



Engineering Test Report No. 2201780-03

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>	
Tested by	Nathaniel Bouchie	
Signature	<i>Raymond J Klouda</i>	
Approved by	Raymond J. Klouda, Registered Professional Engineer of Illinois – 44894	
PO Number	4900083434	

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1. Report Revision History

Revision	Date	Description
–	07 JUN 2022	Initial Release of Engineering Test Report No. 2201780-03

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 EUT meets 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 Frequency Hopping Spread Spectrum intentional radiator operating within the 902 – 928MHz band.

The test series was also performed to determine if the EUT meets 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 Frequency Hopping Spread Spectrum intentional radiator operating within the 902 – 928MHz band.

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

2.3. Identification of the EUTs

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	Frequency Hopping Transmission Device
Band of Operation	902 – 928MHz
Modulation Type	GFSK
Antenna Type	Monopole
Antenna Gain (dBi) ¹	-2
Conducted Output Power	18.54dBm
20dB Bandwidth	139.9kHz
Occupied Bandwidth (99% CBW)	185.27kHz
Emission Classification	185KF1D
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	Frequency Hopping Transmission Device

Band of Operation	902 – 928MHz
Modulation Type	GFSK
Antenna Type	Monopole
Antenna Gain (dBi) ¹	-2
Conducted Output Power	18.54dBm
20dB Bandwidth	139.9kHz
Occupied Bandwidth (99% CBW)	185.27kHz
Emission Classification	185KF1D
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 its 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 item:

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 Low @ 902.25MHz	Tx on at Ch0, 902.25MHz
Tx Mid @ 914.75MHz	Tx on at Ch25. 914.75MHz
Tx High @ 926.75MHz	Tx on at Ch49, 926.75MHz
Rx Only @ 902.25MHz	Rx Only at Ch0, 902.25MHz
Rx Only @ 914.75MHz	Rx Only at Ch25. 914.75MHz
Rx Only @ 926.75MHz	Rx Only at Ch49, 926.75MHz
Tx Hopping	Tx Hopping in the 902 – 928MHz band

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
Receiver Radiated Emissions	FCC 15.109 ISED RSS-GEN	ANSI C63.4:2014	151220510865	Conforms
Transmitter Conducted Emissions (AC Mains)	FCC 15.207 ISED RSS-GEN	ANSI C63.10:2013	151220510793	Conforms
20dB 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
Carrier Frequency Separation	FCC 15.247 ISED RSS-247	ANSI C63.10:2013	151220510865	Conforms
Number of Carrier Channels	FCC 15.247 ISED RSS-247	ANSI C63.10:2013	151220510865	Conforms
Average Time of Occupancy	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

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).

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

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.

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

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

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

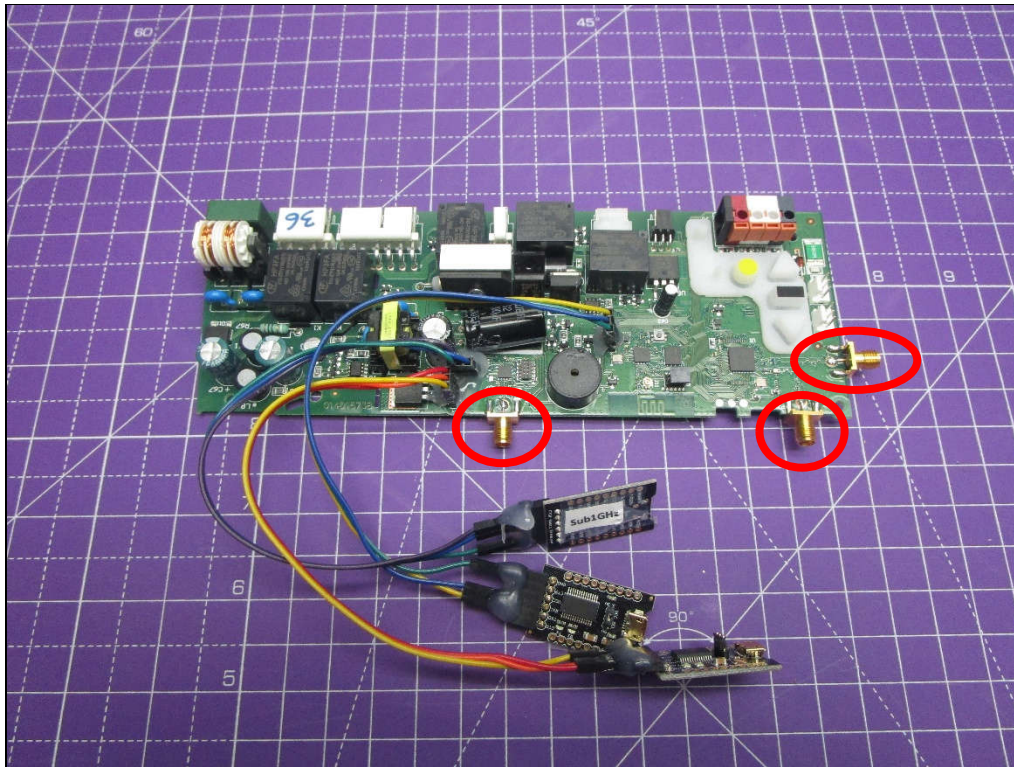
15. Statement of Conformity

The Chamberlain Phoenix AC GDO Logic Board (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	0UOHM-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

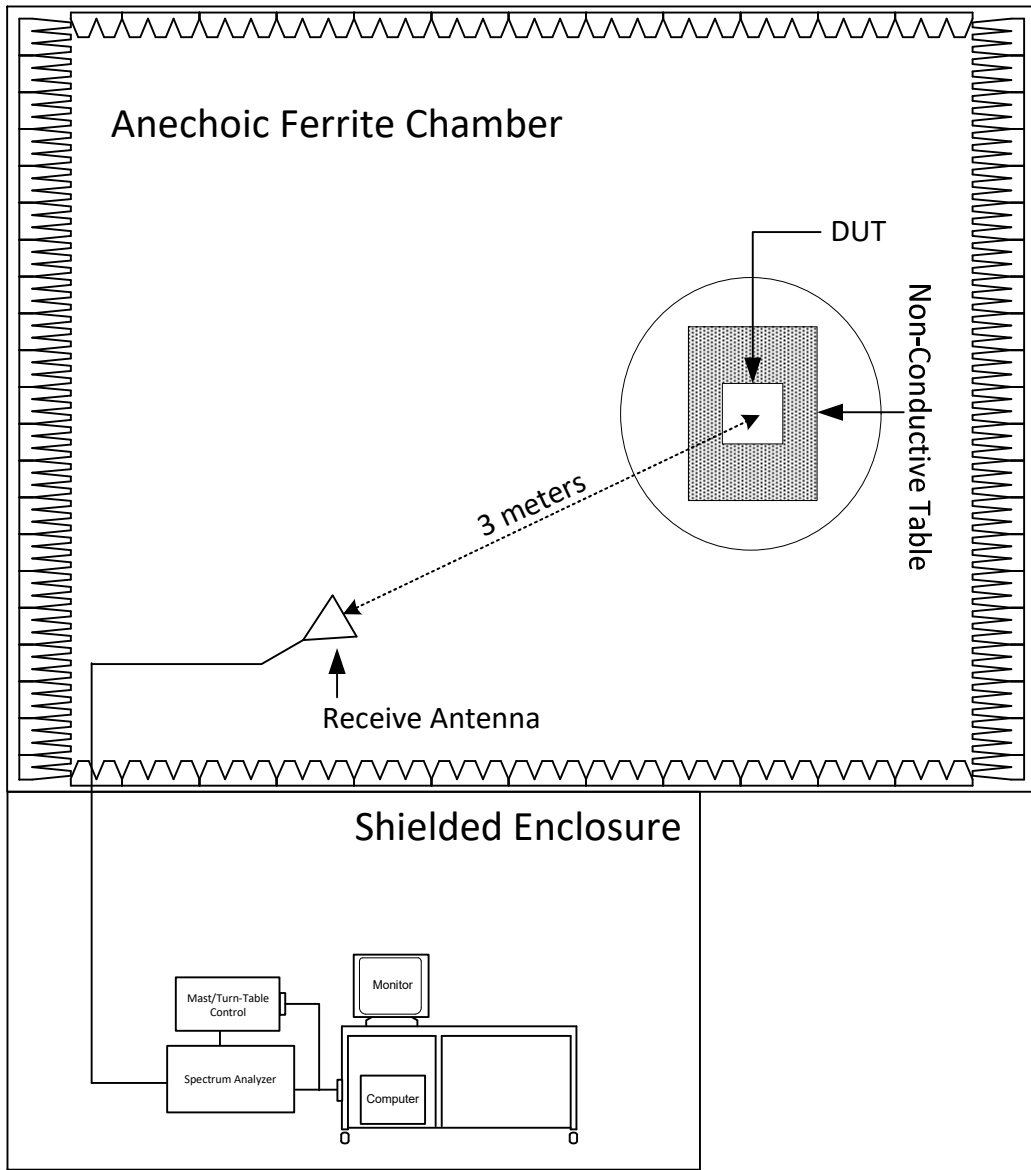
N/A: Not Applicable

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. Receiver Radiated Emissions

EUT Information	
Manufacturer	Chamberlain
Product	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Rx Only @ 902.25MHz Rx Only @ 914.75MHz Rx Only @ 926.75MHz

Test Site Information	
Setup Format	Tabletop
Height of Support	N/A
Type of Test Site	Semi-Anechoic Chamber
Test Site Used	Room 21
Type of Antennas Used	Below 1GHz: Bilog (or equivalent) Above 1GHz: Double-ridged waveguide (or equivalent)
Highest Internal Frequency	926.75MHz
Highest Measurement Frequency	5GHz
Notes	The cables were manually maximized during the preliminary emissions sweeps. The cable arrangement which resulted in the worst-case emissions was utilized.

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

Requirements
The field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the values in the following table.

Radiated Emissions Limits (30MHz to 1GHz)		
Frequency of Emission (MHz)	Field Strength ($\mu\text{V}/\text{m}$)	Field Strength ($\text{dB}\mu\text{V}/\text{m}$)
30 – 88	100	40
88 – 216	150	43.5
216 – 960	200	46
Above 960	500	54
Radiated Emissions Limits (Above 1GHz)		
Frequency of Emission (MHz)	Peak Limit ($\text{dB}\mu\text{V}/\text{m}$)	Average Limit ($\text{dB}\mu\text{V}/\text{m}$)
Above 1000	74	54

Procedure

Since a quasi-peak detector and an average detector requires long integration times, it is not practical to automatically sweep through the quasi-peak and average levels. Therefore, radiated emissions from the EUT were first scanned using a peak detector and automatically plotted. The frequencies where significant emission levels were noted were then remeasured using the quasi-peak detector or average detector.

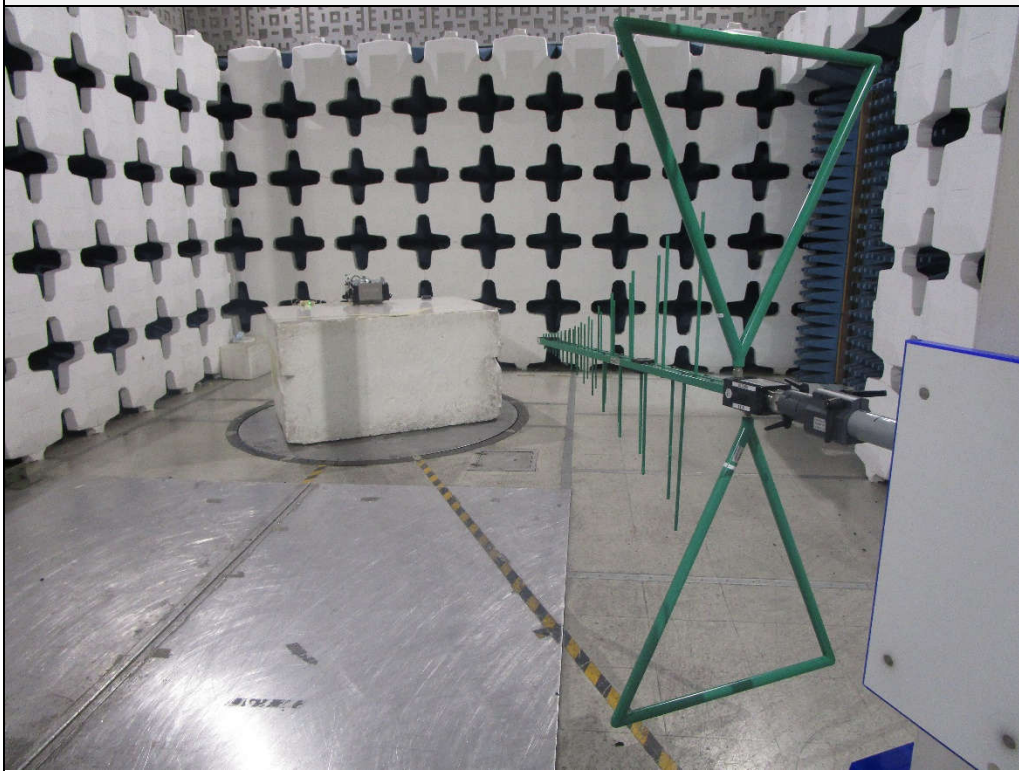
The EUT and all peripheral equipment were placed on an 80cm high non-conductive stand. The broadband measuring antenna was positioned at a 3-meter distance from the EUT. The frequency range from 30MHz to 1GHz was investigated using a peak detector function with the bilog antenna at several heights, horizontal and vertical polarization, and with several different orientations of the EUT with respect to the antenna. The frequency range from 1GHz to 5GHz was investigated using a peak detector function with the double ridged waveguide antenna at several heights, horizontal and vertical polarization, and with several different orientations of the EUT with respect to the antenna. The maximum levels for each antenna polarization were plotted.

