Engineering Test Report No. 2301687-03	
Report Date	January 8, 2024
Manufacturer Name	The Chamberlain Group LLC
Manufacturer Address	300 Windsor Dr Oak Brook, IL 60523
Product Name Brand/Model No.	CBG24DCW
Date Received	December 20, 2023
Assessment Date	January 8, 2024
Specifications	FCC 47 CFR Part 2.1093 KDB, 447498 D01 OET Bulletin 65:1997 RSS-102
Test Facility	Elite Electronic Engineering, Inc. 1516 Centre Circle, Downers Grove, IL 60515
Signature	
Tested by	Javier Cardenas
Signature	
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PO Number	4900092248

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1. Report Revision History

Revision	Date	Description
–	9 JAN 2024	Initial Release of Engineering Test Report No. 2301687-03

2. Introduction

The FCC, Innovation, Science and Economic Development Canada, European Union and Australia/New Zealand publish standards regarding the evaluation of the RF Exposure hazard of radio communications devices. An evaluation has been performed on the The Chamberlain Group LLC gate operator, Model No. CBG24DCW pursuant to the relevant requirements.

3. Subject of Investigation

This document presents the demonstration of RF Exposure compliance on a gate operator, (hereinafter referred to as the Equipment under Test (EUT)). The EUT was identified as follows:

EUT Identification	
Description	gate operator
Model/Part No.	CBG24DCW
S/N	Prototype
Radio Access Technology	WiFi 802.b/g/n, BLE and 900MHz FHSS
Bands of Operation	2400-2483.5MHz and 902-928MHz

4. Standards and Requirements

The tests were performed to selected portions of, and in accordance with the following specifications.

- 47 CFR Parts 1.1310, 2.1091 and 2.1093 Code of Federal Regulations, Title 47, Telecommunications

- KDB 447498 D01 – “RF Exposure Procedures and Equipment Authorization Polices for Mobile and Portable Devices, General RF Exposure Guidance v06”

- OET Bulletin 65 Edition 97-01:1997 – “Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields”

- ANSI/IEEE C95.1:1992 – "Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz,"

- RSS-102, Issue 5 Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands

- 1999/519/EC Council Recommendation on the Limitation of Exposure of The General Public to Electromagnetic fields (0Hz-300GHz)

5. Sample Calculations

The far field power density can be calculated using the following formula:

$$S = \frac{PG}{4\pi R^2} \quad (1)$$

where P is the transmit output power (mW), G is the maximum antenna gain relative to an isotropic antenna (linear) and R is the evaluation distance (cm).

In cases where multiple antennas are utilized for a single signal, the following formula is applied to calculate the maximum antenna gain:

$$Gain\ (dBi) = G + 10\log \mathrm{N} \quad (2)$$

where N is the number of antennas, G is the gain of a single antenna.

A minimum separation distance can be calculated using the following formulas

$$Minimum\ Seperation\ Distance = \sqrt{\frac{PG}{4\pi(Power\ Density\ Limit)}} \quad (3)$$

where P is the transmit output power (mW) and G is the maximum antenna gain relative to an isotropic antenna (linear).

