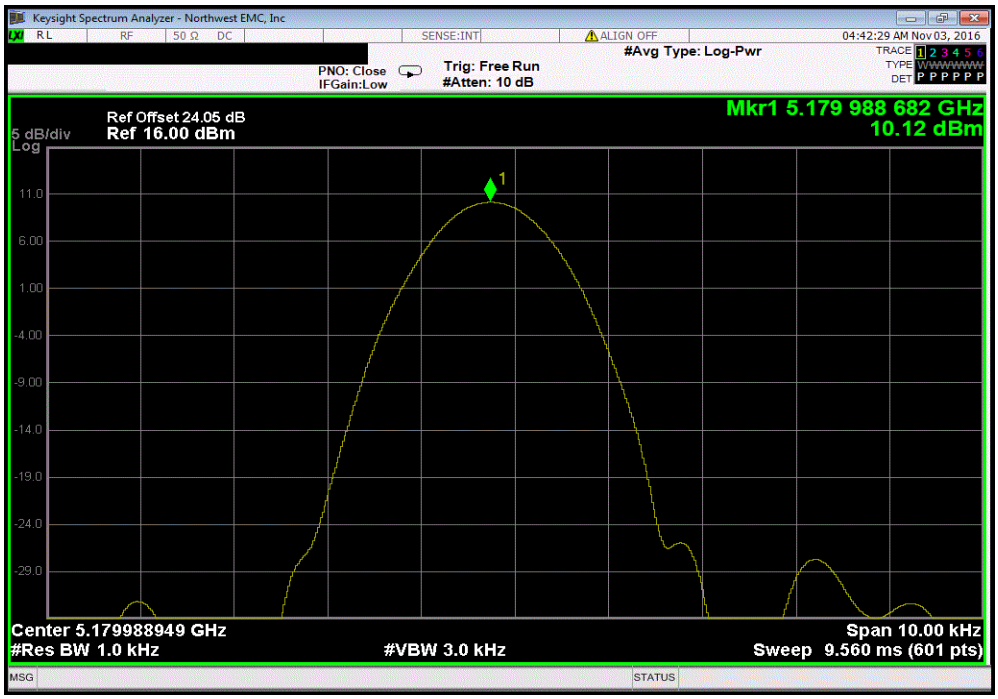
5150 MHz - 5250 MHz Band - Low Channel 36, 5180 MHz, Temperature: +20°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		5180.038847	5180	7.5	100	Pass



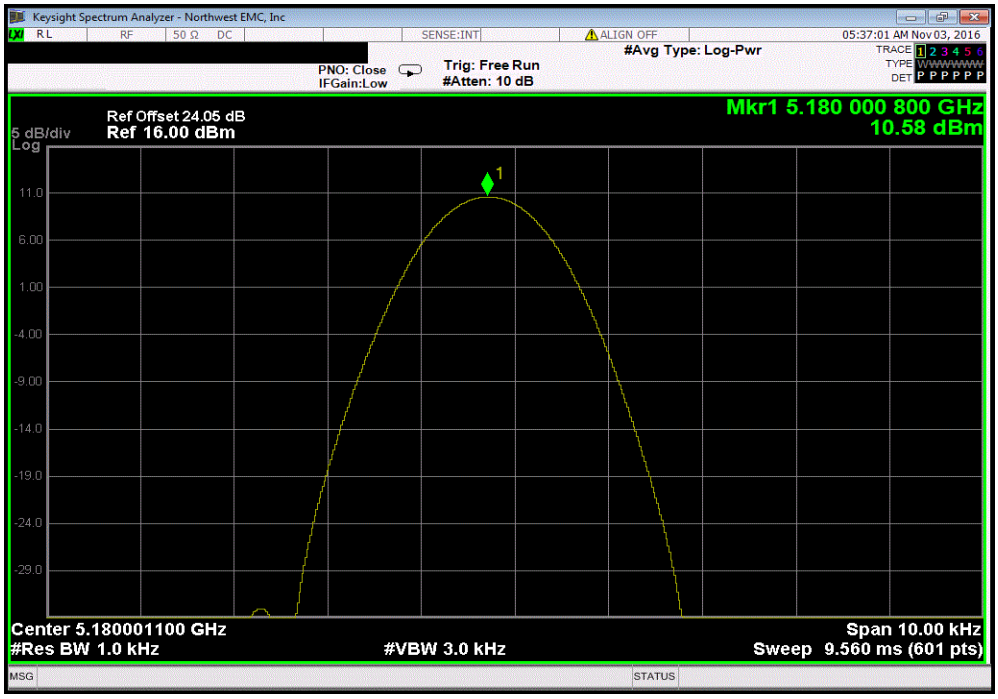
5150 MHz - 5250 MHz Band - Low Channel 36, 5180 MHz, Temperature: +10°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		5179.975716	5180	4.7	100	Pass