Final radiated emissions were performed on all significant broadband and narrowband emissions found in the exploratory sweeps using the following methods:

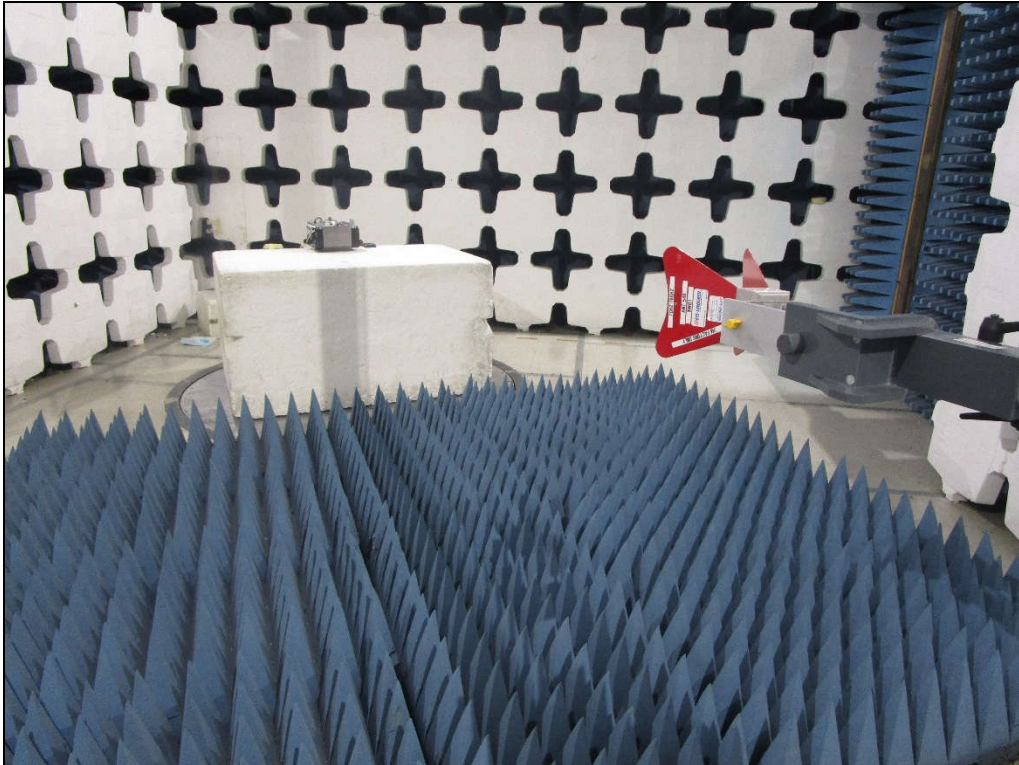
- 1) Measurements from 30MHz to 1GHz were made using a quasi-peak detector and a broadband bilog antenna. Measurements above 1GHz were made using an average detector and a broadband double ridged waveguide antenna.
- 2) To ensure that maximum or worst case, emission levels were measured, the following steps were taken:
 - a) The EUT was rotated so that all sides were exposed to the receiving antenna.
 - b) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
 - c) The measuring antenna was raised and lowered from 1 to 4 meters for each antenna polarization to maximize the readings.
 - d) For hand-held or body-worn devices, the EUT was rotated through three orthogonal axes to determine which orientation produces the highest emission relative to the limit.
- 3) Steps (b) through (d) were repeated with the EUT operated in the Rx Only @ 914.75MHz mode.
- 4) Steps (b) through (d) were repeated with the EUT operated in the Rx Only @ 926.75MHz mode.



Test Setup for Radiated Emissions: 30MHz to 1GHz, Horizontal Polarization



Test Setup for Radiated Emissions: 30MHz to 1GHz, Vertical Polarization



Test Setup for Radiated Emissions: 1GHz to 18GHz, Horizontal Polarization



Test Setup for Radiated Emissions: 1GHz to 18GHz, Vertical Polarization



FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 03/23/2022

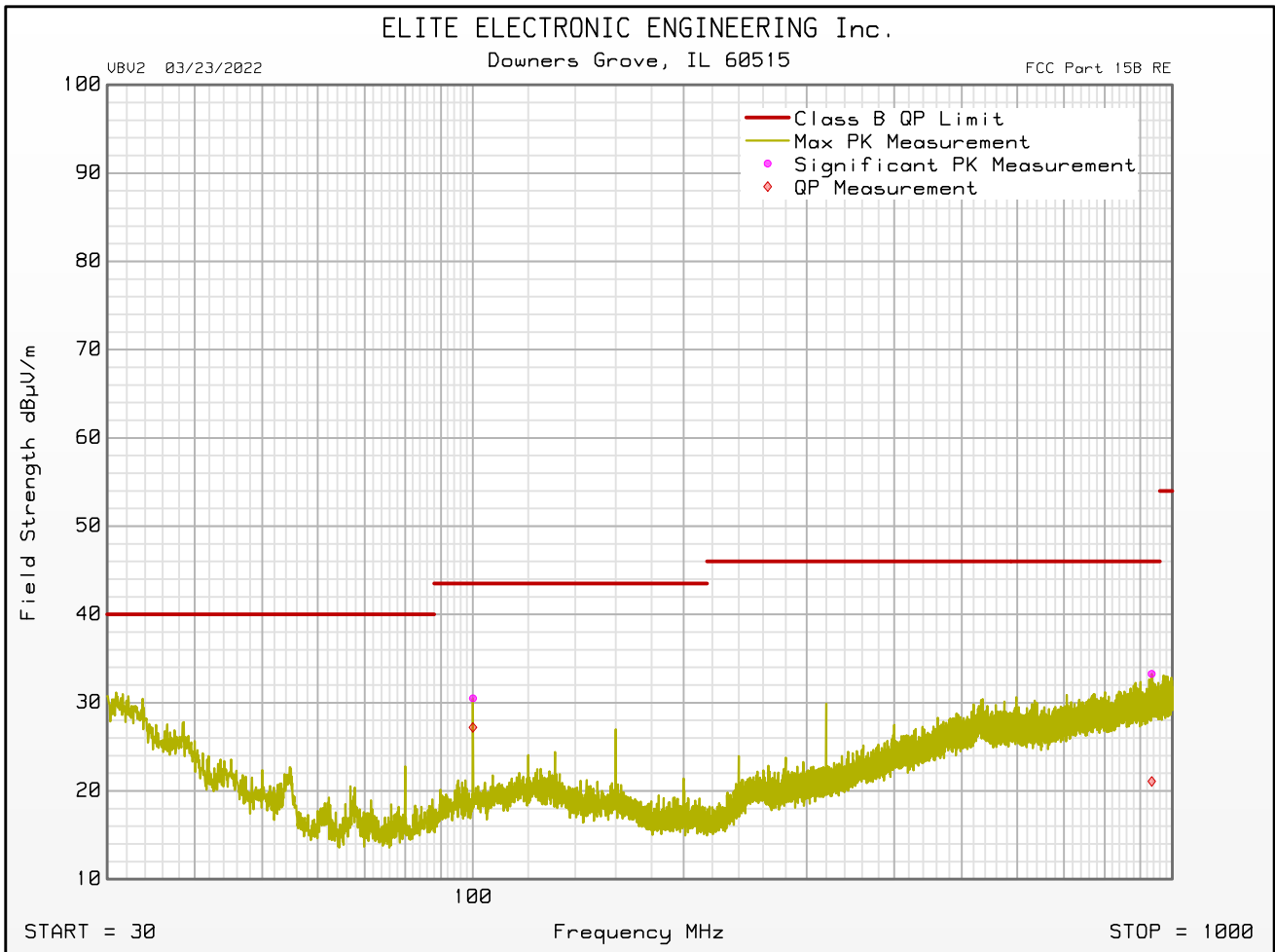
Manufacturer : Chamberlain
 Model : 003-0458-5
 Serial Number : 151220510865
 DUT Mode : FHSS Rx @ 902.25MHz
 Turntable Step Angle (°): 45
 Mast Positions (cm) : 120, 200, 340
 Scan Type : Stepped Scan
 Test RBW : 120 kHz
 Prelim Dwell Time (s) : 0.0001
 Notes :
 Test Engineer : N. Bouchie
 Test Date : Apr 26, 2022 12:21:52 PM

Freq MHz	Peak Mtr Rdg dBuV	QP Mtr Rdg dBuV	Ant Fac dB/m	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Peak Total dBµV/m	QP Total dBµV/m	QP Limit dBµV/m	QP Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °	Excessive QP Level
32.100	7.7	-2.7	23.7	0.0	0.5	0.0	31.9	21.5	40.0	-18.5	Horizontal	120	180	
58.020	10.0	-7.2	12.7	0.0	0.5	0.0	23.2	6.0	40.0	-34.0	Horizontal	120	135	
79.980	9.6	3.8	13.3	0.0	0.5	0.0	23.4	17.6	40.0	-22.4	Horizontal	200	0	
90.040	11.0	-5.6	15.1	0.0	0.5	0.0	26.5	10.0	43.5	-33.5	Horizontal	200	180	
100.000	13.2	9.9	16.8	0.0	0.5	0.0	30.5	27.2	43.5	-16.3	Vertical	120	180	
106.960	9.9	-7.7	17.4	0.0	0.5	0.0	27.9	10.3	43.5	-33.2	Horizontal	340	180	
121.060	8.5	-7.6	18.2	0.0	0.6	0.0	27.3	11.2	43.5	-32.3	Horizontal	340	225	
240.000	10.1	5.6	17.3	0.0	1.0	0.0	28.4	23.9	46.0	-22.1	Horizontal	120	90	
319.980	11.9	5.7	19.5	0.0	1.1	0.0	32.6	26.3	46.0	-19.7	Horizontal	120	45	
799.980	7.9	2.3	26.0	0.0	2.0	0.0	35.9	30.3	46.0	-15.7	Horizontal	120	45	
934.200	4.4	-7.8	26.9	0.0	2.0	0.0	33.3	21.1	46.0	-24.9	Vertical	200	135	

FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 03/23/2022

Manufacturer : Chamberlain
Model : 003-0458-5
Serial Number : 151220510865
DUT Mode : FHSS Rx @ 902.25MHz
Turntable Step Angle (°): 45
Mast Positions (cm) : 120, 200, 340
Antenna Polarization : Vertical
Scan Type : Stepped Scan
Test RBW : 120 kHz
Prelim Dwell Time (s) : 0.0001
Notes :
Test Engineer : N. Bouchie
Test Date : Apr 26, 2022 12:21:52 PM



FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 03/23/2022

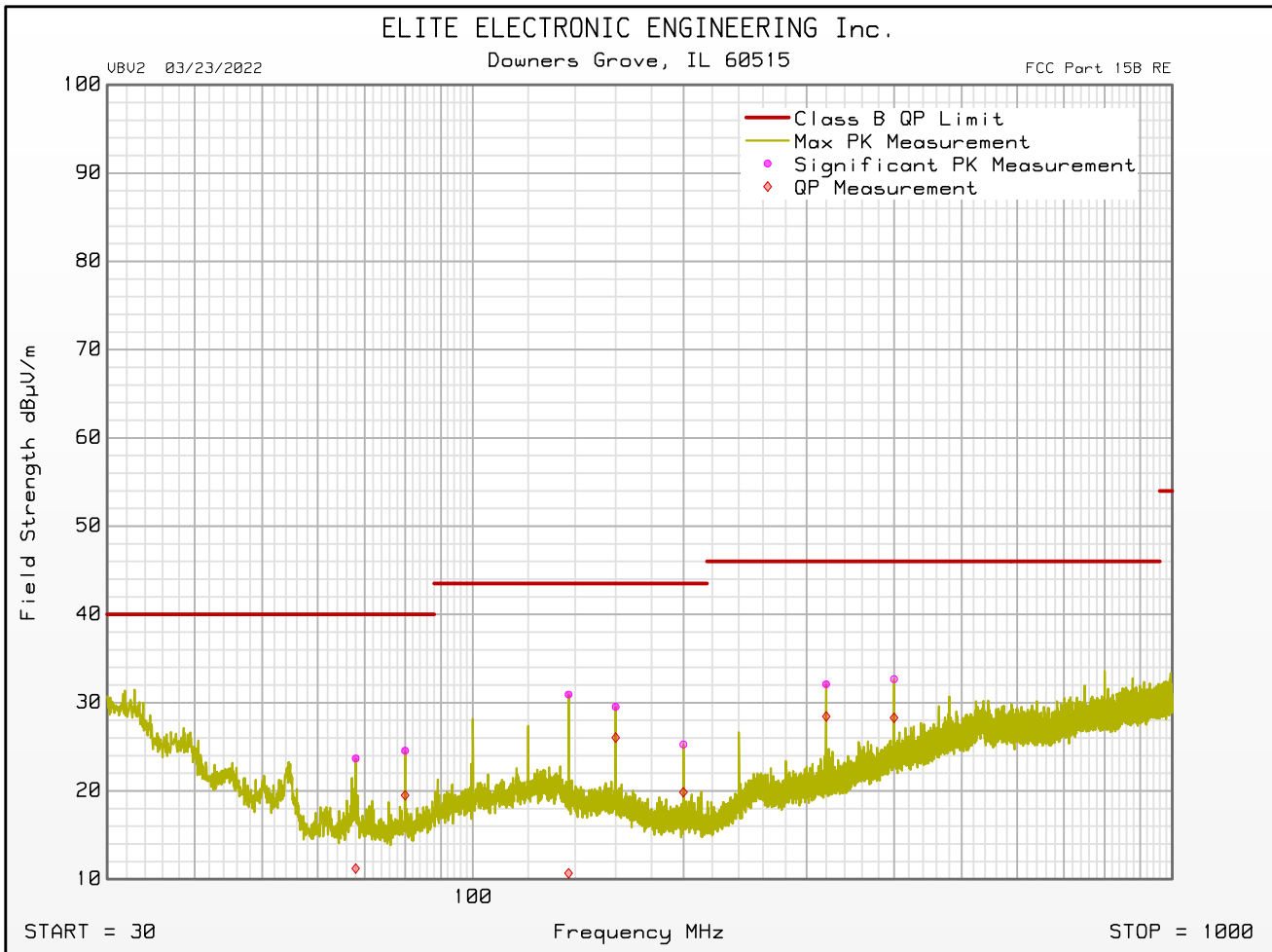
Manufacturer : Chamberlain
 Model : 003-0458-5
 Serial Number : 151220510865
 DUT Mode : FHSS Rx @ 914.75MHz
 Turntable Step Angle (°): 45
 Mast Positions (cm) : 120, 200, 340
 Scan Type : Stepped Scan
 Test RBW : 120 kHz
 Prelim Dwell Time (s) : 0.0001
 Notes :
 Test Engineer : N. Bouchie
 Test Date : Apr 26, 2022 01:25:08 PM

Freq MHz	Peak Mtr Rdg dBuV	QP Mtr Rdg dBuV	Ant Fac dB/m	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Peak Total dBµV/m	QP Total dBµV/m	QP Limit dBµV/m	QP Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °	Excessive QP Level
32.280	8.8	-2.4	23.6	0.0	0.5	0.0	32.9	21.7	40.0	-18.3	Horizontal	120	45	
67.980	10.7	-1.8	12.5	0.0	0.5	0.0	23.7	11.2	40.0	-28.8	Vertical	200	315	
79.980	10.8	5.7	13.3	0.0	0.5	0.0	24.6	19.5	40.0	-20.5	Vertical	120	225	
81.900	11.6	-7.6	13.5	0.0	0.5	0.0	25.6	6.4	40.0	-33.6	Horizontal	200	270	
101.020	13.6	-7.3	17.0	0.0	0.5	0.0	31.1	10.2	43.5	-33.3	Horizontal	120	315	
137.020	12.8	-7.5	17.4	0.0	0.7	0.0	30.9	10.7	43.5	-32.8	Vertical	120	0	
160.000	11.5	8.0	17.2	0.0	0.8	0.0	29.5	26.0	43.5	-17.5	Vertical	200	270	
199.960	8.8	3.4	15.4	0.0	1.0	0.0	25.3	19.9	43.5	-23.7	Vertical	200	0	
240.000	12.9	9.7	17.3	0.0	1.0	0.0	31.3	28.0	46.0	-18.0	Horizontal	120	225	
319.980	11.5	7.8	19.5	0.0	1.1	0.0	32.1	28.5	46.0	-17.5	Vertical	200	225	
400.020	9.3	4.9	21.8	0.0	1.5	0.0	32.7	28.3	46.0	-17.7	Vertical	120	180	
799.980	10.4	6.1	26.0	0.0	2.0	0.0	38.4	34.2	46.0	-11.8	Horizontal	120	45	
955.500	4.0	-8.5	27.1	0.0	2.0	0.0	33.1	20.6	46.0	-25.4	Horizontal	120	225	

FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 03/23/2022

Manufacturer : Chamberlain
 Model : 003-0458-5
 Serial Number : 151220510865
 DUT Mode : FHSS Rx @ 914.75MHz
 Turntable Step Angle (°): 45
 Mast Positions (cm) : 120, 200, 340
 Antenna Polarization : Vertical
 Scan Type : Stepped Scan
 Test RBW : 120 kHz
 Prelim Dwell Time (s) : 0.0001
 Notes :
 Test Engineer : N. Bouchie
 Test Date : Apr 26, 2022 01:25:08 PM





FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 03/23/2022

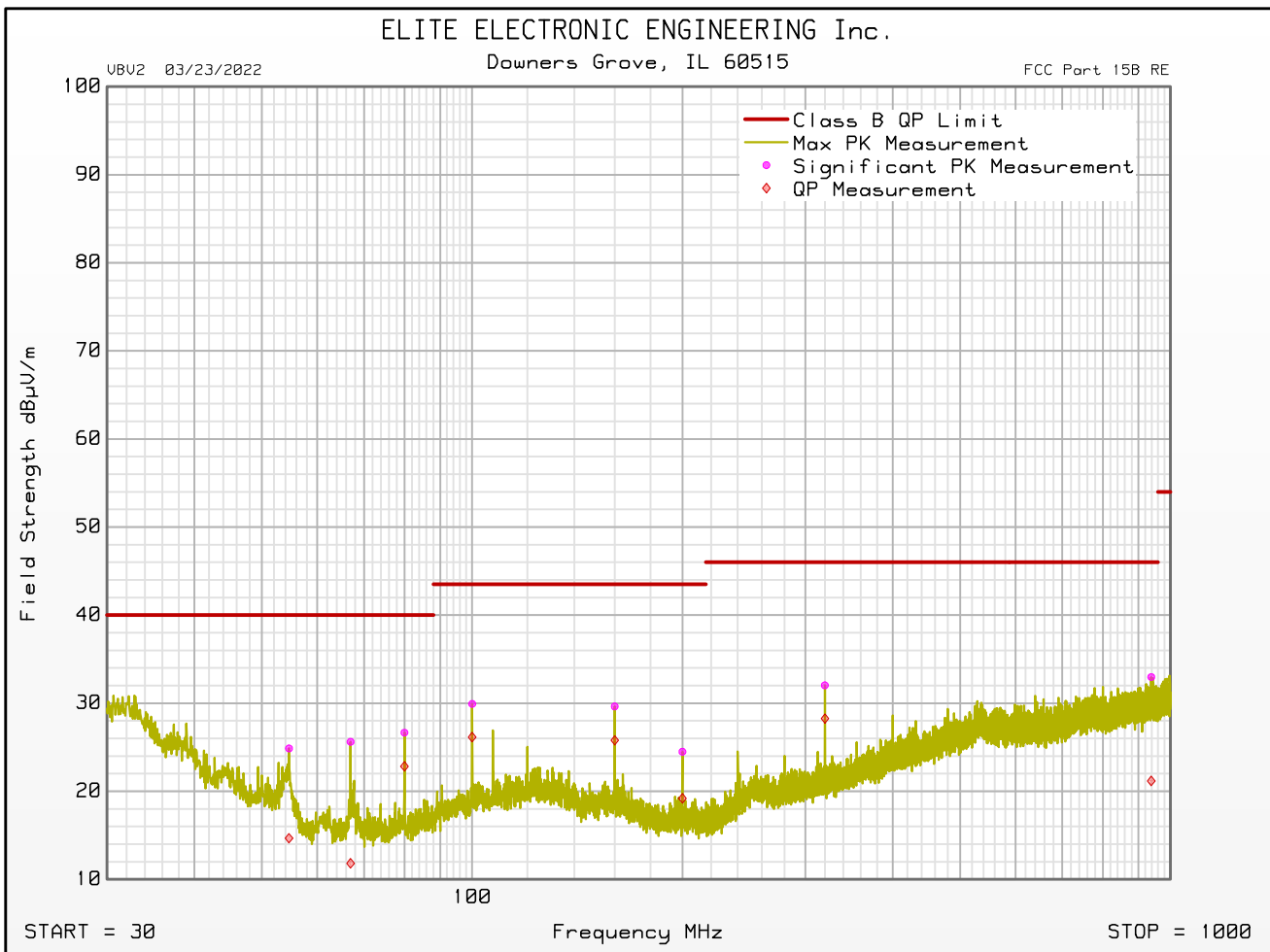
Manufacturer : Chamberlain
 Model : 003-0458-5
 Serial Number : 151220510865
 DUT Mode : FHSS Rx @ 926_75MHz
 Turntable Step Angle (°): 45
 Mast Positions (cm) : 120, 200, 340
 Scan Type : Stepped Scan
 Test RBW : 120 kHz
 Prelim Dwell Time (s) : 0.0001
 Notes :
 Test Engineer : N. Bouchie
 Test Date : Apr 26, 2022 01:54:21 PM

Freq MHz	Peak Mtr Rdg dBuV	QP Mtr Rdg dBuV	Ant Fac dB/m	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Peak Total dBµV/m	QP Total dBµV/m	QP Limit dBµV/m	QP Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °	Excessive QP Level
31.800	7.9	-3.0	23.9	0.0	0.5	0.0	32.2	21.4	40.0	-18.6	Horizontal	200	0	
54.660	10.9	0.8	13.4	0.0	0.5	0.0	24.9	14.7	40.0	-25.3	Vertical	120	180	
66.960	12.7	-1.1	12.4	0.0	0.5	0.0	25.6	11.8	40.0	-28.2	Vertical	120	45	
79.980	12.9	9.1	13.3	0.0	0.5	0.0	26.7	22.8	40.0	-17.2	Vertical	200	270	
100.000	12.6	8.8	16.8	0.0	0.5	0.0	29.9	26.2	43.5	-17.4	Vertical	120	270	
119.980	10.7	-7.7	18.2	0.0	0.6	0.0	29.6	11.1	43.5	-32.4	Horizontal	120	0	
160.000	11.6	7.8	17.2	0.0	0.8	0.0	29.6	25.8	43.5	-17.7	Vertical	120	45	
200.020	8.1	2.8	15.4	0.0	1.0	0.0	24.5	19.2	43.5	-24.3	Vertical	120	0	
240.000	10.8	5.0	17.3	0.0	1.0	0.0	29.1	23.3	46.0	-22.7	Horizontal	120	90	
319.980	11.4	7.6	19.5	0.0	1.1	0.0	32.0	28.3	46.0	-17.7	Vertical	200	225	
938.520	4.0	-7.8	26.9	0.0	2.0	0.0	33.0	21.2	46.0	-24.8	Vertical	200	0	

FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 03/23/2022

Manufacturer : Chamberlain
 Model : 003-0458-5
 Serial Number : 151220510865
 DUT Mode : FHSS Rx @ 926_75MHz
 Turntable Step Angle (°): 45
 Mast Positions (cm) : 120, 200, 340
 Antenna Polarization : Vertical
 Scan Type : Stepped Scan
 Test RBW : 120 kHz
 Prelim Dwell Time (s) : 0.0001
 Notes :
 Test Engineer : N. Bouchie
 Test Date : Apr 26, 2022 01:54:21 PM





FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 03/23/2022

Manufacturer : Chamberlain
 Model : 003-0458-5
 Serial Number : 151220510865
 DUT Mode : FHSS Rx @ 902.25MHz
 Turntable Step Angle (°): 45
 Mast Positions (cm) : 120, 200, 340
 Scan Type : Stepped Scan
 Test RBW : 1 MHz
 Prelim Dwell Time (s) : 0.0001
 Notes :
 Test Engineer : N. Bouchie
 Test Date : Apr 27, 2022 03:57:10 PM

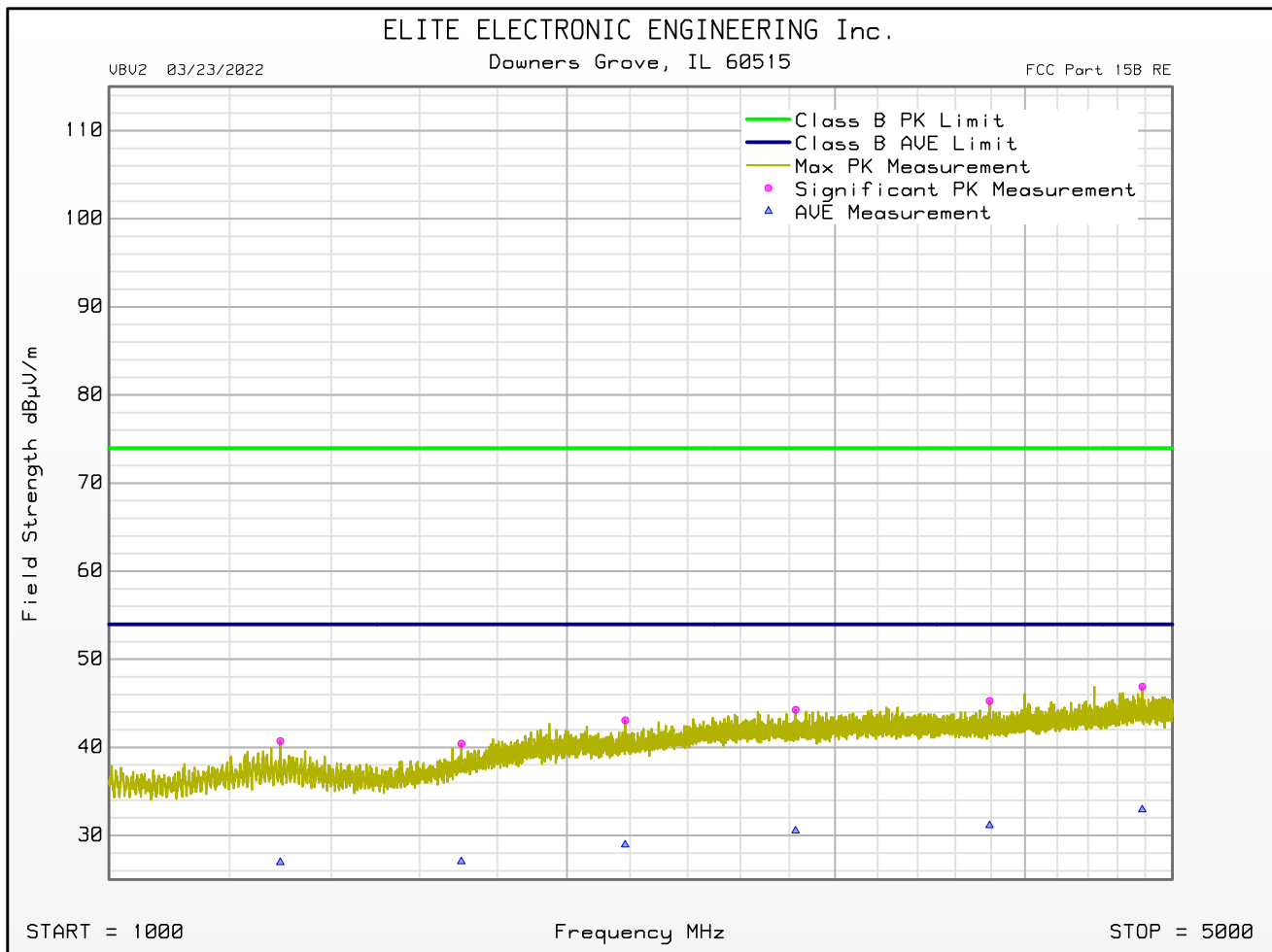
Freq MHz	Peak Mtr Rdg dBuV	Ant Fac dB/m	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Peak Total dBµV/m	Peak Limit dBµV/m	Peak Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °	Excessive Peak Level
1296.000	51.0	29.1	-41.8	2.4	0.0	40.7	74.0	-33.3	Horizontal	340	270	
1704.500	49.3	29.5	-41.1	2.8	0.0	40.4	74.0	-33.6	Horizontal	340	270	
2184.000	49.1	31.4	-40.6	3.2	0.0	43.1	74.0	-30.9	Horizontal	120	45	
2826.500	49.3	32.4	-41.2	3.8	0.0	44.3	74.0	-29.7	Horizontal	200	0	
3791.500	48.2	33.0	-40.4	4.4	0.0	45.3	74.0	-28.7	Horizontal	340	225	
4776.500	48.2	34.5	-40.7	4.9	0.0	46.9	74.0	-27.1	Horizontal	340	180	

Freq MHz	Average Mtr Rdg dBuV	Ant Fac dB/m	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Average Total dBµV/m	Average Limit dBµV/m	Average Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °	Excessive Average Level
1296.000	37.3	29.1	-41.8	2.4	0.0	27.0	54.0	-27.0	Horizontal	340	270	
1704.500	35.9	29.5	-41.1	2.8	0.0	27.0	54.0	-26.9	Horizontal	340	270	
2184.000	35.0	31.4	-40.6	3.2	0.0	28.9	54.0	-25.0	Horizontal	120	45	
2826.500	35.5	32.4	-41.2	3.8	0.0	30.5	54.0	-23.5	Horizontal	200	0	
3791.500	34.1	33.0	-40.4	4.4	0.0	31.1	54.0	-22.8	Horizontal	340	225	
4776.500	34.2	34.5	-40.7	4.9	0.0	32.9	54.0	-21.1	Horizontal	340	180	

FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 03/23/2022

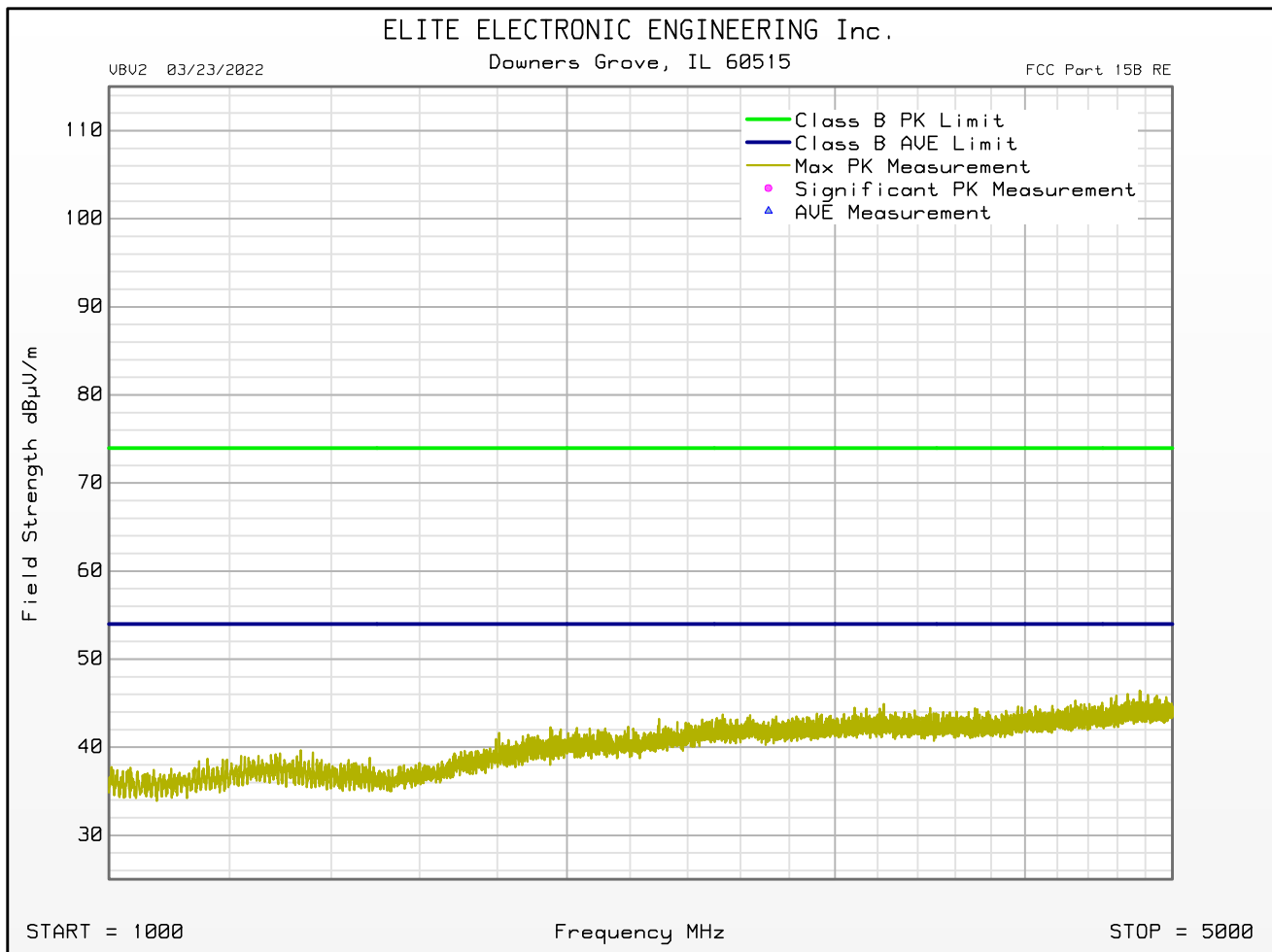
Manufacturer : Chamberlain
 Model : 003-0458-5
 Serial Number : 151220510865
 DUT Mode : FHSS Rx @ 902.25MHz
 Turntable Step Angle (°): 45
 Mast Positions (cm) : 120, 200, 340
 Antenna Polarization : Horizontal
 Scan Type : Stepped Scan
 Test RBW : 1 MHz
 Prelim Dwell Time (s) : 0.0001
 Notes :
 Test Engineer : N. Bouchie
 Test Date : Apr 27, 2022 03:57:10 PM



FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 03/23/2022

Manufacturer : Chamberlain
Model : 003-0458-5
Serial Number : 151220510865
DUT Mode : FHSS Rx @ 902.25MHz
Turntable Step Angle (°): 45
Mast Positions (cm) : 120, 200, 340
Antenna Polarization : Vertical
Scan Type : Stepped Scan
Test RBW : 1 MHz
Prelim Dwell Time (s) : 0.0001
Notes :
Test Engineer : N. Bouchie
Test Date : Apr 27, 2022 03:57:10 PM





FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 03/23/2022

Manufacturer : Chamberlain
 Model : 003-0458-5
 Serial Number : 151220510865
 DUT Mode : FHSS Rx @ 914.75MHz
 Turntable Step Angle (°): 45
 Mast Positions (cm) : 120, 200, 340
 Scan Type : Stepped Scan
 Test RBW : 1 MHz
 Prelim Dwell Time (s) : 0.0001
 Notes :
 Test Engineer : N. Bouchie
 Test Date : Apr 27, 2022 04:25:30 PM

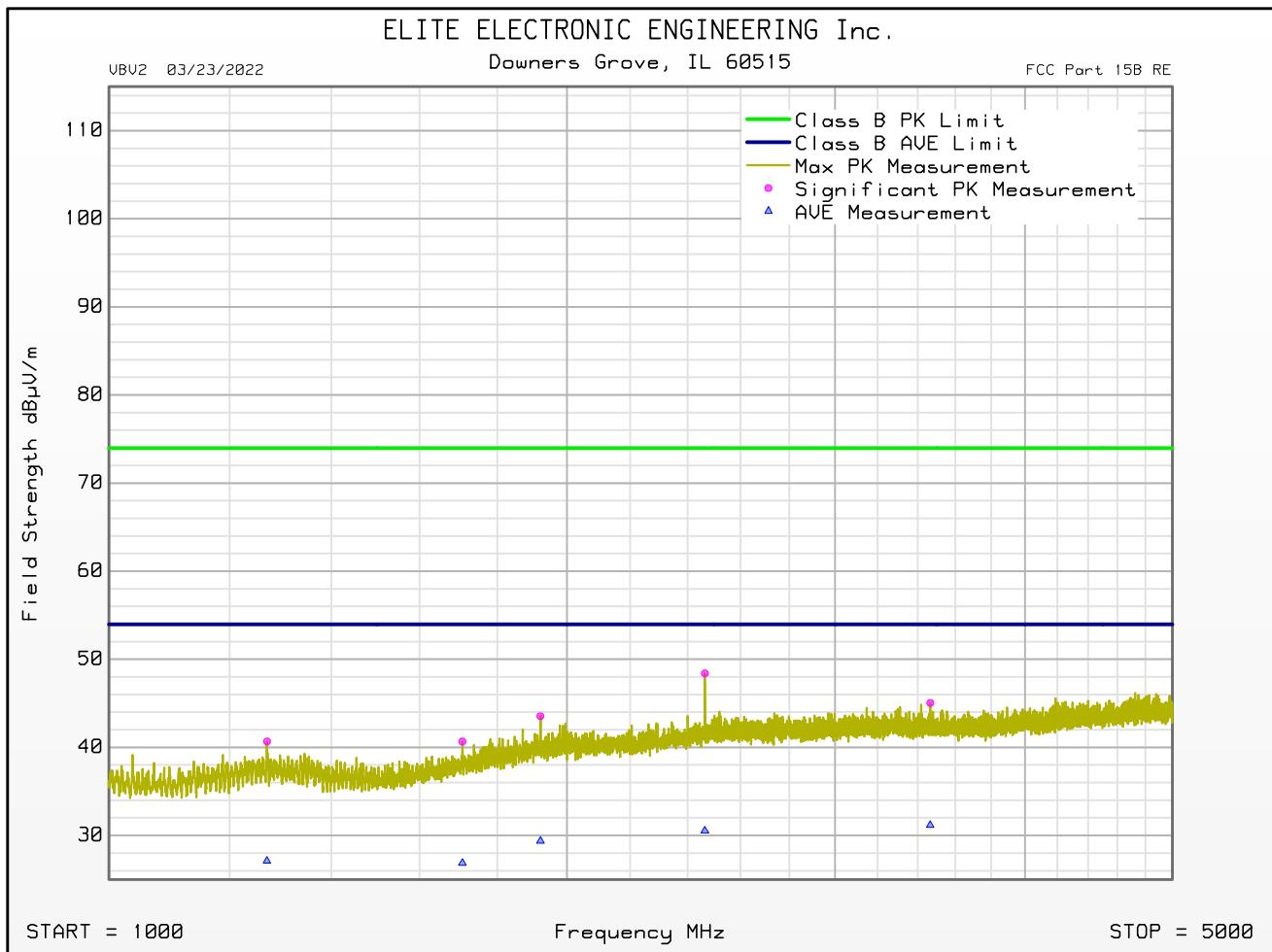
Freq MHz	Peak Mtr Rdg dBuV	Ant Fac dB/m	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Peak Total dBµV/m	Peak Limit dBµV/m	Peak Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °	Excessive Peak Level
1270.000	51.1	29.1	-41.9	2.3	0.0	40.7	74.0	-33.3	Horizontal	120	225	
1707.000	49.5	29.5	-41.1	2.8	0.0	40.7	74.0	-33.3	Horizontal	200	90	
1921.000	50.2	31.2	-40.8	2.9	0.0	43.5	74.0	-30.4	Horizontal	340	315	
2464.000	53.6	32.5	-41.2	3.5	0.0	48.4	74.0	-25.6	Horizontal	120	45	
3465.500	48.4	32.9	-40.5	4.2	0.0	45.0	74.0	-28.9	Horizontal	200	0	
4718.000	47.9	34.5	-40.7	4.9	0.0	46.5	74.0	-27.4	Vertical	340	45	

Freq MHz	Average Mtr Rdg dBuV	Ant Fac dB/m	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Average Total dBµV/m	Average Limit dBµV/m	Average Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °	Excessive Average Level
1270.000	37.5	29.1	-41.9	2.3	0.0	27.1	54.0	-26.9	Horizontal	120	225	
1707.000	35.7	29.5	-41.1	2.8	0.0	26.9	54.0	-27.1	Horizontal	200	90	
1921.000	36.0	31.2	-40.8	2.9	0.0	29.4	54.0	-24.6	Horizontal	340	315	
2464.000	35.8	32.5	-41.2	3.5	0.0	30.5	54.0	-23.5	Horizontal	120	45	
3465.500	34.6	32.9	-40.5	4.2	0.0	31.2	54.0	-22.8	Horizontal	200	0	
4718.000	34.3	34.5	-40.7	4.9	0.0	32.9	54.0	-21.1	Vertical	340	45	

FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 03/23/2022

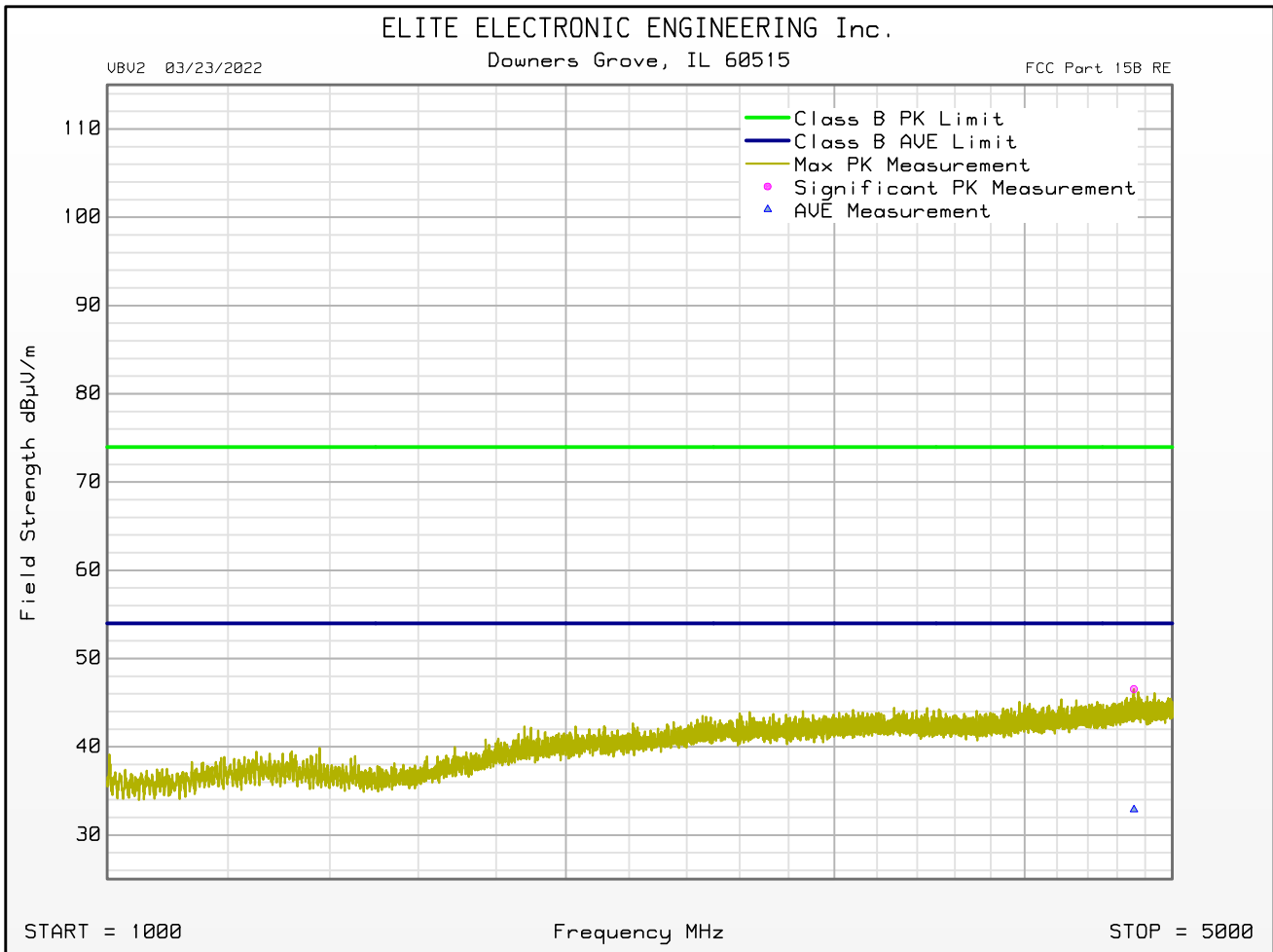
Manufacturer : Chamberlain
 Model : 003-0458-5
 Serial Number : 151220510865
 DUT Mode : FHSS Rx @ 914.75MHz
 Turntable Step Angle (°): 45
 Mast Positions (cm) : 120, 200, 340
 Antenna Polarization : Horizontal
 Scan Type : Stepped Scan
 Test RBW : 1 MHz
 Prelim Dwell Time (s) : 0.0001
 Notes :
 Test Engineer : N. Bouchie
 Test Date : Apr 27, 2022 04:25:30 PM



FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 03/23/2022

Manufacturer : Chamberlain
Model : 003-0458-5
Serial Number : 151220510865
DUT Mode : FHSS Rx @ 914.75MHz
Turntable Step Angle (°): 45
Mast Positions (cm) : 120, 200, 340
Antenna Polarization : Vertical
Scan Type : Stepped Scan
Test RBW : 1 MHz
Prelim Dwell Time (s) : 0.0001
Notes :
Test Engineer : N. Bouchie
Test Date : Apr 27, 2022 04:25:30 PM





FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 03/23/2022

Manufacturer : Chamberlain
 Model : 003-0458-5
 Serial Number : 151220510865
 DUT Mode : FHSS Rx @ 926.75MHz
 Turntable Step Angle (°): 45
 Mast Positions (cm) : 120, 200, 340
 Scan Type : Stepped Scan
 Test RBW : 1 MHz
 Prelim Dwell Time (s) : 0.0001
 Notes :
 Test Engineer : N. Bouchie
 Test Date : Apr 27, 2022 04:56:28 PM

