Certification Test Report

FCC ID: X32-GMHKG000
IC: 8797A-GMHKG000

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

Report Number: AT72138233-1C3

Manufacturer: iKeyless, LLC
Model: GMHKL-G000

Test Begin Date: April 24, 2018
Test End Date: May 21, 2018

Report Issue Date: June 13, 2018

For Scope of Accreditation Under Certificate Number: 2955.09

This report must not be used by the client to claim product certification, approval, or endorsement by A2LA, NIST, or any agency of the Federal Government.

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This report contains 21 pages

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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 for certification.

1.2 Product description

The GMHKL-G000 is a 314.9MHz, ASK modulation, remote keyless entry FOB.

Technical Information:

Detail	Description
Frequency Range	314.9 MHz
Number of Channels	1
Modulation Format	ASK
Operating Voltage	3 Vdc (CR1620 coin cell)
Antenna Type / Gain	Loop Antenna / -15dBi

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

Test Sample Serial Number(s): #1 (Continuous Mode), #2 (Normal Mode)

Test Sample Condition: The test sample was provided in working order with no visible defects.

1.3 Test Methodology and Considerations

All modes of operation, including all available data rates, were evaluated. The data presented in this report represents the worst case where applicable.

For Radiated Emissions, the EUT was programmed to generate a continuously modulated signal. The EUT was evaluated in three orthogonal orientations. See test setup photos for more information.

For RF bandwidth and timing parameter testing, the EUT was programmed for normal operation. The EUT was evaluated with a near field probe to facilitate coupling to the test equipment.

The EUT is a battery powered device with no provisions for connection to the public utilities, therefore power line conducted emissions was not performed.

Software power setting during test: 7dBm

2 TEST FACILITIES

2.1 Location

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

TÜV SÜD America, Inc.
5015 B.U. Bowman Drive
Buford, GA 30518
Phone: (770) 831-8048

TÜV SÜD America, Inc.
5945 Cabot Pkwy, Suite 100
Alpharetta, GA 30005
Phone: (678) 341-5900

2.2 Laboratory Accreditations/Recognitions/Certifications

TÜV SÜD America, Inc. (Buford Facility) is accredited to ISO/IEC 17025 by the ANSI-ASQ National Accreditation Board/ANAB accreditation program and has been issued certificate number AT-2021 in recognition of this accreditation.

TÜV SÜD America, Inc. (Alpharetta Facility) is accredited to ISO/IEC 17025 by the American Association for Laboratory Accreditation/A2LA accreditation program and has been issued certificate number 2955.09 in recognition of this accreditation.

Unless otherwise specified, all tests methods described within this report are covered under the ISO/IEC 17025 scopes of accreditation.

The Semi-Anechoic Chamber Test Sites, Open Area Test Sites (OATS) and Conducted Emissions Sites have been fully described, submitted to, and accepted by the FCC, ISED Canada and the Japanese Voluntary Control Council for Interference by information technology equipment.

Buford Facility

FCC Registration Number:	391271
ISED Canada Lab Code:	23597
VCCI Member Number:	1831
• VCCI Registration Number	A-0259

Alpharetta Facility

FCC Registration Number:	967699
ISED Canada Lab Code:	23932
VCCI Member Number:	1831
• VCCI Registration Number	A-0295

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site (Buford Facility)

The Semi-Anechoic Chamber Test Site consists of a 20' x 30' x 18' shielded enclosure. The chamber is lined with Toyo Ferrite Grid Absorber, model number FFG-1000. The ferrite tile grid is 101 x 101 x 19mm thick and weighs approximately 550 grams. These tiles are mounted on steel panels and installed directly on the inner walls of the chamber.

The turntable is 150cm in diameter and is located 160cm from the back wall of the chamber. The chamber is grounded via 1 - 8' copper ground rod, installed at the center of the back wall, it is bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is all steel, flush mounted table installed in an all steel frame. The table is remotely operated from inside the control room located 25' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Behind the turntable is a 3' x 6' x 4' deep shielded pit used for support equipment if necessary. The pit is equipped with 1 - 4" PVC chases from the turntable to the pit that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit.

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3-1 below:

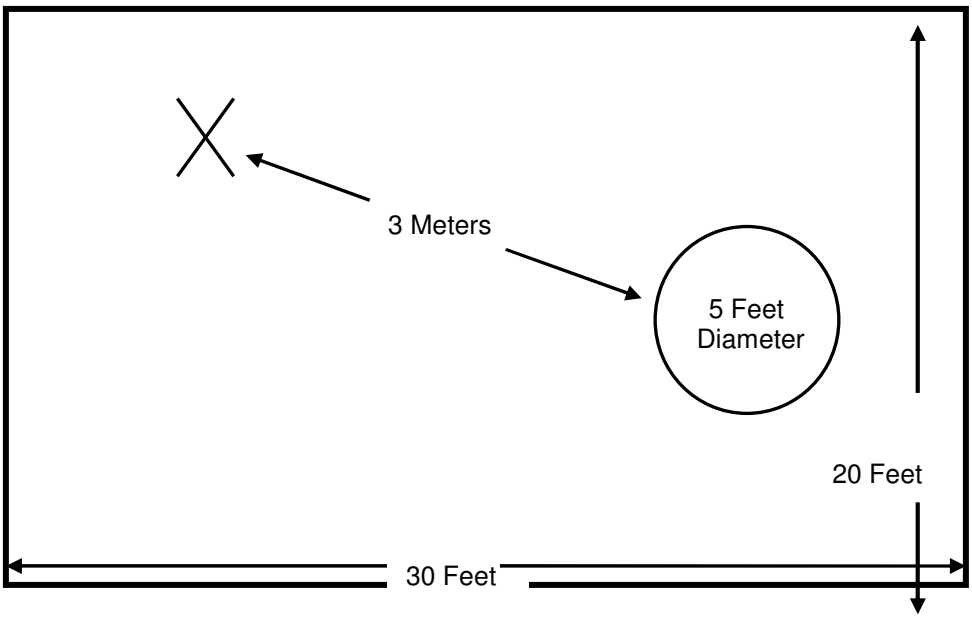

Figure 2.3.1: Semi-Anechoic Chamber Test Site (Buford Facility)

2.3.2 Semi-Anechoic Chamber Test Site (Alpharetta Facility)

The Semi-Anechoic Chamber Test Site consists of a 20'W x 30'L x 20'H shielded enclosure. The chamber is lined with ETS-Lindgren Ferrite Absorber, model number FT-1500. The ferrite tile 600 mm x 600 mm (2.62 in x 23.62 in) panels and are mounted directly on the inner walls of the chamber shield.

