ENGINEERING TEST REPORT

IXM TOUCH2 FP2W
Model: IXM401W
FCC ID: S38-TS2ENXP

Applicant:

Invixium Access Inc.
50 Acadia Avenue, Suite 310
Markham, Ontario
Canada L3R 0B3

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.: 19INVX067_FCC15C225

This Test report is Issued under the Authority of Tri M. Luu Vice President of Engineering UltraTech Group of Labs Date: August 6, 2019	
Report Prepared by: Dan Huynh Issued Date: August 6, 2019	Tested by: Hung Trinh Test Date(s): April 26 & August 7, 2018

- *The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.*
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ANSI ACCREDITED #0685 ISO/IEC 17065 Product Certification Body

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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:	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	2018	Code of Federal Regulations (CFR), Title 47 – Telecommunication, Part 15 – Radio Frequency Devices
ANSI C63.4	2014	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	2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. CLIENT INFORMATION

Applicant	
Name:	Invixium Access Inc.
Address:	50 Acadia Avenue, Suite 310 Markham, Ontario Canada L3R 0B3
Contact Person:	Shiraz Kapadia Phone #: 1-647-282-1745 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 TOUCH2 FP2W
Model Name or Number:	IXM401W
Serial Number:	Test sample
Type of Equipment:	Part 15 Low Power Transmitter Below 1705 kHz
Input Power Supply Type:	12-24V DC external power supply / Power over Ethernet (PoE)
Primary User Functions of EUT:	Identify person based on fingerprint and/or smart of proximity card, send data to Access Control Panel to open the door. Device can control the door by itself. Device can send the data to a Time & Attendance software.

2.3. EUT'S TECHNICAL SPECIFICATIONS

Transmitter	
Intended Operating Environment:	Commercial, light industry & heavy industry
Power Supply Requirement:	5V, 3.3V DC
Field Strength:	36.83 dBµV/m at 10 m
Operating Frequency Range:	13.56 MHz
RF Output Impedance:	50 Ω
20 dB Bandwidth:	849.70 Hz
Modulation Type:	ASK
Oscillator Frequencies:	32768Hz, 24MHz, 25MHz, 27.12MHz
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	Non-shielded
3	Ethernet 100 BASETX	1	RJ-45 on cable	Non-shielded
4	RS-485 (2 lines)	1	Header	Non-shielded
5	RS-232 (Tx, Rx)*	1	DB-9, socket on cable	Non-shielded
6	Form C Relay, 3 lines	1	Header	Non-shielded
7	GPO	4	Header	Non-shielded
8	GPI	8	Header	Non-shielded
9	GND for different interfaces	4	Header	Non-shielded
10	USB 2.0 OTG*	1	USB-Micro-AB	Shielded
11	Power Input (12-24V)	1	Header	Non-shielded
12	RS-485 GND	1	Header	Non-shielded
13	EGND	1	Header	Non-shielded
14	DS_OUT	1	Header	Non-shielded

* Used for service by administrator only.

2.5. ANCILLARY EQUIPMENT

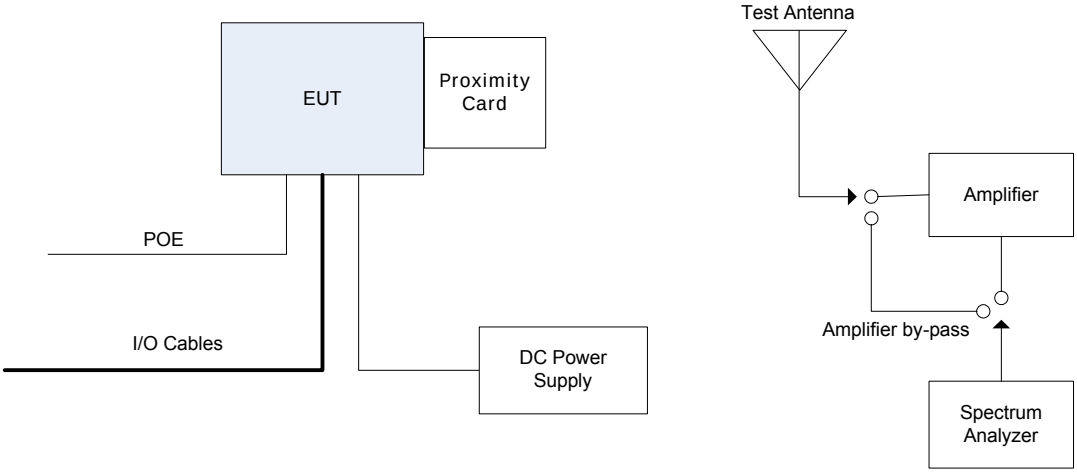
The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

