FCC 47 CFR PART 15 SUBPART C
INDUSTRY (ISED) CANADA RSS-210 ISSUE 8

CERTIFICATION TEST REPORT

FOR

NFC/ BLE ELECTRONIC DOOR-MOUNTED ACCESS CONTROL

MODEL NUMBER: M1

FCC ID: 2AK5B-M1
IC: 22134-M1

REPORT NUMBER: R11464238-E3

ISSUE DATE: 2017-01-12

Prepared for
LATCHABLE, INC.
450 WEST 33RD STREET,12TH FLOOR
NEW YORK, NY 10001, USA

Prepared by
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NVLAP TESTING

NVLAP LAB CODE 200246-0

Revision History

Ver.	Issue Date	Revisions	Revised By
1	2016-12-02	Initial Issue	Brian Kiewra
2	2016-12-22	Corrected FCC ID to 2AK5B-M1	Brian Kiewra
3	2017-01-05	Added “Tested at RBW=9kHz, lowest RBW SA allows for accurate measurement” statement in Section 7.	Brian Kiewra
4	2017-01-12	Corrected OBW measurements and removed above statement from Section 7.	Brian Kiewra

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Latchable, Inc.
450 W. 33rd ST.,12th Floor
New York, NY 10001, USA

EUT DESCRIPTION: NFC/BLE Electronic Door-Mounted Access Control

MODEL: M1

SERIAL NUMBER: 29004f000F51353235373138

DATE TESTED: 2016-11-10 and 2017-01-12

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 15 SUBPART C	Pass
INDUSTRY (ISED) CANADA RSS-210 Issue 8	Pass
INDUSTRY (ISED) CANADA RSS-GEN Issue 4	Pass

UL LLC tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL LLC based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released
For UL LLC By:

Jeffrey Moser
EMC Program Manager
UL – Consumer Technology Division

Prepared By:

Brian T. Kiewra
EMC Engineer
UL – Consumer Technology Division

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 4, and RSS-210 Issue 8 Annex 2.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 12 Laboratory Dr., Research Triangle Park, NC 27709, USA and 2800 Suite B, Perimeter Park Drive, Morrisville, NC 27560.

12 Laboratory Dr., RTP, NC 27709
☐ Chamber A
☐ Chamber C

2800 Suite B Perimeter Park Dr., Morrisville, NC 27560
☐ Chamber NORTH
☒ Chamber SOUTH

The onsite chambers are covered under Industry (ISED) Canada company address code 2180C with site numbers 2180C -1 through 2180C-4, respectively.

UL LLC (RTP) is accredited by NVLAP, Laboratory Code 200246-0. The full scope of accreditation can be viewed at http://www.nist.gov/nvlap/.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
RF output power, conducted	±0.45 dB
Power Spectral Density, conducted	±1.50 dB
Unwanted Emissions, conducted	±2.94 dB
All emissions, radiated	±5.36 dB
Conducted Emissions (0.150 – 30MHz)	±3.65 dB
Temperature	±0.07 °C
Humidity	±2.26 %
DC and Low Frequency Voltages	±1.27 %

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is an electronic door-mounted access control that contains BLE and NFC radios.

5.2. MAXIMUM OUTPUT POWER

The testing was performed at 3 meter. The transmitter maximum E-field at the 30 meter distance is -0.05 dBuV/m, which is converted from the 3 meter data.

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an integrated loop antenna.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was Component Firmware rev. 3.7.1.

5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case channel is determined as the channel with the highest output power.

5.6. MODIFICATIONS

No modifications were made during testing.

