VendScreen

Revolution

FCC 15.225:2012

FCC 15.209:2012

Report #: VEND0002

Report Prepared By Northwest EMC Inc.

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

California – Minnesota – Oregon – New York – Washington

CERTIFICATE OF TEST

Last Date of Test: August 31, 2012
VendScreen
Model: Revolution

Emissions

Test Description	Specification	Test Method	Pass/Fail
Field Strength of Fundamental	FCC 15.225:2012	ANSI C63.10:2009	Pass
Field Strength of Spurious Emissions < 30 MHz	FCC 15.209:2012	ANSI C63.10:2009	Pass
Field Strength of Spurious Emissions > 30 MHz	FCC 15.209:2012	ANSI C63.10:2009	Pass
Frequency Stability	FCC 15.225:2012	ANSI C63.10:2009	Pass
AC Powerline Conducted Emissions	FCC 15.207:2012	ANSI C63.10:2009	Pass

Deviations From Test Standards

None

Approved By:

Tim O'Shea, Operations Manager

NVLAP Lab Code: 200630-0

Test Facility

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

Northwest EMC, Inc.
22975 NW Evergreen Parkway, Suite 400
Hillsboro, OR 97124

Phone: (503) 844-4066 Fax: 844-3826

This site has been fully described in a report filed with and accepted by the FCC (Federal Communications Commission) and Industry Canada (Site filing #2834D-1).

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

Product compliance is the responsibility of the client, therefore the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. This Report may only be duplicated in its entirety. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test.

NORTHWEST EMC
REV 2012.08.02

REVISION HISTORY

Revision Number	Description	Date	Page Number
00	None		

Barometric Pressure

The recorded barometric pressure has been normalized to sea level.

NORTHWEST EMC

REV 2012.05.24

ACCREDITATIONS AND AUTHORIZATIONS

United States

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

A2LA - Accredited by A2LA to ISO / IEC Guide 65 as a product certifier. This allows Northwest EMC to certify transmitters to FCC and IC specifications.

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

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

European Union

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

Australia/New Zealand

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

Korea

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

Japan

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

Taiwan

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

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

Singapore

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

Hong Kong

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

Vietnam

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

Russia

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

SCOPE

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

MEASUREMENT UNCERTAINTY

Measurement Uncertainty

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

A measurement uncertainty estimation has been performed for each test per our internal quality document WP 342. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) for each test is 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 16-4-1 as applicable), and are available upon request.

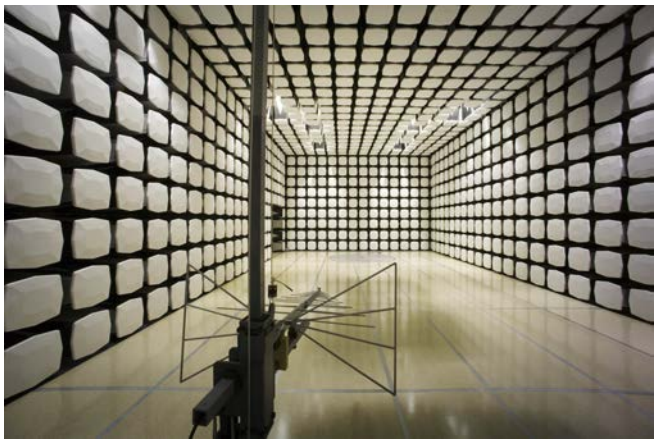
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

Test	+ MU	- MU
Frequency Accuracy (Hz)	0.12	-0.01
Amplitude Accuracy (dB)	0.49	-0.49
Conducted Power (dB)	0.41	-0.41
Radiated Power via Substitution (dB)	0.69	-0.68
Temperature (degrees C)	0.81	-0.81
Humidity (% RH)	2.89	-2.89
Field Strength (dB)	4.00	-4.00
AC Powerline Conducted Emissions (dB)	2.70	-2.70

LOCATIONS

REV 2012.08.03

Oregon Labs EV01-EV12 22975 NW Evergreen Pkwy, #400 Hillsboro, OR 97124 (503) 844-4066	**California** Labs OC01-OC13 41 Tesla Irvine, CA 92618 (949) 861-8918	**New York** Labs WA01-WA04 4939 Jordan Rd. Elbridge, NY 13060 (315) 685-0796	**Minnesota** Labs MN01-MN08 9349 W Broadway Ave. Brooklyn Park, MN 55445 (763) 425-2281	**Washington** Labs SU01-SU07 14128 339th Ave. SE Sultan, WA 98294 (360) 793-8675
VCCI				
A-0108	A-0029		A-0109	A-0110
Industry Canada				
2834D-1, 2834D-*2*	2834B-1, 2834B-2, 2834B-3		2834E-1	2834C-1



