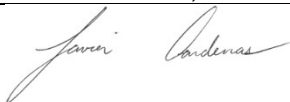
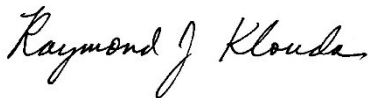




Engineering Test Report No. 2401701-02

Report Date	November 22, 2024	
Manufacturer Name	The Chamberlain Group LLC	
Manufacturer Address	300 Windsor Dr Oak Brook, IL 60523	
Model No.	CH348/C	
Date Received	November 11, 2024	
Test Dates	November 13, 2024 through November 18, 2024	
Specifications	FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C, Section 15.231(b) Innovation, Science, and Economic Development Canada, RSS-210 Innovation, Science, and Economic Development Canada, RSS-GEN	
Test Facility	Elite Electronic Engineering, Inc. 1516 Centre Circle, Downers Grove, IL 60515	FCC Reg. Number: 269750 IC Reg. Number: 2987A CAB Identifier: US0107
Signature		
Tested by	Javier Cardenas	
Signature		
Approved by	Raymond J. Klouda, Registered Professional Engineer of Illinois – 44894	
PO Number	4900097910	

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1. Report Revision History

Revision	Date	Description
–	27 NOV 2024	Initial Release of Engineering Test Report No. 2401701-02

2. Introduction

2.1. Scope of Tests

This document presents the results of a limited radiated spurious emissions test that was performed on The Chamberlain Group LLC Keypad (hereinafter referred to as the Equipment Under Test (EUT)). The EUT was manufactured and submitted for testing by The Chamberlain Group LLC located in Oak Brook, IL.

2.2. Purpose

The test series was performed to determine if the EUT meets the RF emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Sections 15.231(b).

The test series was also performed to determine if the EUT meets the RF emission requirements of the Industry Canada Radio Standards Specification RSS-Gen and Industry Canada Radio Standards Specification RSS-210 for Transmitters.

Testing was performed in accordance with ANSI C63.10-2013.

2.3. Identification of the EUT

The EUT was identified as follows:

EUT Identification	
Product Description	Keypad
Model/Part No.	CH348/C / 900-15619-2/014D15619 rev C
S/N	Sample 7
Band of Operation	315MHz and 390MHz
Software/Firmware Version	"security3-keypad_uscan_max_test_cont ook_v3.0.13" version 3.0.13
Size of EUT	12.5cm Length x 7.2cm Width x 3cm Depth
FCC ID:	HBW15619X2
ISED ID:	2666A-15619X2

The EUT listed above was used throughout the test series.

3. Power Input

The EUT was powered by 9V from a battery.

4. Grounding

The EUT was not connected to ground.

5. Support Equipment

No support equipment was used during the tests.

6. Interconnect Leads

No interconnect leads were used during the tests.

7. Modifications Made to the EUT

No modifications were made to the EUT during the testing.

8. Modes of Operation

Mode	Description
Tx	D Code 315MHz D Code 390MHz E Code 315MHz E Code 390MHz

9. Test Specifications

The tests were performed to selected portions of, and in accordance with the FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C, Section 15.231 and Innovation, Science, and Economic Development Canada, RSS-210 test specification(s).

- Federal Communications Commission "Code of Federal Regulations", Title 47, Part 15, Subpart C
- 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 9kHz to 40 GHz"
- ANSI C63.10-2013, "American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices"
- RSS-210 Issue 10, December 2019, "License-Exempt Radio Apparatus: Category I Equipment"
- RSS-Gen Issue 5, March 2019, Amendment 1, Innovation, Science, and Economic Development Canada, "Spectrum Management and Telecommunications, Radio Standards Specification, General Requirements for Compliance of Radio Apparatus"

10. Test Plan

No test plan was provided. Instructions were provided by personnel from The Chamberlain Group LLC and used in conjunction with the FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C, Section 15.231 and Innovation, Science, and Economic Development Canada, RSS-210, and ANSI C63.4-2014 specification(s).

11. Deviation, Additions to, or Exclusions from Test Specifications

There were no deviations, additions to, or exclusions from the test specifications during this test series.

12. Laboratory Conditions

Ambient Parameters	Value
Temperature	23°C
Relative Humidity	38%
Atmospheric Pressure	1013.3mb.

13. Summary

The following EMC tests were performed and the results are shown below:

Test Description	Requirements	Test Methods	S/N	Results
Duty Cycle Factor Measurements	FCC 15C ISED RSS-210	ANSI C63.10: 2013	N/A	---
Spurious Radiated Emissions	FCC 15C ISED RSS-210	ANSI C63.10: 2013	Sample 7	Conforms

14. Sample Calculations

For Powerline Conducted Emissions:

The resultant voltage level (VL) is a summation in decibels (dB) of the receiver meter reading (MTR) and the cable loss factor (CF).

$$\text{Formula 1: VL (dBuV)} = \text{MTR (dBuV)} + \text{CF (dB)}.$$

For Radiated Emissions:

The resultant field strength (FS) is a summation in decibels (dB) of the receiver meter reading (MTR), the antenna correction factor (AF), and the cable loss factor (CF). If an external preamplifier is used, the total is reduced by its gain (-PA). If a distance correction (DC) is required, it is added to the total.

$$\text{Formula 1: FS (dBuV/m)} = \text{MTR (dBuV)} + \text{AF (dB/m)} + \text{CF (dB)} + (-\text{PA (dB)}) + \text{DC (dB)}$$

To convert the Field Strength dBuV/m term to uV/m, the dBuV/m is first divided by 20. The Base 10 AntiLog is taken of this quotient. The result is the Field Strength value in uV/m terms.

$$\text{Formula 2: FS (uV/m)} = \text{AntiLog}[(\text{FS (dBuV/m)})/20]$$

15. Statement of Conformity

The Chamberlain Group LLC Keypad, Model No. CH348/C, Serial No. Sample 7, did not fully conform to the radiated spurious emissions requirements of FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C, Section 15.231(b) and Innovation, Science, and Economic Development Canada, RSS-210.