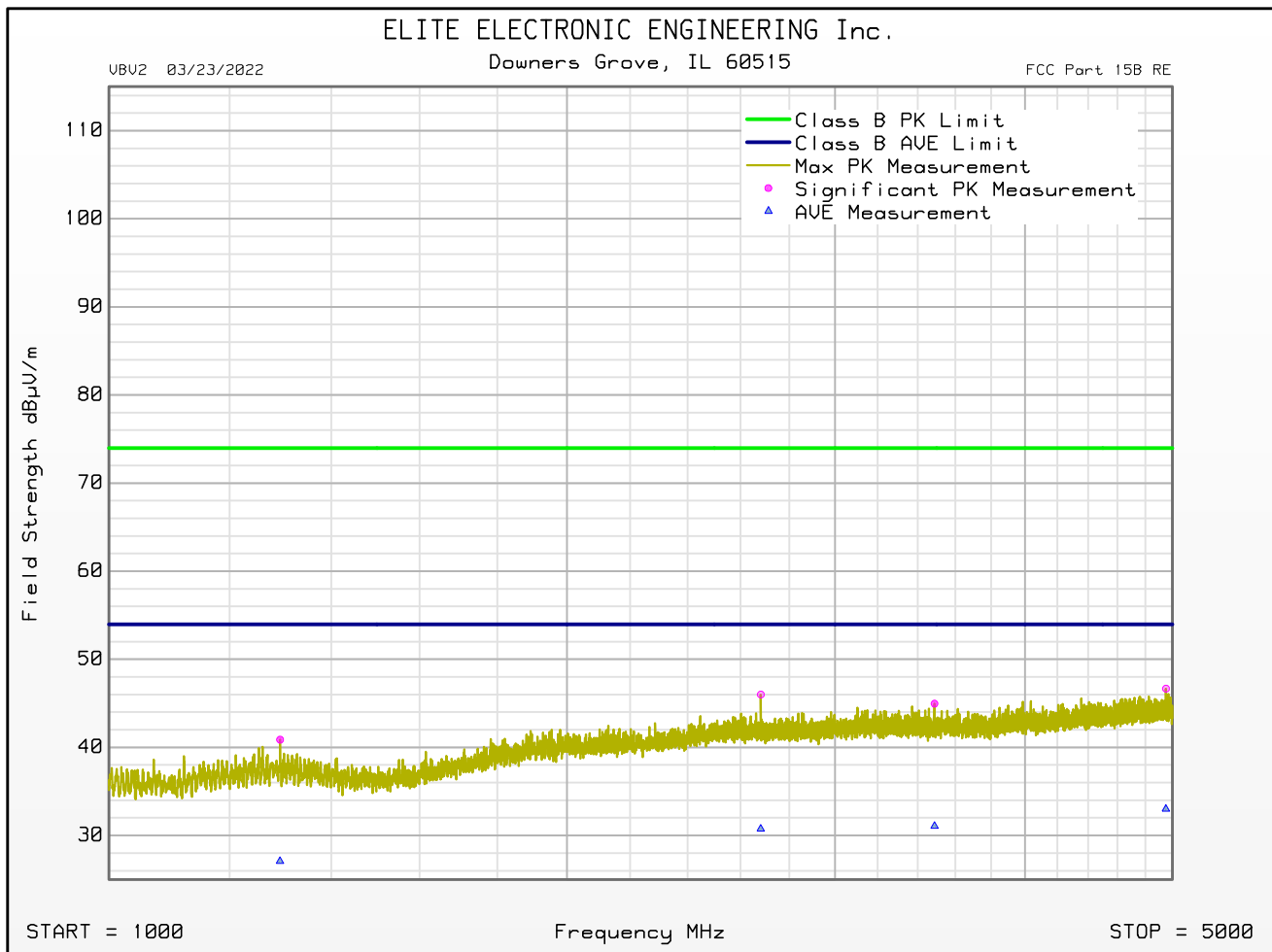
Freq MHz	Peak Mtr Rdg dBuV	Ant Fac dB/m	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Peak Total dBµV/m	Peak Limit dBµV/m	Peak Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °	Excessive Peak Level
1295.500	51.2	29.1	-41.8	2.4	0.0	40.9	74.0	-33.1	Horizontal	120	180	
1669.000	49.0	29.0	-41.1	2.7	0.0	39.6	74.0	-34.4	Vertical	120	270	
2235.000	48.6	31.4	-40.7	3.2	0.0	42.6	74.0	-31.4	Vertical	200	270	
2681.500	51.2	32.6	-41.4	3.6	0.0	46.0	74.0	-28.0	Horizontal	340	180	
3488.000	48.3	32.9	-40.5	4.2	0.0	45.0	74.0	-29.0	Horizontal	340	270	
4951.000	47.9	34.4	-40.6	5.0	0.0	46.7	74.0	-27.3	Horizontal	200	180	

Freq MHz	Average Mtr Rdg dBuV	Ant Fac dB/m	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Average Total dBµV/m	Average Limit dBµV/m	Average Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °	Excessive Average Level
1295.500	37.4	29.1	-41.8	2.4	0.0	27.1	54.0	-26.9	Horizontal	120	180	
1669.000	35.5	29.0	-41.1	2.7	0.0	26.1	54.0	-27.9	Vertical	120	270	
2235.000	35.1	31.4	-40.7	3.2	0.0	29.1	54.0	-24.9	Vertical	200	270	
2681.500	35.9	32.6	-41.4	3.6	0.0	30.8	54.0	-23.2	Horizontal	340	180	
3488.000	34.4	32.9	-40.5	4.2	0.0	31.1	54.0	-22.9	Horizontal	340	270	
4951.000	34.2	34.4	-40.6	5.0	0.0	33.0	54.0	-21.0	Horizontal	200	180	

FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 03/23/2022

Manufacturer : Chamberlain
 Model : 003-0458-5
 Serial Number : 151220510865
 DUT Mode : FHSS Rx @ 926.75MHz
 Turntable Step Angle (°): 45
 Mast Positions (cm) : 120, 200, 340
 Antenna Polarization : Horizontal
 Scan Type : Stepped Scan
 Test RBW : 1 MHz
 Prelim Dwell Time (s) : 0.0001
 Notes :
 Test Engineer : N. Bouchie
 Test Date : Apr 27, 2022 04:56:28 PM



21. 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 Mid @ 914.75MHz

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.

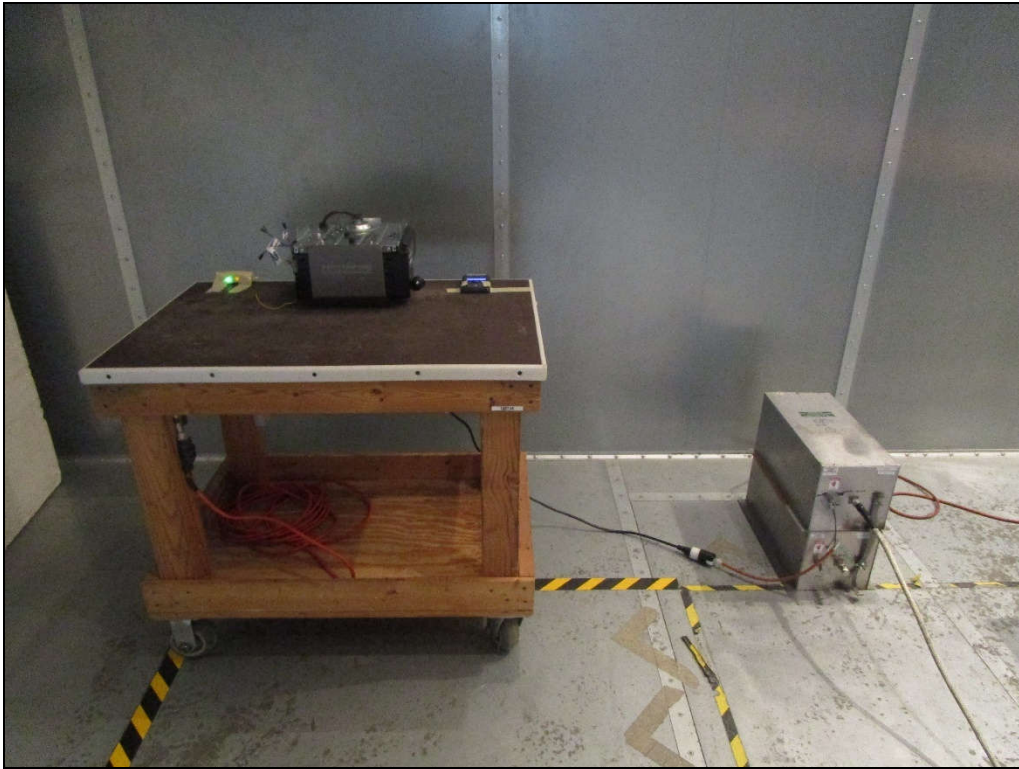
Procedure

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 Tx Mid @ 914.75MHz 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).

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

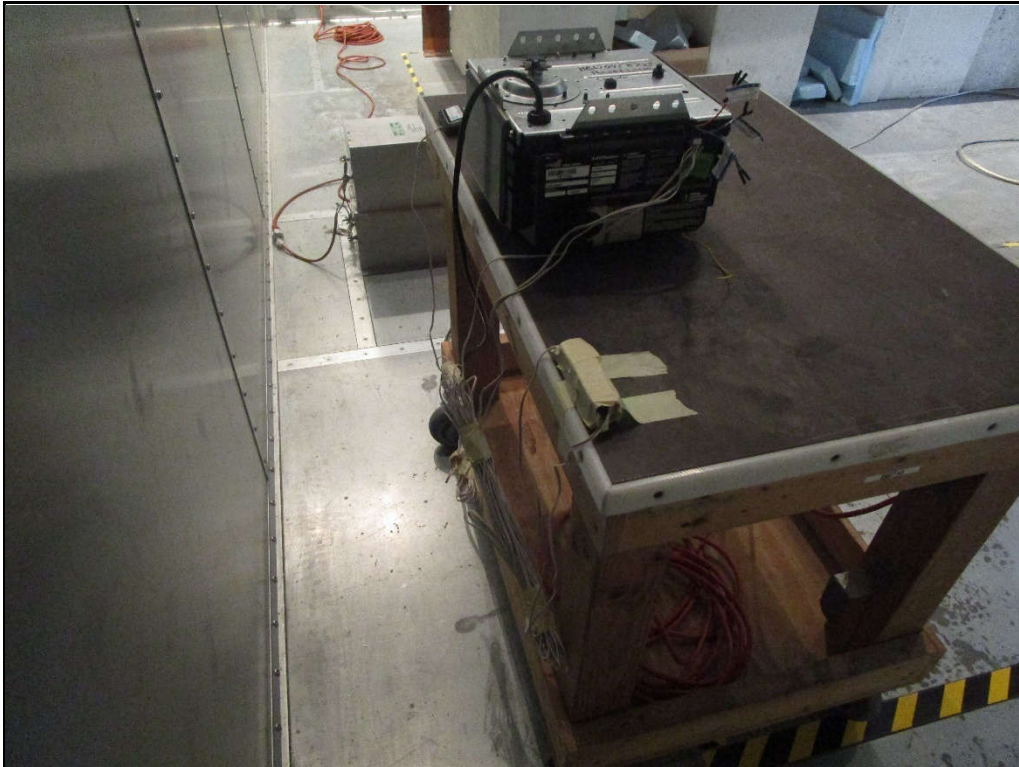
- 7) Steps (3) through (6) were repeated on the 120VAC 60Hz return line.



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

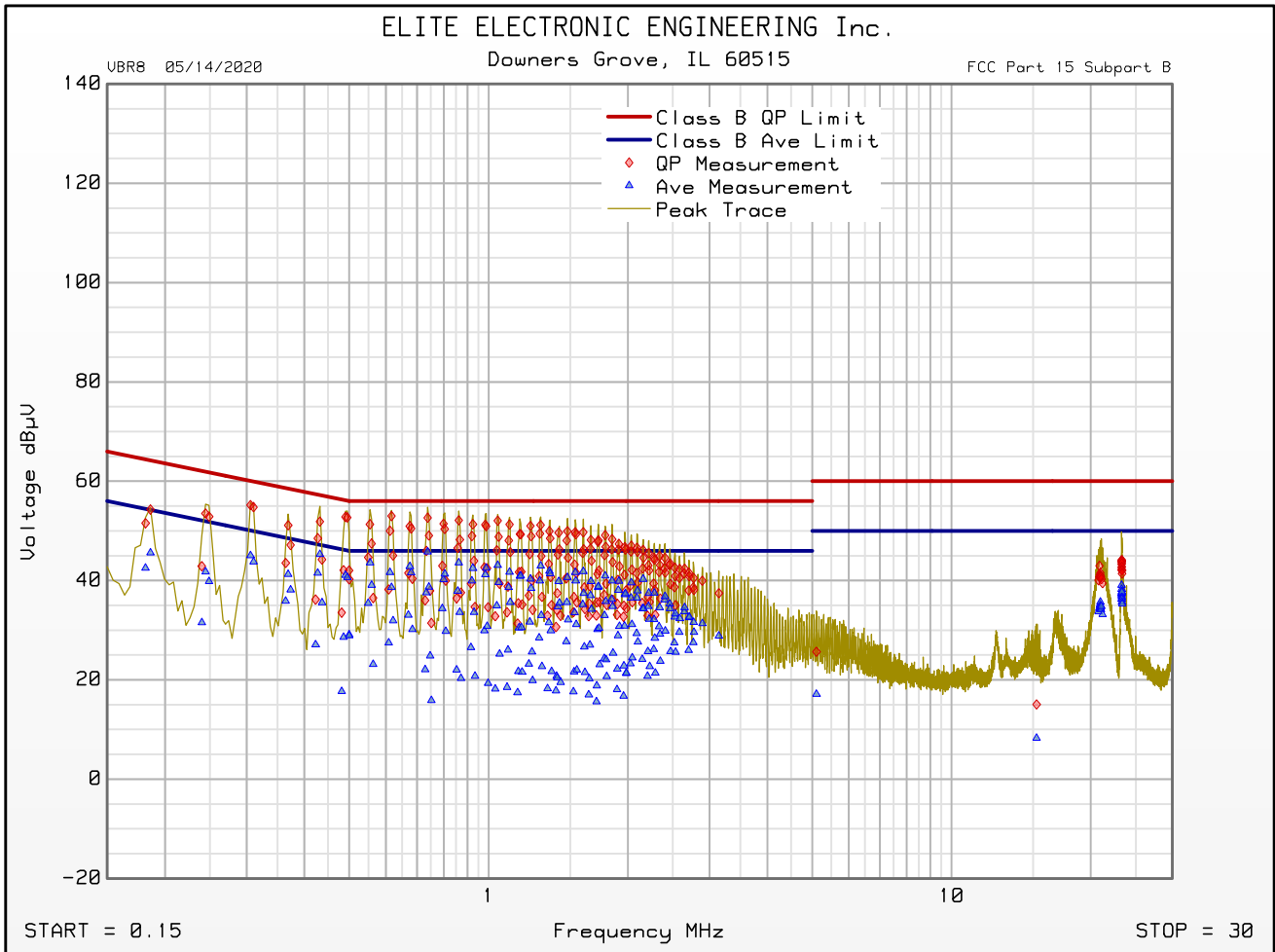
Manufacturer : Chamberlain
 Model : 003-0458-5
 DUT Revision :
 Serial Number : 151220510865
 DUT Mode : 900MHz Tx @ 914.75MHz
 Line Tested : High, PLF4
 Scan Step Time [ms] : 30
 Meas. Threshold [dB] : -4
 Notes :
 Test Engineer : N. Bouchie
 Limit : Class B
 Test Date : Apr 28, 2022 10:11:09 AM
 Data Filter : Up to 80 maximum levels detected with 6 dB level excursion threshold over 4 dB margin below limit