5.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Apple	Macbook	NA	NA

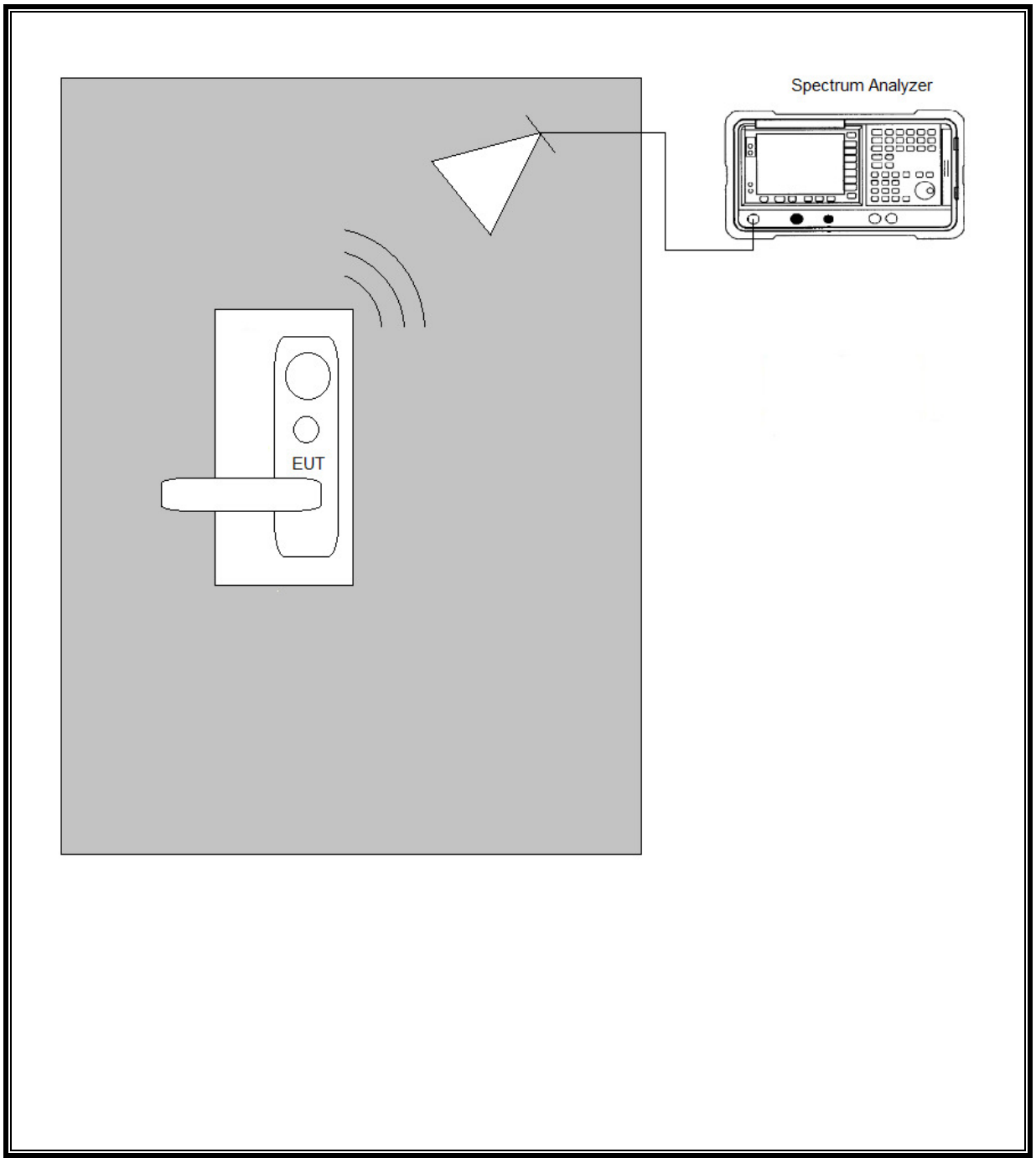
I/O CABLES

I/O Cable List						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
None						

TEST SETUP

The EUT is installed as a standalone device. Test software exercised the radio card.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - South Chamber)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	0.009-30MHz	**(Loop Ant.)**			
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2015-12-08	2016-12-31
	30-1000 MHz				
AT0074	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2016-06-07	2017-06-30
	Gain-Loss Chains				
S-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2016-10-04	2017-10-04
S-SAC02	Gain-loss string: 30-1000MHz	Various	Various	2016-06-26	2017-06-30
	Receiver & Software				
SA0025	Spectrum Analyzer	Agilent	N9030A	2016-03-17	2017-03-31
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
	Additional Equipment used				
139843	Temp/Humid/Pressure Meter	Control Co./Fisher	14-650-118	2016-02-19	2017-02-19

