Engineering Test Report No. 2100243-01		
Report Date	February 15, 2021	
Manufacturer Name	The Chamberlain Group, Inc.	
Manufacturer Address	300 Windsor Dr Oak Brook, IL 60523	
Model No.	HPH1	
Date Received	February 3, 2021	
Test Dates	February 12 & 15, 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 CAB Identifier: US0107
Signature		
Tested by	Tylar Jozefczyk	
Signature		
Approved by	Raymond J. Klouda, Registered Professional Engineer of Illinois – 44894	
PO Number	4900074127	

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, 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 dates specified. Any electrical or mechanical modifications made to the EUT subsequent to the specified test date will serve to invalidate the data and void this certification. This report must not be used to claim product certification, approval, or endorsement by A2LA, NIST, or any agency of the Federal Government.

Table of Contents

1. Report Revision History

Revision	Date	Description
–	17 FEB 2021	Initial Release of Engineering Test Report No. 2100243-01

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. Wall Control Station (hereinafter referred to as the Equipment Under Test (EUT)). The EUT was manufactured and submitted for testing by The Chamberlain Group, Inc. located in Oak Brook, IL.

2.2. Purpose

The test series was performed to determine if The Chamberlain Group, Inc. Wall Control Station, FCC ID: HBW9586, meets the Class II Permissive Change requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Sections 15.247.

The test series was also performed to determine if The Chamberlain Group, Inc. Wall Control Station, ISED UPN: 2666A-9586 meets the Class II Permissive Change 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 Transmitters.

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	Wall Control Station
Model/Part No.	HPH1
Device Type	Digitally Modulated Transmission Device (also equipped with a Frequency Hopping Transmitter (see note below))
Band of Operation	2400-2483.5MHz
Rated Output Power	12.20dBm
Emission Classification	1M3F1D
FCC ID & IC UPN Number	FCC ID: HBW9586 ISED UPN: 2666A-9586

Note: For the Multi-Transmitter test, the 900MHz transmitter was tested concurrently with the 2.4GHz BLE transmitter. Other test results for the 900MHz transmitter can be found in Engineering Test Report 2004712-01.

The EUT listed above was used throughout the test series.

3. Power Input

The EUT was powered by 24VDC from a 2-meter wire harness.

Note: The EUT is normally powered through a Powerhead Unit that is attached to the Wall Control Station with 120/230/480VAC, but for the purposes of this testing, the EUT was powered straight from a 24VDC source. This was done with the acknowledgement of The Chamberlain Group, Inc. personnel.

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
Chamberlain Test Laptop	N/A	N/A
Photo Eyes (2)	N/A	N/A

6. Interconnect Leads

No interconnect cables were submitted with the test item.

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
BLE	The EUT was powered on and set to transmit at the following frequencies: - 2402MHz - 2440MHz - 2480MHz
Multi-Tx	The EUT was powered on and set to transmit with the following combination of frequencies: - BLE: 2480MHz - 914.75MHz

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 specifications.

- 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”
- KDB 996369 D04 Module Integration Guide v01, February 1, 2019

10. Test Plan

No test plan was provided. Instructions were provided by personnel from The Chamberlain Group, Inc. 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

Ambient Parameters	Value
Temperature	22.6°C
Relative Humidity	17%
Atmospheric Pressure	1021.8mb

13. Summary

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

Test Description	Requirements	Test Methods	Results
Effective Isotropic Radiated Power (EIRP)	FCC 15C 15.247 ISED RSS-247	ANSI C63.10:2013	Conforms
Case Spurious Radiated Emissions	FCC 15C 15.247 ISED RSS-247	ANSI C63.10:2013	Conforms
Band-Edge Compliance	FCC 15C 15.247 ISED RSS-247	ANSI C63.10:2013	Conforms
RF Radiated Emissions Multi-Transmitter	FCC 15C 15.247 ISED RSS-247	ANSI C63.10:2013	Conforms

14. Sample Calculations

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 (dBµV/m) = MTR (dBµV) + AF (dB/m) + CF (dB) + (- PA (dB)) + DC (dB)

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

Formula 2: FS (µV/m) = AntiLog [(FS (dBµV/m))/20]

15. Statement of Conformity

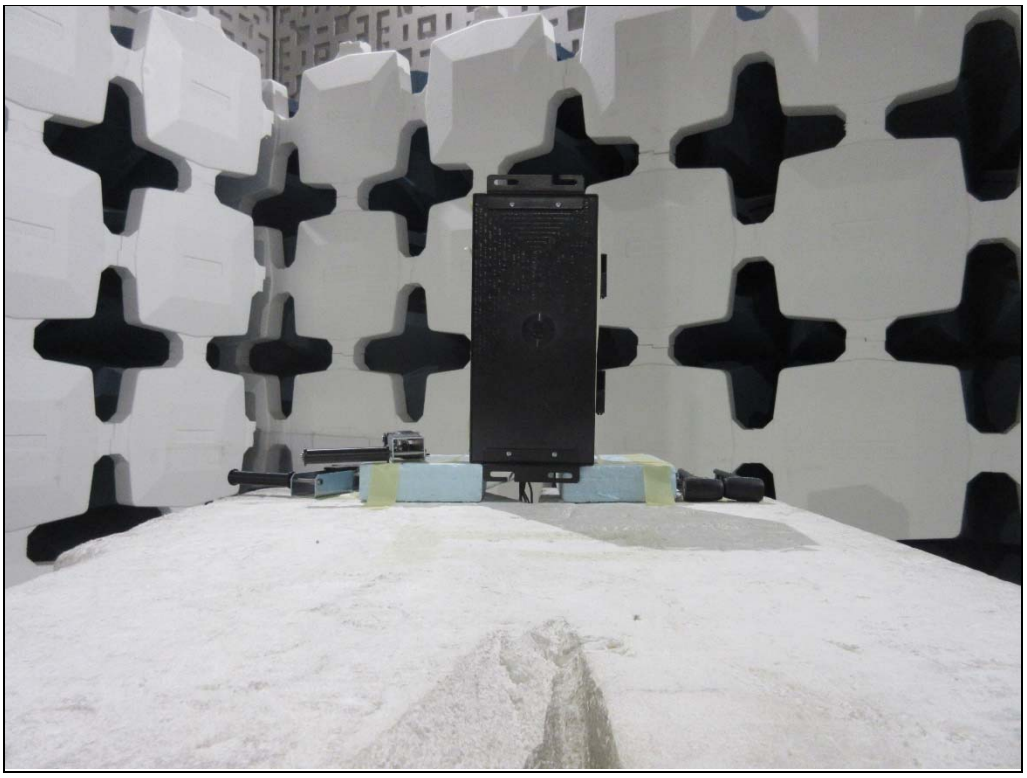
The Chamberlain Group, Inc. Wall Control Station, Model No. HPH1, did fully conform to the selected requirements of FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C, Section 15.247 and Innovation, Science, and Economic Development Canada, RSS-247.