Freq MHz	Quasi-peak Level dBµV	Quasi-peak Limit dBµV	Excessive Quasi-peak Emissions	Average Level dBµV	Average Limit dBµV	Excessive Average Emissions
0.245	53.5	61.9		41.8	51.9	
0.432	51.9	57.2		45.3	47.2	
0.491	52.8	56.2		41.1	46.2	
0.554	51.3	56.0		43.6	46.0	
0.617	53.0	56.0		38.6	46.0	
0.676	51.0	56.0		42.8	46.0	
0.739	52.6	56.0		45.8	46.0	
0.862	52.1	56.0		43.6	46.0	
0.925	51.3	56.0		42.5	46.0	
0.988	50.9	56.0		42.5	46.0	
1.047	52.0	56.0		43.1	46.0	
1.295	51.2	56.0		43.0	46.0	
2.034	47.0	56.0		39.6	46.0	
3.145	37.4	56.0		28.8	46.0	
5.108	25.6	60.0		17.1	50.0	
15.273	15.0	60.0		8.3	50.0	
23.320	44.1	60.0		37.7	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 : 900MHz Tx @ 914.75MHz
 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 10:11:09 AM



Emissions Meet QP Limit
 Emissions Meet Ave Limit

FCC Part 15 Subpart B Conducted Emissions Test

Significant Emissions Data VBR8 05/14/2020

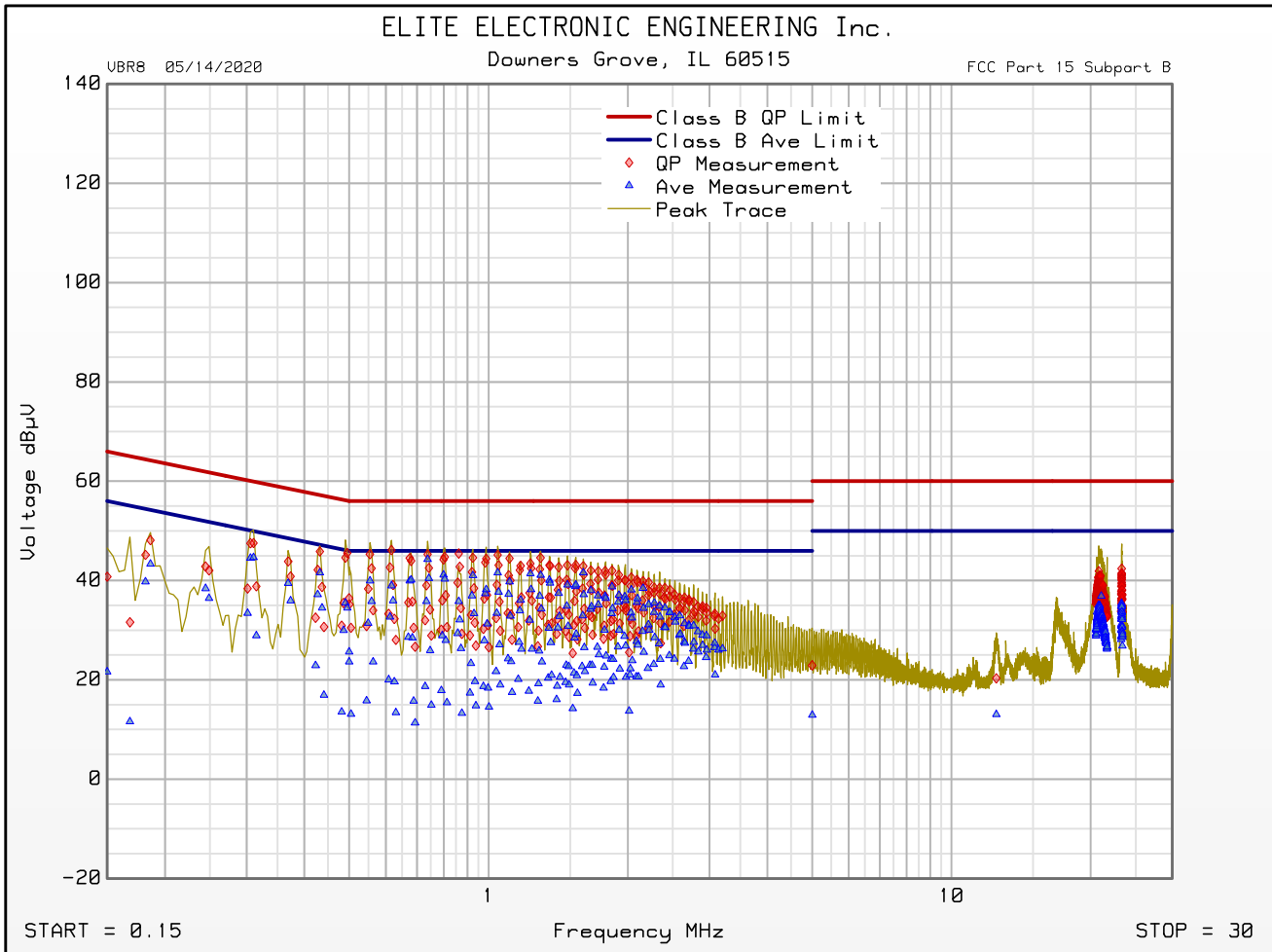
Manufacturer : Chamberlain
 Model : 003-0458-5
 DUT Revision :
 Serial Number : 151220510865
 DUT Mode : 900MHz Tx @ 914.75MHz
 Line Tested : Neutral, PLF2
 Scan Step Time [ms] : 30
 Meas. Threshold [dB] : -10
 Notes :
 Test Engineer : N. Bouchie
 Limit : Class B
 Test Date : Apr 28, 2022 10:02:12 AM
 Data Filter : Up to 80 maximum levels detected with 6 dB level excursion threshold over 10 dB margin below limit

Freq MHz	Quasi-peak Level dBµV	Quasi-peak Limit dBµV	Excessive Quasi-peak Emissions	Average Level dBµV	Average Limit dBµV	Excessive Average Emissions
0.186	48.1	64.2		43.3	54.2	
0.311	47.5	60.0		44.7	50.0	
0.369	43.8	58.5		39.4	48.5	
0.432	45.9	57.2		41.6	47.2	
0.554	45.3	56.0		40.0	46.0	
0.617	46.1	56.0		39.0	46.0	
0.680	43.9	56.0		40.2	46.0	
0.739	45.3	56.0		44.3	46.0	
0.799	44.2	56.0		41.1	46.0	
0.925	44.6	56.0		41.0	46.0	
0.988	44.4	56.0		38.2	46.0	
1.047	45.2	56.0		41.6	46.0	
1.110	44.4	56.0		39.7	46.0	
1.173	43.0	56.0		36.1	46.0	
1.231	43.4	56.0		41.4	46.0	
1.295	44.6	56.0		41.1	46.0	
1.354	43.1	56.0		40.1	46.0	
1.417	42.7	56.0		37.4	46.0	
1.480	43.1	56.0		39.2	46.0	
1.543	43.1	56.0		39.1	46.0	
1.601	42.9	56.0		41.6	46.0	
1.664	42.0	56.0		38.0	46.0	
1.723	40.2	56.0		36.9	46.0	
1.786	41.9	56.0		36.8	46.0	
1.849	42.0	56.0		38.7	46.0	
1.912	41.1	56.0		37.0	46.0	
1.970	40.1	56.0		36.7	46.0	
2.034	40.6	56.0		38.1	46.0	
2.097	39.7	56.0		36.4	46.0	
2.156	39.8	56.0		38.4	46.0	
3.203	32.9	56.0		26.3	46.0	
5.000	22.9	56.0		12.9	46.0	
12.501	20.3	60.0		13.0	50.0	
23.324	42.4	60.0		35.2	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 : 900MHz Tx @ 914.75MHz
 Line Tested : Neutral, PLF2
 Scan Step Time [ms] : 30
 Meas. Threshold [dB] : -10
 Notes :
 Test Engineer : N. Bouchie
 Limit : Class B
 Test Date : Apr 28, 2022 10:02:12 AM



Emissions Meet QP Limit
 Emissions Meet Ave Limit

22. 20dB Bandwidth

EUT Information	
Manufacturer	Chamberlain
Product	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx Low @ 902.25MHz Tx Mid @ 914.75MHz Tx High @ 926.75MHz

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 frequency hopping techniques operating in the 902 – 928MHz band are allowed a maximum 20dB bandwidth of 500kHz.

Procedure
<p>The antenna port of the EUT was connected to the spectrum analyzer through 30dB of attenuation. With the hopping function disabled, the EUT was allowed to transmit continuously.</p> <p>The frequency hopping channel was set separately to low, middle, and high hopping channels. The resolution bandwidth (RBW) was set to $\geq 1\%$ of the 20dB BW. The span was set to approximately 2 to 3 times the 20dB bandwidth.</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 Low @ 902.25MHz
Frequency Tested	902.25MHz
Result	20dB BW = 138.9kHz
Notes	None



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Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx Mid @ 914.75MHz
Frequency Tested	914.75MHz
Result	20dB BW = 139.9kHz
Notes	None



10:10:42 11.05.2022

Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx High @ 926.75MHz
Frequency Tested	926.75MHz
Result	20dB BW = 139.9kHz
Notes	None



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23. Occupied Bandwidth (99%)

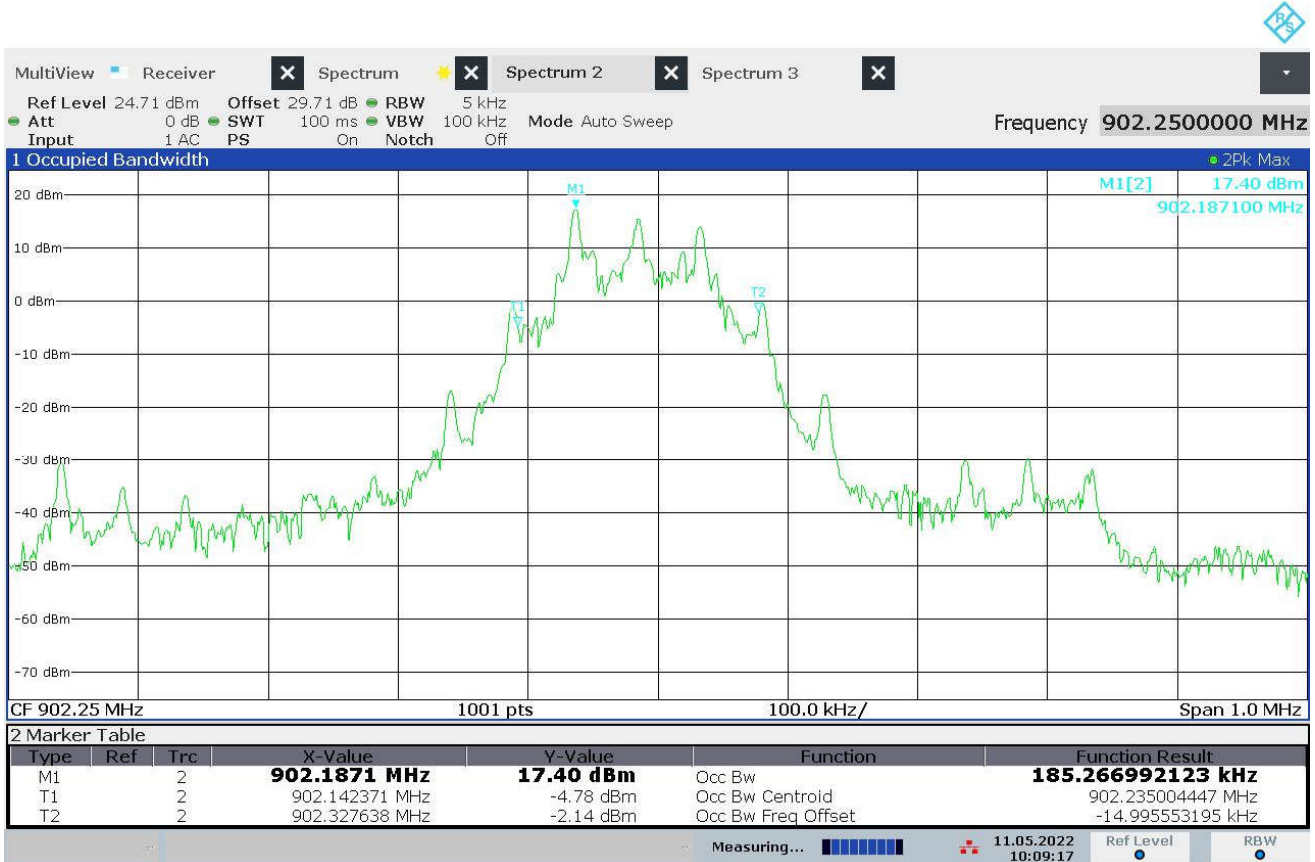
EUT Information	
Manufacturer	Chamberlain
Product	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx Low @ 902.25MHz Tx Mid @ 914.75MHz Tx High @ 926.75MHz

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 Low @ 902.25MHz
Frequency Tested	902.25MHz
Result	OBW = 185.27kHz
Notes	None



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Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx Mid @ 914.75MHz
Frequency Tested	914.75MHz
Result	OBW = 184.05kHz
Notes	None



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Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx High @ 926.75MHz
Frequency Tested	926.75MHz
Result	OBW = 183.04kHz
Notes	None



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24. Carrier Frequency Separation

EUT Information	
Manufacturer	Chamberlain
Product	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx Hopping

