ENGINEERING TEST REPORT

IXM MYCRO ENXP
Model No.: IXM051
FCC ID: S38-MENXP

Applicant:

Invixium Access Inc.
#5 – 205 Riviera Drive
Markham, Ontario
Canada L3R 5J8

In Accordance With

Federal Communications Commission (FCC)
Part 15, Subpart C
Unlicensed Low Power Transmitter Operating in the Band 13.110-14.010 MHz

UltraTech's File No.: INVX-002F15C225FP2

This Test report is Issued under the Authority of Tri M. Luu Vice President of Engineering UltraTech Group of Labs Date: February 13, 2014	
Report Prepared by: Dan Huynh Issued Date: February 13, 2014	Tested by: Hung Trinh Test Dates: January 3 & 6, 2014 February 7, 2014

- *The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.*
- *This report must not be used by the client to claim product endorsement by NVLAP or any agency of the US Government.*

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91038 | 1309 | 46390-2049 | NVLAP LAB CODE 200093-0 | SL2-IN-E-1119R | CA2049 | TL363_B | TPTDP DA1300

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EXHIBIT 1. INTRODUCTION

1.1. SCOPE

Reference:	FCC Part 15, Subpart C, Sec. 15.225 - Operation within the band 13.110 – 14.010 MHz.
Title:	Code of Federal Regulations (CFR), Title 47 Telecommunication, Part 15, Subpart C - Intentional Radiators
Purpose of Test:	To gain FCC Equipment Certification for FCC Part 15C.
Test Procedures:	ANSI C63.4 and ANSI C63.10
Environmental Classification:	Commercial, industrial or business environment

1.2. RELATED SUBMITTAL(S)/GRANT(S)

None.

1.3. NORMATIVE REFERENCES

Publication	Year	Title
FCC 47 CFR 15	2013	Code of Federal Regulations (CFR), Title 47 – Telecommunication, Part 15 Radio Frequency Devices
ANSI C63.4	2009	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 KHz to 40 GHz
ANSI C63.10	2009	American National Standard for Testing Unlicensed Wireless Devices
CISPR 22 & EN 55022	2008-09, Edition 6.0 2006	Information Technology Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement
CISPR 16-1-1 +A1 +A2	2006 2006 2007	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus
CISPR 16-1-2 +A1 +A2	2003 2004 2006	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-2: Conducted disturbances

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. CLIENT INFORMATION

Applicant	
Name:	Invixium Access Inc.
Address:	205 Riviera Drive, Unit 5 Markam, ON Canada L3R 5J8
Contact Person:	Shiraz Kapadia Phone #: 647-282-1745 Fax #: N/A Email Address: SKapadia@invixium.com

Manufacturer	
Name:	Mara Technologies Inc.
Address:	5680 14th Avenue Markham, Ontario Canada L3S 3K8
Contact Person:	Matthew Ruscica Phone #: 1-905-201-1787 Fax #: 1-905-201-9114 Email Address: matthew@maratech.ca

2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

Brand Name:	Invixium Access Inc.
Product Name:	IXM MYCRO ENXP
Model Name or Number:	IXM051
Serial Number:	Test sample
Type of Equipment:	Low Power Communication Device Transmitter
Input Power Supply Type:	12-24V DC external power supply
Primary User Functions of EUT:	Identifies person, either by fingerprint matching, or by card (proximity or contactless smart card), or both. Sends result of identification to Access Control Panel, or to Time and Attendance software application.

