



Engineering Test Report No. 2200529-04	
Report Date	May 23, 2022
Manufacturer Name	Chamberlain Group, Inc.
Manufacturer Address	300 Windsor Dr Oak Brook, IL 60523
Product Name Brand/Model No.	GDO 003-0454-1 Rev B
Date Received	May 2, 2022
Assessment Date	May 23, 2022
Specifications	FCC 47 CFR Part 2.1093 KDB, 447498 D01 OET Bulletin 65:1997 RSS-102
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## 1. Report Revision History

Revision	Date	Description
-	07 JUN 2022	Initial Release of Engineering Test Report No. 2200529-04

## 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 Chamberlain Group, Inc. Falcon GDO Logic Board, Model No. GDO 003-0454-1 Rev B pursuant to the relevant requirements.

## 3. Subject of Investigation

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

EUT Identification	
Description	Falcon GDO Logic Board
Model/Part No.	GDO 003-0454-1 Rev B
S/N	Sample 1
Equipment Classification	Fixed
Radio Access Technology	802.11b/g/n BLE x 3 (Realte BLE, Sec 3.0 BLE and Cam BLE) FHSS 900MHz
EIRP	Realtek 802.11b/g/n: 19.63dBm Realtek BLE: 4.8dBm Cam BLE: 4.26dBm FHSS 900MHz: 18.79dBm
Bands of Operation	902-928MHz 2400-24865MHz
Minimum User/Equipment Separation Distance	≥20cm for mobile

## 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 Policies 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)

## 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:

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

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

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

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

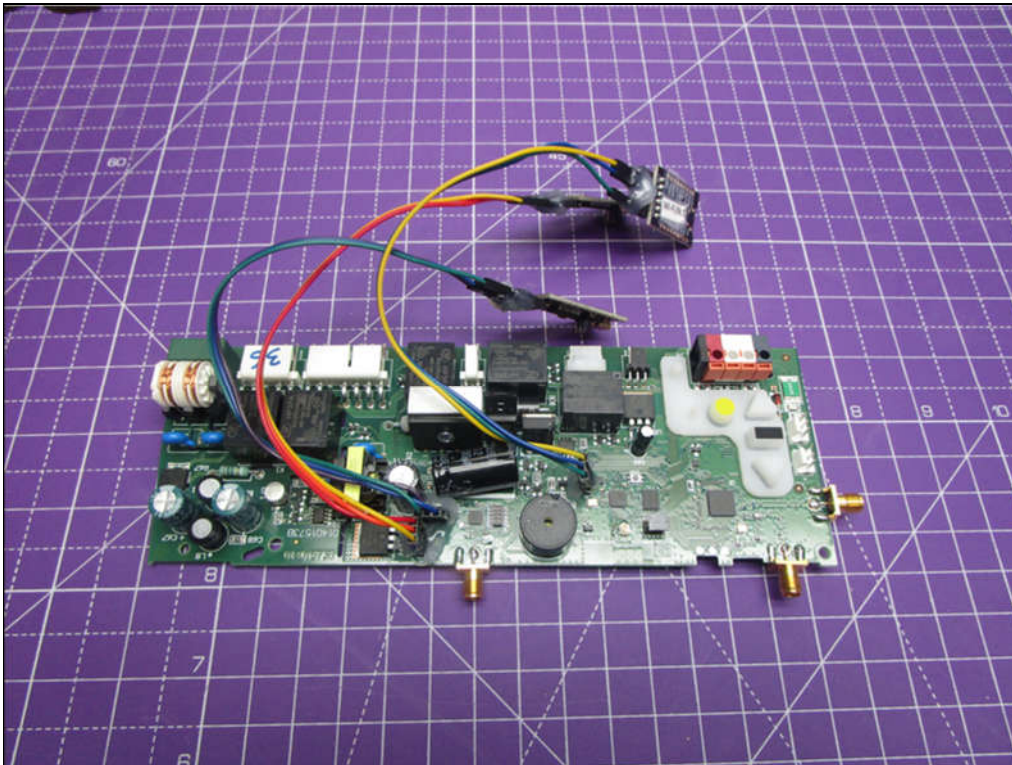
$$\text{Separation Distance} = R \left( 10^{\frac{(FS_{Limit}-FS_R)}{40}} \right)^{-1} \quad (4)$$

