Engineering Test Report No. 2004506-01 Rev A		
Report Date	February 5, 2021	
Manufacturer Name	Chamberlain Group, Inc.	
Manufacturer Address	300 Windsor Dr Oak Brook, IL 60523	
Model No.	CAPXM	
Date Received	December 10, 2020	
Test Dates	December 11, 2020 to February 5, 2021	
Specifications	FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C, Section 15.247 FCC “Code of Federal Regulations” Title 47, Part15, Subpart 15B Innovation, Science, and Economic Development Canada, RSS-247 Innovation, Science, and Economic Development Canada, RSS-GEN	
Test Facility	Elite Electronic Engineering, Inc. 1516 Centre Circle, Downers Grove, IL 60515	FCC Reg. Number: 269750 IC Reg. Number: 2987A
Signature		
Tested by	Javier Cardenas	
Signature		
Approved by	Raymond J. Klouda, Registered Professional Engineer of Illinois – 44894	
PO Number	4900072392	

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 and RSS-GEN test specifications. The data presented in this test report pertains to the EUT on the test date(s) 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
–	09 FEB 2021	Initial Release of Engineering Test Report No. 2004506-01
A	18 FEB 2021 By Javier Cardenas	• Throughout the report: “Rev A” was added to the report number in the header. • Section 5: The model number of the power supply was updated to “QX72W240300D3.”

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 Group, Inc. Access Control Device (hereinafter referred to as the Equipment Under Test (EUT)). The EUT was manufactured and submitted for testing by Chamberlain Group, Inc. 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, Part15, Subpart 15B, Section 15.107 and 15.109 for Receivers and Part 15, Subpart C, Sections 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 EUT

The EUT was identified as follows:

EUT Identification	
Product Description	Access Control Device
Model/Part No.	CAPXM
S/N	SMP-76795 & SMP-76780
Device Type	Frequency Hopping Transmission Device
Band of Operation	902-928MHz
Software/Firmware Version	Version 1.0
Conducted Output Power	11.64dBm
20dB Bandwidth	207.8kHz
Occupied Bandwidth (99% CBW)	192.8kHz
Size of EUT	43cm Height x 15cm Width x 10.5cm Depth

The EUT listed above was used throughout the test series.

3. Power Input

The EUT obtained 24VDC power via an AC/DC switching power supply. The power supply was connected to the AC mains on the input side.

4. Grounding

The EUT was not connected to ground.

5. Support Equipment

The EUT was submitted for testing along with the following support equipment:

Description	Model #	S/N
Hitoh Power Supply	QX72W240300D3	NA

6. Interconnect Leads

The following interconnect cables were submitted with the test item:

Item	Description
Ethernet	Connects EUT to online directories.

7. Modifications Made to the EUT

No modifications were made to the EUT during the testing.

8. Modes of Operation

The EUT and all peripheral equipment were energized. The unit was programmed to transmit in one of the following modes:

Mode	Description
Tx	902.24MHz, Power 11.64dBm 914.74MHz, Power 11.16dBm 926.74MHz, Power 11.62dBm
Hopping Enabled	Hopping on 50 Channels
Standby	310MHz, 315MHz, 390MHz, 433.3MHz, 433.92MHz, 434.54MHz and 900MHz band

9. Test Specifications

The tests were performed to selected portions of, and in accordance with the FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C, Section 15.247 test specification(s).

- Federal Communications Commission “Code of Federal Regulations”, Title 47, Part 15, Subpart C
- Federal Communications Commission “Code of Federal Regulations”, Title 47, Part 15, Subpart B
- 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 40 GHz”
- 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-247 Issue 2, February 2017, “Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices”
- RSS-Gen Issue 5, March 2019, Amendment 1, Innovation, Science, and Economic Development Canada, “Spectrum Management and Telecommunications, Radio Standards Specification, General Requirements for Compliance of Radio Apparatus”

10. Test Plan

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

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

Ambient Parameters	Value
Temperature	23°C
Relative Humidity	17%
Atmospheric Pressure	1013.9mb.

13. Summary

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

Test Description	Requirements	Test Methods	S/N	Results
Receiver Radiated Emissions Test	FCC 15B 15.107 ISED RSS-GEN	ANSI C63.4: 2014	SMP-76780	Conforms
Transmitter Conducted Emissions Test (AC Mains)	FCC 15B 15.207 ISED RSS-GEN	ANSI C63.10: 2013	SMP-76780	Conforms
20dB Bandwidth	FCC 15C 15.247 ISED RSS-247	ANSI C63.10: 2013	SMP-76795	Conforms
Occupied Bandwidth (99%)	FCC 15C 15.247 ISED RSS-247	ANSI C63.10: 2013	SMP-76795	Conforms
Carrier Frequency Separation	FCC 15C 15.247 ISED RSS-247	ANSI C63.10: 2013	SMP-76795	Conforms
Number of Carrier Channels	FCC 15C 15.247 ISED RSS-247	ANSI C63.10: 2013	SMP-76795	Conforms
Average Time of Occupancy	FCC 15C 15.247 ISED RSS-247	ANSI C63.10: 2013	SMP-76795	Conforms
Maximum Peak Conducted Output Power	FCC 15C 15.247 ISED RSS-247	ANSI C63.10: 2013	SMP-76795	Conforms
Effective Isotropic Radiated Power (EIRP)	FCC 15C 15.247 ISED RSS-247	ANSI C63.10: 2013	SMP-76795	Conforms
Duty Cycle Factor Measurements	FCC 15C 15.247 ISED RSS-247	ANSI C63.10: 2013	SMP-76795	—
Case Spurious Radiated Emissions	FCC 15C 15.247 ISED RSS-247	ANSI C63.10: 2013	SMP-76795	Conforms
Band-Edge Compliance	FCC 15C 15.247 ISED RSS-247	ANSI C63.10: 2013	SMP-76795	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).

Formula 1: VL (dBuV) = MTR (dBuV) + 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.

Formula 1: FS (dBuV/m) = MTR (dBuV) + AF (dB/m) + CF (dB) + (- PA (dB)) + DC (dB)

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

Formula 2: FS (uV/m) = AntiLog [(FS (dBuV/m))/20]

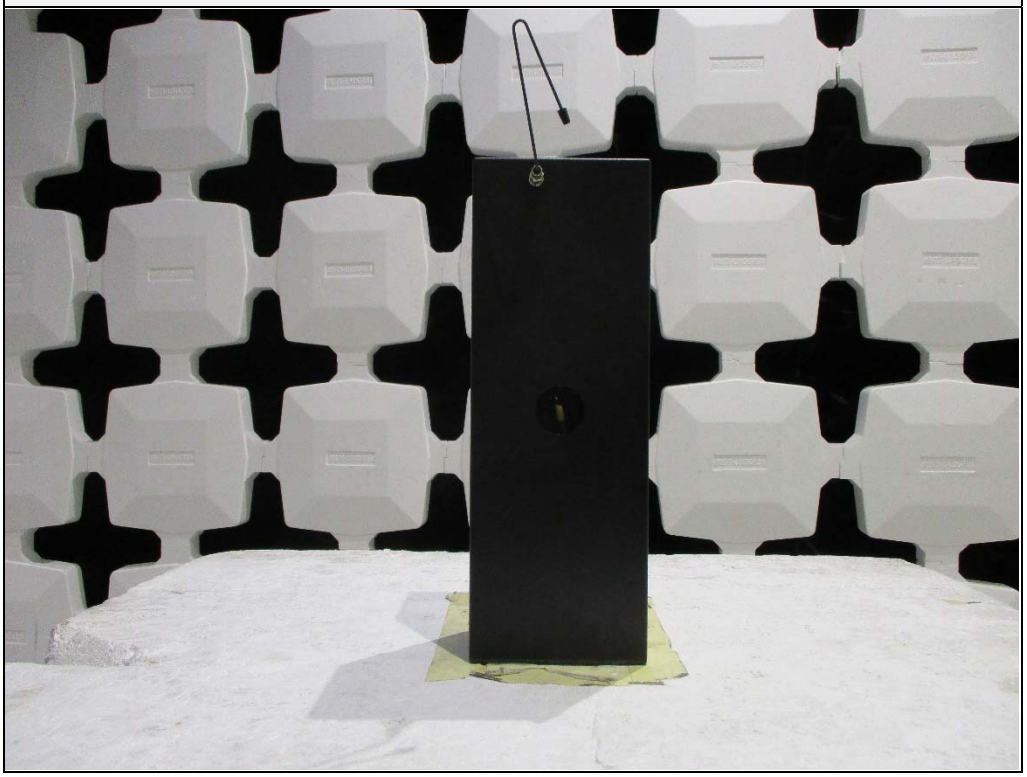
15. Statement of Conformity

The Chamberlain Group, Inc. Access Control Device, Model No. CAPXM, Serial No. SMP-76795, 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 EUT on the test date 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.

17. Photographs of EUT



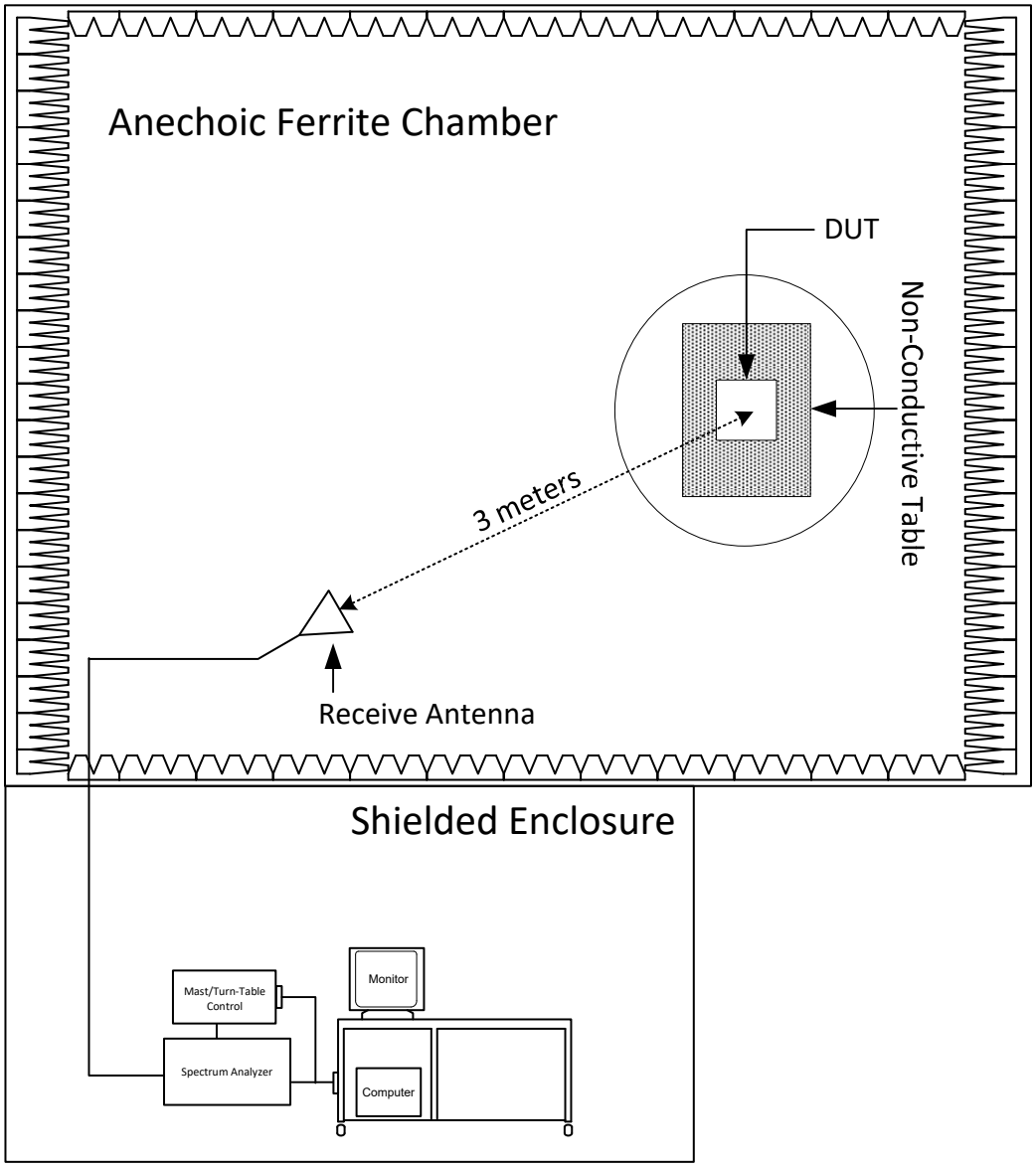
18. Equipment List

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
APW3	PREAMPLIFIER	PLANAR ELECTRONICS	PE2-35-120-5R0-10-12	PL2924	1GHZ-20GHZ	3/23/2020	3/23/2021
CDZ2	LAB WORKSTATION	ELITE	LWS-10		WINDOWS 10	CNR	
GRE1	SIGNAL GENERATOR	AGILENT	E4438C	MY42081749	250KHZ-6GHZ	2/25/2020	2/25/2021
NTA4	BILOG ANTENNA	TESEQ	6112D	46660	20-2000GHZ	10/5/2020	10/5/2021
NWQ0	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS LINDGREN	3117	66657	1GHZ-18GHZ	5/13/2020	5/13/2022
PLF6	CISPR16 50UH LISN	ELITE	CISPR16/15A	007	.15-30MHz	4/21/2020	4/21/2021
PLF7	CISPR16 50UH LISN	ELITE	CISPR16/15A	008	.15-30MHz	4/21/2020	4/21/2021
RBD0	EMI TEST RECIEVER	ROHDE & SCHWARZ	ESU40	100010	20Hz-40GHz	8/27/2020	8/27/2021
RBG2	EMI ANALYZER	ROHDE & SCHWARZ	ESW44	101591	2HZ-44GHZ	3/23/2020	3/23/2021
RBG3	EMI ANALYZER	ROHDE & SCHWARZ	ESW44	101592	2HZ-44GHZ	4/24/2020	4/24/2021
T1D2	10DB 20W ATTENUATOR	NARDA	768-10	---	DC-11GHZ	1/10/2020	1/10/2022
T2DN	20DB, 25W ATTENUATOR	WEINSCHEL	46-20-34	BS2147	DC-18GHZ	1/10/2020	1/10/2022
T2S7	20DB 25W ATTENUATOR	WEINSCHEL	46-20-34	BU8139	DC-18GHZ	3/10/2020	3/10/2022
T2SG	20DB 25W ATTENUATOR	WEINSCHEL	46-20-34	CD5016	DC-18GHZ	1/9/2020	1/9/2022
VBR8	CISPR EN FCC CE VOLTAGE.exe					N/A	
XLT32	5W, 50 OHM TERMINATION	JFW INDUSTRIES	50T-199 N M	---	DC-18 GHZ	10/30/2019	10/30/2021
XPQ4	HIGH PASS FILTER	K&L MICROWAVE	11SH10-4800/X20000-O/O	1	4.8-20GHZ	9/6/2019	9/6/2021

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 Test

Test Information	
Manufacturer	Chamberlain Group, Inc.
Product	Access Control Device
Model	CAPXM
Serial No	SMP-76795
Mode	Standby

