NORTHWEST EMC

Microsoft Corporation

1638

FCC 15.225:2015

Report # MCSO1725

NVLAP Lab Code: 200630-0
NVLAP Lab Code: 200629-0

CERTIFICATE OF TEST

NORTHWEST EMC
2014-12-10

Last Date of Test: February 4, 2015
Microsoft Corporation
Model: 1638

Radio Equipment Testing

Standards

Specification	Method
FCC 15.207:2015	ANSI C63.10:2009
FCC 15.225:2015	ANSI C63.10:2009

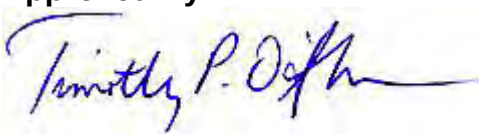
Results

Method Clause	Test Description	Applied	Results	Comments
6.8	Frequency Stability	Yes	Pass	
6.4	Field Strength of Fundamental	Yes	Pass	
6.4	Field Strength of Spurious Emissions < 30 MHz	Yes	Pass	
6.5	Field Strength of Spurious Emissions > 30 MHz	Yes	Pass	
6.2	Powerline Conducted Emissions	Yes	Pass	

Deviations From Test Standards

None

Approved By:



Tim O'Shea, 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.

REVISION HISTORY

NORTHWEST EMC
REV 2014.10.14

Revision Number	Description	Date	Page Number
00	None		

ACCREDITATIONS AND AUTHORIZATIONS

REV 2015.2.10

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

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

European Union

European Commission – Validated by the European Commission as a Conformity Assessment Body (CAB) under the EMC directive and as a Notified Body under the R&TTE Directive.

Australia/New Zealand

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

Korea

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

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

Vietnam

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

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

MEASUREMENT UNCERTAINTY

TMU.2014.12.03

Measurement Uncertainty

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

A measurement uncertainty estimation has been performed for each test per our internal quality document WP 342. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) for each test is on each data sheet. 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.

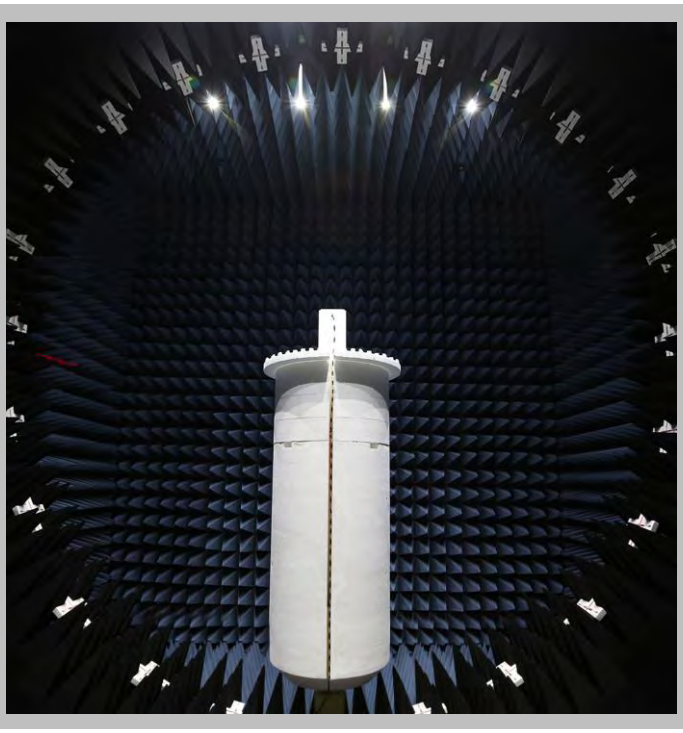
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

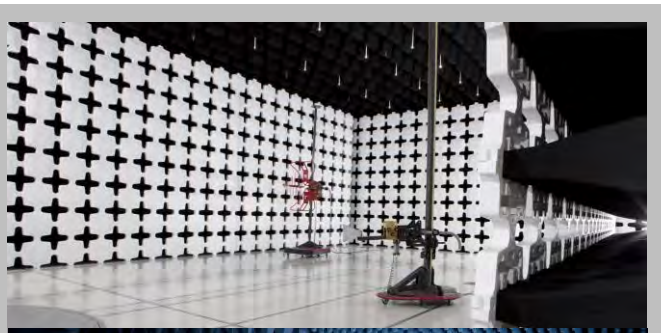
Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.2 dB	-5.2 dB
AC Powerline Conducted Emissions (dB)	2.9 dB	-2.9 dB

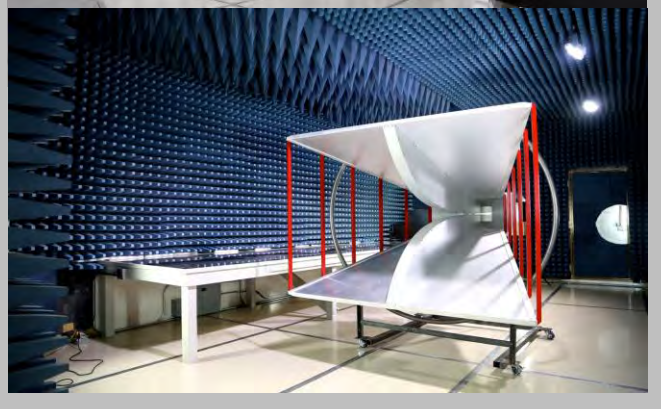
FACILITIES

NORTHWEST EMC
REV 2015.2.10

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 9801 (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
Industry 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, OFTA					
US0158	US0175	N/A	US0017	US0191	US0157







PRODUCT DESCRIPTION

NORTHWEST EMC 2014-12-10

Client and Equipment Under Test (EUT) Information

Company Name:	Microsoft Corporation
Address:	One Microsoft Way
City, State, Zip:	Redmond, WA 98052
Test Requested By:	Kitty Tam
Model:	1638
First Date of Test:	January 29, 2015
Last Date of Test:	February 4, 2015
Receipt Date of Samples:	January 29, 2015
Equipment Design Stage:	Production
Equipment Condition:	No Damage

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
13.56 MHz NFC radio module

Testing Objective:
To demonstrate compliance to FCC Part 15.225 specifications

CONFIGURATIONS

NORTHWEST EMC 2014-12-10

Configuration MCSO1725- 1

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
NFC Radio Board	Microsoft Corporation	1638	445000984

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
DC Power Supply	Kikusui	None	1930492

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
DC Power Leads	No	1m	No	DC Power Supply	Spliced Micro-USB Cable
Spliced Micro-USB Cable	No	0.4m	No	DC Power Leads	NFC Radio Board

Configuration MCSO1725- 2

Software/Firmware Running during test	
Description	**Version**
NFC Test Tool	2.07

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
NFC Radio Board	Microsoft Corporation	1638	445000984

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
DC Power Supply	Kikusui	None	1930492
Laptop PC	Lenovo	T430s	None

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
Spliced Micro-USB Cable	No	0.4m	No	DC Power Leads	NFC Radio Board
DC Power Leads	No	0.5m	No	DC Power Supply	Spliced Micro-USB Cable
AC Power	No	1.8m	No	AC Mains	DC Power Supply
Spliced USB Cable	No	0.4m	No	Spliced Micro-USB Cable	Laptop PC

CONFIGURATIONS

NORTHWEST EMC 2014-12-10

Configuration MCSO1725- 5

Software/Firmware Running during test	
Description	**Version**
NFC Test Tool	2.07

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
NFC Radio Board	Microsoft Corporation	1638	445000930

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop PC	Lenovo	T430s	None
AC Adapter	Lenovo	42T4418	None

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
AC Power	No	0.9m	No	AC Mains	AC Adapter
DC Power	No	1.75m	Yes	AC Adapter	Laptop PC
USB-Micro USB	Yes	1m	No	NFC Radio Board	USB Extender
USB Extender	Yes	4.4m	No	USB-Micro USB	Laptop PC

Configuration MCSO1725- 6

Software/Firmware Running during test	
Description	**Version**
NFC Test Tool	2.07

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
NFC Radio Board	Microsoft Corporation	1638	445000930

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
DC Power Supply	Kikusui	None	1930492
Laptop PC	Lenovo	T430s	None

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
Spliced Micro-USB Cable	No	0.4m	No	DC Power Leads	NFC Radio Board
DC Power Leads	No	0.5m	No	DC Power Supply	Spliced Micro-USB Cable
AC Power	No	1.8m	No	AC Mains	DC Power Supply
Spliced USB Cable	No	0.4m	No	Spliced Micro-USB Cable	Laptop PC

MODIFICATIONS

NORTHWEST EMC
2014-12-10

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	1/29/2015	Powerline Conducted Emissions	Modified from delivered configuration.	Client removed resistor from EUT circuit board to effectively terminate the antenna connection for conducted emissions measurements. Modification authorized by Kitty Tam.	EUT remained at Northwest EMC following the test.
2	1/29/2015	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.
3	2/2/2015	Field Strength of Spurious Emissions greater than 30 MHz	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	2/4/2015	Field Strength of Spurious Emissions less than 30 MHz	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	2/4/2015	Field Strength of Fundamental	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

FREQUENCY STABILITY

XMit 2015.01.14

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 (mo)
Spectrum Analyzer	Agilent	E4446A	AAT	6/27/2014	12
Near Field Probe Set	Com-Power	PS-400	IPE	NCR	0
40GHz DC Block	Fairview Microwave	SD3379	AMJ	6/9/2014	12
Attenuator	Fairview Microwave	SA4014-20	TKE	1/16/2015	12
NC02 Cable	ESM Cable Corp.	TTBJ-141 KMKM-72	NC5	6/9/2014	12
Multimeter	Fluke	111	MMM	3/20/2013	36
Thermometer	Omega Engineering, Inc.	iTHX-W3	DUD	1/7/2013	36
Probe, Temperature and Humidity	Omega Engineering, Inc.	ITHP-5-DB9	DUK	1/2/2014	36
Humidity Temperature Chamber	Tenney	T6S	TBG	NCR	12

TEST DESCRIPTION

Variation of Supply Voltage
The primary supply voltage was varied from 85% to 115% of the nominal voltage. A DC lab supply was used to vary the supply voltage.

Variation of Ambient Temperature
Using a temperature chamber, the transmit frequency was recorded at the extremes of the specified temperature range (-20° to +50° C) and at 10°C intervals.

The measurement was made with a direct connection between the EUT antenna port and the test equipment. The spectrum analyzer is equipped with a precision frequency reference that exceeds the stability requirement of the EUT.