For sources with frequencies >30MHz

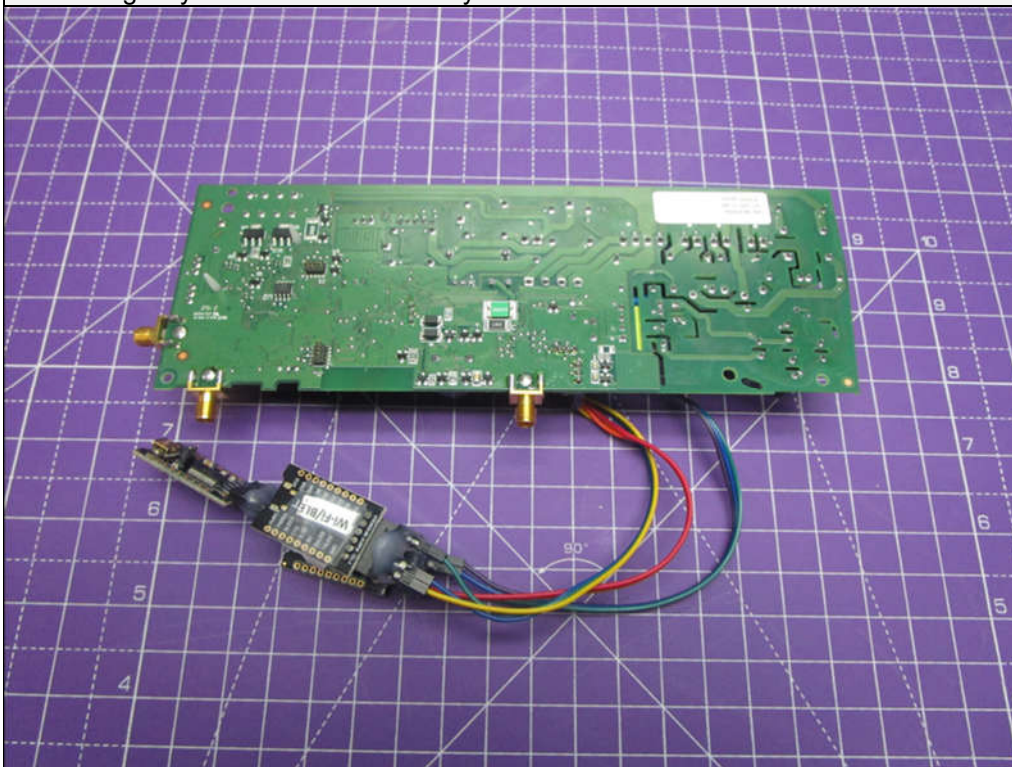
$$\text{Separation Distance} = R \left( 10^{\frac{(FS_{Limit}-FS_R)}{20}} \right)^{-1} \quad (5)$$

