Excellence in Compliance Testing

Certification Test Report

FCC ID: X32-APKN1G01
IC: 8797A-APKN1G01

FCC Rule Part: 15.231
ISED Canada Radio Standards Specification: RSS-210

ACS Report Number: 16-2079.W06.1B

Manufacturer: iKeyless, LLC.
Model(s): 300-0481

Test Begin Date: **December 15, 2016**
Test End Date: **December 20, 2016**

Report Issue Date: January 16, 2017

FOR THE SCOPE OF ACCREDITATION UNDER CERTIFICATE NUMBER AT-1533

This report must not be used by the client to claim product certification, approval, or endorsement by ANAB, ANSI, or any agency of the Federal Government.

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This report contains 17 pages

TABLE OF CONTENTS

1 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations and Innovation, Science and Economic Development Canada's Radio Standards Specification RSS-210.

1.2 Product description

The iKeyless, LLC. Model 300-0481 is a passive entry passive start remote key fob operating at 315 MHz. The device also includes a 125 kHz receiver.

Technical Details

Frequency of Operation:	315 MHz
Number of Channels:	1
Modulation:	FSK
Data Rate:	2.0 kbps
Antenna / Gain:	PCB Loop Antenna / -16 dBi
Input Voltage:	3 VDC (CR2032 Coin Cell Battery)

Manufacturer Information:
iKeyless, LLC.
828 E. Market St.
Louisville, KY 40206

Test Sample Serial Number(s): ACS#5

Test Sample Condition: The equipment was provided in good condition without any physical damage.

1.3 Test Methodology and Considerations

The EUT was evaluated for radiated emissions. The EUT is battery operated only without any provision for connection to the AC mains. The device is exempted from the power line conducted emission requirements. The device was evaluated using test software version v1.1 which used a power setting of 7 dBm for the RF output power of the transmitter.

The radiated emissions evaluation was performed for the EUT standalone set in three orthogonal orientations with respect to the ground plane.

The timing parameters were measured via RF coupling using a near field probe connected to the spectrum analyzer.

The equipment was also evaluated for unintentional emissions. The results are documented separately in a verification test report.

2 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

Advanced Compliance Solutions, Inc.
3998 FAU Blvd, Suite 310
Boca Raton, Florida 33431
Phone: (561) 961-5585
Fax: (561) 961-5587
www.acstestlab.com

FCC Test Firm Registration #: 475089
Innovation, Science and Economic Development Canada Lab Code: 4175C

2.2 Laboratory Accreditations/Recognitions/Certifications

ACS is accredited to ISO/IEC 17025 by ANSI-ASQ National Accreditation Board under their ACLASS program and has been issued certificate number AT-1533 in recognition of this accreditation. Unless otherwise specified, all test methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

2.3 Radiated & Conducted Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The EMC radiated test facility consists of an RF-shielded enclosure. The interior dimensions of the indoor semi-anechoic chamber are approximately 48 feet (14.6 m) long by 36 feet (10.8 m) wide by 24 feet (7.3 m) high and consist of rigid, 1/8 inch (0.32 cm) steel-clad, wood core modular panels with steel framing. In the shielded enclosure, the faces of the panels are galvanized and the chamber is self-supporting. 8-foot RF absorbing cones are installed on 4 walls and the ceiling. The steel-clad ground plane is covered with vinyl flooring.

The turntable is driven by pneumatic motor, which is capable of supporting a 2000 lb. load. The turntable is flush with the chamber floor which it is connected to, around its circumference, with a continuous metallic loaded spring. An EMCO Model 1060 Multi-device Controller controls the turntable position.

A pneumatic motor is used to control antenna polarizations and height relative to the ground. The height information is displayed on the control unit EMCO Model 1050.

The control room is an RF shielded enclosure attached to the semi-anechoic chamber with two bulkhead panels for connecting RF, and control cables. The dimension of the room is 7.3 m x 4.9 m x 3 m high and the entrance doors of both control and conducted rooms are 3 feet (0.91 m) by 7 feet (2.13 m).

