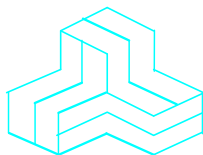


ENGINEERING TEST REPORT



IXM MERGE CR
Model No.: IXM006
FCC ID: S38-MRGCR

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-059F15C225

This Test report is Issued under the Authority
of
Tri M. Luu
Vice President of Engineering
UltraTech Group of Labs

Date: February 1, 2018

Report Prepared by: Santhosh Fernandez

Tested by: Nimisha Desai and Hien Luu

Issued Date: February 1, 2018

Test Dates:
August 22, 2016, June 14, Sep 29 and Oct 6, 2017

- 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 any agency of the US Government.
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UltraTech

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91038



1309



46390-2049



AT-1945



SL2-IN-E-
1119R



Korea
KCC-RRR
CA2049

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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 CFR Parts 0-19, 80-End	2017	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 for Testing Unlicensed Wireless Devices
CISPR 22 &	2008-09, Edition 6.0	Information Technology Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement
CISPR 16-1-1	2010	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

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File #: INVX-002F15C225FP2
February 13, 2014

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. CLIENT INFORMATION

Applicant	
Name:	Invixium Access Inc.
Address:	5-205 Riviera Drive Markam, ON Canada L3R 5J8
Contact Person:	Shiraz Kapadia Phone #: 647-282-1745 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 MERGE CR
Model Name or Number:	IXM006
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:	Biometric Reader, application in Access Control, Time & Attendance

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February 1, 2018

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2.3. EUT'S TECHNICAL SPECIFICATIONS

Transmitter	
Equipment Type:	Portable
Intended Operating Environment:	Residential, Commercial, light industry & heavy industry
Power Supply Requirement:	12V DC
Field Strength:	39.3 dBµV/m at 10 m
Operating Frequency Range:	13.56 MHz
RF Output Impedance:	50 Ω
20 dB Bandwidth:	2.90 kHz
Modulation Type:	OOK with AM and PM
Oscillator Frequencies:	13.56 MHz
Antenna Connector Type:	Integral

Antenna Description	
Manufacturer:	Invisium Access Inc.
Type:	PCB
Model:	XAD-00X-06S
Frequency Range:	13.56 MHz

2.4. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Specify minimum length and shielded/non-shielded)
1	DC Supply	2	Header/Bullet	1 m N/S
2	EGND	1	Header	20 cm N/S
3	Ethernet	1	RJ45	N/S
4	Wiegand In	2	Header	10 cm N/S
5	Wiegand Out	2	Header	N/S
6	RS485 (D+, D-, RS485GND)	1	Header	N/S
7	Door Control (4 lines)	1	Header	1m N/S
8	Relay (NO, NC, C)	1	Header	20 cm N/S
9	GPOUT	1	Header	20 cm N/S
10	DGND	1	Header	N/S
11	Tamper Alarm	1	Header	N/S

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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	
Equipment Make and Name:	Windows PC
Connected to EUT's Port #: (See above table 2)	7 (Ethernet) Ping device to verify that device is operational during immunity testing

Ancillary Equipment # 2	
Equipment Make and Name:	MIFARE contactless smart card, or DESFire contactless smart card
Connected to EUT's Port #: (See above table 2)	N/A To be used to verify device operation during immunity testing, as an alternative to pinging device via Ethernet.