16. Certification

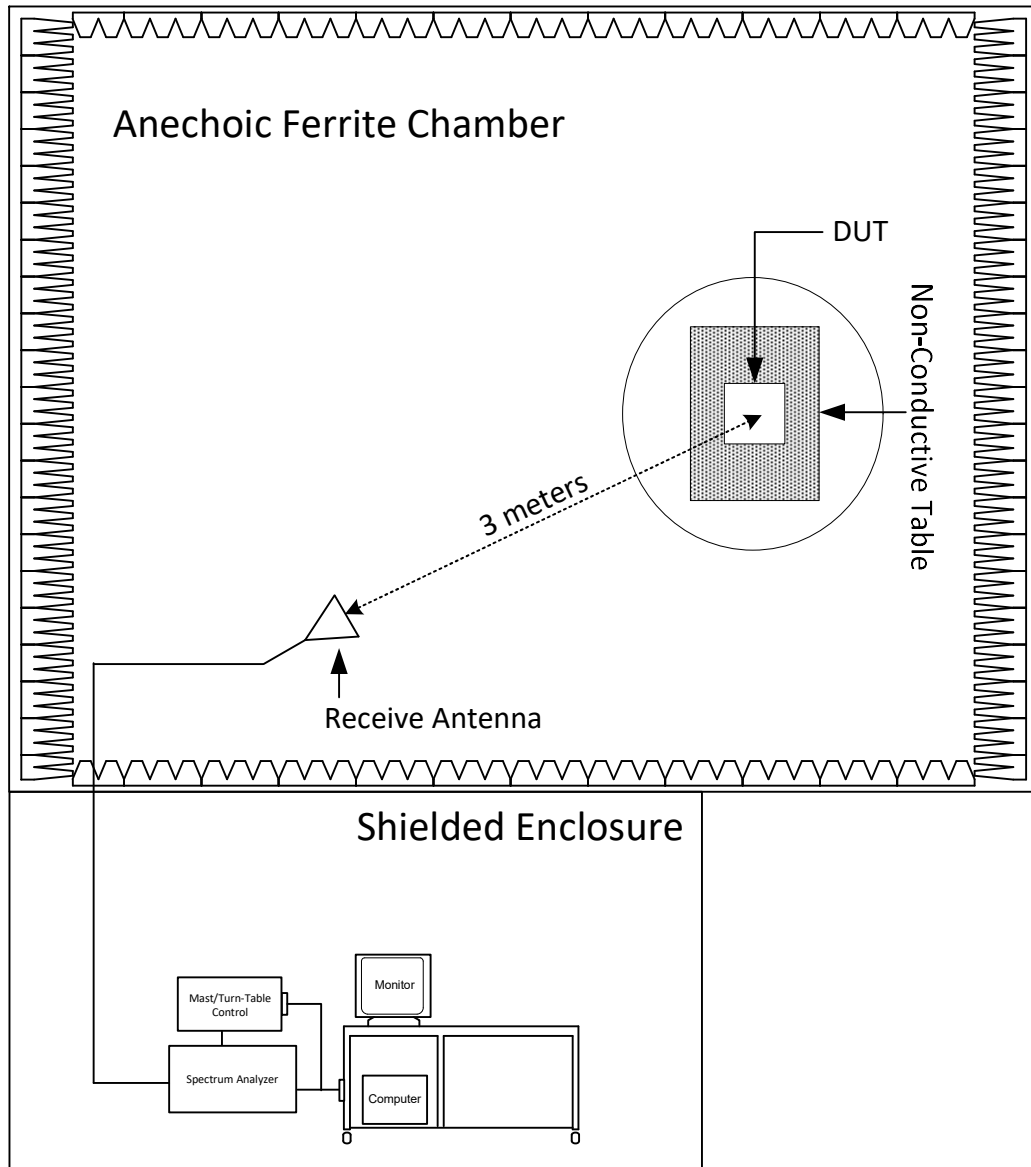
Elite Electronic Engineering Incorporated certifies that the information contained in this report was obtained under conditions which meet or exceed those specified in the FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C, Section 15.231 and Innovation, Science, and Economic Development Canada, RSS-210 test specifications. The data presented in this test report pertains to the EUT as provided by the customer on the test date specified. Any electrical or mechanical modifications made to the EUT subsequent to the specified test date will serve to invalidate the data and void this certification.

17. Photographs of EUT

Picture removed for short term confidentiality purposes.

Picture removed for short term confidentiality purposes.

18. Block Diagram of Test Setup



Radiated Measurements Test Setup

19. Equipment List

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
APW10	PREAMPLIFIER	PLANAR ELECTRONICS	PE2-35-120-5R0-10-12-SFF	PL11685/1241	1GHZ-20GHZ	3/20/2024	3/20/2025
CDZ3	LAB WORKSTATION	ELITE	LWS-10		WINDOWS 10	CNR	
GSF0	VECTOR SIGNAL GENERATOR	ROHDE & SCHWARZ	SMBV100A	260452	9KHZ - 6GHZ	9/15/2024	9/15/2026
NTA2	BILOG ANTENNA	TESEQ	6112D	28040	25-2000MHz	6/21/2024	6/21/2026
NWQ1	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS-LINDGREN	3117	66655	1GHZ-18GHZ	7/26/2024	7/26/2026
RBG2	EMI ANALYZER	ROHDE & SCHWARZ	ESW44	101591	2HZ-44GHZ	6/16/2024	6/16/2025
RBG4	EMI ANALYZER	ROHDE & SCHWARZ	ESW44	103007	2HZ-44GHZ	3/16/2024	3/16/2025
SES0	24VDC POWER SUPPLY	P-TRANS	FS-32024-1M	001	18-27VDC	NOTE 1	
T1EG	10DB 25W ATTENUATOR	WEINSCHEL	46-10-34	CD3551	DC-18GHZ	6/27/2024	6/27/2026
WKA1	SOFTWARE, UNIVERSAL RCV EMI	ELITE	UNIV_RCV_EMI	1	---	I/O	

N/A: Not Applicable

I/O: Initial Only

CNR: Calibration Not Required

NOTE 1: For the purpose of this test, the equipment was calibrated over the specified frequency range, pulse rate, or modulation prior to the test or monitored by a calibrated instrument.