FREQUENCY STABILITY

NORTHWEST EMC

XMit 2015.01.14

EUT:	1638			**Work Order:**	MCSO1725
Serial Number:	445000984			**Date:**	01/29/15
Customer:	Microsoft Corporation			**Temperature:**	24°C
Attendees:	Kitty Tam			**Humidity:**	35%
Project:	None			**Barometric Pres.:**	1029mb
Tested by:	Richard Mellroth	**Power:**	5 VDC	**Job Site:**	NC02

TEST SPECIFICATIONS	Test Method
FCC 15.225:2015	ANSI C63.10:2009

COMMENTS

EUT operating at 100% Duty Cycle, Continuous Waveform.

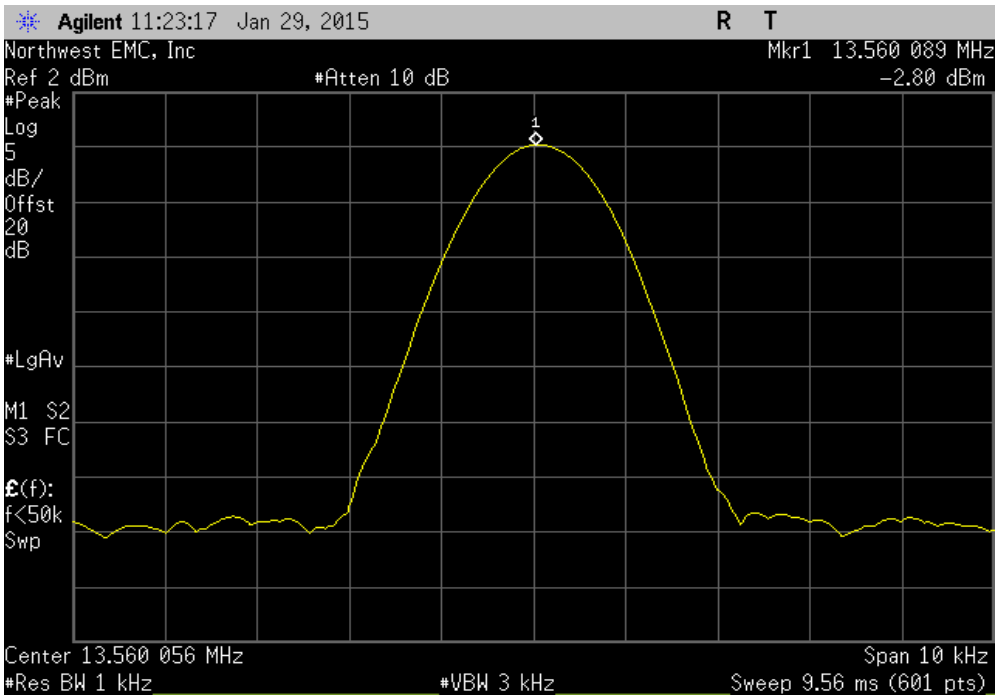
DEVIATIONS FROM TEST STANDARD

None

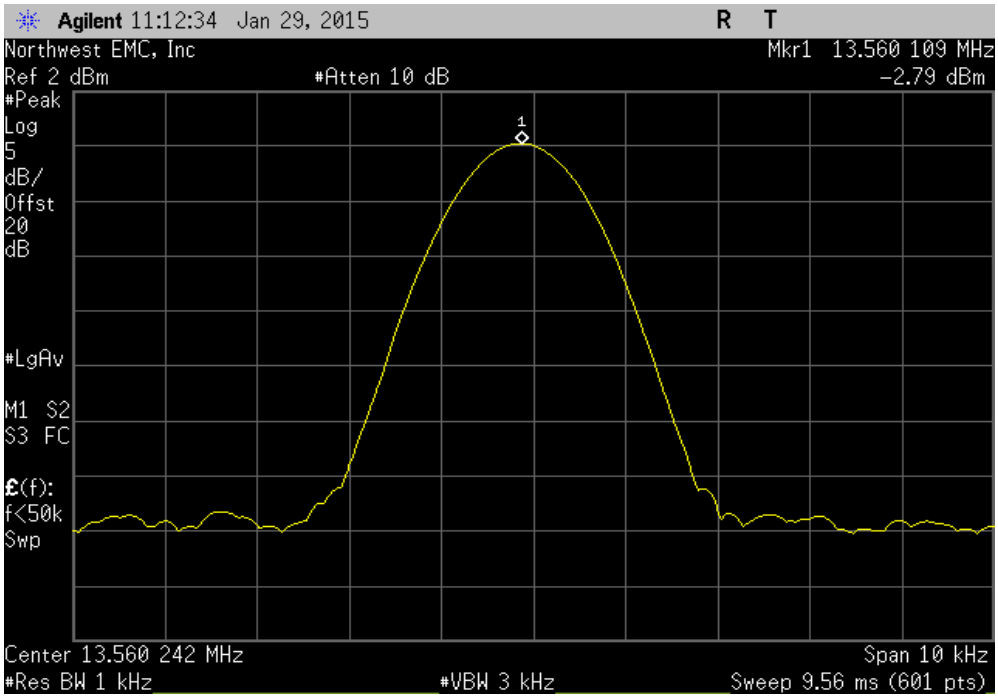
Configuration #	1	Signature

	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
NFC, 13.56 MHz					
Voltage 100%, Temperature +50°C	13.560089	13.56	6.6	100	Pass
Voltage 100%, Temperature +40°C	13.560109	13.56	8	100	Pass
Voltage 100%, Temperature +30°C	13.560118	13.56	8.7	100	Pass
Voltage 100%, Temperature +20°C	13.560139	13.56	10.3	100	Pass
Voltage 115%, Temperature +20°C	13.56014	13.56	10.3	100	Pass
Voltage 85%, Temperature +20°C	13.560143	13.56	10.6	100	Pass
Voltage 100%, Temperature +10°C	13.56017	13.56	12.5	100	Pass
Voltage 100%, Temperature 0°C	13.560184	13.56	13.6	100	Pass
Voltage 100%, Temperature -10°C	13.560188	13.56	13.9	100	Pass
Voltage 100%, Temperature -20°C	13.560192	13.56	14.2	100	Pass

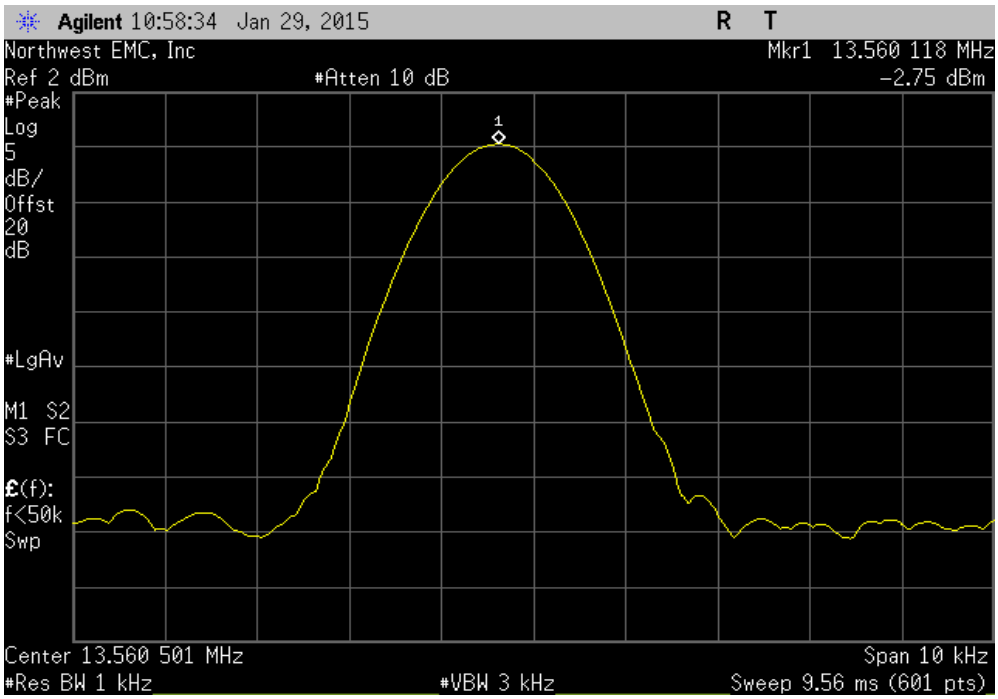
NFC, 13.56 MHz, Voltage 100%, Temperature +50°C						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.560089	13.56	6.6	100	Pass



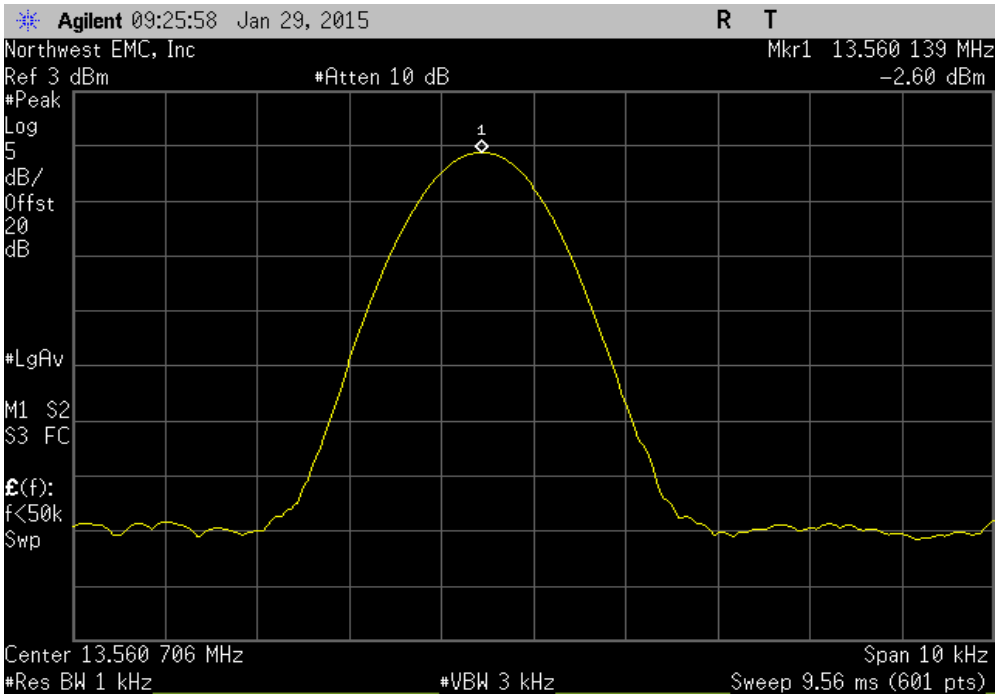
NFC, 13.56 MHz, Voltage 100%, Temperature +40°C						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.560109	13.56	8	100	Pass



