



### Engineering Test Report No. 2201780-02

Report Date	June 7, 2022	
Manufacturer Name	Chamberlain	
Manufacturer Address	300 Windsor Dr Oak Brook, IL 60523	
Test Item Name Model No.	Phoenix AC GDO Logic Board 003-0458-5	
Date Received	April 26, 2022	
Test Dates	April 27, 2022 – May 25, 2022	
Specifications	FCC "Code of Federal Regulations" Title 47, Part 15, Subpart B FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C, Section 15.247 Innovation, Science, and Economic Development Canada, RSS-GEN Innovation, Science, and Economic Development Canada, RSS-247	
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	<i>Nathaniel Bouchie</i>	MARK E. LONGINOTTI
Tested by	Nathaniel Bouchie Mark Longinotti	
Signature	<i>Raymond J Klouda</i>	
Approved by	Raymond J. Klouda, Registered Professional Engineer of Illinois – 44894	
PO Number	4900083434	

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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 15.247 and Innovation, Science, and Economic Development Canada, RSS-247 test specifications. The data presented in this test report pertains to the EUT on the test dates 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. This report must not be used to claim product certification, approval, or endorsement by A2LA, NIST, or any agency of the Federal Government.

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## 1. Report Revision History

Revision	Date	Description
–	07 JUN 2022	Initial Release of Engineering Test Report No. 2201780-02

## 2. Introduction

### 2.1. Scope of Tests

This document presents the results of a series of RF emissions tests that were performed on the Chamberlain Phoenix AC GDO Logic Board (hereinafter referred to as the Equipment Under Test (EUT)). The EUTs were manufactured and submitted for testing by Chamberlain located in Oak Brook, IL.

### 2.2. Purpose

The test series was performed to determine if the EUTs meet the RF emission requirements of the FCC “Code of Federal Regulations” Title 47, Part 15, Subpart B, §15.107 and §15.109 for Receivers and Subpart C, §15.247 for a Digital Modulation intentional radiator operating within the 2400 – 2483.5MHz band.

The test series was also performed to determine if the EUTs meet the RF emission requirements of the Innovation, Science, and Economic Development Canada Radio Standards Specification RSS-Gen and Innovation, Science, and Economic Development Canada Radio Standards Specification RSS-247 for a Digital Modulation intentional radiator operating within the 2400 – 2483.5MHz band.

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

### 2.3. Identification of the EUT

The EUTs were identified as follows:

EUT Identification	
Test Item #1	
Product Description	Phoenix AC GDO Logic Board
Model/Part No.	003-0458-5
Serial No.	151220510865
Size of EUT	3 in x 8 in x 1.5 in
Software/Firmware Version	Realtek Wi-Fi/BLE= 126A0542-Realtek-Application Rev C.6 Sec+3.0 BLELR: Preliminary test image Rev 1 GDO Firmware: Motor Forever Run 126A0542-Silabs-Application Rev C.6
Device Type	Digitally Modulated Transmission Device
Band of Operation	2400 – 2483.5MHz
Modulation Type	FSK
Antenna Type	Integrated Meandered Inverted F
Antenna Gain (dBi) <sup>1</sup>	1
Conducted Output Power	1.5dBm
Rated Output Power	4.5dBm
6dB Bandwidth	832kHz
Occupied Bandwidth (99% CBW)	1.03MHz
Emission Classification	1M03F1D
Product FCC ID & ISED ID Number	FCC ID: HBW0458X2 ISED ID: 2666A-0458X2
Test Item #2	
Product Description	Phoenix AC GDO Logic Board
Model/Part No.	85870
Serial No.	151220510793
Size of EUT	3 in x 8 in x 1.5 in
Software/Firmware Version	Realtek Wi-Fi/BLE= 126A0542-Realtek-Application Rev C.6 Sec+3.0 BLELR: Preliminary test image Rev 1 GDO Firmware: Motor Forever Run 126A0542-Silabs-Application Rev C.6

Device Type	Digitally Modulated Transmission Device
Band of Operation	2400 – 2483.5MHz
Modulation Type	FSK
Antenna Type	Integrated Meandered Inverted F
Antenna Gain (dBi) <sup>1</sup>	1
Conducted Output Power	1.5dBm
Rated Output Power	4.5dBm
6dB Bandwidth	832kHz
Occupied Bandwidth (99% CBW)	1.03MHz
Emission Classification	1M03F1D
Product FCC ID & ISED ID Number	FCC ID: HBW0458X2 ISED ID: 2666A-0458X2

Note 1 – Antenna gain is supplied by the manufacturer and Elite is not responsible for the accuracy of the antenna gain.

The EUTs listed above were used throughout the test series. EUT #2 was used for Powerline Conducted Emissions tests, and EUT #1 was used for all others.

### 3. Power Input

The EUTs obtained 120V 60Hz power via a 3-wire, 1-meter, unshielded power cord.

### 4. Grounding

The EUTs were connected to ground through the third wire of the input power cord.

### 5. Support Equipment

The EUTs were submitted for testing along with the following support equipment:

Description	Model #	S/N
Motion Sensor	041-0136	n/a
Light Switch	880LMW	n/a

### 6. Interconnect Leads

The following interconnect cables were submitted with the test items:

Item	Description
Double Wire I/O	Connects Motion Sensor to EUT
Double Wire I/O	Connects Light Switch to EUT

### 7. Modifications Made to the EUT

No modifications were made to the EUTs during the testing.

### 8. Modes of Operation

The EUTs and all peripheral equipment were energized. The units were programmed to transmit in one of the following modes:

Mode	Description
Tx @ Ch0, 2402MHz	Transmitter set to Ch0, 2402MHz. Tx setting set to 0x23 in the support software.
Tx @ Ch19, 2440MHz	Transmitter set to Ch19, 2440MHz. Tx setting set to 0x23 in the support software.
Tx @ Ch39, 2480MHz	Transmitter set to Ch39, 2480MHz. Tx setting set to 0x23 in the support software.

### 9. Test Specifications

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

- Federal Communications Commission "Code of Federal Regulations", Title 47, Chapter I, Subchapter A, Part 15, Subpart B
- Federal Communications Commission "Code of Federal Regulations", Title 47, Chapter I, Subchapter A, 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 40GHz"
- ANSI C63.10-2013, "American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices"
- Federal Communications Commission Office of Engineering and Technology Laboratory Division, Guidance For Compliance Measurements On Digital Transmission Systems, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under Section 15.247 April 2, 2019 KDB 558074 D01v05r02
- RSS-Gen Issue 5, February 2020, Amendment 2, Innovation, Science, and Economic Development Canada, "General Requirements for Compliance of Radio Apparatus"
- RSS-247 Issue 2, February 2017, "Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices"

### 10. Test Plan

No test plan was provided. Instructions were provided by personnel from Chamberlain and used in conjunction with the FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C, Section 15.247, Innovation, Science, and Economic Development Canada, RSS-247, and ANSI C63.4-2014 specifications.

### 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

The ambient parameters of the laboratory during testing were as follows:

Ambient Parameters	Value
Temperature	22.8°C
Relative Humidity	18%
Atmospheric Pressure	1024.5mb

### 13. Summary

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

Test Description	Requirements	Test Method	S/N	Results
Transmitter Conducted Emissions (AC Mains)	FCC 15.107 ISED RSS-GEN	ANSI C63.10:2013	151220510793	Conforms
6dB Bandwidth	FCC 15.247 ISED RSS-247	ANSI C63.10:2013	151220510865	Conforms
Occupied Bandwidth (99%)	FCC 15.247 ISED RSS-247	ANSI C63.10:2013	151220510865	Conforms

Maximum Peak Conducted Output Power	FCC 15.247 ISED RSS-247	ANSI C63.10:2013	151220510865	Conforms
Effective Isotropic Radiated Power (EIRP)	FCC 15.247 ISED RSS-247	ANSI C63.10:2013	151220510865	Conforms
Duty Cycle Factor Measurements	FCC 15.247 ISED RSS-247	ANSI C63.10:2013	151220510865	—
Case Spurious Radiated Emissions	FCC 15.247 ISED RSS-247	ANSI C63.10:2013	151220510865	Conforms
Band-Edge Compliance	FCC 15.247 ISED RSS-247	ANSI C63.10:2013	151220510865	Conforms
Power Spectral Density	FCC 15.247 ISED RSS-247	ANSI C63.10:2013	151220510865	Conforms

Note 1: Per the FCC "Code of Federal Regulations" Title 47, Subchapter A, Part 15, Subpart B, Section 15.101(b), receivers operating above 960MHz are exempt from complying with the technical provisions of §15.5.

## 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).

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

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.

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

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

$$\text{Formula 2: FS (}\mu\text{V/m)} = \text{AntiLog} [(\text{FS (dB}\mu\text{V/m)})/20]$$

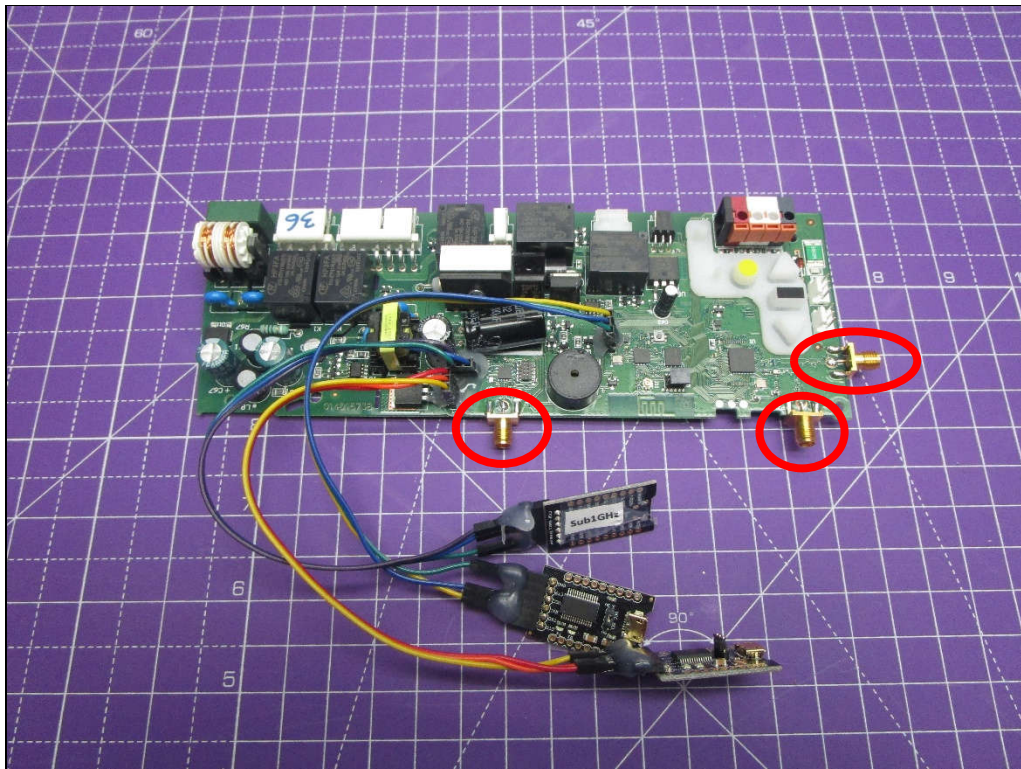
## 15. Statement of Conformity

The Chamberlain Phoenix AC GDO Logic Boards (Model No. 003-0458-5, Serial No. 151220510865 and 151220510793) did fully conform to the selected requirements of FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C, Section 15.247 and Innovation, Science, and Economic Development Canada, RSS-247.

## 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 15.247 and Innovation, Science, and Economic Development Canada, RSS-247 test specifications. The data presented in this test report pertains to the EUTs on the test date specified. Any electrical or mechanical modifications made to the EUTs subsequent to the specified test date will serve to invalidate the data and void this certification.

### 17. Photographs of EUT



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







### 18. Equipment List

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
APW0	PREAMPLIFIER	PLANAR ELECTRONICS	PE2-30-20G20R6G	PL2926/0646	20GHZ-26.5GHZ	9/21/2021	9/21/2022
CDX9	COMPUTER	ELITE	WORKSTATION			N/A	
CDZ3	LAB WORKSTATION	ELITE	LWS-10		WINDOWS 10	CNR	
CDZ4	LAB WORKSTATION	ELITE	LWS-10		WINDOWS 10	CNR	
GCM0	SFC COMPACT MODULATOR	ROHDE & SCHWARZ	2115.3510K02	100552	---	3/23/2022	3/23/2024
GRB0	1MHZ, LISN SIGNAL CHECKER	ELITE	LISNCHKR1M	1	1MHZ	6/17/2021	6/17/2023
GRE2	SIGNAL GENERATOR	AGILENT	E4438C	MY42081749	250KHZ-6GHZ	3/4/2022	3/4/2023
GSF0	VECTOR SIGNAL GENERATOR	ROHDE & SCHWARZ	SMBV100A	260452	9kHz to 6GHz	8/24/2021	8/24/2022
GSFB	OSP120 BASE UNIT	ROHDE & SCHWARZ	OSP120	101246	---	5/11/2021	5/11/2023
GSFE	OSP120	ROHDE & SCHWARZ	OSP120	101288	.01-40GHZ	6/11/2021	6/11/2023
MEA3	MICRO-OHM METER	KEITHLEY	580	772667	10UOHM-200KOHM	6/3/2021	6/3/2022
NHG1	STANDARD GAIN HORN ANTENNA	NARDA	638	---	18-26.5GHZ	NOTE 1	
NSDS1	UNIVERSAL SPHERICAL DIPOLE SOURCE	AET	USDS-H	AET-1116		NOTE 1	
NTA4	BILOG ANTENNA	TESEQ	6112D	46660	20-2000GHZ	10/5/2020	10/5/2022
NWQ0	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS LINDGREN	3117	66657	1GHZ-18GHZ	5/13/2020	6/13/2022
NWQ1	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS-LINDGREN	3117	66655	1GHZ-18GHZ	4/28/2020	5/28/2022
NWQ2	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS LINDGREN	3117	66659	1GHZ-18GHZ	4/27/2022	4/27/2024
PLF2	CISPR16 50UH LISN	ELITE	CISPR16/70A	002	.15-30MHz	4/5/2022	4/5/2023
PLF4	CISPR16 50UH LISN	ELITE	CISPR16/70A	003	.15-30MHz	4/5/2022	4/5/2023
R14ML	ROOM 14	ETS LINDGREN		14A	DC-DAYLIGHT	CNR	
R21F	3M ANECHOIC CHAMBER NSA	EMC TEST SYSTEMS	3M ANECHOIC		30MHZ-18GHZ	3/30/2022	3/30/2023
R29F	3M ANECHOIC CHAMBER NSA	EMC TEST SYSTEMS	3M ANECHOIC		30MHZ-18GHZ	3/25/2022	3/25/2023
RBG0	EMI ANALYZER	ROHDE & SCHWARZ	ESW44	101533	10HZ-44GHZ	11/15/2021	11/15/2022
RBG2	EMI ANALYZER	ROHDE & SCHWARZ	ESW44	101591	2HZ-44GHZ	3/31/2022	3/31/2023
T1ED	10DB 25W ATTENUATOR	WEINSCHTEL	46-10-34	BN2320	DC-18GHZ	1/6/2022	1/6/2024
T1EJ	10DB 25W ATTENUATOR	WEINSCHTEL	46-10-34	CD6790	DC-18GHZ	1/12/2022	1/12/2024
T2D1	20DB, 25W ATTENUATOR	WEINSCHTEL	46-20-43	AV5814	DC-18GHZ	1/18/2022	1/18/2024
VBR8	CISPR EN FCC CE VOLTAGE.exe					N/A	
VBV2	CISPR EN FCC ICES RE.EXE	ELITE	CISPR EN FCC ICES RE.EXE	---	---	N/A	
WKA1	SOFTWARE, UNIVERSAL RCV EMI	ELITE	UNIV_RCV_EMI	1	---	I/O	
XLTK	5W, 50 OHM TERMINATION	JFW INDUSTRIES	50T-052	---	DC-2GHZ	1/5/2022	1/5/2024