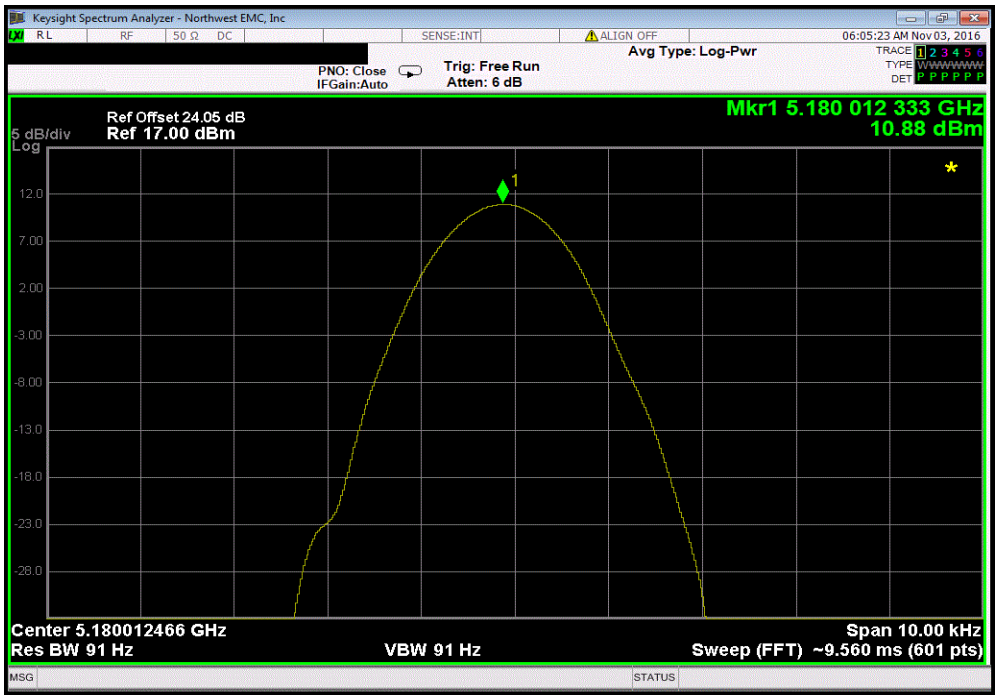
5150 MHz - 5250 MHz Band - Low Channel 36, 5180 MHz, Temperature: 0°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		5179.988682	5180	2.2	100	Pass



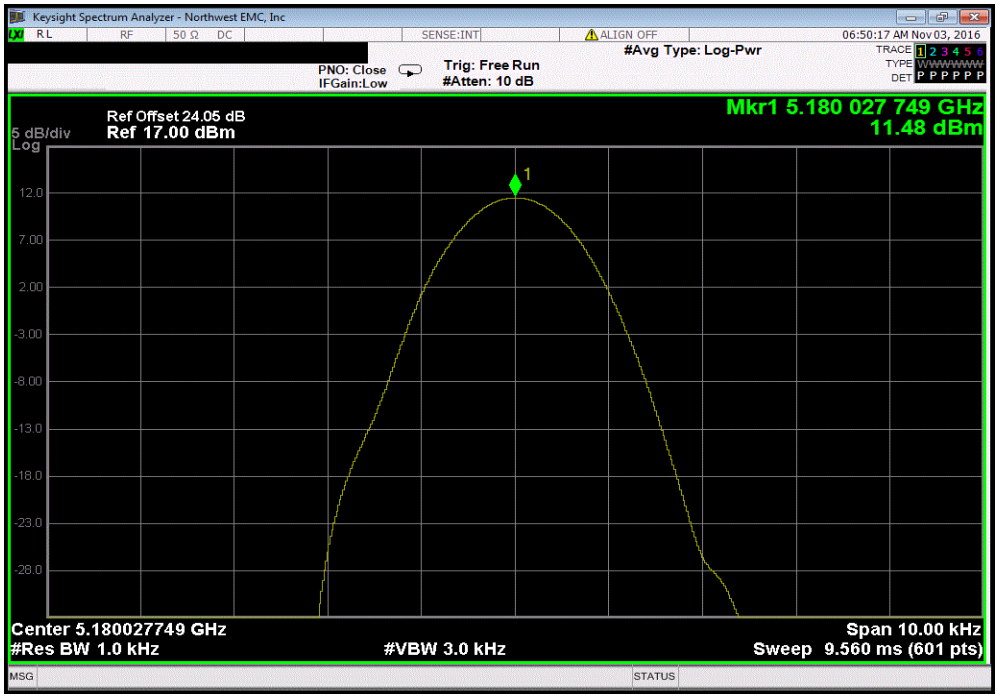
5150 MHz - 5250 MHz Band - Low Channel 36, 5180 MHz, Temperature: -10°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		5180.0008	5180	0.2	100	Pass