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

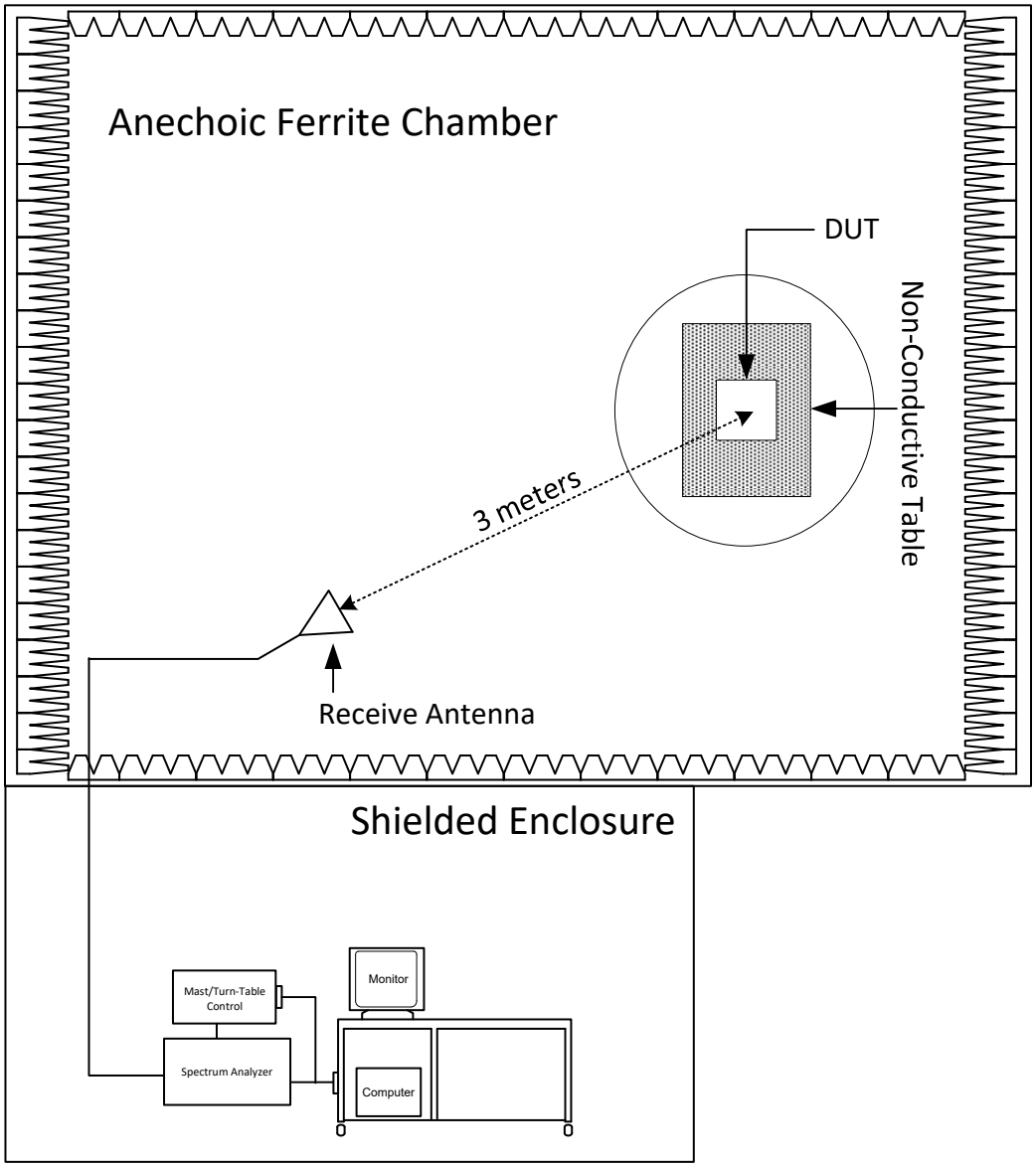


18. Equipment List

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
APW0	PREAMPLIFIER	PLANAR ELECTRONICS	PE2-30-20G20R6G	PL2926/0646	20GHZ-26.5GHZ	9/24/2020	9/24/2021
APW14	PREAMPLIFIER	PLANAR	PE2-35-120-5R0-10-12-SFF	PL22671	1-20GHz	9/24/2020	9/24/2021
CDZ4	LAB WORKSTATION	ELITE	LWS-10		WINDOWS 10	CNR	
NHG0	STANDARD GAIN HORN ANTENNA	NARDA	638	---	18-26.5GHZ	NOTE 1	
NTA3	BILOG ANTENNA	TESEQ	6112D	32853	25-1000MHz	10/20/2020	10/20/2021
NWQ1	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS-LINDGREN	3117	66655	1GHZ-18GHZ	4/28/2020	4/28/2022
RBG2	EMI ANALYZER	ROHDE & SCHWARZ	ESW44	101591	2HZ-44GHZ	3/23/2020	3/23/2021
SHC2	Power Supplies	HENGFU	HF60W-SL-24	A11372702	24V	NOTE 1	
SMA37	POWER SUPPLY	VOLTEQ	HY3020EX	190106021	30V/20A	NOTE 1	
WKA1	SOFTWARE, UNIVERSAL RCV EMI	ELITE	UNIV_RCV_EMI	1	---	I/O	
XPR0	HIGH PASS FILTER	K&L MICROWAVE	11SH10-4800/X20000	001	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. Effective Isotropic Radiated Power (EIRP)

Test Information	
Manufacturer	The Chamberlain Group, Inc.
Product	Wall Control Station
Model No.	HPH1
Modes	BLE

Test Setup Details	
Setup Format	Tabletop
Measurement Method	Radiated
Type of Test Site	Semi-Anechoic Chamber
Type of Antennas Used	Above 1GHz: Double-ridged waveguide (or equivalent)
Notes	N/A

Measurement Uncertainty	
Measurement Type	Expanded Measurement Uncertainty
Radiated disturbance (electric field strength on an open area test site or alternative test site) (30 MHz – 1000 MHz)	4.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (1 GHz – 6 GHz)	3.1
Radiated disturbance (electric field strength on an open area test site or alternative test site) (6 GHz – 18 GHz)	3.2
Radiated disturbance (electric field strength on an open area test site or alternative test site) (18 GHz – 26.5 GHz)	3.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (26.5 GHz – 40 GHz)	3.4

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

Procedures
The EUT was placed on the non-conductive stand and set to transmit. A double ridged waveguide antenna was placed at a test distance of 3 meters from the EUT. The resolution bandwidth (RBW) of the spectrum analyzer was set to greater than the 6dB bandwidth. The EUT was maximized for worst case emissions (or maximum output power) at the measuring antenna. The maximum meter reading was recorded. The peak power output was measured for the low, middle, and high channels. 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.

Test Details	
Manufacturer	The Chamberlain Group, Inc.
EUT	Wall Control Station
Model No.	HPH1
Mode	BLE
Result	Output Power = 0.01659W (12.20dBm)
Notes	N/A

EFFECTIVE ISOTROPIC RADIATED POWER

Freq. (MHz)	Ant Pol	Wide BW Meter Reading (dBµV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP Total (dBm)	Limit (dBm)	Margin (dB)
2402.00	H	69.03	7.03	5.63	2.75	9.91	36.00	-26.09
2402.00	V	66.53	4.83	5.63	2.75	7.71	36.00	-28.29
2440.00	H	69.65	7.73	5.44	2.77	10.40	36.00	-25.60
2440.00	V	70.18	8.52	5.44	2.77	11.18	36.00	-24.82
2480.00	H	71.27	9.43	5.57	2.80	12.20	36.00	-23.80
2480.00	V	69.46	7.84	5.57	2.80	10.61	36.00	-25.39

EIRP = Calculated Signal (dBm) + Antenna Gain (dB) – Cable Loss (dB)

21. Case Spurious Radiated Emissions

Test Information	
Manufacturer	The Chamberlain Group, Inc.
Product	Wall Control Station
Model No.	HPH1
Modes	BLE

Test Setup Details	
Setup Format	Tabletop
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

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 25GHz was investigated using a peak detector function.

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

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

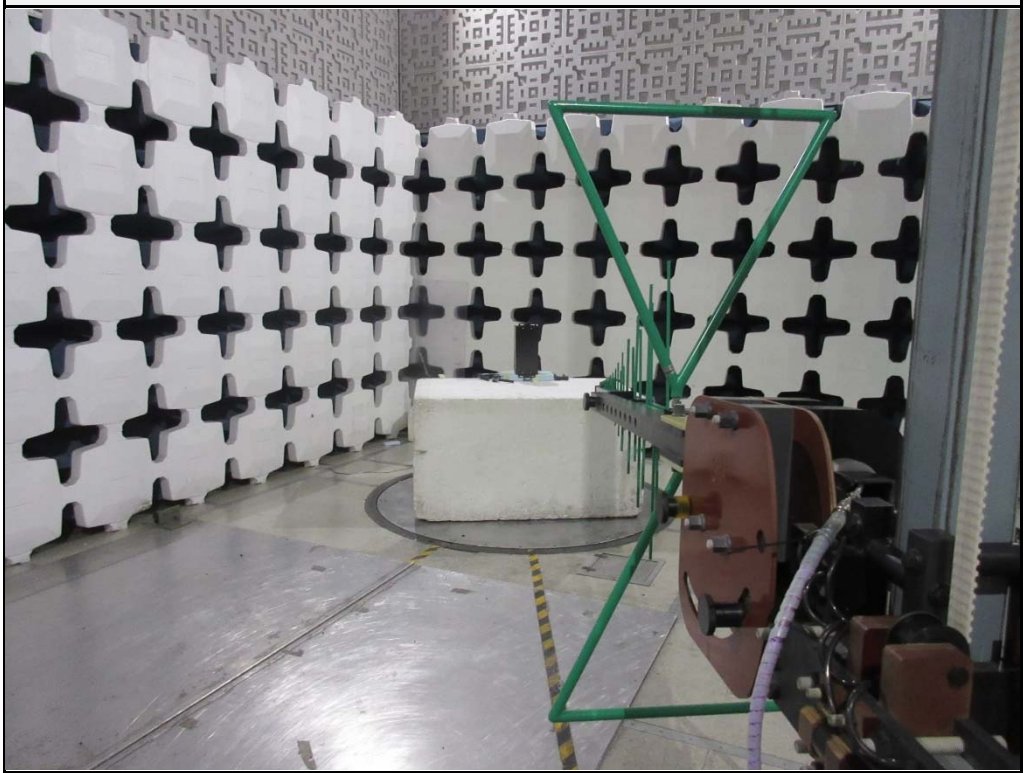
iv) In instances where it was necessary to use a shortened cable between the measuring antenna and the spectrum analyzer. The measuring antenna was not raised or lowered to ensure maximized readings, instead the EUT was rotated through all axis to ensure the maximum readings were recorded for the EUT.