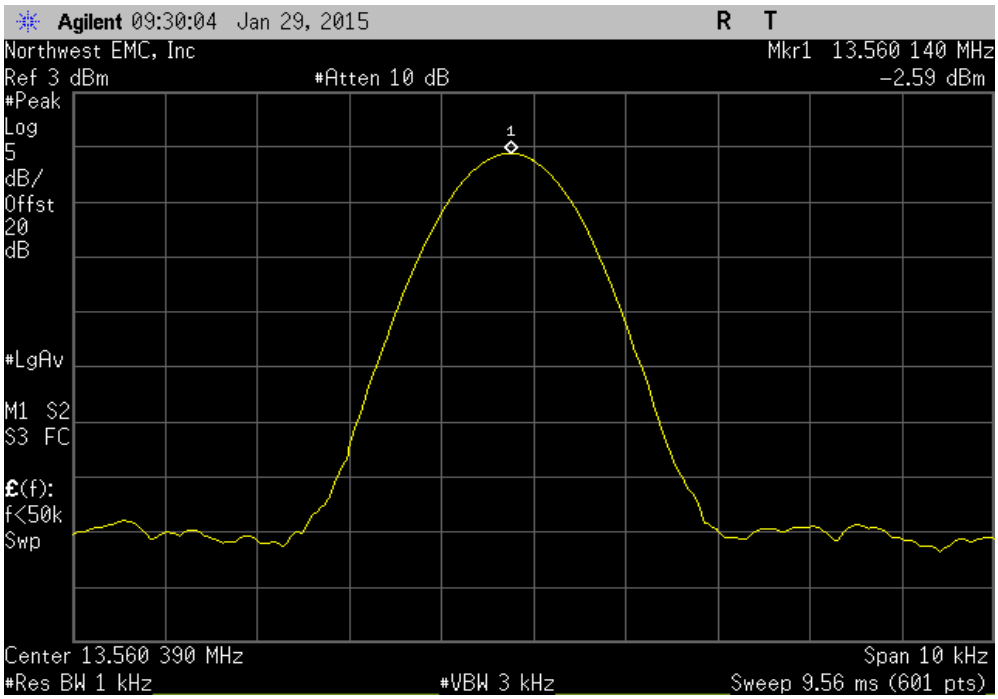
NFC, 13.56 MHz, Voltage 100%, Temperature +30°C						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.560118	13.56	8.7	100	Pass



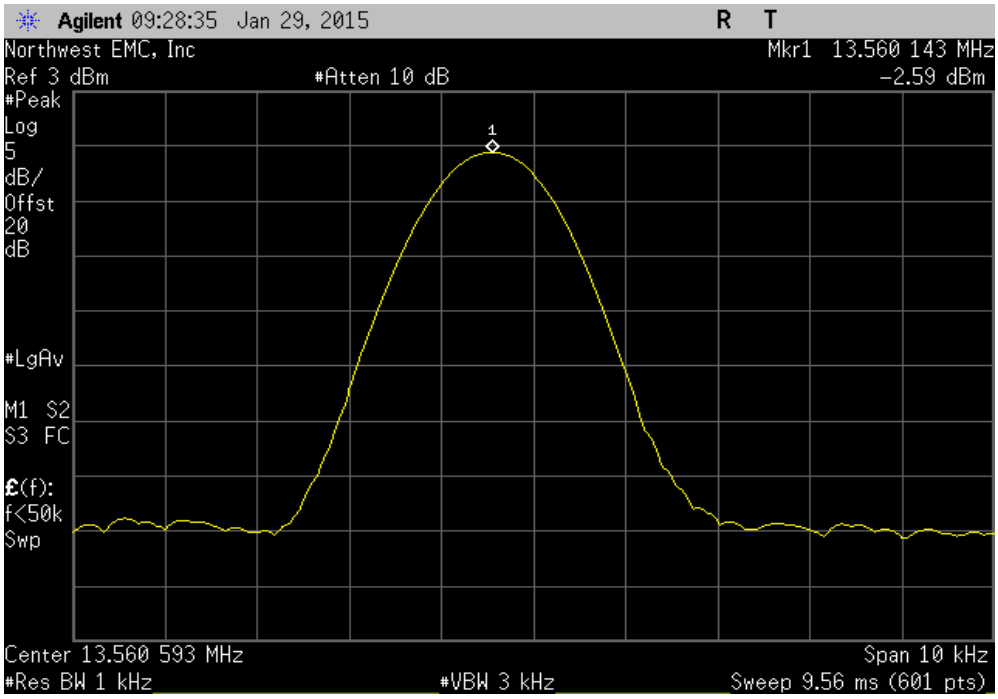
NFC, 13.56 MHz, Voltage 100%, Temperature +20°C						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.560139	13.56	10.3	100	Pass



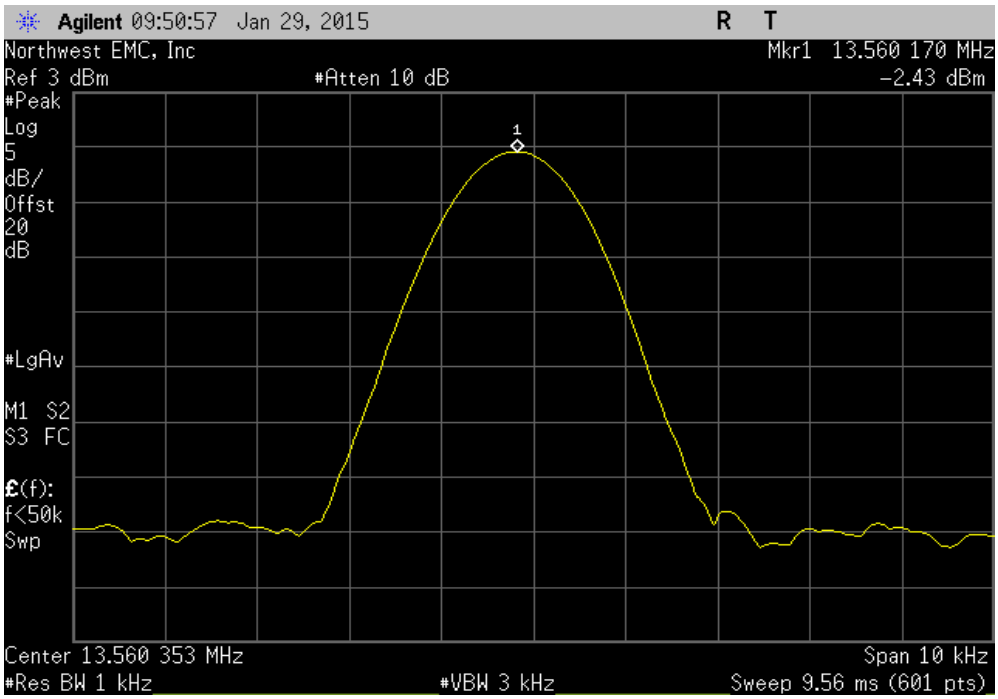
NFC, 13.56 MHz, Voltage 115%, Temperature +20°C						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.56014	13.56	10.3	100	Pass



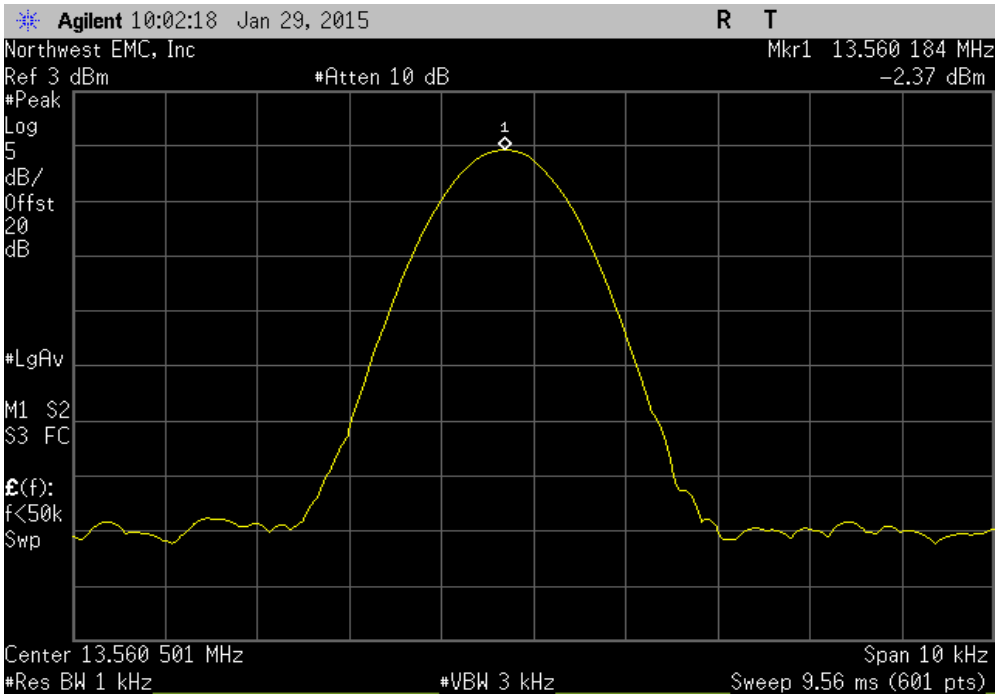
NFC, 13.56 MHz, Voltage 85%, Temperature +20°C						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.560143	13.56	10.6	100	Pass