2.3. EUT'S TECHNICAL SPECIFICATIONS

Transmitter	
Equipment Type:	Portable
Intended Operating Environment:	Commercial, light industry & heavy industry
Power Supply Requirement:	5V DC
Field Strength:	52.25 dBµV/m at 3 m
Operating Frequency Range:	13.56 MHz
RF Output Impedance:	50 Ω
20 dB Bandwidth:	1.38 kHz
Modulation Type:	ASK
Oscillator Frequencies:	13.56 MHz
Antenna Connector Type:	Integral

2.4. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
1	Wiegand Output (to Access Control Panel), 2 lines	1	Header	Non-shielded
2	Wiegand Input (from external RFID), 2 lines	1	Header	30cm, non-shielded
3	Ethernet !00 BASETX	1	RJ-45 on cable	Non-shielded
4	RS-485 (slave), 2 lines	1	Header	Non-shielded
5	RS-232, 2 lines	1	DB-9, socket on cable	Non-shielded
6	Form C Relay, 3 lines	1	Header	Non-shielded
7	GPO, 4 lines	1	Header	Non-shielded
8	GPI, 8 lines	1	Header	Non-shielded
9	GND, 5 lines	1	Header	Non-shielded
10	USB OTG (Service Port)	1	USB-Micro-AB	Shielded (service port)
11	Power Input (12-24V)	1	Header	Non-shielded
12	EGND	1	Header	Non-shielded

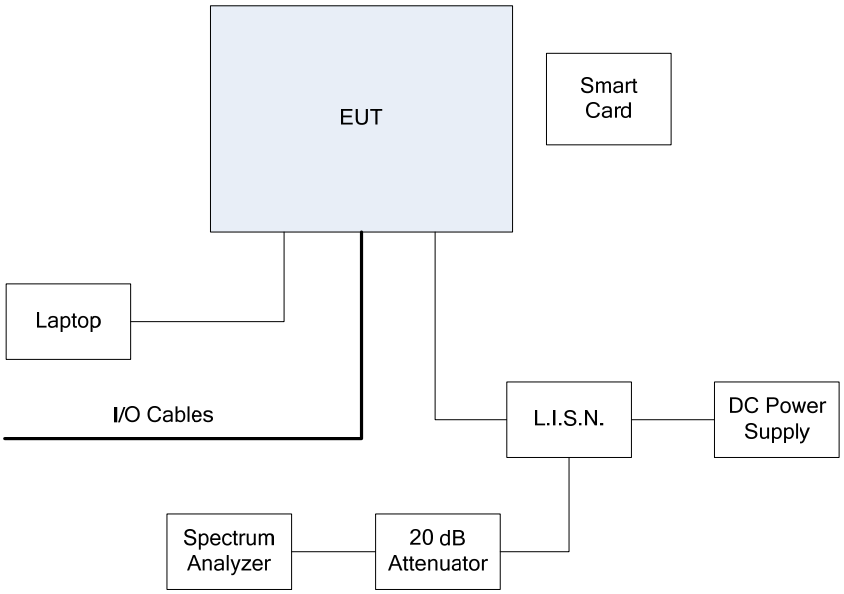
2.5. ANCILLARY EQUIPMENT

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

Ancillary Equipment # 1	
Description:	Smart Card
Brand Name:	MIFARE, DESFire
Model Name or Number:	N/A
Serial Number:	N/A
Cable Length & Type:	N/A
Connected to EUT's Port:	N/A