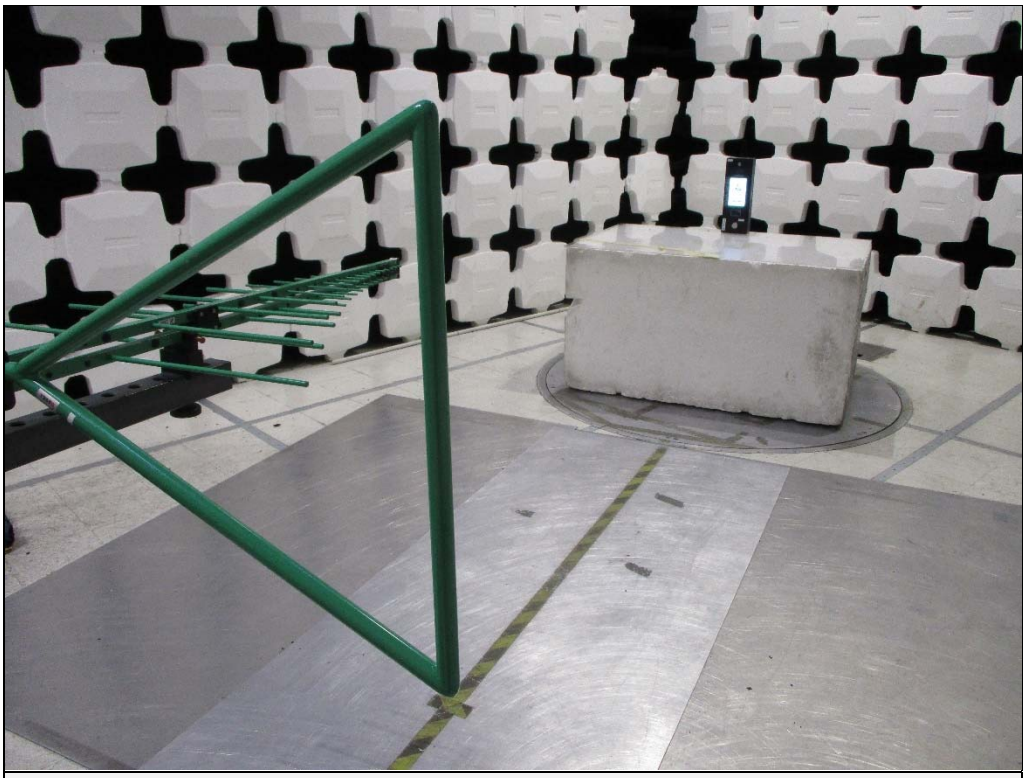
Test Setup Details	
Setup Format	Tabletop
Height of Support	NA
Type of Test Site	Semi-Anechoic Chamber
Type of Antennas Used	Below 1GHz: Bilog (or equivalent) Above 1GHz: Double-ridged waveguide (or equivalent)
Highest Internal Frequency of the EUT:	2.4GHz
Highest Measurement Frequency:	12.5GHz
Notes	The cables were manually maximized during the preliminary emissions sweeps. The cable arrangement which resulted in the worst-case emissions was utilized.

Requirements	
The field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:	
Frequency of Emission (MHz)	Field Strength (µV/m)
30-88 88-216 216-960 Above 960	100 150 200 500

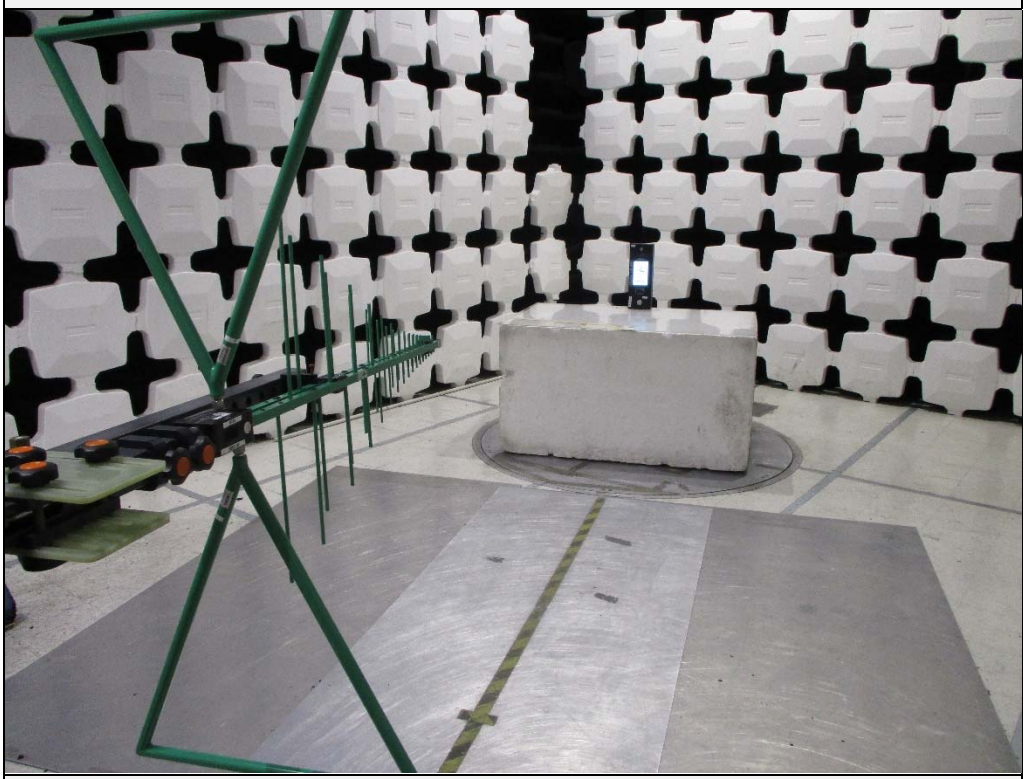
Procedures
Since a quasi-peak detector and an average detector requires a long integration times, it is not practical to automatically sweep through the quasi-peak and average levels. Therefore, radiated emissions from the EUT were first scanned using a peak detector and automatically plotted. The frequencies where significant emission levels were noted were then remeasured using the quasi-peak detector or average detector. The EUT was placed on a 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 12.5GHz 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

Procedures
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.

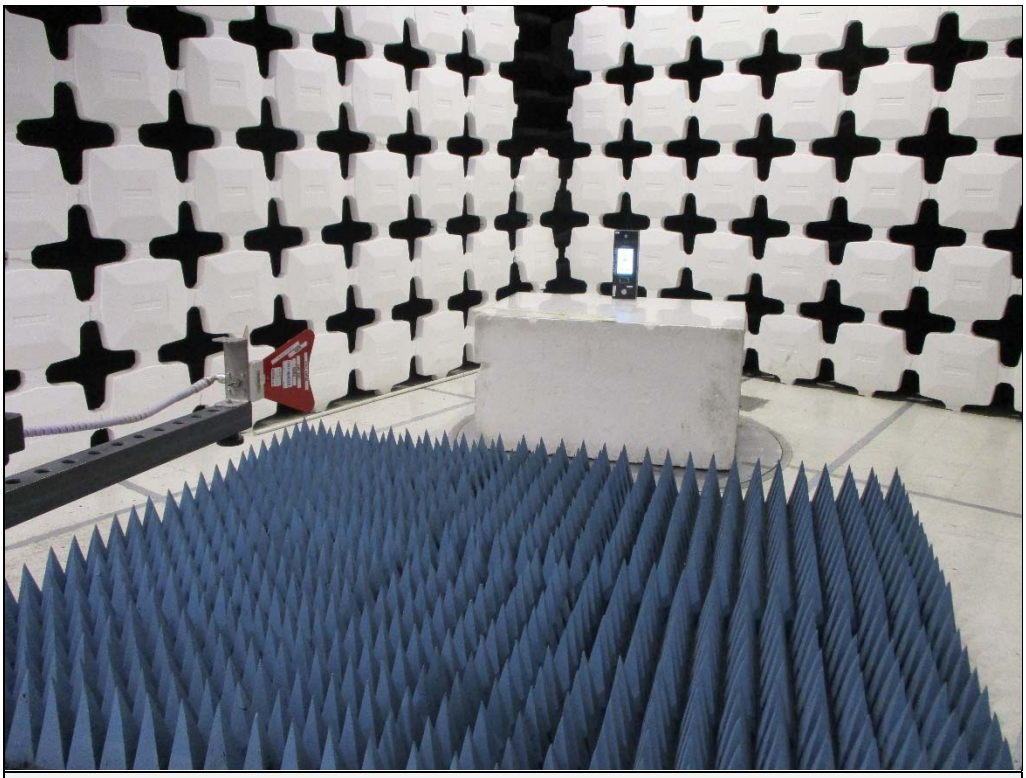
Measurement Uncertainty	
Measurement Type	Expanded Measurement Uncertainty
Radiated disturbance (electric field strength on an open area test site or alternative test site) (30 MHz – 1000 MHz)	4.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (1 GHz – 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



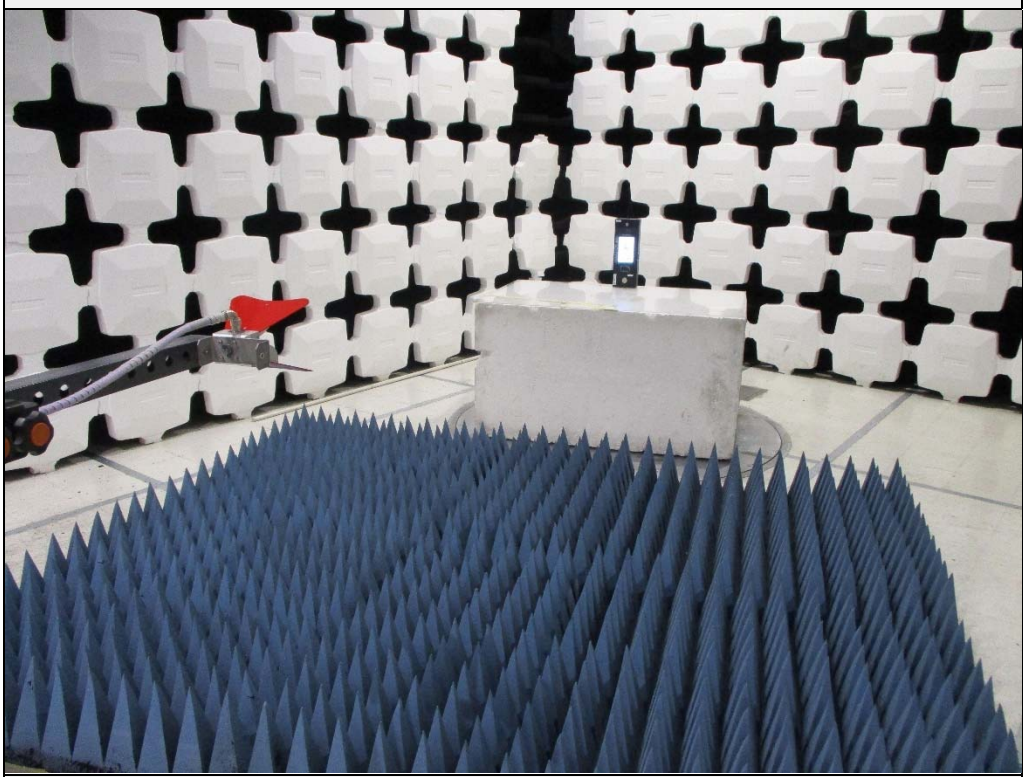
Test Setup for Radiated Emissions: 30MHz to 1GHz, Horizontal Polarization



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



Test Setup for Radiated Emissions: 1GHz to 12.5GHz, Horizontal Polarization



Test Setup for Radiated Emissions: 1GHz to 12.5GHz, Vertical Polarization

FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 01/02/2019

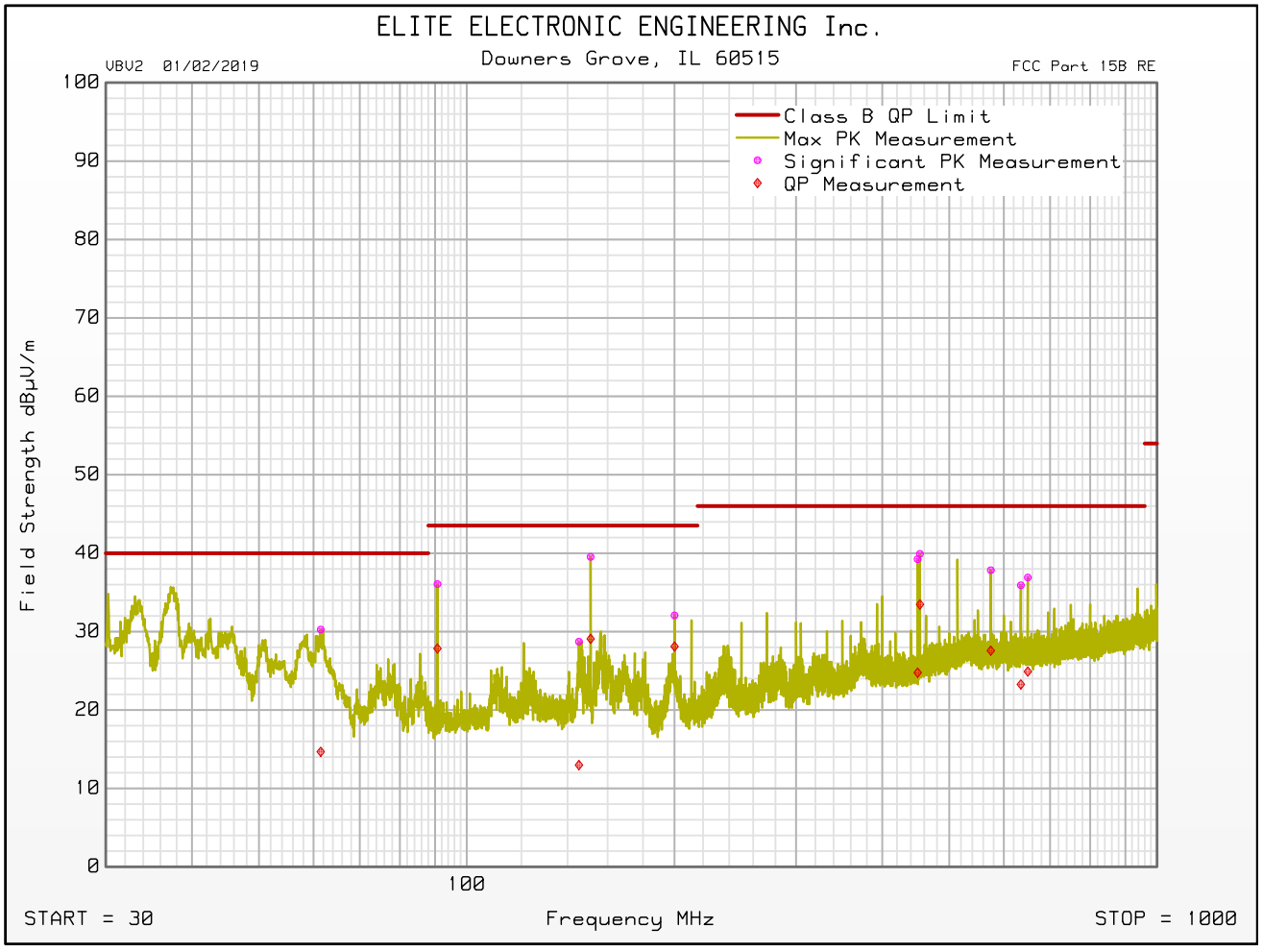
Manufacturer	:	Chamberlain Group, Inc.
Model	:	CAPXM
Serial Number	:	SMP-76780
DUT Mode	:	Standby
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	NA
Test Engineer	:	J. Cardenas
Test Date	:	Feb 04, 2021 08:54:09 AM