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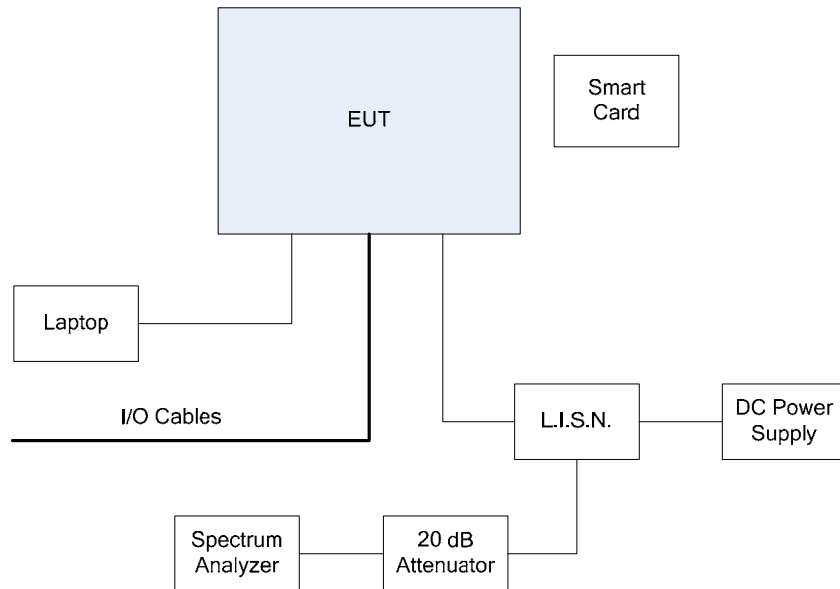
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February 1, 2018

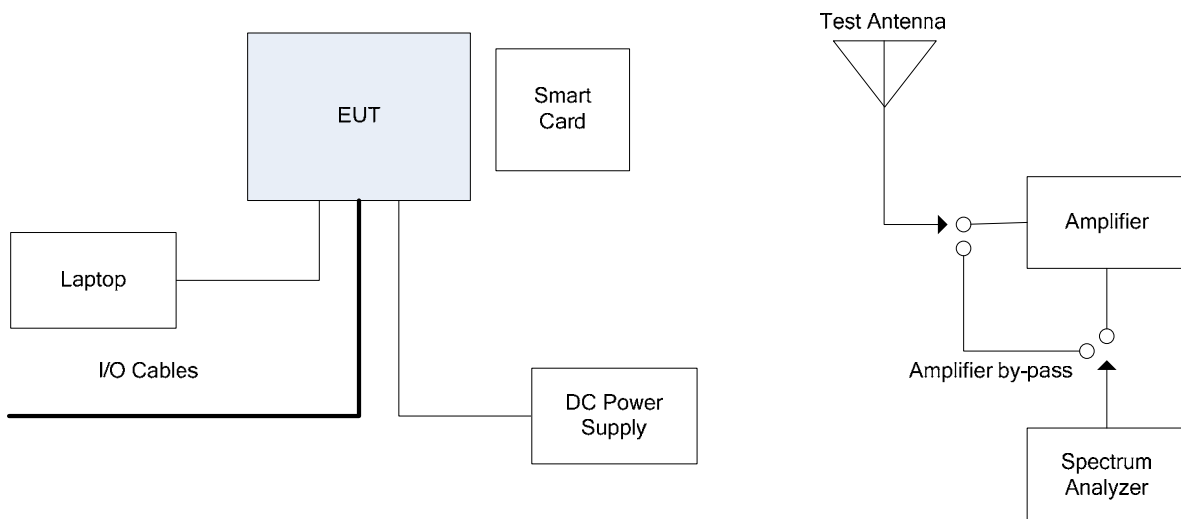
All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

2.6. GENERAL TEST SETUP

2.6.1. Power Line Conducted Emission Test Setup



2.6.2. Radiated Emission Test Setup



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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:	23%
Pressure:	102 kPa
Power input source:	12 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):	39.29 dBμV/m at 10 m (49.8 dBμV/m extrapolated at 3 m)
▪ Normal Test Modulation:	OOK with AM and PM
▪ 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.

- 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*
15.107 & 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 DC power Cable a ferrite was added with 3 turns: Ferrite used : Steward P/N 28A3039-0A2
2. Metal shield added at the back of RF PCB
3. 3 wire antenna cable was replaced with 2 RF Coaxial cables.