The specular regions of the chamber are lined with additional ETS-Lindgren PS-600 hybrid absorber to extend its frequency range up to 18GHz and beyond.

The turntable is a 2m ETS-Lindgren Model 2170, and installed off the center axis is located 5'6" from the back wall of the chamber. The chamber is grounded via 1 - 8' copper ground rod, installed at the center of the back wall, it is bound to the shield using #8 solid copper wire.

The antenna mast is an EMCO 1060 and is remotely controlled from the control room for both antenna height and polarization.

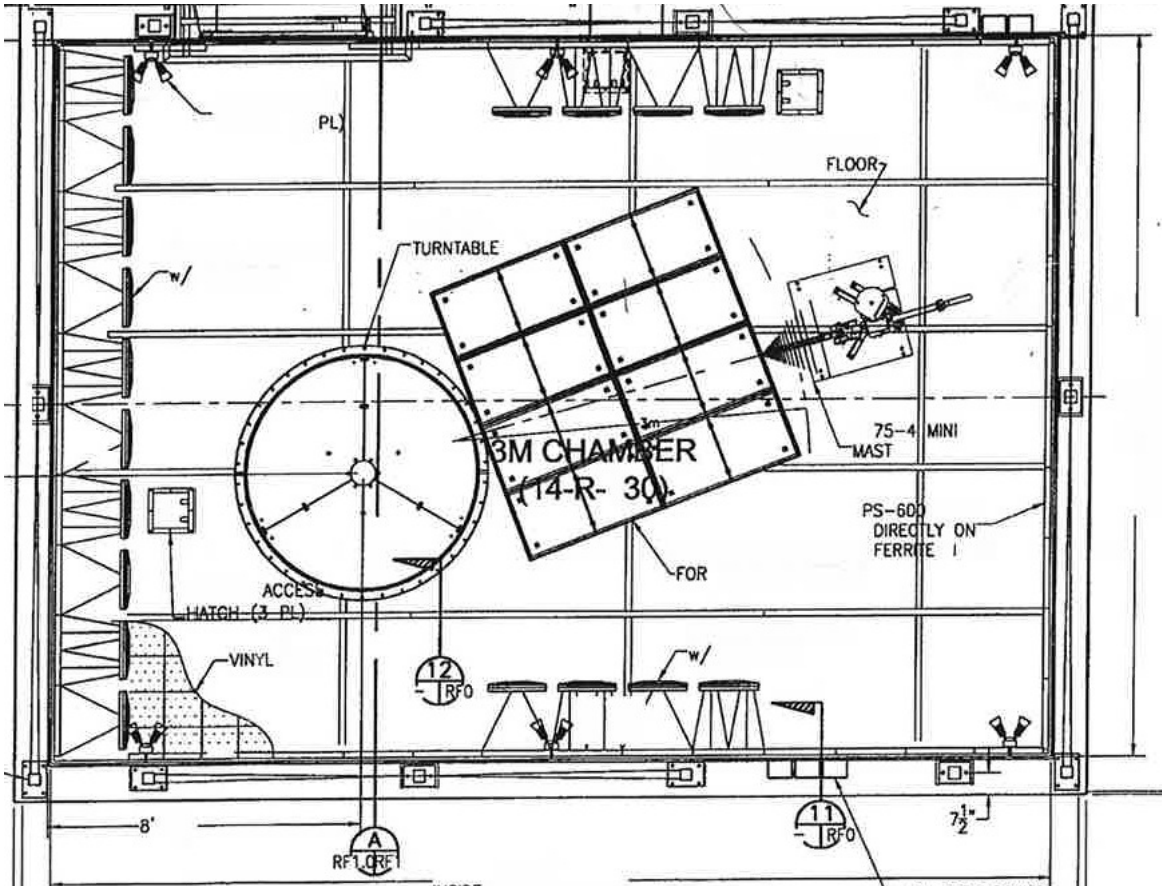

Figure 2.3.2: Semi-Anechoic Chamber Test Site (Alpharetta Facility)

2.3.3 Open Area Tests Site (Buford Facility)

The open area test site consists of a 40' x 66' concrete pad covered with a perforated electro-plated galvanized sheet metal. The perforations in the sheet metal are 1/8" holes that are staggered every 3/16". The individual sheets are placed to overlap each other by 1/4" and are riveted together to provide a continuous seam. Rivets are spaced every 3" in a 3 x 20 meter perimeter around the antenna mast and EUT area. Rivets in the remaining area are spaced as necessary to properly secure the ground plane and maintain the electrical continuity.

The entire ground plane extends 12' beyond the turntable edge and 16' beyond the antenna mast when set to a 10 meter measurement distance. The ground plane is grounded via 4 - 8' copper ground rods, each installed at a corner of the ground plane and bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is an all aluminum 10' flush mounted table installed in an all aluminum frame. The table is remotely operated from inside the control room located 40' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Adjacent to the turntable is a 7' x 7' square and 4' deep concrete pit used for support equipment if necessary. The pit is equipped with 5 - 4" PVC chases from the pit to the control room that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit. The pit is covered with 2 sheets of 1/4" diamond style re-enforced steel sheets. The sheets are painted to match the perforated steel ground plane; however the underside edges have been masked off to maintain the electrical continuity of the ground plane. All reflecting objects are located outside of the ellipse defined in ANSI C63.4.