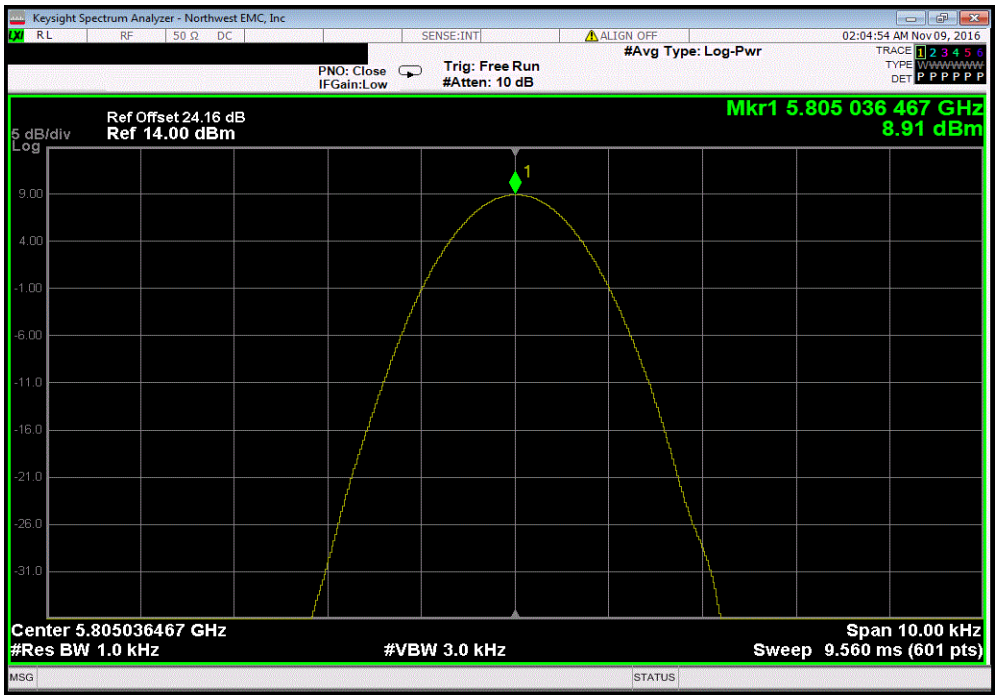
5150 MHz - 5250 MHz Band - Low Channel 36, 5180 MHz, Temperature: -20°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		5180.012333	5180	2.4	100	Pass



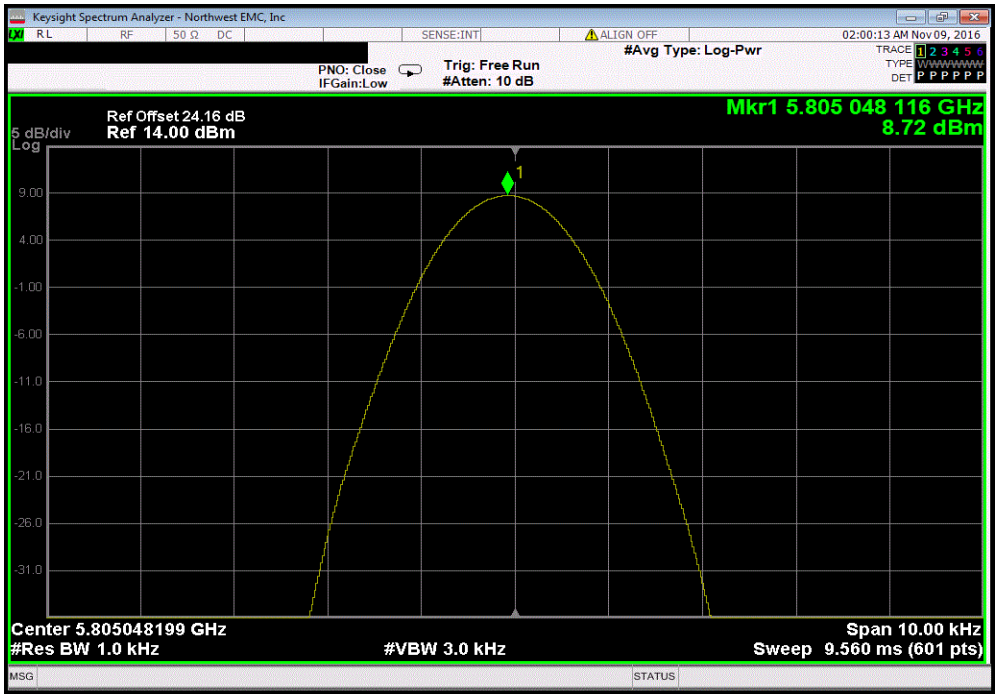
5150 MHz - 5250 MHz Band - Low Channel 36, 5180 MHz, Temperature: -30°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		5180.027749	5180	5.4	100	Pass