2.6. GENERAL TEST SETUP

2.6.1. Power Line Conducted Emission Test Setup



2.6.2. Radiated Emission Test Setup

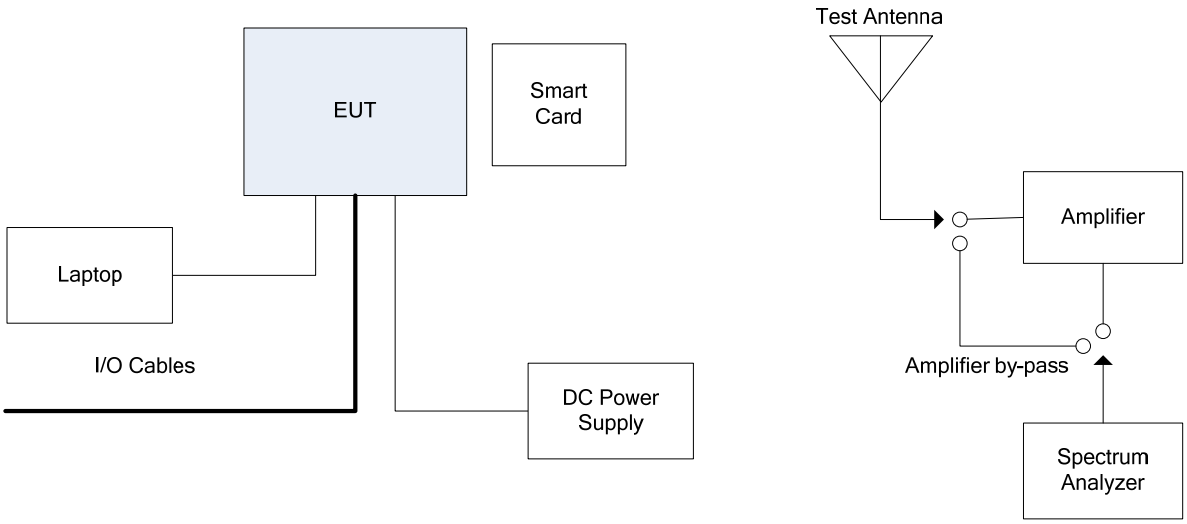


EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21°C
Humidity:	51%
Pressure:	102 kPa
Power input source:	24 VDC

3.2. OPEPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

Operating Modes:	The EUT was configured for continuous transmission for the duration of testing.
Special Test Software:	N/A
Special Hardware Used:	N/A
Transmitter Test Antenna:	The EUT was tested with the antenna fitted in a manner typical of normal intended use as integral antenna equipment.

Transmitter Test Signals:	
Frequency Band(s):	13.56 MHz
Test Frequency(ies):	13.56 MHz
Transmitter Wanted Output Test Signals:	
▪ RF Power Output (measured maximum output power):	52.25 dBµV/m at 3 m
▪ Normal Test Modulation:	ASK
▪ Modulating signal source:	Internal

EXHIBIT 4. SUMMARY OF TEST RESULTS

4.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- AC Power Line Conducted Emissions were performed in UltraTech's shielded room, 24'(L) by 16'(W) by 8'(H).

- Radiated Emissions were performed at the Ultratech's 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville 3-10 TDK Semi-Anechoic Chamber has been filed with FCC office (FCC File No.: 91038) and Industry Canada office (Industry Canada File No.: 2049A-3). Expiry Date: 2014-04-04.

4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC Regulations	Test Requirements	Compliance (Yes/No)
15.203 & 15.204	The transmitter shall use a transmitting antenna that is an integral part of the device	Yes*
15.107 & 15.207	Class B - Power Line Conducted Emissions	Yes
15.215(c)	Emission Bandwidth	Yes
15.225(a) – (d)	Field Strength of Emissions Inside and Outside the Permitted Band 13.110 - 14.010 MHz	Yes
15.225(e)	Frequency Stability	Yes

* The EUT complies with the requirement; it employs integral antenna.

4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

The following modifications were made for compliance:

1. On 4 wires between the radio board and antenna board:
    a. Antenna_Smart_Card_0
    b. Antenna_Smart_Card_1
    c. Antenna_Smart_Card_2
    d. Antenna_Smart_Card_3
    - NEOSID 140X050X130 ferrite bead (pearl-like)
2. On power supply lines pass-through ferrite Steward P/N 28A0350-0B2
3. On Ethernet lines, two loop through snap-on ferrite Steward P/N 28A3039-0A2

EXHIBIT 5. TEST DATA

5.1. POWERLINE CONDUCTED EMISSION [47 CFR 15.207(a)]

5.1.1. Limit(s)

The equipment shall meet the limits of the following table:

Frequency of emission (MHz)	Conducted Limits (dBμV)	
	Quasi-peak	Average
0.15–0.5 .....……..	66 to 56*	56 to 46*
0.5–5 .....……..	56	46
5-30 ……..	60 ...……..	50