PRODUCT DESCRIPTION

WTD 12.5.23

Client and Equipment Under Test (EUT) Information

Company Name:	VendScreen
Address:	9600 NE Cascades Parkway, Suite 360
City, State, Zip:	Portland, OR 97220
Test Requested By:	Glenn Butler
Model:	Revolution
First Date of Test:	August 30, 2012
Last Date of Test:	August 31, 2012
Receipt Date of Samples:	August 30, 2012
Equipment Design Stage:	Production
Equipment Condition:	No Damage

Information Provided by the Party Requesting the Test

Functional Description of the EUT (Equipment Under Test):
Payment terminal using near-field communications (NFC).

Testing Objective:
Seeking system approval under FCC 15.225

CONFIGURATIONS

WTD 12.5.23

Configuration VEND0002- 1

Software/Firmware Running during test	
Description	**Version**
Standard OS Build	8.24.2012 Release

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Vending Machine Payment System	VendScreen	Revolution	15100006

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Antenna	None	None	None

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Power Adapter	Condor	Plug-In Class 2 Transformer	None

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
Antenna	PA	1.0m	Yes	Vending Machine Payment System	Antenna
Harness	No	.5m	Yes	Vending Machine Payment System	Power and Unterminated
Power	PA	2.5m	PA	Harness	Power Adapter
PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.					

Configuration VEND0002- 2

Software/Firmware Running during test	
Description	**Version**
Standard OS Build	8.24.2012 Release

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Vending Machine Payment System	VendScreen	Revolution	15100006

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Antenna	None	None	None

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
Antenna	PA	1.0m	Yes	Vending Machine Payment System	Antenna
Harness	No	.5m	Yes	Vending Machine Payment System	Power and Unterminated
Power	No	3.0m	No	Harness	DC Power
PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.					

MODIFICATIONS

WTD 12.5.23

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	8/30/2012	Field Strength of Spurious Emissions > 30 MHz	Modified from delivered configuration.	Added a Ferrico NF-70 ferrite to the power harness extension and a Steward 28A0350-0B2 ferrite to the antenna cable. Modification authorized by Ward Ramsdell.	EUT remained at Northwest EMC following the test.
2	8/30/2012	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	8/31/2012	AC Powerline Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
4	8/31/2012	Field Strength of Fundamentals	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	8/31/2012	Field Strength of Spurious Emissions < 30 MHz	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

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

Transmitting and Receiving. NFC sandbox running.

POWER SETTINGS INVESTIGATED

120VAC/60Hz

CONFIGURATIONS INVESTIGATED

VEND0002 - 1

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	1/31/2012	12 mo
EV11 Cables	N/A	3m Test Distance Cables	EVM	3/15/2012	12 mo
Antenna, Loop	EMCO	6502	AOA	6/28/2011	24 mo

MEASUREMENT BANDWIDTHS

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

TEST DESCRIPTION

The 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 orientation in 3 orthogonal planes. An active loop antenna was used for this test in order to provide sufficient measurement sensitivity.

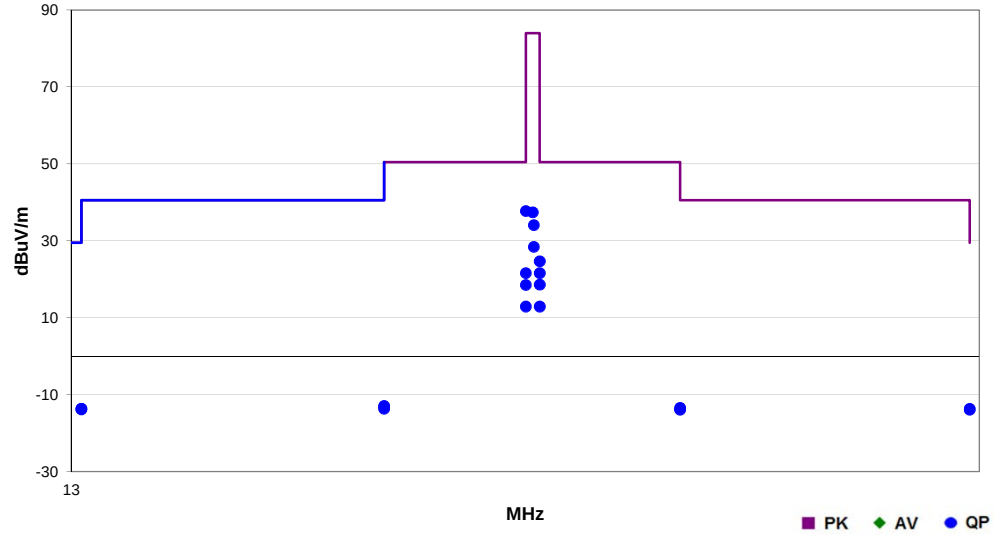
As outlined in 15.209(e), and associated reference to 15.31, measurements may be performed at a distance closer than specified as was the case in this testing. In this case the limit for the defined distance is outlined on the data sheet. For transmitters operating below 30 MHz, the data is adjusted by using the square of the inverse linear distance extrapolation factor of 40dB/decade.