A diagram of the Open Area Test Site is shown in Figure 2.3-2 below:

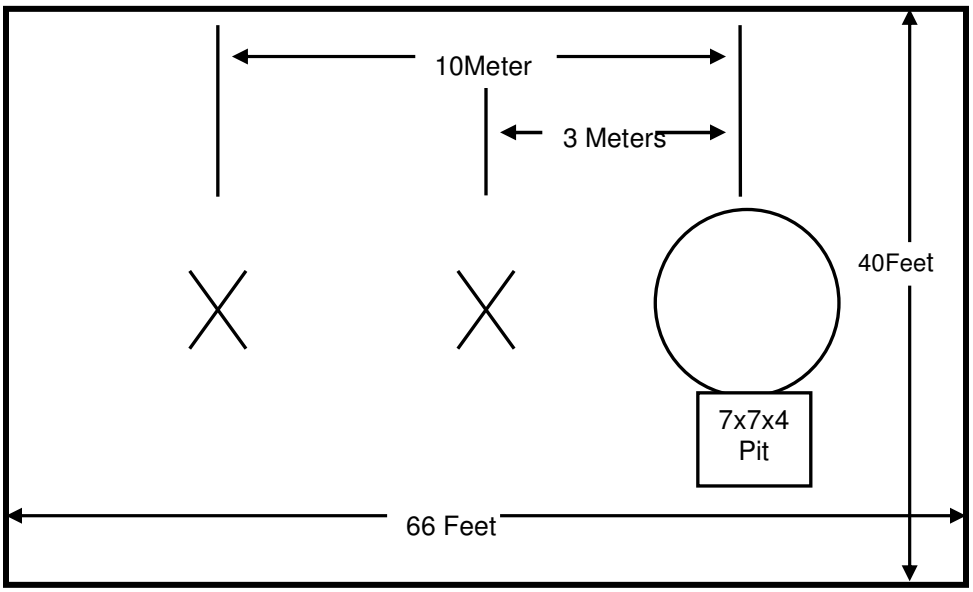

Figure 2.3.3: Open Area Test Site (Buford Facility)

2.4 Conducted Emissions Test Site Description

2.4.1 Conducted Emissions Test Site (Buford Facility)

The AC mains conducted EMI site is located in the main EMC lab. It consists of an 8' x 8' solid aluminum horizontal ground reference plane (GRP) bonded every 3" to an 8' X 8' vertical ground plane.

A diagram of the room is shown below in figure 4.1.3-1:

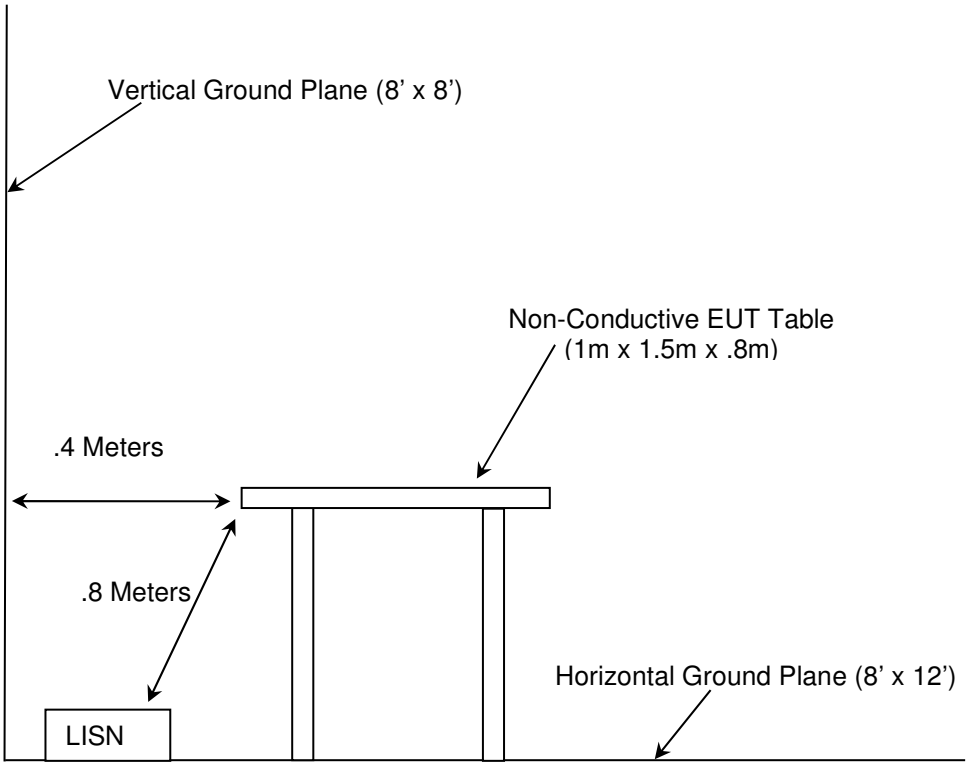

Figure 2.4.1: AC Mains Conducted EMI Site (Buford Facility)

2.4.2 Conducted Emissions Test Site (Buford Facility)

The AC mains conducted EMI site is located in the main EMC lab. It consists of a 12' x 10' horizontal coupling plane(HCP) as well as a 12'x8' vertical coupling plane(VCP). The HGP is constructed of 4' x 10' sheets of particle board sandwiched by galvanized steel sheets. These panels are bonded using 11AWG 1/8" x 2" by 10' galvanized sheet steel secured to the panels via by screws. The VCP is constructed of three 4'x8' sheets of 11AWG solid aluminum.

The HCP and VCP are electrically bonded together using 1"x1" angled aluminum secured with screws.

The site is of sufficient size to test table top and floor standing equipment in accordance with section 6.1.4 of ANSI C63.4:2003 and 2009.