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3.1-1 below:

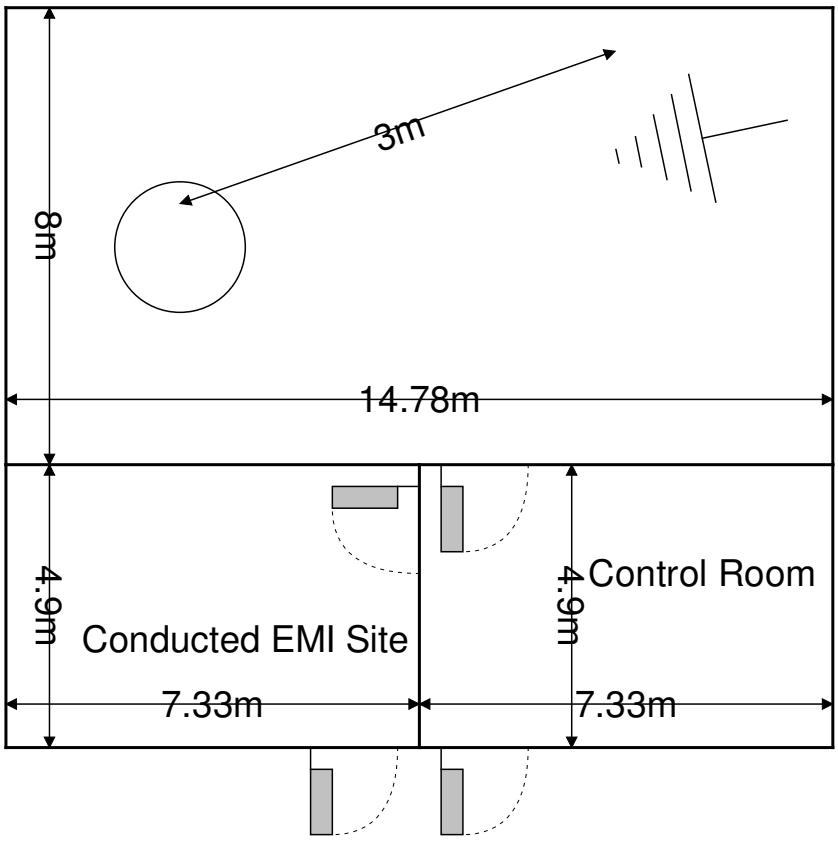


Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

2.3.2 Conducted Emissions Test Site Description

The dimensions of the shielded conducted room are 7.3 x 4.9 x 3 m^3. The power line conducted emission site includes two LISNs: a Solar Model 8028-50 50 Ω/50 µH and an EMCO Model 3825/2R, which are installed as shown in the figure below. For evaluations requiring 230 V, 50 Hz AC input, a Polarad LISN (S/N 879341/048) is used in conjunction with a California Instruments signal generator Model 2001RP-OP1.

A diagram of the room is shown below in figure 2.3.2-1:

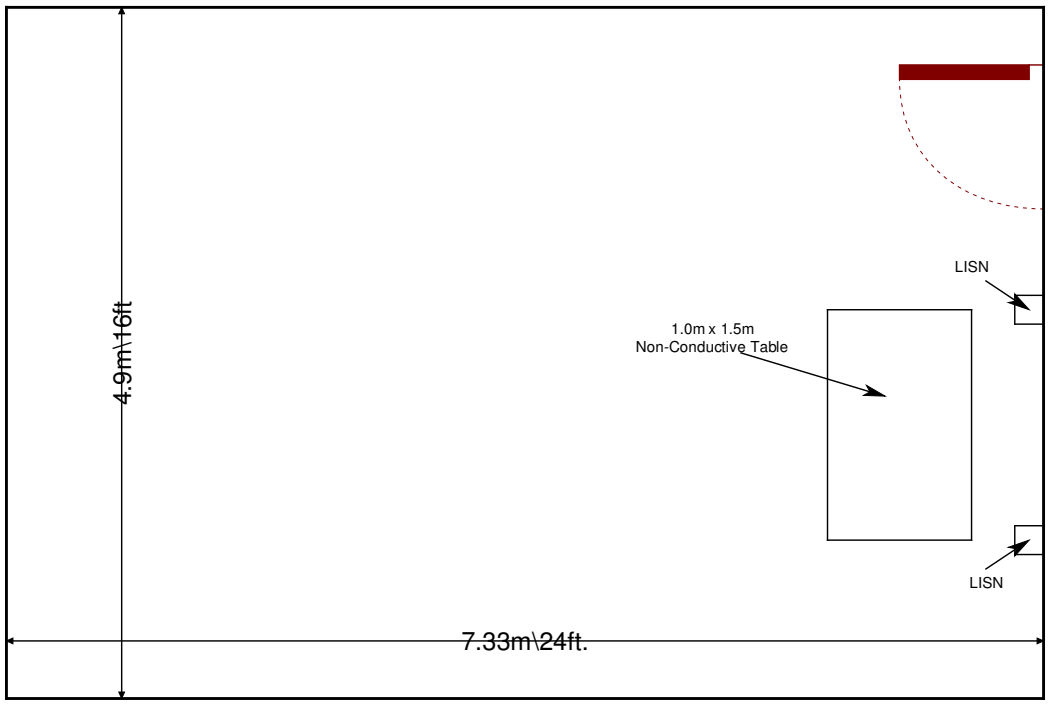


Figure 2.3.2-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2016.
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2016
- Innovation, Science and Economic Development Canada Radio Standards Specification: RSS-GEN – General Requirements for Compliance of Radio Apparatus, Issue 4, November 2014.
- Innovation, Science and Economic Development Canada Radio Standards Specification: RSS-210 - Licence-Exempt Radio Apparatus: Category I Equipment, Issue 9 August 2016.

4 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

Table 4-1: Test Equipment

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
78	EMCO	6502	Antennas	9104-2608	5/11/2016	5/11/2018
79	EMCO	7405	Antennas	93	NCR	NCR
283	Rohde & Schwarz	FSP40	Spectrum Analyzers	1000033	7/21/2016	7/21/2018
523	Agilent	E7405	Spectrum Analyzers	MY45103293	12/9/2016	12/9/2018
2002	EMCO	3108	Antennas	2147	11/19/2015	11/19/2017
2004	EMCO	3146	Antennas	1385	11/19/2015	11/19/2017
2006	EMCO	3115	Antennas	2573	4/14/2015	4/14/2017
2011	Hewlett-Packard	HP 8447D	Amplifiers	2443A03952	11/2/2016	11/2/2017
2083	Mini-Circuits	NHP-600	Filter	2083	6/20/2016	6/20/2017
2087	Mini-Circuit	NHP-400	Filter	7772700640	10/31/2016	10/31/2017
2089	Agilent Technologies, Inc.	83017A	Amplifiers	3123A00214	12/2/2016	12/2/2017
2094	Mini Circuits	SHP-1000+	Filter	R UU27401137	3/25/2016	3/25/2017
2095	ETS Lindgren	TILE4! - Version 4.2.A	Software	85242	NCR	NCR
2111	Aeroflex Inmet	40AH2W-20	Attenuator	2111	7/20/2016	7/20/2017
2112	Teledyne Storm Products	921-0101-036	Cables	12-06-698	11/2/2016	11/2/2017
2121	ACS Boca	Radiated Cable Set	Cable Set	2121	8/1/2016	8/1/2017