Field Strength of Fundamental

Work Order:	VEND0002	**Date:**	08/31/12		
Project:	None	**Temperature:**	23 °C		
Job Site:	EV11	**Humidity:**	39% RH		
Serial Number:	15100006	**Barometric Pres.:**	1013.5 mbar	**Tested by:**	Jennifer Herrett
EUT:	Revolution				
Configuration:	1				
Customer:	VendScreen				
Attendees:	Ward Ramsdell				
EUT Power:	120VAC/60Hz				
Operating Mode:	Transmitting and Receiving. NFC sandbox running.				
Deviations:	None				
Comments:	Ferrite beads on antenna and power cables				

Test Specifications	**Test Method**
FCC 15.225:2012	ANSI C63.10:2009

Run #	6	**Test Distance (m)**	5	**Antenna Height(s)**	1-4m	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
13.110	5.8	11.6	1.0	304.0	5.0	0.0	Vert	QP	-31.1	-13.7	29.5	-43.2	5m Receive antenna is perp to the EUT and para to the floor.
13.110	5.7	11.6	1.0	237.0	5.0	0.0	Horz	QP	-31.1	-13.8	29.5	-43.3	5m Receive antenna is perp to the EUT and perp to the floor.
13.110	5.8	11.6	1.0	169.0	5.0	0.0	Horz	QP	-31.1	-13.7	29.5	-43.2	5m Receive antenna is para to the EUT and perp to the floor.
13.410	6.3	11.6	1.0	304.0	5.0	0.0	Vert	QP	-31.1	-13.2	40.5	-53.7	5m Receive antenna is perp to the EUT and para to the floor.
13.410	6.6	11.6	1.0	237.0	5.0	0.0	Horz	QP	-31.1	-12.9	40.5	-53.4	5m Receive antenna is perp to the EUT and perp to the floor.
13.410	5.8	11.6	1.0	169.0	5.0	0.0	Horz	QP	-31.1	-13.7	40.5	-54.2	5m Receive antenna is para to the EUT and perp to the floor.
13.553	38.0	11.6	1.0	169.0	5.0	0.0	Horz	QP	-31.1	18.5	50.5	-32.0	5m Receive antenna is para to the EUT and perp to the floor.
13.553	41.1	11.6	1.0	304.0	5.0	0.0	Vert	QP	-31.1	21.6	50.5	-28.9	5m Receive antenna is perp to the EUT and para to the floor.
13.553	57.3	11.6	1.0	304.0	5.0	0.0	Vert	QP	-31.1	37.7	50.5	-12.8	5m Receive antenna is perp to the EUT and para to the floor.
13.553	32.4	11.6	1.0	237.0	5.0	0.0	Horz	QP	-31.1	12.9	50.5	-37.6	5m Receive antenna is perp to the EUT and perp to the floor.
13.561	47.9	11.6	1.0	237.0	5.0	0.0	Horz	QP	-31.1	28.4	84.0	-55.6	5m Receive antenna is perp to the EUT and perp to the floor.
13.561	53.6	11.6	1.0	169.0	5.0	0.0	Horz	QP	-31.1	34.1	84.0	-49.9	5m Receive antenna is para to the EUT and perp to the floor.
13.560	56.9	11.6	1.0	304.0	5.0	0.0	Vert	QP	-31.1	37.4	84.0	-46.6	5m Receive antenna is perp to the EUT and para to the floor.
13.567	38.1	11.6	1.0	169.0	5.0	0.0	Horz	QP	-31.1	18.6	50.5	-31.9	5m Receive antenna is para to the EUT and perp to the floor.
13.567	41.1	11.6	1.0	304.0	5.0	0.0	Vert	QP	-31.1	21.6	50.5	-28.9	5m Receive antenna is perp to the EUT and para to the floor.
13.567	44.2	11.6	1.0	304.0	5.0	0.0	Vert	QP	-31.1	24.7	50.5	-25.8	5m Receive antenna is perp to the EUT and para to the floor.
13.567	32.4	11.6	1.0	237.0	5.0	0.0	Horz	QP	-31.1	12.9	50.5	-37.6	5m Receive antenna is perp to the EUT and perp to the floor.
13.710	5.6	11.6	1.0	169.0	5.0	0.0	Horz	QP	-31.1	-13.9	40.5	-54.4	5m Receive antenna is para to the EUT and perp to the floor.
13.710	6.1	11.6	1.0	237.0	5.0	0.0	Horz	QP	-31.1	-13.4	40.5	-53.9	5m Receive antenna is para to the EUT and perp to the floor.
13.710	5.8	11.6	1.0	304.0	5.0	0.0	Vert	QP	-31.1	-13.7	40.5	-54.2	5m Receive antenna is perp to the EUT and para to the floor.
14.010	5.8	11.6	1.0	304.0	5.0	0.0	Vert	QP	-31.1	-13.7	29.5	-43.2	5m Receive antenna is perp to the EUT and para to the floor.
14.010	5.6	11.6	1.0	169.0	5.0	0.0	Horz	QP	-31.1	-13.9	29.5	-43.4	5m Receive antenna is para to the EUT and perp to the floor.
14.010	5.7	11.6	1.0	237.0	5.0	0.0	Horz	QP	-31.1	-13.8	29.5	-43.3	5m Receive antenna is perp to the EUT and perp to the floor.