20. Duty Cycle Factor Measurements

Duty Cycle calculations are found in etr2401702-02, Section 21.

21. Spurious Radiated Emissions

Test Information	
Manufacturer	The Chamberlain Group LLC
Product	Keypad
Model	CH348/C
Serial No	Sample 7
Mode	Tx

Test Setup Details	
Setup Format	Tabletop
Height of Support	NA
Type of Test Site	Semi-Anechoic Chamber
Test site used	R29F
Notes	None

Measurement Uncertainty	
Measurement Type	Expanded Measurement Uncertainty
Radiated disturbance (electric field strength on an open area test site or alternative test site) (30 MHz – 1000 MHz)	4.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (1 GHz – 6 GHz)	3.1
Radiated disturbance (electric field strength on an open area test site or alternative test site) (6 GHz – 18 GHz)	3.2
Radiated disturbance (electric field strength on an open area test site or alternative test site) (18 GHz – 26.5 GHz)	3.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (26.5 GHz – 40 GHz)	3.4

Requirements		
The EUT must comply with the requirements of FCC "Code of Federal Regulations Title 47", Part 15, Subpart C, Section 15.205 et seq. as well as the requirements of the RSS-GEN specification Section 8.10.		
Carrier Frequency (MHz)	Field Strength of Carrier (μV/m)	Field Strength of Spurious Emissions (μV/m)
260-470 Above 470	3750 to 12500* 12500	375 to 1250* 1250
*Linear interpolations		

Procedures

All tests were performed in a 32ft. x 20ft. x 18ft. hybrid ferrite-tile/anechoic absorber lined test chamber. The walls and ceiling of the shielded chamber are lined with ferrite tiles. Anechoic absorber material is installed over the ferrite tile. The floor of the chamber is used as the ground plane. The chamber complies with ANSI C63.4-2014 for site attenuation.

The shielded enclosure prevents emissions from other sources, such as radio and TV stations from interfering with the measurements. All powerlines and signal lines entering the enclosure pass through filters on the enclosure wall. The powerline filters prevent extraneous signals from entering the enclosure on these leads.

A preliminary radiated emissions test was performed to determine the emission characteristics of the EUT. For the preliminary test, a broadband measuring antenna was positioned at a 3 meter distance from the EUT. The entire frequency range from 30MHz to 4.5GHz was investigated using a peak detector function. The data was then processed by the computer to calculate equivalent field intensity.

The final emission tests were then manually performed over the frequency range of 30MHz to 4.5GHz. Between 30MHz and 1000MHz, a bi-log antenna was used as the pick-up device. The EUT was placed on an 80cm high non-conductive stand. A peak detector with a resolution bandwidth of 100 kHz was used on the spectrum analyzer.

Above 1GHz, a broadband double ridged waveguide antenna was used as the pick-up device. The EUT was placed on an 150cm high non-conductive stand. A peak detector with a resolution bandwidth of 1 MHz was used on the spectrum analyzer.

The peak detected levels were converted to average levels using a duty cycle factor which was computed from the pulse train.

To ensure that maximum or worst case, emission levels were measured, the following steps were taken:

- 1) The EUT was rotated so that all of its sides were exposed to the receiving antenna.
- 2) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
- 3) The measuring antenna was raised and lowered from 1 to 4 meters for each antenna polarization to maximize the readings.
- 4) For hand-held or body-worn devices, the EUT was rotated through three orthogonal axes to determine which orientation produces the highest emission relative to the limit.

In instances where it was necessary to use a shortened cable between the measuring antenna and the spectrum analyzer and the antenna cannot be raised to 4 meters. The measuring antenna is raised or lowered as much as the cable will allow and the EUT is rotated through all axis to ensure the maximum readings are recorded.

Picture removed for short term confidentiality purposes.

Test Setup for Spurious Radiated Emissions, 30-1000MHz – Antenna Polarization
Horizontal

Picture removed for short term confidentiality purposes.

Test Setup for Spurious Radiated Emissions, 30-1000MHz – Antenna Polarization
Vertical

Picture removed for short term confidentiality purposes.

Test Setup for Spurious Radiated Emissions, Above 1GHz – Antenna Polarization
Horizontal

Picture removed for short term confidentiality purposes.

Test Setup for Spurious Radiated Emissions, Above 1GHz – Antenna Polarization
Vertical

Test Details	
Manufacturer	The Chamberlain Group LLC
Model	CH348/C
S/N	Sample 7
Mode	Tx
Carrier Frequency	315MHz
Requirements	Field Strength of Carrier Limit = 1148.2µV/m
Notes	D Code
Test Date(s)	11/13/2024 and 11/18/2024

Freq. (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Duty Cycle (dB)	Total (dBuV/m)	Total (uV/m)	Limit (uV/m)	Margin (dB)
315.000	H	48.1		0.9	19.7	0.0	-14.1	54.6	538.9	6041.7	-21.0
315.000	V	54.7		0.9	19.7	0.0	-14.1	61.2	1148.2	6041.7	-14.4
630.000	H	20.6		1.3	25.3	0.0	-14.1	33.1	45.3	604.2	-22.5
630.000	V	34.2		1.3	25.3	0.0	-14.1	46.7	217.2	604.2	-8.9
945.000	H	25.6		1.6	26.9	0.0	-14.1	40.0	100.0	604.2	-15.6
945.000	V	26.9		1.6	26.9	0.0	-14.1	41.3	115.7	604.2	-14.4
1260.000	H	53.6		1.9	29.7	-40.7	-14.1	30.4	32.9	604.2	-25.3
1260.000	V	55.1		1.9	29.7	-40.7	-14.1	31.8	39.0	604.2	-23.8
1575.000	H	70.8		2.1	27.9	-40.2	-14.1	46.5	210.4	500.0	-7.5
1575.000	V	70.3		2.1	27.9	-40.2	-14.1	46.0	198.4	500.0	-8.0
1890.000	H	57.7		2.3	30.0	-40.0	-14.1	35.9	62.7	604.2	-19.7
1890.000	V	55.6		2.3	30.0	-40.0	-14.1	33.8	48.9	604.2	-21.8
2205.000	H	52.8		2.5	31.4	-39.9	-14.1	32.8	43.5	500.0	-21.2
2205.000	V	53.1		2.5	31.4	-39.9	-14.1	33.0	44.8	500.0	-20.9
2520.000	H	51.0		2.7	33.1	-39.9	-14.1	32.8	43.7	604.2	-22.8
2520.000	V	54.2		2.7	33.1	-39.9	-14.1	36.0	63.2	604.2	-19.6
2835.000	H	51.2		2.9	32.8	-39.7	-14.1	33.2	45.5	500.0	-20.8
2835.000	V	51.4	*	2.9	32.8	-39.7	-14.1	33.3	46.2	500.0	-20.7
3150.000	H	51.1	*	3.0	33.0	-39.5	-14.1	33.6	47.9	604.2	-22.0
3150.000	V	50.9	*	3.0	33.0	-39.5	-14.1	33.5	47.1	604.2	-22.2