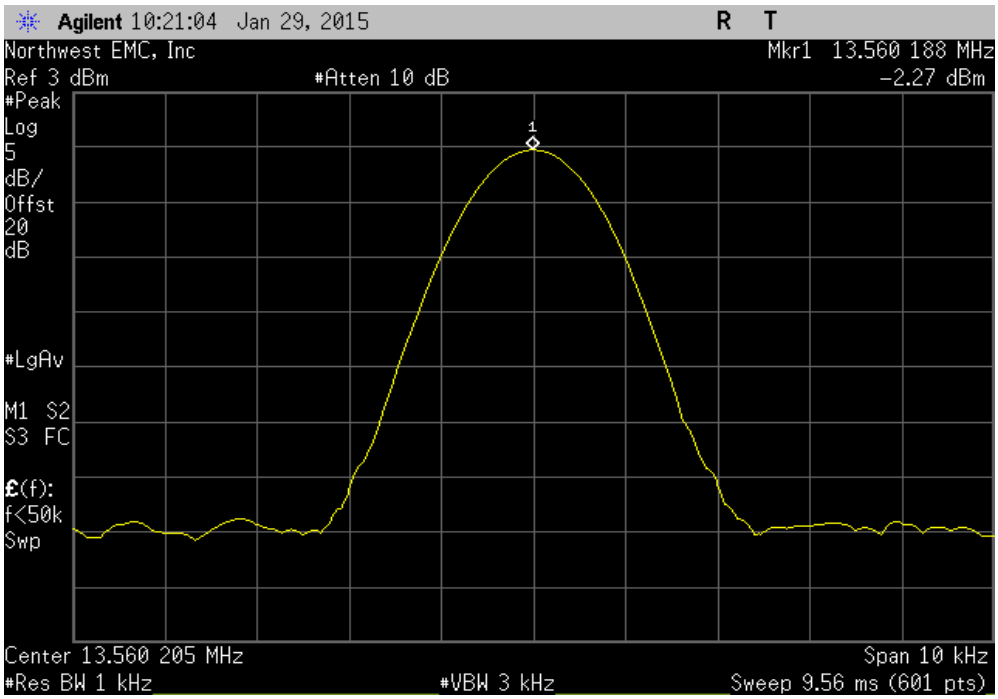
NFC, 13.56 MHz, Voltage 100%, Temperature +10°C						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.56017	13.56	12.5	100	Pass



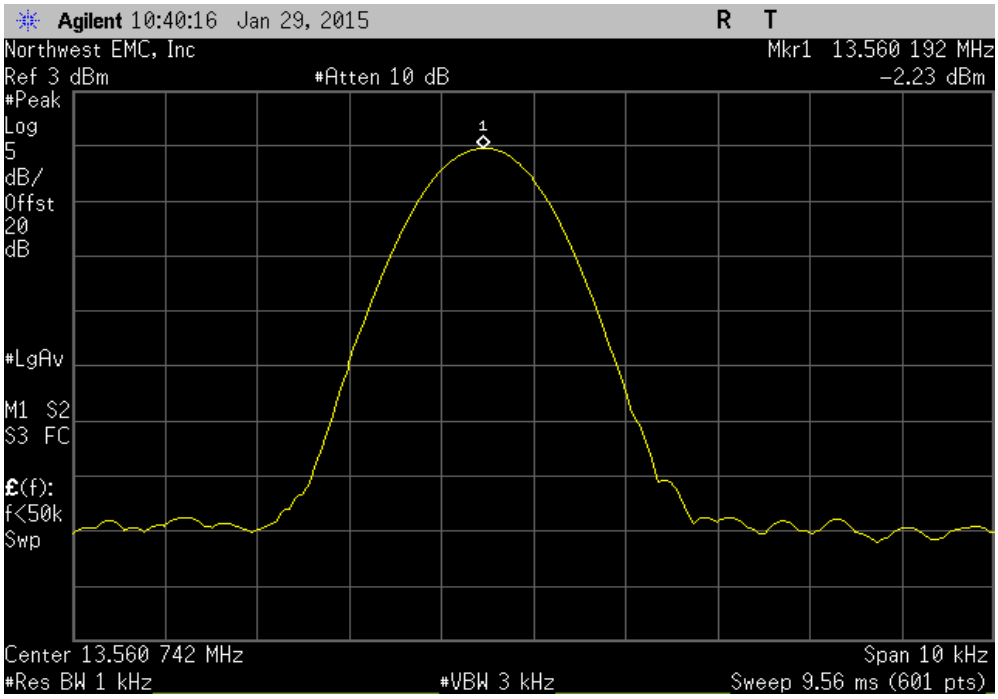
NFC, 13.56 MHz, Voltage 100%, Temperature 0°C						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.560184	13.56	13.6	100	Pass



NFC, 13.56 MHz, Voltage 100%, Temperature -10°C						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.560188	13.56	13.9	100	Pass



NFC, 13.56 MHz, Voltage 100%, Temperature -20°C						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.560192	13.56	14.2	100	Pass



FIELD STRENGTH OF FUNDAMENTAL

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

Continuous transmit of NFC at 13.56 MHz. 106 kbps.

POWER SETTINGS INVESTIGATED

5 VDC

CONFIGURATIONS INVESTIGATED

MCSO1725 - 5

FREQUENCY RANGE INVESTIGATED

Start Frequency	9 kHz	Stop Frequency	30 MHz

SAMPLE CALCULATIONS

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Spectrum Analyzer	Agilent	E4443A	AFB	2/12/2014	12 mo
EV11 Cables	N/A	3m Test Distance Cables	EVM	8/14/2014	12 mo
Antenna, Loop	EMCO	6502	AOA	6/24/2014	36 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 antennas to be used with the EUT were tested. The EUT was continuously transmitting while set to the channel specified.

While scanning, fundamental carrier from the EUT was maximized by rotating the EUT, adjusting the measurement antenna height and orientation in 3 orthogonal planes, the EUT and/or associated antenna is positioned in 3 orthogonal planes (per ANSI C63.10). An active loop antenna was used for this test in order to provide sufficient measurement sensitivity.

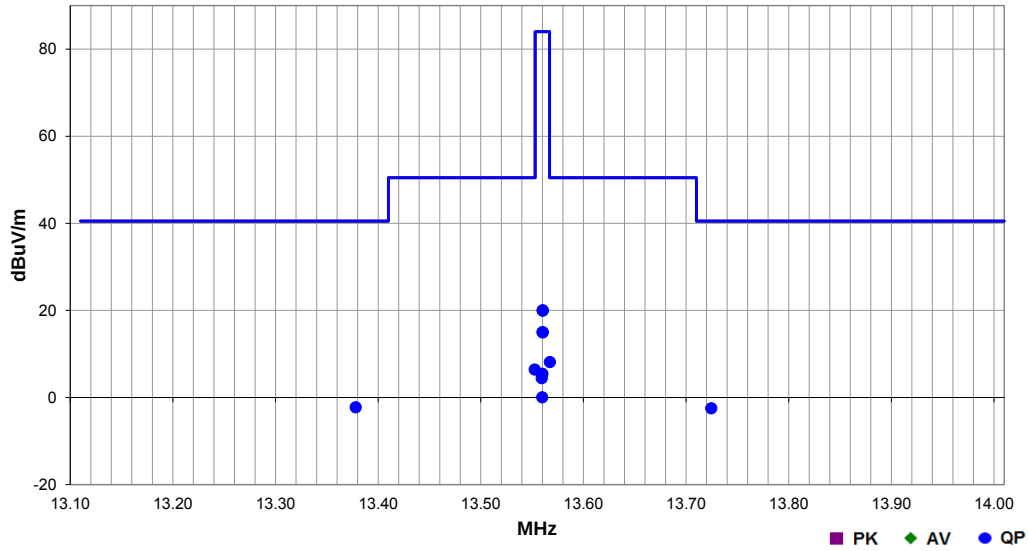
As outlined in 15.209(e) and 15.31(f)(2), measurements may be performed at a distance closer than what is specified with the limit. The limit at the specified distance is shown on the data sheet. Measurements are made at a closer distance and the data is adjusted using a distance correction factor of 40dB/decade for comparison to the limit.

FIELD STRENGTH OF FUNDAMENTAL

Work Order:	MCSO1725	**Date:**	02/04/15		
Project:	None	**Temperature:**	23.8 °C		
Job Site:	EV11	**Humidity:**	40.2% RH		
Serial Number:	445000930	**Barometric Pres.:**	1013.1 mbar	**Tested by:**	Jared Ison
EUT:	1638				
Configuration:	5				
Customer:	Microsoft Corporation				
Attendees:	None				
EUT Power:	5 VDC				
Operating Mode:	Continuous transmit of NFC at 13.56 MHz. Single modulation rate of 106 kbps tested.				
Deviations:	None				
Comments:	Reference data comments for antenna polarity and EUT orientation.				

Test Specifications	**Test Method**
FCC 15.225:2015	ANSI C63.10:2009

Run #	4	**Test Distance (m)**	10	**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
13.567	16.3	10.9	1.0	12.0	10.0	0.0	Horz	QP	-19.1	8.1	50.5	-42.3	Ant Perp to Gnd and Ant Perp to EUT, EUT On Side
13.378	5.9	10.9	1.0	50.0	10.0	0.0	Horz	QP	-19.1	-2.3	40.5	-42.8	Ant Perp to Gnd and Ant Perp to EUT, EUT On Side
13.725	5.7	10.9	1.0	242.0	10.0	0.0	Horz	QP	-19.1	-2.5	40.5	-43.0	Ant Perp to Gnd and Ant Perp to EUT, EUT On Side
13.553	14.6	10.9	1.0	350.0	10.0	0.0	Horz	QP	-19.1	6.4	50.5	-44.0	Ant Perp to Gnd and Ant Perp to EUT, EUT On Side
13.560	28.2	10.9	1.0	1.0	10.0	0.0	Horz	QP	-19.1	20.0	84.0	-64.0	Ant Perp to Gnd and Ant Perp to EUT, EUT On Side
13.560	28.1	10.9	1.0	179.0	10.0	0.0	Horz	QP	-19.1	19.9	84.0	-64.1	Ant Perp to Gnd and Ant Perp to EUT, EUT Vert
13.560	23.2	10.9	1.0	304.0	10.0	0.0	Horz	QP	-19.1	15.0	84.0	-69.0	Ant Perp to Gnd and Ant Para to EUT, EUT Vert
13.560	23.1	10.9	1.0	110.0	10.0	0.0	Horz	QP	-19.1	14.9	84.0	-69.1	Ant Perp to Gnd and Ant Para to EUT, EUT On Side
13.560	13.6	10.9	1.0	228.0	10.0	0.0	Vert	QP	-19.1	5.4	84.0	-78.6	Ant Para to Gnd and Ant Perp to EUT, EUT On Side
13.559	13.6	10.9	1.0	243.0	10.0	0.0	Vert	QP	-19.1	5.4	84.0	-78.6	Ant Para to Gnd and Ant Perp to EUT, EUT Vert
13.560	13.5	10.9	1.0	120.0	10.0	0.0	Horz	QP	-19.1	5.3	84.0	-78.7	Ant Perp to Gnd and Ant Para to EUT, EUT Horz
13.559	12.6	10.9	1.0	2.0	10.0	0.0	Horz	QP	-19.1	4.4	84.0	-79.6	Ant Perp to Gnd and Ant Perp to EUT, EUT Horz
13.560	8.2	10.9	1.0	16.0	10.0	0.0	Vert	QP	-19.1	0.0	84.0	-84.0	Ant Para to Gnd and Ant Perp to EUT, EUT Horz

FIELD STRENGTH OF SPURIOUS EMISSIONS < 30 MHz

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

Continuous transmit of NFC at 13.56 MHz. Single modulation rate of 106 kbps.