NCR=No Calibration Required

5 SUPPORT EQUIPMENT

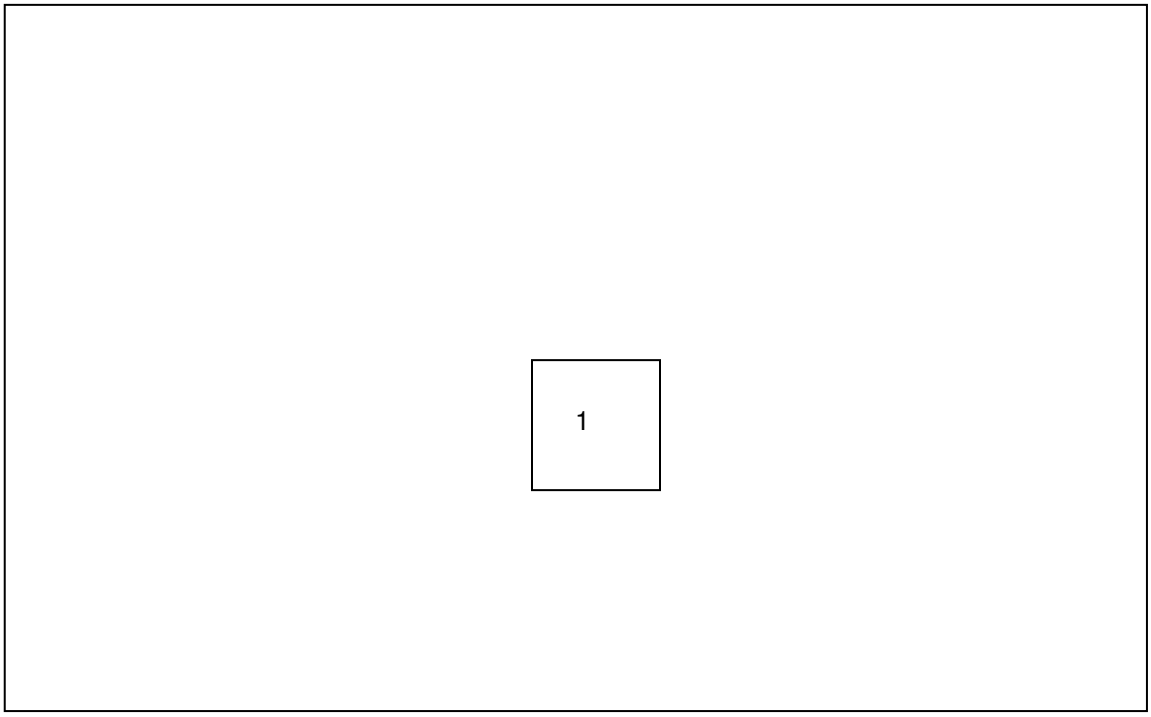
Table 5-1: Support Equipment

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	iKeyless, LLC.	300-0481	ACS#5

Table 5-2: Cable Description

Cable #	Cable Type	Length	Shield	Termination
	The EUT is standalone only with no provision for connection to accessory equipment.			

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM



7 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 Antenna Requirement – FCC: Section 15.203

The EUT uses an integral -16 dBi PCB trace loop antenna that is etched on the PCB. The antenna is not detachable thus meeting the requirements of FCC Section 15.203.

7.2 Periodic Operation – FCC: Section 15.231(a) / ISED Canada: RSS-210 A.1.1

7.2.1 Measurement Procedure

A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

A transmitter activated automatically shall cease transmission within 5 seconds after activation.

The transmitter was activated manually and was evaluated using a spectrum analyzer at zero span.

7.2.2 Measurement Results

The transmitter ceased operation 225 ms after manual activation. The results are shown below.