For sources with frequencies <30MHz

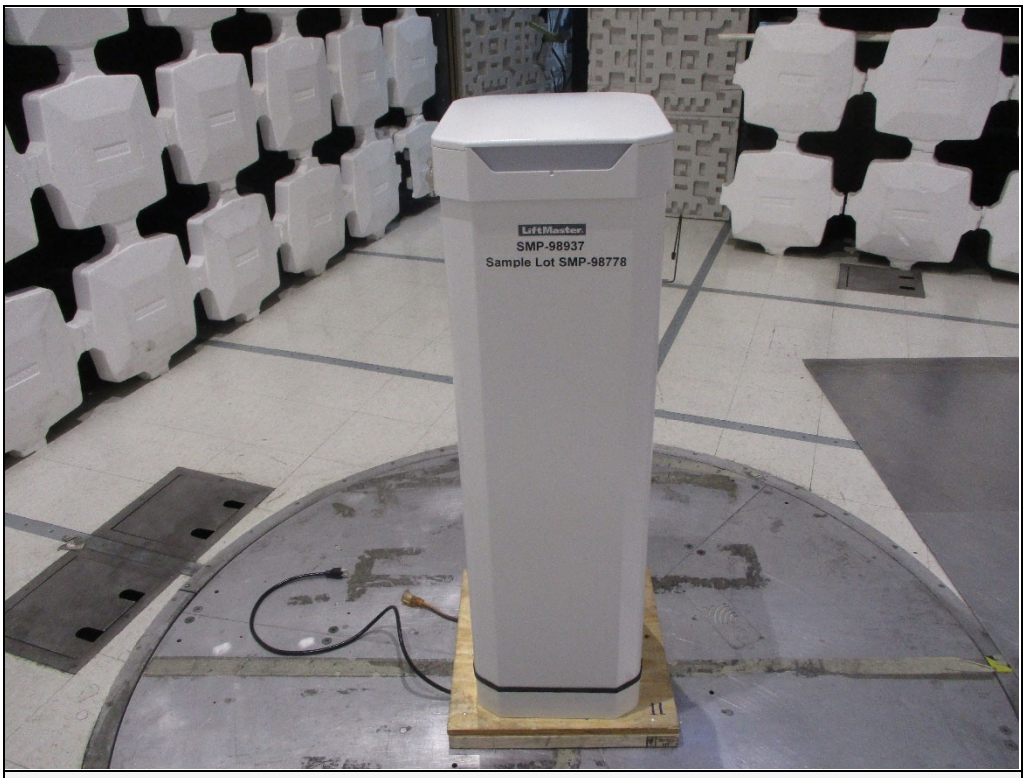
$$Seperation\ Distance = R\left(10^{\frac{(FS_{Limit}-FS_R)}{40}}\right)^{-1} \quad (4)$$