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

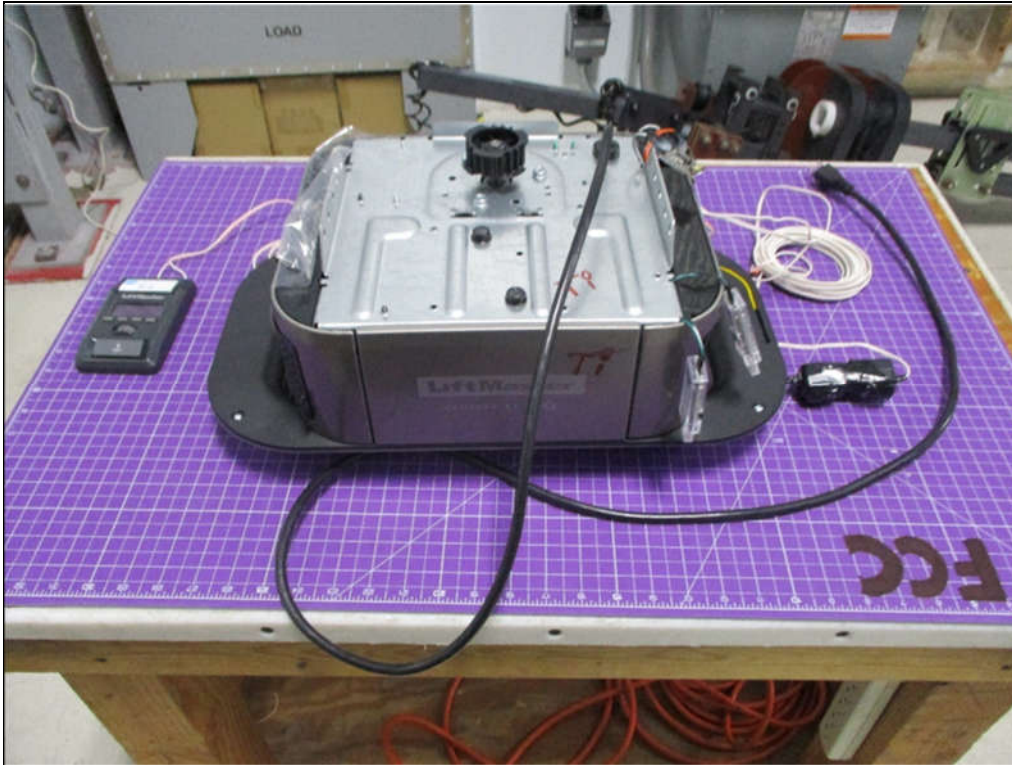
## 6. Photographs of EUT



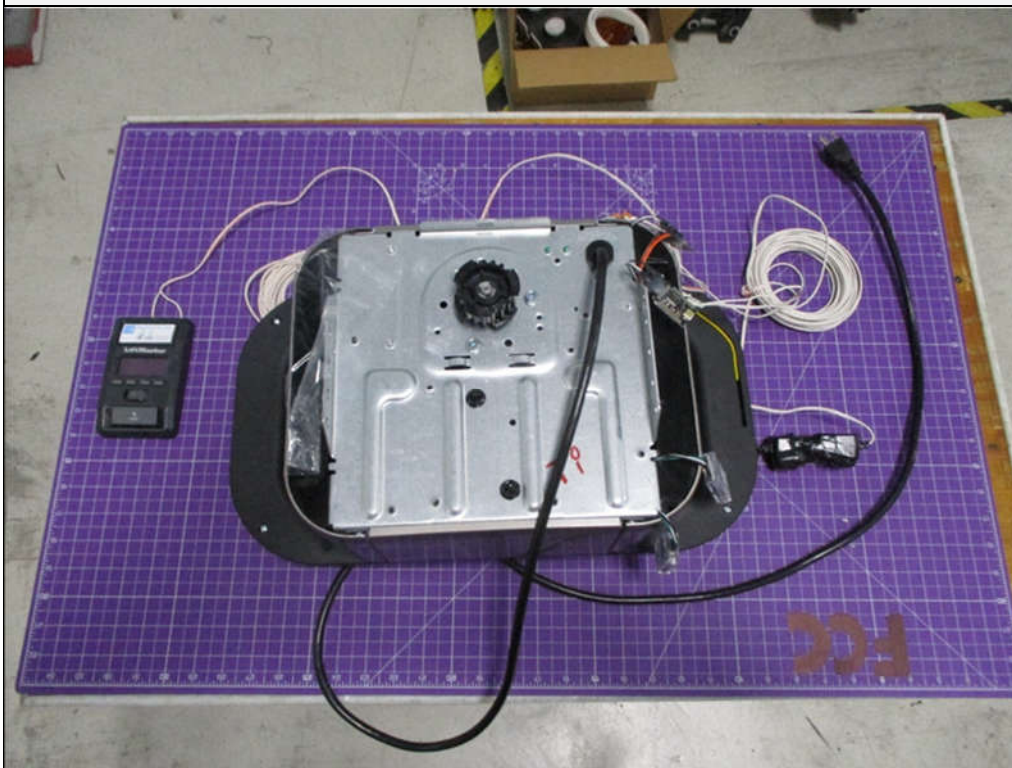
EUT top and bottom. EUT modified with external connectors for antenna conducted testing only. EUT does not normally have the external connectors attached.







EUT tested in a host GDO



## 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).

Multiple RF sources are exempt if:

Exemption 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).

Exemption 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  $P_{th}$ , 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.

$P_i$  = 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).

$P_{th,i}$  = the exemption threshold power ( $P_{th}$ ) according to paragraph (b)(3)(i)(B) of this section for fixed, mobile, or portable RF source  $i$ .

$ERP_j$  = the ERP of fixed, mobile, or portable RF source  $j$ .

$ERP_{th,j}$  = exemption threshold ERP for fixed, mobile, or portable RF source  $j$ , at a distance of at least  $\lambda/2\pi$  according to the applicable formula of paragraph (b)(3)(i)(C) of this section.

$Evaluated_k$  = 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.