POWER SETTINGS INVESTIGATED

5 VDC

CONFIGURATIONS INVESTIGATED

MCSO1725 - 5

FREQUENCY RANGE INVESTIGATED

Start Frequency	9 kHz	Stop Frequency	30 MHz

SAMPLE CALCULATIONS

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
EV11 Cables	N/A	3m Test Distance Cables	EVM	8/14/2014	12 mo
Antenna, Loop	EMCO	6502	AOA	6/24/2014	36 mo
Spectrum Analyzer	Agilent	E4443A	AFB	2/12/2014	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 antennas to be used with the EUT were tested. The EUT was continuously transmitting while set to the channel specified.

While scanning, emissions from the EUT were maximized by rotating the EUT, adjusting the measurement antenna height and orientation in 3 orthogonal planes, the EUT and/or associated antenna is positioned in 3 orthogonal planes (per ANSI C63.10). An active loop antenna was used for this test in order to provide sufficient measurement sensitivity.

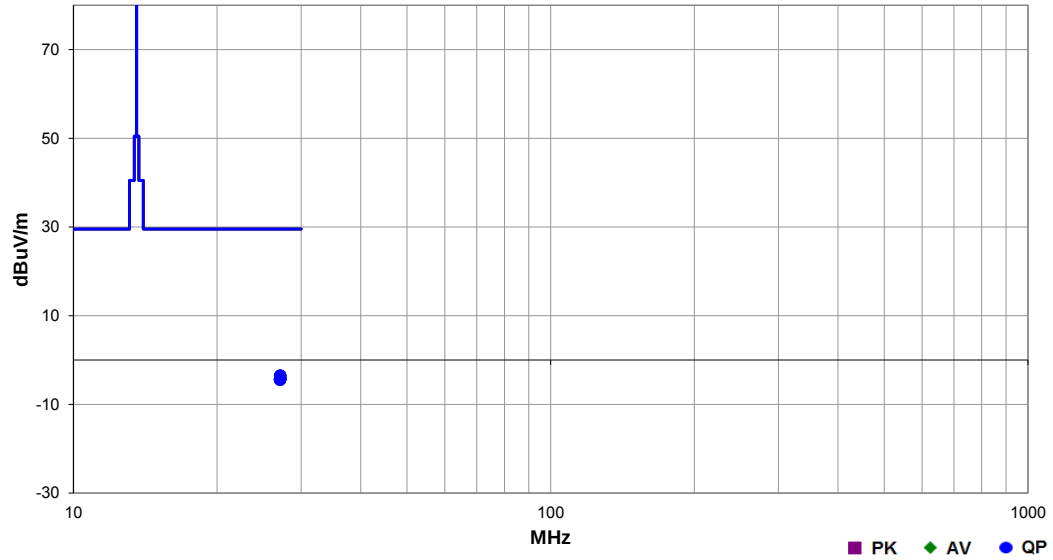
As outlined in 15.209(e) and 15.31(f)(2), measurements may be performed at a distance closer than what is specified with the limit. The limit at the specified distance is shown on the data sheet. Measurements are made at a closer distance and the data is adjusted using a distance correction factor of 40dB/decade for comparison to the limit.

FIELD STRENGTH OF SPURIOUS EMISSIONS < 30 MHz

Work Order:	MCSO1725	**Date:**	02/04/15		
Project:	None	**Temperature:**	22.5 °C		
Job Site:	EV11	**Humidity:**	42.9% RH		
Serial Number:	445000930	**Barometric Pres.:**	1011.8 mbar	**Tested by:**	Jared Ison
EUT:	1638				
Configuration:	5				
Customer:	Microsoft Corporation				
Attendees:	None				
EUT Power:	5 VDC				
Operating Mode:	Continuous transmit of NFC at 13.56 MHz. Single modulation rate of 106 kbps tested.				
Deviations:	None				
Comments:	Reference data comments for antenna polarity and EUT orientation.				

Test Specifications	**Test Method**
FCC 15.225:2015	ANSI C63.10:2009

Run #	5	**Test Distance (m)**	10	**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
27.120	6.3	9.3	1.0	4.0	10.0	0.0	Horz	QP	-19.1	-3.5	29.5	-33.0	Ant Perp to Gnd and Ant Perp to EUT, EUT Vert
27.120	6.2	9.3	1.0	259.0	10.0	0.0	Horz	QP	-19.1	-3.6	29.5	-33.1	Ant Perp to Gnd and Ant Perp to EUT, EUT Horz
27.122	6.1	9.3	1.0	217.0	10.0	0.0	Horz	QP	-19.1	-3.7	29.5	-33.2	Ant Perp to Gnd and Ant Perp to EUT, EUT On Side
27.096	5.5	9.3	1.0	354.0	10.0	0.0	Vert	QP	-19.1	-4.3	29.5	-33.8	Ant Para to Gnd and Ant Perp to EUT, EUT Horz
27.109	5.5	9.3	1.0	185.0	10.0	0.0	Vert	QP	-19.1	-4.3	29.5	-33.8	Ant Para to Gnd and Ant Perp to EUT, EUT On Side
27.109	5.5	9.3	1.0	157.0	10.0	0.0	Horz	QP	-19.1	-4.3	29.5	-33.8	Ant Perp to Gnd and Ant Para to EUT, EUT Vert
27.120	5.5	9.3	1.0	218.0	10.0	0.0	Vert	QP	-19.1	-4.3	29.5	-33.8	Ant Para to Gnd and Ant Perp to EUT, EUT Vert
27.080	5.4	9.3	1.0	299.0	10.0	0.0	Horz	QP	-19.1	-4.4	29.5	-33.9	Ant Perp to Gnd and Ant Para to EUT, EUT Horz
27.098	5.3	9.3	1.0	356.0	10.0	0.0	Horz	QP	-19.1	-4.5	29.5	-34.0	Ant Perp to Gnd and Ant Para to EUT, EUT On Side

FIELD STRENGTH OF SPURIOUS EMISSIONS > 30MHz

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 NFC 13.56 MHz, Modulated, Maximum Duty Cycle

POWER SETTINGS INVESTIGATED

USB

CONFIGURATIONS INVESTIGATED

MCSO1725 - 5

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	140 MHz

SAMPLE CALCULATIONS

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Spectrum Analyzer	Agilent	E4440A	AFE	10/28/2014	12 mo
NC01 Cables	N/A	Bilog Cables	NC1	9/8/2014	12 mo
Pre-Amplifier	Miteq	AM-1616-1000	PAB	9/8/2014	12 mo
Antenna, Biconilog	EMCO	3142B	AXJ	5/16/2012	36 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 antennas to be used with the EUT were tested. The EUT was transmitting while set at the operating channel.

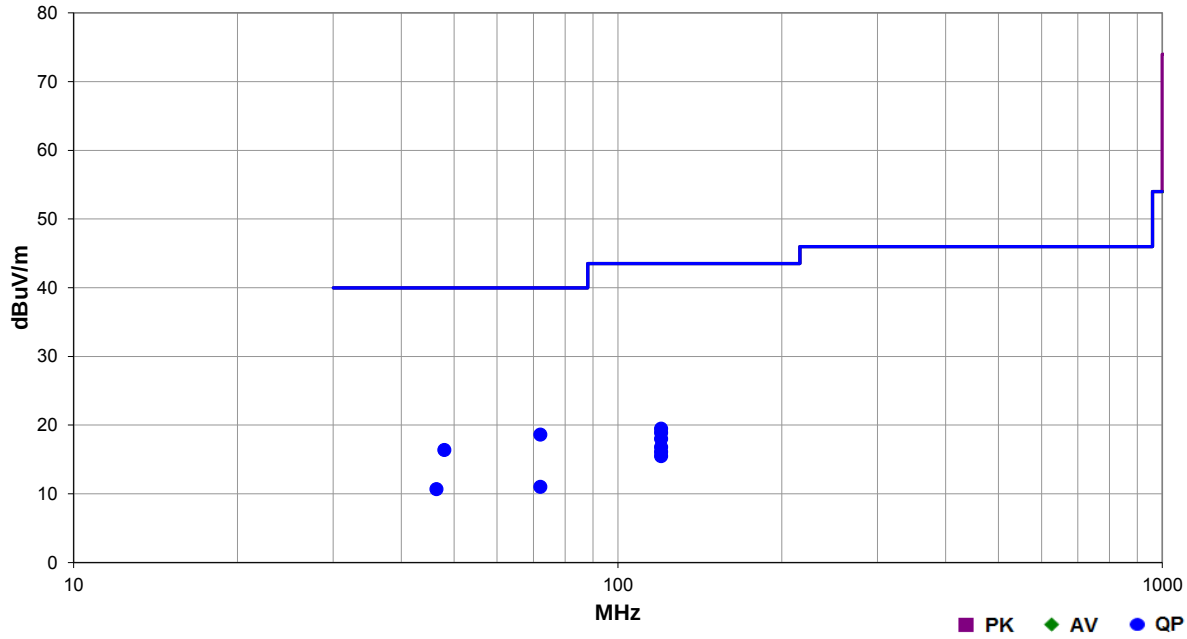
While scanning, emissions from the EUT were maximized by rotating the EUT, adjusting the measurement antenna height and polarization, and manipulating the EUT antenna in 3 orthogonal planes (per ANSI C63.10:2009).