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

Transmitting and Receiving. NFC sandbox running.

POWER SETTINGS INVESTIGATED

120VAC/60Hz

CONFIGURATIONS INVESTIGATED

VEND0002 - 1

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
Antenna, Loop	EMCO	6502	AOA	6/28/2011	24 mo
EV11 Cables	N/A	3m Test Distance Cables	EVM	3/15/2012	12 mo
Spectrum Analyzer	Agilent	E4443A	AFB	1/31/2012	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 C63.4). An active loop antenna was used for this test in order to provide sufficient measurement sensitivity.

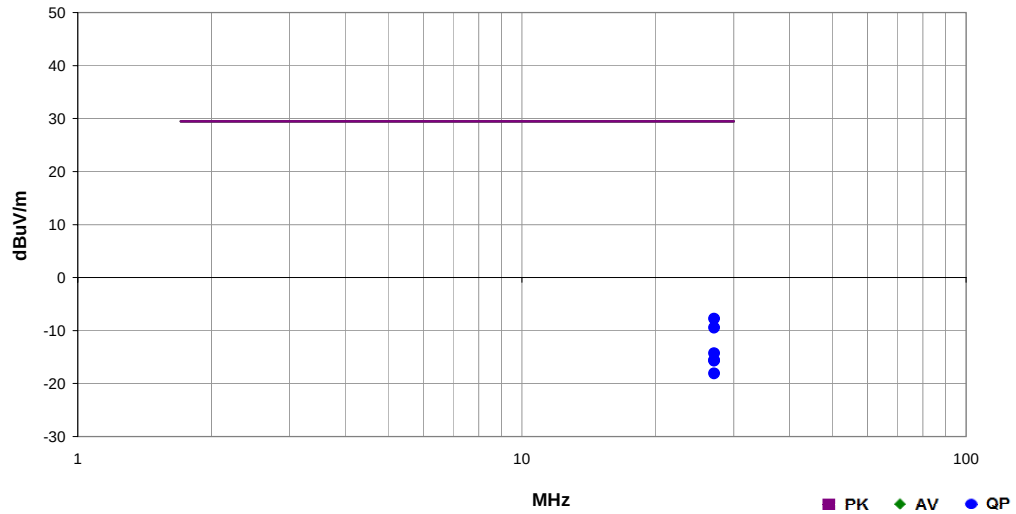
As outlined in 15.209(e), and associated reference to 15.31, measurements may be performed at a distance closer than specified as was the case in this testing. In this case the limit for the defined distance is outlined on the data sheet. For transmitters operating below 10 MHz, the data is adjusted by using the square of the inverse linear distance extrapolation factor of 40dB/decade or a distance correction factor derived from testing at two distances.