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.

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



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

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

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

Test Setup for Spurious Radiated Emissions, 18 – 25GHz – Antenna Polarization Horizontal

Test Setup for Spurious Radiated Emissions, 18 – 25GHz – Antenna Polarization Vertical

Test Details	
Manufacturer	The Chamberlain Group, Inc.
EUT	Wall Control Station
Model No.	HPH1
Mode	BLE
Frequency Tested	2402MHz
Notes	Peak Measurements in the Restricted Bands

Freq. (MHz)	Ant Pol	Meter Reading (dBµV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Peak Total dBµV/m at 3m	Peak Total µV/m at 3 m	Peak Limit µV/m at 3 m	Margin (dB)
4804.00	H	50.03	Ambient	5.69	34.47	-39.71	50.48	334.15	5000.00	-23.50
4804.00	V	49.03	Ambient	5.69	34.47	-39.71	49.48	297.81	5000.00	-24.50
12010.00	H	48.68	Ambient	8.62	38.62	-39.00	56.92	701.68	5000.00	-17.06
12010.00	V	48.34	Ambient	8.62	38.62	-39.00	56.58	674.74	5000.00	-17.40
19216.00	H	29.12	Ambient	2.21	40.38	-28.22	43.48	149.35	5000.00	-30.50
19216.00	V	29.57	Ambient	2.21	40.38	-28.22	43.93	157.29	5000.00	-30.05

Test Details	
Manufacturer	The Chamberlain Group, Inc.
EUT	Wall Control Station
Model No.	HPH1
Mode	BLE
Frequency Tested	2402MHz
Notes	Average Measurements in the Restricted Bands

Freq. (MHz)	Ant Pol	Meter Reading (dBµV)	Ambient	CBL Fac. (dB)	Ant Fac. (dB/m)	Pre Amp (dB)	Duty Cycle (dB)	Ave. Total dBµV/m at 3m	Ave. Total µV/m at 3 m	Ave. Limit µV/m at 3 m	Margin (dB)
4804.00	H	34.45	Ambient	5.69	34.47	-39.71	0.00	34.90	55.58	500.00	-19.08
4804.00	V	33.71	Ambient	5.69	34.47	-39.71	0.00	34.16	51.04	500.00	-19.82
12010.00	H	32.83	Ambient	8.62	38.62	-39.00	0.00	41.07	113.15	500.00	-12.91
12010.00	V	32.81	Ambient	8.62	38.62	-39.00	0.00	41.05	112.89	500.00	-12.93
19216.00	H	14.14	Ambient	2.21	40.38	-28.22	0.00	28.50	26.62	500.00	-25.48
19216.00	V	14.38	Ambient	2.21	40.38	-28.22	0.00	28.74	27.37	500.00	-25.24

Test Details	
Manufacturer	The Chamberlain Group, Inc.
EUT	Wall Control Station
Model No.	HPH1
Mode	BLE
Frequency Tested	2402MHz
Notes	Peak Measurements in Non-Restricted Bands

Freq. (MHz)	Ant Pol	Meter Reading (dBµV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Peak Total dBµV/m at 3m	Peak Total µV/m at 3 m	Peak Limit µV/m at 3 m	Margin (dB)
2402.00	H	67.62		4.28	32.20	0.00	104.10	160293.85		
2402.00	V	65.76		4.28	32.20	0.00	102.24	129394.81		
7206.00	H	38.68	Ambient	6.86	35.67	-39.66	41.55	119.50	16029.38	-42.55
7206.00	V	38.31	Ambient	6.86	35.67	-39.66	41.18	114.51	16029.38	-42.92
9608.00	H	37.10	Ambient	8.20	36.65	-39.30	42.65	135.72	16029.38	-41.45
9608.00	V	37.97	Ambient	8.20	36.65	-39.30	43.52	150.01	16029.38	-40.58
14412.00	H	38.04	Ambient	9.56	39.82	-38.58	48.83	276.53	16029.38	-35.26
14412.00	V	37.21	Ambient	9.56	39.82	-38.58	48.00	251.33	16029.38	-36.09
16814.00	H	36.69	Ambient	10.94	43.44	-37.37	53.70	484.14	16029.38	-30.40
16814.00	V	37.05	Ambient	10.94	43.44	-37.37	54.06	504.62	16029.38	-30.04
21618.00	H	19.55	Ambient	2.25	40.56	-28.49	33.86	49.33	16029.38	-50.24
21618.00	V	19.71	Ambient	2.25	40.56	-28.49	34.02	50.25	16029.38	-50.08
24020.00	H	20.71	Ambient	2.24	40.62	-29.27	34.30	51.90	16029.38	-49.79
24020.00	V	19.74	Ambient	2.24	40.62	-29.27	33.33	46.42	16029.38	-50.76

Test Details	
Manufacturer	The Chamberlain Group, Inc.
EUT	Wall Control Station
Model No.	HPH1
Mode	BLE
Frequency Tested	2440MHz
Notes	Peak Measurements in the Restricted Bands

Freq. (MHz)	Ant Pol	Meter Reading (dBµV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Peak Total dBµV/m at 3m	Peak Total µV/m at 3 m	Peak Limit µV/m at 3 m	Margin (dB)
4880.00	H	49.70	Ambient	5.74	34.37	-39.62	50.19	323.05	5000.00	-23.79
4880.00	V	49.59	Ambient	5.74	34.37	-39.62	50.08	318.98	5000.00	-23.90
7320.00	H	49.03	Ambient	6.88	35.69	-39.62	51.98	397.00	5000.00	-22.00
7320.00	V	48.47	Ambient	6.88	35.69	-39.62	51.42	372.21	5000.00	-22.56
12200.00	H	47.53	Ambient	8.94	38.88	-38.89	56.46	665.19	5000.00	-17.52
12200.00	V	47.35	Ambient	8.94	38.88	-38.89	56.28	651.55	5000.00	-17.70
19520.00	H	28.54	Ambient	2.22	40.39	-27.76	43.39	147.77	5000.00	-30.59
19520.00	V	28.63	Ambient	2.22	40.39	-27.76	43.48	149.30	5000.00	-30.50

Test Details	
Manufacturer	The Chamberlain Group, Inc.
EUT	Wall Control Station
Model No.	HPH1
Mode	BLE
Frequency Tested	2440MHz
Notes	Average Measurements in the Restricted Bands

Freq. (MHz)	Ant Pol	Meter Reading (dBµV)	Ambient	CBL Fac. (dB)	Ant Fac. (dB/m)	Pre Amp (dB)	Duty Cycle (dB)	Ave. Total dBµV/m at 3m	Ave. Total µV/m at 3 m	Ave. Limit µV/m at 3 m	Margin (dB)
4880.00	H	34.03	Ambient	5.74	34.37	-39.62	0.00	34.52	53.18	500.00	-19.46
4880.00	V	34.00	Ambient	5.74	34.37	-39.62	0.00	34.49	53.00	500.00	-19.49
7320.00	H	33.04	Ambient	6.88	35.69	-39.62	0.00	35.99	62.99	500.00	-17.99
7320.00	V	33.08	Ambient	6.88	35.69	-39.62	0.00	36.03	63.28	500.00	-17.95
12200.00	H	32.37	Ambient	8.94	38.88	-38.89	0.00	41.30	116.13	500.00	-12.68
12200.00	V	32.30	Ambient	8.94	38.88	-38.89	0.00	41.23	115.20	500.00	-12.75
19520.00	H	13.75	Ambient	2.22	40.39	-27.76	0.00	28.60	26.92	500.00	-25.38
19520.00	V	13.69	Ambient	2.22	40.39	-27.76	0.00	28.54	26.73	500.00	-25.44

Test Details	
Manufacturer	The Chamberlain Group, Inc.
EUT	Wall Control Station
Model No.	HPH1
Mode	BLE
Frequency Tested	2440MHz
Notes	Peak Measurements in Non-Restricted Bands

Freq. (MHz)	Ant Pol	Meter Reading (dBµV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Peak Total dBµV/m at 3m	Peak Total µV/m at 3 m	Peak Limit µV/m at 3 m	Margin (dB)
2440.00	H	68.35		4.31	32.52	0.00	105.18	181480.59		
2440.00	V	69.35		4.31	32.52	0.00	106.18	203624.57		
9760.00	H	37.13	Ambient	8.24	36.87	-39.27	42.97	140.81	20362.46	-43.20
9760.00	V	37.40	Ambient	8.24	36.87	-39.27	43.24	145.26	20362.46	-42.93
14640.00	H	37.60	Ambient	9.71	40.17	-38.62	48.85	277.16	20362.46	-37.32
14640.00	V	37.18	Ambient	9.71	40.17	-38.62	48.43	264.08	20362.46	-37.74
17080.00	H	36.28	Ambient	10.97	42.96	-37.37	52.84	438.41	20362.46	-33.34
17080.00	V	37.09	Ambient	10.97	42.96	-37.37	53.65	481.26	20362.46	-32.53
21960.00	H	20.04	Ambient	2.20	40.58	-28.88	33.94	49.80	20362.46	-52.23
21960.00	V	20.17	Ambient	2.20	40.58	-28.88	34.07	50.55	20362.46	-52.10
24400.00	H	20.27	Ambient	2.22	40.63	-29.29	33.84	49.18	20362.46	-52.34
24400.00	V	20.98	Ambient	2.22	40.63	-29.29	34.55	53.37	20362.46	-51.63