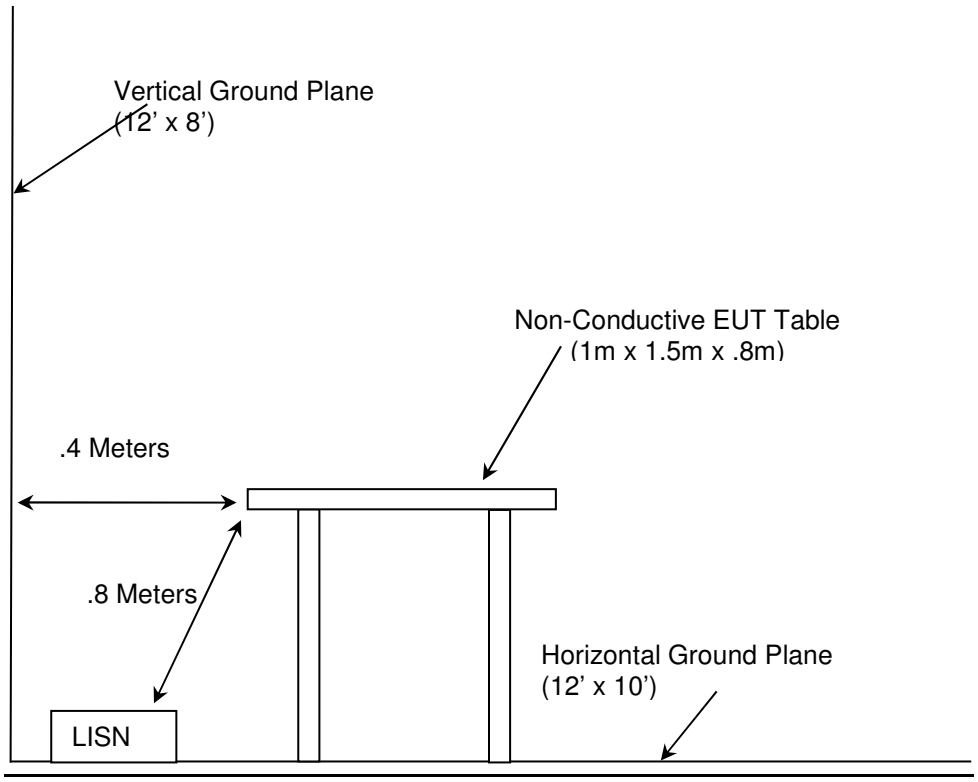

Figure 2.4.2: AC Mains Conducted EMI Site (Alpharetta Facility)

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- 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
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2018
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2018
- Innovation, Science and Economic Development Canada Radio Standards Specification: RSS-210 – Low-power License-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, Issue 9, August 2016
- Innovation, Science and Economic Development Canada Radio Standards Specification: RSS-GEN – General Requirements for Compliance of Radio Apparatus, Issue 4, Nov 2014.

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

Device-No.	Name	Manufacturer	Model	Serial-No.	Last Calibration	Valid Until
30	1-18GHz Horn Antenna	Spectrum Technologies	DRH-0118	970102	05/09/2017	05/09/2019
40	Bicon Antenna	EMCO	3104	3211	06/08/2016	06/08/2018
73	Pre-Amp	Hewlett Packard	8447D	2727A05624	07/24/2017	07/24/2018
167	Consisits of cables 485, 242, 204 and 10	ACS	Chamber EMI Cable Set	167	09/29/2017	09/29/2018
338	High Frequency Pre-Amp	Hewlett Packard	8449B	3008A01111	07/11/2017	07/11/2019
412	Log Periodic Antenna	Electro Metrics	LPA-25	1241	08/08/2016	08/08/2018
422	Cable	Florida RF	SMS-200AW-72.0-SMR	805	11/27/2017	11/27/2018
616	High Frequency Cable	Florida RF Cables	SMRE-200W-12.0-SMRE	N/A	10/07/2017	10/07/2018
620	High Frequency Cable	Teledyne Storm Microwave	90-195-456	13-10-602	05/01/2018	05/01/2019
622	FSV Signal Analyzer 10Hz to 40GHz	Rohde & Schwarz	FSV40 (v3.40)	101338	07/15/2016	07/15/2018
628	Active Loop Antenna 10kHz-30MHz	EMCO	6502	9407-2877	02/11/2016	08/11/2018
676	Cable	Florida RF Labs	SMS-290AW-480.0-SMS	MFR2Y194	01/08/2018	01/08/2019
819	EMI Test Receiver	Rohde & Schwarz USA, Inc.	ESR26	101345	10/31/2017	10/31/2018
837	High Frequency Cable	MegaPhase	CF-300-55-NM-NM	N/A	05/01/2018	05/01/2019
838	High Frequency Cable	MegaPhase	CF-300-98-NM-NM	N/A	05/01/2018	05/01/2019

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item #	Type Device	Manufacturer	Model/Part #	Serial #
The EUT is a battery operated equipment therefore no ancillary or support equipment was utilized. The EUT was tested stand-alone.				

Table 5-2: Cable Description

Cable #	Cable Type	Length	Shield	Termination
The EUT is a battery operated equipment therefore no ancillary or support equipment was utilized. The EUT was tested stand-alone.				

