



Engineering Test Report No. 2201780-07	
Report Date	June 7, 2022
Manufacturer Name	Chamberlain Group Inc.
Manufacturer Address	300 Windsor Dr Oak Brook, IL 60523
Product Name Brand/Model No.	Phoenix AC GDO Logic Board 003-0458-5
Date Received	April 26, 2022
Assessment Dates	April 27, 2022 – May 25, 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
-	08 JUN 2022	Initial Release of Engineering Test Report No. 2201780-07

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. Phoenix AC GDO Logic Board, Model No. 003-0458-5 pursuant to the relevant requirements.

3. Subject of Investigation

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

EUT Identification	
Description	Phoenix AC GDO Logic Board
Model/Part No.	003-0458-5
S/N	151220510865
Equipment Classification	Fixed
Radio Access Technology	802.11b 802.11g 802.11n BLE (Realtek) BLE (Security 3.0) FHSS
EIRP	802.11b: 20.8dBm 802.11g: 23.8dBm 802.11n: 21.7dBm BLE (Realtek): 2.8dBm BLE (Security 3.0): 12.2dBm FHSS: 22.9dBm
Bands of Operation	902-928MHz 2400-2483.5MHz
Minimum User/Equipment Separation Distance	≥ 20cm

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

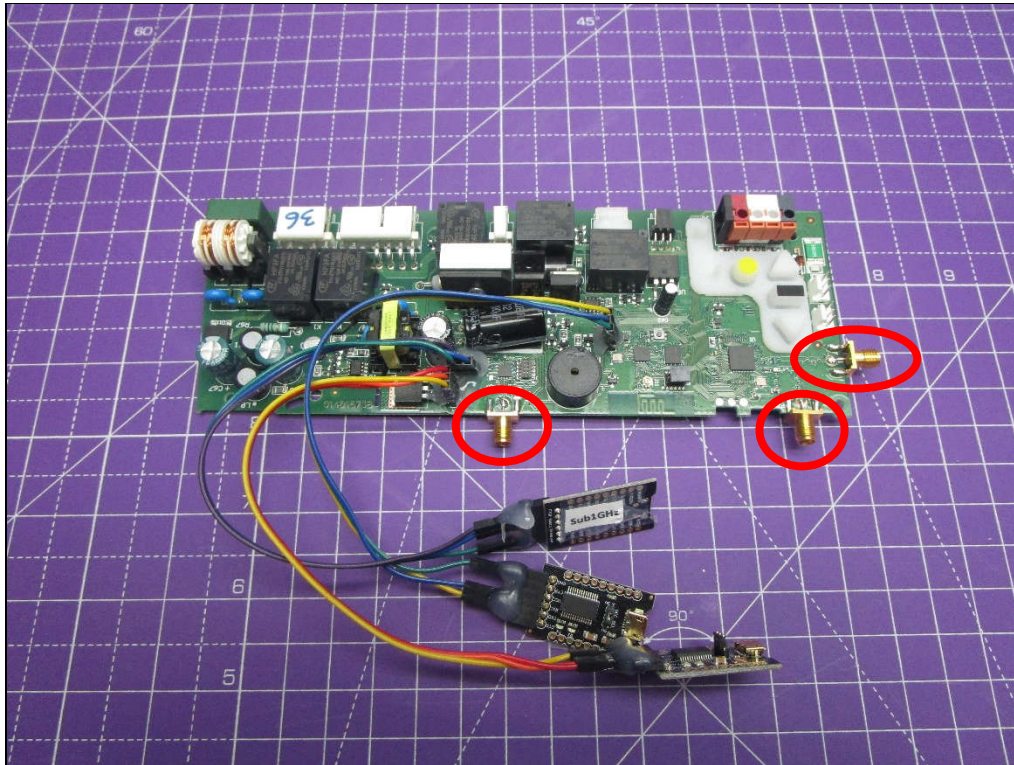
$$\text{Separation Distance} = R \left(10^{\frac{(FS_{Limit}-FS_R)}{40}} \right)^{-1} \quad (4)$$

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



Above Antenna Ports populated in final product.
Pictured below is the complete GDO that the Phoenix Logic Board will sit inside.





7. Limits and Requirements

7.1. Requirements mandated by the FCC

The first step is to determine if the product is categorically exempt from RF exposure evaluation based on the criteria listed in 1.1307(b)(1)

The next step is to evaluate RF exposure either by measurement or by calculating the power density at distance of 0.2m, as specified by ANSI/IEEE C95.1-1992. If it is determined that the resulting 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:

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

where:

- S is the measured/calculated power density.
- S_L 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 ²)
0.3 - 3.0	614	1.63	*100
3.0 – 30	1842 / f	4.89 / f	*900 / f ²
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 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 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 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. 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.