FIELD STRENGTH OF SPURIOUS EMISSIONS > 30MHz

Work Order:	MCSO1725	**Date:**	02/02/15		
Project:	None	**Temperature:**	24 °C		
Job Site:	NC01	**Humidity:**	34% RH		
Serial Number:	445000930	**Barometric Pres.:**	1013 mbar	**Tested by:**	Richard Mellroth
EUT:	1638				
Configuration:	5				
Customer:	Microsoft Corporation				
Attendees:	Kitty Tam				
EUT Power:	USB				
Operating Mode:	Transmitting NFC 13.56 MHz, Modulated, Maximum Duty Cycle				
Deviations:	None				
Comments:	None				

Test Specifications	**Test Method**
FCC 15.225:2015	ANSI C63.10:2009

Run #	1	**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
72.006	26.7	-8.1	1.5	338.0	3.0	0.0	Vert	QP	0.0	18.6	40.0	-21.4	EUT Vert
48.007	22.6	-6.2	1.6	331.0	3.0	0.0	Vert	QP	0.0	16.4	40.0	-23.6	EUT Vert
120.003	26.8	-7.3	2.5	282.0	3.0	0.0	Horz	QP	0.0	19.5	43.5	-24.0	EUT Horz
120.002	26.2	-7.3	2.6	109.0	3.0	0.0	Horz	QP	0.0	18.9	43.5	-24.6	EUT Flat
120.005	25.3	-7.3	1.5	295.0	3.0	0.0	Horz	QP	0.0	18.0	43.5	-25.5	EUT Vert
120.005	24.1	-7.3	1.5	206.0	3.0	0.0	Vert	QP	0.0	16.8	43.5	-26.7	EUT Vert
120.002	23.4	-7.3	1.1	195.0	3.0	0.0	Vert	QP	0.0	16.1	43.5	-27.4	EUT Flat
120.003	22.8	-7.3	1.5	190.0	3.0	0.0	Vert	QP	0.0	15.5	43.5	-28.0	EUT Horz
72.005	19.1	-8.1	1.5	306.0	3.0	0.0	Horz	QP	0.0	11.0	40.0	-29.0	EUT Horz
46.400	16.5	-5.8	1.5	155.0	3.0	0.0	Horz	QP	0.0	10.7	40.0	-29.3	EUT Horz

POWERLINE CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2015.01.28
PSA-ESCI 2015.01.16, EmiR5 2014.11.19.2

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 50 Ω measuring port is terminated by a 50 Ω EMI meter or a 50 Ω resistive load. All 50 Ω measuring ports of the LISN are terminated by 50Ω.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Receiver	Rohde & Schwarz	ESCI	ARE	06/06/2014	12 mo
LISN	Solar	9252-50-R-24-BNC	LIM	12/09/2014	12 mo
NC05 Cables	N/A	Conducted / NF Probe Cable	NC4	10/14/2014	12 mo
High Pass Filter	TTE	H97-100K-50-720B	HHF	12/08/2014	12 mo
Attenuator	Fairview Microwave	SA03B-20	RKD	10/14/2014	12 mo

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	2.4 dB	-2.4 dB

CONFIGURATIONS INVESTIGATED

MCSO1725-2
MCSO1725-6

MODES INVESTIGATED

Transmitting NFC 13.56 MHz, Maximum Duty Cycle

POWERLINE CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2015.01.28
PSA-ESCI 2015.01.16, EmiR5 2014.11.19.2

EUT:	1638	Work Order:	MCSO1725
Serial Number:	445000930	Date:	02/02/2015
Customer:	Microsoft Corporation	Temperature:	24°C
Attendees:	Kitty Tam	Relative Humidity:	37%
Customer Project:	None	Bar. Pressure:	1013 mb
Tested By:	Richard Mellroth	Job Site:	NC05
Power:	110VAC/60Hz	Configuration:	MCSO1725-6

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2015	ANSI C63.10:2009

TEST PARAMETERS

Run #:	11	Line:	High Line	Ext. Attenuation (dB):	20

COMMENTS

EUT powered at 5 VDC from DC Power Supply. USB cable disconnected from laptop PC.

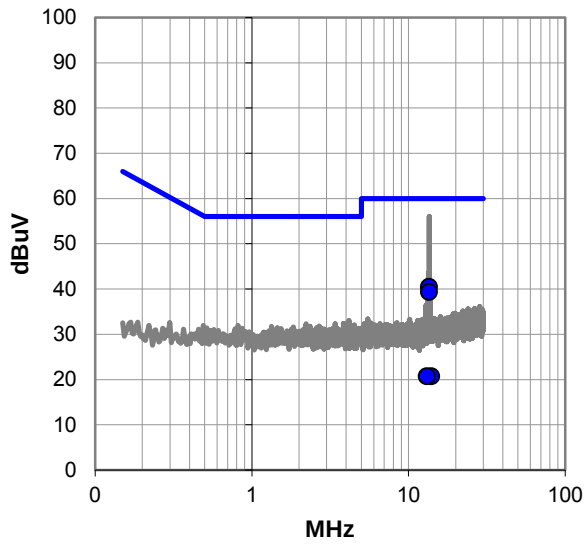
EUT OPERATING MODES

Transmitting NFC 13.56 MHz, Maximum Duty Cycle

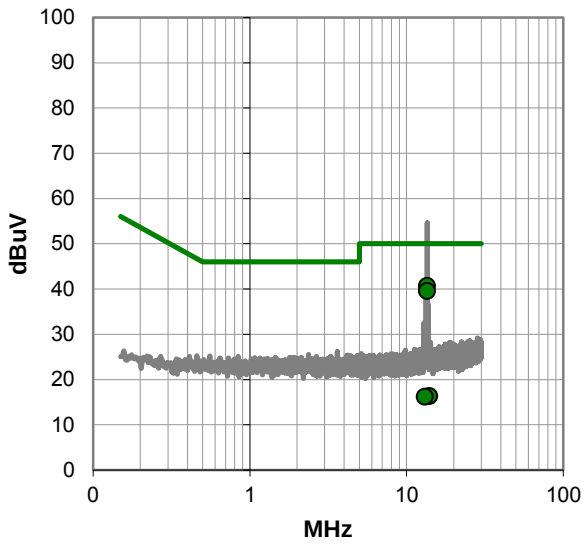
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2015.01.28
PSA-ESCI 2015.01.16, EmiR5 2014.11.19.2

RESULTS - Run #11

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
13.567	18.8	21.6	40.4	60.0	-19.6
13.553	17.7	21.6	39.3	60.0	-20.7
14.008	-1.0	21.7	20.7	60.0	-39.3
13.119	-0.9	21.6	20.7	60.0	-39.3

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
13.567	19.0	21.6	40.6	50.0	-9.4
13.553	17.9	21.6	39.5	50.0	-10.5
14.008	-5.4	21.7	16.3	50.0	-33.7
13.119	-5.4	21.6	16.2	50.0	-33.8

CONCLUSION

Pass

Tested By

POWERLINE CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2015.01.28
PSA-ESCI 2015.01.16, EmiR5 2014.11.19.2

EUT:	1638	Work Order:	MCSO1725
Serial Number:	445000930	Date:	02/02/2015
Customer:	Microsoft Corporation	Temperature:	24°C
Attendees:	Kitty Tam	Relative Humidity:	37%
Customer Project:	None	Bar. Pressure:	1013 mb
Tested By:	Richard Mellroth	Job Site:	NC05
Power:	110VAC/60Hz	Configuration:	MCSO1725-6

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2015	ANSI C63.10:2009

TEST PARAMETERS

Run #:	12	Line:	Neutral	Ext. Attenuation (dB):	20

COMMENTS

EUT powered at 5 VDC from DC Power Supply. USB cable disconnected from laptop PC.

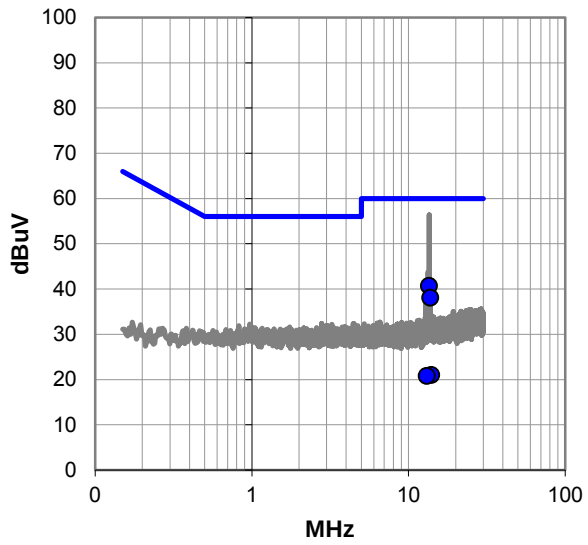
EUT OPERATING MODES

Transmitting NFC 13.56 MHz, Maximum Duty Cycle

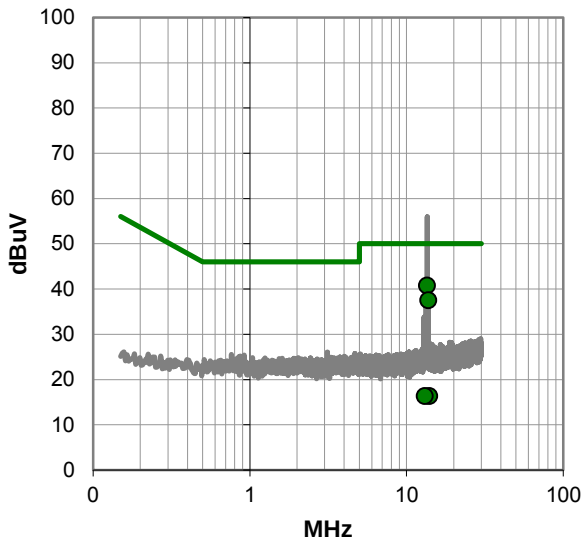
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2015.01.28
PSA-ESCI 2015.01.16, EmiR5 2014.11.19.2

RESULTS - Run #12

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
13.553	19.0	21.6	40.6	60.0	-19.4
13.771	16.4	21.7	38.1	60.0	-21.9
14.014	-0.7	21.7	21.0	60.0	-39.0
13.116	-0.8	21.6	20.8	60.0	-39.2

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
13.553	19.1	21.6	40.7	50.0	-9.3
13.771	15.8	21.7	37.5	50.0	-12.5
14.014	-5.4	21.7	16.3	50.0	-33.7
13.116	-5.3	21.6	16.3	50.0	-33.7

CONCLUSION

Pass

Tested By

POWERLINE CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2015.01.28
PSA-ESCI 2015.01.16, EmiR5 2014.11.19.2

EUT:	1638	Work Order:	MCSO1725
Serial Number:	445000930	Date:	01/29/2015
Customer:	Microsoft Corporation	Temperature:	24°C
Attendees:	Kitty Tam	Relative Humidity:	35%
Customer Project:	None	Bar. Pressure:	1029 mb
Tested By:	Richard Mellroth	Job Site:	NC05
Power:	110VAC/60Hz	Configuration:	MCSO1725-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2015	ANSI C63.10:2009

TEST PARAMETERS

Run #:	5	Line:	High Line	Ext. Attenuation (dB):	20

COMMENTS

Antenna trace disconnected. EUT powered at 5 VDC from DC power supply. USB cable connected to laptop PC.