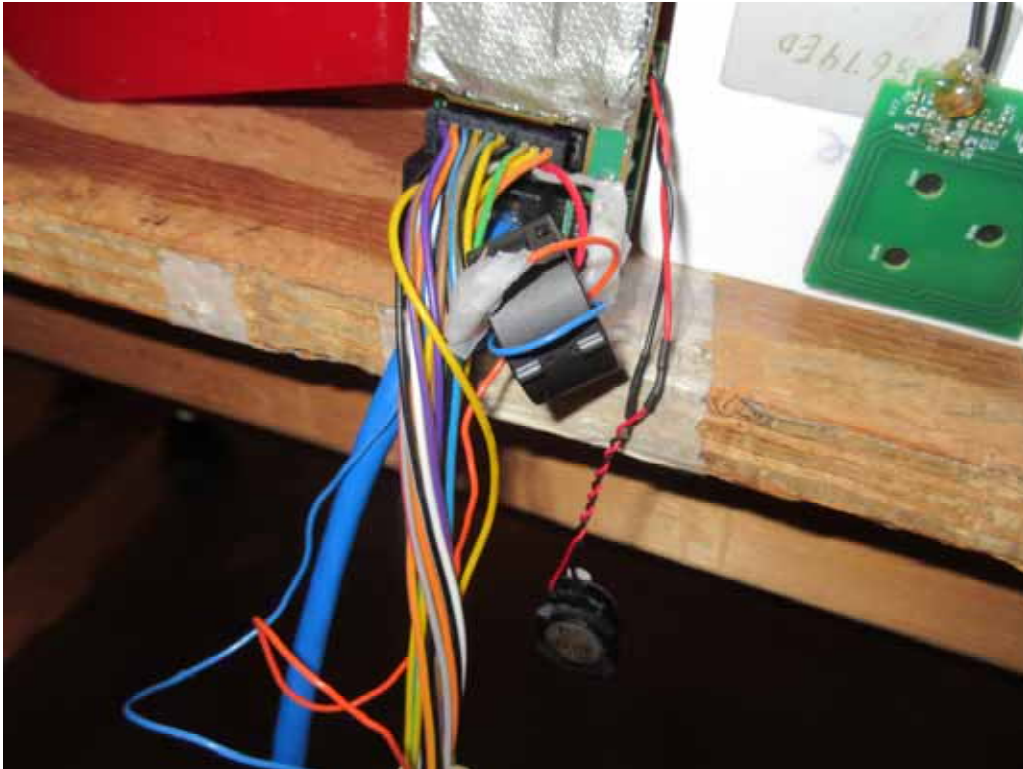


EXHIBIT 5. TEST DATA

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 (dB μ V)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