Field Strength of Spurious Emissions < 30 MHz

Work Order:	VEND0002	**Date:**	08/31/12		
Project:	None	**Temperature:**	23 °C		
Job Site:	EV11	**Humidity:**	39% RH		
Serial Number:	15100006	**Barometric Pres.:**	1013.5 mbar	**Tested by:**	Jennifer Herrett
EUT:	Revolution				
Configuration:	1				
Customer:	VendScreen				
Attendees:	Ward Ramsdell				
EUT Power:	120VAC/60Hz				
Operating Mode:	Transmitting and Receiving. NFC sandbox running.				
Deviations:	None				
Comments:	Ferrite beads on antenna and power cables				

Test Specifications	**Test Method**
FCC 15.209:2012	ANSI C63.10:2009

Run #	6	**Test Distance (m)**	3	**Antenna Height(s)**	1-4m	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
27.119	22.5	9.7	1.0	-5.0	3.0	0.0	See comments	QP	-40.0	-7.8	29.5	-37.3	Receive antenna is perp to the EUT and perp to the floor.
27.120	20.8	9.7	1.0	-5.0	5.0	0.0	See comments	QP	-40.0	-9.5	29.5	-39.0	5m Receive antenna is perp to the EUT and perp to the floor.
27.118	14.6	9.7	1.0	103.0	3.0	0.0	See comments	QP	-40.0	-15.7	29.5	-45.2	Receive antenna is perp to the EUT and para to the floor.
27.120	16.0	9.7	1.0	103.0	5.0	0.0	See comments	QP	-40.0	-14.3	29.5	-43.8	5m Receive antenna is perp to the EUT and para to the floor.
27.120	14.7	9.7	1.0	244.0	3.0	0.0	See comments	QP	-40.0	-15.6	29.5	-45.1	Receive antenna is para to the EUT and perp to the floor.
27.120	12.2	9.7	1.0	244.0	5.0	0.0	See comments	QP	-40.0	-18.1	29.5	-47.6	5m Receive antenna is para to the EUT and perp to the floor.

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

Transmitting and Receiving. NFC sandbox running.

POWER SETTINGS INVESTIGATED

120VAC/60Hz

CONFIGURATIONS INVESTIGATED

VEND0002 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	1000 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
Antenna, Biconilog	EMCO	3141	AXG	4/10/2012	12 mo
Pre-Amplifier	Miteq	AM-1616-1000	AOL	6/26/2012	12 mo
EV01 Cables	N/A	Bilog Cables	EVA	6/26/2012	12 mo
Spectrum Analyzer	Agilent	E4446A	AAQ	2/7/2012	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 transmitting and receiving while set at the channel available. 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 > 30 MHz

PSA 2012.06.05
EMI 2008.1.9

EUT:	Revolution	**Work Order:**	VEND0002
Serial Number:	15100006	**Date:**	08/30/12
Customer:	VendScreen	**Temperature:**	23
Attendees:	Ward Ramsdell	**Humidity:**	40%
Project:	None	**Barometric Pres.:**	1015.5
Tested by:	Jennifer Herrett	**Power:** 120VAC/60Hz	**Job Site:** EV01

TEST SPECIFICATIONS

FCC 15.225:2011

Test Method

ANSI C63.10:2009

TEST PARAMETERS

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

COMMENTS

NFC sandbox running. With ferrite on antenna cable.

EUT OPERATING MODES

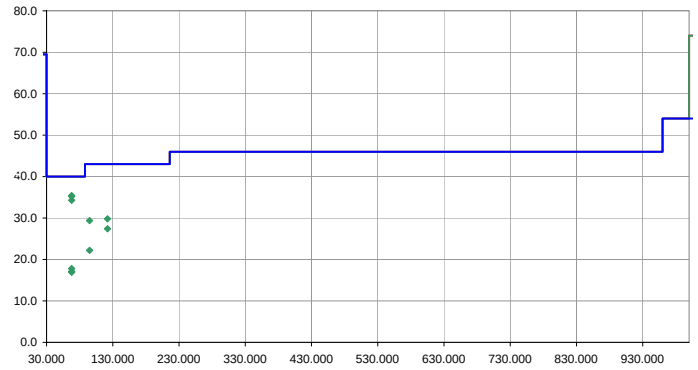
Transmitting and Receiving

DEVIATIONS FROM TEST STANDARD

No deviations.