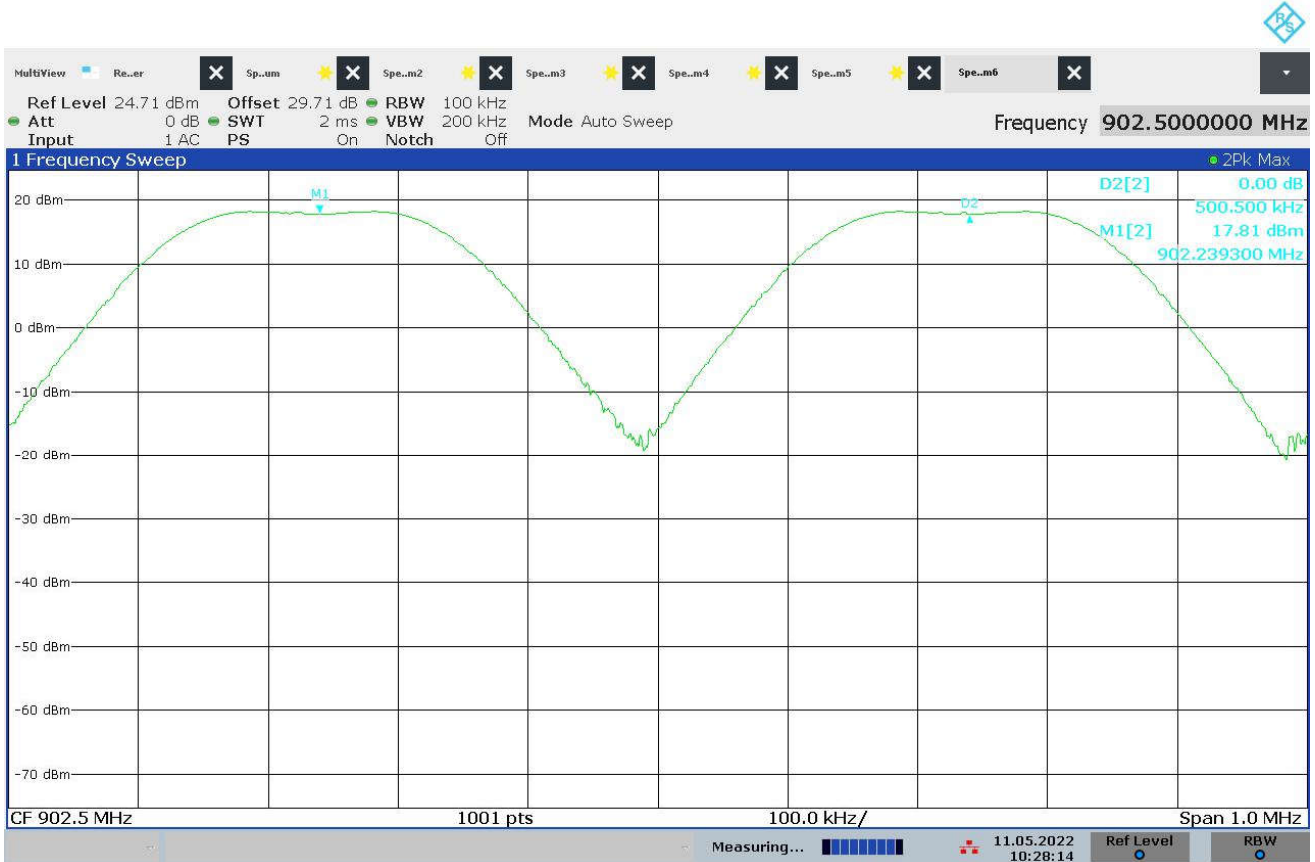
Test Setup Details	
Setup Format	Tabletop
Height of Support	N/A
Measurement Method	Antenna Conducted
Type of Test Site	Tabletop
Test Site Used	EMC Bench
Type of Antennas Used	N/A
Notes	None

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
Channel carrier frequencies shall be separated by a minimum of 25kHz or the 20dB bandwidth, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5MHz band may have hopping channel carrier frequencies that are separated by 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125mW.

Procedure
<p>The antenna port of the EUT was connected to the spectrum analyzer through 40dB of attenuation. With the hopping function enabled, the EUT was allowed to transmit continuously.</p> <p>Span was set wide enough to capture the peaks of two adjacent channels. The resolution bandwidth was set to approximately 30% of the channel spacing. The peak detector and 'Max-Hold' function were engaged. The span was set wide enough to capture the peaks of at least two adjacent channels. When the trace had stabilized after multiple scans, the marker-delta function was used to determine the separation between the peaks of the adjacent channels. 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 Hopping
Frequency Tested	902.25MHz and 902.75MHz
Result	Separation = 500.5kHz
Notes	None



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25. Number of Carrier Channels

EUT Information	
Manufacturer	Chamberlain
Product	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx Hopping

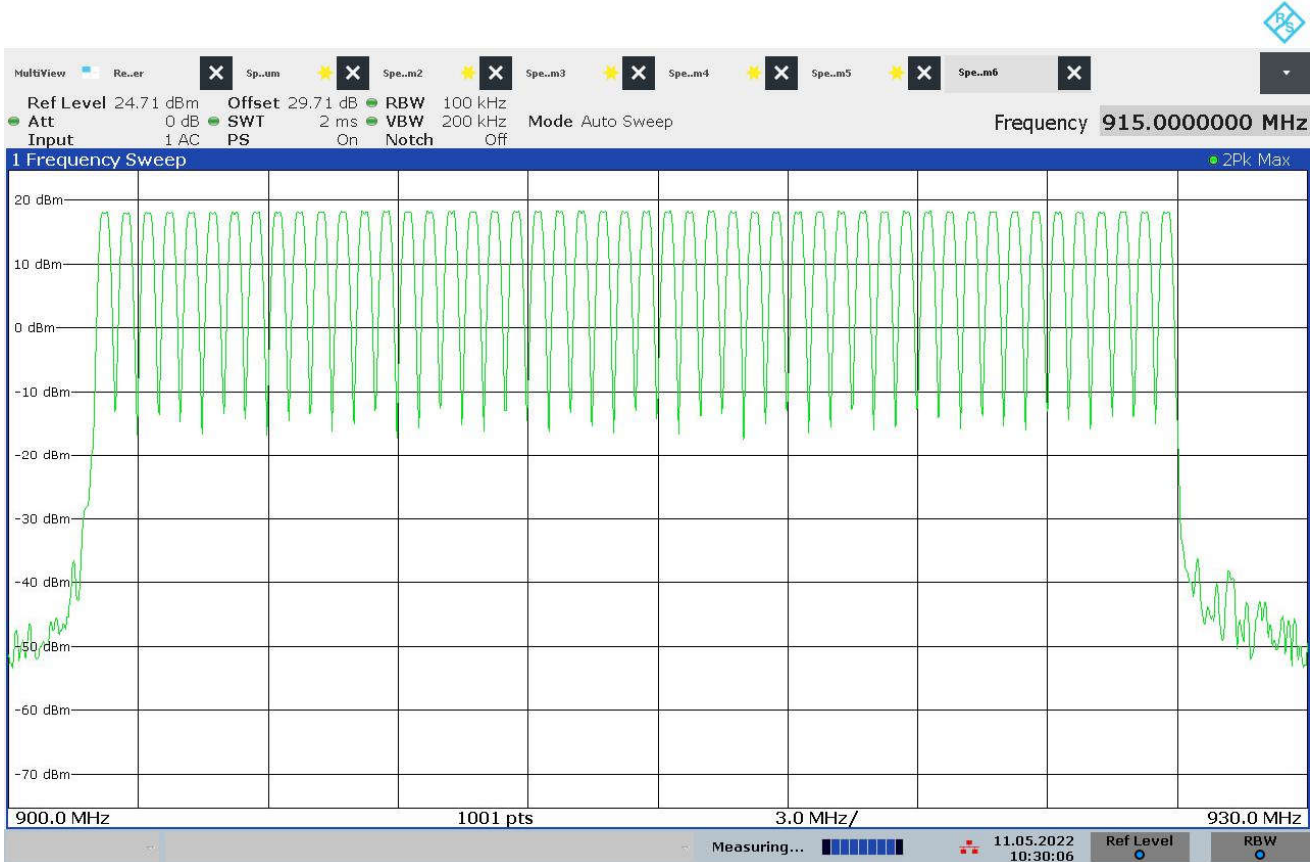
Test Setup Details	
Setup Format	Tabletop
Height of Support	N/A
Measurement Method	Antenna Conducted
Type of Test Site	Tabletop
Test Site Used	EMC Bench
Type of Antennas Used	N/A
Notes	None

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 system shall use at least 50 hopping frequencies.

Procedure
<p>The antenna port of the EUT was connected to the spectrum analyzer through 40dB of attenuation. With the hopping function enabled, the EUT was allowed to transmit continuously.</p> <p>The resolution bandwidth (RBW) was set to less than 30% of the channel spacing or the 20dB bandwidth, whichever is smaller. The peak detector and 'Max-Hold' function were engaged. The span was set wide enough to capture the entire frequency band of operation.</p> <p>The EUT's signal was allowed to stabilize after multiple scans. The number of hopping frequencies was counted. 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 Hopping
Frequency Range	902-928MHz
Result	50 hopping frequencies
Notes	None



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26. Average Time of Occupancy

EUT Information	
Manufacturer	Chamberlain
Product	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx Hopping

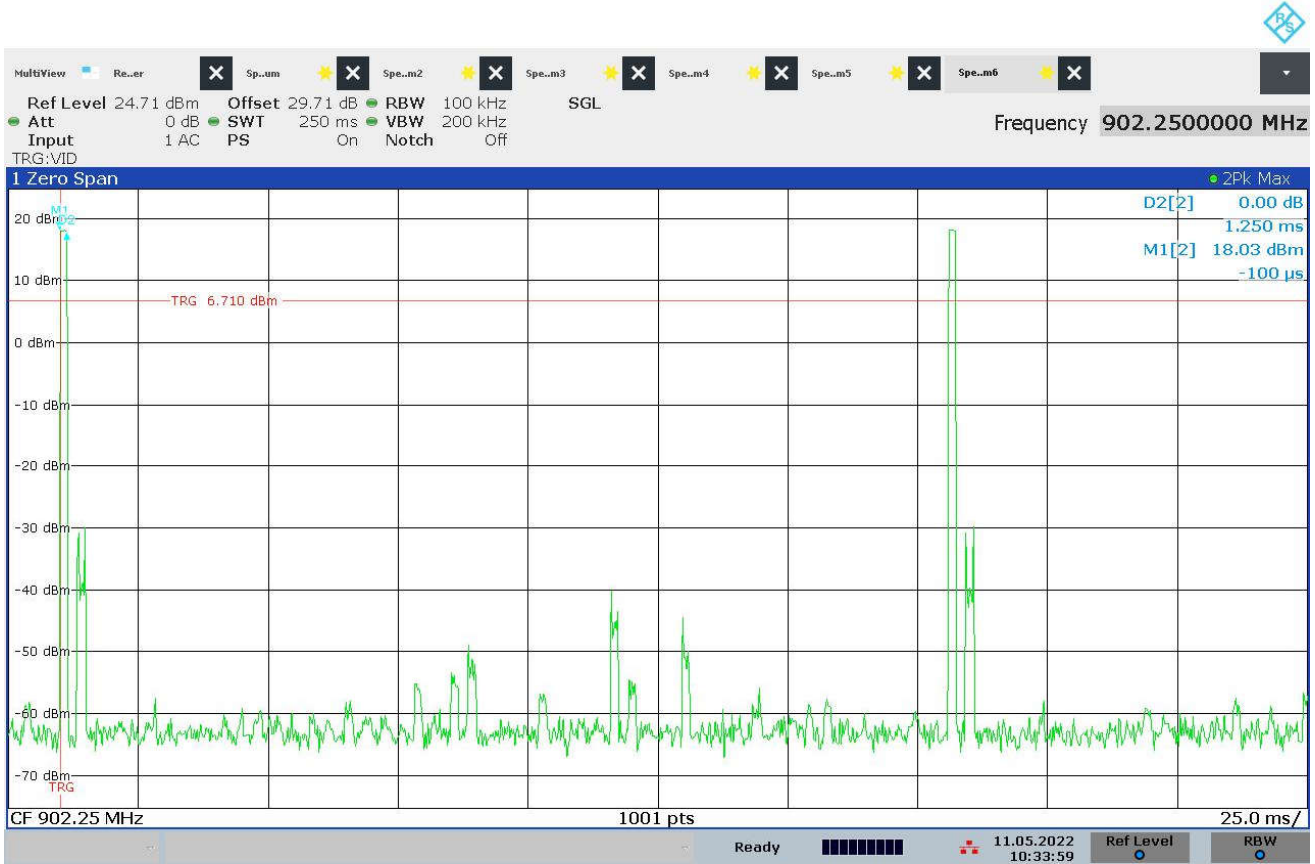
Test Setup Details	
Setup Format	Tabletop
Height of Support	N/A
Measurement Method	Antenna Conducted
Type of Test Site	Tabletop
Test Site Used	EMC Bench
Type of Antennas Used	N/A
Notes	None

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 average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.

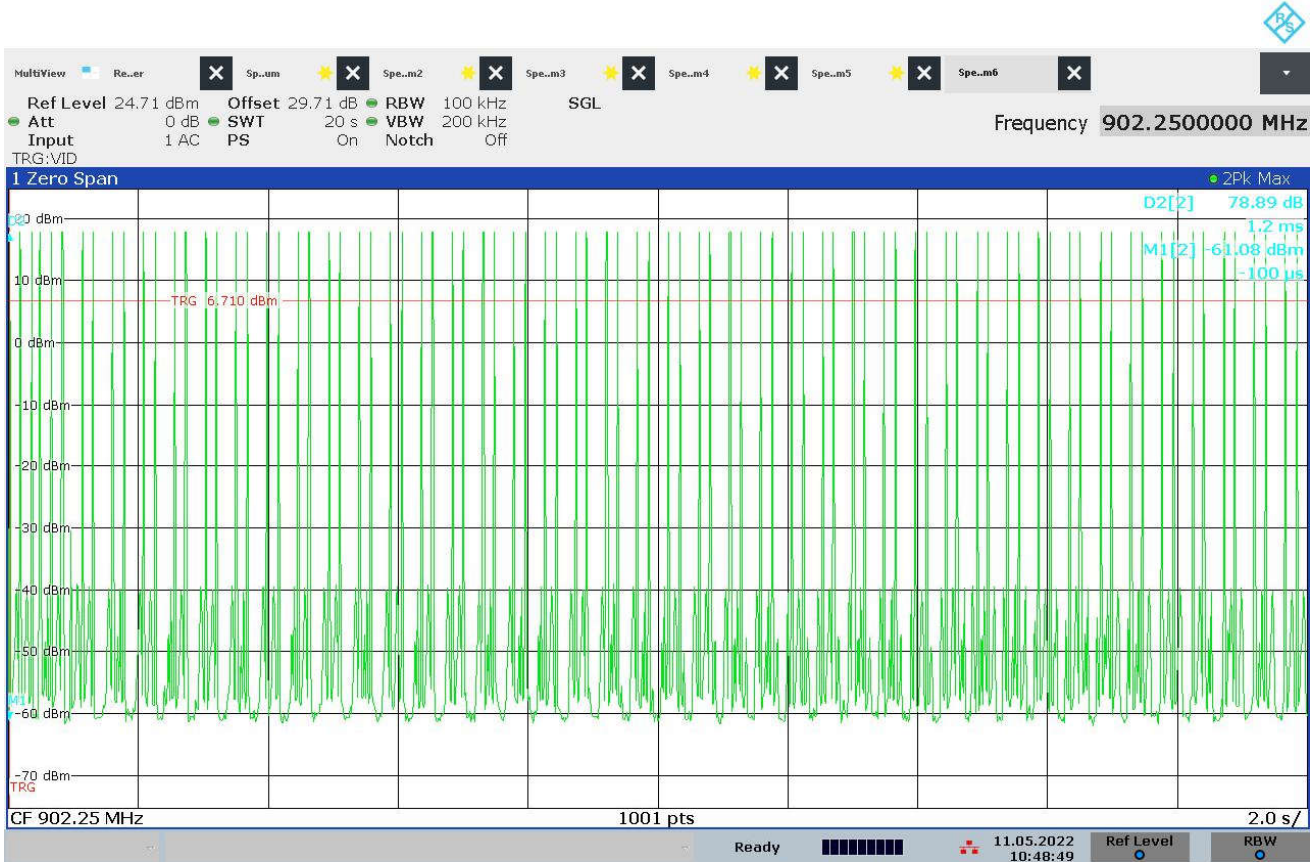
Procedure
<p>The antenna port of the EUT was connected to the spectrum analyzer through 30dB of attenuation. With the hopping function enabled, the EUT was allowed to transmit continuously.</p> <p>The spectrum analyzer was set to zero span centered on a hopping channel. The resolution bandwidth (RBW) was set \geq to the channel spacing. The sweep was set to capture the entire dwell time per hopping channel. The peak detector and 'Max-Hold' function were engaged. 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 Hopping
Frequency Range	902-928MHz
Result	Ave. Time of Occupancy = 0.1075 s
Notes	Length of one pulse = 1.25 ms