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

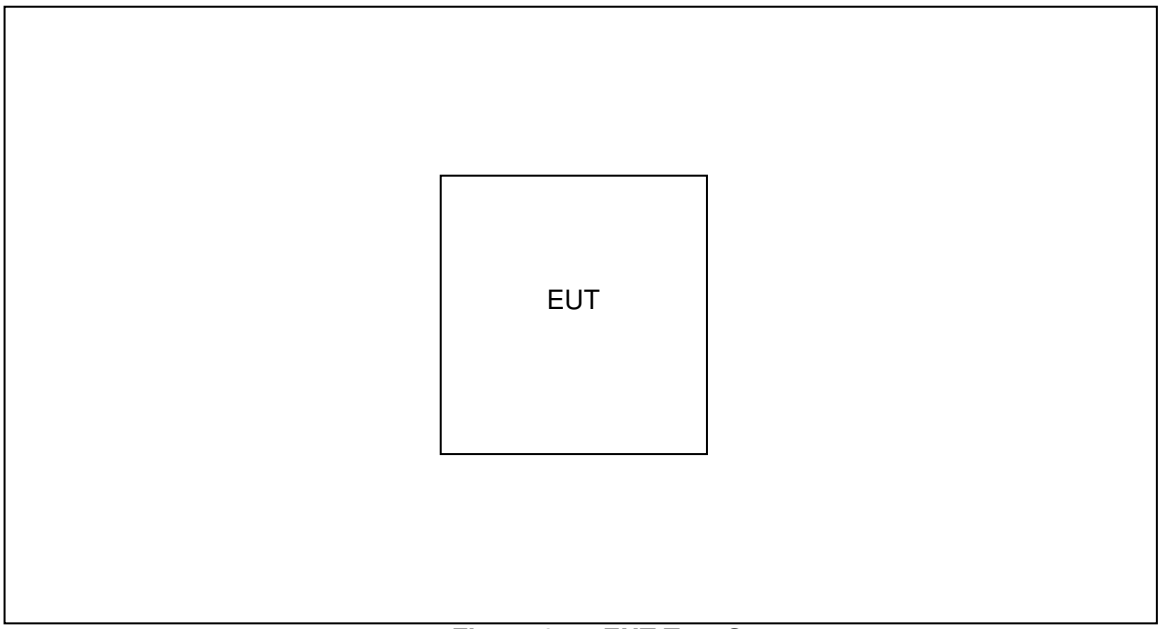

Figure 6-1: EUT Test Setup

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: Part 15.203

The antenna is a PCB Printed Loop antenna and is non-detachable without compromising the device, therefore satisfying Part 15.203. The antenna gain is -15dBi.

7.2 Power Line Conducted Emissions – FCC: Part 15.207; ISED Canada: RSS-GEN 8.8

7.2.1 Measurement Procedure

The EUT is a battery powered device with no provisions for connection to the public utilities, therefore power line conducted emissions was not performed.

7.3 Periodic Operation – FCC: Part 15.231(a); ISED Canada: RSS-210 A.1.1

7.3.1 Test Methodology

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 with a > 5 second sweep time.

7.3.2 Test Results

Performed by: Jeremy Pickens in Buford Facility

The transmitter ceased operation after 4 transmission strings or 379.92 ms after being manually activated. The results are shown in Figures 7.3.2-1 and 7.3.2-2.

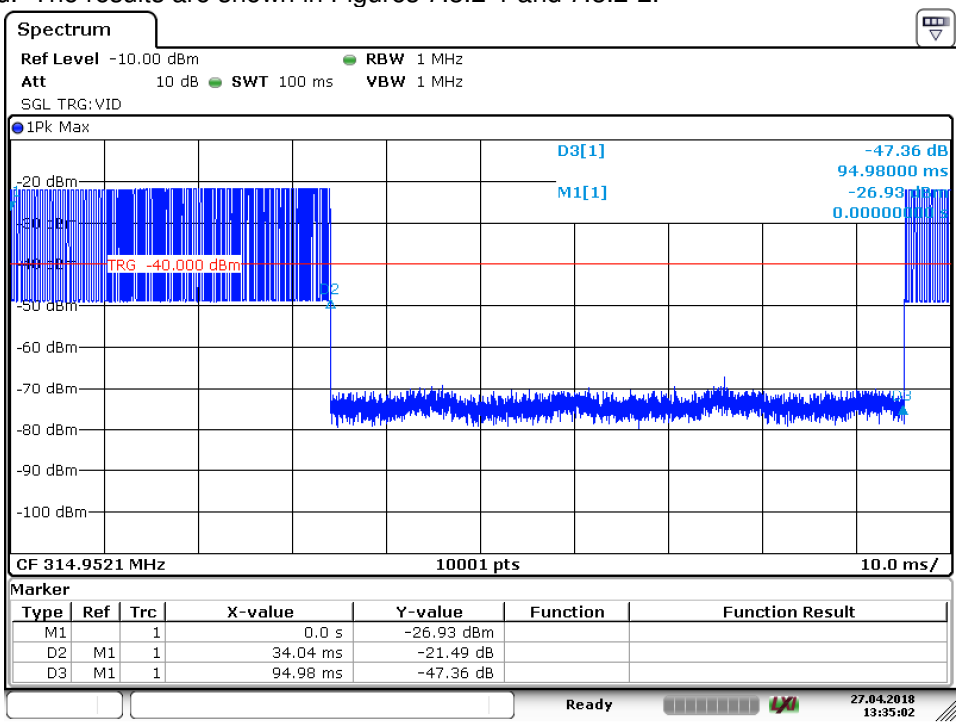

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Figure 7.3.2-1: Transmit Period

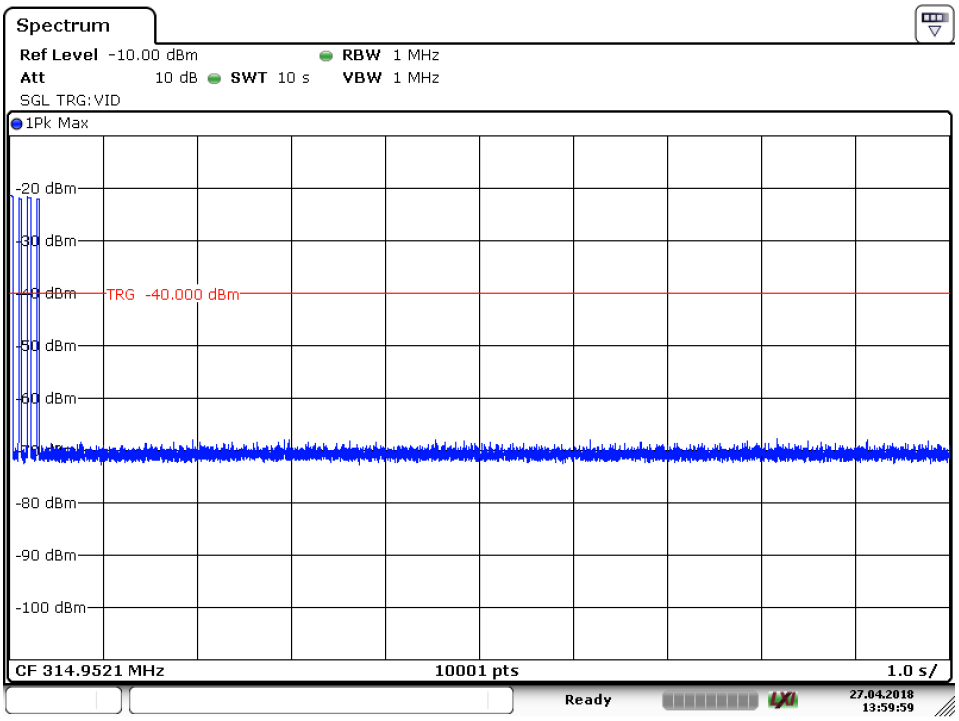

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Figure 7.3.2-2: TX Hold Time