$Exposure\ Limit_k$  = 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.



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:

$$\sum_{i=1}^n \frac{S_1}{S_{L,1}} + \frac{S_2}{S_{L,2}} + \frac{S_3}{S_{L,3}} + \dots + \frac{S_n}{S_{L,n}} \leq 1 \tag{6}$$

where:

S is the measured/calculated power density.

S<sub>L</sub> is the MPE limit.

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

Limits for Occupational/Controlled Exposure			
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )
0.3 - 3.0	614	1.63	*100
3.0 – 30	1842 / f	4.89 / f	*900 / f <sup>2</sup>
30 – 300	61.4	0.163	1.0
300 – 1,500	—	—	f / 300
1,500 – 100,000	—	—	5
Limits for General/Uncontrolled Exposure			
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )
0.3 – 1.34	614	1.63	*100
1.34 – 30	842 / f	2.19 / f	*180 / f <sup>2</sup>
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 is 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)
$f < 20 \text{ MHz}$	$x \leq 1$
$20 \text{ MHz} \leq f < 48 \text{ MHz}$	$x \leq \frac{4.49}{f^{0.5}}$
$48 \text{ MHz} \leq f < 300 \text{ MHz}$	$x \leq 0.6$
$300 \text{ MHz} \leq f < 6 \text{ GHz}$	$x \leq (1.31 * 10^{-2}) * f^{0.6834}$
$6 \text{ GHz} \leq f$	$x \leq 5$

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:

$$\sum_{i=1}^n \frac{S_{C,i}}{S_{L,i}} + \frac{S_{C,2}}{S_{L,2}} + \frac{S_{C,3}}{S_{L,3}} + \dots + \frac{S_{C,n}}{S_{L,n}} \leq 1 \tag{7}$$

where:

- S<sub>C</sub> is the measured/calculated power density.
- S<sub>L</sub> is the RF exposure limit.

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

Limits for Occupational/Controlled Exposure			
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (W/m <sup>2</sup> )
0.003 – 10*	170	180	—
0.1 – 10*	—	1.6 / f	—
1.29 – 10*	193 / f <sup>0.5</sup>	—	—
10 – 20	61.4	0.163	10
20 – 48	129.8 / f <sup>0.25</sup>	0.3444 / f <sup>0.25</sup>	44.72 / f <sup>0.5</sup>
48 – 100	49.33	0.1309	6.455
100 – 6000	15.60 f <sup>0.25</sup>	0.04138 f <sup>0.25</sup>	0.6455 f <sup>0.5</sup>
6000 – 15000	137	0.364	50
15000 – 150000	137	0.364	50
150000 – 300000	0.354 f <sup>0.5</sup>	9.40x10 <sup>-4</sup> f <sup>0.5</sup>	3.33x10 <sup>-4</sup> f
Limits for General/Uncontrolled Exposure			
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (W/m <sup>2</sup> )
0.003 – 10*	83	90	—
0.1 – 10*	—	0.73 / f	—
1.1 – 10*	87 / f <sup>0.5</sup>	—	—
10 – 20	27.46	0.0728	2
20 – 48	58.07 / f <sup>0.25</sup>	0.1540 / f <sup>0.25</sup>	8.944 / f <sup>0.5</sup>
48 – 300	22.06	0.05852	1.291
300 – 6000	3.142 f <sup>0.3417</sup>	0.008335 f <sup>0.3417</sup>	0.02619 f <sup>0.6834</sup>
6000 – 15000	61.4	0.163	10
15000 – 150000	61.4	0.163	10
150000 – 300000	0.158 f <sup>0.5</sup>	4.21x10 <sup>-4</sup> f <sup>0.5</sup>	6.67x10 <sup>-5</sup> 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

Configuration 1:

Radio Access Technology	$f$ Transmit Frequency (MHz)	ERP/P (dBm)	ERP/P (mW)
Realtek 802.11g	2437.00	19.63	91.83
Cam BLE	2402.00	4.26	2.67
FHSS 900MHz	926.75	18.79	75.68

Radio Access Technology	$f$ Transmit Frequency (MHz)	ERP/P (mW)	Power Threshold (mW)	Fractional Contributions	$\Sigma$ Fractional Contributions
Realtek 802.11g	2437.00	91.83	3060.00	0.03	0.07
Cam BLE	2402.00	2.67	3060.00	$8.72 \times 10^{-4}$	
FHSS 900MHz	926.75	75.68	1890.57	0.04	

