



| Engineering Test Report No. 2201780-07 | |
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| 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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| Tested by | Nathaniel Bouchie |
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| Approved by | Raymond J. Klouda, Registered Professional Engineer of Illinois – 44894 |
| PO Number | 4900083434 |
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Table of Contents

| | | |
|------|--|----|
| 1. | Report Revision History | 3 |
| 2. | Introduction | 4 |
| 3. | Subject of Investigation | 4 |
| 4. | Standards and Requirements | 4 |
| 5. | Sample Calculations | 5 |
| 6. | Photographs of EUT | 6 |
| 7. | Limits and Requirements | 8 |
| 7.1. | Requirements mandated by the FCC | 8 |
| 7.2. | Requirements mandated by Innovation, Science and Economic Development Canada | 9 |
| 8. | Assessment Results | 10 |
| 8.1. | RF Exposure Evaluation Relevant to the Requirements of the FCC | 10 |
| 8.2. | RF Exposure Evaluation Relevant to the Requirements of ISED | 11 |
| 9. | Statement of Compliance | 12 |

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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

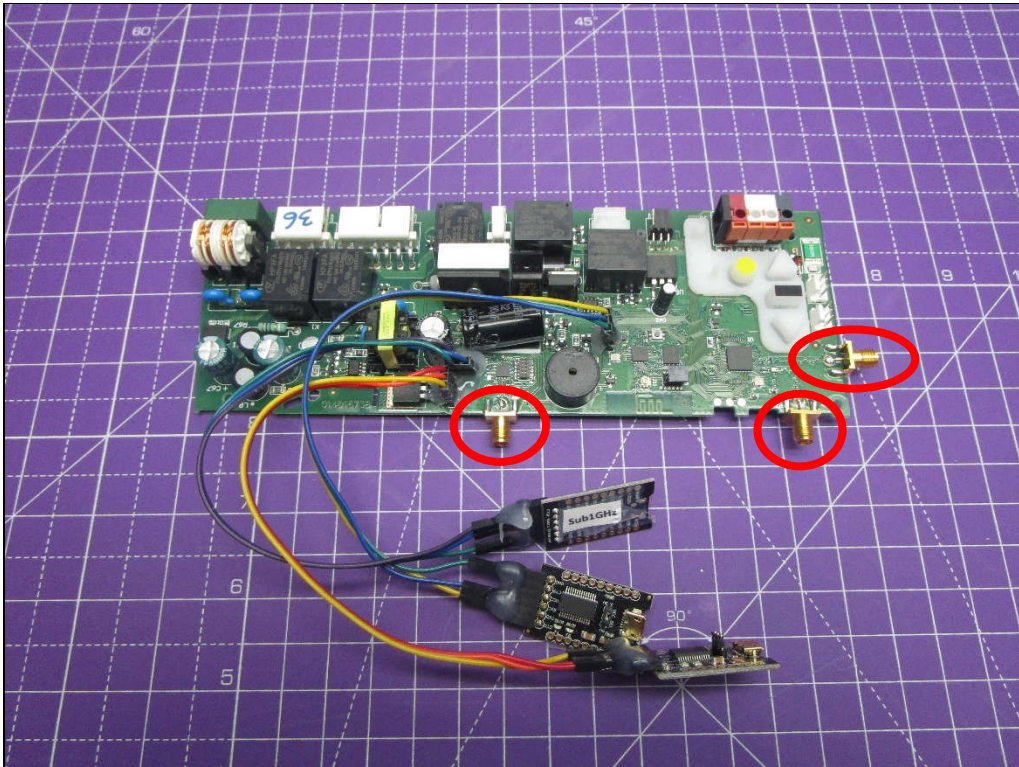
$$\text{Separation Distance} = R \left(10^{\frac{(FS_{Limit}-FS_R)}{40}} \right)^{-1} \quad (4)$$

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.