7.4 Occupied Bandwidth – FCC: Part 15.231(c); ISED Canada: RSS-210 A.1.3, RSS-GEN 6.6

7.4.1 Test Methodology

The RBW of the spectrum analyzer was set to approximately 1 % to 5 % of the OBW. 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.

The occupied bandwidth measurement function of the spectrum analyzer was used to measure the 99% bandwidth. The span of the analyzer was set to capture all products of the modulation process, including the emission sidebands. The resolution bandwidth was set to 1% to 5% of the occupied bandwidth. The video bandwidth was set to 3 times the resolution bandwidth. A peak detector was used.

7.4.2 Test Results

Performed by: Jeremy Pickens in Alpharetta Facility

0.25% of the 315 MHz center frequency is equivalent to 787.5 kHz. Therefore the 20 dB and 99% bandwidths of the emission are less than 0.25% of the center frequency. The results are shown in Table 7.4.2-1 and Figures 7.4.2-1 and 7.4.2-2.

Table 7.4.2-1: 20dB / 99% Bandwidth

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
315	35.02	62.23

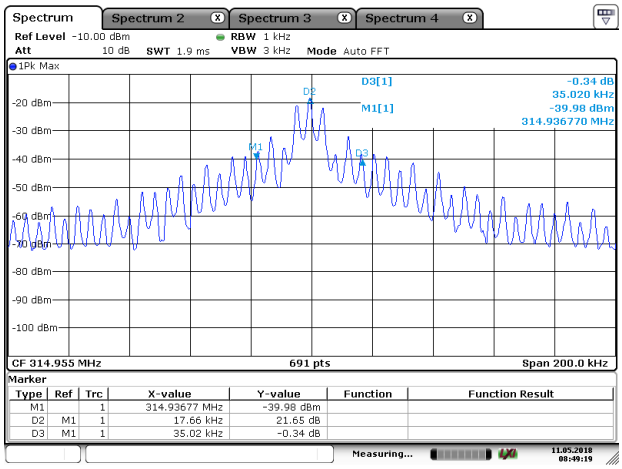

Figure 7.4.2-1: 20 dB Bandwidth

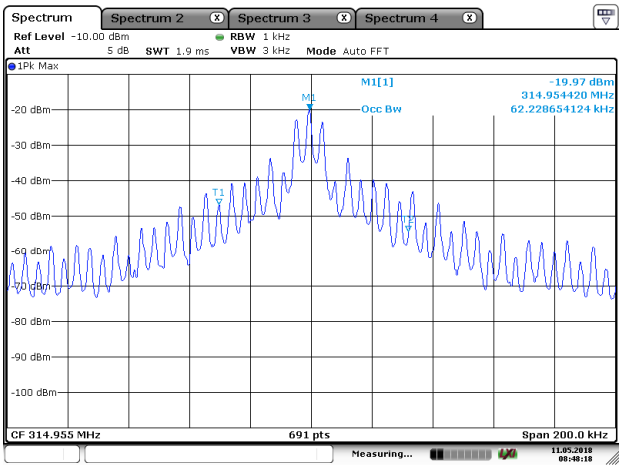

Figure 7.4.2-2: 99% Bandwidth

7.5 Radiated Emissions – FCC: Part 15.231(b); ISED Canada: RSS-210 A.1.2

7.5.1 Measurement Procedure

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

Measurements below 30 MHz were performed in the Buford Facility semi-anechoic chamber with a 3 meter separation distance between the EUT and measurement antenna. The EUT was rotated 360° to maximize each emission. The magnetic loop receiving antenna was positioned with its lowest point 1 meter above the ground. The loop antenna was aligned along the site axis, orthogonal to the site axis, and ground-parallel to the site axis.

The spectrum analyzer's resolution and video bandwidths were set to 200 Hz and 1000 Hz respectively for frequencies below 150 kHz and 9 kHz and 30 kHz respectively for frequencies above 150 kHz and below 30 MHz.

For measurements above 30 MHz, the EUT was rotated through 360° and the receive antenna height was varied from 1 meter to 4 meters so that the maximum radiated emissions level would be detected. For frequencies below 1000 MHz, measurements were made in the Buford Facility using a resolution bandwidth (RBW) of 120 kHz and a video bandwidth (VBW) of 300 kHz. For frequencies above 1000 MHz, measurements were made in the Alpharetta Facility with RBW of 1 MHz and a VBW of 3 MHz.

The peak emissions were compared to a limit corresponding to 20 dB above the maximum permitted average limit according to Part 15.35. The peak emissions were corrected by the duty cycle of the transmitter in a normal operational mode and compared to the average limit. The final measurements were then corrected by antenna correction factors and cable loss for comparison to the limits. Further, compliance with the provisions of Part 15.205 was demonstrated using the measurement instrumentation specified in that section where applicable.