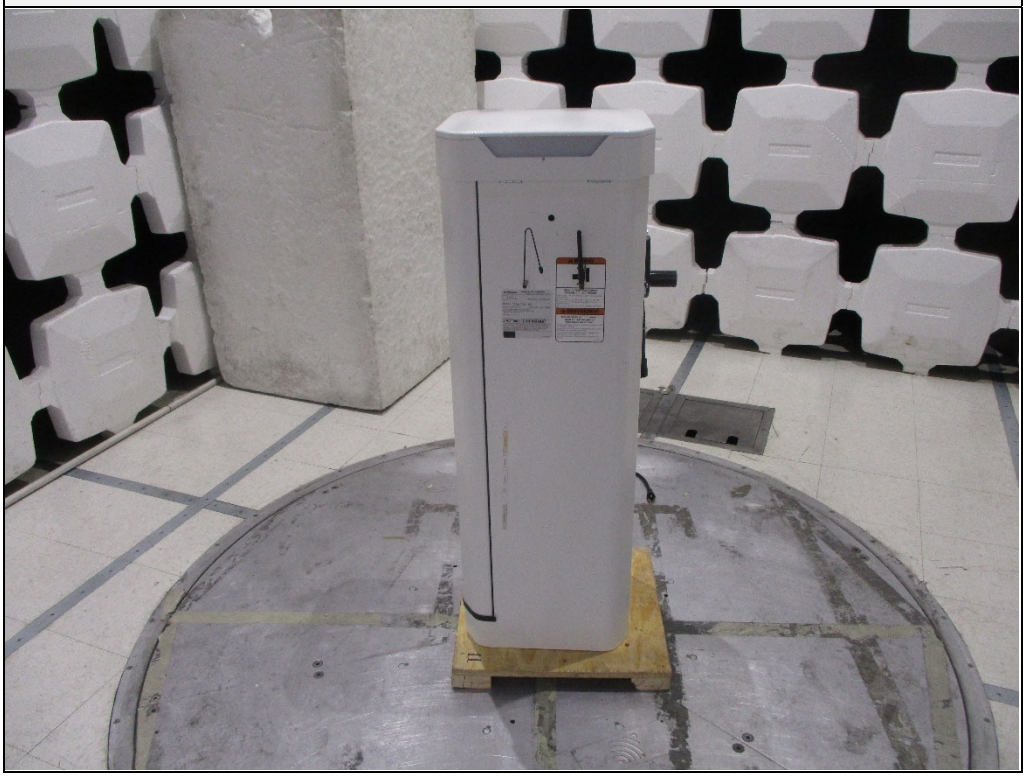
For sources with frequencies >30MHz

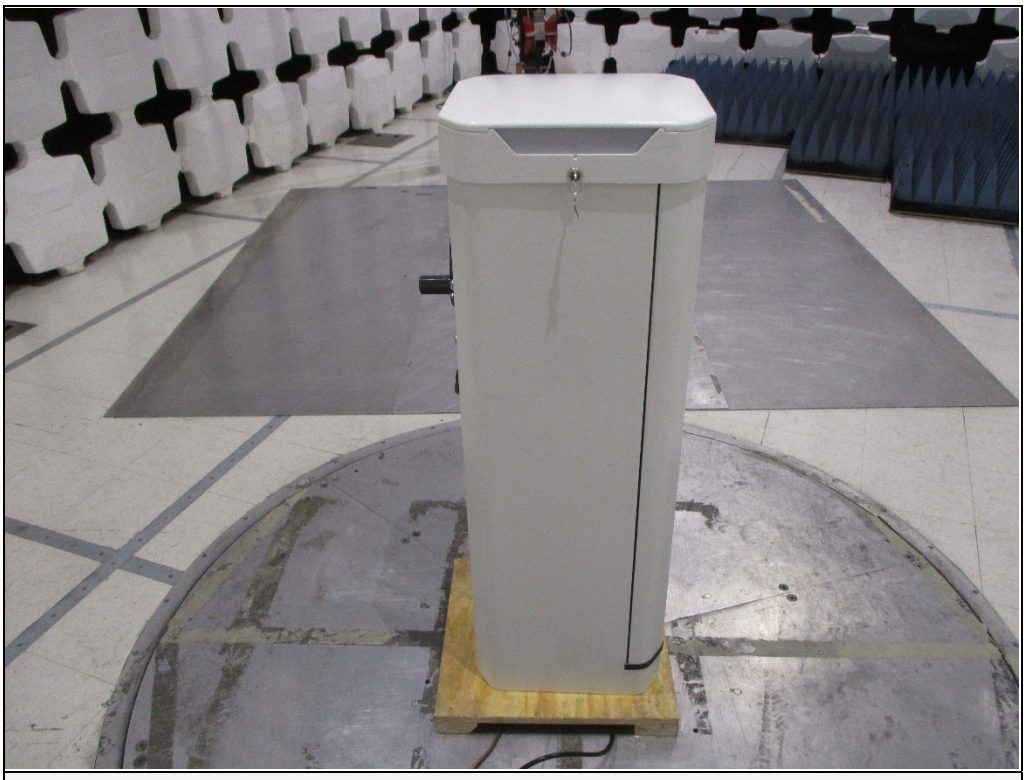
$$Seperation\ Distance = R\left(10^{\frac{(FS_{Limit}-FS_R)}{20}}\right)^{-1} \quad (5)$$