Test Details	
Manufacturer	The Chamberlain Group, Inc.
EUT	Wall Control Station
Model No.	HPH1
Mode	BLE
Frequency Tested	2480MHz
Notes	Peak Measurements in the Restricted Bands

Freq. (MHz)	Ant Pol	Meter Reading (dBµV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Peak Total dBµV/m at 3m	Peak Total µV/m at 3 m	Peak Limit µV/m at 3 m	Margin (dB)
4960.00	H	49.38	Ambient	5.79	34.34	-39.65	49.87	311.43	5000.00	-24.11
4960.00	V	49.37	Ambient	5.79	34.34	-39.65	49.86	311.07	5000.00	-24.12
7440.00	H	48.28	Ambient	6.91	35.64	-39.56	51.27	366.06	5000.00	-22.71
7440.00	V	48.64	Ambient	6.91	35.64	-39.56	51.63	381.55	5000.00	-22.35
12400.00	H	47.70	Ambient	9.40	39.01	-38.76	57.34	736.39	5000.00	-16.64
12400.00	V	47.97	Ambient	9.40	39.01	-38.76	57.61	759.65	5000.00	-16.37
19840.00	H	29.84	Ambient	2.23	40.40	-28.04	44.44	166.64	5000.00	-29.54
19840.00	V	30.62	Ambient	2.23	40.40	-28.04	45.22	182.30	5000.00	-28.76
22320.00	H	30.06	Ambient	2.23	40.59	-28.84	44.03	159.10	5000.00	-29.95
22320.00	V	30.18	Ambient	2.23	40.59	-28.84	44.15	161.32	5000.00	-29.83

Test Details	
Manufacturer	The Chamberlain Group, Inc.
EUT	Wall Control Station
Model No.	HPH1
Mode	BLE
Frequency Tested	2480MHz
Notes	Average Measurements in the Restricted Bands

Freq. (MHz)	Ant Pol	Meter Reading (dBµV)	Ambient	CBL Fac. (dB)	Ant Fac. (dB/m)	Pre Amp (dB)	Duty Cycle (dB)	Ave. Total dBµV/m at 3m	Ave. Total µV/m at 3 m	Ave. Limit µV/m at 3 m	Margin (dB)
4960.00	H	34.07	Ambient	5.79	34.34	-39.65	0.00	34.56	53.44	500.00	-19.42
4960.00	V	34.02	Ambient	5.79	34.34	-39.65	0.00	34.51	53.13	500.00	-19.47
7440.00	H	32.83	Ambient	6.91	35.64	-39.56	0.00	35.82	61.81	500.00	-18.16
7440.00	V	32.87	Ambient	6.91	35.64	-39.56	0.00	35.86	62.09	500.00	-18.12
12400.00	H	32.85	Ambient	9.40	39.01	-38.76	0.00	42.49	133.23	500.00	-11.49
12400.00	V	32.86	Ambient	9.40	39.01	-38.76	0.00	42.50	133.39	500.00	-11.48
19840.00	H	14.65	Ambient	2.23	40.40	-28.04	0.00	29.25	28.99	500.00	-24.73
19840.00	V	14.89	Ambient	2.23	40.40	-28.04	0.00	29.49	29.80	500.00	-24.49
22320.00	H	15.28	Ambient	2.23	40.59	-28.84	0.00	29.25	29.02	500.00	-24.73
22320.00	V	15.49	Ambient	2.23	40.59	-28.84	0.00	29.46	29.73	500.00	-24.52

Test Details	
Manufacturer	The Chamberlain Group, Inc.
EUT	Wall Control Station
Model No.	HPH1
Mode	BLE
Frequency Tested	2480MHz
Notes	Peak Measurements in Non-Restricted Bands

Freq. (MHz)	Ant Pol	Meter Reading (dBµV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Peak Total dBµV/m at 3m	Peak Total µV/m at 3 m	Peak Limit µV/m at 3 m	Margin (dB)
2480.00	H	69.02		4.33	32.53	0.00	105.88	196894.99		
2480.00	V	67.58		4.33	32.53	0.00	104.44	166814.84		
9920.00	H	37.01	Ambient	8.29	37.03	-39.23	43.09	142.80	19689.50	-42.79
9920.00	V	36.84	Ambient	8.29	37.03	-39.23	42.92	140.03	19689.50	-42.96
14880.00	H	36.61	Ambient	9.84	40.39	-38.54	48.30	259.97	19689.50	-37.59
14880.00	V	36.44	Ambient	9.84	40.39	-38.54	48.13	254.93	19689.50	-37.76
17360.00	H	35.65	Ambient	10.98	42.37	-37.42	51.57	378.87	19689.50	-34.31
17360.00	V	35.41	Ambient	10.98	42.37	-37.42	51.33	368.55	19689.50	-34.55
24800.00	H	22.07	Ambient	2.21	40.64	-29.32	35.60	60.24	19689.50	-50.29
24800.00	V	22.81	Ambient	2.21	40.64	-29.32	36.34	65.60	19689.50	-49.55

22. Band-Edge Compliance

EUT Information	
Manufacturer	The Chamberlain Group, Inc.
Product	Wall Control Station
Model No.	HPH1
Mode	BLE

Test Setup Details	
Setup Format	Tabletop
Measurement Method	Radiated
Type of Test Site	Semi-Anechoic Chamber
Type of Antennas Used	Above 1GHz: Double-Ridged Waveguide (or equivalent)
Notes	N/A

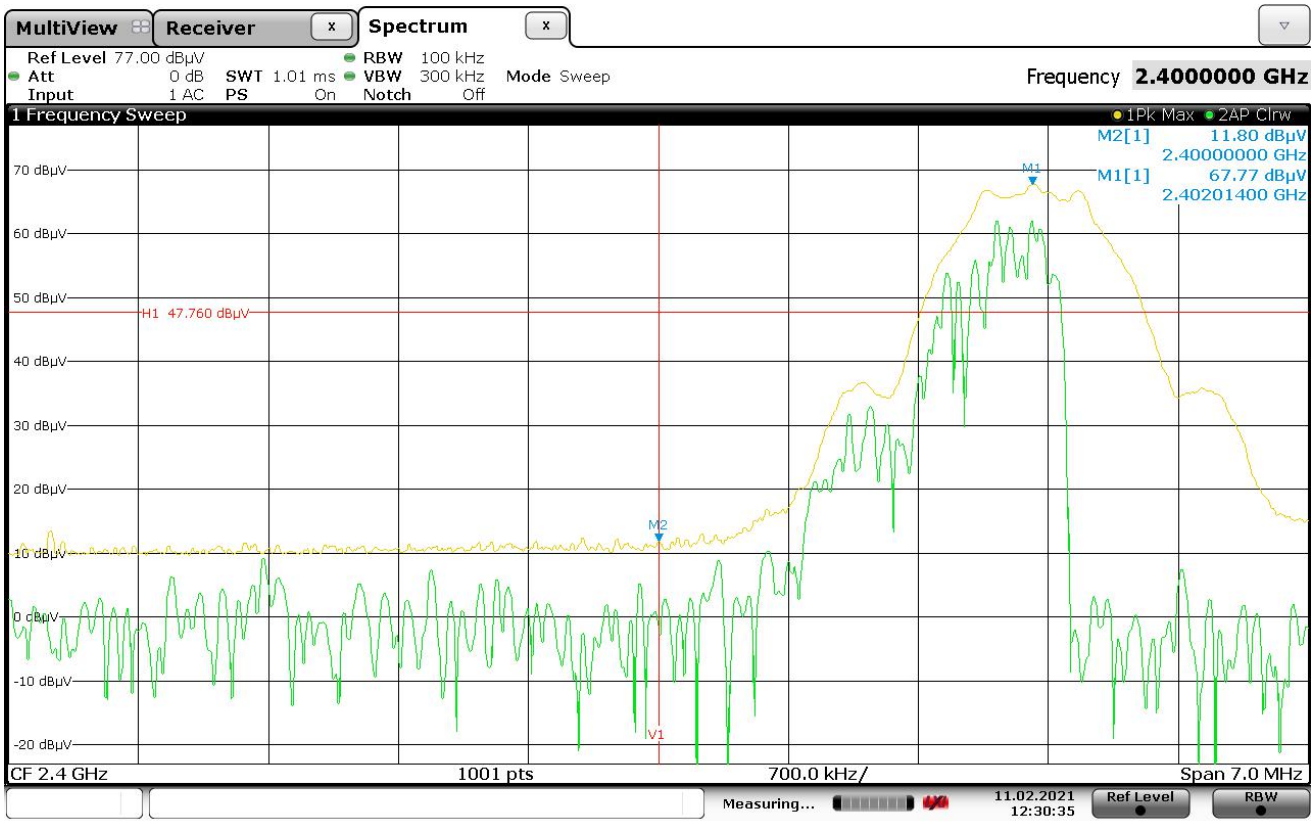
Measurement Uncertainty	
Measurement Type	Expanded Measurement Uncertainty
Radiated disturbance (electric field strength on an open area test site or alternative test site) (30 MHz – 1000 MHz)	4.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (1 GHz – 6 GHz)	3.1
Radiated disturbance (electric field strength on an open area test site or alternative test site) (6 GHz – 18 GHz)	3.2
Radiated disturbance (electric field strength on an open area test site or alternative test site) (18 GHz – 26.5 GHz)	3.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (26.5 GHz – 40 GHz)	3.4