*Decreases linearly with the logarithm of the frequency

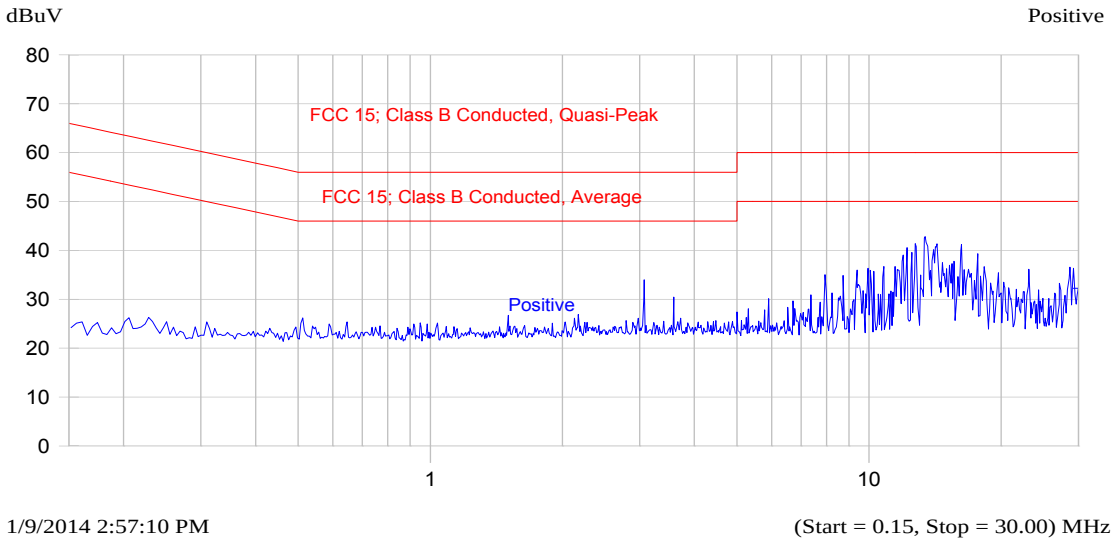
5.1.2. Method of Measurements

Refer to ANSI C63.4.

5.1.3. Test Data

Plot 5.1.3.1. Power Line Conducted Emissions
Line Voltage: 24 VDC; Line Tested: Positive