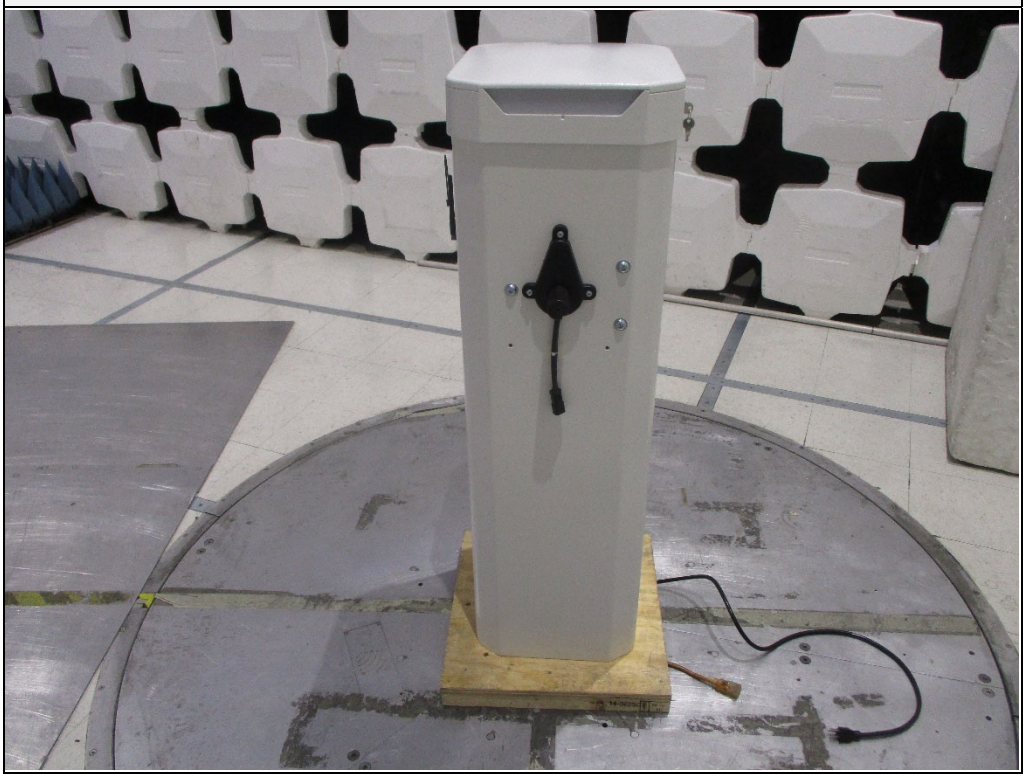
where R is the measurement distance, FS_{Limit} is the field strength limit and FS_R is the measured field strength at distance R.

6. Photographs of EUT









7. Limits and Requirements

7.1. Requirements mandated by the FCC

Equipment pursuing compliance to the requirements with respect to the limits of human exposure to RF provided in FCC 1.1310, need follow the criteria in FCC 1.1307(b)(1).

Equipment exemption qualification must be demonstrated pursuant to FCC 1.1307(b)(3).

RF Source frequency (MHz)	Threshold ERP (watts)
0.3 – 1.34	1920 R^2
1.34 – 30	3450 R^2 / f^2
30 – 300	3.83 R^2
300 – 1,500	0.0128 R^2
1,500 – 100,000	19.2 R^2

Multiple RF sources are exempt if:

- FCC 1.1307(b)(3)(ii)(A) The available maximum time-averaged power of each source is no more than 1 mW and there is a separation distance of two centimeters between any portion of a radiating structure operating and the nearest portion of any other radiating structure in the same device, except if the sum of multiple sources is less than 1 mW during the time-averaging period, in which case they may be treated as a single source (separation is not required).

- FCC 1.1307(b)(3)(ii)(B) in the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation.

$$\sum_{i=1}^{a} \frac{P_i}{P_{th,i}} + \sum_{j=1}^{b} \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^{c} \frac{Evaluated_k}{Exposure\ Limit_k} \leq 1$$

Where:

a = number of fixed, mobile, or portable RF sources claiming exemption using paragraph (b)(3)(i)(B) of this section for *Pth*, including existing exempt transmitters and those being added.

b = number of fixed, mobile, or portable RF sources claiming exemption using paragraph (b)(3)(i)(C) of this section for Threshold ERP, including existing exempt transmitters and those being added.

c = number of existing fixed, mobile, or portable RF sources with known evaluation for the specified minimum distance including existing evaluated transmitters.