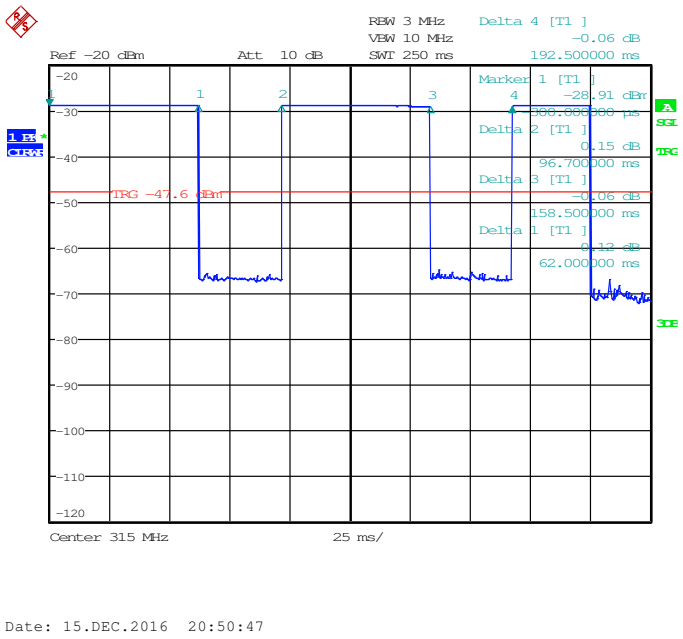


Figure 7.2.2-1: Periodic Operation – 250 ms

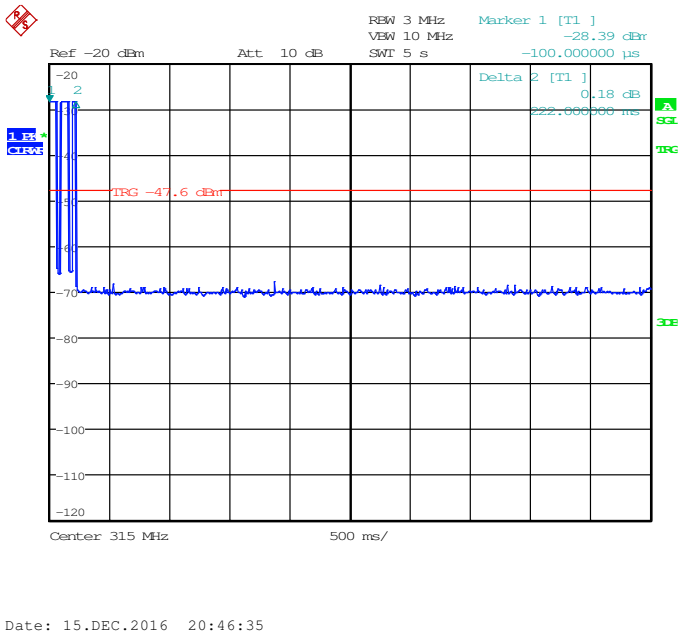


Figure 7.2.2-2: Periodic Operation – 5 s

7.3 20dB / 99% Bandwidth: FCC: Section 15.231(c)(1) / ISED Canada RSS-210.A.1.3

7.3.1 Measurement Procedure

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected.

For the 20 dB bandwidth measurement, the RBW was set between 1% and 5% of the estimated emission bandwidth. The trace was set to max hold with a peak detector active. The Delta function of the analyzer was utilized to determine the 20 dB bandwidth of the emission.

For the 99% occupied bandwidth measurements, the RBW was set between 1% and 5% of the estimated bandwidth. The occupied 99% bandwidth was measured by using a delta marker at the lower and upper frequencies leading to 0.5% of the total power using a peak detector.