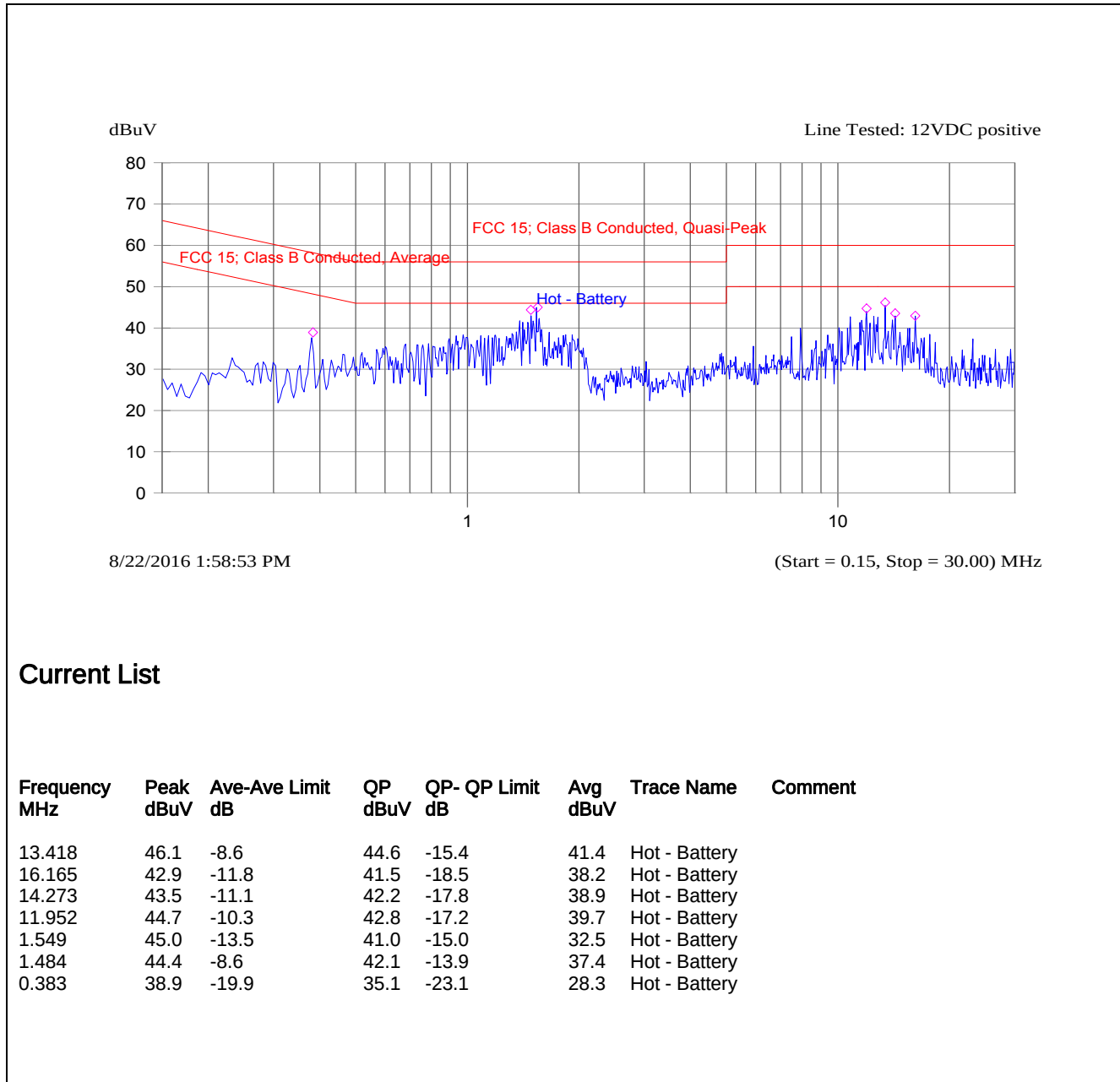
*Decreases linearly with the logarithm of the frequency

5.1.2. Method of Measurements

Refer to ANSI C63.4.