Run #	2
Configuration #	1
Results	Pass

Signature



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)	Comments
67.804	43.5	-8.1	83.0	1.0	3.0	0.0	V-Bilog	QP	0.0	35.4	40.0	-4.6	EUT face down on table, antenna horizontal. Added ferrite on power cable at power adapter connector.
67.802	43.3	-8.1	121.0	1.0	3.0	0.0	V-Bilog	QP	0.0	35.2	40.0	-4.8	EUT vertical on table, antenna vertical. Added ferrite on power cable at power adapter connector.
67.811	42.4	-8.1	149.0	1.0	3.0	0.0	V-Bilog	QP	0.0	34.3	40.0	-5.7	EUT on side, antenna horizontal. Added ferrite on power cable at power adapter connector.
122.049	37.4	-7.6	57.0	1.5	3.0	0.0	H-Bilog	QP	0.0	29.8	43.0	-13.2	EUT on side, antenna horizontal.
94.935	36.2	-6.8	9.0	1.0	3.0	0.0	V-Bilog	QP	0.0	29.4	43.0	-13.6	EUT on face down on table, antenna horizontal.
122.044	35.0	-7.6	102.0	1.0	3.0	0.0	V-Bilog	QP	0.0	27.4	43.0	-15.6	EUT on face down on table, antenna horizontal.
94.929	29.0	-6.8	83.0	1.0	3.0	0.0	H-Bilog	QP	0.0	22.2	43.0	-20.8	EUT on side, antenna horizontal.
67.806	25.9	-8.1	154.0	1.0	3.0	0.0	H-Bilog	QP	0.0	17.8	40.0	-22.2	EUT vertical on table, antenna vertical. Added ferrite on power cable at power adapter connector.
67.805	25.2	-8.1	72.0	1.9	3.0	0.0	H-Bilog	QP	0.0	17.1	40.0	-22.9	EUT face down on table, antenna horizontal. Added ferrite on power cable at power adapter connector.
67.807	25.0	-8.1	36.0	1.0	3.0	0.0	H-Bilog	QP	0.0	16.9	40.0	-23.1	EUT on side, antenna horizontal. Added ferrite on power cable at power adapter connector.

Frequency Stability

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
Near Field Probe	EMCO	7405	IPD	NCR	0
Temp./Humidity Chamber	Cincinnati Sub Zero (CSZ)	ZH-32-2-2-H/AC	TBA	NCR	0
Chamber Temp. & Humidity Controller	ESZ / Eurotherm	Dimension II	TBC	NCR	0
Multimeter	Tektronix	DMM912	MMH	1/28/2011	24
DC Power Supply	Tektronix	PS280	TPM	NCR	0
Humidity Temperature Meter	Omegaette	HH311	DTY	3/29/2011	24
EV06 Direct Connect Cable	ESM Cable Corp.	TT	ECA	NCR	0
Attenuator 20 dB, SMA M/F 26GHz	S.M. Electronics	SA26B-20	AUY	8/2/2012	12
40GHz DC Block	Miteq	DCB4000	AMD	6/25/2012	12
Spectrum Analyzer	Agilent	E4440A	AFD	7/5/2012	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 near field probe connection between the EUT antenna and the test equipment. The spectrum analyzer is equipped with a precision frequency reference that exceeds the stability requirement of the EUT.

Frequency Stability

EUT:	Revolution			**Work Order:**	VEND0002
Serial Number:	15100006			**Date:**	08/30/12
Customer:	VendScreen			**Temperature:**	23°C
Attendees:	None			**Humidity:**	40%
Project:	None			**Barometric Pres.:**	1015.5
Tested by:	Jennifer Herrett	**Power:**	30VDC	**Job Site:**	EV06

TEST SPECIFICATIONS	Test Method
FCC 15.225:2012	ANSI C63.10:2009

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

Configuration #	2	Signature	Jennifer Herrett

	Measured Value (MHz)	Assigned Value (MHz)	Error (%)	Limit (%)	Result
13.56MHz					
Voltage: 115% (46VDC)	13.559939	13.56	0.000004	0.01	Pass
Voltage: 100% (40VDC, upper)	13.559939	13.56	0.000004	0.01	Pass
Voltage: 100% (30VDC)	13.559939	13.56	0.000004	0.01	Pass
Voltage: 100% (20VDC, lower)	13.559939	13.56	0.000004	0.01	Pass
Voltage: 85% (17VDC)	13.559939	13.56	0.000004	0.01	Pass
Temperature: +50°	13.559989	13.56	0.000001	0.01	Pass
Temperature: +40°	13.559972	13.56	0.000002	0.01	Pass
Temperature: +30°	13.559939	13.56	0.000004	0.01	Pass
Temperature: +20°	13.559939	13.56	0.000004	0.01	Pass
Temperature: +10°	13.559939	13.56	0.000004	0.01	Pass
Temperature: 0°	13.559972	13.56	0.000002	0.01	Pass
Temperature: -10°	13.559989	13.56	0.000001	0.01	Pass
Temperature: -20°	13.560005	13.56	0.000000	0.01	Pass

AC POWERLINE CONDUCTED EMISSIONS

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

MODES OF OPERATION

Transmitting and Receiving. NFC sandbox running.