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7.3.2 Measurement Results

Results are shown below in Table 7.3.2-1 and Figures 7.3.2-1 through 7.3.2-2

Table 7.3.2-1: 20dB / 99% Bandwidth

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
315	64.425	64.533

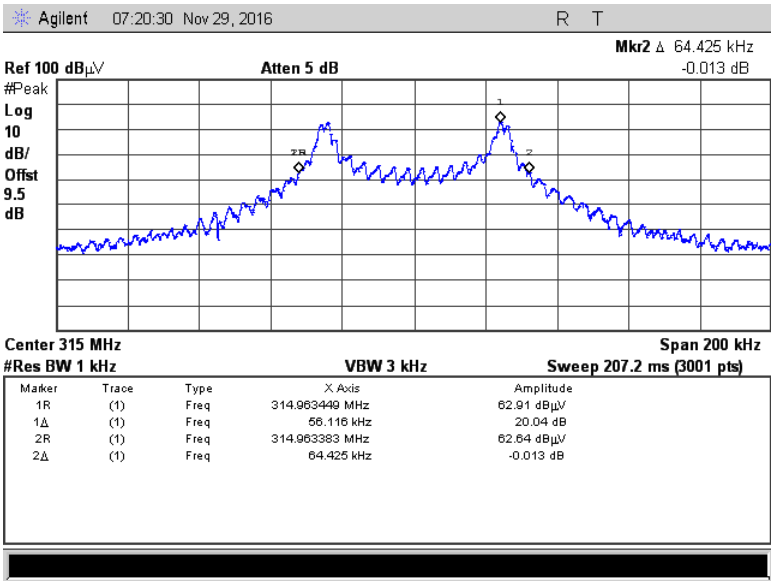

Figure 7.2.2-1: 20dB BW

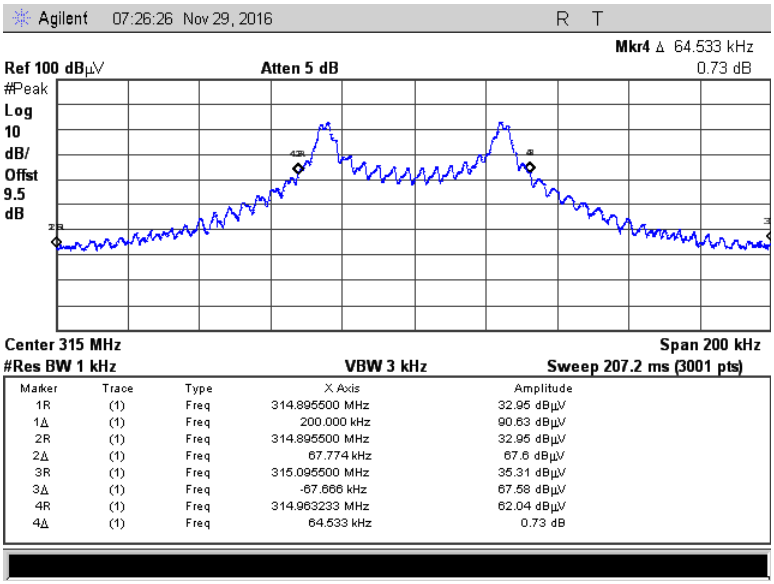

Figure 7.2.2-2: 99% OBW

7.4 Radiated Spurious Emissions – FCC: Section 15.231(b) / ISED Canada: RSS-210 A.1.2

7.4.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 9 kHz to 5 GHz, 10 times the highest fundamental frequency.

For measurements below 30 MHz, the receive antenna height was set to 1m and the EUT was rotated through 360 . The resolution bandwidth was set to 200 Hz below 150 kHz and to 9 kHz above 150 kHz.

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 1000MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 120 kHz and a video bandwidth VBW of 300 kHz. For frequencies above 1000MHz, peak and average measurements made with RBW and VBW of 1 MHz and 3MHz respectively. The average measurements were further corrected using a duty cycle correction factor as described below.

7.4.2 Duty Cycle Correction

For average radiated measurements, the measured level was reduced to account for the duty cycle of the EUT. The worst case duty cycle was determined as 62.2ms/96.4ms = 64.52%. The duty cycle correction factor is calculated using the formula 20*log(62.2/96.4) = -3.81 dB. Determination of the duty cycle correction is determined in the plot and the justification below.