Test Equipment Used - Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	Conducted Room 2				
SA0020	Spectrum Analyzer	Agilent Technologies	E4446A	2016-03-22	2017-03-31
1100502	Temp/Humid Chamber	Cincinnati Sub-Zero	ZPH-8-3.5-SCT/AC	2016-06-06	2017-06-06
139843	Temp/Humid/Pressure Meter	Control Co./Fisher	14-650-118	2016-02-19	2017-02-19
76021	DC Regulated Power Supply	CircuitSpecialists.Com	CSI3005X5	N/A	N/A

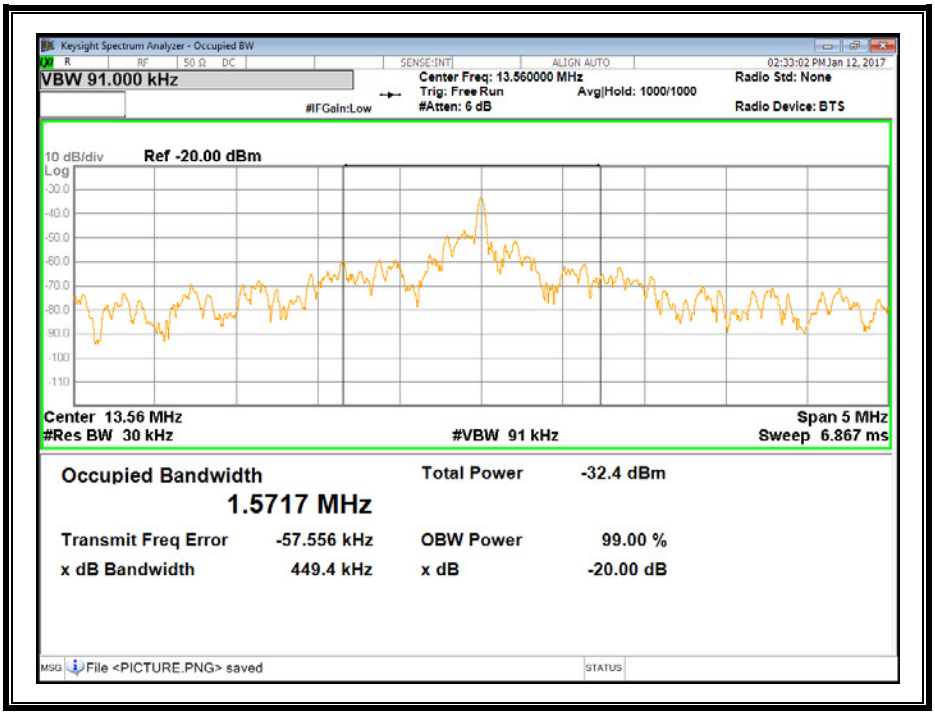
7. OCCUPIED BANDWIDTH

LIMITS

For reporting purposes only.
Tested per ANSI C63.10 (6.9.2, 6.9.3) and FCC 15.215, RSS-GEN Section 6.6

RESULTS

Channel	Frequency (MHz)	20dB Bandwidth (kHz)	99 % Bandwidth (kHz)
Low	13.56	449.400	1571.700



TEST INFORMATION

Date 12/01/16 and 01/12/2017
Project No: 11464238
Tester: Ron Reichard / John Manser and Haydon Niklas/John Manser

8. RADIATED EMISSION TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMIT

§15.225
IC RSS-210, Annex B.6 (Transmitter)
IC RSS-GEN, Section 7.1.2 (Receiver)

(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 and shall not exceed the general radiated emission limits in § 15.209 as follows:
§15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Limits for radiated disturbance of an intentional radiator		
Frequency range (MHz)	Limits (µV/m)	Measurement Distance (m)
0.009 – 0.490	2400 / F (kHz)	300
0.490 – 1.705	24000 / 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

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g. §§ 15.231 and 15.241.
§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

Formula for converting the filed strength from uV/m to dBuV/m is:
Limit (dBuV/m) = 20 log limit (uV/m)

In addition:

§15.209 (d) The emission limits shown the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emissions limits in these three bands are based on measurements employing an average detector.