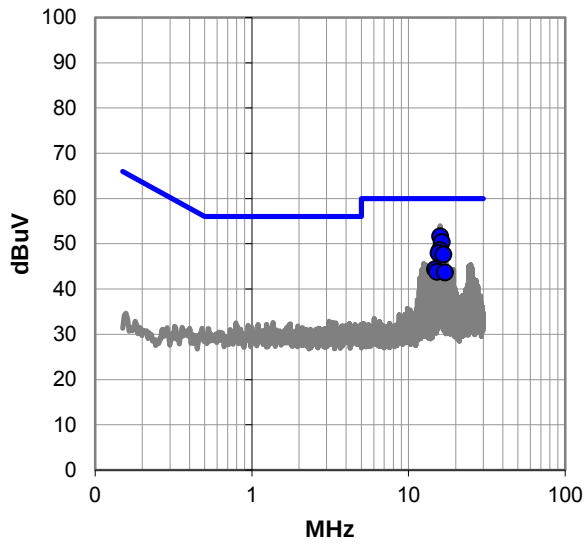
EUT OPERATING MODES

Transmitting NFC 13.56 MHz, Maximum Duty Cycle

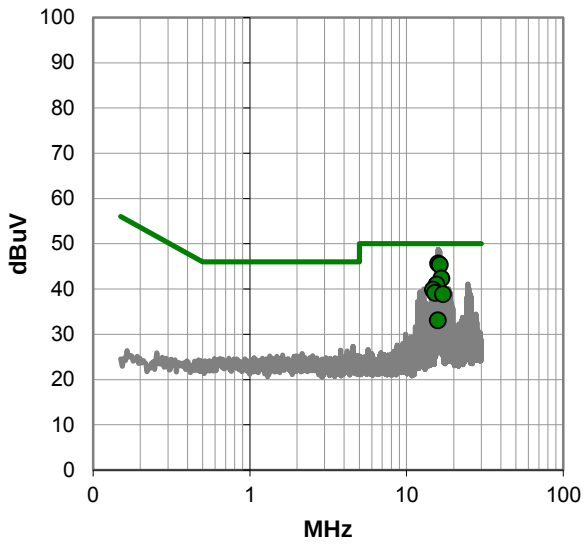
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2015.01.28
PSA-ESCI 2015.01.16, EmiR5 2014.11.19.2

RESULTS - Run #5

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
15.950	29.6	22.0	51.6	60.0	-8.4
16.332	28.3	22.0	50.3	60.0	-9.7
15.849	26.6	22.0	48.6	60.0	-11.4
15.569	26.0	21.9	47.9	60.0	-12.1
16.708	25.5	22.1	47.6	60.0	-12.4
14.812	22.5	21.8	44.3	60.0	-15.7
15.190	21.9	21.9	43.8	60.0	-16.2
17.092	21.5	22.1	43.6	60.0	-16.4

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
15.950	23.6	22.0	45.6	50.0	-4.4
16.332	23.3	22.0	45.3	50.0	-4.7
16.708	20.2	22.1	42.3	50.0	-7.7
15.569	19.0	21.9	40.9	50.0	-9.1
14.812	18.0	21.8	39.8	50.0	-10.2
15.190	17.2	21.9	39.1	50.0	-10.9
17.092	16.7	22.1	38.8	50.0	-11.2
15.849	11.1	22.0	33.1	50.0	-16.9

CONCLUSION

Pass

Tested By

POWERLINE CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2015.01.28
PSA-ESCI 2015.01.16, EmiR5 2014.11.19.2

EUT:	1638	Work Order:	MCSO1725
Serial Number:	445000930	Date:	01/29/2015
Customer:	Microsoft Corporation	Temperature:	24°C
Attendees:	Kitty Tam	Relative Humidity:	35%
Customer Project:	None	Bar. Pressure:	1029 mb
Tested By:	Richard Mellroth	Job Site:	NC05
Power:	110VAC/60Hz	Configuration:	MCSO1725-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2015	ANSI C63.10:2009

TEST PARAMETERS

Run #:	6	Line:	Neutral	Ext. Attenuation (dB):	20

COMMENTS

Antenna trace disconnected. EUT powered at 5 VDC from DC power supply. USB cable connected to laptop PC.

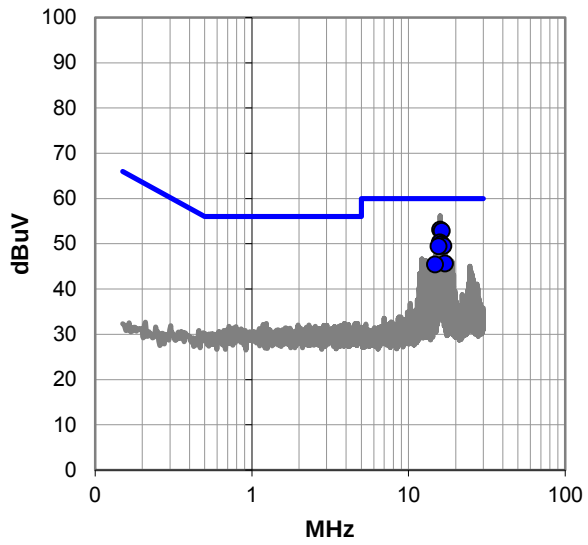
EUT OPERATING MODES

Transmitting NFC 13.56 MHz, Maximum Duty Cycle

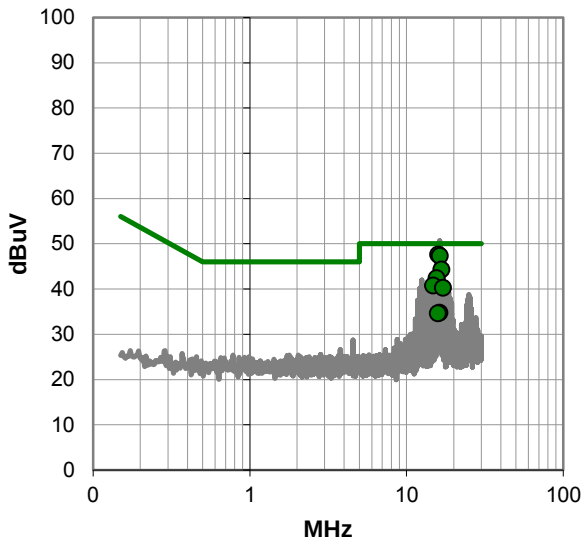
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2015.01.28
PSA-ESCI 2015.01.16, EmiR5 2014.11.19.2

RESULTS - Run #6

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
15.954	31.1	22.0	53.1	60.0	-6.9
16.329	30.8	22.0	52.8	60.0	-7.2
15.847	28.3	22.0	50.3	60.0	-9.7
16.225	27.9	22.0	49.9	60.0	-10.1
16.707	27.4	22.1	49.5	60.0	-10.5
15.569	27.5	21.9	49.4	60.0	-10.6
17.090	23.5	22.1	45.6	60.0	-14.4
14.812	23.6	21.8	45.4	60.0	-14.6

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
15.954	25.6	22.0	47.6	50.0	-2.4
16.329	25.3	22.0	47.3	50.0	-2.7
16.707	22.2	22.1	44.3	50.0	-5.7
15.569	20.4	21.9	42.3	50.0	-7.7
14.812	18.9	21.8	40.7	50.0	-9.3
17.090	18.1	22.1	40.2	50.0	-9.8
16.225	12.7	22.0	34.7	50.0	-15.3
15.847	12.6	22.0	34.6	50.0	-15.4

CONCLUSION

Pass

Tested By

POWERLINE CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2015.01.28
PSA-ESCI 2015.01.16, EmiR5 2014.11.19.2

EUT:	1638	Work Order:	MCSO1725
Serial Number:	445000930	Date:	01/29/2015
Customer:	Microsoft Corporation	Temperature:	24°C
Attendees:	Kitty Tam	Relative Humidity:	35%
Customer Project:	None	Bar. Pressure:	1029 mb
Tested By:	Richard Mellroth	Job Site:	NC05
Power:	110VAC/60Hz	Configuration:	MCSO1725-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2015	ANSI C63.10:2009

TEST PARAMETERS

Run #:	8	Line:	High Line	Ext. Attenuation (dB):	20

COMMENTS

Antenna trace disconnected. EUT powered at 5 VDC from DC power supply. USB disconnected from laptop PC.