Configuration 2:

Radio Access Technology	$f$ Transmit Frequency (MHz)	ERP/P (dBm)	ERP/P (mW)
Realtek BLE	2440.00	4.80	3.02
Cam BLE	2402.00	4.26	2.67
FHSS 900MHz	926.75	18.79	75.68

Radio Access Technology	$f$ Transmit Frequency (MHz)	ERP/P (mW)	Power Threshold (mW)	Fractional Contributions	$\Sigma$ Fractional Contributions
Realtek BLE	2440.00	3.02	3060.00	$9.87 \times 10^{-4}$	0.04
Cam BLE	2402.00	2.67	3060.00	$8.72 \times 10^{-4}$	
FHSS 900MHz	926.75	75.68	1890.57	0.04	

8.2. RF Exposure Evaluation Relevant to the Requirements of ISED

Combination 1:

Radio Access Technology	$f$ Transmit Frequency (MHz)	EIRP (dBm)	EIRP (W)
Realtek 802.11g	2437.00	19.63	0.09
Cam BLE	2402.00	4.26	$2.67 \times 10^{-3}$
FHSS 900MHz	926.75	18.79	0.08

Assessment Results Relevant to General/Uncontrolled Exposure Limits					
Radio Access Technology	$f$ Transmit Frequency (MHz)	$S_c$ Calculated Power Density (W/m <sup>2</sup> )	$S_L$ Power Density Limit (W/m <sup>2</sup> )	$S_c:S_L$ Ratio	$\sum S_c:S_L$ Ratio
Realtek 802.11g	2437.00	0.18	5.40	0.03	0.09
Cam BLE	2402.00	0.01	5.35	$9.92 \times 10^{-4}$	
FHSS 900MHz	926.75	0.15	2.79	0.05	

Assessment Results Relevant to Occupational/Controlled Exposure Limits					
Radio Access Technology	$f$ Transmit Frequency (MHz)	$S_c$ Calculated Power Density (W/m <sup>2</sup> )	$S_L$ Power Density Limit (W/m <sup>2</sup> )	$S_c:S_L$ Ratio	$\sum S_c:S_L$ Ratio
Realtek 802.11g	2437.0000	0.1827	31.87	$5.73 \times 10^{-3}$	0.01
Cam BLE	2402.0000	0.0053	31.64	$1.68 \times 10^{-4}$	
FHSS 900MHz	926.7500	0.1506	19.65	$7.662 \times 10^{-3}$	



Combination 2:

Radio Access Technology	$f$ Transmit Frequency (MHz)	EIRP (dBm)	EIRP (W)
Realtek BLE	2440.00	4.80	$3.02 \times 10^{-3}$
Cam BLE	2402.00	4.26	$2.67 \times 10^{-3}$
FHSS 900MHz	926.75	18.79	0.08

Assessment Results Relevant to General/Uncontrolled Exposure Limits					
Radio Access Technology	$f$ Transmit Frequency (MHz)	$S_c$ Calculated Power Density (W/m <sup>2</sup> )	$S_L$ Power Density Limit (W/m <sup>2</sup> )	$S_c:S_L$ Ratio	$\sum S_c:S_L$ Ratio
Realtek BLE	2440.00	0.01	5.41	$1.11 \times 10^{-3}$	0.06
Cam BLE	2402.00	0.01	5.35	$9.92 \times 10^{-4}$	
FHSS 900MHz	926.75	0.15	2.79	0.05	

Assessment Results Relevant to Occupational/Controlled Exposure Limits					
Radio Access Technology	$f$ Transmit Frequency (MHz)	$S_c$ Calculated Power Density (W/m <sup>2</sup> )	$S_L$ Power Density Limit (W/m <sup>2</sup> )	$S_c:S_L$ Ratio	$\sum S_c:S_L$ Ratio
Realtek BLE	2440.00	0.0060	31.89	$1.88 \times 10^{-4}$	$8.02 \times 10^{-3}$
Cam BLE	2402.00	0.0053	31.64	$1.68 \times 10^{-4}$	
FHSS 900MHz	926.75	0.1506	19.65	$7.66 \times 10^{-3}$	

## 9. Statement of Compliance

The Chamberlain Group, Inc. Falcon GDO Logic Board, Model GDO 003-0454-1 Rev B is in compliance with the FCC and Innovation, Science and Economic Development Canada requirements for RF Exposure.