POWER SETTINGS INVESTIGATED

120VAC/60Hz

CONFIGURATIONS INVESTIGATED

VEND0002 - 1

SAMPLE CALCULATIONS

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Receiver	Rohde & Schwarz	ESCI	ARH	3/29/2012	12 mo
High Pass Filter	TTE	H97-100K-50-720B	HHD	2/1/2012	24 mo
Attenuator	Coaxicom	66702 2910-20	RBR	8/7/2012	12 mo
EV07 Cables	N/A	Conducted Cables	EVG	4/27/2012	12 mo
LISN	Solar	9252-50-R-24-BNC	LIR	11/4/2011	12 mo

MEASUREMENT BANDWIDTHS

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

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

TEST DESCRIPTION

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

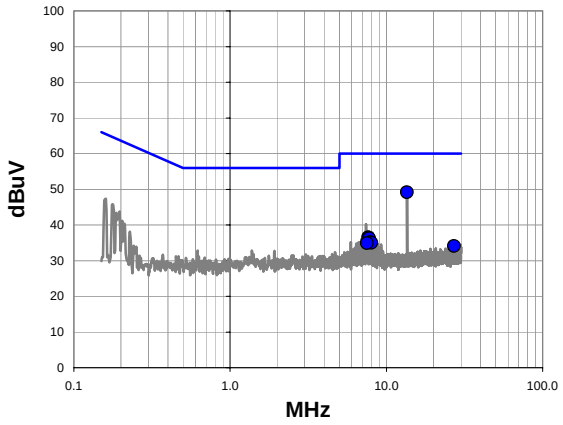
AC POWERLINE CONDUCTED EMISSIONS

Work Order:	VEND0002	**Date:**	08/31/12		
Project:	None	**Temperature:**	23 °C		
Job Site:	EV07	**Humidity:**	39% RH		
Serial Number:	15100006	**Barometric Pres.:**	1013.5 mbar	**Tested by:**	Jennifer Herrett
EUT:	Revolution				
Configuration:	1				
Customer:	VendScreen				
Attendees:	Ward Ramsdell				
EUT Power:	120VAC/60Hz				
Operating Mode:	Transmitting and Receiving. NFC sandbox running.				
Deviations:	None				
Comments:	Ferrite beads on antenna and power cables				

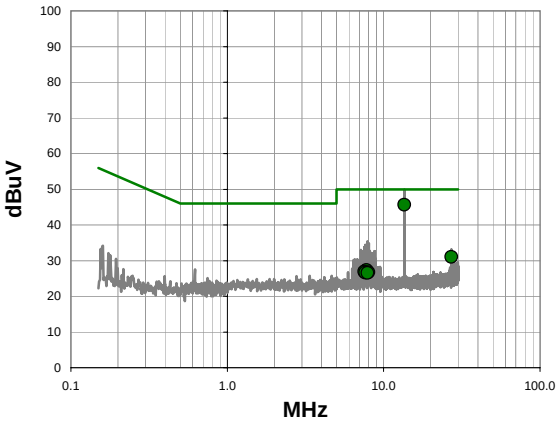
Test Specifications	**Test Method**
FCC 15.207:2012	ANSI C63.10:2009

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

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
13.560	27.9	21.2	49.1	60.0	-10.9
7.642	15.7	20.8	36.5	60.0	-23.5
7.766	15.4	20.8	36.2	60.0	-23.8
7.892	14.3	20.8	35.1	60.0	-24.9
8.016	14.2	20.8	35.0	60.0	-25.0
7.518	14.1	20.8	34.9	60.0	-25.1
27.120	12.1	22.0	34.1	60.0	-25.9

Average Data - vs - Average Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
13.560	24.4	21.2	45.6	50.0	-4.4
27.120	9.0	22.0	31.0	50.0	-19.0
7.766	6.5	20.8	27.3	50.0	-22.7
7.518	6.1	20.8	26.9	50.0	-23.1
8.016	5.9	20.8	26.7	50.0	-23.3
7.642	5.8	20.8	26.6	50.0	-23.4
7.892	5.7	20.8	26.5	50.0	-23.5