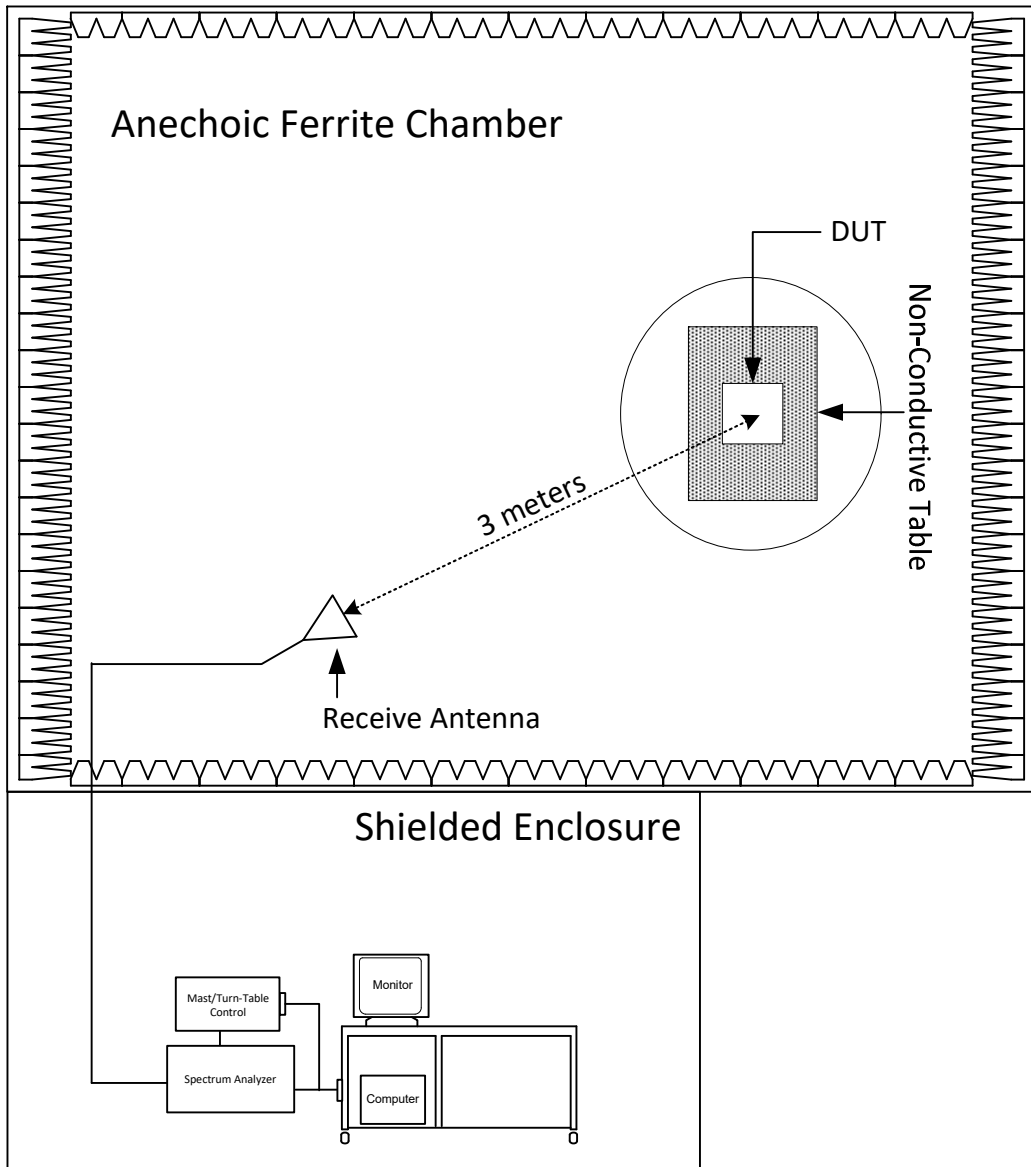
N/A: Not Applicable

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.

### 19. Block Diagram of Test Setup



Radiated Measurements Test Setup

20. Transmitter Conducted Emissions (AC Mains)

Test Information	
Manufacturer	Chamberlain
Product	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510793
Mode	Tx @ Ch19, 2440MHz

Test Setup Details	
Setup Format	Tabletop
Height of Support	N/a
Type of Test Site	Reverberation Chamber
Test Site Used	Room #14
Notes	None

Measurement Uncertainty	
Measurement Type	Expanded Measurement Uncertainty
Conducted disturbance (mains port) (150 kHz – 30 MHz)	2.7

Requirements
All radio frequency voltages on the power lines for any frequency or frequencies of an intentional radiator shall not exceed the limits in the following table:

Transmitter Conducted Emissions Limits		
Frequency of Emission (MHz)	Conducted Limits (dBµV)	
	Quasi-peak	Average
0.15 – 0.5	66 to 56*	56-46*
0.5 – 5	56	46
5 – 30	60	50

\* The lower limit shall apply at the transition frequencies.

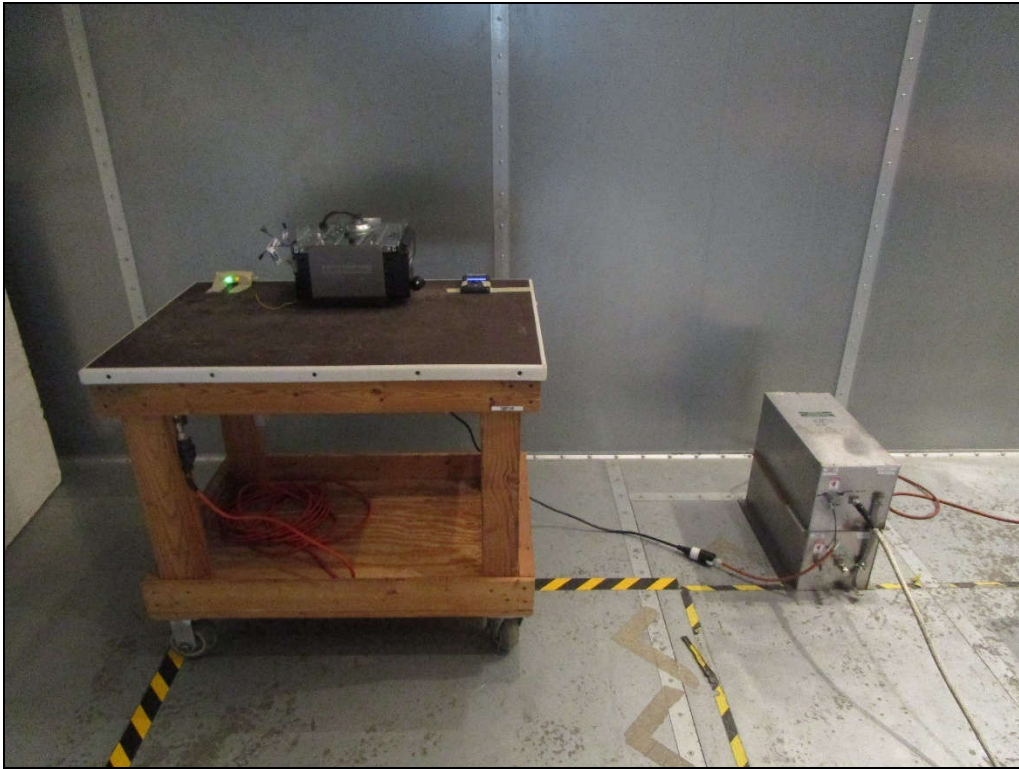
**Procedure**

The interference on each power lead of the EUT was measured by connecting the measuring equipment to the appropriate meter terminal of the Line Impedance Stabilization Network (LISN). The meter terminal of the LISN not under test was terminated with 50 ohms.

- 1) The EUT was operated in the mode.
- 2) Measurements were first made on the 120VAC 60Hz high line.
- 3) The frequency range from 150kHz to 30MHz was broken up into smaller frequency sub-bands.
- 4) Conducted emissions measurements were taken on the first frequency sub-band using a peak detector.
- 5) The data thus obtained was then searched by the computer for the highest levels. Any emissions levels that were within 4dB of the average limit were then measured again using both a quasi-peak detector and an average detector. (If no peak readings were within 10dB of the average limit, quasi-peak and average readings were taken on the highest emissions levels measured during the peak detector scan.)
- 6) Steps (4) and (5) were repeated for the remainder of the frequency sub-bands until the entire frequency range from 150kHz to 30MHz was investigated. The peak trace was automatically plotted. The plot also shows quasi-peak and average readings that were taken on discrete frequencies. A table showing the quasi-peak and average readings was also generated. This tabular data compares the quasi-peak and average conducted emissions to the applicable conducted emissions limits. The resultant voltage level (VL) is a summation in decibels (dB) of the receiver meter reading (MTR) and the cable loss factor (CF).

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

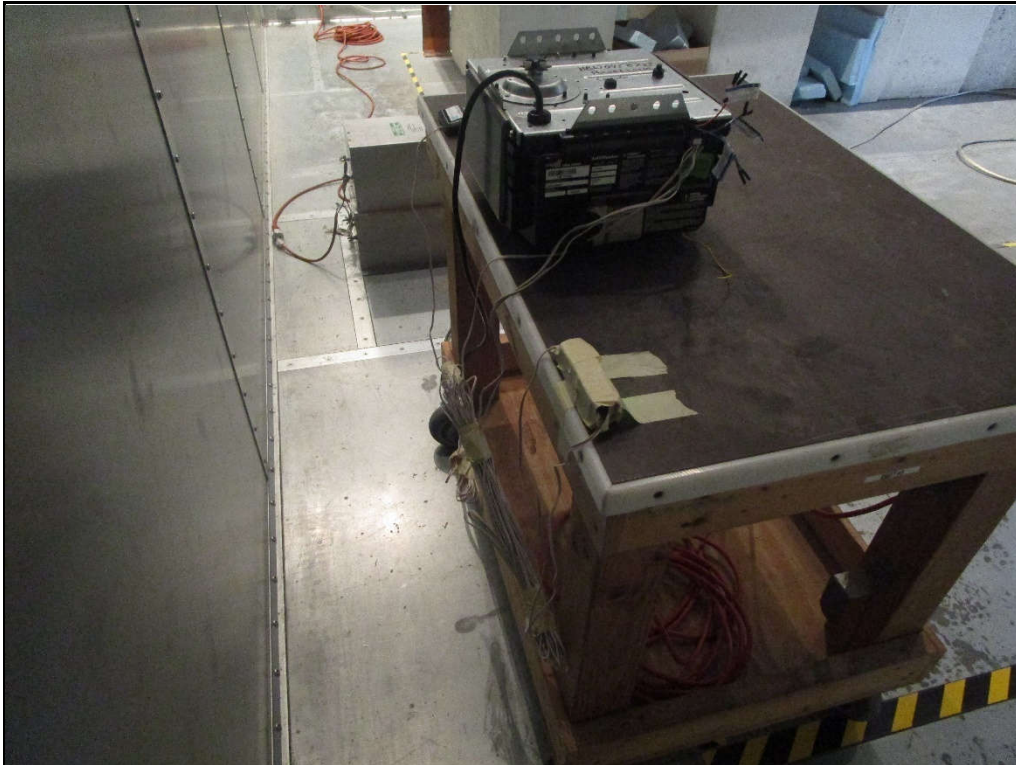
- 7) Steps (3) through (6) were repeated on the 120VAC 60Hz return line.



Test Setup for RF Conducted Emissions (AC Mains)



Test Setup for RF Conducted Emissions (AC Mains)



Test Setup for RF Conducted Emissions (AC Mains)



Test Setup for RF Conducted Emissions (AC Mains)

## FCC Part 15 Subpart B Conducted Emissions Test Significant Emissions Data

VBR8 05/14/2020

Manufacturer : Chamberlain  
 Model : 003-0458-5  
 DUT Revision :  
 Serial Number : 151220510865  
 DUT Mode : Realtek BLE Tx @ 2440MHz  
 Line Tested : High, PLF4  
 Scan Step Time [ms] : 30  
 Meas. Threshold [dB] : -4  
 Notes :  
 Test Engineer : N. Bouchie  
 Limit : Class B  
 Test Date : Apr 28, 2022 10:52:49 AM  
 Data Filter : Up to 80 maximum levels detected with 6 dB level excursion threshold over 4 dB margin below limit

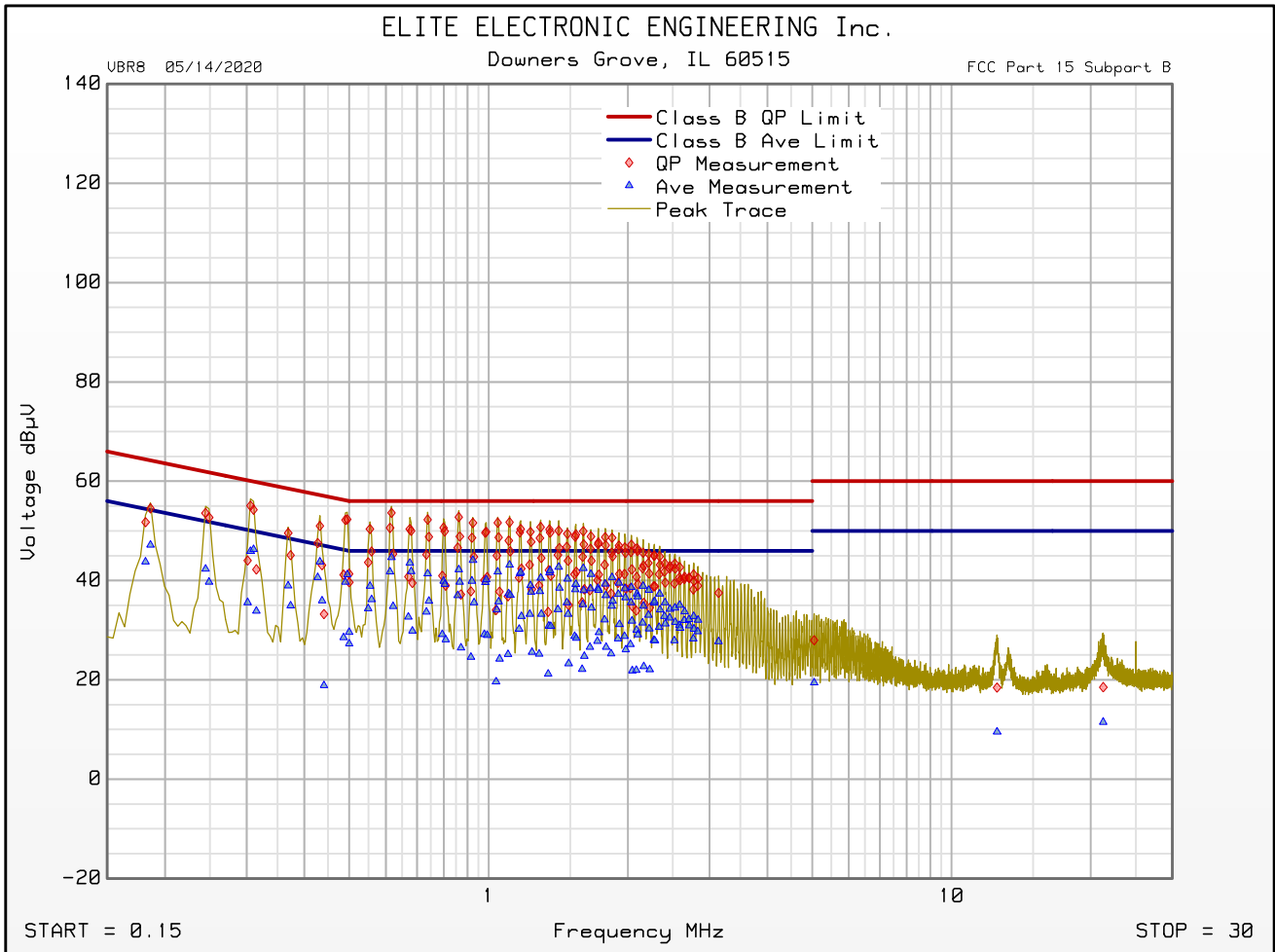
Freq MHz	Quasi-peak Level dB $\mu$ V	Quasi-peak Limit dB $\mu$ V	Excessive Quasi-peak Emissions	Average Level dB $\mu$ V	Average Limit dB $\mu$ V	Excessive Average Emissions
0.245	53.6	61.9		42.3	51.9	
0.311	54.3	60.0		46.3	50.0	
0.432	51.0	57.2		43.8	47.2	
0.495	52.3	56.1		41.2	46.1	
0.617	53.6	56.0		44.6	46.0	
0.676	50.3	56.0		43.5	46.0	
0.739	52.3	56.0		41.4	46.0	
0.862	52.8	56.0		42.2	46.0	
0.925	51.6	56.0		44.1	46.0	
1.110	51.7	56.0		43.1	46.0	
1.358	49.7	56.0		42.0	46.0	
1.417	50.0	56.0		42.7	46.0	
1.601	49.9	56.0		42.4	46.0	
2.034	47.2	56.0		38.6	46.0	
3.140	37.5	56.0		27.7	46.0	
5.050	28.0	60.0		19.5	50.0	
12.546	18.4	60.0		9.5	50.0	
21.277	18.5	60.0		11.5	50.0	