Procedure

1) Low Band Edge:
   a) The EUT was setup inside the test chamber on a non-conductive stand and a broadband measuring antenna was placed at a test distance of 3 meters from the EUT.
   b) The EUT was set to transmit continuously at the channel closest to the low band-edge.
   c) The EUT was maximized for worst case emissions at the measuring antenna and the maximum meter reading was recorded.
   d) To determine the band edge compliance, the following spectrum analyzer settings were used:
      - Center Frequency = 2400MHz (low band-edge frequency).
      - Span = Wide enough to capture the peak level of the emission operating on the channel closest to the band-edge, as well as any modulation products which fall outside of the authorized band of operation.
      - Resolution Bandwidth (RBW) = ≥ 1% of the span.
      - 'Max-Hold' function was engaged.
   e) The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined.
   f) The marker was set on the peak of the in-band emissions. A display line was placed 20dB down from the peak of the in-band emissions. All emissions which fall outside of the authorized band of operation must be below the 20dB down display line. (All emissions to the left of the center frequency (band-edge) must be below the display line.)
   g) The analyzer's display was then screenshot and saved.

2) High Band Edge
   a) Step (1)(a) was repeated.
   b) The EUT was set to transmit continuously at the channel closest to the high band-edge.
   c) The EUT was maximized for worst case emissions at the measuring antenna and the maximum meter reading was recorded. A peak reading was taken with a resolution bandwidth of 1MHz and a video bandwidth of 1MHz or greater. An average reading was then taken with a resolution bandwidth of 1MHz and a video bandwidth of 10Hz. The maximum peak and average meter readings were recorded.
   d) To determine the band edge compliance, the following spectrum analyzer settings were used:
      - Center Frequency = 2483.5MHz (high band-edge frequency).
      - Span = Wide enough to capture the peak level of the emission operating on the channel closest to the band-edge, as well as any modulation products which fall outside of the authorized band of operation.
      - Resolution Bandwidth (RBW) = ≥ 1% of the span (but never less than 30kHz).
      - 'Max-Hold' function was engaged.
   e) The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined.
   f) The marker was set on the peak of the in-band emissions. This level corresponds to the maximized peak reading previously taken. The "marker-delta" method described in Public Notice DA 00-705 was then used to determine band-edge compliance. The delta between the marker and the general limit (74dBµV/m or 54dBµV/m) was calculated by subtracting the general limit (74dBµV/m or 54dBµV/m) from the maximum reading taken with a 1MHz bandwidth. This delta represents how far below the marker the emissions outside of the authorized band of operation must be. A display line was placed at this level. All emissions which fall outside of the authorized band of operation must be below the display line. (All emissions to the right of the center frequency (band-edge) must be below the display line.)

Test Details	
Manufacturer	The Chamberlain Group, Inc.
EUT	Wall Control Station
Model No.	HPH1
Mode	BLE
Frequency Tested	2402MHz
Notes	Low Band Edge



Date: 11.FEB.2021 12:30:35

Test Details	
Manufacturer	The Chamberlain Group, Inc.
EUT	Wall Control Station
Model No.	HPH1
Mode	BLE
Frequency Tested	2480MHz
Notes	

BAND EDGE – HIGH – PEAK

Freq. MHz	Ant Pol	Meter Reading (dBµV)	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Peak Total dBµV/m at 3m	Peak Total µV/m at 3 m	Peak Limit µV/m at 3 m	Margin (dB)
2483.50	H	30.52	4.33	32.52	0.00	67.38	2338.46	5000.00	-6.60
2483.50	V	30.01	4.33	32.52	0.00	66.87	2205.11	5000.00	-7.11

BAND EDGE – HIGH – AVERAGE

Freq. MHz	Ant Pol	Meter Reading (dBµV)	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dBµV/m at 3m	Average Total µV/m at 3 m	Average Limit µV/m at 3 m	Margin (dB)
2483.50	H	8.45	4.33	32.52	0.00	0.00	45.31	184.26	500.00	-8.67
2483.50	V	8.62	4.33	32.52	0.00	0.00	45.48	187.90	500.00	-8.50

23. RF Radiated Emissions Multi-Transmitter

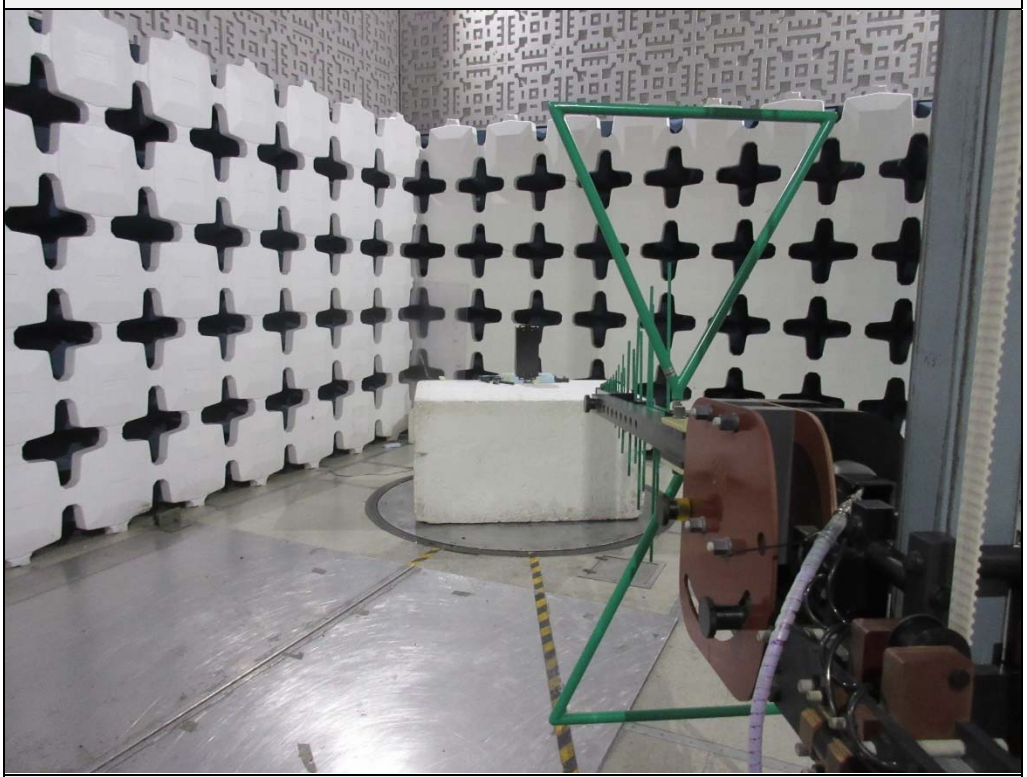
Test Information	
Manufacturer	The Chamberlain Group, Inc.
Product	Wall Control Station
Model No.	HPH1
Mode	Multi-Tx

Information	
Setup Format	Tabletop
Type of Test Site	Semi-Anechoic Chamber
Type of Antennas Used	Below 1GHz: Bilog (or equivalent) Above 1GHz: Double-ridged waveguide (or equivalent)
Highest Measurement Frequency	12.75GHz
Notes	The cables were manually maximized during the preliminary emissions sweeps. The cable arrangement which resulted in the worst-case emissions was utilized.