§15.209 (d) The provisions in §§ 15.225, measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

TEST PROCEDURE

ANSI C63.10-2013

The EUT is an intentional radiator that incorporates a digital device. The highest fundamental frequency generated or used in the device is 13.56 MHz. The frequency range was investigated from 0.15 MHz to the 10th harmonic of the highest fundamental frequency, or 1000 MHz, whichever is greater (1000MHz)

KDB 937606 OATS and Chamber Correlation Justification

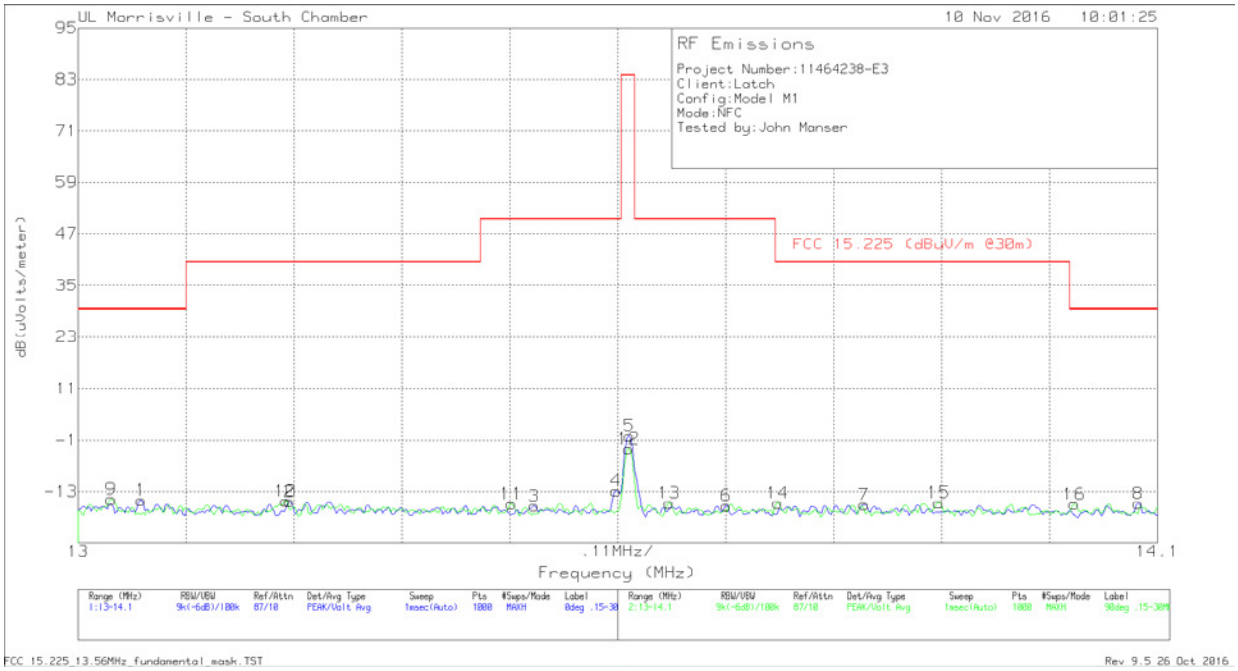
Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