## FCC Part 15 Subpart B Conducted Emissions Test Cumulative Data

VBR8 05/14/2020

Manufacturer : Chamberlain  
 Model : 003-0458-5  
 DUT Revision :  
 Serial Number : 151220510865  
 DUT Mode : Realtek BLE Tx @ 2440MHz  
 Line Tested : High, PLF4  
 Scan Step Time [ms] : 30  
 Meas. Threshold [dB] : -4  
 Notes :  
 Test Engineer : N. Bouchie  
 Limit : Class B  
 Test Date : Apr 28, 2022 10:52:49 AM



Emissions Meet QP Limit  
 Emissions Meet Ave Limit

## FCC Part 15 Subpart B Conducted Emissions Test Significant Emissions Data

VBR8 05/14/2020

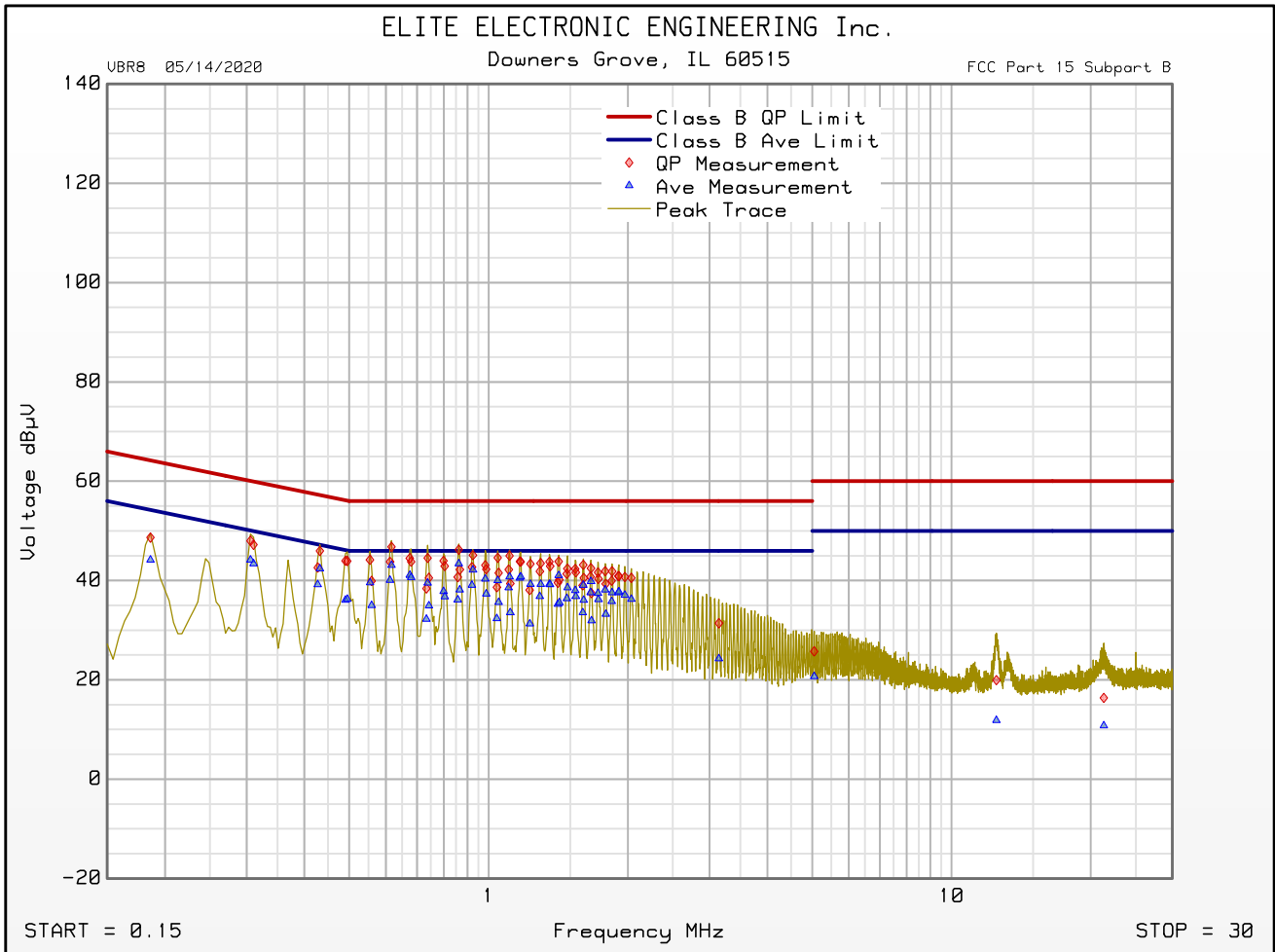
Manufacturer : Chamberlain  
 Model : 003-0458-5  
 DUT Revision :  
 Serial Number : 151220510865  
 DUT Mode : Realtek BLE Tx @ 2440MHz  
 Line Tested : Neutral, PLF2  
 Scan Step Time [ms] : 30  
 Meas. Threshold [dB] : -4  
 Notes :  
 Test Engineer : N. Bouchie  
 Limit : Class B  
 Test Date : Apr 28, 2022 10:58:38 AM  
 Data Filter : Up to 80 maximum levels detected with 6 dB level excursion threshold over 4 dB margin below limit

Freq MHz	Quasi-peak Level dB $\mu$ V	Quasi-peak Limit dB $\mu$ V	Excessive Quasi-peak Emissions	Average Level dB $\mu$ V	Average Limit dB $\mu$ V	Excessive Average Emissions
0.186	48.6	64.2		44.2	54.2	
0.432	46.0	57.2		42.4	47.2	
0.617	46.8	56.0		43.1	46.0	
0.862	46.2	56.0		43.4	46.0	
0.925	45.1	56.0		42.2	46.0	
1.417	43.8	56.0		41.0	46.0	
2.034	40.5	56.0		36.2	46.0	
3.145	31.4	56.0		24.2	46.0	
5.050	25.7	60.0		20.7	50.0	
12.506	19.9	60.0		11.8	50.0	
21.326	16.4	60.0		10.8	50.0	

## FCC Part 15 Subpart B Conducted Emissions Test Cumulative Data

VBR8 05/14/2020

Manufacturer : Chamberlain  
 Model : 003-0458-5  
 DUT Revision :  
 Serial Number : 151220510865  
 DUT Mode : Realtek BLE Tx @ 2440MHz  
 Line Tested : Neutral, PLF2  
 Scan Step Time [ms] : 30  
 Meas. Threshold [dB] : -4  
 Notes :  
 Test Engineer : N. Bouchie  
 Limit : Class B  
 Test Date : Apr 28, 2022 10:58:38 AM



Emissions Meet QP Limit  
 Emissions Meet Ave Limit

21. 6dB Bandwidth

EUT Information	
Manufacturer	Chamberlain
Product	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch0, 2402MHz Tx @ Ch19, 2440MHz Tx @ Ch39, 2480MHz

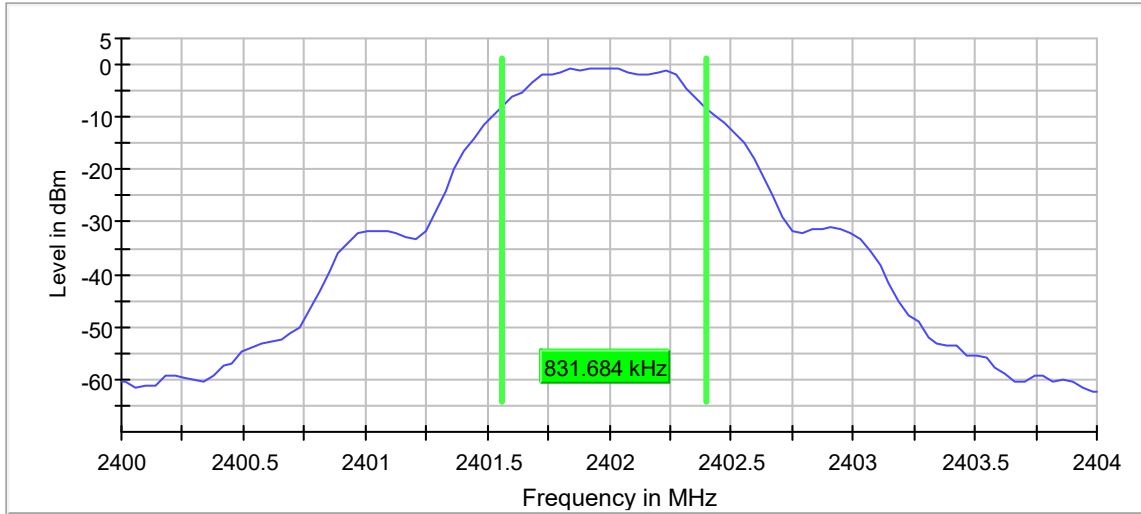
Test Setup Details	
Setup Format	Tabletop
Height of Support	N/A
Measurement Method	Antenna Conducted
Type of Test Site	Tabletop
Test Site Used	EMC Bench
Notes	None

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

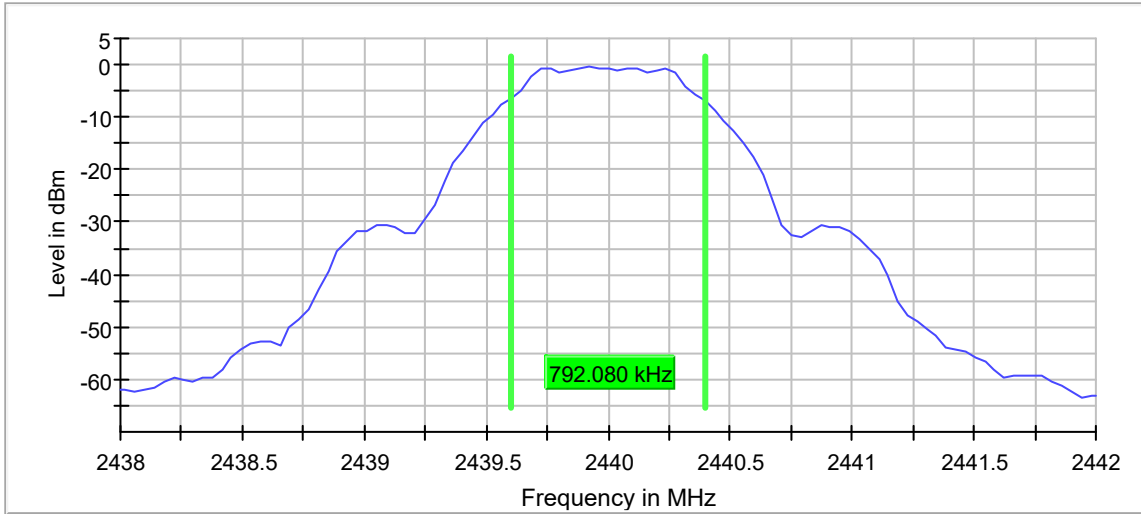
Requirements
Systems using digital modulation techniques shall have a minimum 6dB bandwidth of 500kHz.

Procedure
<p>The antenna port of the EUT was connected to the spectrum analyzer through 40dB of attenuation. The EUT was allowed to transmit continuously.</p> <p>The transmit channel was set separately to low, middle, and high channels. The resolution bandwidth (RBW) was set to 100kHz, the video bandwidth (VBW) was set to the same as or 3 times greater than the RBW, and the span was set to 3 times the RBW.</p> <p>The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined. The analyzer's display was then screenshot and saved.</p>

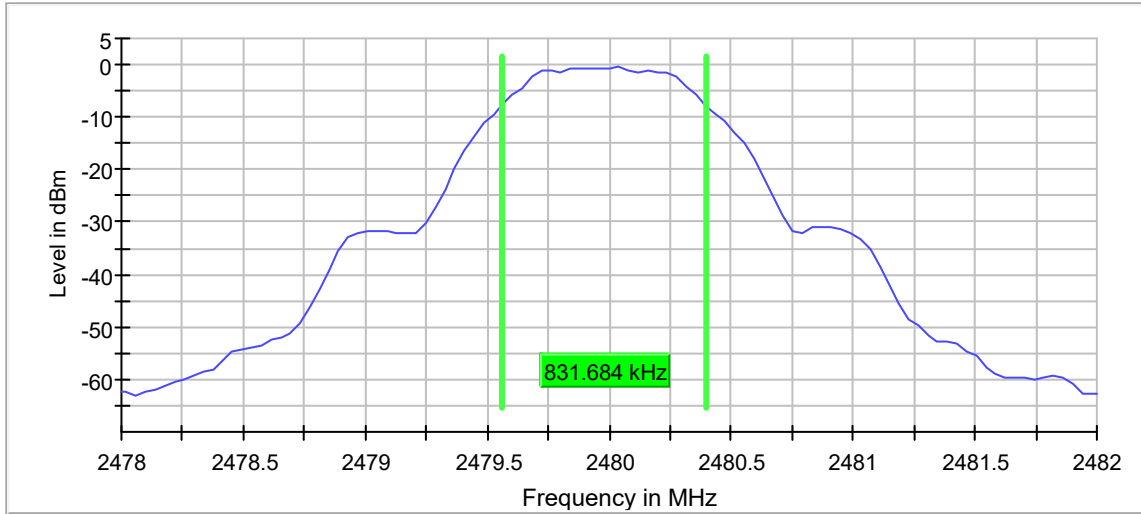
Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch0, 2402MHz
Frequency Tested	2402MHz
Result	6dB BW = 0.832MHz
Notes	None



Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch19, 2440MHz
Frequency Tested	2440MHz
Result	6dB BW = 0.792MHz
Notes	None



Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch39, 2480MHz
Frequency Tested	2480MHz
Result	6dB BW = 0.832MHz
Notes	None



22. Occupied Bandwidth (99%)

EUT Information	
Manufacturer	Chamberlain
Product	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch0, 2402MHz Tx @ Ch19, 2440MHz Tx @ Ch39, 2480MHz

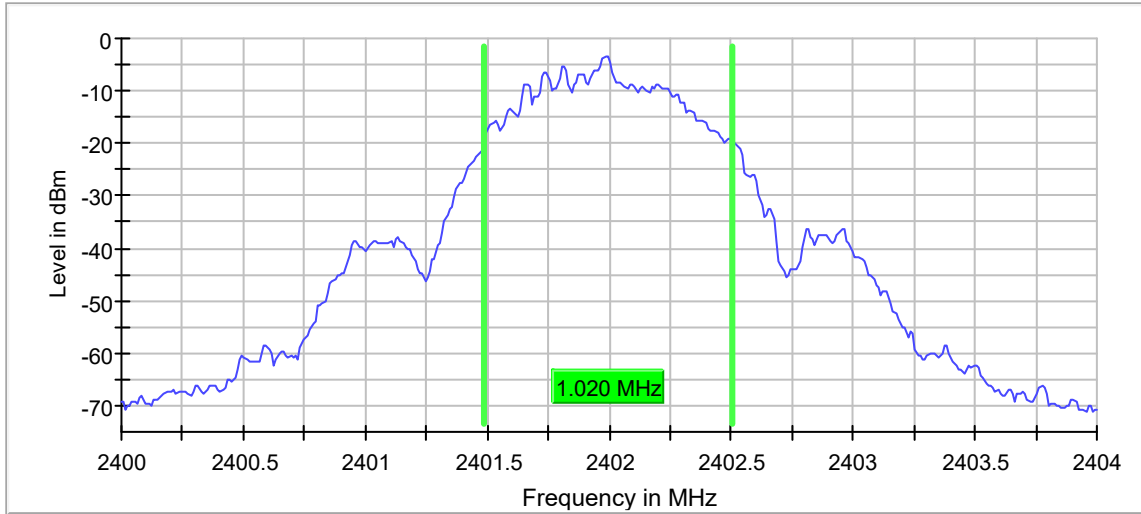
Test Setup Details	
Setup Format	Tabletop
Height of Support	N/A
Measurement Method	Antenna Conducted
Type of Test Site	Tabletop
Test Site Used	EMC Bench
Type of Antennas Used	N/A
Notes	None