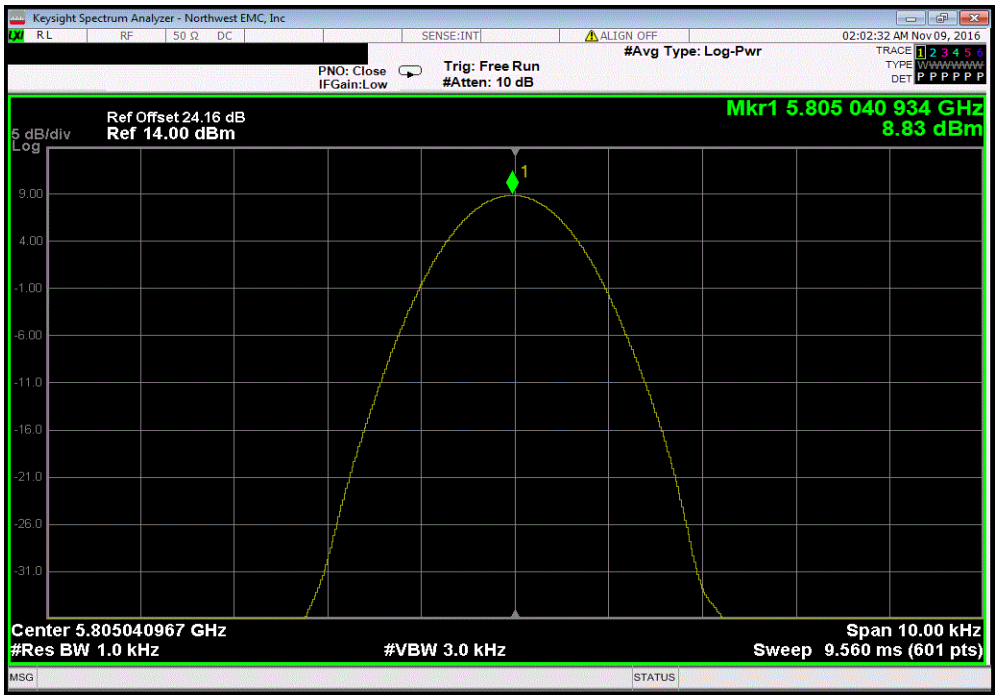
5725 MHz - 5850 MHz Band - High Channel 161, 5805 MHz, Voltage: 115%						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		5805.036467	5805	6.3	100	Pass



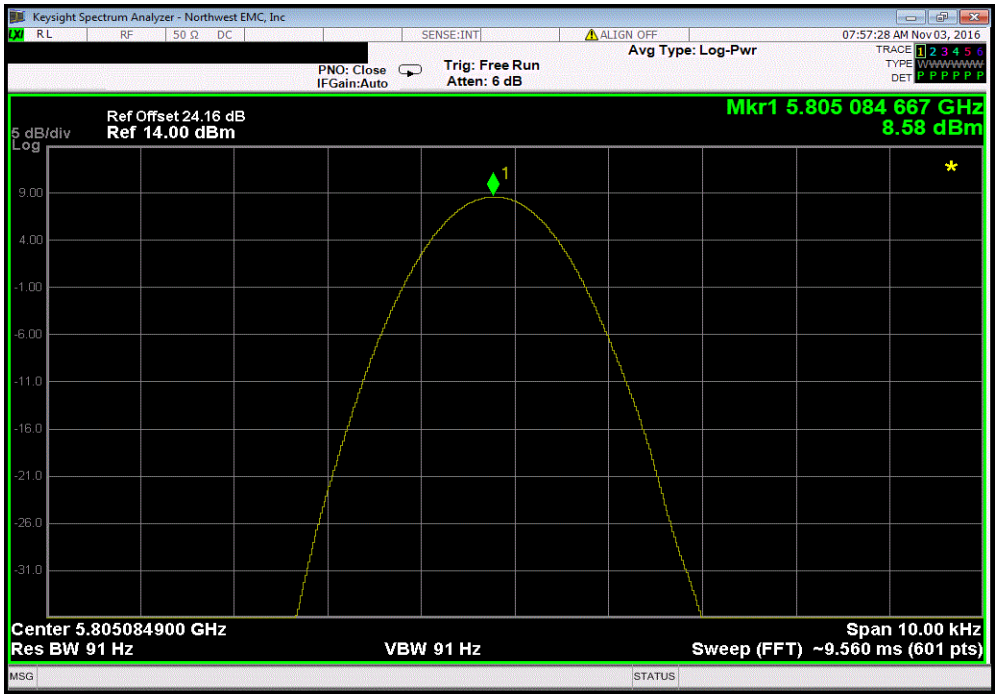
5725 MHz - 5850 MHz Band - High Channel 161, 5805 MHz, Voltage: 100%						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		5805.048116	5805	8.3	100	Pass