Test Details	
Manufacturer	The Chamberlain Group LLC
Model	CH348/C
S/N	Sample 7
Mode	Tx
Carrier Frequency	390MHz
Requirements	Field Strength of Carrier Limit = 5147.3µV/m
Notes	D Code
Test Date(s)	11/13/2024 and 11/18/2024

Freq. (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Duty Cycle (dB)	Total (dBuV/m)	Total (uV/m)	Limit (uV/m)	Margin (dB)
390.000	H	49.1		1.0	21.4	0.0	-13.9	57.6	759.6	9166.7	-21.6
390.000	V	65.7		1.0	21.4	0.0	-13.9	74.2	5147.3	9166.7	-5.0
780.000	H	25.8		1.4	25.9	0.0	-13.9	39.2	91.0	916.7	-20.1
780.000	V	39.7		1.4	25.9	0.0	-13.9	53.2	454.9	916.7	-6.1
1170.000	H	60.9		1.8	29.2	-40.8	-13.9	37.1	71.9	500.0	-16.8
1170.000	V	68.9		1.8	29.2	-40.8	-13.9	45.1	180.5	500.0	-8.8
1560.000	H	56.8		2.1	27.9	-40.3	-13.9	32.7	43.0	500.0	-21.3
1560.000	V	59.9		2.1	27.9	-40.3	-13.9	35.7	60.9	500.0	-18.3
1950.000	H	61.9		2.3	30.3	-39.9	-13.9	40.7	108.0	916.7	-18.6
1950.000	V	61.2		2.3	30.3	-39.9	-13.9	40.0	99.6	916.7	-19.3
2340.000	H	52.9		2.6	32.2	-39.9	-13.9	33.8	49.1	500.0	-20.2
2340.000	V	54.2		2.6	32.2	-39.9	-13.9	35.2	57.4	500.0	-18.8
2730.000	H	50.6	*	2.8	33.0	-39.8	-13.9	32.8	43.5	500.0	-21.2
2730.000	V	50.5	*	2.8	33.0	-39.8	-13.9	32.7	43.1	500.0	-21.3
3120.000	H	50.7		3.0	33.0	-39.5	-13.9	33.3	46.1	916.7	-26.0
3120.000	V	51.0		3.0	33.0	-39.5	-13.9	33.6	47.9	916.7	-25.6
3510.000	H	50.4	*	3.2	33.2	-39.2	-13.9	33.6	48.0	916.7	-25.6
3510.000	V	50.2	*	3.2	33.2	-39.2	-13.9	33.5	47.1	916.7	-25.8
3900.000	H	50.7		3.4	33.5	-39.2	-13.9	34.4	52.3	500.0	-19.6
3900.000	V	53.6		3.4	33.5	-39.2	-13.9	37.2	72.7	500.0	-16.7

Test Details	
Manufacturer	The Chamberlain Group LLC
Model	CH348/C
S/N	Sample 7
Mode	Tx
Carrier Frequency	315MHz
Requirements	Field Strength of Carrier Limit = 890.2µV/m
Notes	E Code
Test Date(s)	11/13/2024 and 11/15/2024

Freq. (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Duty Cycle (dB)	Total (dBuV/m)	Total (uV/m)	Limit (uV/m)	Margin (dB)
315.000	H	45.6		0.9	19.7	0.0	-12.8	53.4	465.6	6041.7	-22.3
315.000	V	51.2		0.9	19.7	0.0	-12.8	59.0	890.2	6041.7	-16.6
630.000	H	20.2		1.3	25.3	0.0	-12.8	34.0	50.1	604.2	-21.6
630.000	V	31.2		1.3	25.3	0.0	-12.8	45.0	177.8	604.2	-10.6
945.000	H	23.7		1.6	26.9	0.0	-12.8	39.3	92.7	604.2	-16.3
945.000	V	24.5		1.6	26.9	0.0	-12.8	40.1	101.5	604.2	-15.5
1260.000	H	52.7		1.9	29.7	-40.7	-12.8	30.8	34.5	604.2	-24.9
1260.000	V	54.0		1.9	29.7	-40.7	-12.8	32.1	40.0	604.2	-23.6
1575.000	H	65.3		2.1	27.9	-40.2	-12.8	42.2	129.4	500.0	-11.7
1575.000	V	64.2		2.1	27.9	-40.2	-12.8	41.1	113.7	500.0	-12.9
1890.000	H	54.1		2.3	30.0	-40.0	-12.8	33.5	47.5	604.2	-22.1
1890.000	V	53.4		2.3	30.0	-40.0	-12.8	32.9	44.0	604.2	-22.8
2205.000	H	50.7	*	2.5	31.4	-39.9	-12.8	31.9	39.5	500.0	-22.1
2205.000	V	51.5		2.5	31.4	-39.9	-12.8	32.7	43.3	500.0	-21.3
2520.000	H	54.3		2.7	33.1	-39.9	-12.8	37.3	73.3	604.2	-18.3
2520.000	V	52.4		2.7	33.1	-39.9	-12.8	35.4	58.7	604.2	-20.2
2835.000	H	50.5	*	2.9	32.8	-39.7	-12.8	33.7	48.4	500.0	-20.3
2835.000	V	51.0	*	2.9	32.8	-39.7	-12.8	34.2	51.4	500.0	-19.8
3150.000	H	51.0	*	3.0	33.0	-39.5	-12.8	34.7	54.6	604.2	-20.9
3150.000	V	50.9	*	3.0	33.0	-39.5	-12.8	34.6	54.0	604.2	-21.0