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

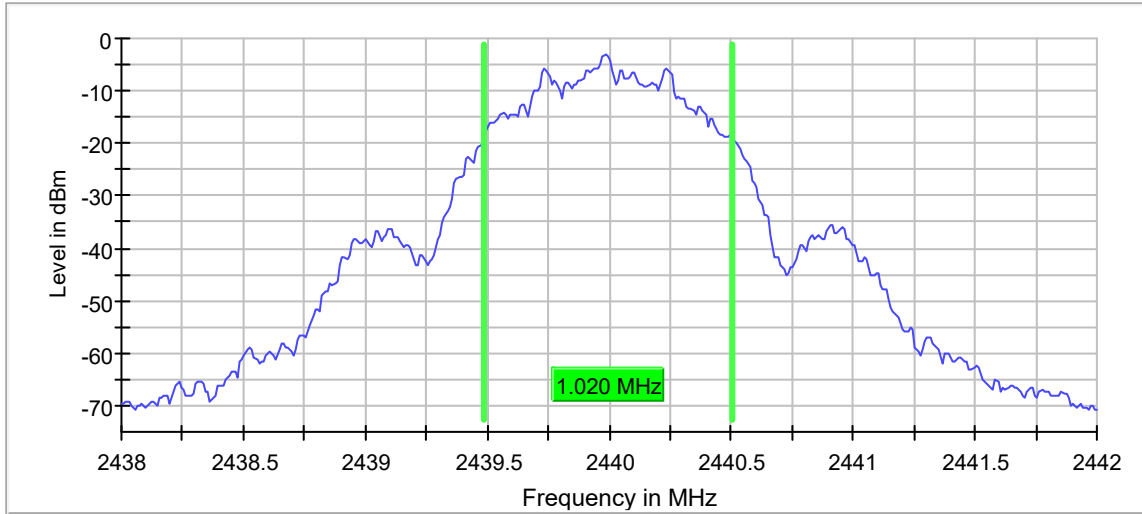
Procedure
<p>The antenna port of the EUT was connected to the spectrum analyzer through 40dB of attenuation.</p> <p>The EUT was allowed to transmit continuously. The transmit channel was set separately to low, middle, and high channels. The resolution bandwidth (RBW) was set to 1% to 5% of the actual occupied / x dB bandwidth, the video bandwidth (VBW) was set 3 times greater than the RBW, and the span was set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency.</p> <p>The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined. The analyzer's display was plotted using a 'screen dump' utility.</p>



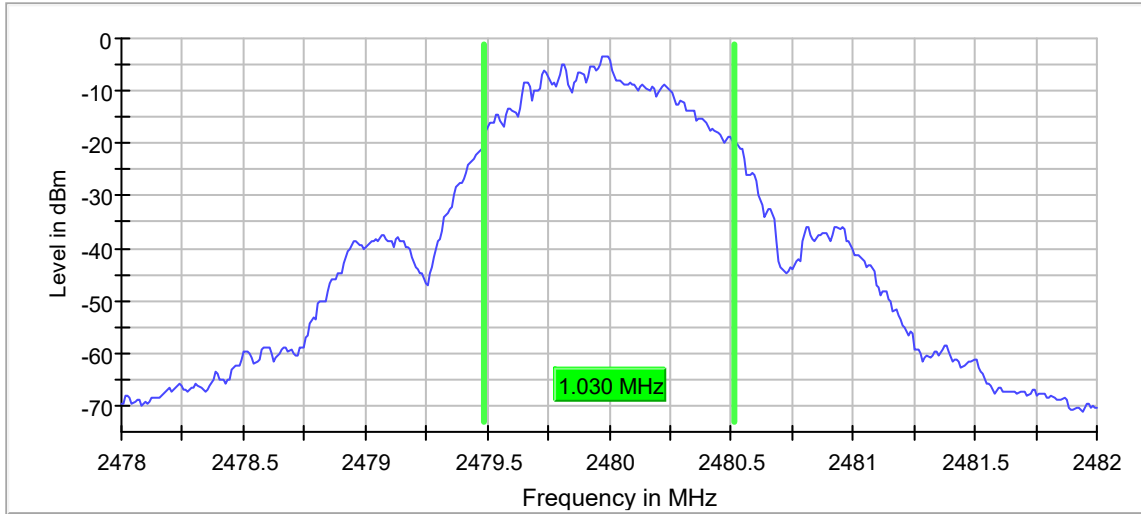
Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch0, 2402MHz
Frequency Tested	2402MHz
Result	OBW = 1.02MHz
Notes	None



Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch19, 2440MHz
Frequency Tested	2440MHz
Result	OBW = 1.02MHz
Notes	None



Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch39, 2480MHz
Frequency Tested	2480MHz
Result	OBW = 1.03MHz
Notes	None



23. Maximum Peak Conducted Output Power

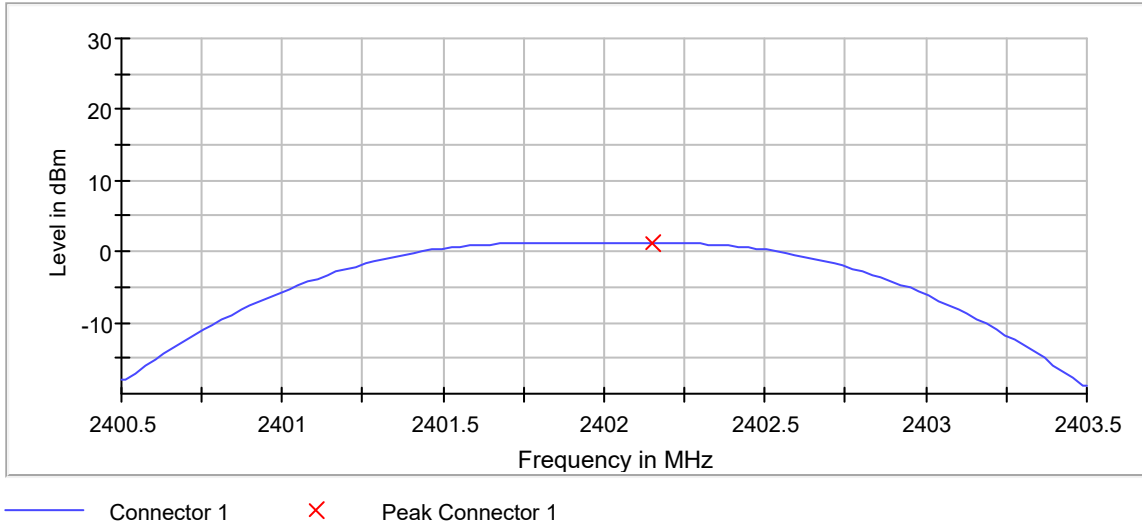
EUT Information	
Manufacturer	Chamberlain
Product	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch0, 2402MHz Tx @ Ch19, 2440MHz Tx @ Ch39, 2480MHz

Test Setup Details	
Setup Format	Tabletop
Height of Support	N/A
Measurement Method	Antenna Conducted
Type of Test Site	Tabletop
Test Site Used	EMC Bench
Notes	N/A

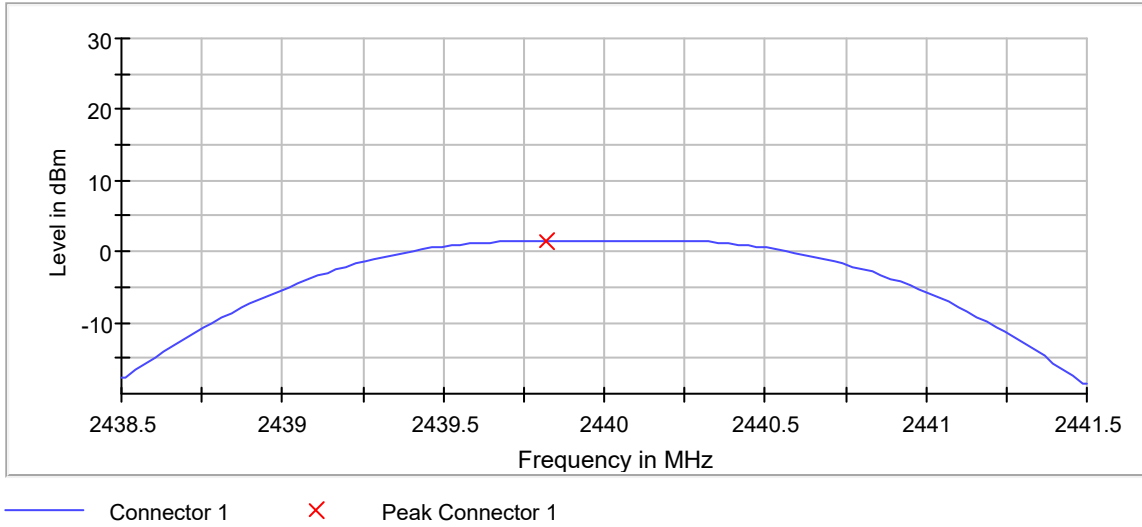
Requirements
The output power shall not exceed 1W (30dBm).

Procedure
The antenna port of the EUT was connected to the spectrum analyzer through 40dB of attenuation. The EUT was set to transmit separately at the low, middle, and high channels. The resolution bandwidth (RBW) was set to greater than the 6dB bandwidth. The span was set to greater than 3 times the RBW. The 'Max-Hold' function was engaged. The maximum meter reading was recorded. The peak power output was calculated for the low, middle, and high channels.

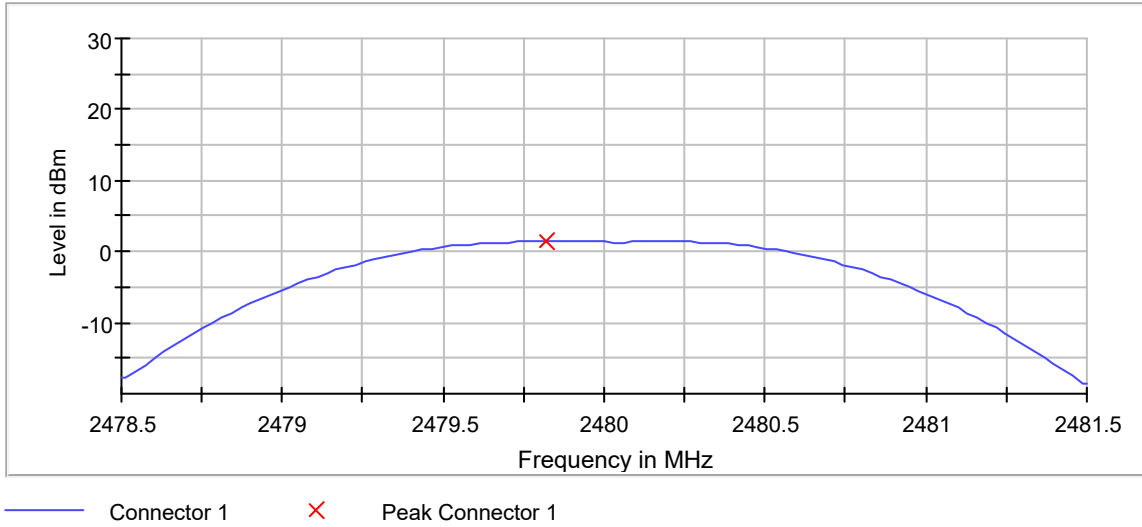
Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch0, 2402MHz
Frequency Tested	2402MHz
Result	Output Power = 1.31mW (1.2dBm)
Notes	None



Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch19, 2440MHz
Frequency Tested	2440MHz
Result	Output Power = 1.41mW (1.5dBm)
Notes	None



Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch39, 2480MHz
Frequency Tested	2480MHz
Result	Output Power = 1.38mW (1.4dBm)
Notes	None



24. Effective Isotropic Radiated Power (EIRP)

EUT Information	
Manufacturer	Chamberlain
Product	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch0, 2402MHz Tx @ Ch19, 2440MHz Tx @ Ch39, 2480MHz

Test Setup Details	
Setup Format	Tabletop
Height of Support	N/a
Measurement Method	Antenna Conducted
Type of Test Site	Tabletop
Test Site Used	EMC Bench
Type of Antennas Used	N/A
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

Requirements
The output power shall not exceed 4W (36dBm).

Procedure
<p>The EUT was placed on the non-conductive stand and set to transmit. A double ridged waveguide antenna was placed at a test distance of 3 meters from the EUT. The resolution bandwidth (RBW) of the spectrum analyzer was set to greater than the 6dB bandwidth. The EUT was maximized for worst case emissions (or maximum output power) at the measuring antenna. The maximum meter reading was recorded. The peak power output was measured for the low, middle, and high channels.</p> <p>The equivalent power was determined from the field intensity levels measured at 3 meters using the substitution method. To determine the emission power, a dipole antenna (double ridged waveguide antenna for all measurements above 1GHz) was then set in place of the EUT and connected to a calibrated signal generator. The output of the signal generator was adjusted to match the received level at the spectrum analyzer. The signal level was recorded. The reading was then corrected to compensate for cable loss (and antenna gain for all measurements above 1GHz), as required. The peak power output was calculated for low, middle, and high hopping frequencies.</p>



Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch0, 2402MHz Tx @ Ch19, 2440MHz Tx @ Ch39, 2480MHz
Result	Max EIRP = 1.91mW (2.8dBm)
Notes	None

Freq (MHz)	Ant Pol	Wide BW Meter Reading (dBμV)	Matched Sig Gen Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
2402.00	H	60.9	-1.3	5.6	2.7	1.6	36.0	-34.4
	V	60.9	-0.1	5.6	2.7	2.8	36.0	-33.2
2440.00	H	60.3	-1.2	5.4	2.8	1.5	36.0	-34.5
	V	58.4	-2.7	5.4	2.8	0.0	36.0	-36.0
2480.00	H	57.0	-5.6	5.6	2.8	-2.8	36.0	-38.8
	V	55.0	-6.8	5.6	2.8	-4.0	36.0	-40.0

## 25. Duty Cycle Factor Measurements

EUT Information	
Manufacturer	Chamberlain
Product	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch0, 2402MHz Tx @ Ch19, 2440MHz Tx @ Ch39, 2480MHz

Test Setup Details	
Setup Format	Tabletop
Height of Support	N/A
Measurement Method	Radiated
Type of Test Site	Semi-Anechoic Chamber
Type of Antennas Used	Double-Ridged Waveguide (or equivalent)
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

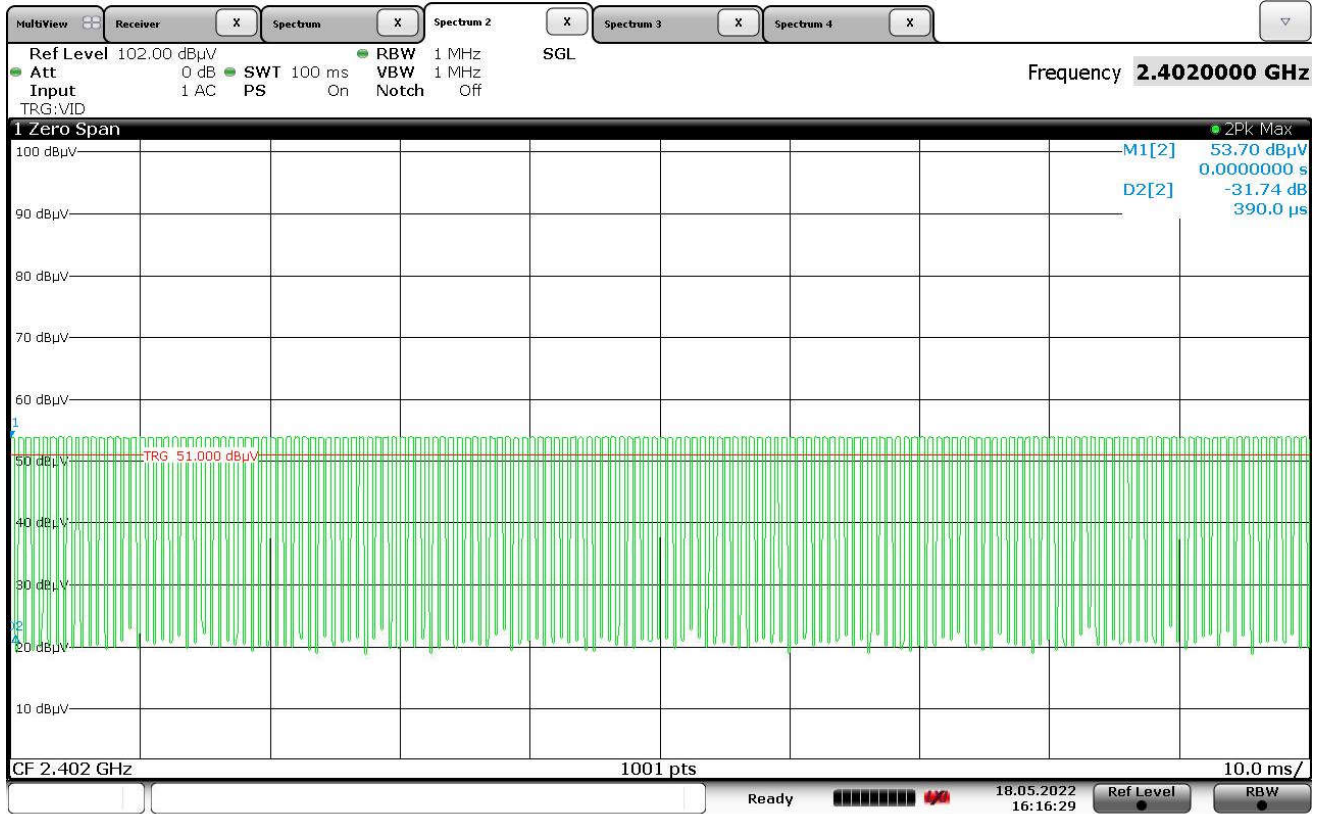
Procedure
<p>Given that continuous transmission of the EUT (<math>D \geq 98\%</math>) could not be achieved. The following procedure was used to calculate a duty cycle correction factor for the data in Sec 26:</p> <ol style="list-style-type: none"> <li>1. The EUT was configured to operate at the maximum achievable duty cycle.</li> <li>2. The center frequency of the spectrum analyzer was set to the center frequency of transmission.</li> <li>3. The zero-span method was used.</li> <li>4. The sweep time was set to 100ms.</li> <li>5. A video trigger was employed and the total on time was recorded.</li> </ol> <p>The duty cycle factor is then computed as <math>20 \text{ LOG} \left( \frac{1}{\text{Duty Cycle}} \right)</math>, where <math>\text{Duty Cycle} = (\text{On Time ms}/100\text{ms})</math>.</p>

Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch0, 2402MHz
Frequency Tested	2402MHz
Result	On Time = 0.39ms
Notes	None



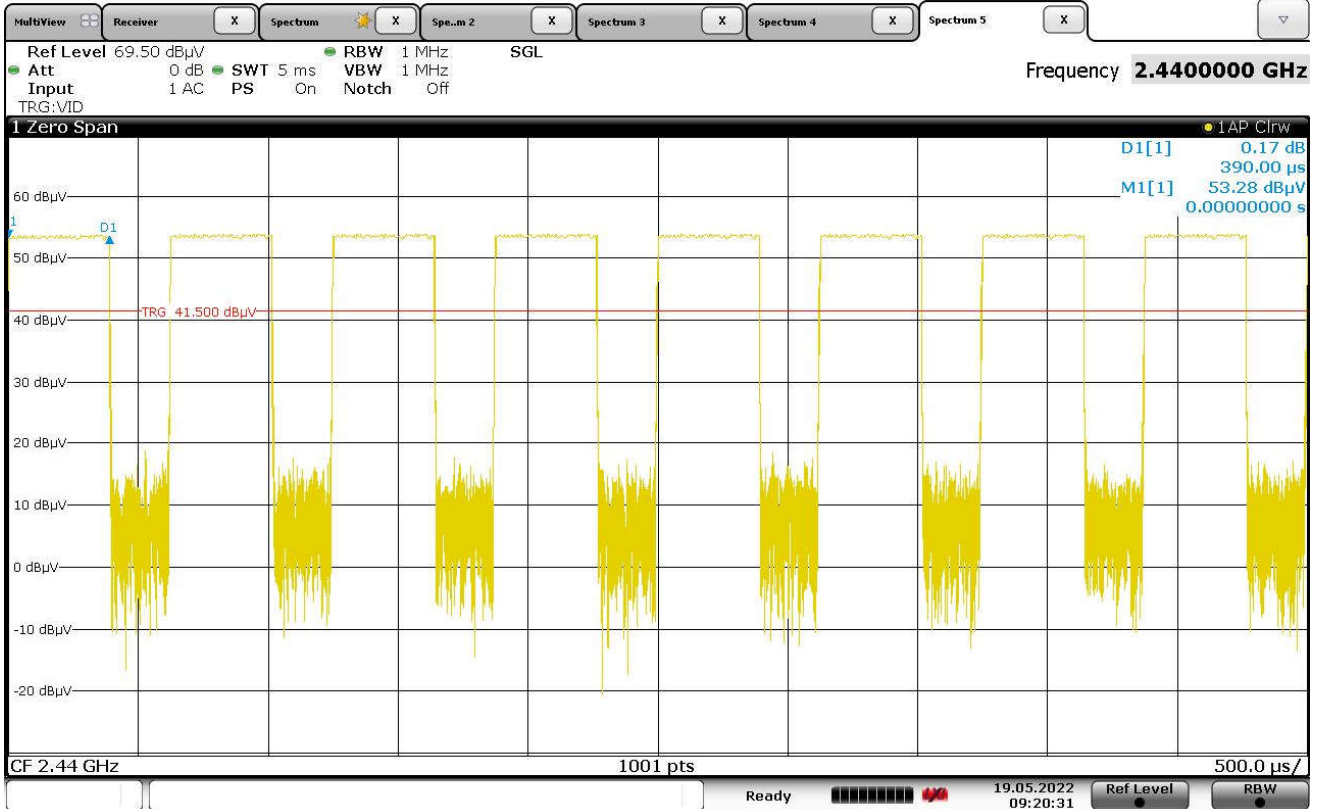
Date: 18.MAY.2022 16:15:39

Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch0, 2402MHz
Frequency Tested	2402MHz
Result	Duty Cycle Correction Factor = -4.096dB
Notes	Duty Cycle Factor Calculation: $160 \times 0.39\text{ms} = 62.4\text{ms}$ $\text{Duty Cycle Factor} = 20 \log \left( \frac{62.4\text{ms}}{100\text{ms}} \right) = -4.096\text{dB}$



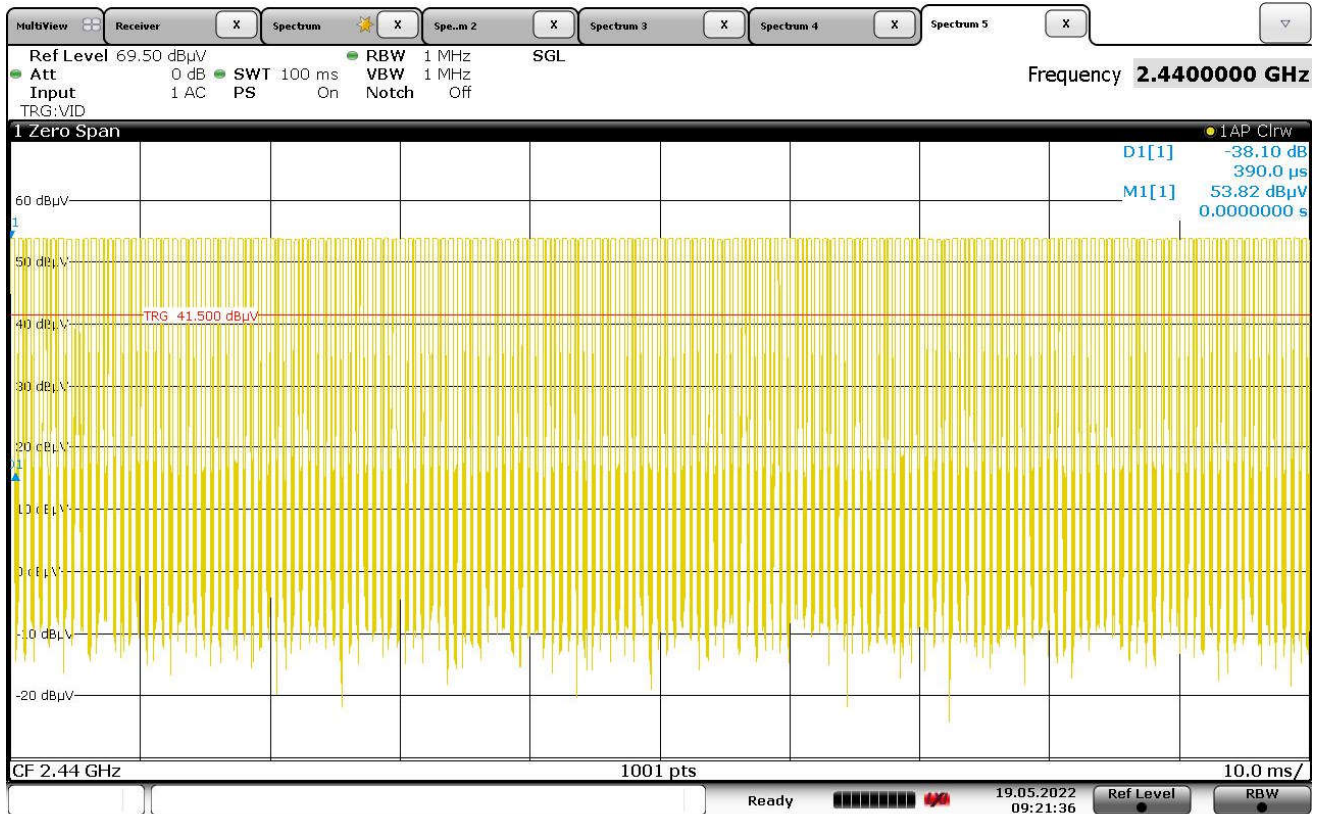
Date: 18.MAY.2022 16:16:29

Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch19, 2440MHz
Frequency Tested	2440MHz
Result	On Time = 0.39ms
Notes	None



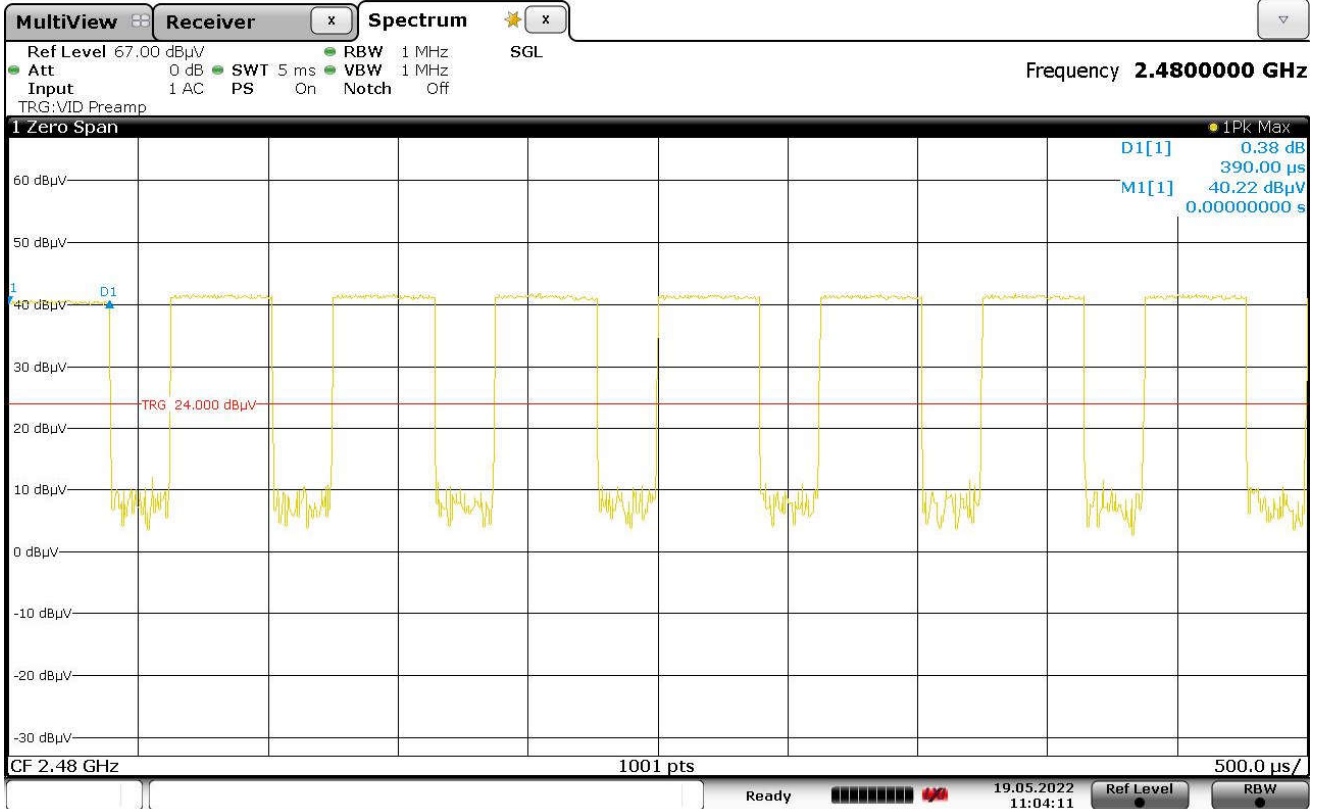
Date: 19.MAY.2022 09:20:32

Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch19, 2440MHz
Frequency Tested	2440MHz
Result	Duty Cycle Correction Factor = -4.096dB
Notes	Duty Cycle Factor Calculation: $160 \times 0.39\text{ms} = 62.4\text{ms}$ $\text{Duty Cycle Factor} = 20 \log \left( \frac{62.4\text{ms}}{100\text{ms}} \right) = -4.096\text{dB}$



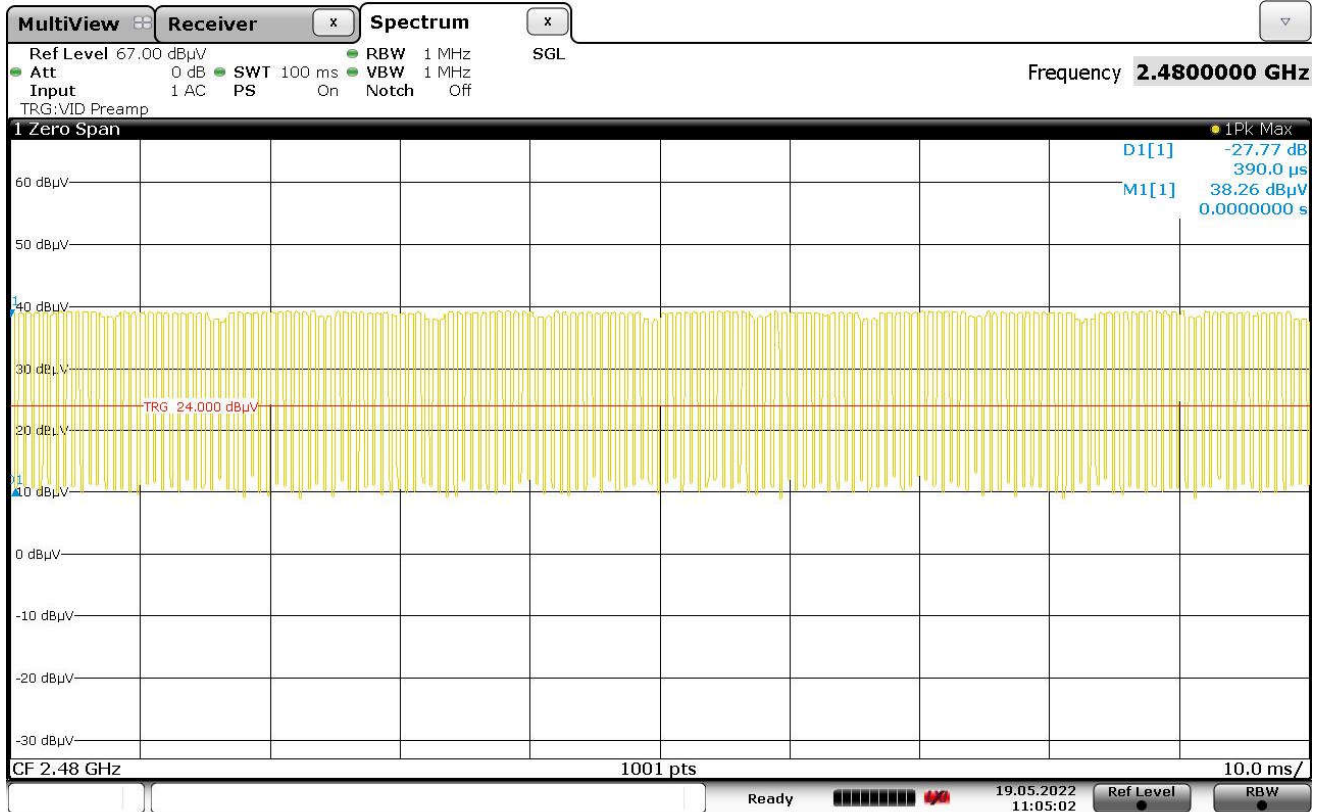
Date: 19.MAY.2022 09:21:36

Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch39, 2480MHz
Frequency Tested	2480MHz
Result	On Time = 0.39ms
Notes	None



Date: 19.MAY.2022 11:04:12

Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch39, 2480MHz
Frequency Tested	2480MHz
Result	Duty Cycle Correction Factor = -4.096dB
Notes	Duty Cycle Factor Calculation: $160 \times 0.39\text{ms} = 62.4\text{ms}$ $\text{Duty Cycle Factor} = 20 \log \left( \frac{62.4\text{ms}}{100\text{ms}} \right) = -4.096\text{dB}$



Date: 19.MAY.2022 11:05:03



## 26. Case Spurious Radiated Emissions

EUT Information	
Manufacturer	Chamberlain
Product	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch0, 2402MHz Tx @ Ch19, 2440MHz Tx @ Ch39, 2480MHz

Test Setup Details	
Setup Format	Tabletop
Height of Support	N/A
Type of Test Site	Semi-Anechoic Chamber
Test Site Used	Room 29
Type of Antennas Used	1 – 18GHz: Double-Ridged Waveguide (or equivalent) Above 18GHz: Horn (or equivalent)
Notes	N/A

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

**Procedure**

Radiated measurements were performed in a 32ft. x 20ft. x 14ft. high shielded enclosure. 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.