Current Graph

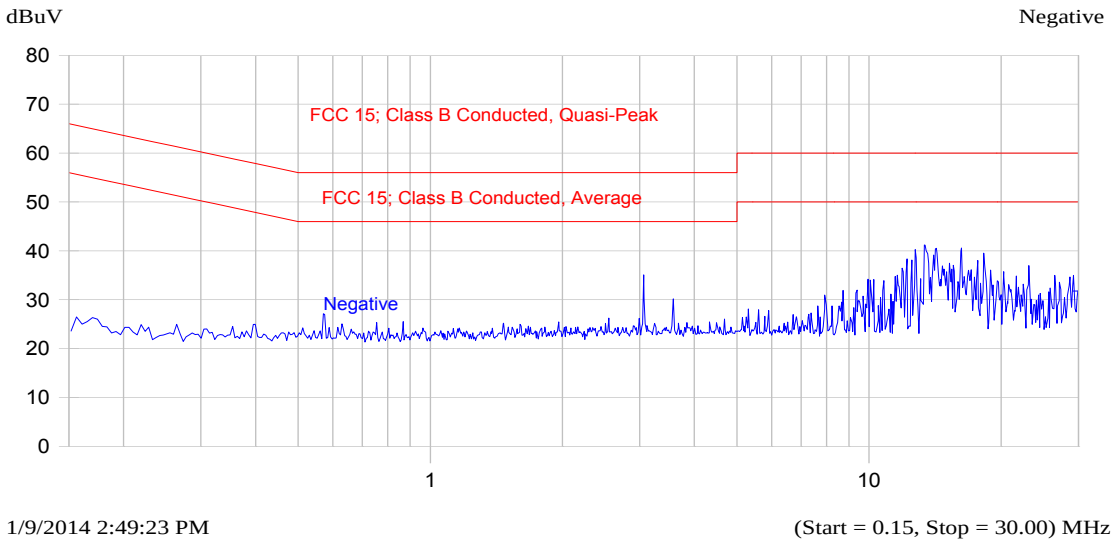


Current List

Frequency MHz	Peak dBuV	QP dBuV	Delta QP-QP Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Trace Name
3.068	38.7	35.2	-20.8	31.7	-14.3	Positive
13.357	44.9	42.9	-17.1	39.9	-10.1	Positive

Plot 5.1.3.2. Power Line Conducted Emissions
Line Voltage: 24 VDC; Line Tested: Negative

Current Graph



Current List

Frequency MHz	Peak dBuV	QP dBuV	Delta QP-QP Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Trace Name
3.060	39.9	35.9	-20.1	32.7	-13.3	Negative
13.358	43.6	41.3	-18.7	37.7	-12.3	Negative

5.2. EMISSION BANDWIDTH

5.2.1. Limit(s)

The 20 dB bandwidth of the emission shall be contained within the band 13.110–14.010 MHz.

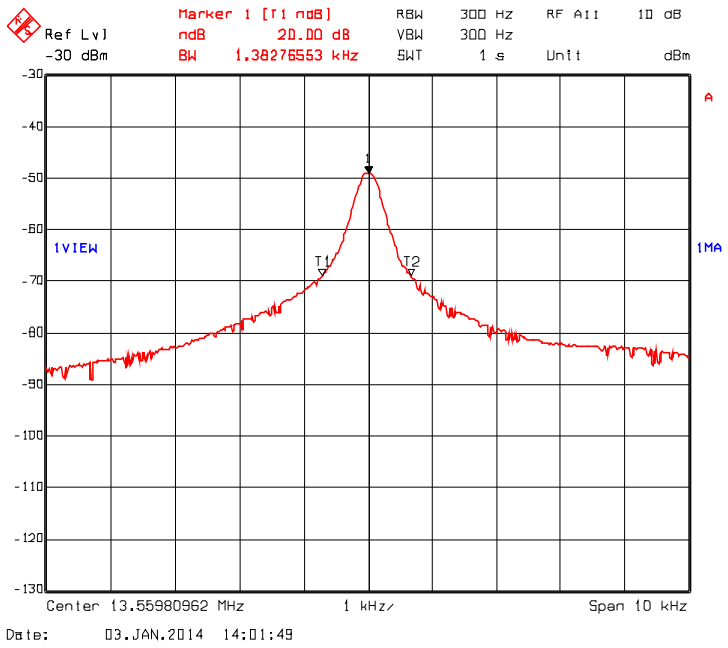
5.2.2. Method of Measurements

The measurements were performed in accordance with Ultratech Test Procedures, File # ULTR P001-2004 and ANSI C63.4:2009.