Freq MHz	Peak Mtr Rdg dBuV	QP Mtr Rdg dBuV	Ant Fac dB	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 °
30.240	11.8	6.2	24.8	0.0	0.4	0.0	37.0	31.4	40.0	-8.6	H	120	315
33.660	13.9	6.0	22.8	0.0	0.4	0.0	37.1	29.1	40.0	-10.9	H	120	225
37.200	14.5	5.3	20.8	0.0	0.4	0.0	35.7	26.5	40.0	-13.5	H	120	135
61.440	17.5	1.9	12.4	0.0	0.4	0.0	30.3	14.7	40.0	-25.3	V	200	0
87.960	12.9	-2.3	14.6	0.0	0.4	0.0	27.8	12.7	40.0	-27.3	H	340	225
90.700	20.5	12.3	15.2	0.0	0.4	0.0	36.1	27.8	43.5	-15.7	V	200	0
145.420	11.2	-4.5	16.9	0.0	0.6	0.0	28.7	13.0	43.5	-30.5	V	340	135
151.180	21.9	11.4	17.1	0.0	0.6	0.0	39.5	29.1	43.5	-14.4	V	340	135
155.920	14.0	8.0	17.2	0.0	0.6	0.0	31.8	25.8	43.5	-17.7	H	340	180
200.020	15.9	11.9	15.4	0.0	0.8	0.0	32.1	28.1	43.5	-15.4	V	200	225
211.660	21.2	1.0	15.1	0.0	0.8	0.0	37.1	16.9	43.5	-26.7	H	120	90
272.100	13.8	2.6	18.4	0.0	0.8	0.0	32.9	21.7	46.0	-24.3	H	120	90
450.000	15.4	0.9	22.7	0.0	1.1	0.0	39.2	24.8	46.0	-21.2	V	120	90
453.480	15.9	9.4	22.9	0.0	1.1	0.0	39.9	33.5	46.0	-12.5	V	120	0
513.960	16.7	11.3	24.2	0.0	1.1	0.0	42.0	36.7	46.0	-9.3	H	340	45
574.440	11.9	1.6	24.8	0.0	1.1	0.0	37.8	27.6	46.0	-18.4	V	120	0
634.920	9.7	-2.9	25.0	0.0	1.2	0.0	35.9	23.3	46.0	-22.7	V	200	0
649.980	10.8	-1.2	24.8	0.0	1.2	0.0	36.9	24.9	46.0	-21.1	V	120	0

FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 01/02/2019

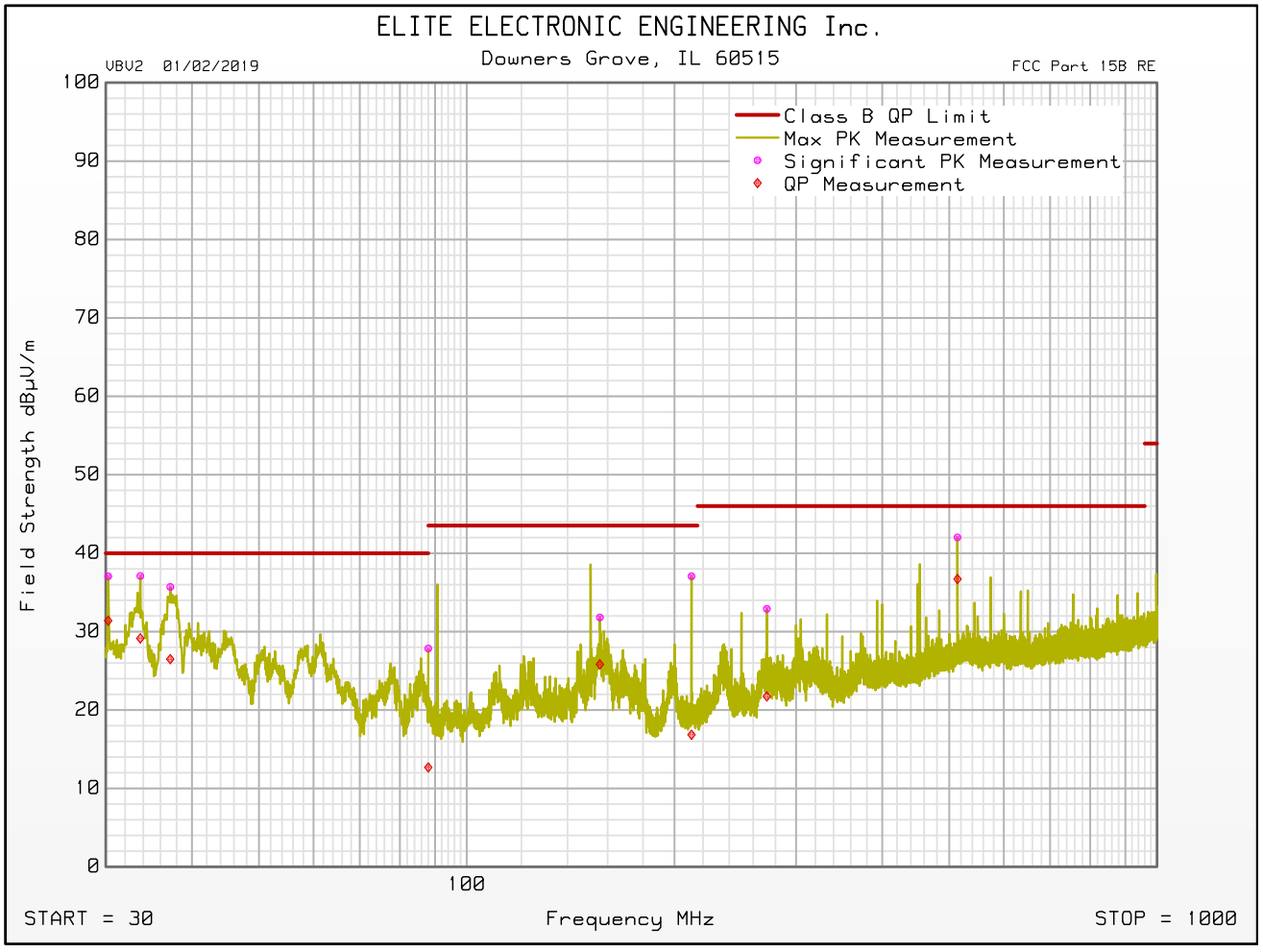
Manufacturer	:	Chamberlain Group, Inc.
Model	:	CAPXM
Serial Number	:	SMP-76780
DUT Mode	:	Standby
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Ant. Polarization(s)	:	V
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	NA
Test Engineer	:	J. Cardenas
Test Date	:	Feb 04, 2021 08:54:09 AM



FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 01/02/2019

Manufacturer	:	Chamberlain Group, Inc.
Model	:	CAPXM
Serial Number	:	SMP-76780
DUT Mode	:	Standby
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Ant. Polarization(s)	:	H
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	NA
Test Engineer	:	J. Cardenas
Test Date	:	Feb 04, 2021 08:54:09 AM



FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 01/02/2019

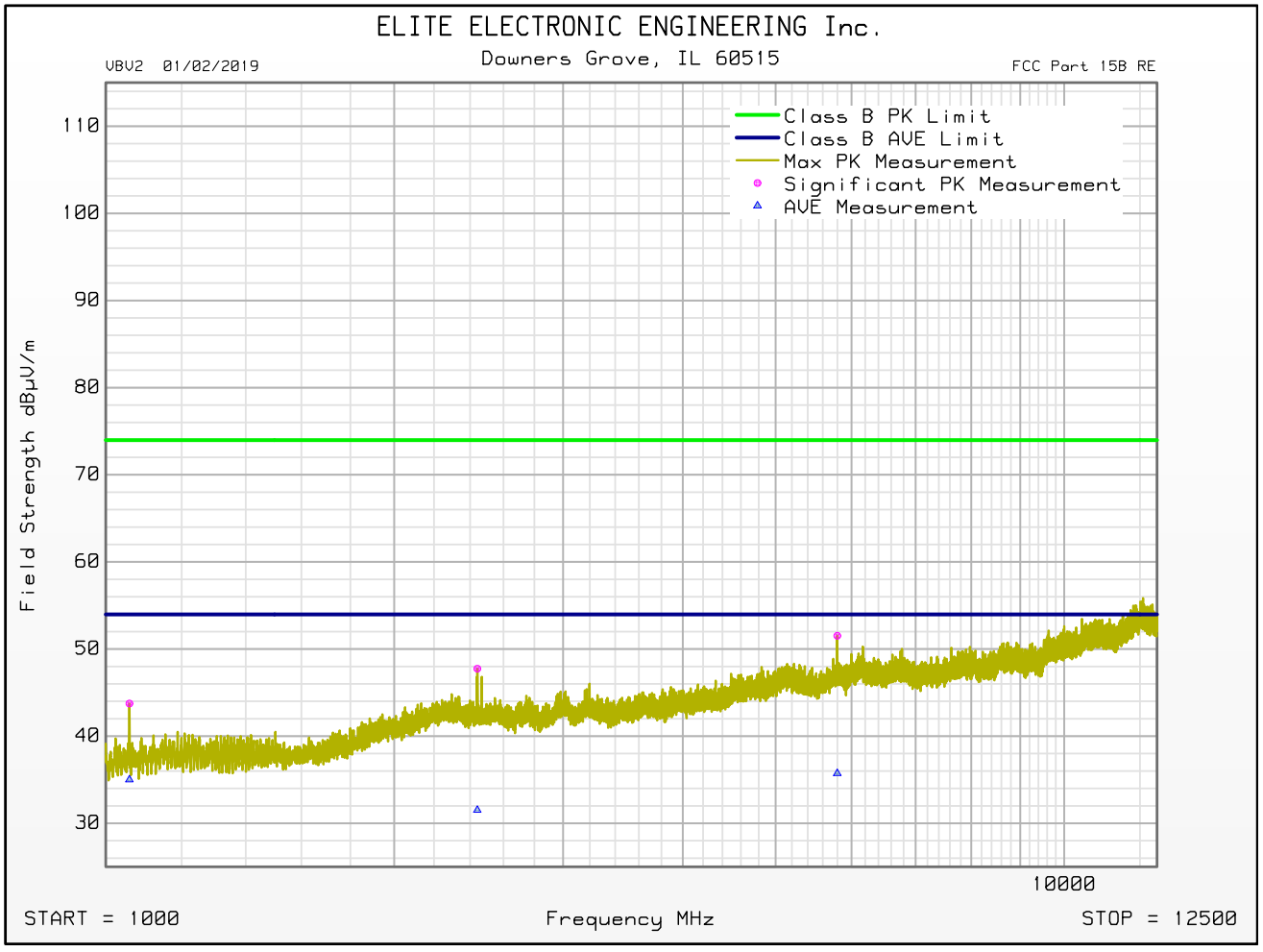
Manufacturer	:	Chamberlain Group, Inc.
Model	:	CAPXM
Serial Number	:	SMP-76780
DUT Mode	:	Standby
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Scan Type	:	Stepped Scan
Test RBW	:	1 MHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	NA
Test Engineer	:	J. Cardenas
Test Date	:	Feb 04, 2021 09:44:07 AM

Freq MHz	Peak Mtr Rdg dBuV	Average Mtr Rdg dBuV	Ant Fac dB	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Peak Total dBµV/m	Peak Limit dBµV/m	Peak Lim Mrg dB	Average Total dBµV/m	Average Limit dBµV/m	Average Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °
1058.500	54.0	45.3	29.1	-41.0	1.6	0.0	43.7	74.0	-30.2	35.0	54.0	-19.0	V	200	0
1851.500	61.2	35.5	31.5	-41.0	2.2	0.0	53.9	74.0	-20.1	28.1	54.0	-25.8	H	340	90
2442.000	52.1	35.8	33.6	-40.5	2.6	0.0	47.7	74.0	-26.2	31.5	54.0	-22.5	V	200	0
5179.000	47.6	34.5	37.6	-40.2	3.9	0.0	48.9	74.0	-25.1	35.8	54.0	-18.2	H	340	180
5798.500	50.0	34.2	37.8	-40.4	4.1	0.0	51.5	74.0	-22.5	35.7	54.0	-18.2	V	200	90
12158.500	48.1	34.3	41.8	-39.7	6.1	0.0	56.3	74.0	-17.7	42.5	54.0	-11.5	H	340	90

FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 01/02/2019

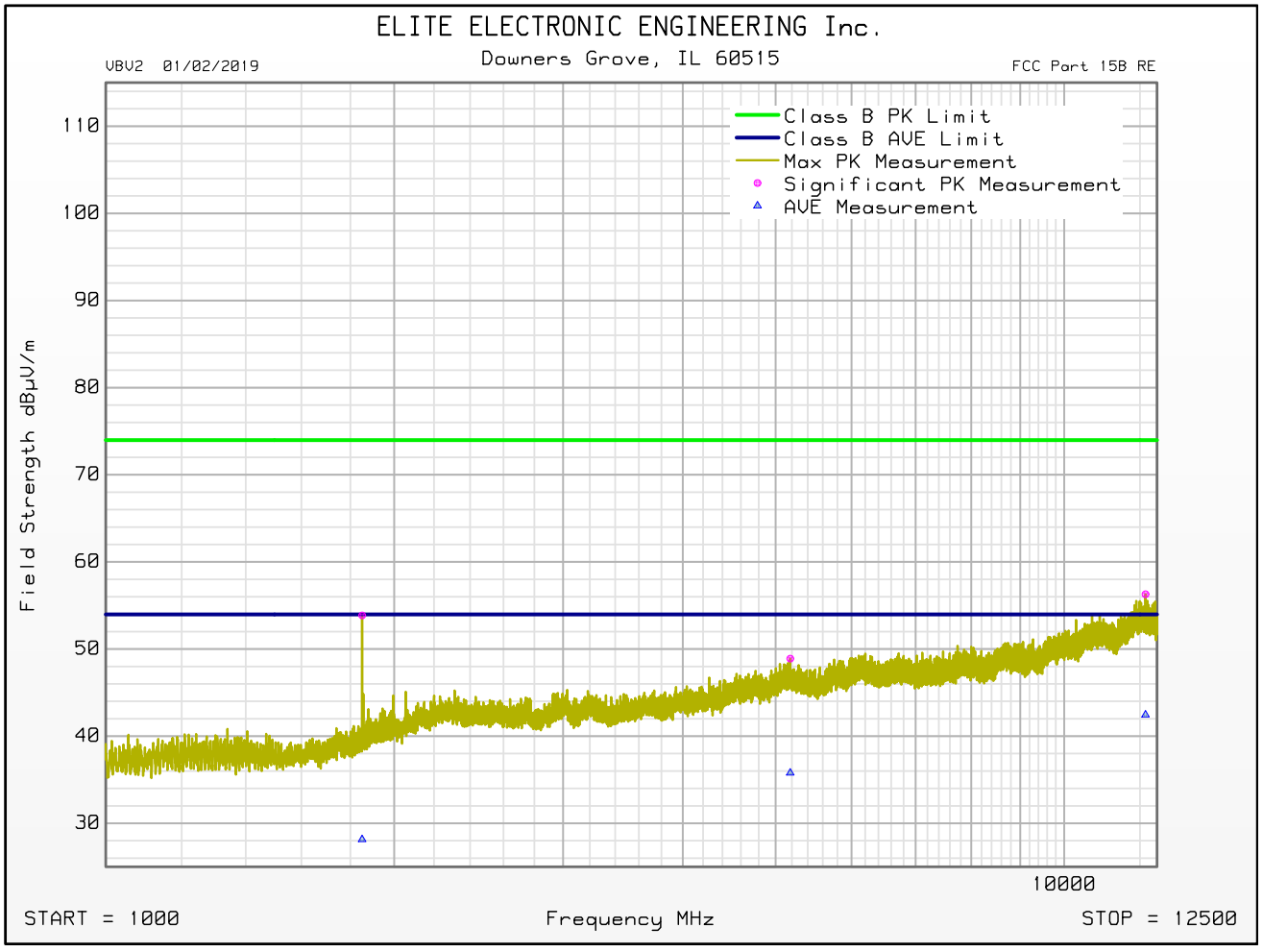
Manufacturer	:	Chamberlain Group, Inc.
Model	:	CAPXM
Serial Number	:	SMP-76780
DUT Mode	:	Standby
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Ant. Polarization(s)	:	V
Scan Type	:	Stepped Scan
Test RBW	:	1 MHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	NA
Test Engineer	:	J. Cardenas
Test Date	:	Feb 04, 2021 09:44:07 AM



FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 01/02/2019

Manufacturer	:	Chamberlain Group, Inc.
Model	:	CAPXM
Serial Number	:	SMP-76780
DUT Mode	:	Standby
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Ant. Polarization(s)	:	H
Scan Type	:	Stepped Scan
Test RBW	:	1 MHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	NA
Test Engineer	:	J. Cardenas
Test Date	:	Feb 04, 2021 09:44:07 AM



21. Transmitter Conducted Emissions Test (AC Mains)

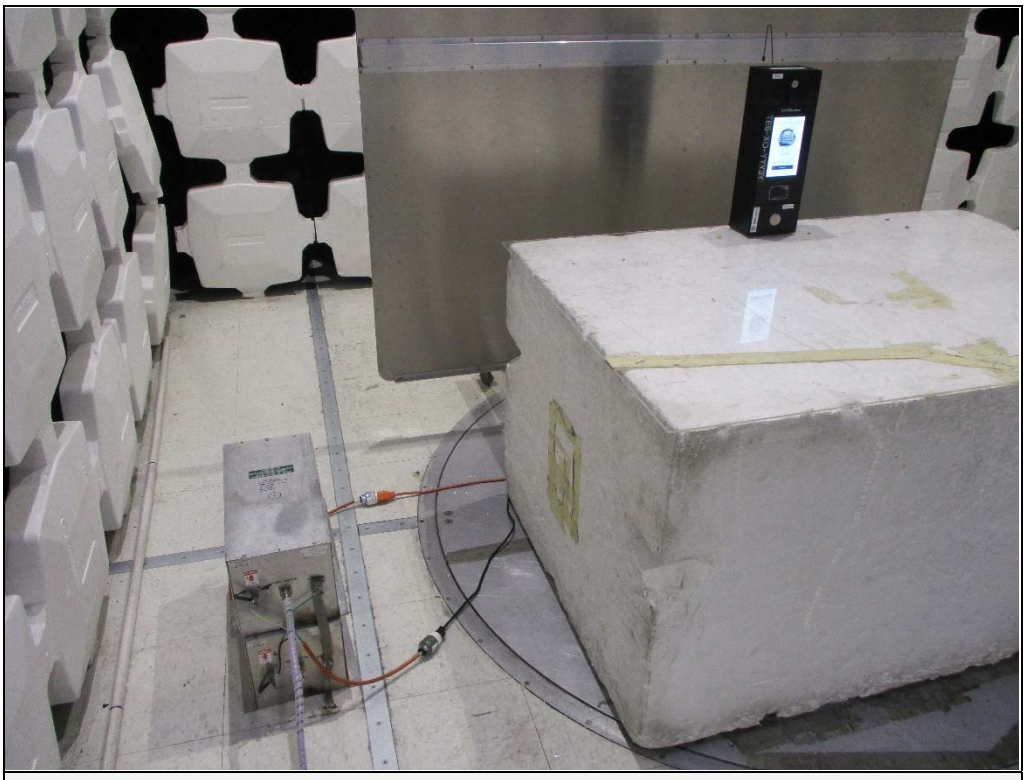
Test Information	
Manufacturer	Chamberlain Group, Inc.
Product	Access Control Device
Model	CAPXM
Serial No	SMP-76795
Mode	Hopping Enabled

Test Setup Details	
Setup Format	Tabletop
Height of Support	NA
Type of Test Site	Semi-Anechoic Chamber or Shielded Enclosure
Note	None

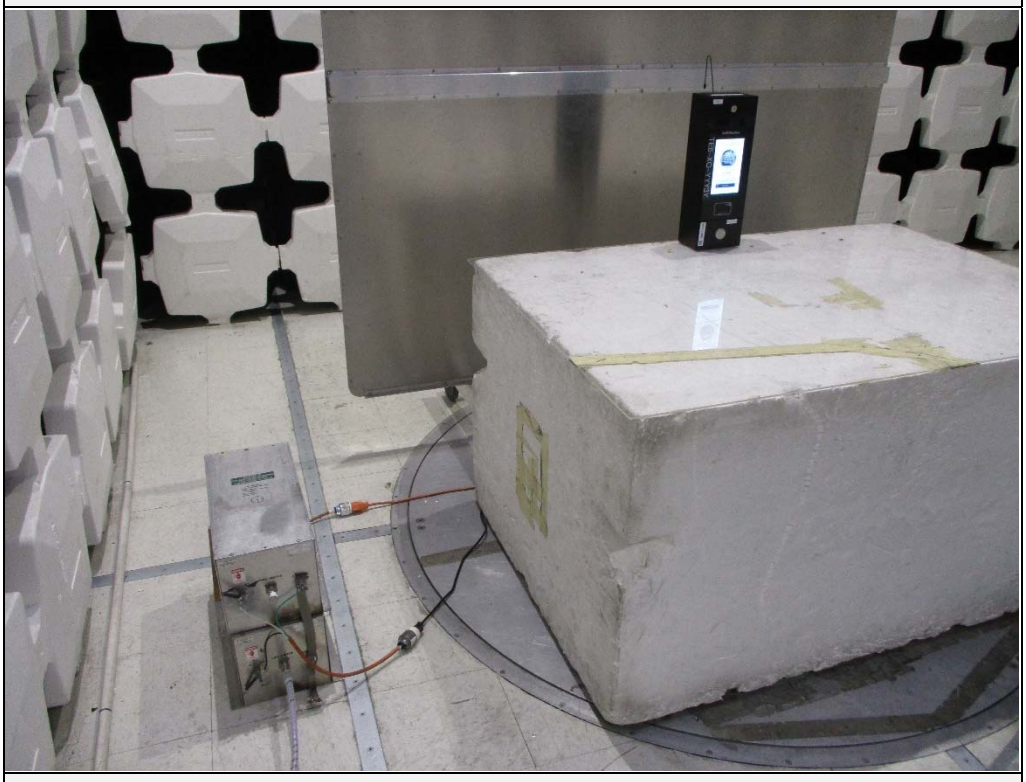
Requirements		
All radio frequency voltages on the power lines for any frequency or frequencies of an intentional radiator shall not exceed the limits in the following table:		
Frequency of Emission (MHz)	Conducted Limits (dBµV)	
	Quasi-peak	Average
0.15-05 0.5-5 5-30	66 to 56* 56 60	56-46* 46 50

Procedures
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 Hopping Enabled mode. 2) Measurements were first made on the 120VAC, 60Hz high line. 3) The frequency range from 150 kHz to 30 MHz 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 10dB 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. 7) Steps (3) through (6) were repeated on the 120VAC, 60Hz neutral line.

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



Test Setup for Conducted Emissions



Test Setup for Conducted Emissions

FCC Part 15 Subpart B Conducted Emissions Test

Significant Emissions Data

VBR8 05/14/2020

Manufacturer	:	Chamberlain Group, Inc.
Model	:	CAPXM
DUT Revision	:	1.0
Serial Number	:	SMP-76780
DUT Mode	:	Hopping Enabled
Line Tested	:	120VAC, 60Hz
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	Hitoh Power Supply
Test Engineer	:	J. Cardenas
Limit	:	Class B
Test Date	:	Feb 04, 2021 10:36:54 AM
Data Filter	:	Up to 80 maximum levels detected with 6 dB level excursion threshold over 10 dB margin below limit

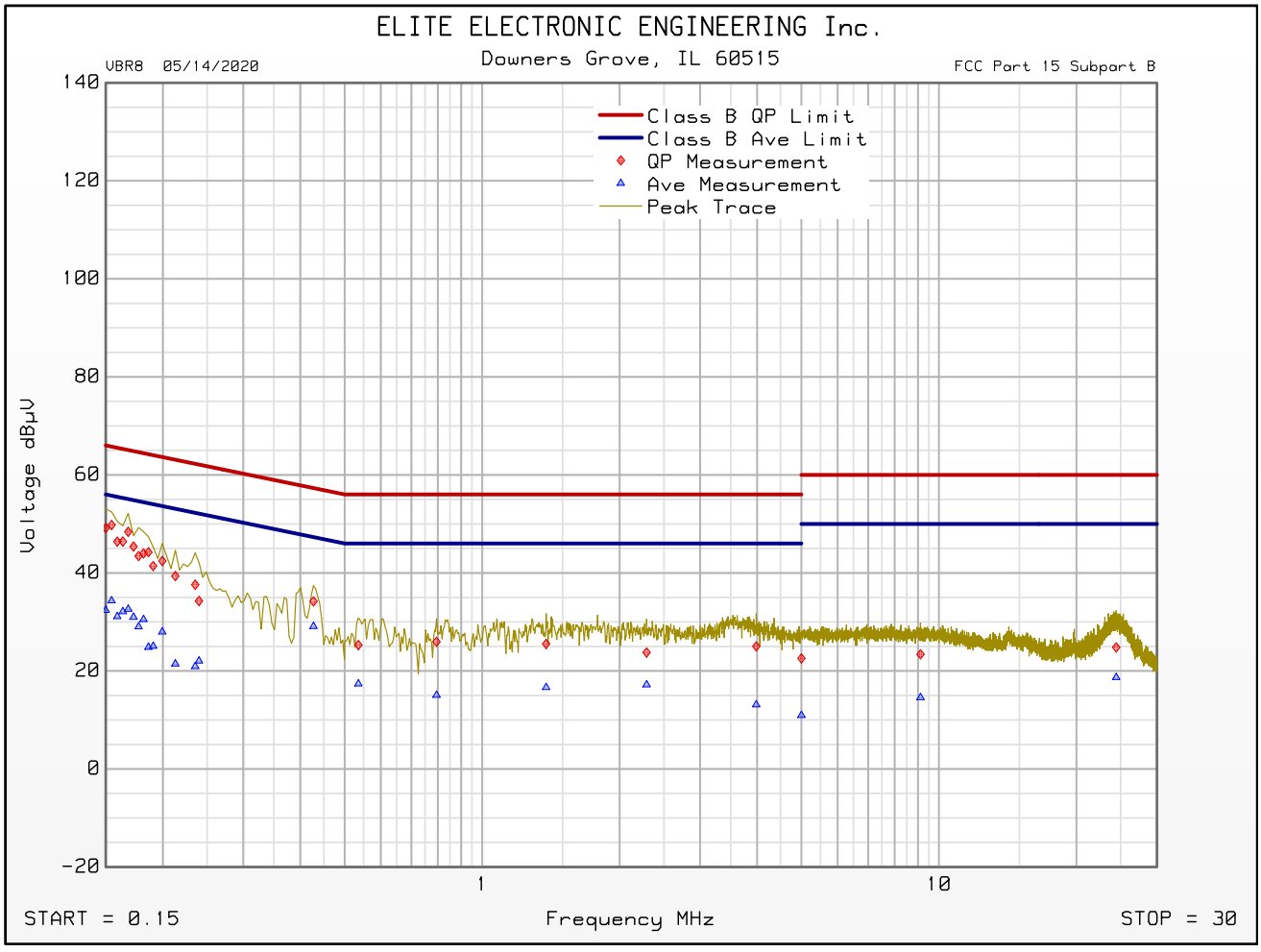
Freq MHz	Quasi-peak Level dBµV	Quasi-peak Limit dBµV	Excessive Quasi-peak Emissions	Average Level dBµV	Average Limit dBµV	Excessive Average Emissions
0.155	49.8	65.8		34.3	55.8	
0.428	34.2	57.3		29.1	47.3	
0.536	25.3	56.0		17.4	46.0	
0.795	25.9	56.0		15.0	46.0	
1.381	25.5	56.0		16.6	46.0	
2.291	23.8	56.0		17.2	46.0	
3.982	25.0	56.0		13.1	46.0	
5.000	22.6	56.0		11.0	46.0	
9.113	23.4	60.0		14.6	50.0	
24.436	24.8	60.0		18.7	50.0	

FCC Part 15 Subpart B Conducted Emissions Test

Cumulative Data

VBR8 05/14/2020

Manufacturer	:	Chamberlain Group, Inc.
Model	:	CAPXM
DUT Revision	:	1.0
Serial Number	:	SMP-76780
DUT Mode	:	Hopping Enabled
Line Tested	:	120VAC, 60Hz
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	Hitoh Power Supply
Test Engineer	:	J. Cardenas
Limit	:	Class B
Test Date	:	Feb 04, 2021 10:36:54 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 Group, Inc.
Model	:	CAPXM
DUT Revision	:	1.0
Serial Number	:	SMP-76780
DUT Mode	:	Hopping Enabled
Line Tested	:	Neutral
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	Hitoh Power Supply
Test Engineer	:	J. Cardenas
Limit	:	Class B
Test Date	:	Feb 04, 2021 10:30:37 AM
Data Filter	:	Up to 80 maximum levels detected with 6 dB level excursion threshold over 10 dB margin below limit

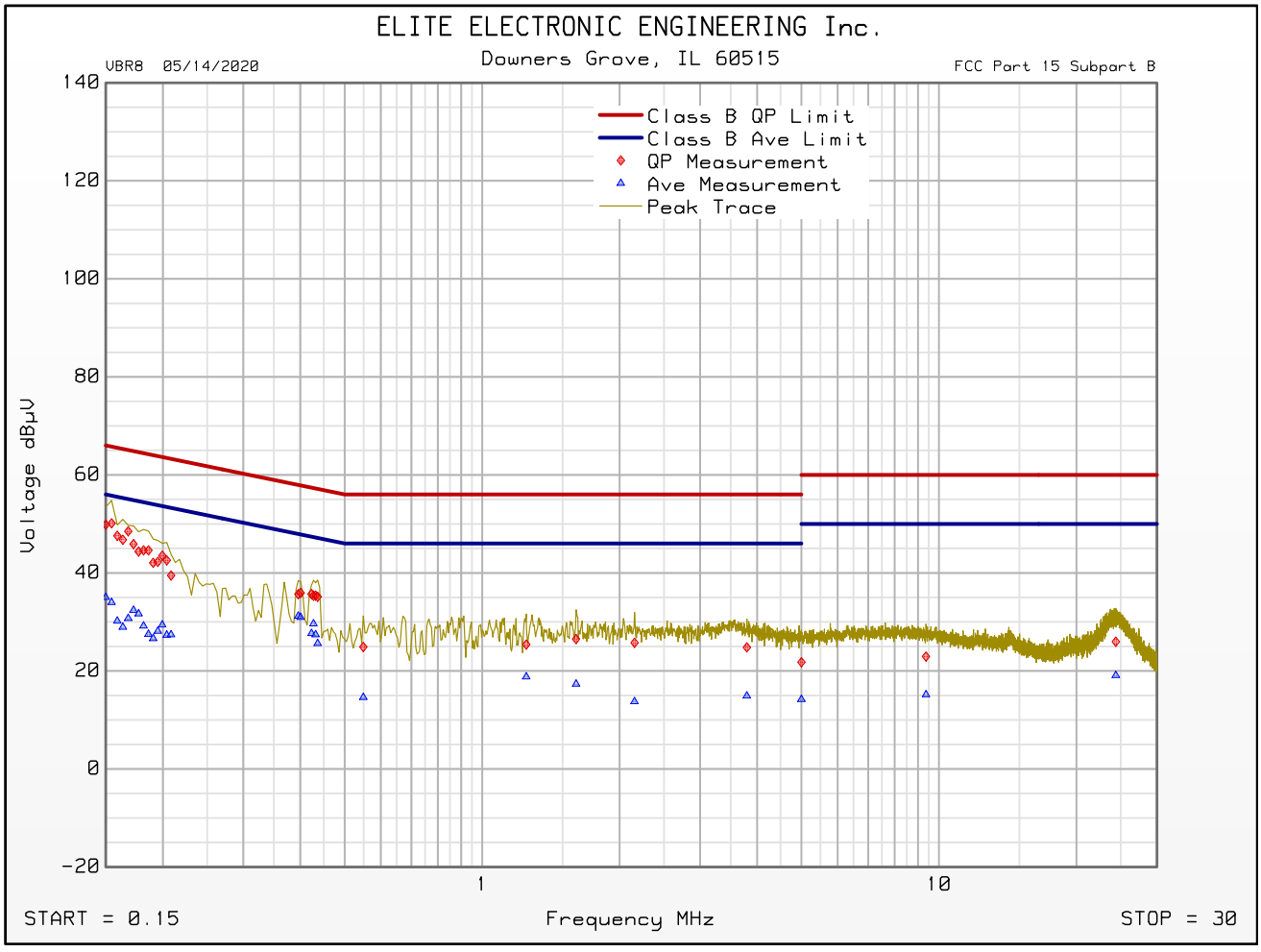
Freq MHz	Quasi-peak Level dBµV	Quasi-peak Limit dBµV	Excessive Quasi-peak Emissions	Average Level dBµV	Average Limit dBµV	Excessive Average Emissions
0.155	50.1	65.8		34.0	55.8	
0.423	35.7	57.4		27.7	47.4	
0.550	24.9	56.0		14.6	46.0	
1.249	25.4	56.0		18.8	46.0	
1.606	26.5	56.0		17.3	46.0	
2.156	25.7	56.0		13.8	46.0	
3.797	24.8	56.0		14.9	46.0	
5.000	21.8	56.0		14.2	46.0	
9.365	22.9	60.0		15.2	50.0	
24.386	26.0	60.0		19.1	50.0	