5.1.3. Test Data

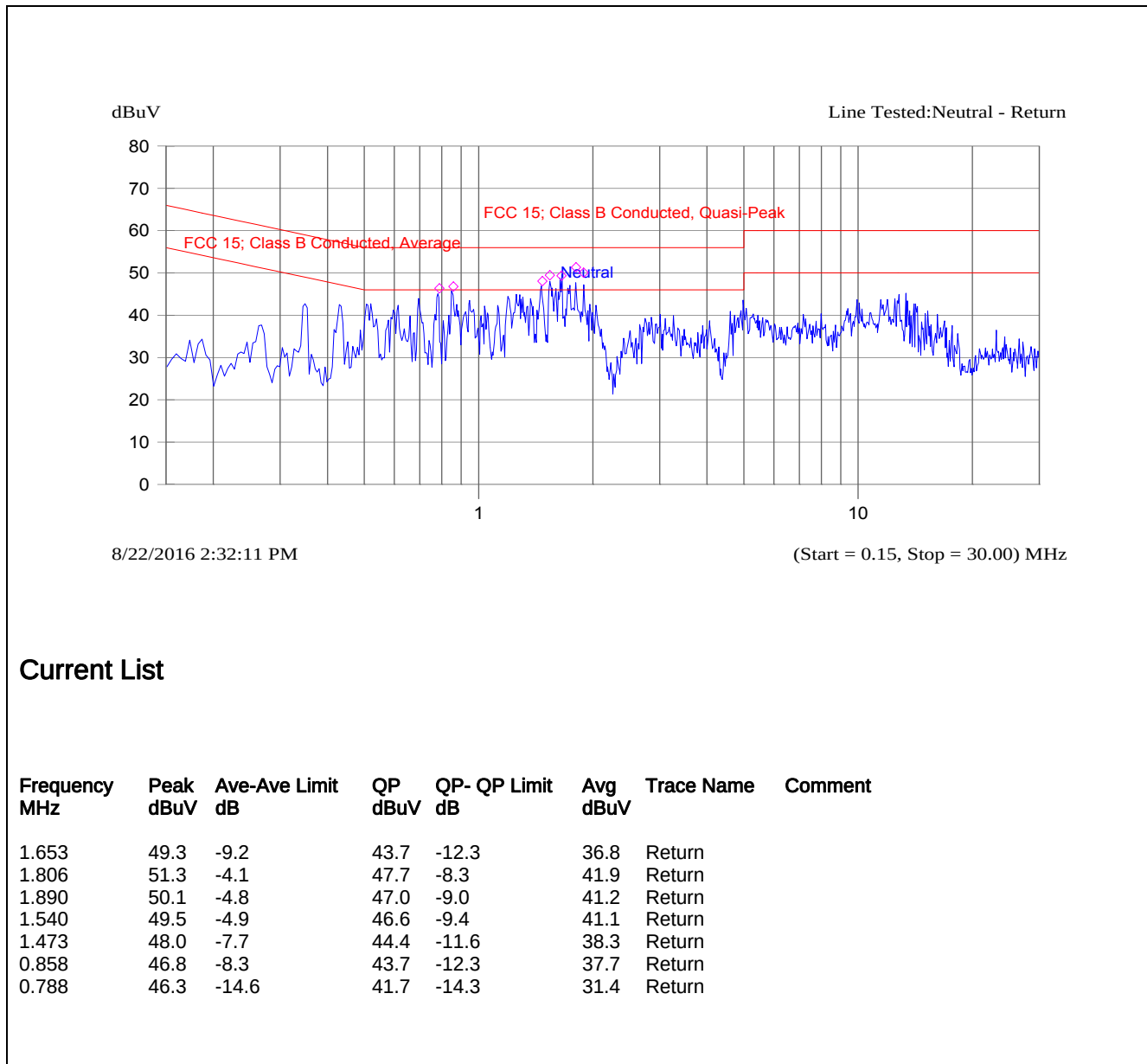
Plot 5.1.3.1. Power Line Conducted Emissions
Line Voltage: 12 VDC; Line Tested: Positive



Current List

Frequency MHz	Peak dBuV	Ave-Ave Limit dB	QP dBuV	QP- QP Limit dB	Avg dBuV	Trace Name	Comment
13.418	46.1	-8.6	44.6	-15.4	41.4	Hot - Battery	
16.165	42.9	-11.8	41.5	-18.5	38.2	Hot - Battery	
14.273	43.5	-11.1	42.2	-17.8	38.9	Hot - Battery	
11.952	44.7	-10.3	42.8	-17.2	39.7	Hot - Battery	
1.549	45.0	-13.5	41.0	-15.0	32.5	Hot - Battery	
1.484	44.4	-8.6	42.1	-13.9	37.4	Hot - Battery	
0.383	38.9	-19.9	35.1	-23.1	28.3	Hot - Battery	

Plot 5.1.3.2. Power Line Conducted Emissions
Line Voltage: 12 VDC;; Line Tested: 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.