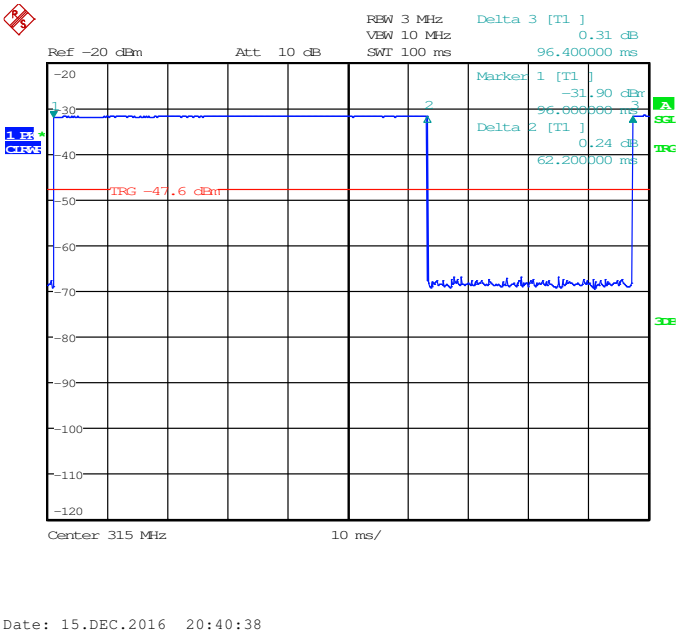

Figure 7.4.2-1: Duty Cycle

7.4.3 Measurement Results

Radiated spurious emissions found in the band of 9 kHz to 5 GHz are reported below.

Table 7.4.3-1: Radiated Spurious Emissions Tabulated Data – X Position

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	avg	(H/V)	(dB)	pk	avg	pk	avg	pk	avg
Standing										
Fundamental Frequency										
315	86.77	81.70	H	-11.44	75.33	66.45	95.6	75.6	20.3	9.1
315	92.40	87.45	V	-11.44	80.96	72.20	95.6	75.6	14.6	3.4
Spurious Emissions										
630	36.45	26.43	H	-5.79	30.66	16.84	75.6	55.6	44.9	38.8
630	38.85	29.38	V	-5.79	33.06	19.79	75.6	55.6	42.5	35.8
945	31.40	18.01	H	-0.76	30.64	13.44	75.6	55.6	45.0	42.2
945	33.60	20.75	V	-0.76	32.84	16.18	75.6	55.6	42.8	39.4
1260	50.39	37.99	H	-12.03	38.36	22.15	75.6	55.6	37.2	33.4
1260	51.27	41.18	V	-12.03	39.24	25.34	75.6	55.6	36.4	30.3
1575	49.77	37.82	H	-9.81	39.96	24.20	74	54	34.0	29.8
1575	55.00	49.18	V	-9.81	45.19	35.56	74	54	28.8	18.4
1890	49.92	38.94	H	-7.57	42.35	27.56	75.6	55.6	33.3	28.0
1890	48.90	38.00	V	-7.57	41.33	26.62	75.6	55.6	34.3	29.0
2520	46.97	33.71	H	-4.32	42.65	25.59	75.6	55.6	32.9	30.0
2520	46.81	34.05	V	-4.32	42.49	25.93	75.6	55.6	33.1	29.7
3150	44.84	32.16	H	-1.47	43.37	26.88	75.6	55.6	32.2	28.7
3150	45.94	32.72	V	-1.47	44.47	27.44	75.6	55.6	31.1	28.2

Note: The average measurement levels were further corrected by using a duty cycle correction factor of 20*log(62.2/96.4) = -3.81 dB.