1) Invixium Smart Card
2) PowerDsine 3001 POE Injector Power over Ethernet

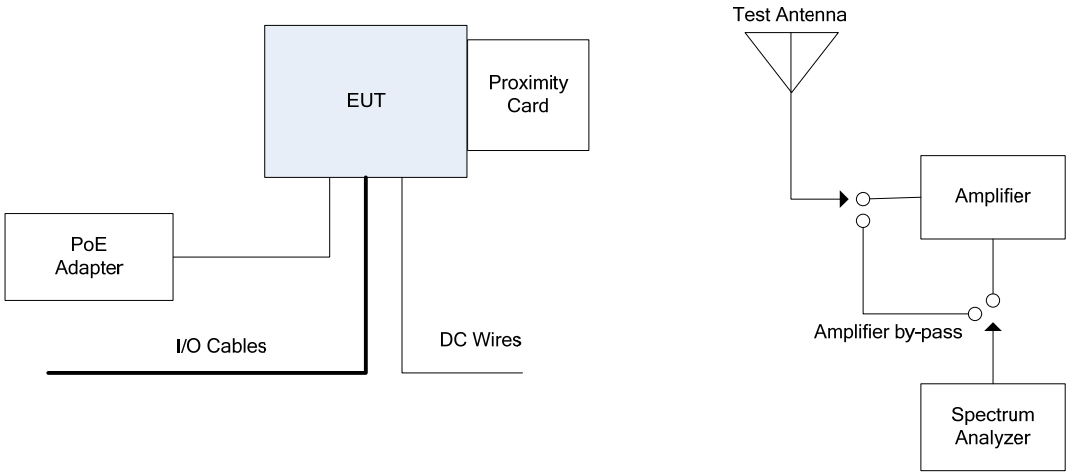
2.6. GENERAL TEST SETUP

2.6.1. Radiated Emission Test Setup

Powered by External DC Power Supply



Powered by PoE Injector Power over Ethernet



2.6.2. Frequency Stability Test Setup

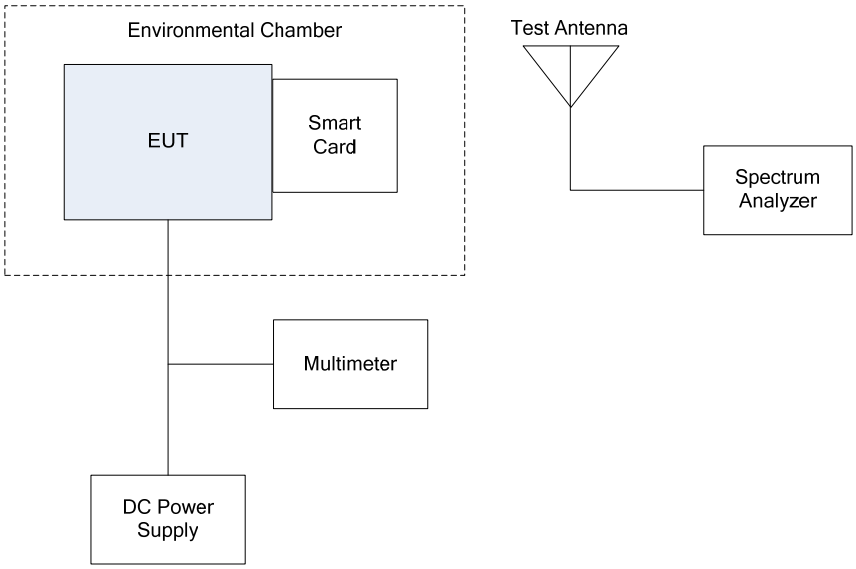


EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21 to 23 °C
Humidity:	45 to 58%
Pressure:	102 kPa
Power input source:	12-24V DC / Power over Ethernet (PoE)

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):	36.83 dBµV/m at 10 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 ANAB File No.: AT-1945.