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_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 Occupational/Controlled Exposure			
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (W/m ²)
0.003 – 10	170	180	—
0.1 – 10	—	1.6 / f	—
1.29 – 10	193 / f ^{0.5}	—	—
10 – 20	61.4	0.163	10
20 – 48	129.8 / f ^{0.25}	0.3444 / f ^{0.25}	44.72 / f ^{0.5}
48 – 100	49.33	0.1309	6.455
100 – 6000	15.60 f ^{0.25}	0.04138 f ^{0.25}	0.6455 f ^{0.5}
6000 – 15000	137	0.364	50
15000 – 150000	137	0.364	50
150000 – 300000	0.354 f ^{0.5}	9.40x10 ⁻⁴ f ^{0.5}	3.33x10 ⁻⁴ f
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 ^{0.5}
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}	4.21x10 ⁻⁴ f ^{0.5}	6.67x10 ⁻⁵ f

f – Frequency in MHz

8. Assessment Results

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

Mode 1:

Radio Access Technology	f Transmit Frequency (MHz)	ERP/P (dBm)	ERP/P (mW)
802.11g	2412	23.8	239.88
Security BLE	2480	12.2	16.60
FHSS 900MHz	902.25	22.9	194.98

Radio Access Technology	f Transmit Frequency (MHz)	ERP/P (mW)	Power Threshold (mW)	Fractional Contributions	Σ Fractional Contributions
802.11g	2412.00	239.88	3060.00	0.078393	0.19
Security BLE	2480.00	16.60	3060.00	0.005423	
FHSS 900MHz	902.25	194.98	1840.59	0.105936	

Mode 2:

Radio Access Technology	f Transmit Frequency (MHz)	ERP/P (dBm)	ERP/P (mW)
Realtek BLE	2402	2.8	1.91
FHSS 900MHz	902.25	22.9	194.98

Radio Access Technology	f Transmit Frequency (MHz)	ERP/P (mW)	Power Threshold (mW)	Fractional Contributions	Σ Fractional Contributions
Realtek BLE	2402.00	1.91	3060.00	0.000623	0.11
FHSS 900MHz	902.25	194.98	1840.59	0.105936	

8.2. RF Exposure Evaluation Relevant to the Requirements of ISED

Mode 1:

Radio Access Technology	f Transmit Frequency (MHz)	EIRP (dBm)	EIRP (W)
802.11g	2412	23.8	0.23988
Security BLE	2480	12.2	0.02
FHSS 900MHz	902.25	22.9	0.19

Assessment Results Relevant to General/Uncontrolled Exposure Limits					
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	$\sum S_c:S_L$ Ratio
802.11g	2412.00	0.48	5.37	0.08894	0.24
Security BLE	2480.00	0.03	5.47	0.006037	
FHSS 900MHz	902.25	0.39	2.74	0.141555	

Assessment Results Relevant to Occupational/Controlled Exposure Limits					
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	$\sum S_c:S_L$ Ratio
802.11g	2412.0000	0.4772	31.7019	0.015054	0.0361
Security BLE	2480.0000	0.0330	32.1456	0.001027	
FHSS 900MHz	902.2500	0.3879	19.3892	0.020006	

Mode 2:

Radio Access Technology	f Transmit Frequency (MHz)	EIRP (dBm)	EIRP (W)
Realtek BLE	2402	2.8	0.00191
FHSS 900MHz	902.25	22.9	0.19

Assessment Results Relevant to General/Uncontrolled Exposure Limits

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	\sum $S_c:S_L$ Ratio
Realtek BLE	2402.00	0.00	5.35	0.00071	0.14
FHSS 900MHz	902.25	0.39	2.74	0.141555	

Assessment Results Relevant to Occupational/Controlled Exposure Limits

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	\sum $S_c:S_L$ Ratio
Realtek BLE	2402.0000	0.0038	31.6361	0.000120	0.0201
FHSS 900MHz	902.2500	0.3879	19.3892	0.020006	

9. Statement of Compliance

The Chamberlain Group Inc. Phoenix AC GDO Logic Board, Model 003-0458-5 is in compliance with the FCC and Innovation, Science and Economic Development Canada, requirements for RF Exposure.