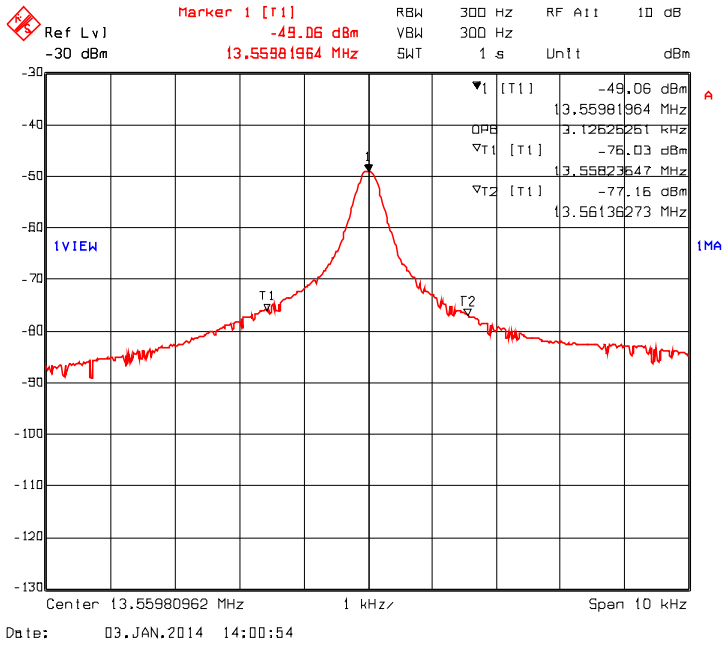
5.2.3. Test Data

Test Frequency (MHz)	Occupied Bandwidth (kHz)	
	20 dB BW	99 % BW
13.56	1.38	3.13

Plot 5.2.3.1. 20 dB Bandwidth, Fc: 13.56 MHz



Plot 5.2.3.2. 99% Occupied Bandwidth, Fc: 13.56 MHz



5.3. FIELD STRENGTH OF EMISSIONS WITHIN & OUTSIDE THE PERMITTED BAND 13.110-14.010 MHz [47 CFR 15.225 (a) to (d)]

5.3.1. Limits

(a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.
(b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.
(c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.
(d) The field strength of any emissions appearing outside of the 13.110 – 14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

47 CFR 15.209(a) – Radiated Emission Limts; general requirements

Frequency (MHz)	Field Strength Limits (microvolts/m)	Distance (Meters)
0.009 - 0.490	2,400 / F (KHz)	300
0.490 - 1.705	24,000 / F (KHz)	30
1.705 - 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 – 960	200	3
Above 960	500	3

5.3.2. Method of Measurements

Refer to Ultratech Test Procedures, File # ULTR P001-2004 and ANSI C63.4-2009 for measurement methods

5.3.3. Test Data

Remarks:

- Radiated spurious emissions measurements were performed at a measuring distance of 3 m, from 10 kHz – 10th harmonic of the fundamental and all spurious emissions that are in excess of 20 dB below the specified limit shall be recorded.
- For frequencies below 30 MHz, the results measured at 3 m distance shall be extrapolated to the specified distance using an extrapolation factor of 40 dB/decade for determining compliance.

5.3.3.1. Field Strength of Emissions Within the Permitted Band at 3 m

Frequency (MHz)	Measured Field Strength @ 3 m (dBµV/m)	Detector Used (Peak/QP)	Antenna Plane (H/V)	Field Strength Extrapolated Value (dBµV/m)	§ 15.225 Field Strength Limits (dBµV/m)	Margin (dB)
13.56	52.25	Peak	V	12.3	84.0	-71.8
13.56	45.81	Peak	H	5.8	84.0	-78.2

5.3.3.2. Field Strength of Emissions Outside the Permitted Band Below 30 MHz at 3 m

Frequency (MHz)	Measured Field Strength @ 3 m (dBµV/m)	Detector Used (Peak/QP)	Antenna Plane (H/V)	Field Strength Extrapolated Value (dBµV/m)	§ 15.209 Field Strength Limits (dBµV/m)	Margin (dB)
All spurious emissions are more than 20 dB below the specified limit.						

5.3.3.3. Field Strength of Emissions Outside the Permitted Band at or Above 30 MHz at 3 m

Frequency (MHz)	Measured Field Strength @ 3 m (dBµV/m)	Detector Used (Peak/QP)	Antenna Plane (H/V)	§ 15.209 Field Strength Limits (dBµV/m)	Margin (dB)
40.68	39.10	QP	V	40.0	-0.9
40.68	31.80	Peak	H	40.0	-8.2
54.24	31.10	Peak	V	40.0	-8.9
67.80	29.65	Peak	V	40.0	-10.4
67.80	20.19	Peak	H	40.0	-19.8
81.36	37.93	Peak	V	40.0	-2.1
94.92	34.19	Peak	V	43.5	-9.3
108.48	39.49	Peak	V	43.5	-4.0
108.48	24.36	Peak	H	43.5	-19.1
122.04	30.27	Peak	V	43.5	-13.2
135.60	30.64	Peak	V	43.5	-12.9

5.4. FREQUENCY STABILITY [47 CFR 15.225(e)]

5.4.1. Limit(s)

The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of –20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

5.4.2. Method of Measurements

ANSI C63.4-2009.