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*
15.207(a)	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.
** Refer to attestation letter from the Applicant.

4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

The following modification(s) implemented for compliance:

Steward ferrite P/N 28A0392-0A0 clamped on Ethernet line Close to device.

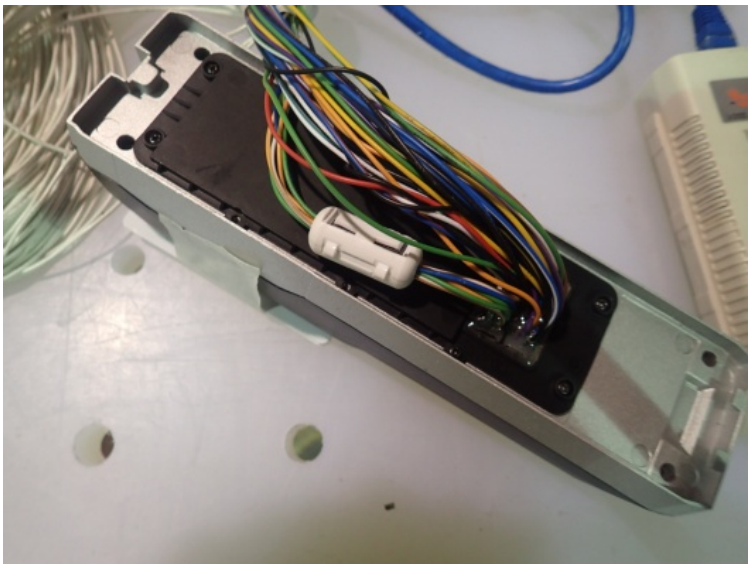


EXHIBIT 5. TEST DATA

5.1. EMISSION BANDWIDTH

5.1.1. Limit(s)

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

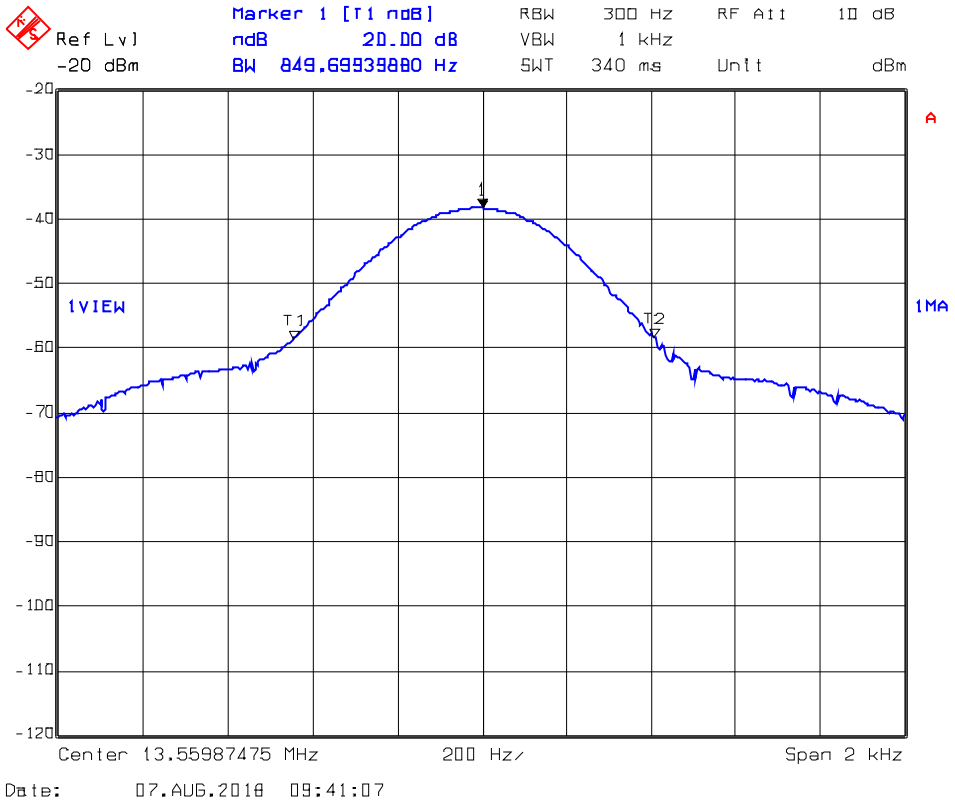
5.1.2. Method of Measurements

ANSI C63.4.

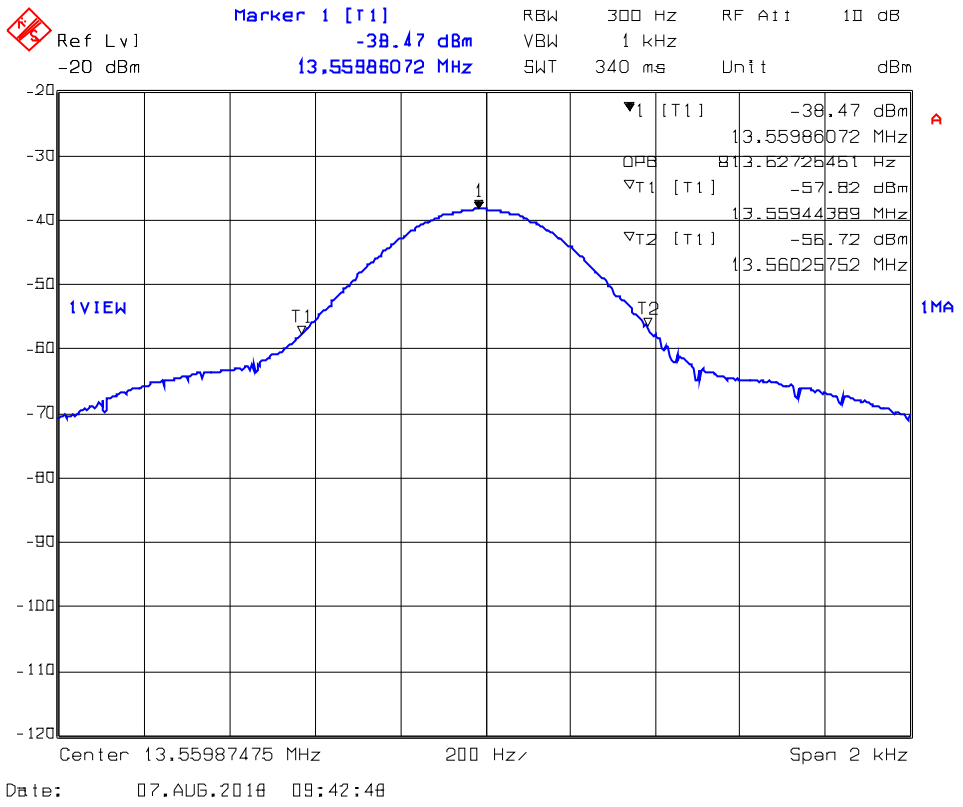
5.1.3. Test Data

Test Frequency	20 dB Bandwidth	99 %Occupied Bandwidth
13.56 MHz	849.70 Hz	813.63

Plot 5.1.3.1. 20 dB Bandwidth, Fc: 13.56 MHz



Plot 5.1.3.2. 99% Occupied Bandwidth, Fc: 13.56 MHz



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

5.2.1. 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

5.2.2. Method of Measurements

ANSI C63.10 and ANSI C63.4 for measurement methods.

5.2.3. Test Data

Remarks:

- Radiated spurious emissions measurements were performed at a measuring distance of 10 m or 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 10 m distance shall be extrapolated to the specified distance using an extrapolation factor of 40 dB/decade for determining compliance.