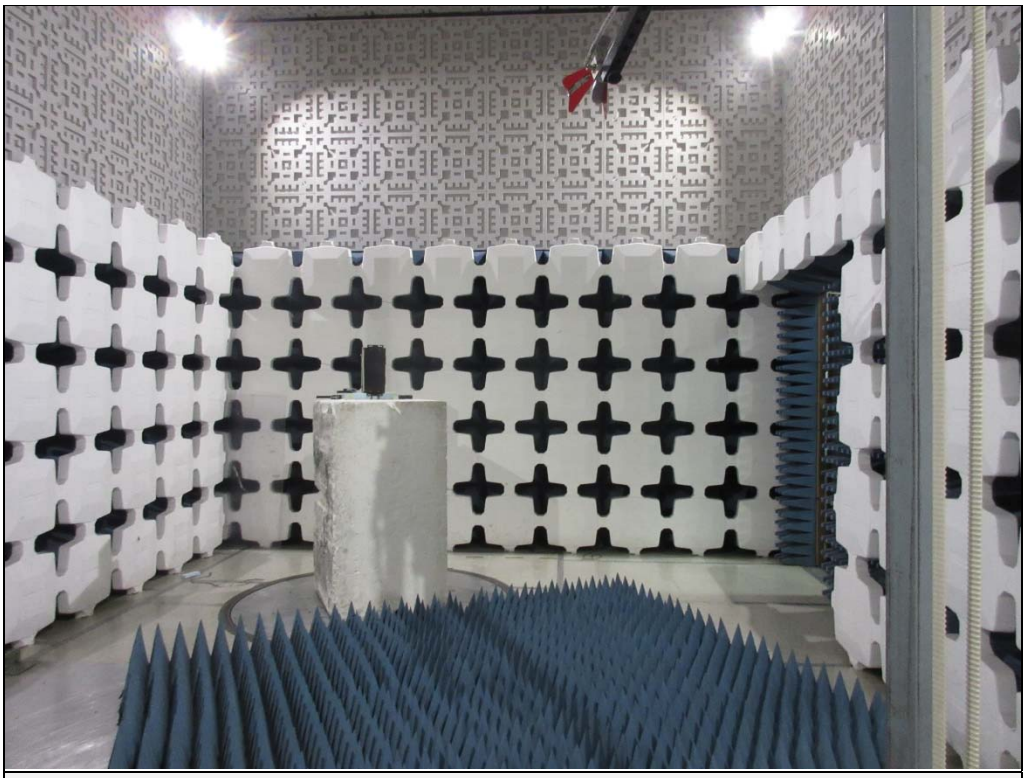
Measurement Uncertainty	
Measurement Type	Expanded Measurement Uncertainty
Radiated disturbance (electric field strength on an open area test site or alternative test site) (30 MHz – 1000 MHz)	4.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (1 GHz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

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 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 above 1 GHz 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.
Per FCC KDB 996369 D04 Module Integration Guide v01 February 1, 2019: Testing of the host product with all the transmitters installed is recommended to verify that the host product meets all the applicable FCC rules. The radio spectrum is to be investigated with all the transmitters in the final host product functioning to determine that no emissions exceed the highest limit permitted for any one individual transmitter as required by Section 2.947(f). The testing shall also check for emissions that may occur due to the intermixing of emissions with the other transmitters, digital circuitry, or due to physical properties of the host product (enclosure). This investigation is especially important when integrating multiple modular transmitters where the certification is based on testing each of them in a stand-alone configuration. No emissions exceed the highest limit permitted for any one individual transmitter as required by Section 2.947(f). 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.