7.5.2 Duty Cycle Correction

Performed by: Jeremy Pickens in Buford Facility

For average radiated measurements, the measured level was reduced by a factor 13.86 dB to account for the duty cycle of the EUT. The worst-case duty cycle was determined to be 20.3%. The duty cycle correction factor is determined using the formula: 20log (19.3/94.98) = -13.86 dB. Determination of the duty cycle correction is included in the plots and justification below. The on time for the transmission sequence was calculated by capturing the trace data and using an Excel spreadsheet. The on time was calculated by capturing a single pulse train (34.1ms) on the spectrum analyzer at zero span using 10,001 points (34.1ms/10,001 = 3.41us resolution). The entire 10,001 points were placed into the spreadsheet and all points that were within 20dB of the highest measured point were considered as "on." The calculation resulted in 19.3ms of on time and 14.8ms off. The on time was then divided by the entire period of the repeating transmission which was 94.98ms to calculate the duty cycle. Detailed calculations below:

Period (T) = 94.98 ms
On Time (ms) = 19.3
Off Time (ms) = 75.7
DC = 19.3 / 94.98 = 0.2027
20*Log(0.2027) = -13.86 dB Average Correction Factor

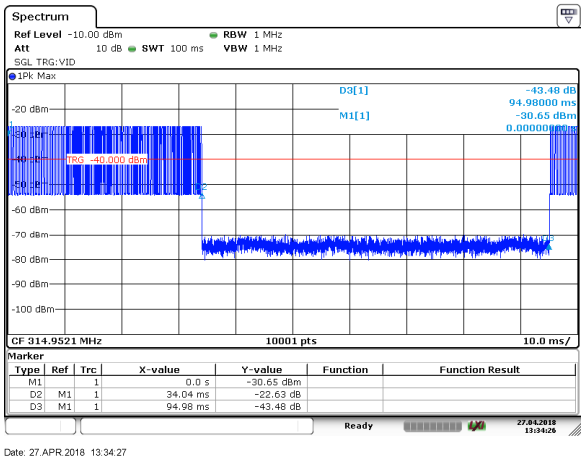

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Figure 7.5.2-1: Duty Cycle

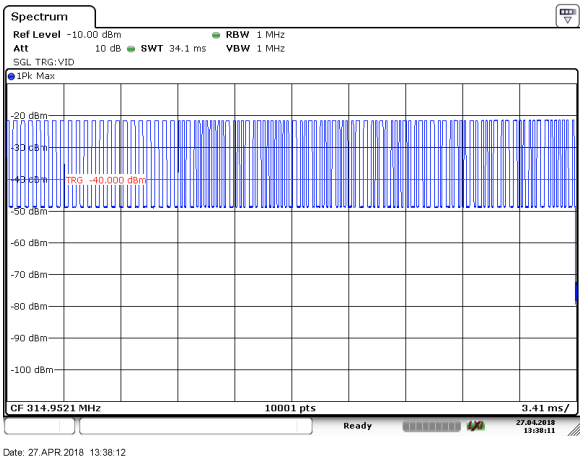

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Figure 7.5.2-2: Duty Cycle

7.5.3 Test Results

Performed by: Art Sumner, Tyler Leeson

Radiated spurious emissions are reported in Table 7.5.3-1 through Table 7.5.3-3. Emissions not reported were below the noise floor of the measurement system.

Table 7.5.3-1: Radiated Emissions – XPOS

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Fundamental Emission										
314.95	82.50	82.50	H	-7.84	74.66	60.81	95.6	75.6	20.9	14.8
314.95	85.20	85.20	V	-7.84	77.36	63.51	95.6	75.6	18.2	12.1
Spurious Emissions										
629.9	40.90	40.90	H	-1.80	39.10	25.25	75.6	55.6	36.5	30.4
629.9	39.40	39.40	V	-1.80	37.60	23.75	75.6	55.6	38.0	31.9
944.85	43.00	43.00	H	3.45	46.45	32.60	75.6	55.6	29.1	23.0
944.85	39.70	39.70	V	3.45	43.15	29.30	75.6	55.6	32.4	26.3
1259.8	55.61	41.31	H	-11.31	44.30	30.00	75.6	55.6	31.3	25.6
1259.8	58.19	44.07	V	-11.31	46.88	32.76	75.6	55.6	28.7	22.9
1574.75	54.60	38.63	H	-9.40	45.20	29.23	74.0	54.0	28.8	24.8
1574.75	52.13	37.04	V	-9.40	42.73	27.64	74.0	54.0	31.3	26.4
1889.7	60.01	47.09	H	-7.22	52.79	39.87	75.6	55.6	22.8	15.8
1889.7	55.19	42.12	V	-7.22	47.97	34.90	75.6	55.6	27.6	20.7
2204.65	54.21	38.44	H	-5.62	48.59	32.82	74.0	54.0	25.4	21.2
2204.65	52.44	37.01	V	-5.62	46.82	31.39	74.0	54.0	27.2	22.6
2519.6	51.93	37.57	H	-4.34	47.59	33.23	75.6	55.6	28.0	22.4
2519.6	51.54	36.51	V	-4.34	47.20	32.17	75.6	55.6	28.4	23.5
2834.55	55.25	40.47	H	-3.16	52.09	37.31	74.0	54.0	21.9	16.7
2834.55	54.63	40.13	V	-3.16	51.47	36.97	74.0	54.0	22.5	17.0
3149.5	55.49	40.97	H	-2.01	53.48	38.96	75.6	55.6	22.1	16.7
3149.5	55.29	40.57	V	-2.01	53.28	38.56	75.6	55.6	22.3	17.1