5.2.3.1. Field Strength of Emissions Within the Permitted Band at 10 m

EUT Powered by External DC Power Supply						
Frequency (MHz)	**Measured Field Strength @ 10 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	36.83	Peak	V	17.7	84.0	-66.3
13.56	26.57	Peak	H	7.5	84.0	-76.5

EUT Powered by PoE Injector Power over Ethernet						
Frequency (MHz)	**Measured Field Strength @ 10 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	36.27	Peak	V	17.2	84.0	-66.8
13.56	26.76	Peak	H	7.7	84.0	-76.3

5.2.3.2. Field Strength of Emissions Outside the Permitted Band Below 30 MHz at 10 m

EUT Powered by External DC Power Supply / PoE Injector Power over Ethernet						
Frequency (MHz)	**Measured Field Strength @ 10 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.						

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

EUT Powered by External DC Power Supply					
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	33.89	Peak	V	40.0	-6.1
40.68	25.77	Peak	H	40.0	-14.2
67.80	25.19	Peak	V	40.0	-14.8
94.92	24.42	Peak	V	43.5	-19.1

EUT Powered by PoE Injector Power over Ethernet					
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	32.92	Peak	V	40.0	-7.1
40.68	22.98	Peak	H	40.0	-17.0
54.24	37.09	Peak	V	40.0	-2.9
67.80	38.69	QP	V	40.0	-1.3
67.80	21.22	Peak	H	40.0	-18.8
81.36	34.26	Peak	V	40.0	-5.7
94.92	32.61	Peak	V	43.5	-10.9
108.48	28.99	Peak	V	43.5	-14.5
122.04	27.40	Peak	V	43.5	-16.1
135.60	23.46	Peak	V	43.5	-20.0

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

5.3.1. 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.

5.3.2. Method of Measurements

ANSI C63.10.

5.3.3. Test Data

Frequency Band:	13.56 MHz
Center Frequency:	13.56 MHz
Frequency Tolerance Limit:	± 0.01% (±1356 Hz)
Max. Frequency Tolerance Measured:	-147 Hz
Input Voltage Rating:	12-24 VDC on DC input / 48 VDC from POE Adapter

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	-51	--	--
-10	-63	--	--
0	-63	--	--
+10	-123	--	--
+20	-139	-119	-143
+30	-127	--	--
+40	-135	--	--
+50	-125	--	--
+60	-147	--	--

48 VDC from POE Adapter			
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	-35	--	--
-10	-51	--	--
0	-71	--	--
+10	-107	--	--
+20	-131	-143	-23
+30	-103	--	--
+40	-123	--	--
+50	-132	--	--
+60	-131	--	--

EXHIBIT 6. TEST EQUIPMENT LIST

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Cal. Due Date
EMI Receiver	Rohde & Schwarz	ESU40	100037	20Hz–40 GHz	04 May 2019
Spectrum Analyzer	Rohde & Schwarz	FSU26	200946	20Hz–26.5 GHz	25 Jul 2020
RF Amplifier	Com-Power	PAM-0118A	551016	0.5 – 18 GHz	09 Mar 2019
RF Amplifier	Hewlett Packard	84498	3008A00769	1 – 26.5 GHz	04 Oct 2018
Loop Antenna	EMCO	6502	9104-2611	0.01 – 30 MHz	15 Dec 2019
Biconilog	EMCO	3142C	00026873	26-2000 MHz	27 Apr 2019
Horn Antenna	EMCO	3155	6570	1 – 18 GHz	13 Oct 2018
DC Power Supply	Xantrex	HPD 60-5SX	63903	0 – 60 Vdc	See Note 1
Multi-Meter	Fluke	8842A	5021295	20mV – 1000V	23 Oct 2019
Environmental Chamber	Thermotron	S-5.5C	29388	-68 to 177ºC	15 Jun 2019
Note 1: Internal Verification/Calibration check					

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. RADIATED EMISSION MEASUREMENT UNCERTAINTY

	Radiated Emission Measurement Uncertainty (10 kHz - 30 MHz):	**Measured (dB)**	**Limit (dB)**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{I=1}^{m} u_i^2(y)}$	**± 1.30**	**± 2.6**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 2.60**	**± 5.2**

	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**