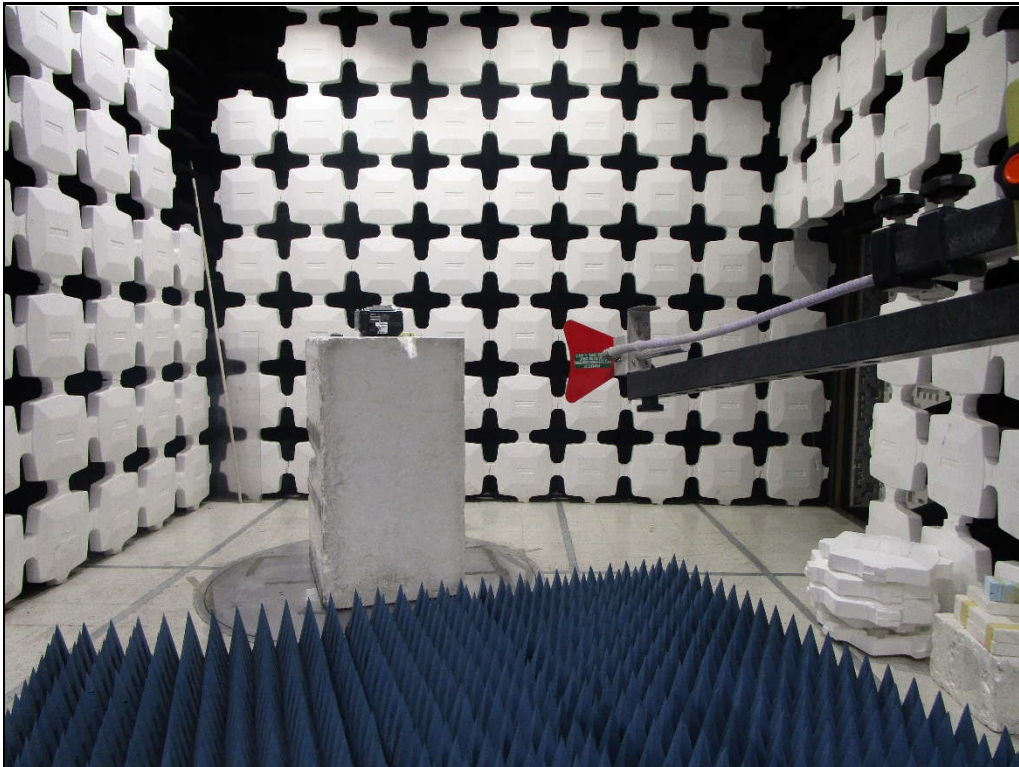
Preliminary radiated emissions tests were performed to determine the emission characteristics of the EUT. For the preliminary test, a broadband measuring antenna was positioned at a 3-meter distance from the EUT. The entire frequency range from 30MHz to 25GHz was investigated using a peak detector function.

The final open field emission tests were then manually performed over the frequency range of 30MHz to 25GHz.

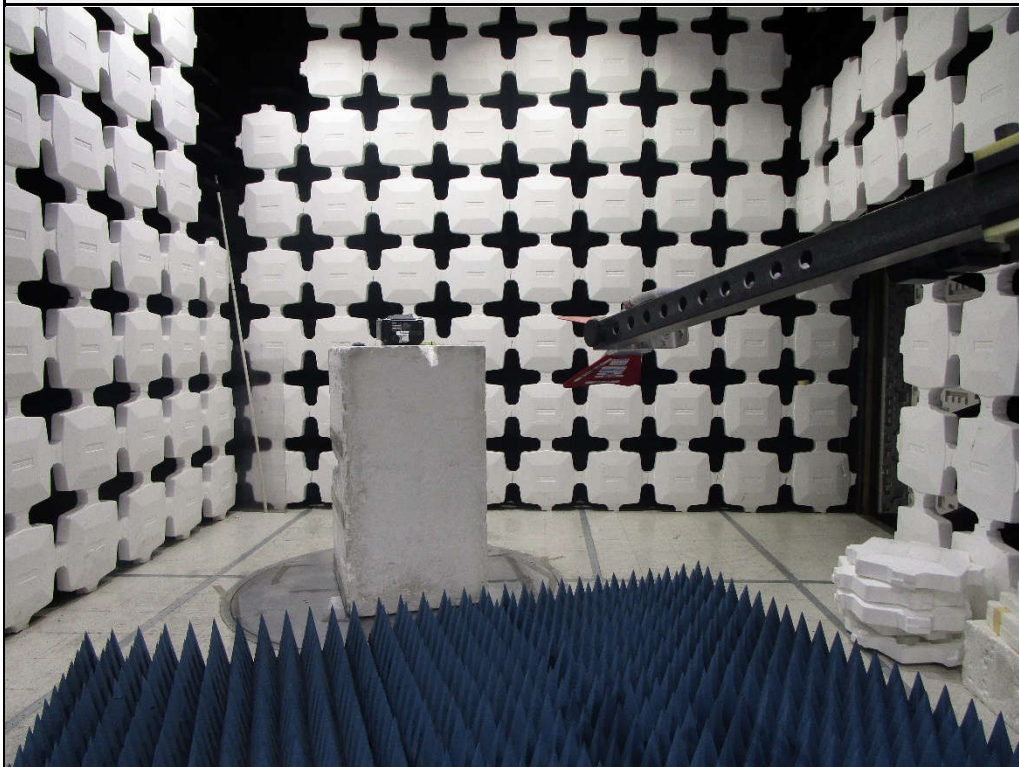
- 1) For all harmonics not in the restricted bands, the following procedure was used:
  - a) The field strength of the fundamental was measured using a double ridged waveguide antenna. The waveguide antenna was positioned at a 3-meter distance from the EUT. The EUT was placed on a 1.5-meter-high non-conductive stand. A peak detector with a resolution bandwidth of 100 kHz was used on the spectrum analyzer.
  - b) The field strengths of all of the harmonics not in the restricted band were then measured using a double-ridged waveguide antenna. The waveguide antenna was positioned at a 3-meter distance from the EUT. The EUT was placed on a 1.5-meter-high non-conductive stand. A peak detector with a resolution bandwidth of 100kHz was used on the spectrum analyzer.
  - c) To ensure that maximum or worst-case emission levels at the fundamental and harmonics were measured, the following steps were taken when measuring the fundamental emissions and the spurious emissions:
    - i) The EUT was rotated so that all of its sides were exposed to the receiving antenna.
    - ii) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
    - iii) The measuring antenna was raised and lowered for each antenna polarization to maximize the readings.
    - iv) In instances where it was necessary to use a shortened cable between the measuring antenna and the spectrum analyzer, the measuring antenna was not raised or lowered to ensure maximized readings. Instead, the EUT was rotated through all axis to ensure the maximum readings were recorded for the EUT.
  - d) All harmonics not in the restricted bands must be at least 20dB below levels measured at the fundamental. However, attenuation below the general limits specified in §15.209(a) is not required.
- 2) For all emissions in the restricted bands, the following procedure was used:
  - a) The field strengths of all emissions below 1GHz were measured using a bi-log antenna. The bi-log antenna was positioned at a 3-meter distance from the EUT. 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.
  - b) The field strengths of all emissions above 1GHz were measured using a double-ridged waveguide antenna. The waveguide antenna was positioned at a 3-meter distance from the EUT. The EUT was placed on a 1.5-meter-high non-conductive stand. A peak detector with a resolution bandwidth of 1MHz was used on the spectrum analyzer.
  - c) To ensure that maximum or worst-case emission levels were measured, the following steps were taken when taking all measurements:
    - i) The EUT was rotated so that all of its sides were exposed to the receiving antenna.
    - ii) Since the measuring antenna is linearly polarized, both horizontal and vertical field components

were measured.

- iii) The measuring antenna was raised and lowered for each antenna polarization to maximize the readings.
- iv) In instances where it was necessary to use a shortened cable between the measuring antenna and the spectrum analyzer, the measuring antenna was not raised or lowered to ensure maximized readings. Instead, the EUT was rotated through all axis to ensure the maximum readings were recorded for the EUT.
- d) For all radiated emissions measurements below 1GHz, if the peak reading is below the limits listed in §15.209(a), no further measurements are required. If, however, the peak readings exceed the limits listed in §15.209(a), then the emissions are remeasured using a quasi-peak detector.
- e) For all radiated emissions measurements above 1GHz, the peak readings must comply with the §15.35(b) limits. §15.35(b) states that when average radiated emissions measurements are specified, there also is a limit on the peak level of the radiated emissions. The limit on the peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. Therefore, all peak readings above 1GHz must be no greater than 20dB above the limits specified in §15.209(a).
- f) Next, for all radiated emissions measurements above 1GHz, the resolution bandwidth was set to 1MHz. The analyzer was set to linear mode with a 10Hz video bandwidth in order to simulate an average detector. An average reading was taken then corrected for duty cycle if the duty cycle is less than 98%.



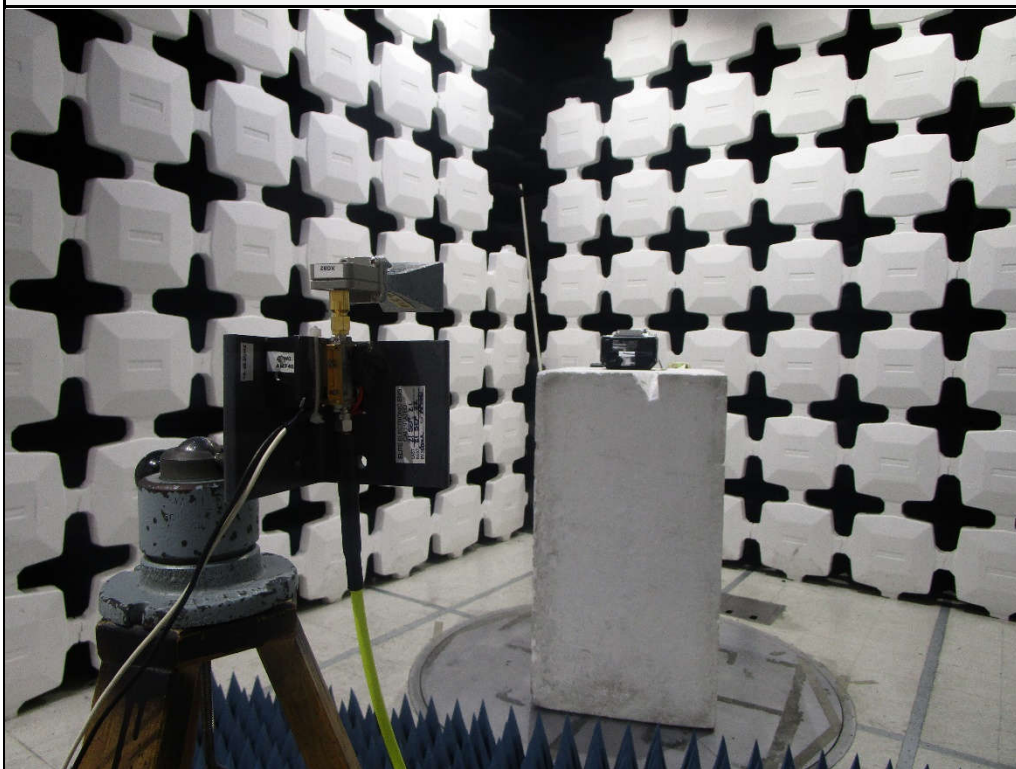
Test Setup for Spurious Radiated Emissions, 1 – 18GHz – Antenna Polarization Horizontal



Test Setup for Spurious Radiated Emissions, 1 – 18GHz – Antenna Polarization Vertical



Test Setup for Spurious Radiated Emissions, Above 18GHz – Antenna Polarization Horizontal



Test Setup for Spurious Radiated Emissions, Above 18GHz – Antenna Polarization Vertical

Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch0, 2402MHz
Frequency Tested	2402MHz
Notes	Peak Measurements in the Restricted Bands

Freq (MHz)	Ant Pol	Meter Reading (dB $\mu$ V)	Ambient	Cable Factor (dB)	Antenna Factor (dB/m)	Pre Amp (dB)	Peak Total at 3m (dB $\mu$ V/m)	Peak Total at 3m ( $\mu$ V/m)	Peak Limit at 3m ( $\mu$ V/m)	Margin (dBm)
4804.00	H	48.6	*	3.7	36.1	-39.7	48.6	270.1	5000.0	-25.3
	V	49.3	*	3.7	36.1	-39.7	49.4	293.5	5000.0	-24.6
12010.00	H	47.5	*	6.1	41.5	-39.0	56.1	639.7	5000.0	-17.9
	V	48.4	*	6.1	41.5	-39.0	57.0	707.9	5000.0	-17.0
19216.00	H	31.9	*	2.2	40.4	-28.2	46.2	204.7	5000.0	-27.8
	V	32.1	*	2.2	40.4	-28.2	46.5	211.4	5000.0	-27.5

Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch0, 2402MHz
Frequency Tested	2402MHz
Notes	Average Measurements in the Restricted Bands

Freq (MHz)	Ant Pol	Meter Reading (dBμV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Duty Cycle Factor (dB)	Average Total at 3m (dBμV/m)	Average Total at 3m (μV/m)	Average Limit at 3m (μV/m)	Margin (dB)
4804.00	H	33.56	*	3.7	36.1	-39.7	4.1	37.7	76.7	500.0	-16.3
	V	33.48	*	3.7	36.1	-39.7	4.1	37.6	76.0	500.0	-16.4
12010.00	H	33.19	*	6.1	41.5	-39.0	4.1	45.9	197.2	500.0	-8.1
	V	33.19	*	6.1	41.5	-39.0	4.1	45.9	197.2	500.0	-8.1
19216.00	H	15.10	*	2.2	40.4	-28.2	4.1	33.6	47.6	500.0	-20.4
	V	15.10	*	2.2	40.4	-28.2	4.1	33.6	47.6	500.0	-20.4

Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch0, 2402MHz
Frequency Tested	2402MHz
Notes	Peak Measurements in Non-Restricted Bands

Freq (MHz)	Ant Pol	Meter Reading (dBμV)	Ambient	Cable Factor (dB)	Antenna Factor (dB/m)	Pre Amp (dB)	Peak Total at 3m (dBμV/m)	Peak Total at 3m (μV/m)	Peak Limit at 3m (μV/m)	Margin (dBm)
2402.00	H	60.16		2.6	32.7	0.0	95.4	59074.4	NA	NA
	V	60.15		2.6	32.7	0.0	95.4	59006.4	NA	NA
7206.00	H	38.00	*	4.6	38.4	-39.7	41.4	117.6	5907.4	-34.0
	V	38.30	*	4.6	38.4	-39.7	41.7	121.7	5907.4	-33.7
9608.00	H	39.22		5.2	39.2	-39.3	44.3	163.2	5907.4	-31.2
	V	41.93		5.2	39.2	-39.3	47.0	222.9	5907.4	-28.5
14412.00	H	37.81	*	6.6	41.7	-38.6	47.5	238.1	5907.4	-27.9
	V	37.73	*	6.6	41.7	-38.6	47.5	235.9	5907.4	-28.0
16814.00	H	37.54	*	7.2	44.7	-37.4	52.0	399.6	5907.4	-23.4
	V	37.65	*	7.2	44.7	-37.4	52.1	404.7	5907.4	-23.3
21618.00	H	21.50	*	2.2	40.6	-28.5	35.8	61.8	5907.4	-39.6
	V	20.83	*	2.2	40.6	-28.5	35.1	57.2	5907.4	-40.3
24020.00	H	21.80	*	2.2	40.6	-29.3	35.4	58.8	5907.4	-40.0
	V	21.78	*	2.2	40.6	-29.3	35.4	58.7	5907.4	-40.1



Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch19, 2440MHz
Frequency Tested	2440MHz
Notes	Peak Measurements in the Restricted Bands