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Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx Hopping
Frequency Range	902-928MHz
Result	Ave. Time of Occupancy = 0.1075 s
Notes	Number of Pulses in a 20 second window = 86



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$$On\ Time = n_{pulses} * width_{pulse}$$

$$On\ Time = 86 * 0.00125 = 0.1075\ seconds$$

27. Maximum Peak Conducted Output Power

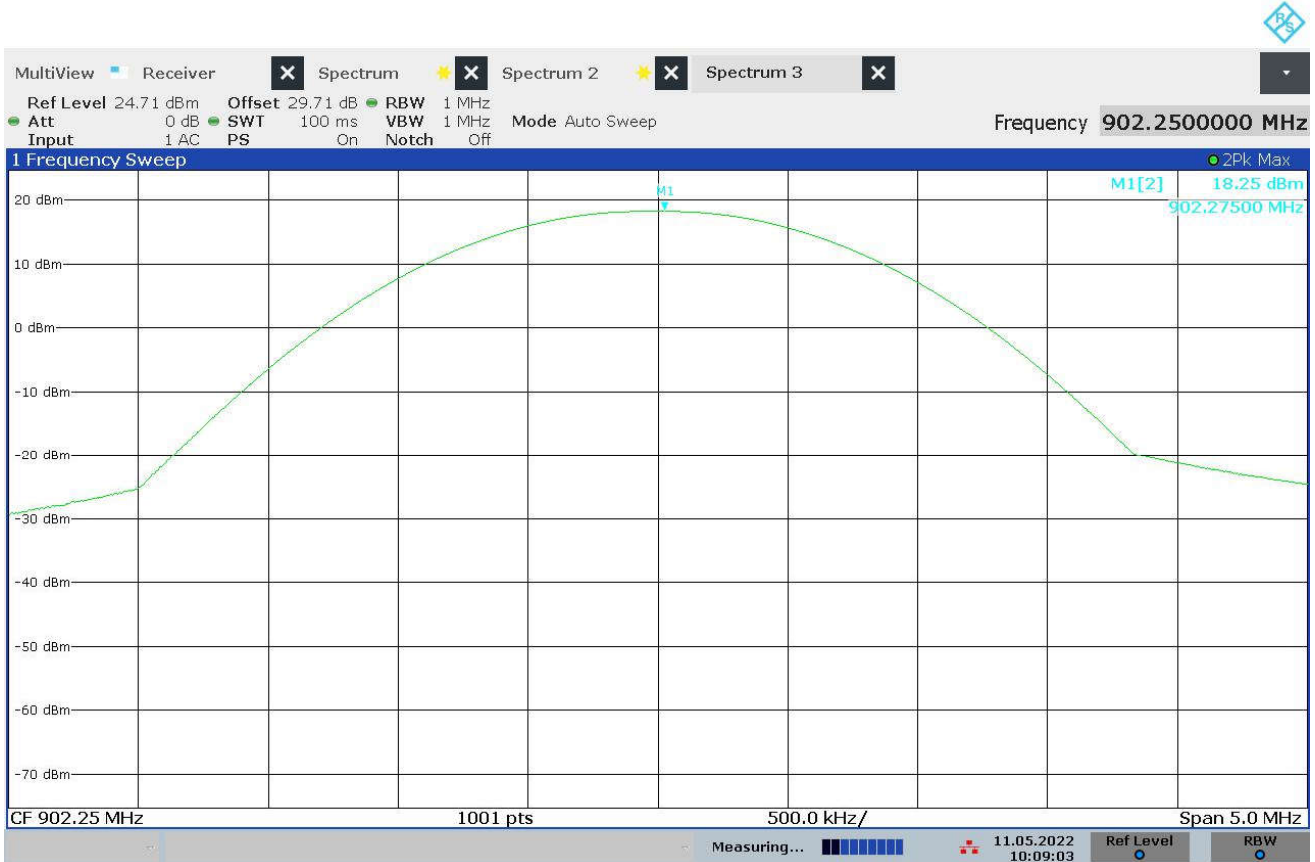
EUT Information	
Manufacturer	Chamberlain
Product	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx Low @ 902.25MHz Tx Mid @ 914.75MHz Tx High @ 926.75MHz

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).

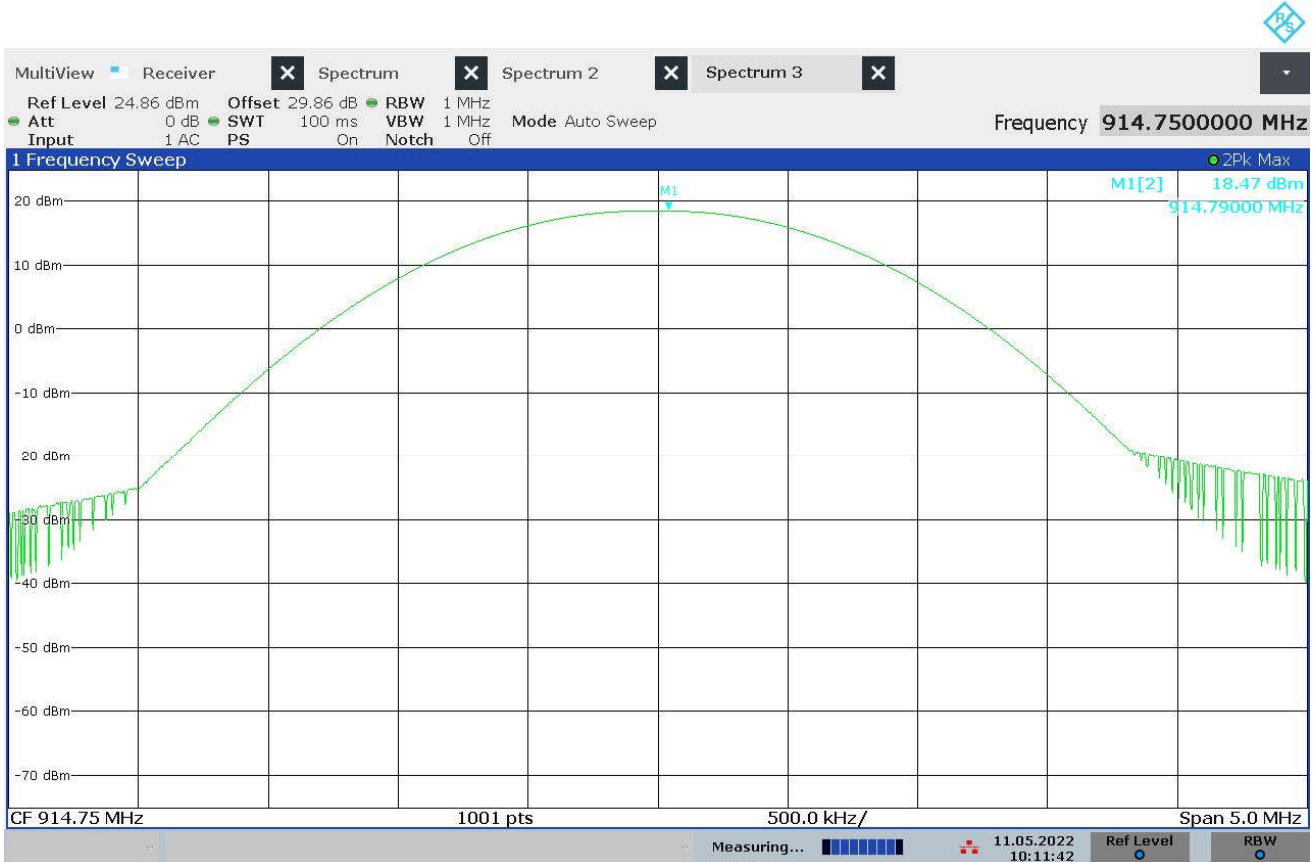
Procedure
The antenna port of the EUT was connected to the spectrum analyzer through 40dB of attenuation. With the hopping function disabled, the EUT was allowed to transmit continuously. The frequency hopping channel was set separately to low, middle, and high hopping channels. The resolution bandwidth (RBW) was set to greater than the 20dB bandwidth. The span was set to approximately 5 times the 20dB bandwidth. The 'Max-Hold' function was engaged. The maximum meter reading was recorded. The peak power output was calculated for the low, middle, and high hopping frequencies.

Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx Low @ 902.25MHz
Frequency Tested	902.25MHz
Result	Output Power = 0.067W (18.25dBm)
Notes	None



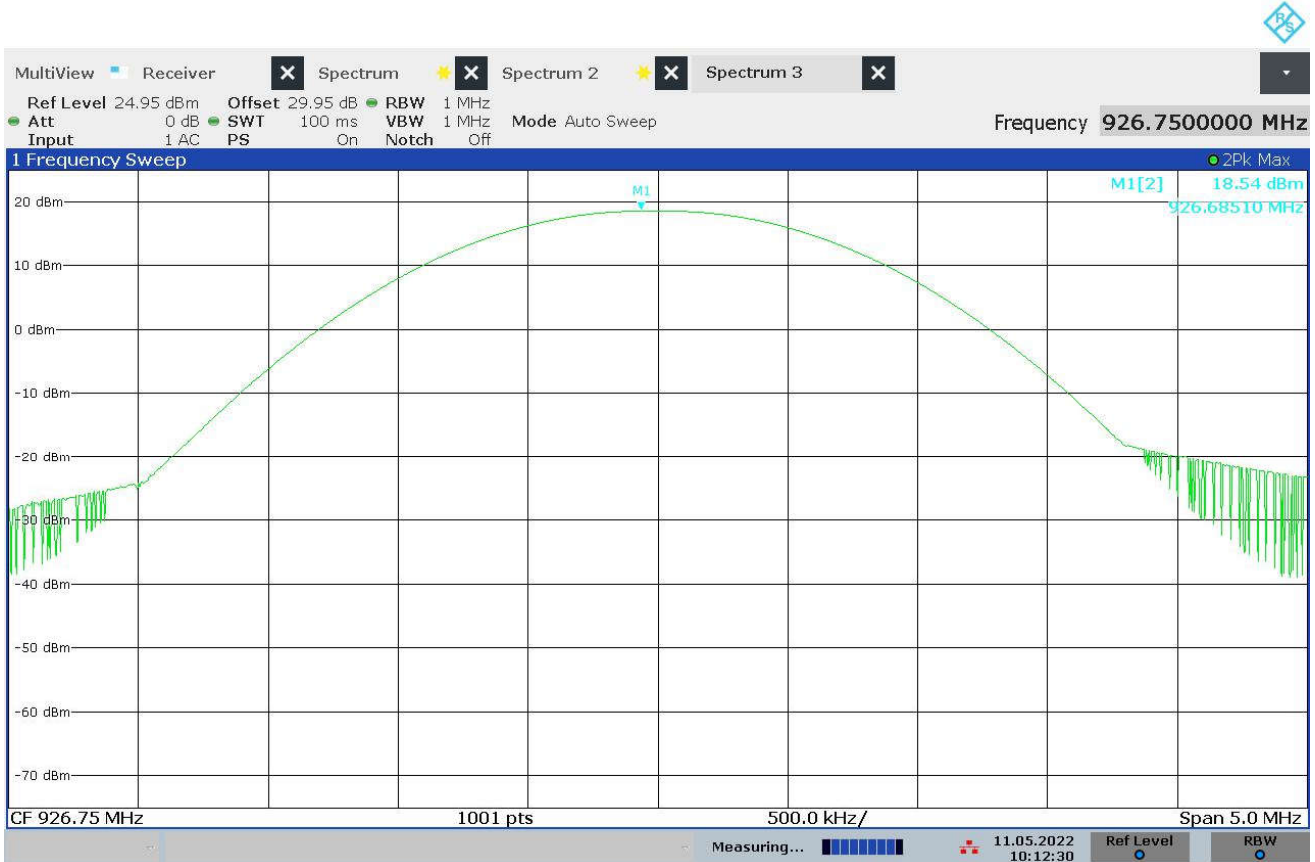
10:09:03 11.05.2022

Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx Mid @ 914.75MHz
Frequency Tested	914.75MHz
Result	Output Power = 0.070W (18.47dBm)
Notes	None



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Test Details	
Manufacturer	Chamberlain
EUT	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx High @ 926.75MHz
Frequency Tested	926.75MHz
Result	Output Power = 0.071W (18.54dBm)
Notes	None



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28. 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 Low @ 902.25MHz Tx Mid @ 914.75MHz Tx High @ 926.75MHz

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 bilog 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 20dB bandwidth. The span was set to approximately 5 times the 20 dB 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 hopping frequencies.</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 Low @ 902.25MHz Tx Mid @ 914.75MHz Tx High @ 926.75MHz
Result	Max EIRP = 0.195W (22.9dBm)
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)
902.25	H	89.7	22.4	2.2	1.6	22.9	30.0	-7.1
	V	84.8	19.4	2.2	1.6	19.9	30.0	-10.1
914.75	H	87.6	20.3	2.2	1.6	20.8	30.0	-9.2
	V	88.0	21.6	2.2	1.6	22.1	30.0	-7.9
926.75	H	88.6	21.5	2.2	1.7	22.0	30.0	-8.0
	V	86.5	20.4	2.2	1.7	20.9	30.0	-9.1

29. Duty Cycle Factor Measurements

EUT Information	
Manufacturer	Chamberlain
Product	Phoenix AC GDO Logic Board
Model No.	003-0458-5
Serial No.	151220510865
Mode	Tx Low @ 902.25MHz

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	Bilog (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>The duty cycle factor is used to convert peak detected readings to average readings when pulsed modulation is employed. This factor is computed from the time domain trace of the pulse modulation signal.</p> <p>With the transmitter set up to transmit for maximum pulse density, the time domain trace is displayed on the spectrum analyzer. This trace is obtained by tuning center frequency to the transmitter frequency and then setting a zero-span width with 10msec/div. The amplitude settings are adjusted so that the on/off transitions clear the 4th division from the bottom of the display. The markers are set at the beginning and end of the “on-time”. The trace is recorded.</p> <p>Next the spectrum analyzer center frequency is set to the transmitter frequency with a zero-span width and 10msec/div. This shows if the word is longer than 100msec or shorter than 100msec. If the word period is less than 100msec, the display is set to show at least one word. The on-time and off-time are then measured. The on-time is total time signal level exceeds the 4th division. Off-time is time under for the word period.</p> <p>The duty cycle is then computed as $\left(\frac{On\ Time}{Word\ Period}\right)$, where $Word\ Period = (On\ Time + Off\ Time)$.</p>