Table 7.4.3-2: Radiated Spurious Emissions Tabulated Data – Y Position

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	avg	(H/V)	(dB)	pk	avg	pk	avg	pk	avg
Side										
Fundamental Frequency										
315	88.66	83.37	H	-11.44	77.22	68.12	95.6	75.6	18.4	7.5
315	90.77	85.81	V	-11.44	79.33	70.56	95.6	75.6	16.3	5.0
Spurious Emissions										
630	39.63	29.90	H	-5.79	33.84	20.31	75.6	55.6	41.8	35.3
630	33.68	23.15	V	-5.79	27.89	13.56	75.6	55.6	47.7	42.0
945	32.44	21.17	H	-0.76	31.68	16.60	75.6	55.6	43.9	39.0
945	29.35	16.54	V	-0.76	28.59	11.97	75.6	55.6	47.0	43.6
1260	51.01	39.48	H	-12.03	38.98	23.64	75.6	55.6	36.6	32.0
1260	50.80	37.89	V	-12.03	38.77	22.05	75.6	55.6	36.8	33.5
1575	54.58	48.92	H	-9.81	44.77	35.30	74	54	29.2	18.7
1575	51.22	41.79	V	-9.81	41.41	28.17	74	54	32.6	25.8
1890	47.70	35.39	H	-7.57	40.13	24.01	75.6	55.6	35.5	31.6
1890	49.30	39.31	V	-7.57	41.73	27.93	75.6	55.6	33.9	27.7
2520	47.34	33.51	H	-4.32	43.02	25.39	75.6	55.6	32.6	30.2
2520	47.04	33.85	V	-4.32	42.72	25.73	75.6	55.6	32.9	29.9
3150	45.43	32.99	H	-1.47	43.96	27.71	75.6	55.6	31.6	27.9
3150	45.32	32.13	V	-1.47	43.85	26.85	75.6	55.6	31.8	28.7

Note: The average measurement levels were further corrected by using a duty cycle correction factor of 20*log(62.2/96.4) = -3.81 dB.

Table 7.4.3-3: Radiated Spurious Emissions Tabulated Data – Z Position

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	avg	(H/V)	(dB)	pk	avg	pk	avg	pk	avg
Flat										
Fundamental Frequency										
315	95.70	90.34	H	-11.44	84.26	75.09	95.6	75.6	11.3	0.5
315	79.09	74.17	V	-11.44	67.65	58.92	95.6	75.6	27.9	16.7
Spurious Emissions										
630	37.67	27.74	H	-5.79	31.88	18.15	75.6	55.6	43.7	37.5
630	37.30	27.83	V	-5.79	31.51	18.24	75.6	55.6	44.1	37.4
945	33.87	22.29	H	-0.76	33.11	17.72	75.6	55.6	42.5	37.9
945	29.60	17.11	V	-0.76	28.84	12.54	75.6	55.6	46.8	43.1
1260	51.60	42.23	H	-12.03	39.57	26.39	75.6	55.6	36.0	29.2
1260	50.13	38.10	V	-12.03	38.10	22.26	75.6	55.6	37.5	33.3
1575	54.14	48.67	H	-9.81	44.33	35.05	74	54	29.7	18.9
1575	51.61	42.41	V	-9.81	41.80	28.79	74	54	32.2	25.2
1890	48.93	37.53	H	-7.57	41.36	26.15	75.6	55.6	34.2	29.4
1890	48.16	35.13	V	-7.57	40.59	23.75	75.6	55.6	35.0	31.8
2520	47.38	34.35	H	-4.32	43.06	26.23	75.6	55.6	32.5	29.4
2520	47.24	34.00	V	-4.32	42.92	25.88	75.6	55.6	32.7	29.7
3150	45.34	32.63	H	-1.47	43.87	27.35	75.6	55.6	31.7	28.2
3150	44.62	32.02	V	-1.47	43.15	26.74	75.6	55.6	32.5	28.9

Note: The average measurement levels were further corrected by using a duty cycle correction factor of 20*log(62.2/96.4) = -3.81 dB.

7.4.4 Sample Calculation:

$R_C = R_U + CF_T$

Where:

CF_T	=	Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
AG	=	Amplifier Gain
DC	=	Duty Cycle Correction Factor

Example Calculation: Peak
Corrected Level: 49.77 + (-9.81) = 39.96 dBµV/m
Margin: 74 dBµV/m – 39.96 dBµV/m = 34.0 dB

Example Calculation: Average
Corrected Level: 37.82 + (-9.81) – 3.81 = 24.2 dBµV
Margin: 54 dBµV – 24.2 dBµV = 29.8 dB

8 CONCLUSION

In the opinion of ACS, Inc. the 300-0481, manufactured by iKeyless, LLC. meets the requirements of FCC Part 15 subpart C and Innovation, Science and Economic Development Canada's Radio Standards Specification RSS-210.

END REPORT