Freq (MHz)	Ant Pol	Meter Reading (dB $\mu$ V)	Ambient	Cable Factor (dB)	Antenna Factor (dB/m)	Pre Amp (dB)	Peak Total at 3m (dB $\mu$ V/m)	Peak Total at 3m ( $\mu$ V/m)	Peak Limit at 3m ( $\mu$ V/m)	Margin (dBm)
4880.00	H	48.5	*	3.7	36.2	-39.6	48.8	274.3	5000.0	-25.2
	V	48.2	*	3.7	36.2	-39.6	48.5	265.0	5000.0	-25.5
7320.00	H	48.2	*	4.7	38.2	-39.6	51.4	373.6	5000.0	-22.5
	V	48.5	*	4.7	38.2	-39.6	51.7	386.7	5000.0	-22.2
12200.00	H	47.4	*	6.1	41.7	-38.9	56.3	649.7	5000.0	-17.7
	V	47.1	*	6.1	41.7	-38.9	56.0	627.7	5000.0	-18.0
19520.00	H	31.7	*	2.2	40.4	-27.8	46.6	213.3	5000.0	-27.4
	V	31.4	*	2.2	40.4	-27.8	46.3	206.3	5000.0	-27.7

Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch19, 2440MHz
Frequency Tested	2440MHz
Notes	Average Measurements in the Restricted Bands

Freq (MHz)	Ant Pol	Meter Reading (dBµV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Duty Cycle Factor (dB)	Average Total at 3m (dBµV/m)	Average Total at 3m (µV/m)	Average Limit at 3m (µV/m)	Margin (dB)
4880.00	H	33.40	*	3.7	36.2	-39.6	4.1	37.8	77.2	500.0	-16.2
	V	33.40	*	3.7	36.2	-39.6	4.1	37.8	77.2	500.0	-16.2
7320.00	H	33.10	*	4.7	38.2	-39.6	4.1	40.4	105.2	500.0	-13.5
	V	33.10	*	4.7	38.2	-39.6	4.1	40.4	105.2	500.0	-13.5
12200.00	H	32.10	*	6.1	41.7	-38.9	4.1	45.0	178.7	500.0	-8.9
	V	32.10	*	6.1	41.7	-38.9	4.1	45.0	178.7	500.0	-8.9
19520.00	H	14.50	*	2.2	40.4	-27.8	4.1	33.4	47.0	500.0	-20.5
	V	14.60	*	2.2	40.4	-27.8	4.1	33.5	47.5	500.0	-20.4

Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch19, 2440MHz
Frequency Tested	2440MHz
Notes	Peak Measurements in Non-Restricted Bands

Freq (MHz)	Ant Pol	Meter Reading (dB $\mu$ V)	Ambient	Cable Factor (dB)	Antenna Factor (dB/m)	Pre Amp (dB)	Peak Total at 3m (dB $\mu$ V/m)	Peak Total at 3m ( $\mu$ V/m)	Peak Limit at 3m ( $\mu$ V/m)	Margin (dBm)
2440.00	H	59.70		2.6	32.9	0.0	95.2	57594.7	NA	NA
	V	57.80		2.6	32.9	0.0	93.3	46278.8	NA	NA
9760.00	H	41.80		5.2	39.3	-39.3	47.1	226.3	5759.5	-28.1
	V	41.30		5.2	39.3	-39.3	46.6	213.7	5759.5	-28.6
14640.00	H	37.50	*	6.7	42.1	-38.6	47.6	241.1	5759.5	-27.6
	V	38.10	*	6.7	42.1	-38.6	48.2	258.3	5759.5	-27.0
17080.00	H	36.70	*	7.3	44.5	-37.4	51.1	357.2	5759.5	-24.1
	V	36.60	*	7.3	44.5	-37.4	51.0	353.1	5759.5	-24.2
21960.00	H	21.52	*	2.2	40.6	-28.9	35.4	59.1	5759.5	-39.8
	V	21.01	*	2.2	40.6	-28.9	34.9	55.7	5759.5	-40.3
24400.00	H	22.24	*	2.2	40.6	-29.3	35.8	61.7	5759.5	-39.4
	V	21.71	*	2.2	40.6	-29.3	35.3	58.1	5759.5	-39.9

Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch39, 2480MHz
Frequency Tested	2480MHz
Notes	Peak Measurements in the Restricted Bands

Freq (MHz)	Ant Pol	Meter Reading (dB $\mu$ V)	Ambient	Cable Factor (dB)	Antenna Factor (dB/m)	Pre Amp (dB)	Peak Total at 3m (dB $\mu$ V/m)	Peak Total at 3m ( $\mu$ V/m)	Peak Limit at 3m ( $\mu$ V/m)	Margin (dBm)
4960.00	H	49.2	*	3.7	36.2	-39.6	49.5	298.7	5000.0	-24.5
	V	49.0	*	3.7	36.2	-39.6	49.3	291.9	5000.0	-24.7
7440.00	H	48.1	*	4.7	38.0	-39.6	51.3	365.4	5000.0	-22.7
	V	47.9	*	4.7	38.0	-39.6	51.1	357.1	5000.0	-22.9
12400.00	H	47.0	*	6.1	41.6	-38.8	55.9	624.9	5000.0	-18.1
	V	47.4	*	6.1	41.6	-38.8	56.3	654.3	5000.0	-17.7
19840.00	H	32.7	*	2.2	40.4	-28.0	47.2	230.3	5000.0	-26.7
	V	32.3	*	2.2	40.4	-28.0	46.9	220.2	5000.0	-27.1
22320.00	H	32.1	*	2.2	40.6	-28.8	46.1	201.5	5000.0	-27.9
	V	32.2	*	2.2	40.6	-28.8	46.2	204.3	5000.0	-27.8
2483.50	H	15.8	*	2.7	33.1	0.0	51.6	378.3	5000.0	-22.4
	V	15.6	*	2.7	33.1	0.0	51.4	369.7	5000.0	-22.6

Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch39, 2480MHz
Frequency Tested	2480MHz
Notes	Average Measurements in the Restricted Bands

Freq (MHz)	Ant Pol	Meter Reading (dBμV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Duty Cycle Factor (dB)	Average Total at 3m (dBμV/m)	Average Total at 3m (μV/m)	Average Limit at 3m (μV/m)	Margin (dB)
4960.00	H	33.80	*	3.7	36.2	-39.6	4.1	38.2	81.2	500.0	-15.8
	V	33.90	*	3.7	36.2	-39.6	4.1	38.3	82.2	500.0	-15.7
7440.00	H	32.70	*	4.7	38.0	-39.6	4.1	39.9	99.4	500.0	-14.0
	V	32.70	*	4.7	38.0	-39.6	4.1	39.9	99.4	500.0	-14.0
12400.00	H	32.10	*	6.1	41.6	-38.8	4.1	45.1	180.0	500.0	-8.9
	V	32.10	*	6.1	41.6	-38.8	4.1	45.1	180.0	500.0	-8.9
19840.00	H	15.50	*	2.2	40.4	-28.0	4.1	34.2	51.2	500.0	-19.8
	V	15.50	*	2.2	40.4	-28.0	4.1	34.2	51.2	500.0	-19.8
22320.00	H	15.60	*	2.2	40.6	-28.8	4.1	33.7	48.2	500.0	-20.3
	V	15.60	*	2.2	40.6	-28.8	4.1	33.7	48.2	500.0	-20.3
2483.50	H	1.70	*	2.7	33.1	0.0	4.1	41.5	119.5	500.0	-12.4
	V	1.70	*	2.7	33.1	0.0	4.1	41.5	119.5	500.0	-12.4

Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch39, 2480MHz
Frequency Tested	2480MHz
Notes	Peak Measurements in Non-Restricted Bands

Freq (MHz)	Ant Pol	Meter Reading (dB $\mu$ V)	Ambient	Cable Factor (dB)	Antenna Factor (dB/m)	Pre Amp (dB)	Peak Total at 3m (dB $\mu$ V/m)	Peak Total at 3m ( $\mu$ V/m)	Peak Limit at 3m ( $\mu$ V/m)	Margin (dBm)
2480.00	H	56.40		2.7	33.1	0.0	92.1	40441.7	NA	NA
	V	54.40		2.7	33.1	0.0	90.1	32124.0	NA	NA
9920.00	H	39.70		5.3	39.4	-39.2	45.2	181.2	4044.2	-27.0
	V	41.00		5.3	39.4	-39.2	46.5	210.4	4044.2	-25.7
14880.00	H	37.20	*	6.8	42.4	-38.5	47.9	247.2	4044.2	-24.3
	V	37.00	*	6.8	42.4	-38.5	47.7	241.6	4044.2	-24.5
17360.00	H	36.20	*	7.4	43.9	-37.4	50.0	316.7	4044.2	-22.1
	V	36.20	*	7.4	43.9	-37.4	50.0	316.7	4044.2	-22.1
24800.00	H	22.19	*	2.2	40.6	-29.3	35.7	61.1	4044.2	-36.4
	V	21.93	*	2.2	40.6	-29.3	35.5	59.3	4044.2	-36.7

## 27. Band-Edge Compliance

EUT Information	
Manufacturer	Chamberlain
Product	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch0, 2402MHz Tx @ Ch19, 2440MHz Tx @ Ch39, 2480MHz

Test Setup Details	
Setup Format	Tabletop
Height of Support	N/A
Measurement Method	Antenna Conducted
Type of Test Site	Tabletop
Type of Antennas Used	N/A
Notes	Bench

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

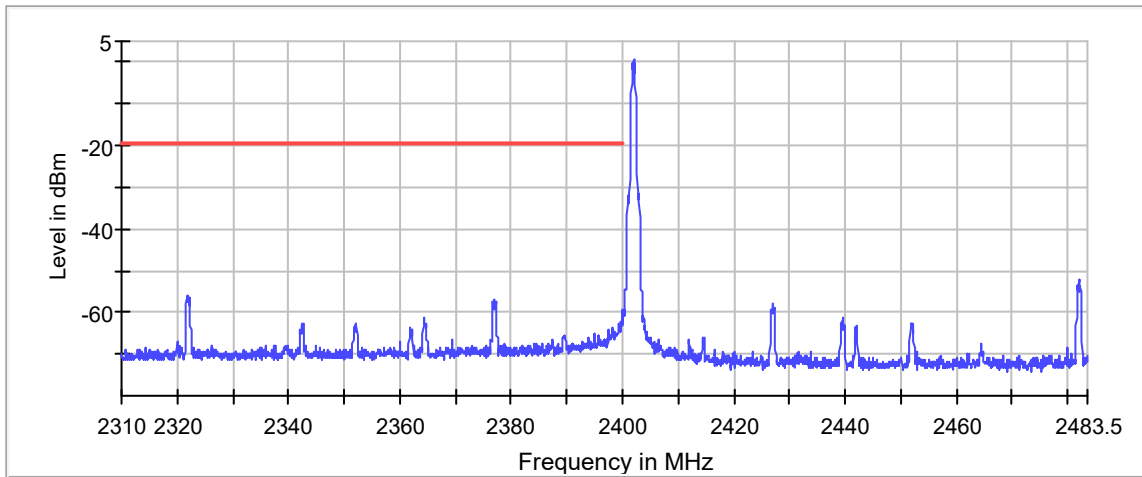
Procedure
<p>1) Low Band Edge:</p> <ul style="list-style-type: none"> <li>a) The antenna port of the EUT was connected to the spectrum analyzer through 30dB of attenuation.</li> <li>b) The EUT was set to transmit continuously at the channel closest to the low band-edge.</li> <li>c) To determine the band edge compliance, the following spectrum analyzer settings were used: <ul style="list-style-type: none"> <li>o Center Frequency = 2400MHz (low band-edge frequency).</li> <li>o Span = Wide enough to capture the peak level of the emission operating on the channel closest to the band-edge, as well as any modulation products which fall outside of the authorized band of operation.</li> <li>o Resolution Bandwidth (RBW) = <math>\geq 1\%</math> of the span.</li> <li>o 'Max-Hold' function was engaged.</li> </ul> </li> <li>d) The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined.</li> <li>e) The marker was set on the peak of the in-band emissions. A display line was placed 20dB down from the peak of the in-band emissions. All emissions which fall outside of the authorized band of operation must be below the 20dB down display line. (All emissions to the left of the center frequency (band-edge) must be below the display line.)</li> <li>f) The analyzer's display was then screenshot and saved.</li> </ul> <p>2) High Band Edge:</p> <ul style="list-style-type: none"> <li>a) The EUT was setup inside the test chamber on a non-conductive stand and set to transmit continuously at the channel closest to the high band-edge.</li> <li>b) A broadband measuring antenna was placed at a test distance of 3 meters from the EUT. The</li> </ul>

antenna was connected to the input of a spectrum analyzer.

- c) The center frequency of the analyzer was set to the high band edge (2483.5MHz).
- d) The Resolution Bandwidth was set to 1MHz.
- e) To ensure that the maximum or worst-case emission level was measured, the following steps were taken:
  - o The EUT was rotated so that all of its sides were exposed to the receiving antenna.
  - o Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
  - o The EUT was rotated so that all of its sides were exposed to the receiving antenna.
  - o The measuring antenna was raised and lowered from 1 to 4 meters for each antenna polarization to maximize the readings.
  - o The highest measured peak reading and the highest measured average reading were recorded.

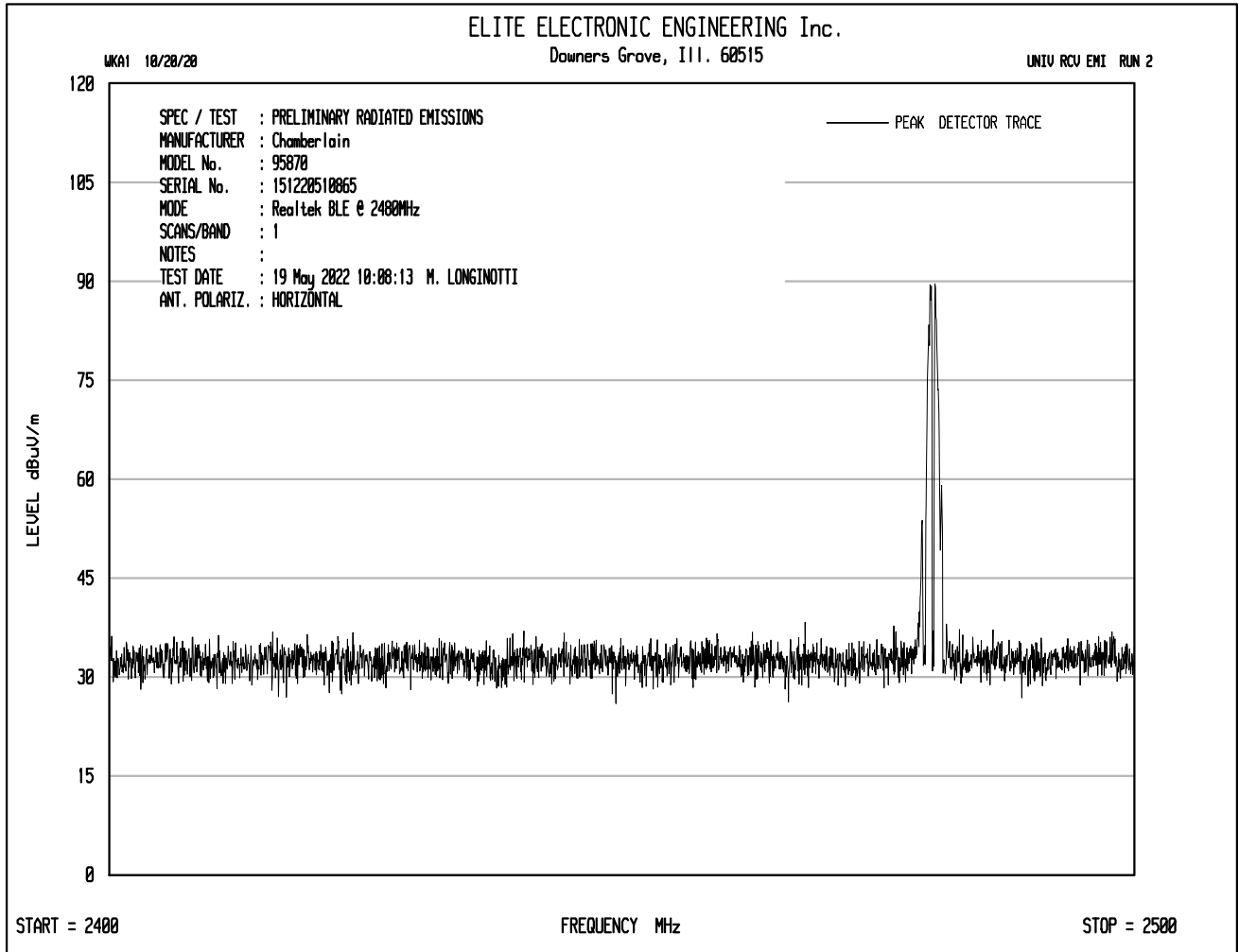


Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch0, 2402MHz
Frequency Tested	2402MHz
Notes	Low Band Edge – Antenna Conducted