OATs and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

RESULTS

8.1.1. FUNDAMENTAL AND SPURIOUS EMISSIONS (0.009 – 30 MHz)

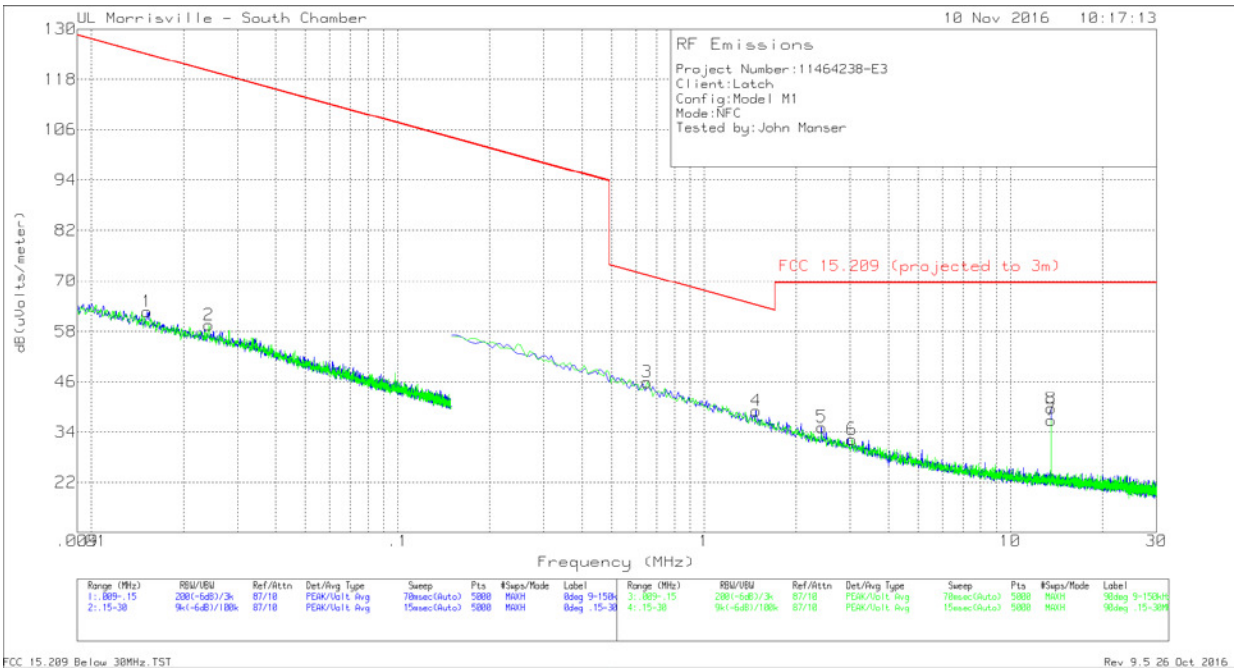
15.225 Fundamental Emission Mask



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 AF (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uV/m)	FCC 15.225 (dBuV/m @30m)	Margin (dB)	Azimuth (Degs)	Polarity
1	13.06386	13.57	Pk	10.8	.6	-40	-15.03	29.5	-44.53	0-360	0°
2	13.21525	13.25	Pk	10.8	.6	-40	-15.35	40.5	-55.85	0-360	0°
3	13.46462	12.15	Pk	10.8	.6	-40	-16.45	50.5	-66.95	0-360	0°
4	13.5483	15.87	Pk	10.7	.6	-40	-12.83	50.5	-63.33	0-360	0°
5	13.56151	28.65	Pk	10.7	.6	-40	-.05	84	-84.05	0-360	0°
6	13.6606	12.36	Pk	10.7	.6	-40	-16.34	50.5	-66.84	0-360	0°
7	13.80098	12.58	Pk	10.7	.6	-40	-16.12	40.5	-56.62	0-360	0°
8	14.08008	12.86	Pk	10.7	.6	-40	-15.84	29.5	-45.34	0-360	0°
9	13.03358	13.75	Pk	10.8	.6	-40	-14.85	29.5	-44.35	0-360	90°
10	13.21139	13.37	Pk	10.8	.6	-40	-15.23	40.5	-55.73	0-360	90°
11	13.4415	12.67	Pk	10.8	.6	-40	-15.93	50.5	-66.43	0-360	90°
12	13.56096	25.61	Pk	10.7	.6	-40	-3.09	84	-87.09	0-360	90°
13	13.60225	12.97	Pk	10.7	.6	-40	-15.73	50.5	-66.23	0-360	90°
14	13.7129	12.97	Pk	10.7	.6	-40	-15.73	40.5	-56.23	0-360	90°
15	13.87695	13.07	Pk	10.7	.6	-40	-15.63	40.5	-56.13	0-360	90°
16	14.01512	12.7	Pk	10.7	.6	-40	-16	29.5	-45.5	0-360	90°