Pi = the available maximum time-averaged power or the ERP, whichever is greater, for fixed, mobile, or portable RF source *i* at a distance between 0.5 cm and 40 cm (inclusive).

Pth,i = the exemption threshold power (*Pth*) according to paragraph (b)(3)(i)(B) of this section for fixed, mobile, or portable RF source *i.*

ERPj = the ERP of fixed, mobile, or portable RF source *j.*

ERPth,j = exemption threshold ERP for fixed, mobile, or portable RF source *j,* at a distance of at least λ/2π according to the applicable formula of paragraph (b)(3)(i)(C) of this section.

Evaluatedk = the maximum reported SAR or MPE of fixed, mobile, or portable RF source *k* either in the device or at the transmitter site from an existing evaluation at the location of exposure.

Exposure Limitk = either the general population/uncontrolled maximum permissible exposure (MPE) or specific absorption rate (SAR) limit for each fixed, mobile, or portable RF source *k,* as applicable from § 1.1310 of this chapter.

If it is determined that the equipment under investigation is not exempt from routine evaluation an assessment must be performed to determine compliance in regard to the RF exposure limits by means of measurement or calculation of the electric field, magnetic field or power density. It may be the case that a minimum separation distance will need to be calculated or measured and maintained from the source of RF to meet the basic restrictions.

In environments where the possibility of simultaneous exposure to fields on different frequencies exists, the exposure shall be considered to be additive. The fraction of the recommended limit incurred within each frequency should be determined, and the sum of all fractional contributions should not exceed 1.0.

Per 1.1310(e)(1), the power density shall not exceed the levels below:

Limits for General/Uncontrolled Exposure			
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)
0.3 – 1.34	614	1.63	*100
1.34 – 30	842 / f	2.19 / f	*180 / f^2
30 – 300	27.5	0.073	0.2
300 – 1,500	—	—	f / 1500
1,500 – 100,000	—	—	1.0
f – Frequency in MHz * – Plane wave Equivalent Power Density			

7.2. Requirements mandated by Innovation, Science and Economic Development Canada

The RF exposure level shall be determined by either measurement or by calculating the power density at an evaluation distance of 0.2m, as specified by ANSI/IEEE C95.1-1992.

If it is found that the product meets the low power exclusion level criteria listed in RSS 102 Section 2.5.2, no further RF exposure evaluation is required. The low power exclusion level criteria are given in the following table (f is given in MHz):

RF Source Frequency (MHz)	Threshold ERP (watts)
$f < 20$ MHz	$x \leq 1$
20 MHz $\leq f < 48$ MHz	$x \leq \frac{4.49}{f^{0.5}}$
48 MHz $\leq f < 300$ MHz	$x \leq 0.6$
300 MHz $\leq f < 6$ GHz	$x \leq (1.31 * 10^{-2}) * f^{0.6834}$
6 GHz $\leq f$	$x \leq 5$

If it is determined that the measured or calculated power density does not meet the basic restrictions, a separation distance must be measured or calculated such that the basic restrictions are met.

In environments where the possibility of simultaneous exposure to fields on different frequencies exists, the exposure shall be considered to be additive. The fraction of the recommended limit incurred within each frequency should be determined, and the sum of all fractional contributions should not exceed 1.0. The following formula shall apply:

$$\sum_{i=1}^{n} \frac{S_{C,1}}{S_{L,1}} + \frac{S_{C,2}}{S_{L,2}} + \frac{S_{C,3}}{S_{L,3}} + \cdots \frac{S_{C,n}}{S_{L,n}} \leq 1 \qquad (6)$$

where:

S_C is the measured/calculated power density.
S_L is the RF exposure limit.