FCC Part 15 Subpart B Conducted Emissions Test

Cumulative Data

VBR8 05/14/2020

Manufacturer	:	Chamberlain Group, Inc.
Model	:	CAPXM
DUT Revision	:	1.0
Serial Number	:	SMP-76780
DUT Mode	:	Hopping Enabled
Line Tested	:	Neutral
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	Hitoh Power Supply
Test Engineer	:	J. Cardenas
Limit	:	Class B
Test Date	:	Feb 04, 2021 10:30:37 AM



Emissions Meet QP Limit
Emissions Meet Ave Limit

22. 20dB Bandwidth

Test Information	
Manufacturer	Chamberlain Group, Inc.
Product	Access Control Device
Model	CAPXM
Serial No	SMP-76795
Mode	Tx

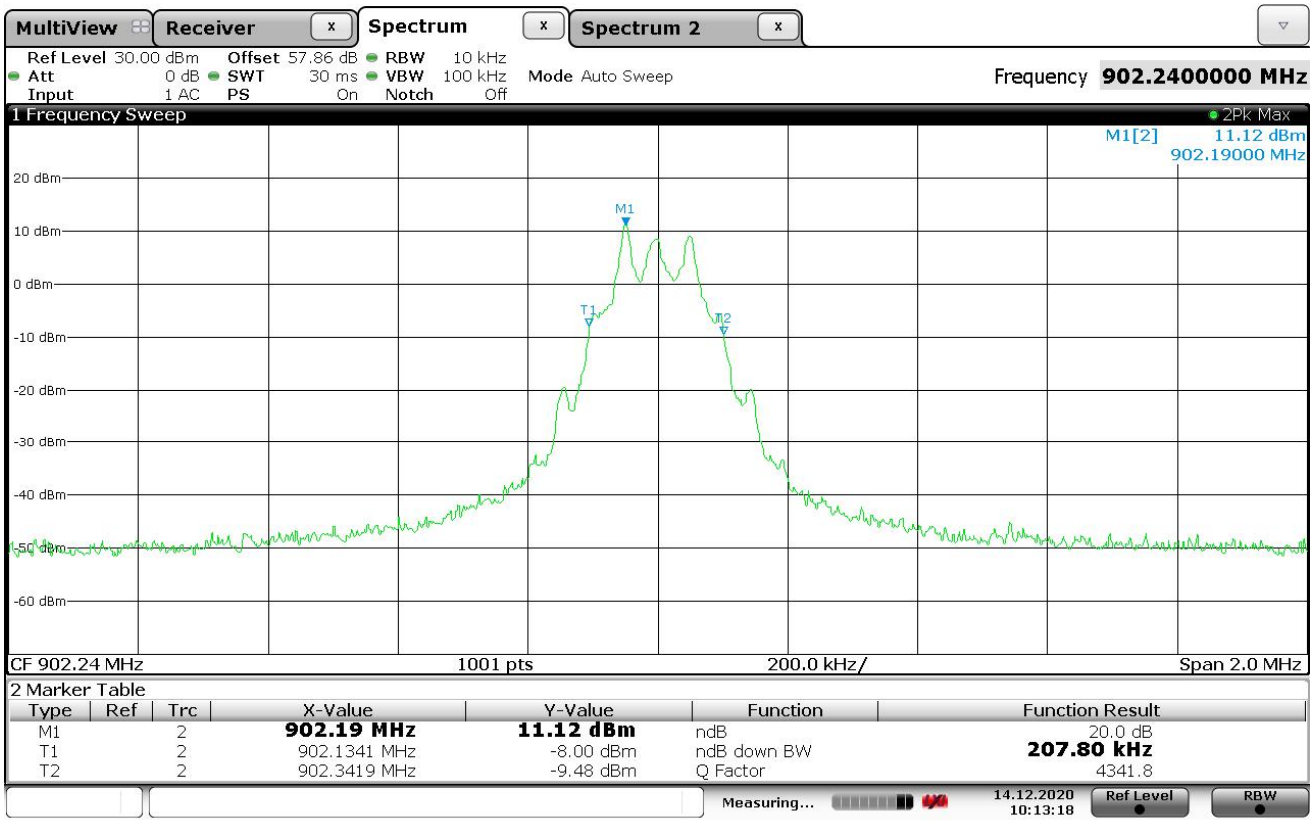
Test Setup Details	
Setup Format	Tabletop
Height of Support	NA
Measurement Method	Antenna Conducted
Type of Test Site	Shielded Chamber
Type of Antennas Used	NA
Notes	None

Requirements
Systems using frequency hopping techniques, operating in the 902-928MHz band, are allowed a maximum 20dB bandwidth of 500kHz.

Procedures
The antenna port of the EUT was connected to the spectrum analyzer through 60dB 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 ≥ 1% of the 20 dB BW. The span was set to approximately 2 to 3 times the 20 dB bandwidth. 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.

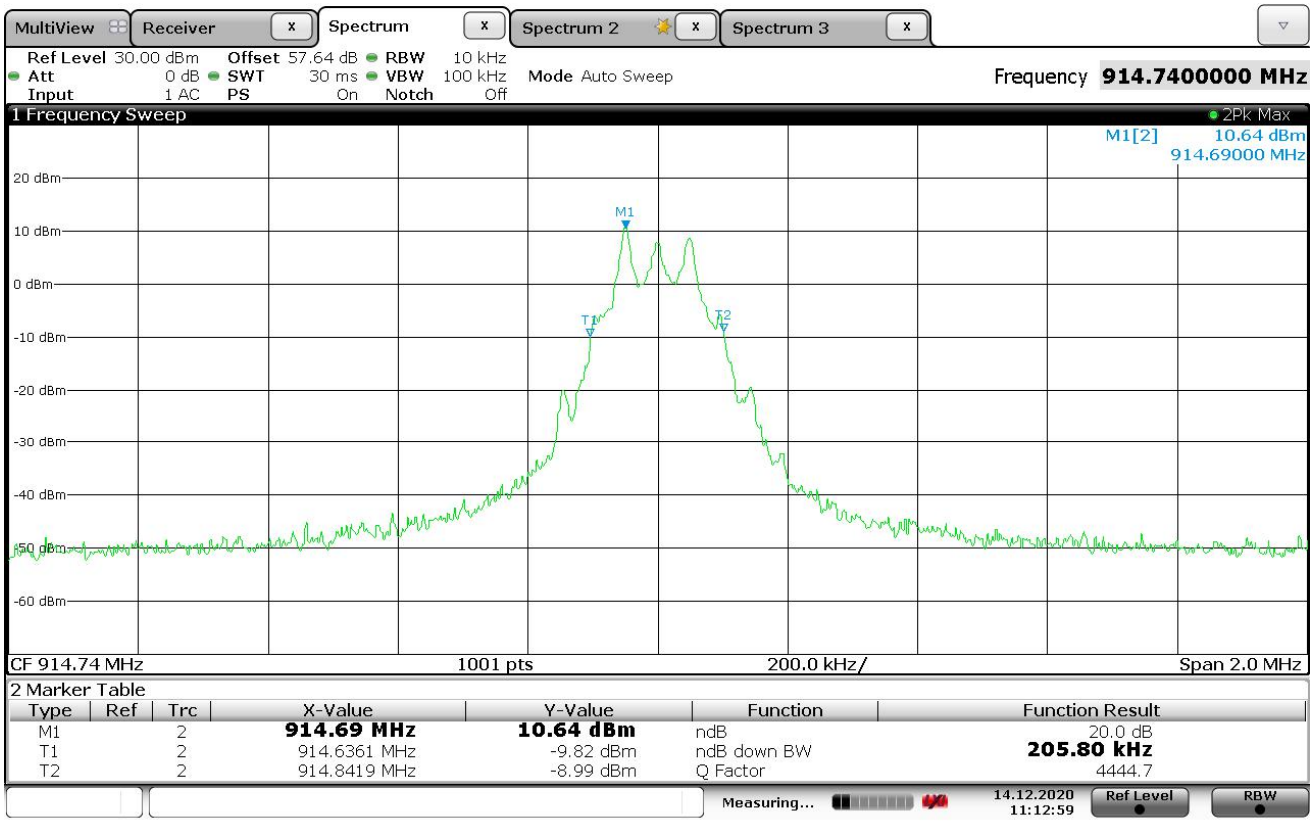
Measurement Uncertainty	
Measurement Type	Expanded Measurement Uncertainty
Radiated disturbance (electric field strength on an open area test site or alternative test site) (30 MHz – 1000 MHz)	4.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (1 GHz – 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

Test Details	
Manufacturer	Chamberlain Group, Inc.
Model	CAPXM
S/N	SMP-76795
Mode	Tx
Carrier Frequency	902.24MHz
Parameters	20dB BW = 207.8kHz
Notes	None



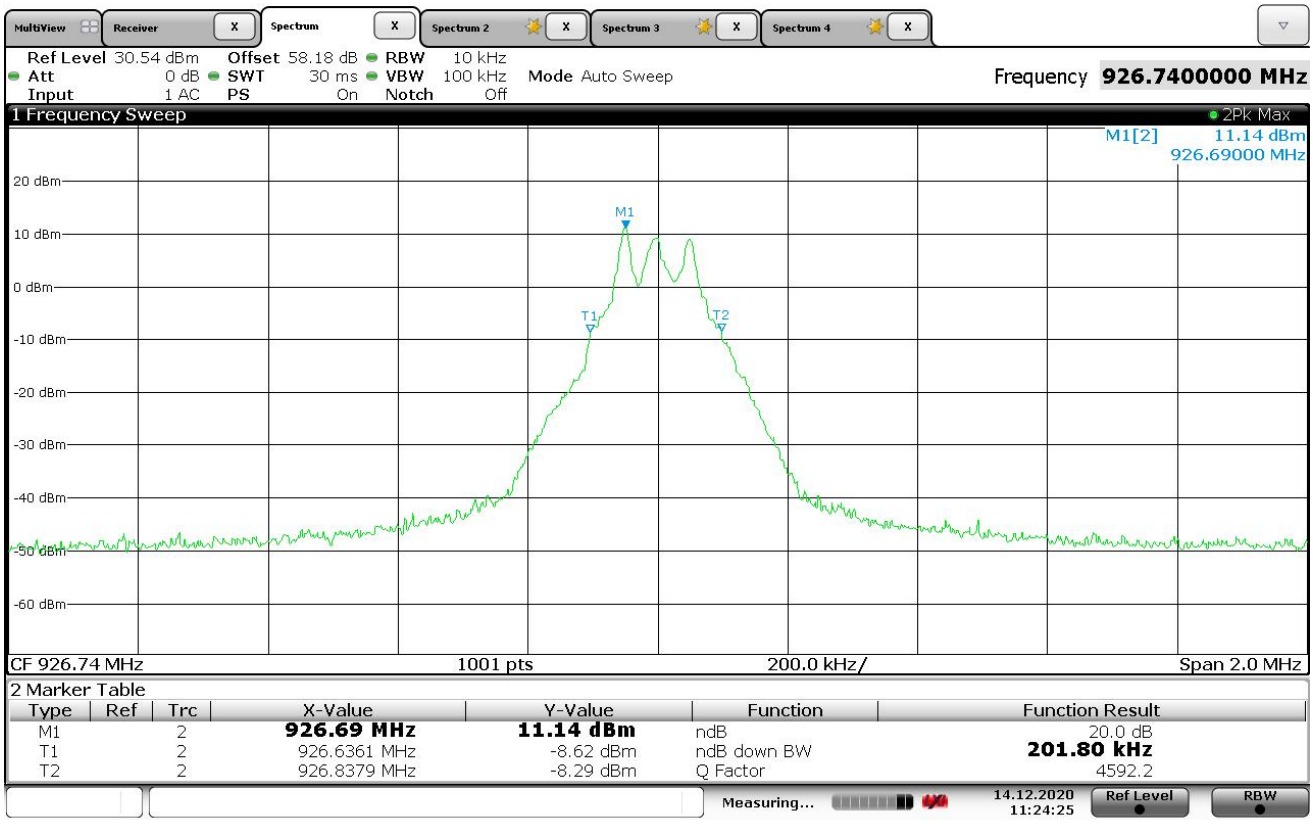
Date: 14.DEC.2020 10:13:18

Test Details	
Manufacturer	Chamberlain Group, Inc.
Model	CAPXM
S/N	SMP-76795
Mode	Tx
Carrier Frequency	914.74MHz
Parameters	20dB BW = 205.8kHz
Notes	None



Date: 14.DEC.2020 11:13:00

Test Details	
Manufacturer	Chamberlain Group, Inc.
Model	CAPXM
S/N	SMP-76795
Mode	Tx
Carrier Frequency	926.74MHz
Parameters	20dB BW = 201.8kHz
Notes	None