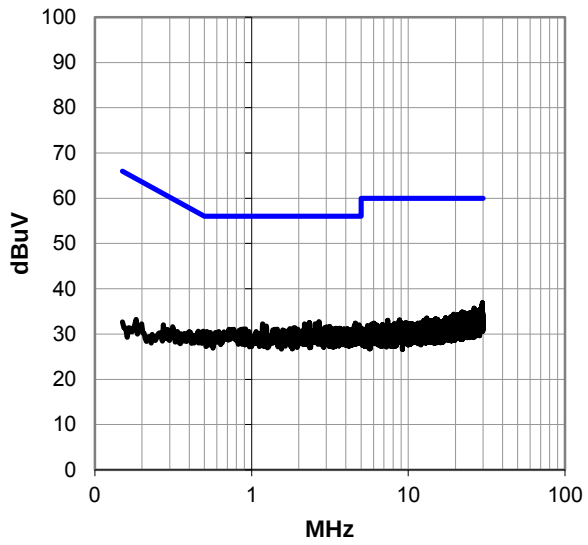
EUT OPERATING MODES

Transmitting NFC 13.56 MHz, Maximum Duty Cycle

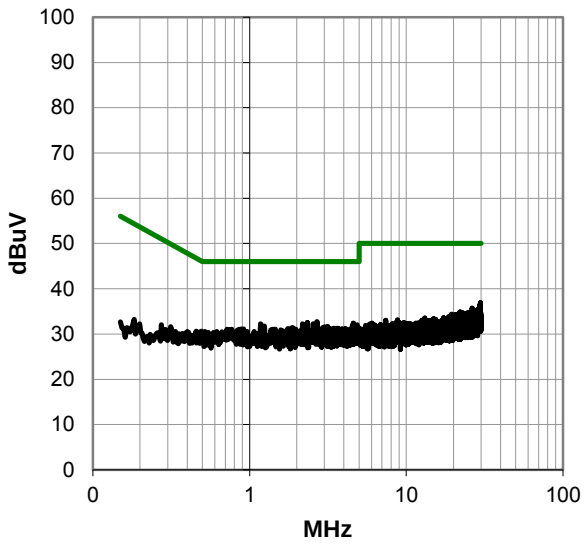
DEVIATIONS FROM TEST STANDARD

None

Peak Data - vs - Quasi Peak Limit



Peak Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS

NORTHWEST EMC

WTD.2015.01.28
PSA-ESCI 2015.01.16, EmiR5 2014.11.19.2

RESULTS - Run #8

Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
29.787	12.8	24.1	36.9	60.0	-23.1
2.694	12.2	20.6	32.8	56.0	-23.3
2.336	12.0	20.5	32.5	56.0	-23.5
4.605	11.7	20.7	32.4	56.0	-23.6
29.522	12.3	24.0	36.3	60.0	-23.7
1.176	11.8	20.5	32.3	56.0	-23.7
2.553	11.7	20.5	32.2	56.0	-23.8
2.176	11.7	20.5	32.2	56.0	-23.8
4.858	11.3	20.7	32.0	56.0	-24.0
4.526	11.2	20.7	31.9	56.0	-24.1
1.247	11.3	20.5	31.8	56.0	-24.2
4.638	11.0	20.7	31.7	56.0	-24.3
26.295	12.3	23.4	35.7	60.0	-24.3
3.164	11.1	20.6	31.7	56.0	-24.3
4.705	10.9	20.7	31.6	56.0	-24.4
3.045	11.0	20.6	31.6	56.0	-24.4
3.004	11.0	20.6	31.6	56.0	-24.4
3.112	10.9	20.6	31.5	56.0	-24.5
2.948	10.9	20.6	31.5	56.0	-24.5
28.698	11.6	23.9	35.5	60.0	-24.5
1.889	10.9	20.5	31.4	56.0	-24.6
29.631	11.3	24.1	35.4	60.0	-24.6
2.747	10.8	20.6	31.4	56.0	-24.6
4.903	10.6	20.7	31.3	56.0	-24.7
3.635	10.6	20.7	31.3	56.0	-24.7
3.452	10.6	20.6	31.2	56.0	-24.8

Peak Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
29.787	12.8	24.1	36.9	50.0	-13.1
2.694	12.2	20.6	32.8	46.0	-13.3
2.336	12.0	20.5	32.5	46.0	-13.5
4.605	11.7	20.7	32.4	46.0	-13.6
29.522	12.3	24.0	36.3	50.0	-13.7
1.176	11.8	20.5	32.3	46.0	-13.7
2.553	11.7	20.5	32.2	46.0	-13.8
2.176	11.7	20.5	32.2	46.0	-13.8
4.858	11.3	20.7	32.0	46.0	-14.0
4.526	11.2	20.7	31.9	46.0	-14.1
1.247	11.3	20.5	31.8	46.0	-14.2
4.638	11.0	20.7	31.7	46.0	-14.3
26.295	12.3	23.4	35.7	50.0	-14.3
3.164	11.1	20.6	31.7	46.0	-14.3
4.705	10.9	20.7	31.6	46.0	-14.4
3.045	11.0	20.6	31.6	46.0	-14.4
3.004	11.0	20.6	31.6	46.0	-14.4
3.112	10.9	20.6	31.5	46.0	-14.5
2.948	10.9	20.6	31.5	46.0	-14.5
28.698	11.6	23.9	35.5	50.0	-14.5
1.889	10.9	20.5	31.4	46.0	-14.6
29.631	11.3	24.1	35.4	50.0	-14.6
2.747	10.8	20.6	31.4	46.0	-14.6
4.903	10.6	20.7	31.3	46.0	-14.7
3.635	10.6	20.7	31.3	46.0	-14.7
3.452	10.6	20.6	31.2	46.0	-14.8

CONCLUSION

Pass

Tested By

POWERLINE CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2015.01.28
PSA-ESCI 2015.01.16, EmiR5 2014.11.19.2

EUT:	1638	Work Order:	MCSO1725
Serial Number:	445000930	Date:	01/29/2015
Customer:	Microsoft Corporation	Temperature:	24°C
Attendees:	Kitty Tam	Relative Humidity:	35%
Customer Project:	None	Bar. Pressure:	1029 mb
Tested By:	Richard Mellroth	Job Site:	NC05
Power:	110VAC/60Hz	Configuration:	MCSO1725-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2015	ANSI C63.10:2009

TEST PARAMETERS

Run #:	9	Line:	Neutral	Ext. Attenuation (dB):	20

COMMENTS

Antenna trace disconnected. EUT powered at 5 VDC from DC power supply. USB disconnected from laptop PC.

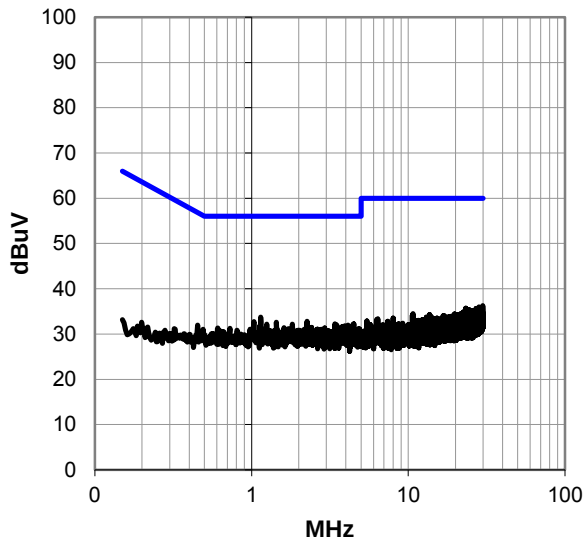
EUT OPERATING MODES

Transmitting NFC 13.56 MHz, Maximum Duty Cycle

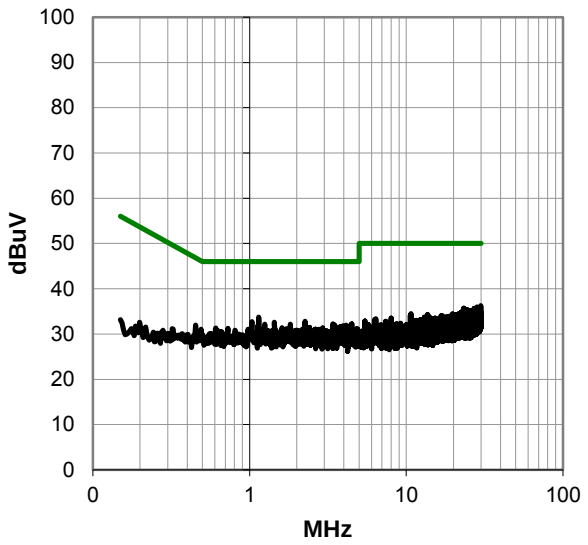
DEVIATIONS FROM TEST STANDARD

None

Peak Data - vs - Quasi Peak Limit



Peak Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2015.01.28
PSA-ESCI 2015.01.16, EmiR5 2014.11.19.2

RESULTS - Run #9

Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
1.142	13.3	20.5	33.8	56.0	-22.2
2.258	12.3	20.5	32.8	56.0	-23.2
1.034	12.3	20.4	32.7	56.0	-23.3
1.441	12.1	20.5	32.6	56.0	-23.4
29.966	12.1	24.1	36.2	60.0	-23.8
3.400	11.6	20.6	32.2	56.0	-23.8
4.493	11.5	20.7	32.2	56.0	-23.8
1.825	11.7	20.5	32.2	56.0	-23.8
1.251	11.7	20.5	32.2	56.0	-23.8
3.433	11.5	20.6	32.1	56.0	-23.9
4.422	11.3	20.7	32.0	56.0	-24.0
4.120	11.3	20.7	32.0	56.0	-24.0
28.321	12.2	23.8	36.0	60.0	-24.0
3.508	11.3	20.7	32.0	56.0	-24.0
1.131	11.5	20.5	32.0	56.0	-24.1
3.929	11.1	20.7	31.8	56.0	-24.2
23.270	12.8	22.9	35.7	60.0	-24.3
3.810	11.0	20.7	31.7	56.0	-24.3
27.038	12.1	23.5	35.6	60.0	-24.4
3.523	10.9	20.7	31.6	56.0	-24.4
2.415	10.9	20.5	31.4	56.0	-24.6
1.609	10.9	20.5	31.4	56.0	-24.6
2.929	10.8	20.6	31.4	56.0	-24.6
0.609	10.9	20.5	31.4	56.0	-24.7
24.568	12.2	23.1	35.3	60.0	-24.7
0.728	10.8	20.5	31.3	56.0	-24.7

Peak Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
1.142	13.3	20.5	33.8	46.0	-12.2
2.258	12.3	20.5	32.8	46.0	-13.2
1.034	12.3	20.4	32.7	46.0	-13.3
1.441	12.1	20.5	32.6	46.0	-13.4
29.966	12.1	24.1	36.2	50.0	-13.8
3.400	11.6	20.6	32.2	46.0	-13.8
4.493	11.5	20.7	32.2	46.0	-13.8
1.825	11.7	20.5	32.2	46.0	-13.8
1.251	11.7	20.5	32.2	46.0	-13.8
3.433	11.5	20.6	32.1	46.0	-13.9
4.422	11.3	20.7	32.0	46.0	-14.0
4.120	11.3	20.7	32.0	46.0	-14.0
28.321	12.2	23.8	36.0	50.0	-14.0
3.508	11.3	20.7	32.0	46.0	-14.0
1.131	11.5	20.5	32.0	46.0	-14.1
3.929	11.1	20.7	31.8	46.0	-14.2
23.270	12.8	22.9	35.7	50.0	-14.3
3.810	11.0	20.7	31.7	46.0	-14.3
27.038	12.1	23.5	35.6	50.0	-14.4
3.523	10.9	20.7	31.6	46.0	-14.4
2.415	10.9	20.5	31.4	46.0	-14.6
1.609	10.9	20.5	31.4	46.0	-14.6
2.929	10.8	20.6	31.4	46.0	-14.6
0.609	10.9	20.5	31.4	46.0	-14.7
24.568	12.2	23.1	35.3	50.0	-14.7
0.728	10.8	20.5	31.3	46.0	-14.7

CONCLUSION

Pass

Tested By