Test Details	
Manufacturer	The Chamberlain Group LLC
Model	CH348/C
S/N	Sample 7
Mode	Tx
Carrier Frequency	390MHz
Requirements	Field Strength of Carrier Limit = 5788.7µV/m
Notes	E Code
Test Date(s)	11/13/2024 and 11/15/2024

Freq. (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Duty Cycle (dB)	Total (dBuV/m)	Total (uV/m)	Limit (uV/m)	Margin (dB)
390.000	H	51.1		1.0	21.4	0.0	-13.0	60.6	1065.6	9166.7	-18.7
390.000	V	65.8		1.0	21.4	0.0	-13.0	75.3	5788.7	9166.7	-4.0
780.000	H	25.8		1.4	25.9	0.0	-13.0	40.2	102.3	916.7	-19.0
780.000	V	40.4		1.4	25.9	0.0	-13.0	54.7	545.7	916.7	-4.5
1170.000	H	60.7		1.8	29.2	-40.8	-13.0	38.0	79.1	500.0	-16.0
1170.000	V	68.7		1.8	29.2	-40.8	-13.0	46.0	198.6	500.0	-8.0
1560.000	H	61.2		2.1	27.9	-40.3	-13.0	38.0	79.3	500.0	-16.0
1560.000	V	62.9		2.1	27.9	-40.3	-13.0	39.7	96.6	500.0	-14.3
1950.000	H	69.1		2.3	30.3	-39.9	-13.0	48.9	277.5	916.7	-10.4
1950.000	V	66.8		2.3	30.3	-39.9	-13.0	46.6	212.7	916.7	-12.7
2340.000	H	54.8		2.6	32.2	-39.9	-13.0	36.7	68.6	500.0	-17.3
2340.000	V	54.4		2.6	32.2	-39.9	-13.0	36.3	65.7	500.0	-17.6
2730.000	H	51.0	*	2.8	33.0	-39.8	-13.0	34.1	51.0	500.0	-19.8
2730.000	V	50.1	*	2.8	33.0	-39.8	-13.0	33.2	45.7	500.0	-20.8
3120.000	H	51.3		3.0	33.0	-39.5	-13.0	34.9	55.5	916.7	-24.4
3120.000	V	52.3		3.0	33.0	-39.5	-13.0	35.9	62.3	916.7	-23.4
3510.000	H	49.5	*	3.2	33.2	-39.2	-13.0	33.7	48.4	916.7	-25.5
3510.000	V	50.0	*	3.2	33.2	-39.2	-13.0	34.2	51.2	916.7	-25.1
3900.000	H	51.8		3.4	33.5	-39.2	-13.0	36.5	66.7	500.0	-17.5
3900.000	V	51.9		3.4	33.5	-39.2	-13.0	36.6	67.4	500.0	-17.4

22. Scope of Accreditation

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

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ELECTRICAL

Valid To: June 30, 2025

Certificate Number: 1786.01

In recognition of the successful completion of the A2LA Accreditation Program evaluation process, accreditation is granted to this laboratory to perform the following automotive electromagnetic compatibility and other electrical tests:

Test Technology:**Test Method(s)¹:**

Transient Immunity
(Max Voltage 60V/Max current 100A)

ISO 7637-2 (including emissions); ISO 7637-3;
ISO 16750-2:2012, Sections 4.6.3 and 4.6.4;
CS-11979, Section 6.4; CS.00054, Section 5.9;
EMC-CS-2009.1 (CI220); FMC1278 (CI220, CI221, CI222);
GMW 3097, Section 3.5; SAE J1113-11; SAE J1113-12;
ECE Regulation 10.06 Annex 10

Electrostatic Discharge (ESD)
(Up to +/-25kV)

ISO 10605 (2001, 2008);
CS-11979 Section 7.0; CS.00054, Section 5.10;
EMC-CS-2009.1 (CI 280); FMC1278 (CI280); SAE J1113-13;
GMW 3097 Section 3.6

Conducted Emissions

CISPR 25 (2002, 2008), Sections 6.2 and 6.3;
CISPR 25 (2016), Sections 6.3 and 6.4;
CS-11979, Section 5.1; CS.00054, Sections 5.6.1 and 5.6.2;
GMW 3097, Section 3.3.2;
EMC-CS-2009.1 (CE 420); FMC1278 (CE420, CE421,
CE 430, CE440)

(A2LA Cert. No. 1786.01) 08/15/2023



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5202 Presidents Court, Suite 220 | Frederick, MD 21703-8515 | Phone: 301 644 3248 | Fax: 240 454 9449 | www.A2LA.org

Test Technology:
Test Method(s)¹:

Radiated Emissions Anechoic
(Up to 6GHz)

CISPR 25 (2002, 2008), Section 6.4;
CISPR 25 (2016), Section 6.5;
CS-11979, Section 5.3; CS.00054, Section 5.6.3;
GMW 3097, Section 3.3.1;
EMC-CS-2009.1 (RE 310); FMC1278 (RE310, RE320);

Vehicle Radiated Emissions

CISPR 12; CISPR 36; ICES-002;
ECE Regulation 10.06 Annex 5

Bulk Current Injection (BCI)
(1 to 400MHz 500mA)

ISO 11452-4; CS-11979, Section 6.1; CS.00054, Section 5.8.1;
GMW 3097, Section 3.4.1; SAE J1113-4;
EMC-CS-2009.1 (RI112); FMC1278 (RI112);
ECE Regulation 10.06 Annex 9