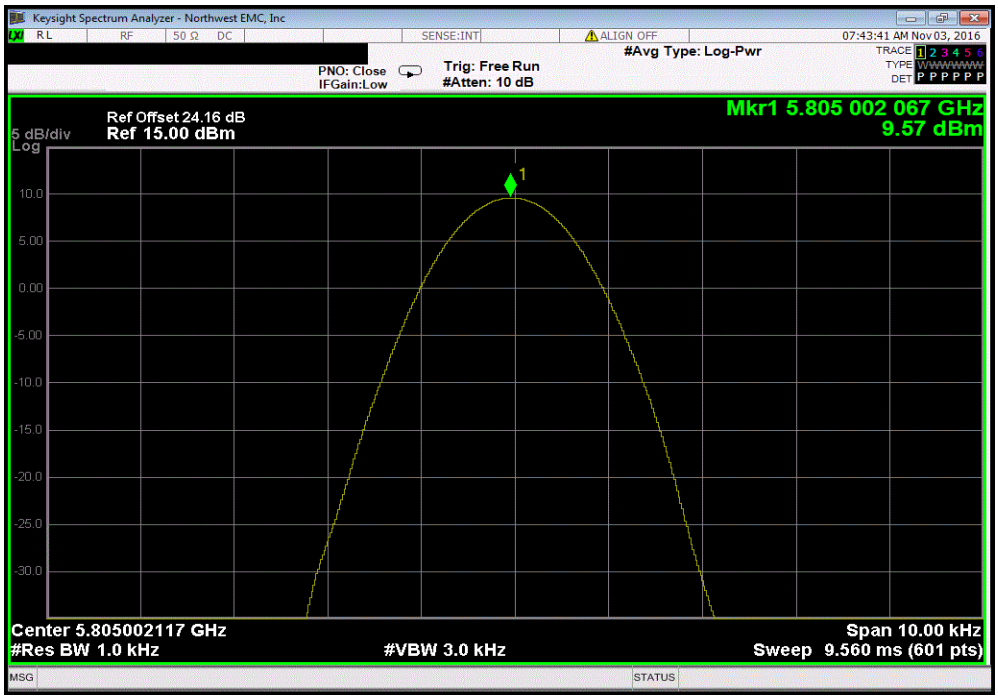
5725 MHz - 5850 MHz Band - High Channel 161, 5805 MHz, Voltage: 85%						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		5805.040934	5805	7.1	100	Pass