Date: 14.DEC.2020 11:24:25

23. Occupied Bandwidth (99%)

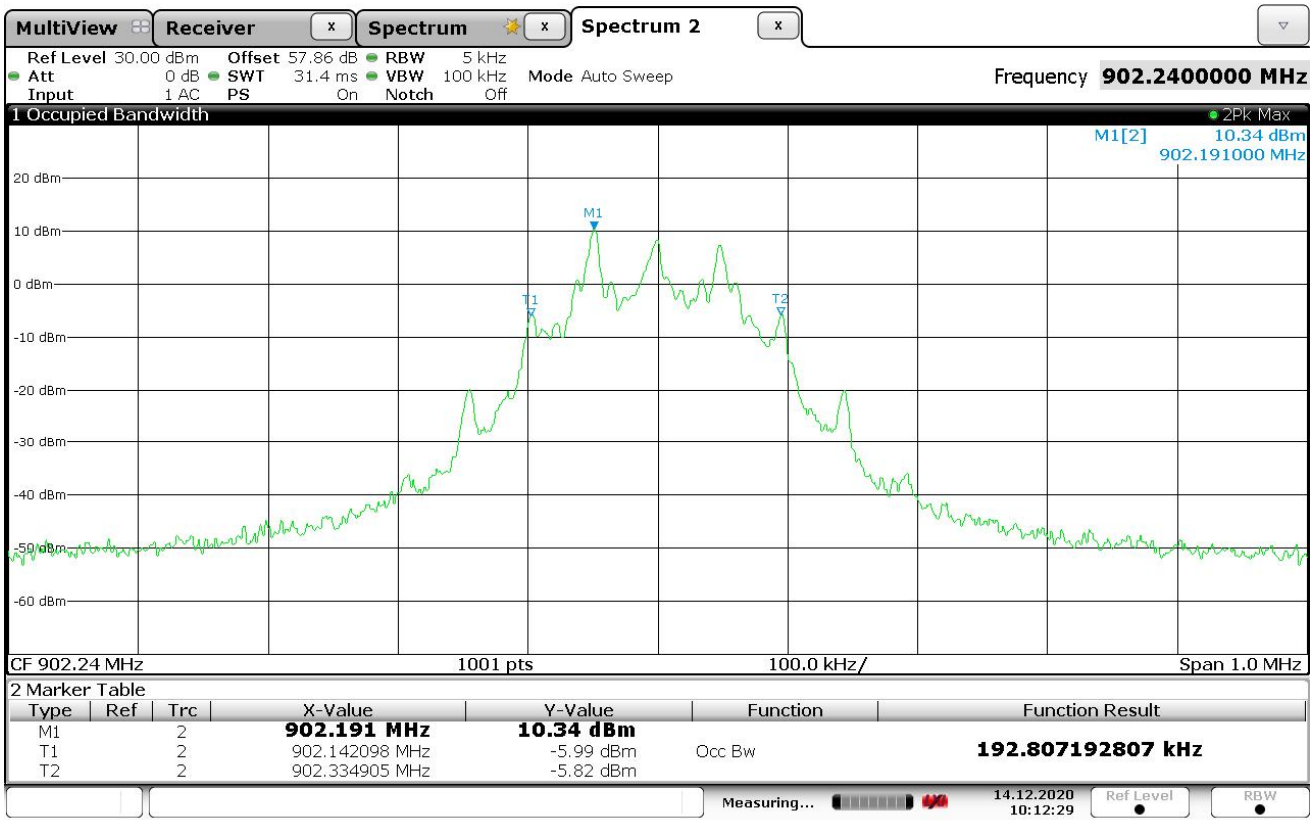
Test Information	
Manufacturer	Chamberlain Group, Inc.
Product	Access Control Device
Model	CAPXM
Serial No	SMP-76795
Mode	Tx

Test Setup Details	
Setup Format	Tabletop
Height of Support	NA
Measurement Method	Antenna Conducted
Type of Test Site	Shielded Chamber
Type of Antennas Used	NA
Notes	None

Procedures
The antenna port of the EUT was connected to the spectrum analyzer through 50dB of attenuation. 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. 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.

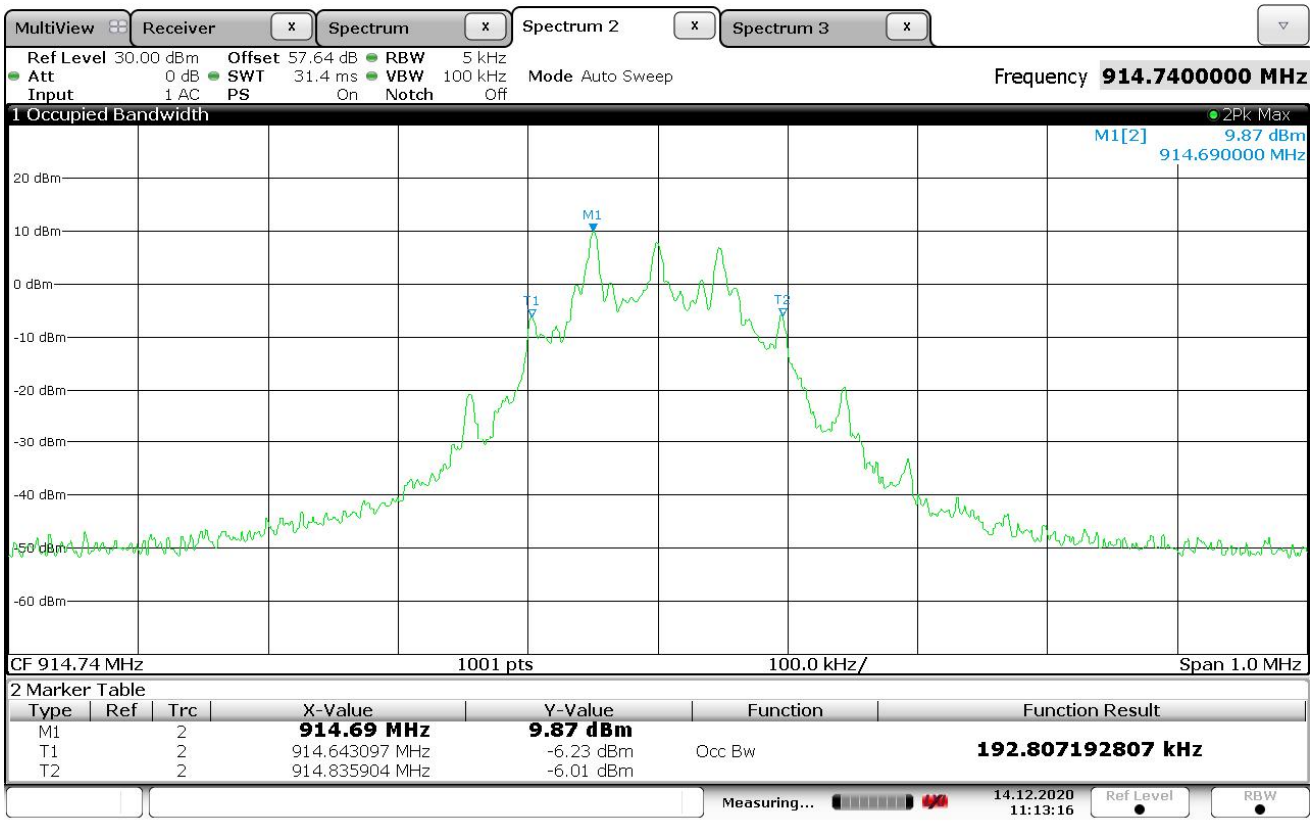
Measurement Uncertainty	
Measurement Type	Expanded Measurement Uncertainty
Radiated disturbance (electric field strength on an open area test site or alternative test site) (30 MHz – 1000 MHz)	4.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (1 GHz – 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

Test Details	
Manufacturer	Chamberlain Group, Inc.
Model	CAPXM
S/N	SMP-76795
Mode	Tx
Carrier Frequency	902.24MHz
Parameters	OBW = 192.8kHz
Notes	None



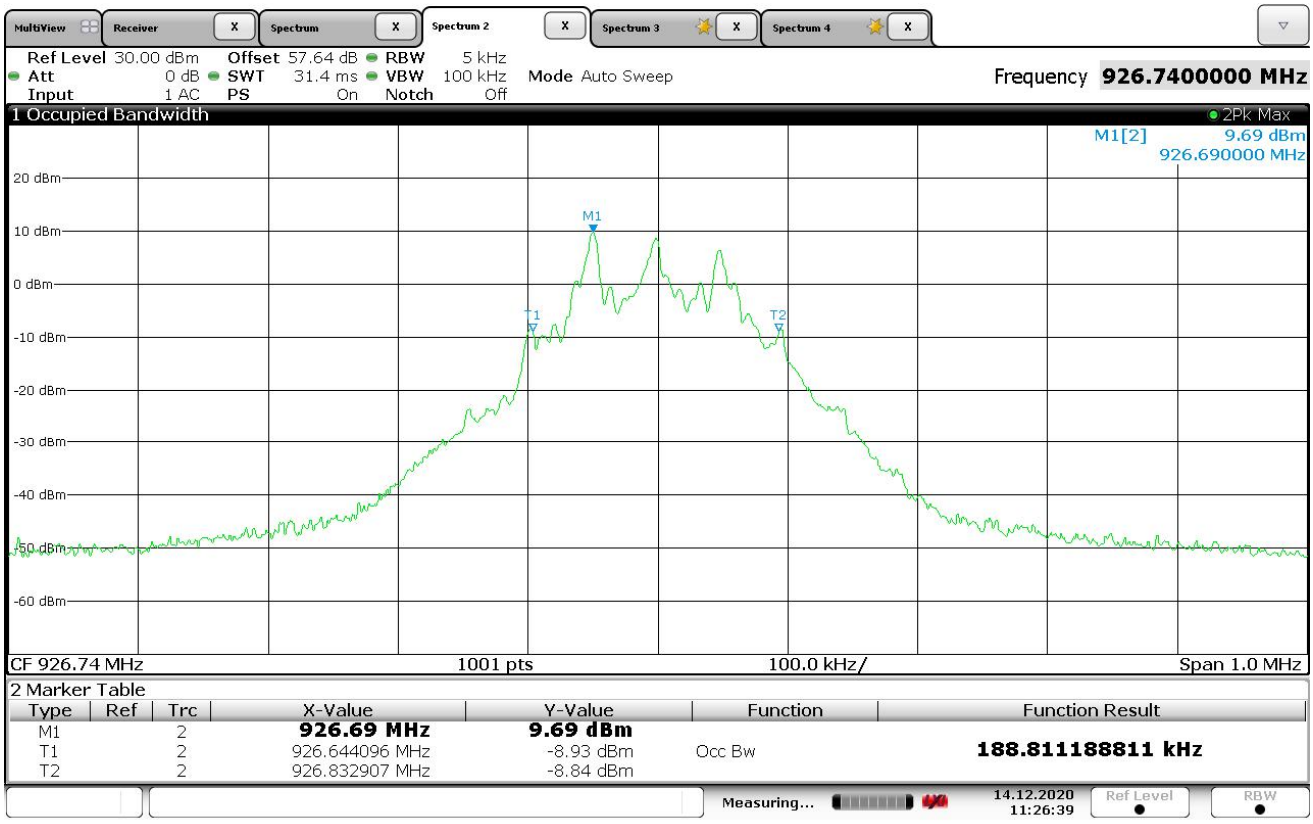
Date: 14.DEC.2020 10:12:30

Test Details	
Manufacturer	Chamberlain Group, Inc.
Model	CAPXM
S/N	SMP-76795
Mode	Tx
Carrier Frequency	914.74MHz
Parameters	OBW = 192.8kHz
Notes	None



Date: 14.DEC.2020 11:13:15

Test Details	
Manufacturer	Chamberlain Group, Inc.
Model	CAPXM
S/N	SMP-76795
Mode	Tx
Carrier Frequency	926.74MHz
Parameters	OBW = 188.8kHz
Notes	None



Date: 14.DEC.2020 11:26:39

24. Carrier Frequency Separation

Test Information	
Manufacturer	Chamberlain Group, Inc.
Product	Access Control Device
Model	CAPXM
Serial No	SMP-76795
Mode	Hopping Enabled

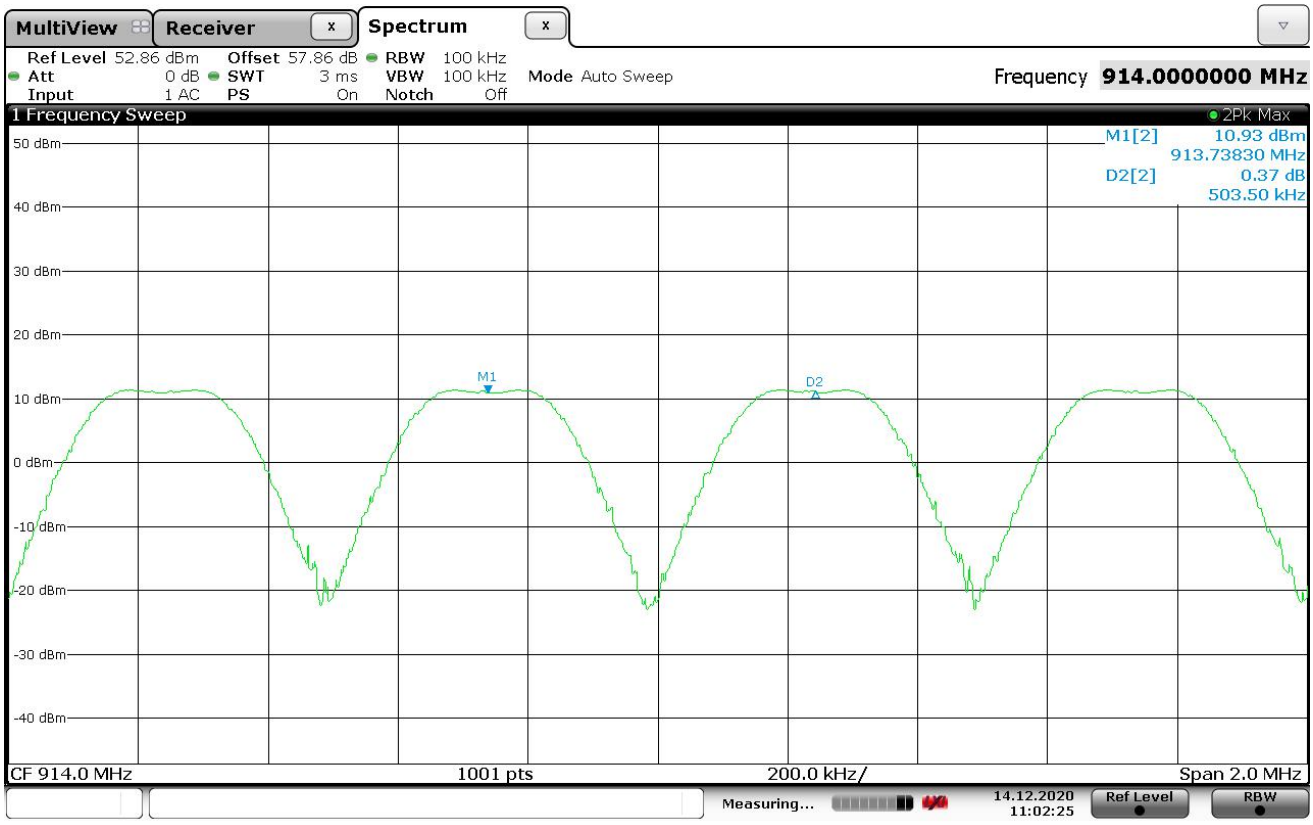
Test Setup Details	
Setup Format	Tabletop
Height of Support	NA
Measurement Method	Antenna Conducted
Type of Test Site	Shielded Enclosure
Type of Antennas Used	NA
Notes	None

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

Procedures
The antenna port of the EUT was connected to the spectrum analyzer through 50dB of attenuation. With the hopping function enabled, the EUT was allowed to transmit continuously. 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.