Radiated Immunity Anechoic
(Up to 6GHz and 200V/m)
(Including Radar Pulse 600V/m)

ISO 11452-2;
CS-11979, Section 6.2; CS.00054, Section 5.8.2;
GMW 3097, Section 3.4.2;
EMC-CS-2009.1 (RI114); FMC1278 (RI114); SAE J1113-21;
ECE Regulation 10.06 Annex 9

Radiated Immunity Magnetic Field

ISO 11452-8; FMC 1278 (RI140)

Radiated Immunity Reverb
(360MHz to 6GHz and 100V/m)

ISO/IEC 61000-4-21; GMW 3097, Section 3.4.3;
EMC-CS-2009.1 (RI114); FMC1278 (RI114);
ISO 11452-11

Radiated Immunity
(Portable Transmitters)
(Up to 6GHz and 20W)

ISO 11452-9;
EMC-CS-2009.1 (RI115); FMC1278 (RI115);
GMW 3097, Sec 3.4.4

Vehicle Radiated Immunity (ALSE)

ISO 11451-2; ECE Regulation 10.06 Annex 6

Vehicle Product Specific EMC Standards

EN 14982; EN ISO 13309; ISO 13766; EN 50498;
EC Regulation No. 2015/208; EN 55012

Electrical Loads

ISO 16750-2

Stripline

ISO 11452-5

Transverse Electromagnetic (TEM) Cell

ISO 11452-3

Test Technology:
Test Method(s)¹:
Emissions

Radiated and Conducted
(3m Semi-anechoic chamber,
up to 40 GHz)

47 CFR, FCC Part 15 B (using ANSI C63.4:2014);
47 CFR, FCC Part 18 (using FCC MP-5:1986);
ICES-001; ICES-003; ICES-005;
IEC/CISPR 11, Ed. 4.1 (2004-06); AS/NZS CISPR 11 (2004);
IEC/CISPR 11 Ed 5 (2009-05) + A1 (2010);
KN 11 (2008-5) with RRL Notice No. 2008-3 (May 20, 2008);
CISPR 11; EN 55011; KS C 9811; CNS 13803 (1997, 2003);
CISPR 14-1; EN 55014-1; AS/NZS CISPR 14.1;
CISPR 16-2-1 (2008); CISPR 16-2-1; KS C 9814-1; KN 14-1;
IEC/CISPR 22 (1997);
EN 55022 (1998) + A1(2000);
EN 55022 (1998) + A1(2000) + A2(2003); EN 55022 (2006);
IEC/CISPR 22 (2008-09); AS/NZS CISPR 22 (2004);
AS/NZS CISPR 22, 3rd Edition (2006); KN 22 (up to 6 GHz);
CNS 13438 (up to 6 GHz); VCCI V-3 (up to 6 GHz);
CISPR 32; EN 55032; KS C 9832; KN 32;
ECE Regulation 10.06 Annex 7 (Broadband);
ECE Regulation 10.06 Annex 8 (Narrowband);
ECE Regulation 10.06 Annex 14 (Conducted)

Cellular Radiated Spurious Emissions

ETSI TS 151 010-1 GSM; 3GPP TS 51.010-1, Sec 12;
ETSI TS 134 124 UMTS; 3GPP TS 34.124;
ETSI TS 136 124 LTE; E-UTRA; 3GPP TS 36.124

Current Harmonics

IEC 61000-3-2; IEC 61000-3-12;
EN 61000-3-2; KN 61000-3-2;
KS C 9610-3-2; ECE Regulation 10.06 Annex 11

Flicker and Fluctuations

IEC 61000-3-3; IEC 61000-3-11;
EN 61000-3-3; KN 61000-3-3;
KS C 9610-3-3; ECE Regulation 10.06 Annex 12

Immunity

Electrostatic Discharge

IEC 61000-4-2, Ed. 1.2 (2001);
IEC 61000-4-2 (1995) + A1(1998) + A2(2000);
EN 61000-4-2 (1995); EN 61000-4-2 (2009-05);
KN 61000-4-2 (2008-5);
RRL Notice No. 2008-4 (May 20, 2008);
IEC 61000-4-2; EN 61000-4-2; KN 61000-4-2;
KS C 9610-4-2; IEEE C37.90.3 2001

Radiated Immunity

IEC 61000-4-3 (1995) + A1(1998) + A2(2000);
IEC 61000-4-3, Ed. 3.0 (2006-02);
IEC 61000-4-3, Ed. 3.2 (2010);
KN 61000-4-3 (2008-5);
RRL Notice No. 2008-4 (May 20, 2008);
IEC 61000-4-3; EN 61000-4-3; KN 61000-4-3;
KS C 9610-4-3; IEEE C37.90.2 2004

Test Technology:
Test Method(s)¹:
Immunity (cont'd)

Electrical Fast Transient/Burst

IEC 61000-4-4, Ed. 2.0 (2004-07);
IEC 61000-4-4, Ed. 2.1 (2011);
IEC 61000-4-4 (1995) + A1(2000) + A2(2001);
KN 61000-4-4 (2008-5);
RRL Notice No. 2008-5 (May 20, 2008);
IEC 61000-4-4; EN 61000-4-4; KN 61000-4-4;
KS C 9610-4-4; ECE Regulation 10.06 Annex 15

Surge

IEC 61000-4-5 (1995) + A1(2000);
IEC 61000-4-5, Ed 1.1 (2005-11);
EN 61000-4-5 (1995) + A1(2001);
KN 61000-4-5 (2008-5);
RRL Notice No. 2008-4 (May 20, 2008);
IEC 61000-4-5; EN 61000-4-5; KN 61000-4-5;
KS C 9610-4-5;
IEEE C37.90.1 2012; IEEE STD C62.41.2 2002;
ECE Regulation 10.06 Annex 16

Conducted Immunity

IEC 61000-4-6 (1996) + A1(2000);
IEC 61000-4-6, Ed 2.0 (2006-05);
IEC 61000-4-6 Ed. 3.0 (2008);
KN 61000-4-6 (2008-5);
RRL Notice No. 2008-4 (May 20, 2008);
EN 61000-4-6 (1996) + A1(2001); IEC 61000-4-6;
EN 61000-4-6; KN 61000-4-6; KS C 9610-4-6