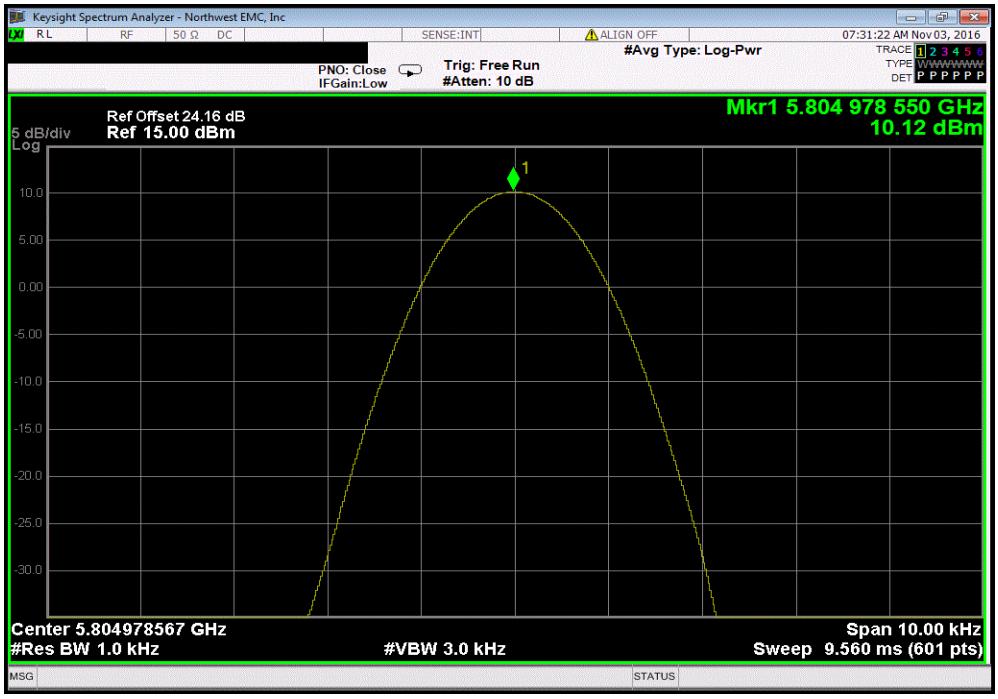
5725 MHz - 5850 MHz Band - High Channel 161, 5805 MHz, Temperature: +50°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		5805.084667	5805	14.6	100	Pass



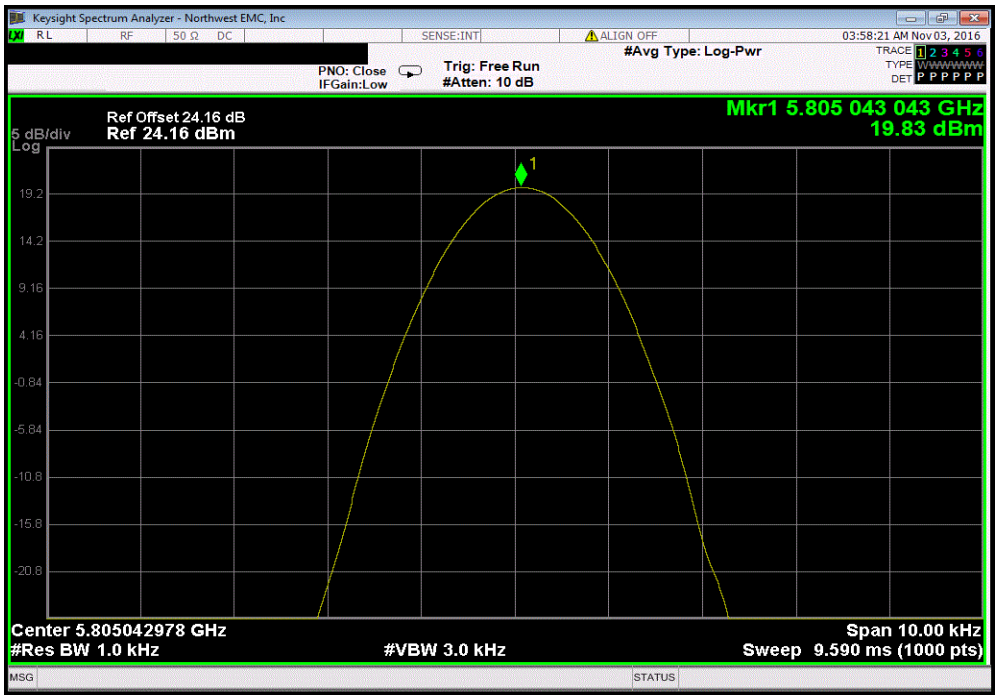
5725 MHz - 5850 MHz Band - High Channel 161, 5805 MHz, Temperature: +40°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		5805.002067	5805	0.4	100	Pass