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

Test Details	
Manufacturer	Chamberlain Group, Inc.
Model	CAPXM
S/N	SMP-76795
Mode	Hopping Enabled
Parameters	Separation = 503.5kHz
Notes	None



25. Number of Carrier Channels

Test Information	
Manufacturer	Chamberlain Group, Inc.
Product	Access Control Device
Model	CAPXM
Serial No	SMP-76795
Mode	Hopping Enabled

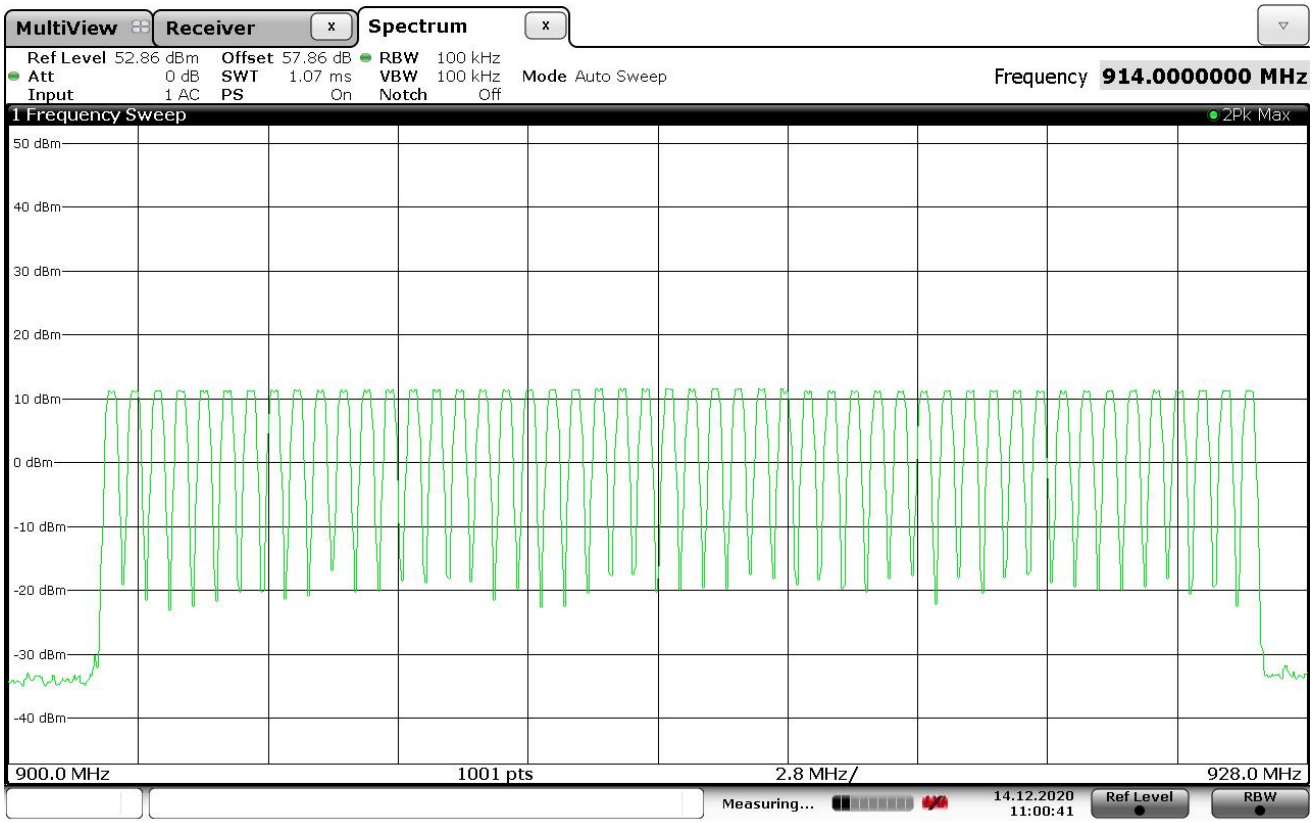
Test Setup Details	
Setup Format	Tabletop
Height of Support	NA
Measurement Method	Antenna Conducted
Type of Test Site	Shielded Chamber
Type of Antennas Used	NA
Notes	None

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
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

Requirements
The system shall use at least 50 hopping frequencies.

Procedures
The antenna port of the EUT was connected to the spectrum analyzer through 60dB of attenuation. With the hopping function enabled, the EUT was allowed to transmit continuously. 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. 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.

Test Details	
Manufacturer	Chamberlain Group, Inc.
Model	CAPXM
S/N	SMP-76795
Mode	Hopping Enabled
Parameters	50 channels
Notes	None



Date: 14.DEC.2020 11:00:41

26. Average Time of Occupancy

Test Information	
Manufacturer	Chamberlain Group, Inc.
Product	Access Control Device
Model	CAPXM
Serial No	SMP-76795
Mode	Hopping Enabled

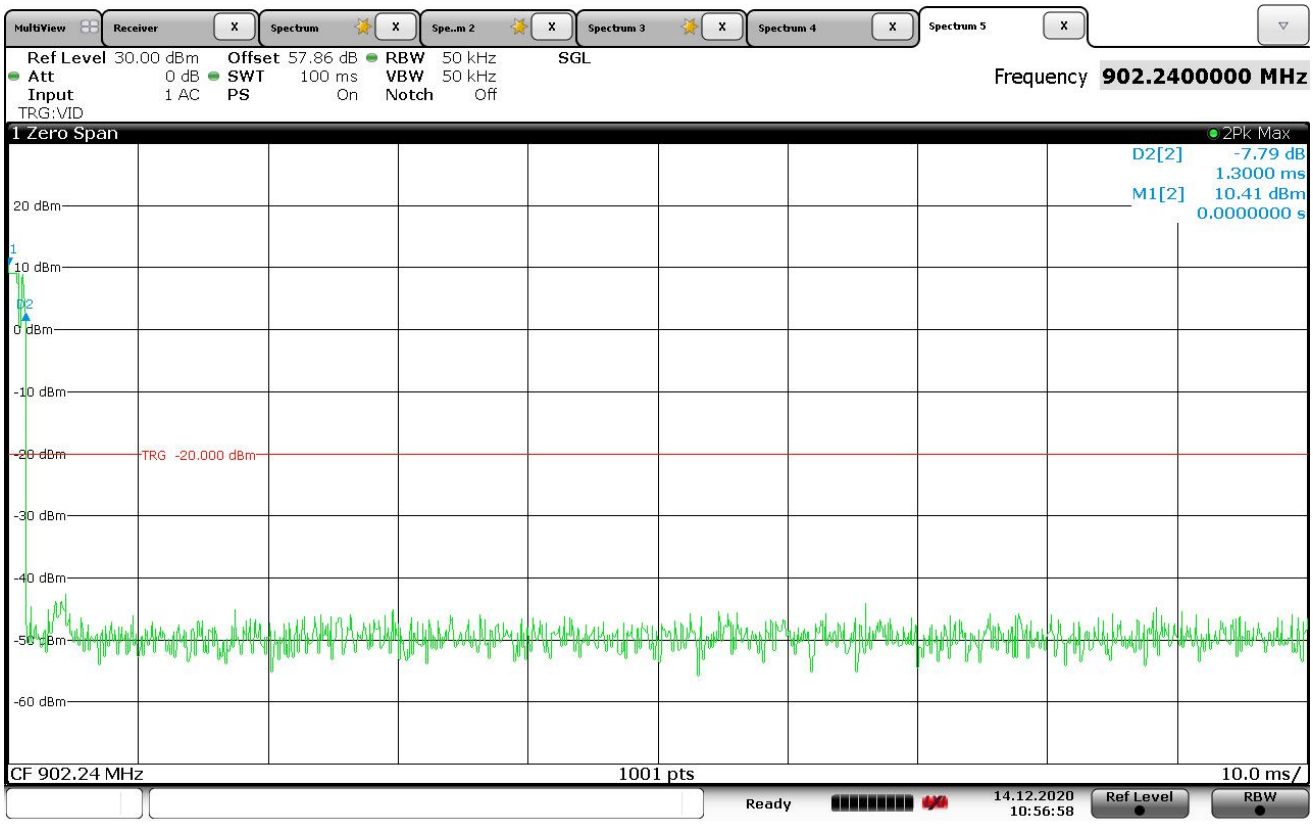
Test Setup Details	
Setup Format	Tabletop
Height of Support	NA
Measurement Method	Antenna Conducted
Type of Test Site	Shielded Chamber
Type of Antennas Used	NA
Notes	None

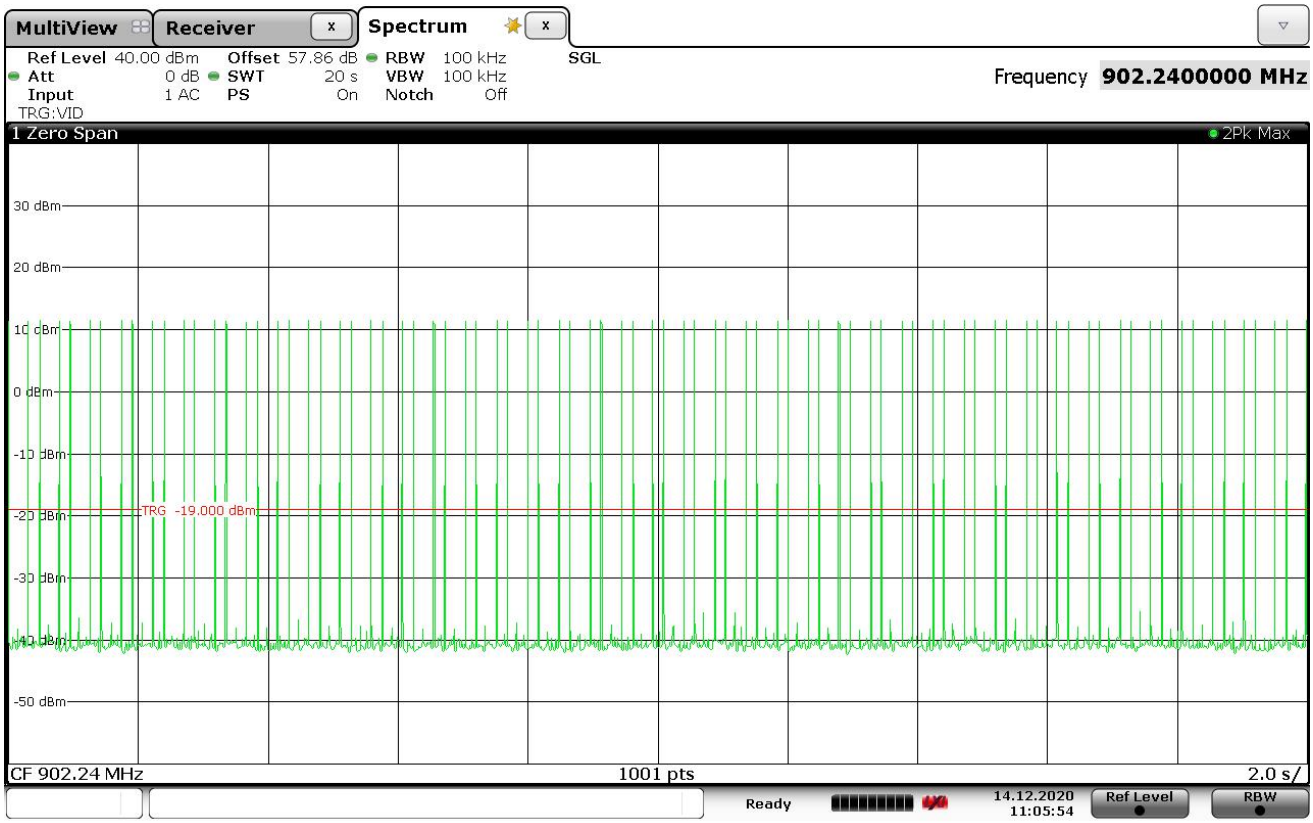
Measurement Uncertainty	
Measurement Type	Expanded Measurement Uncertainty
Radiated disturbance (electric field strength on an open area test site or alternative test site) (30 MHz – 1000 MHz)	4.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (1 GHz – 6 GHz)	3.1
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

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

Procedures
The antenna port of the EUT was connected to the spectrum analyzer through 60dB of attenuation. With the hopping function enabled, the EUT was allowed to transmit continuously. The spectrum analyzer was set to zero span centered on a hopping channel. The resolution bandwidth (RBW) was set ≥ 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.

Test Details	
Manufacturer	Chamberlain Group, Inc.
Model	CAPXM
S/N	SMP-76795
Mode	Hopping Enabled
Parameters	Average Time of Occupancy Measured = 85 x 1.3msec = 110.5msec
Notes	None





Date: 14.DEC.2020 11:05:54

27. Maximum Peak Conducted Output Power

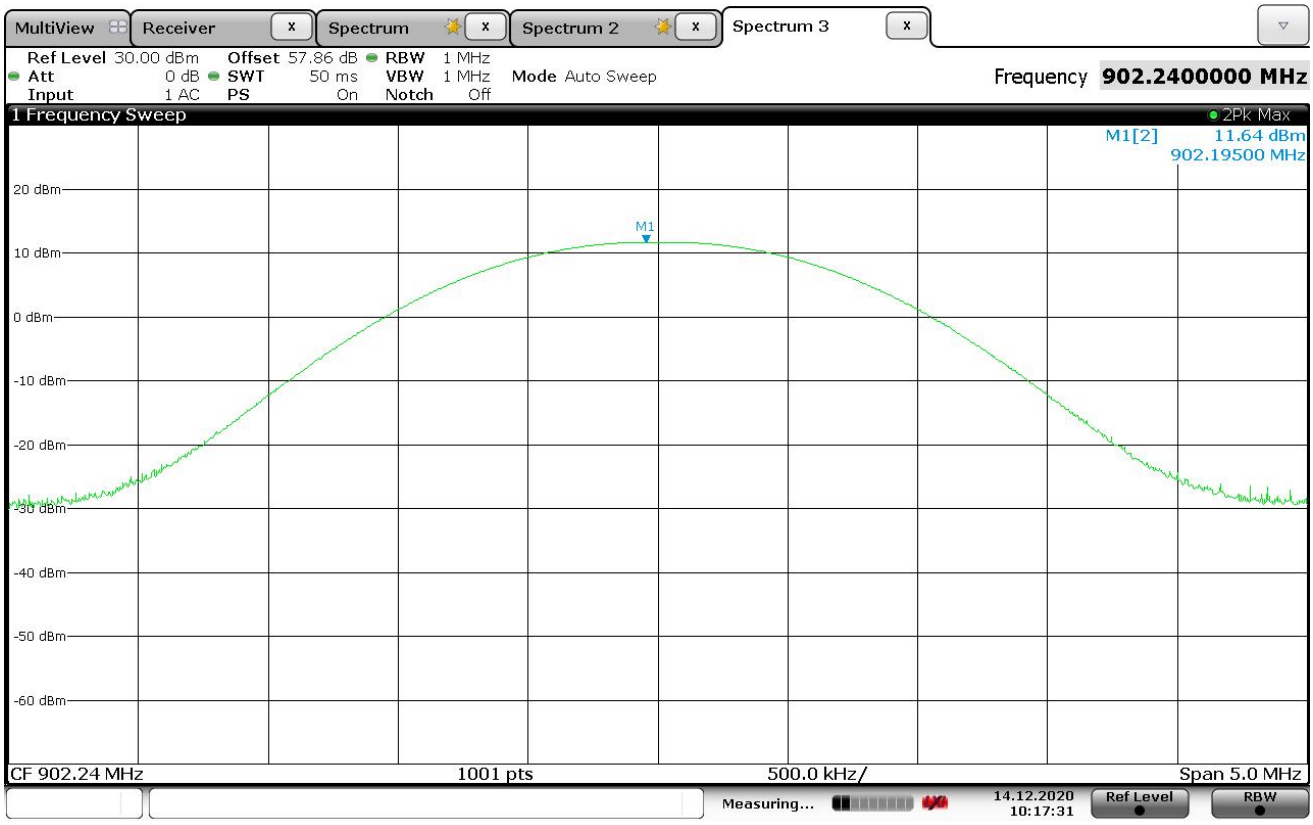
Test Information	
Manufacturer	Chamberlain Group, Inc.
Product	Access Control Device
Model	CAPXM
Serial No	SMP-76795
Mode	Tx

Test Setup Details	
Setup Format	Tabletop
Height of Support	NA
Measurement Method	Antenna Conducted
Type of Test Site	Shielded Chamber
Notes	None