Power Frequency Magnetic Field
Immunity (*Down to 3 A/m*)

IEC 61000-4-8 (1993) + A1(2000); IEC 61000-4-8 (2009);
EN 61000-4-8 (1994) + A1(2000);
KN 61000-4-8 (2008-5);
RRL Notice No. 2008-4 (May 20, 2008);
IEC 61000-4-8; EN 61000-4-8; KN 61000-4-8; KS C 9610-4-8

Voltage Dips, Short Interrupts, and Line
Voltage Variations

IEC 61000-4-11, Ed. 2 (2004-03);
KN 61000-4-11 (2008-5);
RRL Notice No. 2008-4 (May 20, 2008);
IEC 61000-4-11; EN 61000-4-11; KN 61000-4-11;
KS C 9610-4-11

Ring Wave

IEC 61000-4-12, Ed. 2 (2006-09);
EN 61000-4-12:2006;
IEC 61000-4-12; EN 61000-4-12; KN 61000-4-12;
IEEE STD C62.41.2 2002

Test Technology:

Generic and Product Specific EMC Standards

Test Method(s)¹:

IEC/EN 61000-6-1; AS/NZS 61000-6-1; KN 61000-6-1;
KS C 9610-6-1; IEC/EN 61000-6-2; AS/NZS 61000-6-2;
KN 61000-6-2; KS C 9610-6-2; IEC/EN 61000-6-3;
AS/NZS 61000-6-3; KN 61000-6-3; KS C 9610-6-3;
IEC/EN 61000-6-4; AS/NZS 61000-6-4; KN 61000-6-4;
KS C 9610-6-4; EN 50130-4; EN 61326-1; EN 50121-3-2;
EN 12895; EN 50270; EN 50491-1; EN 50491-2; EN 50491-3;
EN 55015; EN 60730-1; EN 60945; IEC 60533;
EN 61326-2-6; EN 61800-3; IEC/CISPR 14-2; EN 55014-2;
AS/NZS CISPR 14-2; KN 14-2; KS C 9814-2;
IEC/CISPR 24; AS/NZS CISPR 24; EN 55024; KN 24;
IEC/CISPR 35; AS/NZS CISPR 35; EN 55035; KN 35;
KS C 9835; IEC 60601-1-2; JIS T0601-1-2

TxRx EMC Requirements

EN 301 489-1; EN 301 489-3; EN 301 489-9;
EN 301 489-17; EN 301 489-19; EN 301 489-20

European Radio Test Standards

ETSI EN 300 086-1; ETSI EN 300 086-2;
ETSI EN 300 113-1; ETSI EN 300 113-2;
ETSI EN 300 220-1; ETSI EN 300 220-2;
ETSI EN 300 220-3-1; ETSI EN 300 220-3-2;
ETSI EN 300 330-1; ETSI EN 300 330-2;
ETSI EN 300 440-1; ETSI EN 300 440-2;
ETSI EN 300 422-1; ETSI EN 300 422-2;
ETSI EN 300 328; ETSI EN 301 893;
ETSI EN 301 511; ETSI EN 301 908-1;
ETSI EN 908-2; ETSI EN 908-13;
ETSI EN 303 413; ETSI EN 302 502;
EN 303 340; EN 303 345-2; EN 303 345-3; EN 303 345-4

Canadian Radio Tests

RSS-102 measurement (RF Exposure Evaluation);
RSS-102 measurement (Nerve Stimulation);
SPR-002; RSS-111; RSS-112; RSS-117; RSS-119; RSS-123;
RSS-125; RSS-127; RSS-130; RSS-131; RSS-132; RSS-133;
RSS-134; RSS-135; RSS-137; RSS-139; RSS-140; RSS-141;
RSS-142; RSS-170; RSS-181; RSS-182; RSS-191; RSS-192;
RSS-194; RSS-195; RSS-196; RSS-197; RSS-199; RSS-210;
RSS-211; RSS-213; RSS-215; RSS-216; RSS-220; RSS-222;
RSS-236; RSS-238; RSS-243; RSS-244; RSS-247; RSS-248;
RSS-251; RSS-252; RSS-287; RSS-288; RSS-310; RSS-GEN

Mexico Radio Tests

IFT-008-2015; NOM-208-SCFI-2016

Japan Radio Tests

Radio Law No. 131, Ordinance of MPT No. 37, 1981,
MIC Notification No. 88:2004, Table No. 22-11;
ARIB STD-T66, Regulation 18

Taiwan Radio Tests

LP-0002 (July 15, 2020)

Test Technology:
Test Method(s)¹:
Australia/New Zealand Radio Tests

AS/NZS 4268; Radiocommunications (Short Range Devices) Standard (2014)

Hong Kong Radio Tests

HKCA 1039 Issue 6;
HKCA 1042;
HKCA 1033 Issue 7;
HKCA 1061;
HKCA 1008;
HKCA 1043;
HKCA 1057;
HKCA 1073

Korean Radio Test Standards

KN 301 489-1; KN 301 489-3; KN 301 489-9;
KN 301 489-17; KN 301 489-52; KS X 3124; KS X 3125;
KS X 3130; KS X 3126; KS X 3129

Vietnam Radio Test Standards

QCVN 47:2015/BTTTT; QCVN 54:2020/BTTTT;
QCVN 55:2011/BTTTT; QCVN 65:2013/BTTTT;
QCVN 73:2013/BTTTT; QCVN 74:2020/BTTTT;
QCVN 112:2017/BTTTT; QCVN 117:2020/BTTTT