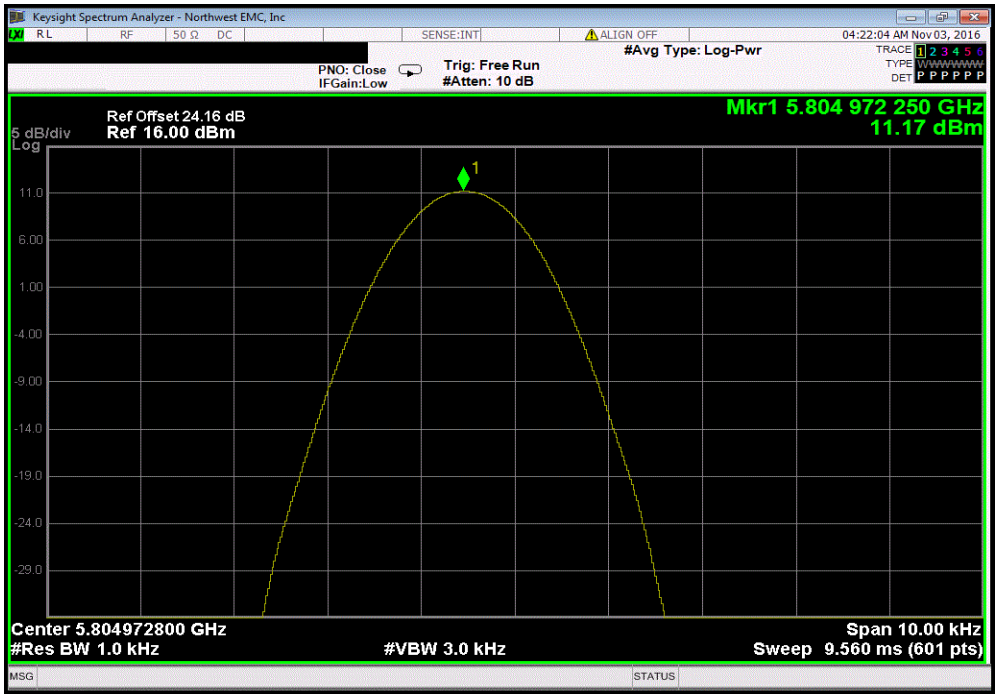
5725 MHz - 5850 MHz Band - High Channel 161, 5805 MHz, Temperature: +30°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		5804.97855	5805	3.7	100	Pass



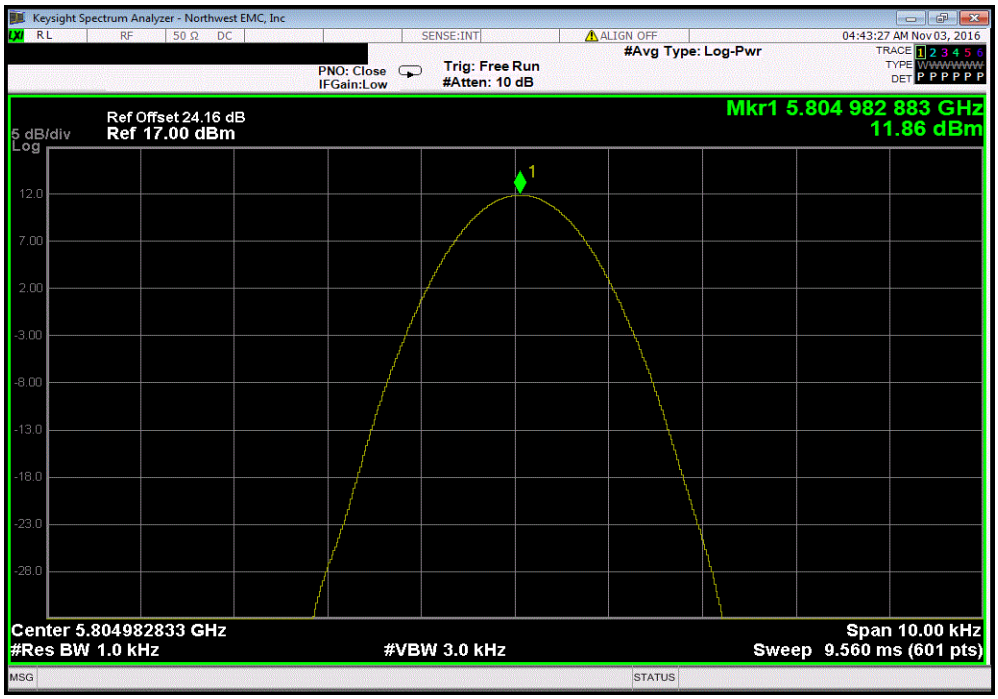
5725 MHz - 5850 MHz Band - High Channel 161, 5805 MHz, Temperature: +20°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		5805.043043	5805	7.4	100	Pass