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

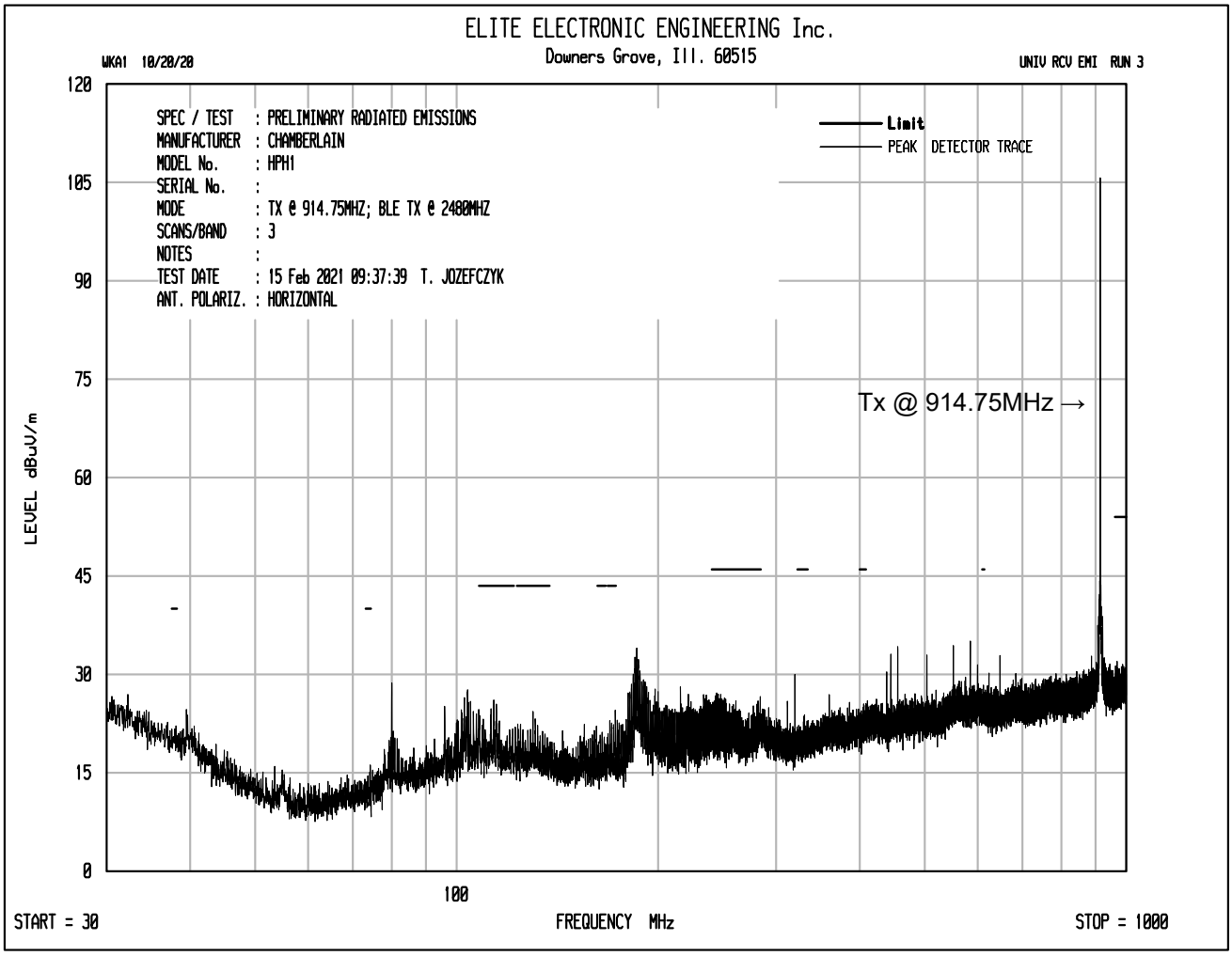


Test Setup for Radiated Emissions: 30MHz to 1GHz, Vertical Polarization

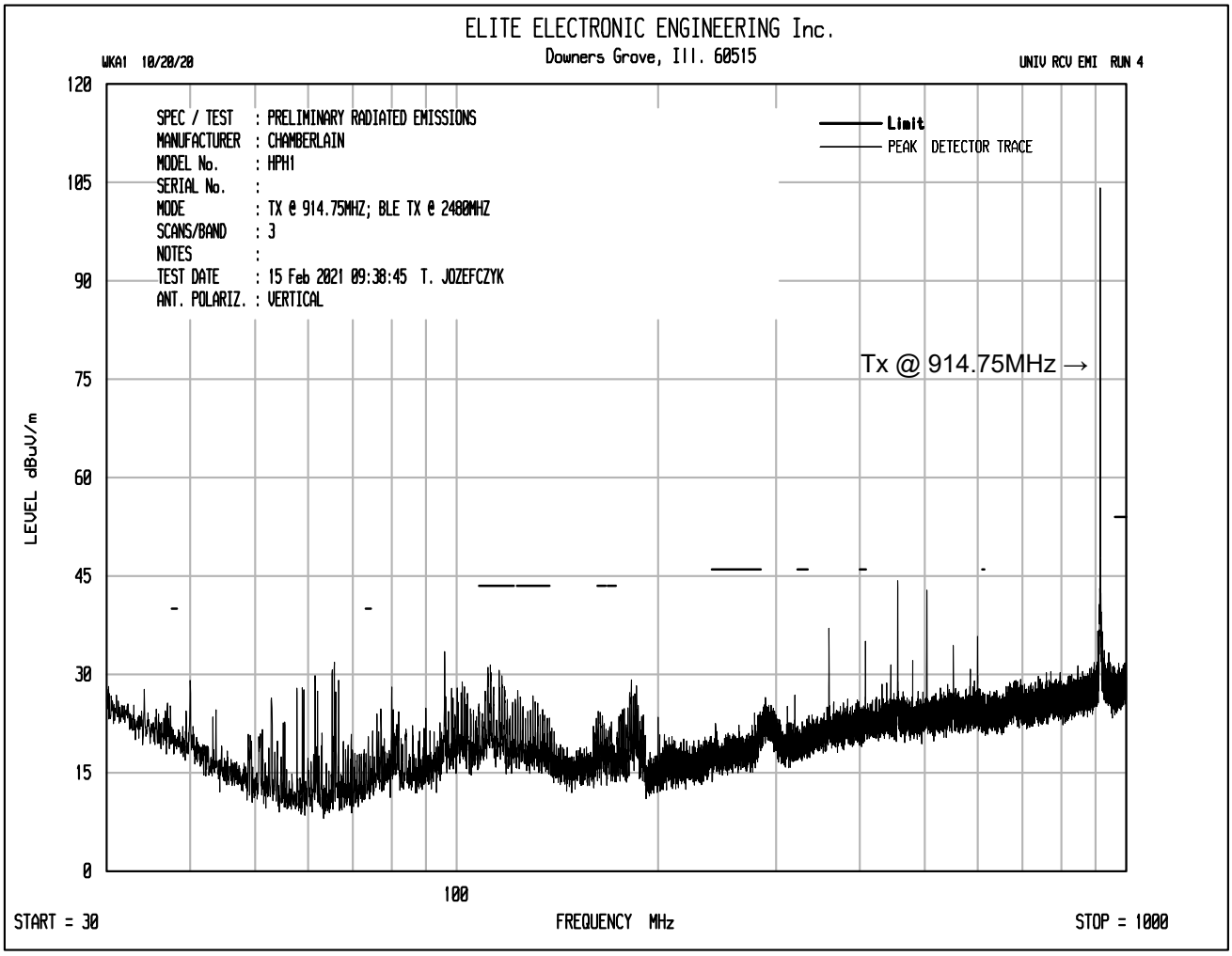


Test Setup for Radiated Emissions: Above 1GHz, Horizontal Polarization

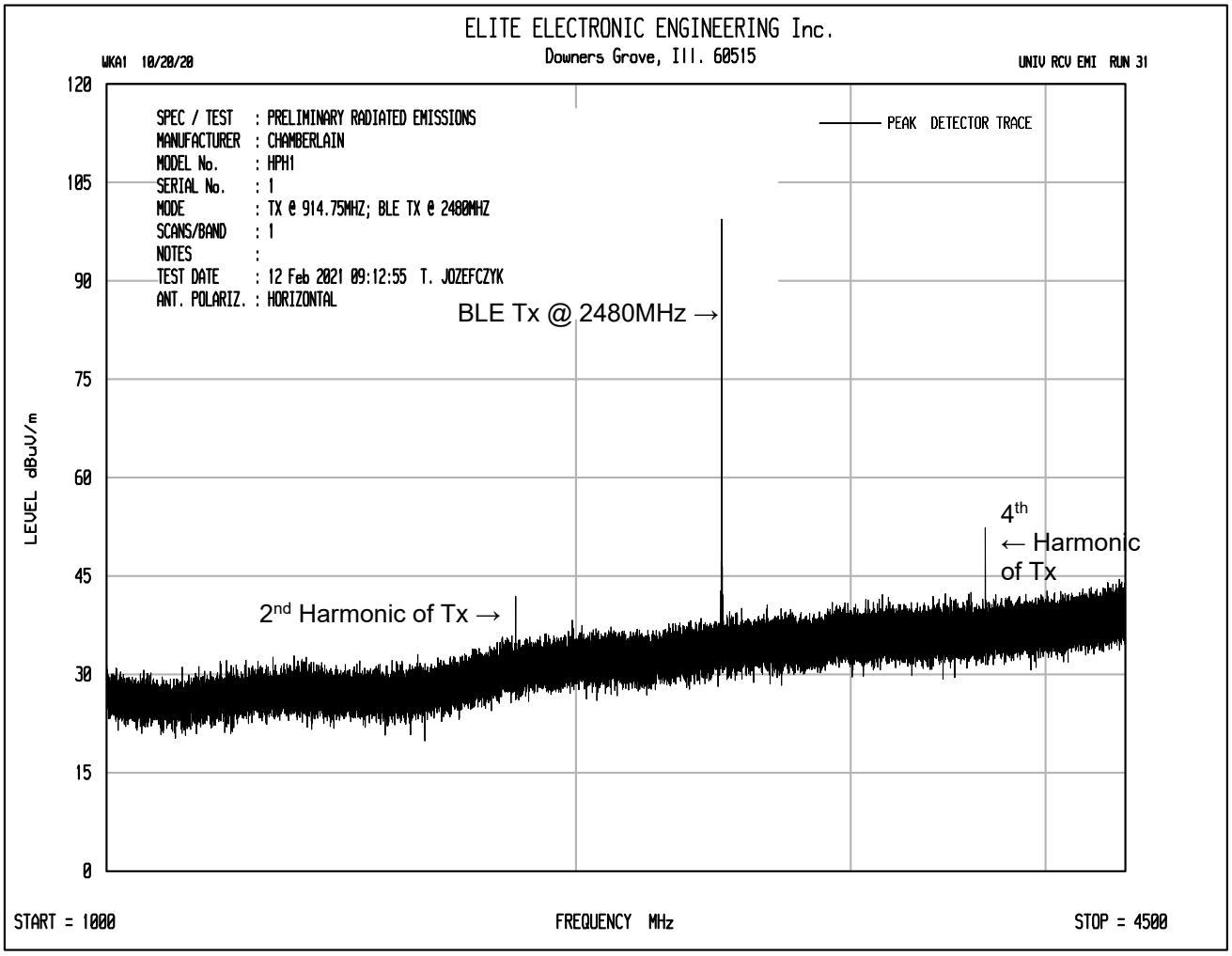
Test Setup for Radiated Emissions: Above 1GHz, Vertical Polarization



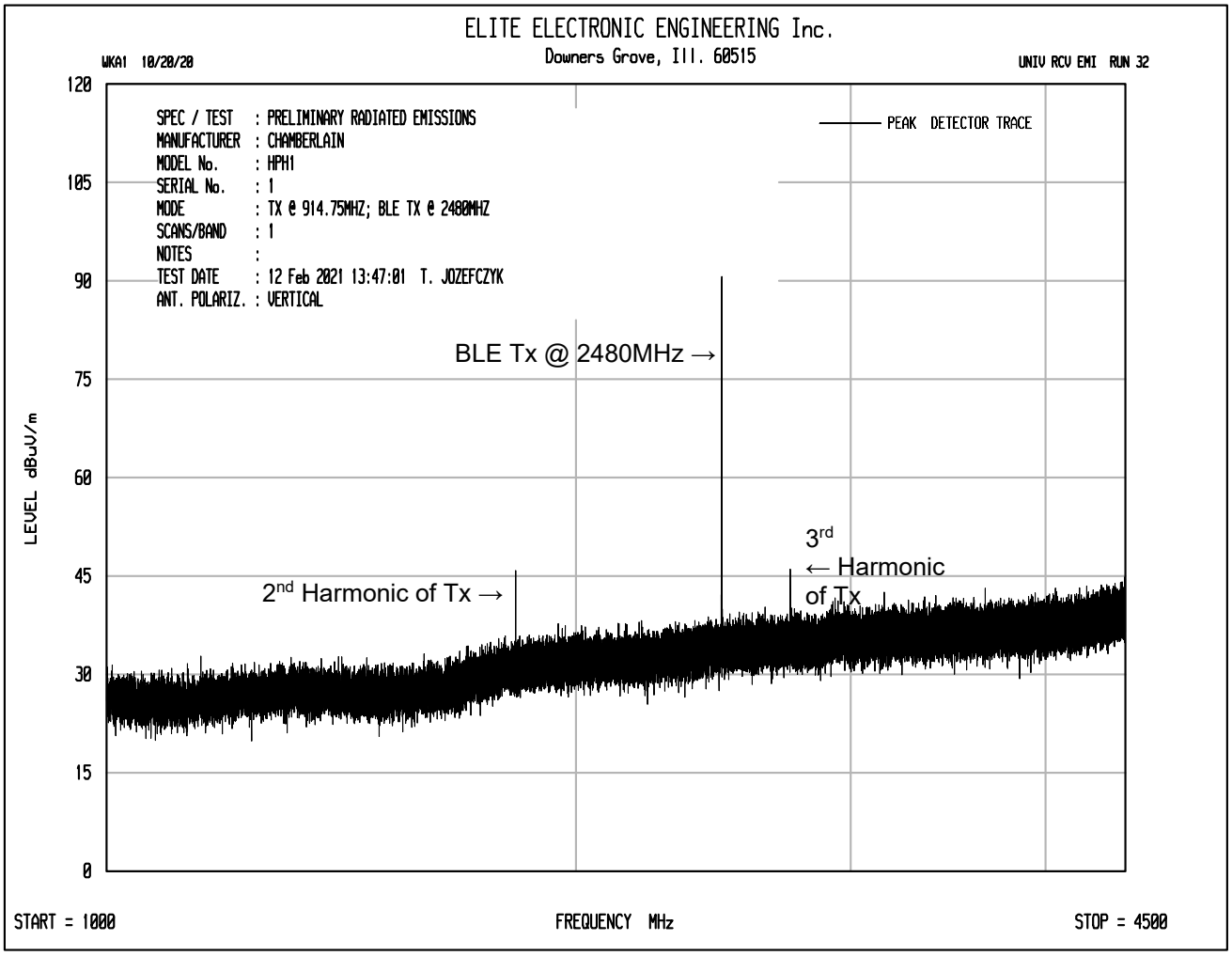
Note	Description
1	Plot shows emissions at 914.75MHz.