Pk - Peak detector

15.209 Spurious Emissions

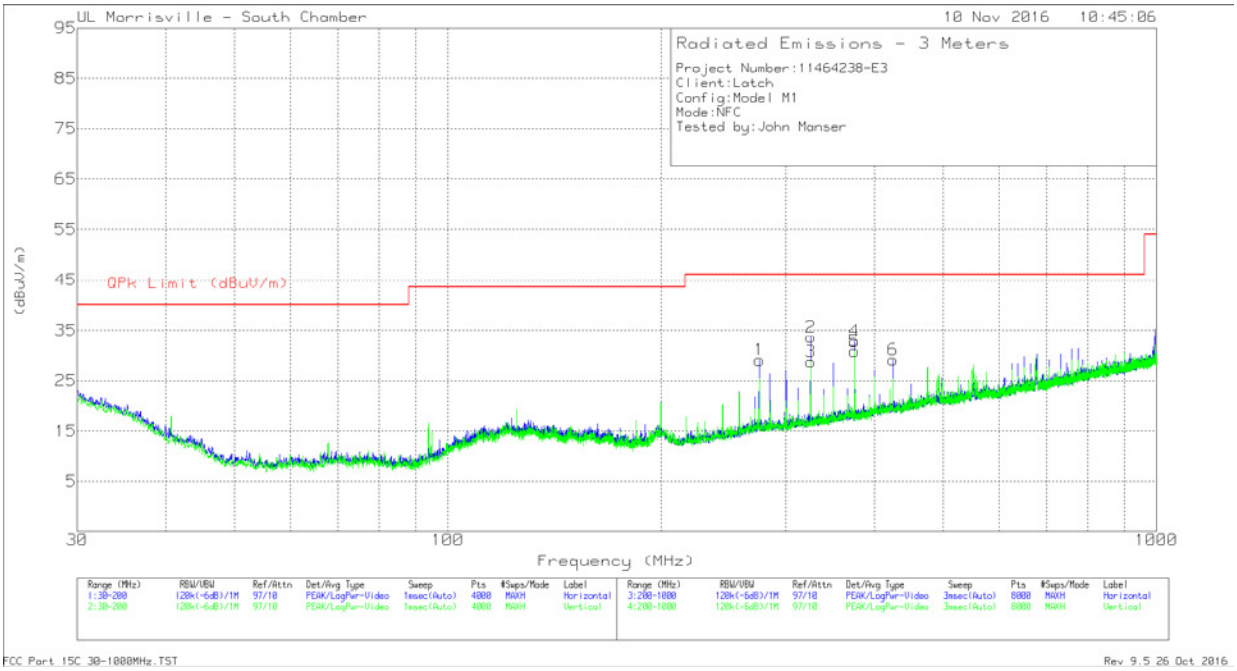


Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 AF (dB/m)	Cbl (dB)	Corrected Reading dB(uV/m)	FCC 15.209 (projected to 3m)	Margin (dB)	Azimuth (Degs)	Polarity
4	1.47855	26.78	Pk	12	.2	38.98	64.21	-25.23	0-360	0°
5	2.41898	22.86	Pk	12.1	.2	35.16	69.54	-34.38	0-360	0°
6	3.03996	19.87	Pk	12.1	.3	32.27	69.54	-37.27	0-360	90°
7	13.56087	25.49	Pk	10.7	.6	36.79	69.54	-32.75	0-360	90°

Pk - Peak detector

Note – Frequency Points were marked for data purposes. However, these points were determined to be noise floor.

8.1.2. TX SPURIOUS EMISSION 30 TO 1000 MHz



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0074 AF (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 275.0213	40.28	Qp	17.8	-29.7	28.38	46.02	-17.64	86	110	H
2	* 325.011	44.26	Qp	18.6	-29.5	33.36	46.02	-12.66	71	102	H
3	* 325.0077	40.38	Qp	18.6	-29.5	29.48	46.02	-16.54	306	138	V
4	375.0228	42.31	Pk	19.8	-29.3	32.81	46.02	-13.21	0-360	199	H
6	425.0293	37.29	Pk	20.9	-29.1	29.09	46.02	-16.93	0-360	199	H
5	375.0228	40.31	Pk	19.8	-29.3	30.81	46.02	-15.21	0-360	102	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
Qp - Quasi-Peak detector

9. FREQUENCY STABILITY

LIMIT

§15.225 (e) 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.