Table 7.5.3-2: Radiated Emissions – YPOS

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Fundamental Emission										
314.95	81.70	81.70	H	-7.84	73.86	60.01	95.6	75.6	21.7	15.6
314.95	85.10	85.10	V	-7.84	77.26	63.41	95.6	75.6	18.3	12.2
Spurious Emissions										
629.9	39.60	39.60	H	-1.80	37.80	23.95	75.6	55.6	37.8	31.7
629.9	40.20	40.20	V	-1.80	38.40	24.55	75.6	55.6	37.2	31.1
944.85	40.30	40.30	H	3.45	43.75	29.90	75.6	55.6	31.8	25.7
944.85	47.50	47.50	V	3.45	50.95	37.10	75.6	55.6	24.6	18.5
1259.8	57.31	43.43	H	-11.31	46.00	32.12	75.6	55.6	29.6	23.5
1259.8	61.27	47.22	V	-11.31	49.96	35.91	75.6	55.6	25.6	19.7
1574.75	50.49	35.59	H	-9.40	41.09	26.19	74.0	54.0	32.9	27.8
1574.75	56.70	40.69	V	-9.40	47.30	31.29	74.0	54.0	26.7	22.7
1889.7	52.48	38.63	H	-7.22	45.26	31.41	75.6	55.6	30.3	24.2
1889.7	61.03	48.30	V	-7.22	53.81	41.08	75.6	55.6	21.8	14.5
2204.65	50.56	35.39	H	-5.62	44.94	29.77	74.0	54.0	29.1	24.2
2204.65	57.10	41.16	V	-5.62	51.48	35.54	74.0	54.0	22.5	18.5
2519.6	48.11	34.37	H	-4.34	43.77	30.03	75.6	55.6	31.8	25.6
2519.6	52.30	37.74	V	-4.34	47.96	33.40	75.6	55.6	27.6	22.2
2834.55	54.13	39.69	H	-3.16	50.97	36.53	74.0	54.0	23.0	17.5
2834.55	53.62	39.29	V	-3.16	50.46	36.13	74.0	54.0	23.5	17.9
3149.5	50.50	35.09	H	-2.01	48.49	33.08	75.6	55.6	27.1	22.5
3149.5	54.81	37.93	V	-2.01	52.80	35.92	75.6	55.6	22.8	19.7

Table 7.5.3-3: Radiated Emissions – ZPOS

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Fundamental Emission										
314.9	87.40	87.40	H	-7.84	79.56	65.71	95.6	75.6	16.0	9.9
314.9	73.80	73.80	V	-7.84	65.96	52.11	95.6	75.6	29.6	23.5
Spurious Emissions										
629.8	43.90	43.90	H	-1.80	42.10	28.25	75.6	55.6	33.5	27.4
629.8	41.00	41.00	V	-1.80	39.20	25.35	75.6	55.6	36.4	30.3
944.7	46.00	46.00	H	3.45	49.45	35.60	75.6	55.6	26.1	20.0
944.7	38.10	38.10	V	3.45	41.55	27.70	75.6	55.6	34.0	27.9
1259.6	58.07	44.02	H	-11.29	46.78	18.88	75.6	55.6	28.8	36.7
1259.6	53.79	39.57	V	-11.29	42.50	14.43	75.6	55.6	33.1	41.2
1574.5	55.74	39.46	H	-9.37	46.37	16.24	74.0	54.0	27.6	37.8
1574.5	48.15	35.08	V	-9.37	38.78	11.86	74.0	54.0	35.2	42.1
1889.4	62.37	50.20	H	-7.14	55.23	29.21	75.6	55.6	20.4	26.4
1889.4	50.13	37.09	V	-7.14	42.99	16.10	75.6	55.6	32.6	39.5
2204.3	58.34	42.23	H	-5.42	52.92	22.96	74.0	54.0	21.1	31.0
2204.3	49.03	35.22	V	-5.42	43.61	15.95	74.0	54.0	30.4	38.1
2519.2	52.69	38.44	H	-4.01	48.68	20.58	75.6	55.6	26.9	35.0
2519.2	48.04	34.83	V	-4.01	44.03	16.97	75.6	55.6	31.6	38.6
2834.1	52.76	39.14	H	-2.87	49.89	22.42	74.0	54.0	24.1	31.6
2834.1	53.67	39.54	V	-2.87	50.80	22.82	74.0	54.0	23.2	31.2
3149	55.81	38.74	H	-1.74	54.07	23.15	75.6	55.6	21.5	32.5
3149	51.97	36.02	V	-1.74	50.23	20.43	75.6	55.6	25.4	35.2

7.5.4 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 – Fundamental Frequency – ZPOS
Corrected Level: 87.40 - 7.84 = 79.56dBuV
Margin: 95.6dBuV – 79.56dBuV = 16.0dB

Example Calculation: Average – Fundamental Frequency – ZPOS
Corrected Level: 87.40 - 7.84 - 13.86 = 65.71dBuV
Margin: 75.6dBuV – 65.71dBuV = 9.9dB

8 ESTIMATION OF MEASUREMENT UNCERTAINTY

The expanded laboratory measurement uncertainty figures (U_{Lab}) provided below correspond to an expansion factor (coverage factor) k = 1.96 which provide confidence levels of 95%.

Table 8-1: Estimation of Measurement Uncertainty

Parameter	U_{lab}
Occupied Channel Bandwidth	± 0.009 %
RF Conducted Output Power	± 0.349 dB
Power Spectral Density	± 0.372 dB
Antenna Port Conducted Emissions	± 1.264 dB
Radiated Emissions ≤ 1 GHz	± 5.814 dB
Radiated Emissions > 1 GHz	± 4.318 dB
Temperature	± 0.860 °C
Radio Frequency	± 2.832 x 10^{-8}
AC Power Line Conducted Emissions	± 3.360 dB

9 CONCLUSION

In the opinion of TÜV SÜD America Inc. the GMHKL-G000 manufactured by iKeyless, LLC met the requirements of FCC Part 15 subpart C and Innovation, Science and Economic Development Canada's Radio Standards Specification RSS-210 for the tests documented herein.

END REPORT

10 Appendix A – ANAB Accreditation Certificate

CERTIFICATE OF ACCREDITATION

ANSI-ASQ National Accreditation Board
500 Montgomery Street, Suite 625, Alexandria, VA 22314, 877-344-3044

This is to certify that

TÜV SÜD America, Inc.
5015 B. U. Bowman Drive
Buford, GA 30518

has been assessed by ANAB
and meets the requirements of international standard

ISO/IEC 17025:2005

while demonstrating technical competence in the field of

TESTING

Refer to the accompanying Scope of Accreditation for information regarding the types of tests to which this accreditation applies.

AT-2021
Certificate Number

ANAB Approval

Certificate Valid: 03/14/2018 - 12/17/2018
Version No. 013 Issued: 03/14/2018

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).