Vietnam EMC Test Standards

QCVN 18:2014/BTTTT; QCVN 86:2019/BTTTT;
QCVN 96:2015/BTTTT; QCVN 118:2018/BTTTT

*Unlicensed Radio Frequency Devices
(3 Meter Semi-Anechoic Room)*

47 CFR FCC Part 15C, 15D, 15E, 15F, 15G, 15H
(using ANSI C63.10:2013, ANSI C63.17:2013 and
FCC KDB 905462 D02 (v02))

Licensed Radio Service Equipment

47 CFR FCC Parts 20, 22, 24, 25, 27, 30, 73, 74, 80, 87,
90, 95, 96, 97, 101 (using ANSI/TIA-603-E,
TIA-102.CAAA-E, ANSI C63.26:2015)

OIA (Over the Air) Performance

GSM, GPRS, EGPRS
UMTS (W-CDMA)
LTE including CAT M1
A-GPS for UMTS/GSM
LTS A-GPS, A-GLONASS,
SIB8/SIB16
Large Device/Laptop/Tablet Testing
Integrated Device Testing
WiFi 802.11 a/b/g/n/a

CTIA Test Plan for Wireless Device Over-the-Air
Performance (Method for Measurement for Radiated Power
and Receiver Performance) V3.8.2;
CTIA Test Plan for RF Performance Evaluation of WiFi
Mobile Converged Devices V2.1.0

Test Technology:
Test Method(s)¹:
Electrical Measurements and Simulation
AC Voltage / Current

(1mV to 5kV) 60 Hz
(0.1V to 250V) up to 500 MHz
(1μA to 150A) 60 Hz

FAA AC 150/5345-10H;
FAA AC 150/5345-43J;
FAA AC 150/5345-44K;
FAA AC 150/5345-46E;
FAA AC 150/5345-47C;
FAA EB 67D

DC Voltage / Current

(1mV to 15 kV) / (1μA to 10A)

Power Factor / Efficiency / Crest Factor

(Power to 30kW)

Resistance

(1mΩ to 4000MΩ)

Surge

(Up to 10 kV / 5 kA) (Combination
Wave and Ring Wave)

On the following products and materials:

Telecommunications Terminal Equipment (TTE), Radio Equipment, Network Equipment, Information Technology Equipment (ITE), Automotive Electronic Equipment, Automotive Hybrid Electronic Devices, Maritime Navigation and Radio Communication Equipment and Systems, Vehicles, Boats and Internal Combustion Engine Driven Devices, Automotive, Aviation, and General Lighting Products, Medical Electrical Equipment, Motors, Industrial, Scientific and Medical (ISM) Radio-Frequency Equipment, Household Appliances, Electric Tools, Low-voltage Switchgear and Control gear, Programmable Controllers, Electrical Equipment for Measurement, Control and Laboratory Use, Base Materials, Power and Data Transmission Cables and Connectors

¹ When the date, edition, version, etc. is not identified in the scope of accreditation, laboratories may use the version that immediately precedes the current version for a period of one year from the date of publication of the standard measurement method, per part C., Section 1 of A2LA R101 - General Requirements - Accreditation of ISO-IEC 17025 Laboratories.

Testing Activities Performed in Support of FCC Certification in Accordance with 47 Code of Federal Regulations and FCC KDB 974614, Appendix A, Table A.1²

Rule Subpart/Technology	Test Method	Maximum Frequency (MHz)
<u>Unintentional Radiators</u>		
Part 15B	ANSI C63.4:2014	40000
<u>Industrial, Scientific, and Medical Equipment</u>		
Part 18	FCC MP-5 (February 1986)	40000
<u>Intentional Radiators</u>		
Part 15C	ANSI C63.10:2013	40000

Testing Activities Performed in Support of FCC Certification in Accordance with 47 Code of Federal Regulations and FCC KDB 974614, Appendix A, Table A.1²

Rule Subpart/Technology	Test Method	Maximum Frequency (MHz)
<u>Unlicensed Personal Communication Systems Devices</u>		
Part 15D	ANSI C63.17:2013	40000
<u>U-NII without DFS Intentional Radiators</u>		
Part 15E	ANSI C63.10:2013	40000
<u>U-NII with DFS Intentional Radiators</u>		
Part 15E	FCC KDB 905462 D02 (v02)	40000
<u>UWB Intentional Radiators</u>		
Part 15F	ANSI C63.10:2013	40000
<u>BPL Intentional Radiators</u>		
Part 15G	ANSI C63.10:2013	40000
<u>White Space Device Intentional Radiators</u>		
Part 15H	ANSI C63.10:2013	40000
<u>Commercial Mobile Services (FCC Licensed Radio Service Equipment)</u>		
Parts 22 (cellular), 24, 25 (below 3 GHz), and 27	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	40000
<u>General Mobile Radio Services (FCC Licensed Radio Service Equipment)</u>		
Parts 22 (non-cellular), 90 (below 3 GHz), 95, 97, and 101 (below 3 GHz)	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	40000
<u>Citizens Broadband Radio Services (FCC Licensed Radio Service Equipment)</u>		
Part 96	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	40000
<u>Maritime and Aviation Radio Services</u>		
Parts 80 and 87	ANSI/TIA-603-E; ANSI C63.26:2015	40000
<u>Microwave and Millimeter Bands Radio Services</u>		
Parts 25, 30, 74, 90 (above 3 GHz), 97 (above 3 GHz), and 101	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	40000

Testing Activities Performed in Support of FCC Certification in Accordance with 47 Code of Federal Regulations and FCC KDB 974614, Appendix A, Table A.1²

Rule Subpart/Technology	Test Method	Maximum Frequency (MHz)
<u>Broadcast Radio Services</u> Parts 73 and 74 (below 3 GHz)	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	40000
<u>Signal Boosters</u> Part 20 (Wideband Consumer Signal Boosters, Provider-specific signal boosters, and Industrial Signal Boosters) Section 90.219	ANSI C63.26:2015	40000

² Accreditation does not imply acceptance to the FCC equipment authorization program. Please see the FCC website (<https://apps.fcc.gov/oetcf/eas/>) for a listing of FCC approved laboratories.



Accredited Laboratory

A2LA has accredited

ELITE ELECTRONIC ENGINEERING INC.

Downers Grove, IL

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. 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).



Presented this 15th day of August 2023.



Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 1786.01
Valid to June 30, 2025

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.