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

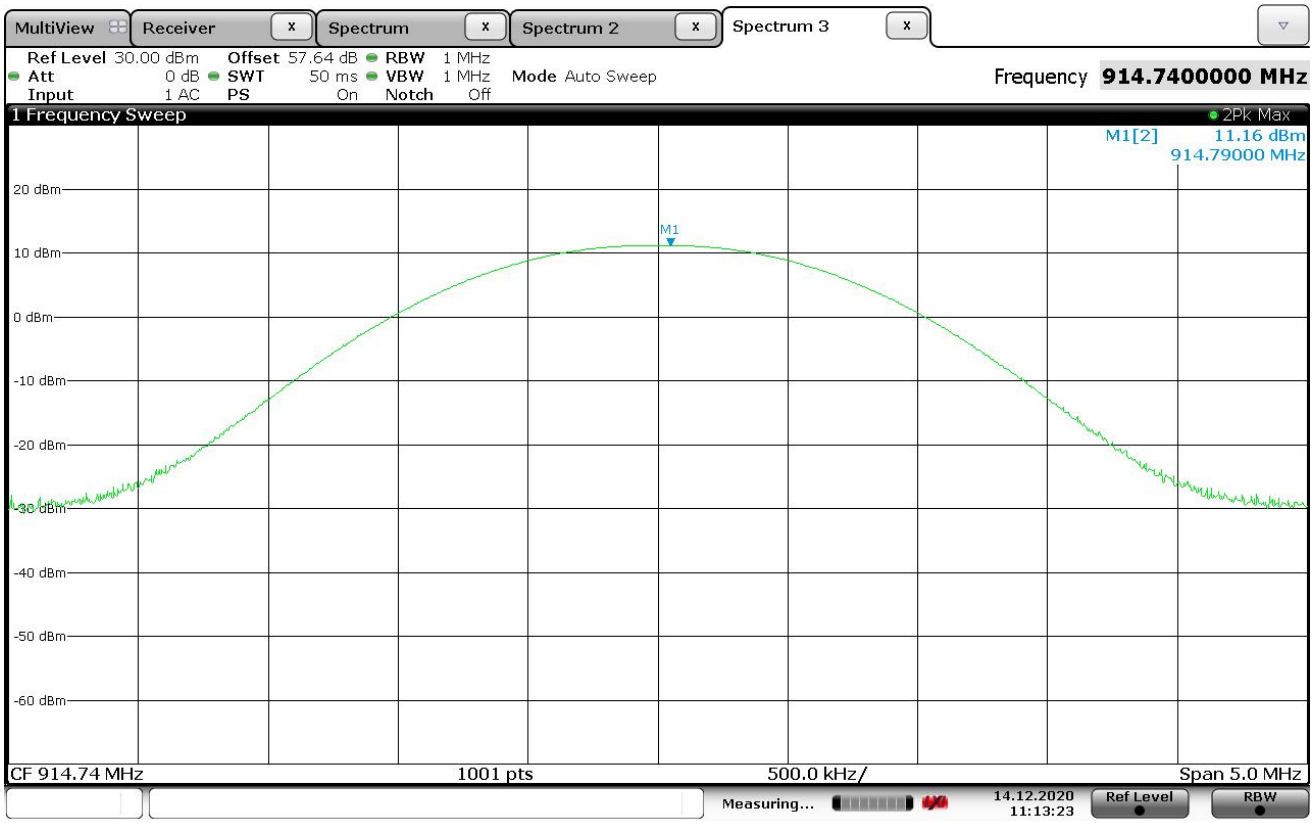
Procedures
The antenna port of the EUT was connected to the spectrum analyzer through 60dB of attenuation. With the hopping function disabled, the EUT was allowed to transmit continuously. The frequency hopping channel was set separately to low, middle, and high hopping channels. The resolution bandwidth (RBW) was set to greater than the 20dB bandwidth. The span was set to approximately 5 times the 20 dB 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 Group, Inc.
Model	CAPXM
S/N	SMP-76795
Mode	Tx
Carrier Frequency	902.24MHz
Parameters	Output Power = 14.6mW (11.64dBm)
Notes	None



Date: 14.DEC.2020 10:17:30

Test Details	
Manufacturer	Chamberlain Group, Inc.
Model	CAPXM
S/N	SMP-76795
Mode	Tx
Carrier Frequency	914.74MHz
Parameters	Output Power = 13.1mW (11.16dBm)
Notes	None



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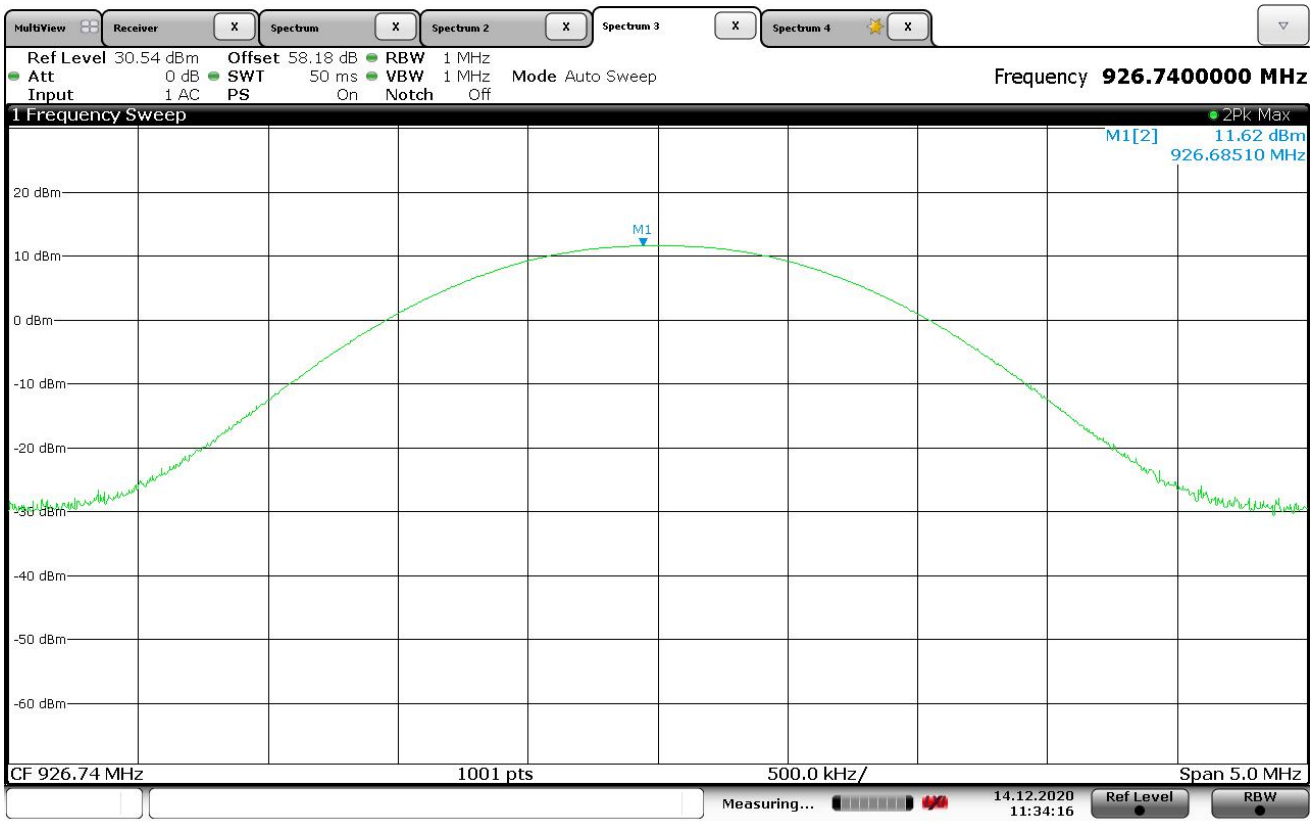
Test Details	
Manufacturer	Chamberlain Group, Inc.
Model	CAPXM
S/N	SMP-76795
Mode	Tx
Carrier Frequency	926.74MHz
Parameters	Output Power = 14.5W (11.62dBm)
Notes	None



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28. Effective Isotropic Radiated Power (EIRP)

Test Information	
Manufacturer	Chamberlain Group, Inc.
Product	Access Control Device
Model	CAPXM
Serial No	SMP-76795
Mode	Tx

Test Setup Details	
Setup Format	Tabletop
Height of Support	NA
Measurement Method	Radiated
Type of Test Site	Semi-Anechoic Chamber
Type of Antennas Used	Below 1GHz: Bilog (or equivalent) Above 1GHz: Double-ridged waveguide (or equivalent)
Notes	None

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

Procedures
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. 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.

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

Test Details	
Manufacturer	Chamberlain Group, Inc.
Model	CAPXM
S/N	SMP-76795
Mode	Tx
Carrier Frequency	902.24MHz
Parameters	EIRP = 17.4mW (12.4dBm)
Notes	None

Freq. (MHz)	Ant Pol	Wide BW Meter Reading (dBuV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
902.24	H	78.9	9.2	2.2	2.0	9.3	36.0	-26.7
902.24	V	77.3	12.3	2.2	2.0	12.4	36.0	-23.6

Test Details	
Manufacturer	Chamberlain Group, Inc.
Model	CAPXM
S/N	SMP-76795
Mode	Tx
Carrier Frequency	914.74MHz
Parameters	EIRP = 12.0mW (10.8dBm)
Notes	None

Freq. (MHz)	Ant Pol	Wide BW Meter Reading (dBuV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
914.74	H	78.4	9.2	2.2	2.1	9.3	36.0	-26.7
914.74	V	77.2	10.7	2.2	2.1	10.8	36.0	-25.2

Test Details	
Manufacturer	Chamberlain Group, Inc.
Model	CAPXM
S/N	SMP-76795
Mode	Tx
Carrier Frequency	926.74MHz
Parameters	EIRP = 16.2mW (12.1dBm)
Notes	None

Freq. (MHz)	Ant Pol	Wide BW Meter Reading (dBuV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
926.74	H	79.9	10.4	2.2	2.1	10.5	36.0	-25.5
926.74	V	78.8	12.0	2.2	2.1	12.1	36.0	-23.9

29. Duty Cycle Factor Measurements

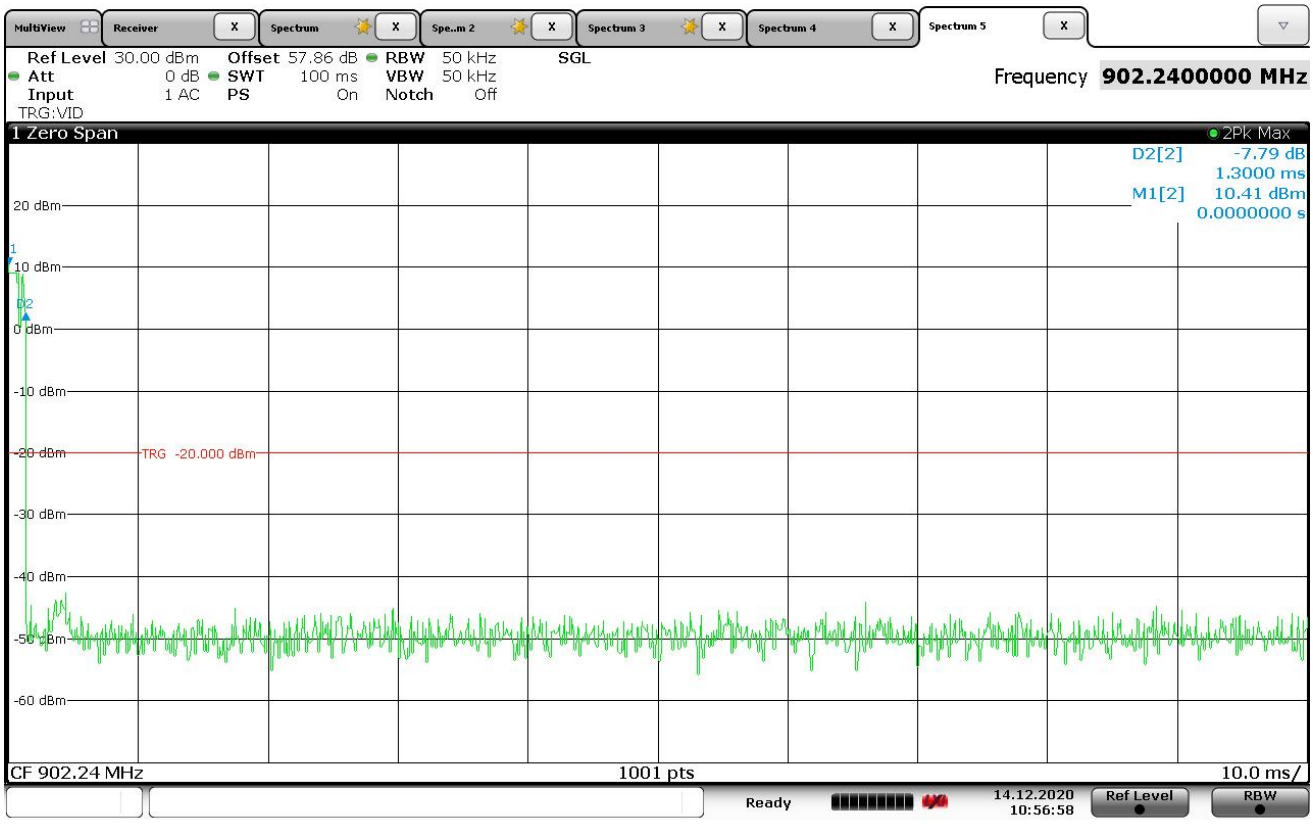
Test Information	
Manufacturer	Chamberlain Group, Inc.
Product	Access Control Device
Model	CAPXM
Serial No	SMP-76795
Mode	Hopping Enabled

Test Setup Details	
Setup Format	Tabletop
Height of Support	NA
Measurement Method	Antenna Conducted
Type of Test Site	Shielded Chamber
Notes	None

Procedures
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. 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. 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. The duty cycle is then computed as the (On-time/ word period) where the word period = (On-time + Off-time).

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

Test Details	
Manufacturer	Chamberlain Group, Inc.
Model	CAPXM
S/N	SMP-76795
Mode	Hopping Enabled
Carrier Frequency	902.24MHz
Parameters	On time = 1.3msec
Notes	None



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$$\text{Duty Cycle Factor} = 20\log\left(\frac{1.3\text{msec}}{100\text{msec}}\right) = -37.721$$

30. Case Spurious Radiated Emissions

Test Information	
Manufacturer	Chamberlain Group, Inc.
Product	Access Control Device
Model	CAPXM
Serial No	SMP-76795
Mode	Tx

Test Setup Details	
Setup Format	Tabletop
Height of Support	NA
Measurement Method	Radiated
Type of Test Site	Semi-Anechoic Chamber
Type of Antennas Used	Below 1GHz: Bilog (or equivalent) Above 1GHz: Double-ridged waveguide (or equivalent)
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
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

Procedures
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 10.0GHz was investigated using a peak detector function. The final open field emission tests were then manually performed over the frequency range of 30MHz to 10.0GHz. 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 bilog antenna. The bilog antenna was positioned at a 3-meter distance from the EUT. The EUT was placed on a 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 non-conductive stand. A peak detector with a resolution bandwidth of 100 kHz 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 20 dB (30dB for DTS systems where average power was used) 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 1 GHz 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 a 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 1 GHz 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 non-conductive stand. A peak detector with a resolution bandwidth of 1 MHz 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 1 GHz, 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 1 GHz, 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 20 dB above the maximum permitted average emission limit applicable to the equipment

under test. Therefore, all peak readings above 1 GHz must be no greater than 20 dB 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.

If the dwell time per channel of the hopping signal is less than 100msec, then the reading obtained with the 10 Hz video bandwidth may be further adjusted by a “duty cycle correction factor”, derived from 20*log(dwell time/100msec). These readings must be no greater than the limits specified in 15.209(a).

Test Setup for Spurious Radiated Emissions, 30-1000MHz – Antenna Polarization Horizontal

Test Setup for Spurious Radiated Emissions, 30-1000MHz – Antenna Polarization Vertical