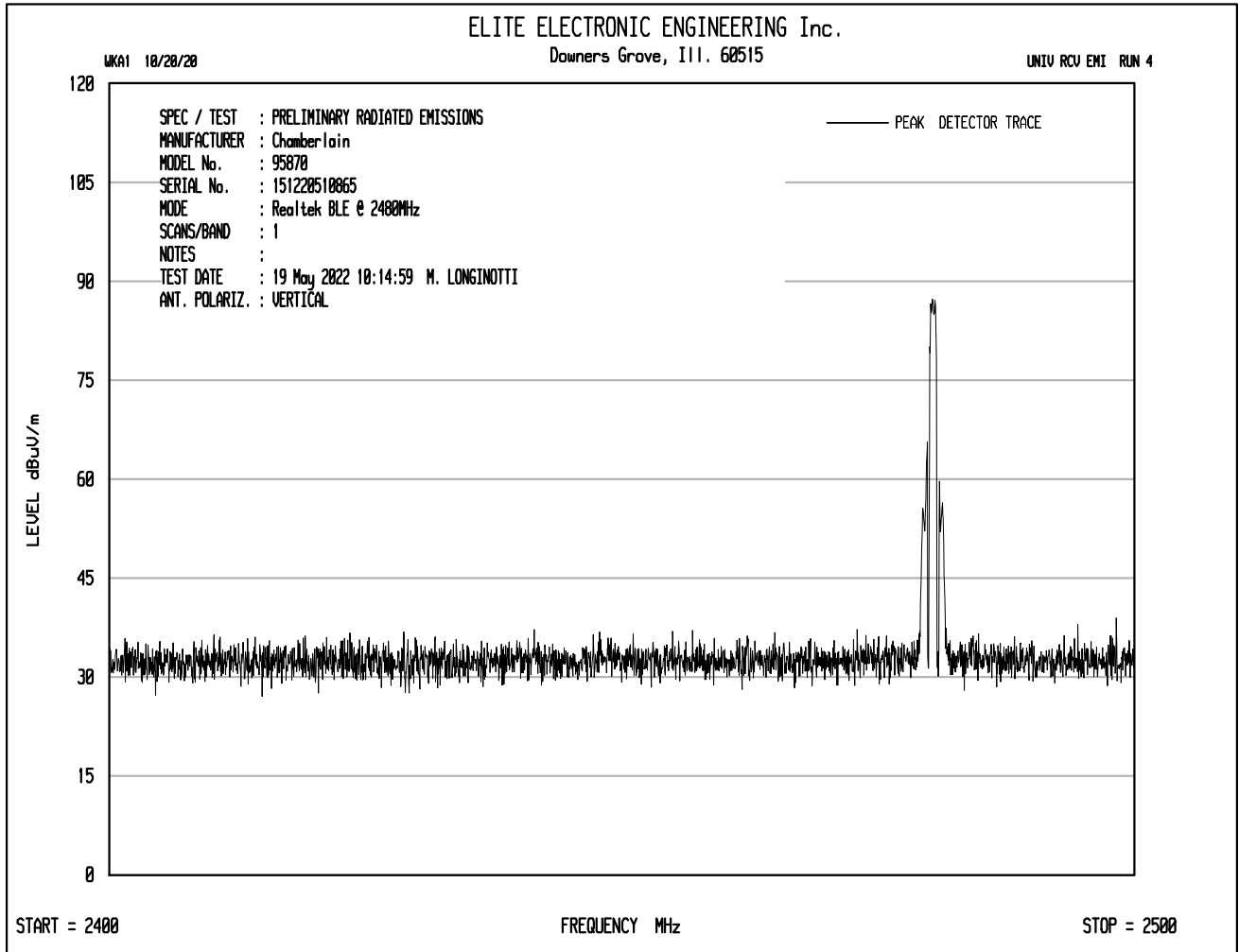


— Limit    — Sum Level    × Fail

Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch39, 2480MHz
Frequency Tested	2480MHz
Notes	High Band Edge – Radiated (Horizontal Antenna)



Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch39, 2480MHz
Frequency Tested	2480MHz
Notes	High Band Edge – Radiated (Vertical Antenna)



Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch39, 2480MHz
Frequency Tested	2480MHz
Notes	High Band Edge – Peak and Average Measurements

Freq (MHz)	Ant Pol	Meter Reading (dBµV)	Ambient	Cable Factor (dB)	Antenna Factor (dB/m)	Pre Amp (dB)	Peak Total at 3m (dBµV/m)	Peak Total at 3m (µV/m)	Peak Limit at 3m (µV/m)	Margin (dBm)
2483.50	H	15.8	*	2.7	33.1	0.0	51.6	378.3	5000.0	-22.4
	V	15.6	*	2.7	33.1	0.0	51.4	369.7	5000.0	-22.6

Freq (MHz)	Ant Pol	Meter Reading (dBµV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Duty Cycle Factor (dB)	Average Total at 3m (dBµV/m)	Average Total at 3m (µV/m)	Average Limit at 3m (µV/m)	Margin (dB)
2483.50	H	1.7	*	2.7	33.1	0.0	4.1	41.5	119.5	500.0	-12.4
	V	1.7	*	2.7	33.1	0.0	4.1	41.5	119.5	500.0	-12.4

## 28. Power Spectral Density

EUT Information	
Manufacturer	Chamberlain
Product	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch0, 2402MHz Tx @ Ch19, 2440MHz Tx @ Ch39, 2480MHz

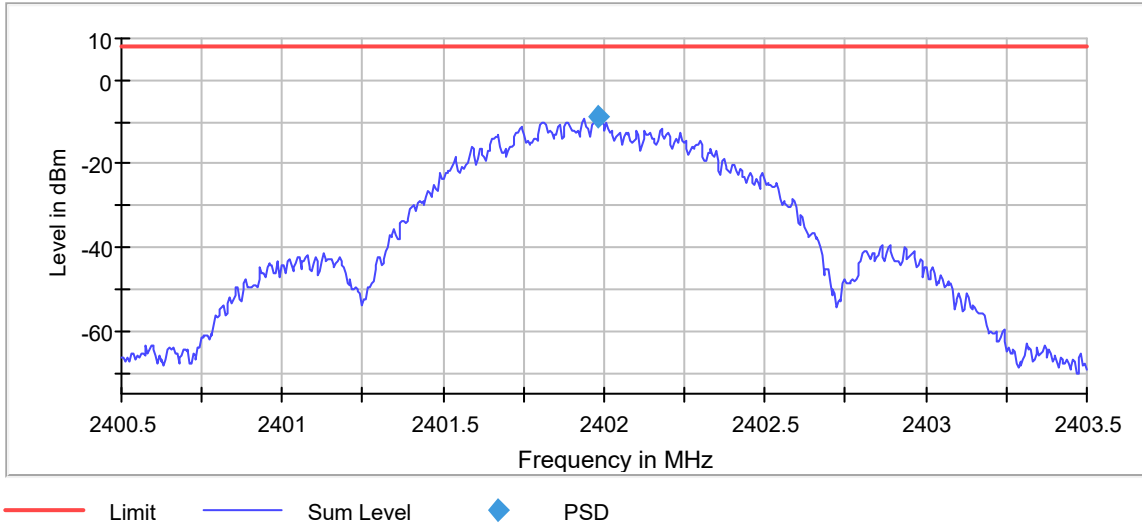
Test Setup Details	
Setup Format	Tabletop
Height of Support	N/A
Measurement Method	Antenna Conducted
Type of Test Site	Tabletop
Test Site Used	EMC Bench
Type of Antennas Used	N/A
Notes	None

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

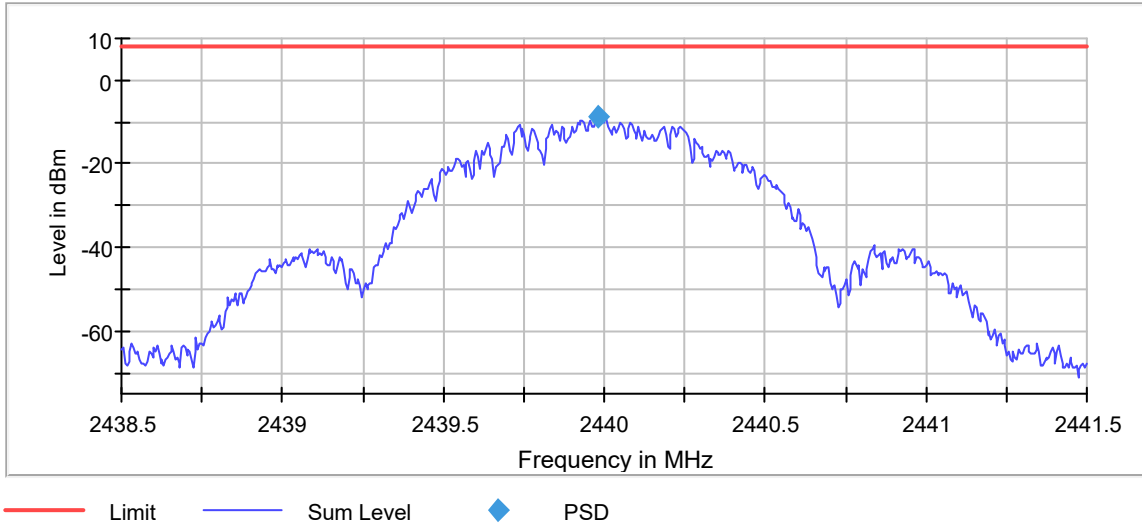
Requirement
The power spectral density from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

Procedure
<ol style="list-style-type: none"> <li>1) The antenna port of the EUT was connected to the spectrum analyzer through a 30dB pad.</li> <li>2) The EUT was then placed in the inquiry mode (for Bluetooth devices).</li> <li>3) To determine the power spectral density, the following spectrum analyzer settings were used:               <ol style="list-style-type: none"> <li>a) Center Frequency = Transmit Frequency</li> <li>b) Span = 1.5× the DTS (6dB) bandwidth</li> <li>c) Resolution Bandwidth (RBW) = 3kHz ≤ RBW ≤ 100kHz</li> <li>d) Sweep time = Auto</li> <li>e) Detector = Peak</li> <li>f) Trace Function = Max-Hold</li> </ol> </li> <li>4) A display line was then placed on the corresponding +8dBm level.</li> <li>5) The analyzers display was then screenshot and saved.</li> </ol>

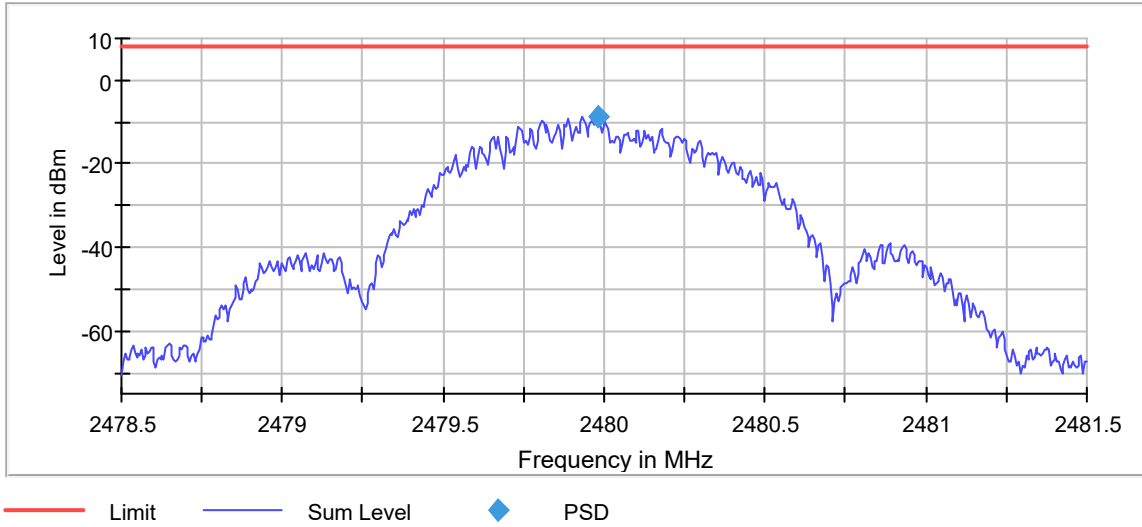
Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch0, 2402MHz
Frequency Tested	2402MHz
Result	PSD = -8.613dBm
Notes	None



Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch19, 2440MHz
Frequency Tested	2440MHz
Result	PSD = -8.571dBm
Notes	None



Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx @ Ch39, 2480MHz
Frequency Tested	2480MHz
Result	PSD = -8.528dBm
Notes	None





## 29. Scope of Accreditation

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

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Website: [www.elitetest.com](http://www.elitetest.com)

## ELECTRICAL

Valid To: June 30, 2023

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***

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)***

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)

***Radiated Emissions Anechoic***

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);  
ECE Regulation 10.06 Annex 7 (Broadband)  
ECE Regulation 10.06 Annex 8 (Narrowband)

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<u>Test Technology:</u>	<u>Test Method(s) 1:</u>
<i>Vehicle Radiated Emissions</i>	CISPR 12; CISPR 36; ICES-002; ECE Regulation 10.06 Annex 5
<i>Bulk Current Injection (BCI)</i>	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); FMCI278 (RI112); ECE Regulation 10.06 Annex 9
<i>Radiated Immunity Anechoic (Including Radar Pulse)</i>	ISO 11452-2; ISO 11452-5; CS-11979, Section 6.2; CS.00054, Section 5.8.2; GMW 3097, Section 3.4.2; EMC-CS-2009.1 (RI114); FMCI278 (RI114); SAE J1113-21; ECE Regulation 10.06 Annex 9
<i>Radiated Immunity Magnetic Field</i>	ISO 11452-8
<i>Radiated Immunity Reverb</i>	ISO/TEC 61000-4-21; GMW 3097, Section 3.4.3; EMC-CS-2009.1 (RI114); FMCI278 (RI114); ISO 11452-11
<i>Radiated Immunity (Portable Transmitters)</i>	ISO 11452-9; EMC-CS-2009.1 (RI115); FMCI278 (RI115)
<i>Vehicle Radiated Immunity (ALSE)</i>	ISO 11451-2; ECE Regulation 10.06 Annex 6
<i>Vehicle Product Specific EMC Standards</i>	EN 14982; EN ISO 13309, ISO 13766; EN 50498; EC Regulation No. 2015/208; EN 55012
<i>Electrical Loads</i>	ISO 16750-2
<b>Emissions</b> 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; 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 14
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

**Test Technology:**

**Test Method(s) 1:**

**Emissions (cont'd)**

Current Harmonics

IEC 61000-3-2; 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; 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

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

**Test Technology:**

**Test Method(s) 1:**

**Immunity (cont'd)**

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

Generic and Product Specific EMC  
Standards

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

**Test Technology:**

**Test Method(s) 1:**

***Canadian Radio Tests***

RSS-102 (RF Exposure Evaluation only); 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-SCFT-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)

***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)

**Test Technology:**

***OTA (Over the Air) Performance***  
 GSM, GPRS, EGPRS  
 UMTS (W-CDMA)  
 LTE including CAT M1  
 A-GPS for UMTS/GSM  
 LRS A-GPS, A-GLONASS,  
 STB8/STB16  
 Large Device/Laptop/Tablet Testing  
 Integrated Device Testing  
 WiFi 802.11 a/b/g/n/a

**Test Method(s) <sup>1</sup>:**

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

***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

**DC Voltage / Current**

(1mV to 15-kV) / (1µA to 10A)

FAA AC 150/5345-46E

**Power Factor / Efficiency / Crest Factor**

(Power to 30kW)

FAA AC 150/5345-47C  
 FAA EB 67D

**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

<sup>1</sup> 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.1<sup>2</sup>

<b>Rule Subpart/Technology</b>	<b>Test Method</b>	<b>Maximum Frequency (MHz)</b>
<b><u>Unintentional Radiators</u></b> Part 15B	ANSI C63.4:2014	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.1<sup>2</sup>

<b>Rule Subpart/Technology</b>	<b>Test Method</b>	<b>Maximum Frequency (MHz)</b>
<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
<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

Testing Activities Performed in Support of FCC Certification in Accordance with 47 Code of Federal Regulations and FCC KDB 974614, Appendix A, Table A.1<sup>2</sup>

Rule Subpart/Technology	Test Method	Maximum Frequency (MHz)
<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
<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

<sup>2</sup> 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 19<sup>th</sup> day of May 2021.



Vice President, Accreditation Services  
For the Accreditation Council  
Certificate Number 1786.01  
Valid to June 30, 2023

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