Per RSS 102 Section 4, the power density shall not exceed the levels below:

Limits for General/Uncontrolled Exposure			
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (W/m^2)
0.003 – 10*	83	90	—
0.1 – 10*	—	0.73 / f	—
1.1 – 10*	$87 / f^{0.5}$	—	—
10 – 20	27.46	0.0728	2
20 – 48	$58.07 / f^{0.25}$	$0.1540 / f^{0.25}$	$8.944 / f^{.05}$
48 – 300	22.06	0.05852	1.291
300 – 6000	$3.142\ f^{0.3417}$	$0.008335\ f^{0.3417}$	$0.02619\ f^{0.6834}$
6000 – 15000	61.4	0.163	10
15000 – 150000	61.4	0.163	10
150000 – 300000	$0.158\ f^{0.5}$	$4.21 \times 10^{-4}\ f^{0.5}$	$6.67 \times 10^{-5}\ f$
f – Frequency in MHz			

*Limits only apply to Specific Absorption Rate and Nerve Stimulation requirements.

8. Assessment Results

8.1. RF Exposure Evaluation Relevant to the Requirements of the FCC

Radio Access Technology	*f* Transmit Frequency (MHz)	P Conducted Output Power (dBm)	ERP (dBm)	EIRP (dBm)
WiFi 802.11n20	2412	22	23.25	25.40
900MHz FHSS	902.245	13	21.65	23.80

Radio Access Technology	*f* Transmit Frequency (MHz)	ERP (W)	ERP_{th} Threshold Limit (W)	Fractional Contribution	∑ Fractional Contributions
WiFi 802.11n20	2412	0.211	0.768	0.275	0.592
900MHz FHSS	902.245	0.146	0.462	0.317	

Radio Access Technology	*f* Transmit Frequency (MHz)	P Conducted Output Power (dBm)	ERP (dBm)	EIRP (dBm)
BLE	2402	-1	1.25	3.40
900MHz FHSS	902.245	13	21.65	23.80

Radio Access Technology	*f* Transmit Frequency (MHz)	ERP (W)	ERP_{th} Threshold Limit (W)	Fractional Contribution	∑ Fractional Contributions
BLE	2402	0.001	0.768	0.002	0.319
900MHz FHSS	902.245	0.146	0.462	0.317	

The equipment under investigation is determined to be exempt from routine evaluation per FCC 1.1307(b)(3)(ii)(B)

8.2. RF Exposure Evaluation Relevant to the Requirements of the ISED

Radio Access Technology	*f* Transmit Frequency (MHz)	EIRP (dBm)	EIRP (W)
WiFi 802.11n20	2412	25.4	0.347
900MHz FHSS	902.245	23.8	0.240

Radio Access Technology	*f* Transmit Frequency (MHz)	EIRP (dBm)	EIRP (W)
BLE	2402	3.4	0.002
900MHz FHSS	902.245	23.8	0.240

8.2.1.Assessment Results for General/Uncontrolled Environments

Evaluation was made at a 20cm separation distance.

Radio Access Technology	*f* Transmit Frequency (MHz)	S_C Calculated Power Density (W/m^2)	S_L Power Density Limit (W/m^2)	S_C:S_L Ratio	∑ S_C:S_L Ratio
WiFi 802.11n20	2412	0.690	5.37	0.129	0.303
900MHz FHSS	902.245	0.477	2.74	0.174	

Radio Access Technology	*f* Transmit Frequency (MHz)	S_C Calculated Power Density (W/m^2)	S_L Power Density Limit (W/m^2)	S_C:S_L Ratio	∑ S_C:S_L Ratio
BLE	2402	0.004	5.35	0.001	0.175
900MHz FHSS	902.245	0.477	2.74	0.174	

9. Statement of Compliance

The The Chamberlain Group LLC gate operator, Model CBG24DCW is in compliance with the FCC and Innovation, Science and Economic Development Canada for RF Exposure at a minimum separation distance of 20cm.

10. 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 and Innovation, Science and Economic Development Canada, requirements for RF Exposure 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.