RSS-210 Annex B.6: Carrier frequency stability shall be maintained to ±0.01% (±100 ppm).

TEST PROCEDURE

ANSI C63.10

RESULTS

No non-compliance noted.

Reference Frequency: EUT Channel 13.56 MHz @ 20ºC Limit: ± 100 ppm = 1.356 kHz				
Power Supply (Vdc)	**Environment Temperature (ºC)**	**Frequency Deviation Measureed with Time Elapse**		
			Delta (ppm)	**Limit (ppm)**
9.50	50	13.5601478	-2.319	± 100
9.50	40	13.5601344	-1.335	± 100
9.50	30	13.5601244	-0.595	± 100
9.50	***20***	***13.5601163***	***0.000***	***± 100***
9.50	10	13.5601027	1.001	± 100
9.50	0	13.5600760	2.970	± 100
9.50	-10	13.5600291	6.431	± 100
9.50	-20	13.5599587	11.621	± 100
8.08	20	13.5601162	0.005	± 100
9.50	***20***	***13.5601163***	***0.000***	***± 100***
10.925	20	13.5601164	-0.010	± 100

Measurements taken at EUT startup

Reference Frequency: EUT Channel 13.56 MHz @ 20ºC Limit: ± 100 ppm = 1.356 kHz				
Power Supply (Vdc)	**Environment Temperature (ºC)**	**Frequency Deviation Measureed with Time Elapse**		
			Delta (ppm)	**Limit (ppm)**
9.50	50	13.5601527	-2.772	± 100
9.50	40	13.5601327	-1.297	± 100
9.50	30	13.5601230	-0.577	± 100
9.50	***20***	***13.5601151***	***0.000***	***± 100***
9.50	10	13.5601005	1.078	± 100
9.50	0	13.5600723	3.160	± 100
9.50	-10	13.5600235	6.758	± 100
9.50	-20	13.5599517	12.055	± 100
8.08	20	13.5601155	-0.025	± 100
9.50	***20***	***13.5601151***	***0.000***	***± 100***
10.925	20	13.5601153	-0.015	± 100

Measurements taken 2 minutes after EUT startup

Reference Frequency: EUT Channel 13.56 MHz @ 20ºC Limit: ± 100 ppm = 1.356 kHz				
Power Supply (Vdc)	**Environment Temperature (ºC)**	**Frequency Deviation Measureed with Time Elapse**		
			Delta (ppm)	**Limit (ppm)**
9.50	50	13.5601544	-2.838	± 100
9.50	40	13.5601337	-1.309	± 100
9.50	30	13.5601236	-0.565	± 100
9.50	***20***	***13.5601159***	***0.000***	***± 100***
9.50	10	13.5601021	1.019	± 100
9.50	0	13.5600747	3.045	± 100
9.50	-10	13.5600277	6.511	± 100
9.50	-20	13.5599569	11.727	± 100
8.08	20	13.5601161	-0.010	± 100
9.50	***20***	***13.5601159***	***0.000***	***± 100***
10.925	20	13.5601162	-0.019	± 100

Measurements taken 5 minutes after EUT startup

Reference Frequency: EUT Channel 13.56 MHz @ 20ºC Limit: ± 100 ppm = 1.356 kHz				
Power Supply	**Environment**	**Frequency Deviation Measureed with Time Elapse**		
(Vdc)	**Temperature (ºC)**		**Delta (ppm)**	**Limit (ppm)**
9.50	50	13.5601553	-2.876	± 100
9.50	40	13.5601344	-1.335	± 100
9.50	30	13.5601244	-0.595	± 100
9.50	***20***	***13.5601163***	***0.000***	***± 100***
9.50	10	13.5601027	1.001	± 100
9.50	0	13.5600760	2.970	± 100
9.50	-10	13.5600291	6.431	± 100
9.50	-20	13.5599587	11.621	± 100
8.08	20	13.5601162	0.005	± 100
9.50	***20***	***13.5601163***	***0.000***	***± 100***
10.925	20	13.5601164	-0.010	± 100

Measurements taken 10 minutes after EUT startup

TEST INFORMATION

Tester: John Manser and Mark Learner
Date: 2016-11-10