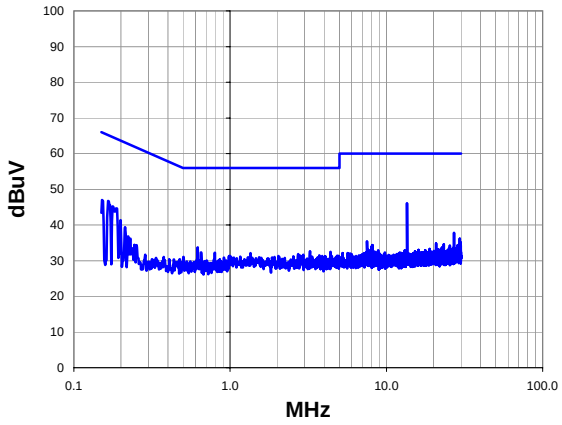
AC POWERLINE CONDUCTED EMISSIONS

Work Order:	VEND0002	**Date:**	08/31/12		
Project:	None	**Temperature:**	23 °C		
Job Site:	EV07	**Humidity:**	39% RH		
Serial Number:	15100006	**Barometric Pres.:**	1013.5 mbar	**Tested by:**	Jennifer Herrett
EUT:	Revolution				
Configuration:	1				
Customer:	VendScreen				
Attendees:	Ward Ramsdell				
EUT Power:	120VAC/60Hz				
Operating Mode:	Transmitting and Receiving. NFC sandbox running.				
Deviations:	None				
Comments:	Ferrite beads on antenna and power cables				

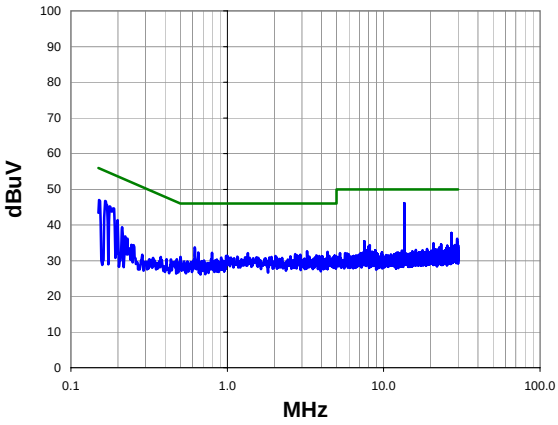
Test Specifications	**Test Method**
FCC 15.207:2012	ANSI C63.10:2009

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

Peak Data - vs - Quasi Peak Limit



Peak Data - vs - Average Limit



Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
13.570	24.9	21.2	46.1	60.0	-13.9
0.165	26.4	20.4	46.8	65.2	-18.4
0.152	26.5	20.5	47.0	65.9	-19.0
0.177	24.9	20.3	45.2	64.6	-19.4
27.120	15.8	22.0	37.8	60.0	-22.2
0.199	21.0	20.4	41.4	63.6	-22.3
0.619	13.4	20.3	33.7	56.0	-22.3
3.240	12.1	20.5	32.6	56.0	-23.4
4.384	11.8	20.7	32.5	56.0	-23.5
0.653	12.0	20.3	32.3	56.0	-23.7
0.213	19.0	20.4	39.4	63.1	-23.7
0.799	11.9	20.3	32.2	56.0	-23.8
29.450	14.0	22.2	36.2	60.0	-23.8
1.352	11.7	20.4	32.1	56.0	-23.9
2.720	11.3	20.5	31.8	56.0	-24.2
2.936	11.1	20.5	31.6	56.0	-24.4
3.720	10.9	20.6	31.5	56.0	-24.5
4.856	10.7	20.7	31.4	56.0	-24.6
7.520	14.6	20.8	35.4	60.0	-24.6
1.000	10.9	20.4	31.3	56.0	-24.7

Peak Data - vs - Average Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
13.570	24.9	21.2	46.1	50.0	-3.9
0.165	26.4	20.4	46.8	55.2	-8.4
0.152	26.5	20.5	47.0	55.9	-9.0
0.177	24.9	20.3	45.2	54.6	-9.4
27.120	15.8	22.0	37.8	50.0	-12.2
0.199	21.0	20.4	41.4	53.6	-12.3
0.619	13.4	20.3	33.7	46.0	-12.3
3.240	12.1	20.5	32.6	46.0	-13.4
4.384	11.8	20.7	32.5	46.0	-13.5
0.653	12.0	20.3	32.3	46.0	-13.7
0.213	19.0	20.4	39.4	53.1	-13.7
0.799	11.9	20.3	32.2	46.0	-13.8
29.450	14.0	22.2	36.2	50.0	-13.8
1.352	11.7	20.4	32.1	46.0	-13.9
2.720	11.3	20.5	31.8	46.0	-14.2
2.936	11.1	20.5	31.6	46.0	-14.4
3.720	10.9	20.6	31.5	46.0	-14.5
4.856	10.7	20.7	31.4	46.0	-14.6
7.520	14.6	20.8	35.4	50.0	-14.6
1.000	10.9	20.4	31.3	46.0	-14.7