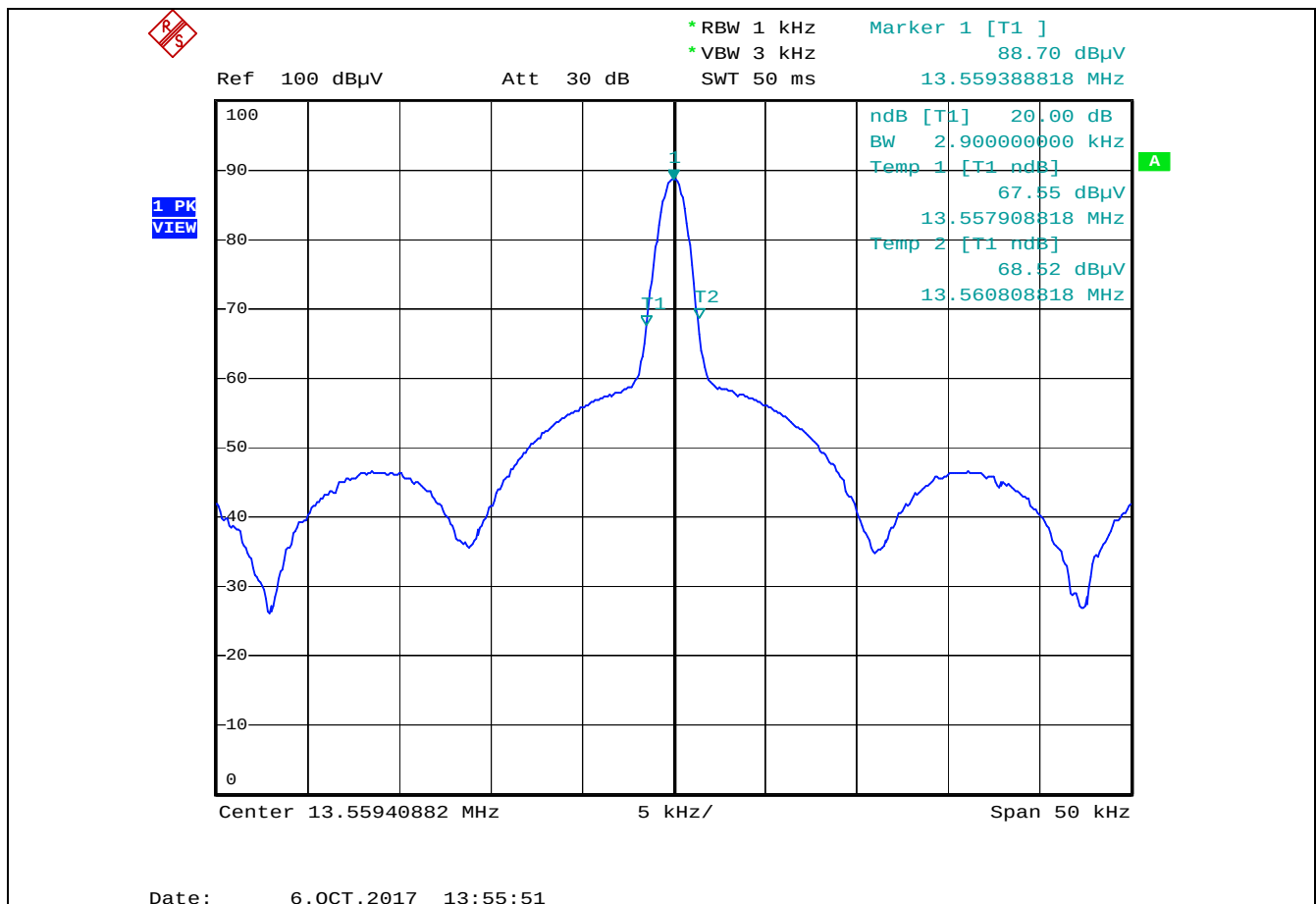
5.2.2. Method of Measurements

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

5.2.3. Test Data

Test Frequency (MHz)	Occupied Bandwidth (kHz)	
	20 dB BW	99 % BW
13.56	2.9	2.8

Plot 5.2.3.1. 20 dB Bandwidth, Fc: 13.56 MHz



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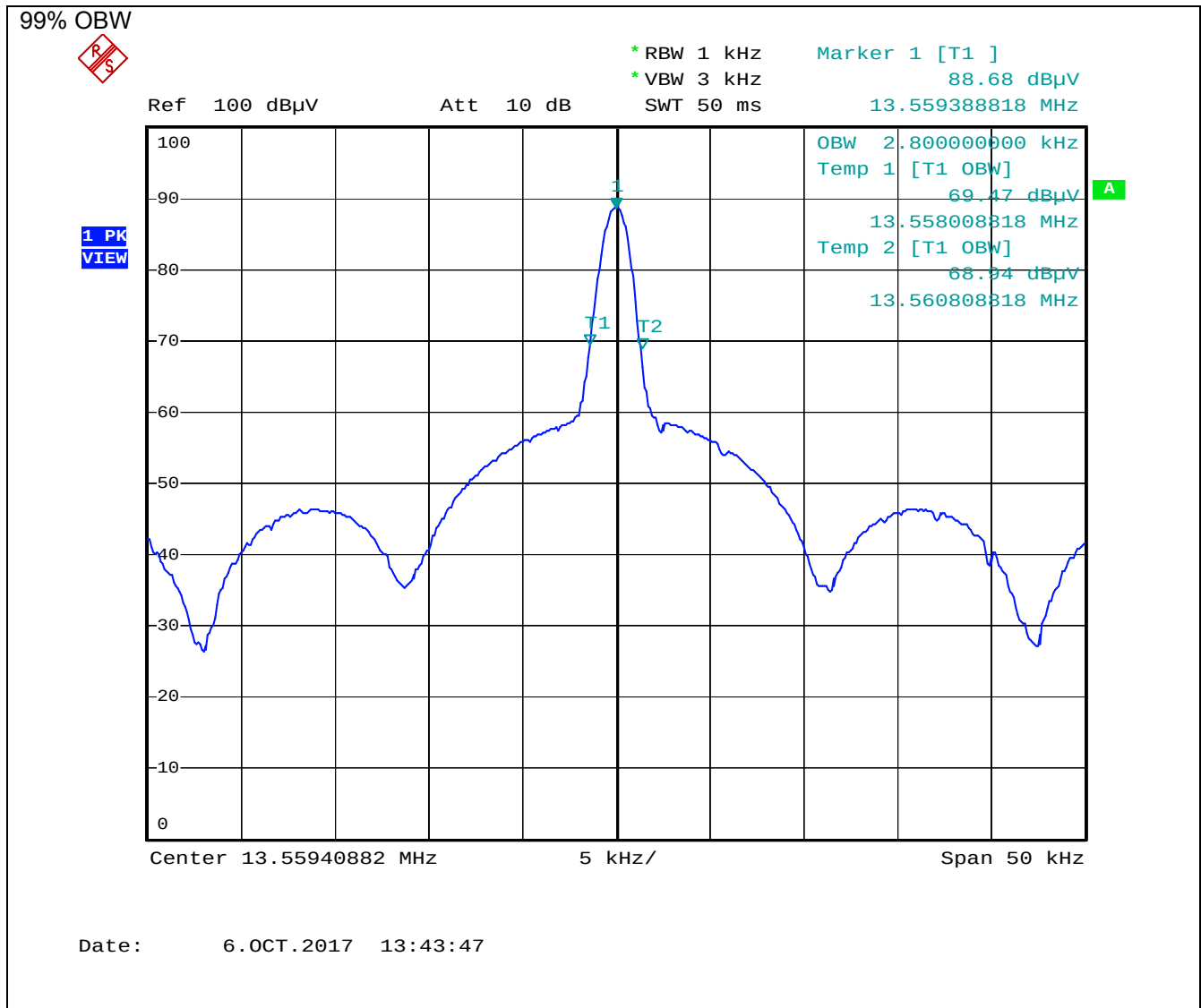
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Plot 5.2.3.2. 99% Occupied Bandwidth, Fc: 13.56 MHz



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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 Limits; 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 for measurement methods

5.3.3. Test Data

Remarks:

- Radiated spurious emissions measurements were performed at a measuring distance of 10 m, from 9 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.