5.4.3. Test Data

Frequency Band:	13.56 MHz
Center Frequency:	13.56 MHz
Frequency Tolerance Limit:	± 0.01% (±1356 Hz)
Max. Frequency Tolerance Measured:	+144 Hz
Input Voltage Rating:	12-24 VDC on DC input

Ambient Temperature (°C)	Frequency Drift (Hz)		
	Supply Voltage (Nominal) 12 VDC	Supply Voltage (85 % of Nominal) 10.2 VDC	Supply Voltage (115% of Nominal) 27.6 VDC
-20	+144	--	--
-10	+132	--	--
0	+81	--	--
+10	+31	--	--
+20	0	0	0
+30	+9	--	--
+40	-9	--	--
+50	-1	--	--
+60	+19	--	--

EXHIBIT 6. TEST EQUIPMENT LIST

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Cal. Due Date
Spectrum Analyzer	Rohde & Schwarz	FSEK30	100077	20 Hz – 40 GHz	08 Nov 2014
Loop Antenna	EMCO	6502	9104-2611	10 kHz – 30 MHz	27 Aug 2015
Environmental Chamber	Envirotronics	SSH32C	11994847-S-11059	-60 to 177 °C	16 Aug 2014
Spectrum Analyzer	Rohde & Schwarz	ESU40	100037	20 Hz – 40 GHz	07 Mar 2014
RF Amplifier	AH System	PAM-0118	225	20 MHz – 18 GHz	25 Mar 2014
Biconi-Log Antenna	ETS Lindgren	3142C	34792	26 – 3000 MHz	26 Jun 2014
Spectrum Analyzer	Hewlett Packard	HP 8593EM	3412A00103	9 kHz–26.5 GHz	06 Feb 2014*
Attenuator	Pasternack	PE7010-20	-	DC–2 GHz	02 Jan 2015
L.I.S.N	EMCO	3825/2	8907-1531	0.01 -100 MHz	14 May 2014

*Equipment used on January 9, 2014.

EXHIBIT 7. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of CISPR 16-4-2 @ IEC:2003 and JCGM 100:2008 (GUM 1995) – Guide to the Expression of Uncertainty in Measurement.

7.1. LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY

	Line Conducted Emission Measurement Uncertainty (9 kHz – 30 MHz):	**Measured**	**Limit**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{I=1}^{m} u_i^2(y)}$	**± 1.44**	**± 1.8**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 2.89**	**± 3.6**

7.2. RADIATED EMISSION MEASUREMENT UNCERTAINTY

	Radiated Emission Measurement Uncertainty @ 3m, Horizontal (30-1000 MHz):	**Measured (dB)**	**Limit (dB)**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{I=1}^{m} u_i^2(y)}$	**± 2.39**	**± 2.6**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 4.79**	**± 5.2**

	Radiated Emission Measurement Uncertainty @ 3m, Vertical (30-1000 MHz):	**Measured (dB)**	**Limit (dB)**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{I=1}^{m} u_i^2(y)}$	**± 2.39**	**± 2.6**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 4.78**	**± 5.2**

	Radiated Emission Measurement Uncertainty @ 3 m, Horizontal & Vertical (1 – 18 GHz):	**Measured (dB)**	**Limit (dB)**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{I=1}^{m} u_i^2(y)}$	**± 1.87**	**Under consideration**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 3.75**	**Under consideration**