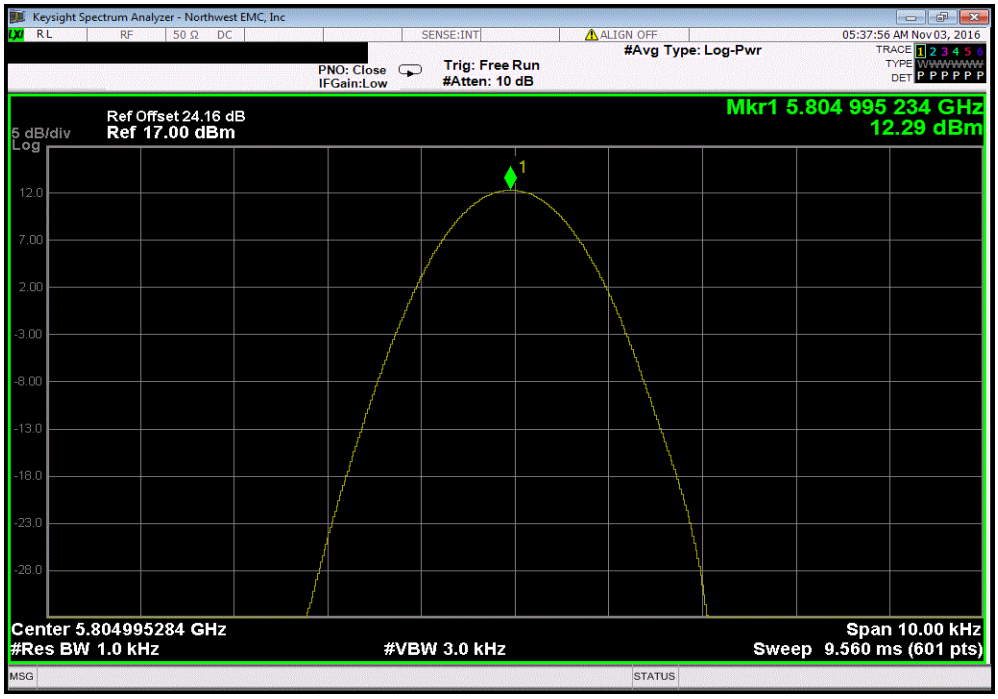
5725 MHz - 5850 MHz Band - High Channel 161, 5805 MHz, Temperature: +10°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		5804.97225	5805	4.8	100	Pass



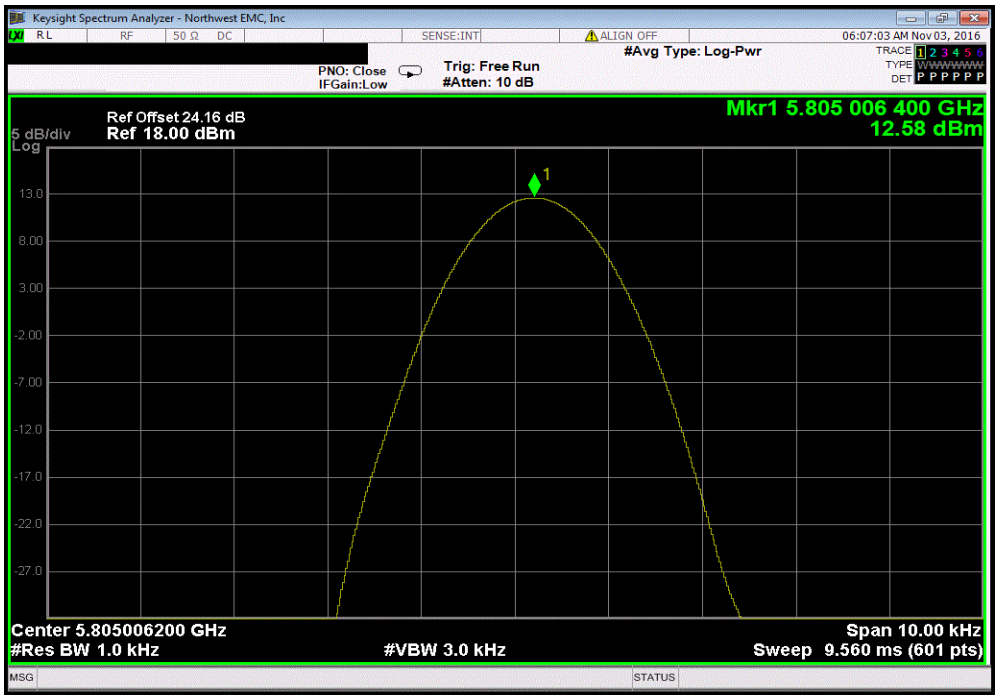
5725 MHz - 5850 MHz Band - High Channel 161, 5805 MHz, Temperature: 0°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		5804.982883	5805	3	100	Pass



5725 MHz - 5850 MHz Band - High Channel 161, 5805 MHz, Temperature: -10°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		5804.995234	5805	0.8	100	Pass



5725 MHz - 5850 MHz Band - High Channel 161, 5805 MHz, Temperature: -20°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		5805.0064	5805	1.1	100	Pass



5725 MHz - 5850 MHz Band - High Channel 161, 5805 MHz, Temperature: -30°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		5805.0226	5805	3.9	100	Pass