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

Frequency (MHz)	Measured Field Strength @ 10 m (dBµV/m)	Detector Used (Peak/QP)	Antenna Plane	Field Strength Extrapolated 30m Value (dBµV/m)	§ 15.225 Field Strength Limits (dBµV/m)	Margin (dB)
13.56	38.6	Peak	360degree	19.6	84.0	-64.4
13.56	39.3	Peak	90 degree	20.3	84.0	-63.7
13.56	31.3	Peak	Flat	12.3	84.0	-71.7

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

Frequency (MHz)	Measured Field Strength @ 10 m (dBµV/m)	Detector Used (Peak/QP)	Antenna Plane	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 10 m

Frequency (MHz)	Measured Field Strength @ 10 m (dBµV/m)	Detector Used (Peak/QP)	Antenna Plane (H/V)	§ 15.209 Field Strength Limits (dBµV/m)	Margin (dB)
40.67	26.3	QP	V	29.5	-3.2
40.67	21.06	Peak	H	29.5	-8.4
67.3	21.85	Peak	V	29.5	-7.7
194.77	24.16	Peak	V	33.0	-8.8
286.49	27.43	Peak	V	35.5	-8.1
286.49	31.99	Peak	H	35.5	-3.5
303.58	28.6	Peak	V	35.5	-6.9
303.58	32.5	Peak	H	35.5	-3.0
308.25	29.77	Peak	V	35.5	-5.7
308.25	30.96	Peak	H	35.5	-4.5
352.54	26.84	Peak	V	35.5	-8.7
352.54	31.5	Peak	H	35.5	-4.0

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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 C63.4-2014.

5.4.3. Test Data

Frequency Band:	13.56 MHz
Center Frequency:	13.56 MHz
Frequency Tolerance Limit:	$\pm 0.01\%$ (± 1356 Hz)
Max. Frequency Tolerance Measured:	962 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
-30	160	-	-
-20	160	-	-
-10	321	-	-
0	962	-	-
10	80	-	-
20	0	0	0
30	-80	-	-
40	-160	-	-
50	-80	-	-
60	-80	-	-

EXHIBIT 6. TEST EQUIPMENT LIST

6.1. Emission Bandwidth, Field Strength of Emissions Inside and Outside the Permitted Band, Frequency Stability

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Cal. Due Date
Spectrum Analyzer	Rohde & Schwarz	FSU	200946	20 Hz – 26.5 GHz	21 Jul 2018
Loop Antenna	EMCO	6502	9104-2611	10 kHz – 30 MHz	5 Nov 2017
Environmental Chamber	Envirotronics	SSH32C	11994847-S-11059	-60 to 177 degree C	01 Jun 2018
Spectrum Analyzer	Rohde & Schwarz	ESU40	100037	20 Hz – 40 GHz	9 May 2018
RF Amplifier	Com-Power	PAM-0118A	551052	500 MHz – 18 GHz	17 Jul 2018
Biconi-Log Antenna	ETS Lindgren	3142	9601-1005	26 – 2000 MHz	12 May 2018

Test Dates: June 14, Sep 29 and Oct 6, 2017

6.2. Power Line Conducted Emissions

Spectrum Analyzer	Hewlett Packard	HP 8593EM	3710A00223	9 kHz–22 GHz	19 OCT 2017
Attenuator	Pasternack	PE7010-20	7	DC–2 GHz	13 Mar 2017
L.I.S.N	EMCO	3810/2	2209	9kHz -100 MHz	23 Jan 2017

Test Dates: August 22, 2016

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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 @ 10m, Horizontal (30-1000 MHz):	Measured (dB)	Limit (dB)
u_c	Combined standard uncertainty: $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	± 2.32	± 2.6
U	Expanded uncertainty U: $U = 2u_c(y)$	± 4.65	± 5.2

	Radiated Emission Measurement Uncertainty @ 10m, Vertical (30-1000 MHz):	Measured (dB)	Limit (dB)
u_c	Combined standard uncertainty: $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	± 2.32	± 2.6
U	Expanded uncertainty U: $U = 2u_c(y)$	± 4.64	± 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

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All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)