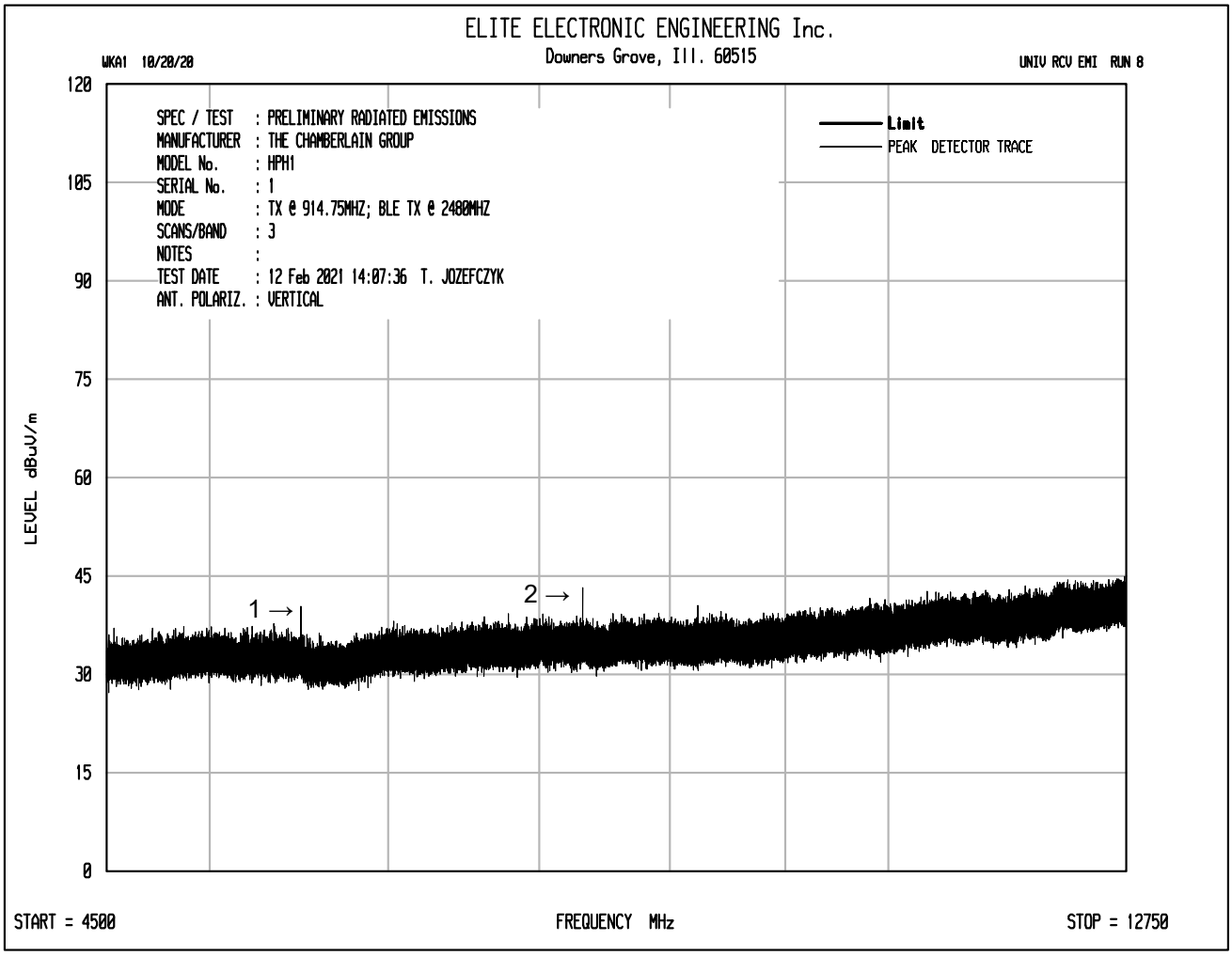
Note	Description
1	Plot shows emissions at 914.75MHz.



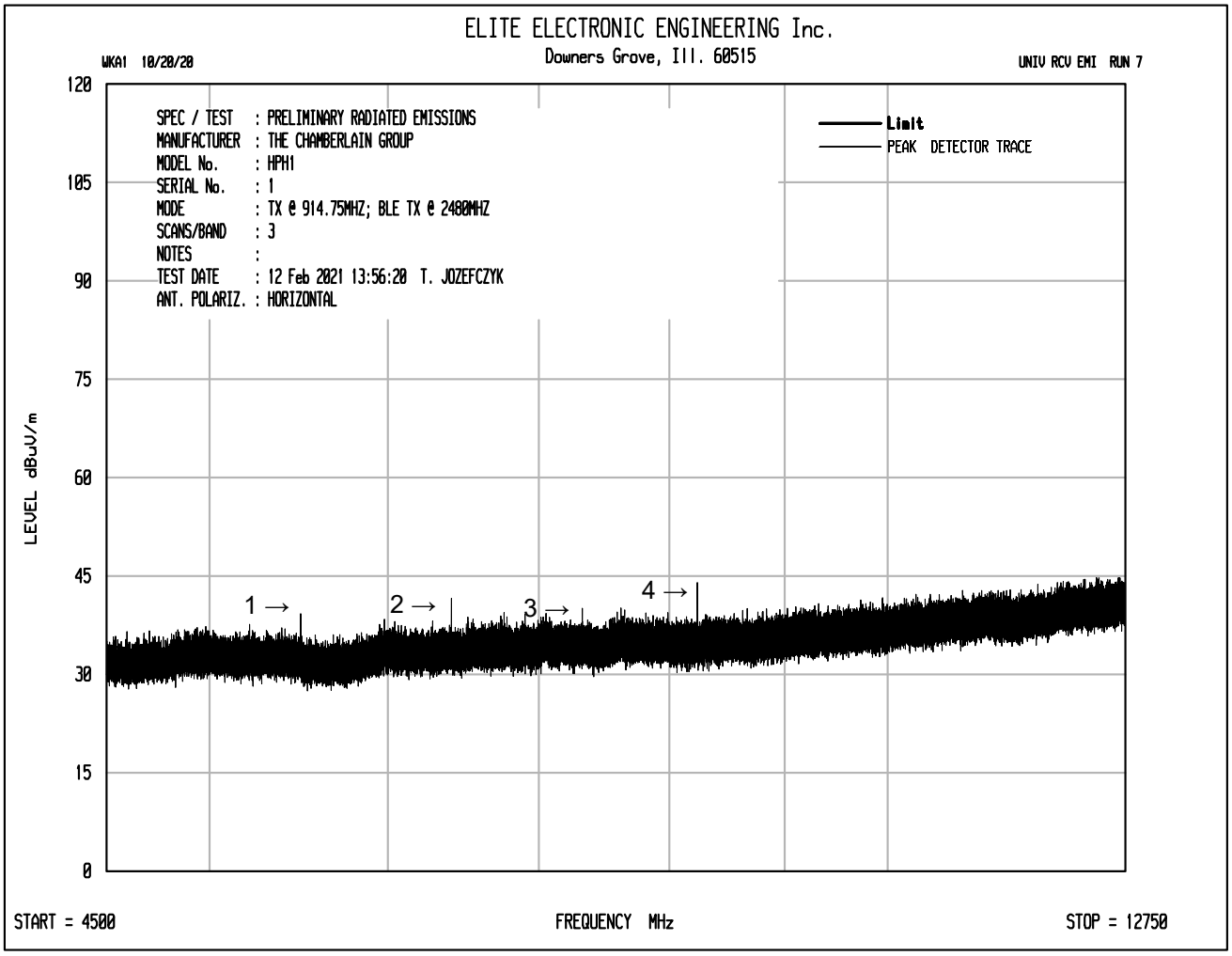
Note	Description
1	Plot shows the 2nd harmonic of 914.75MHz (1829.5MHz).
2	Plot shows BLE emissions at 2480MHz.
3	Plot shows the 4th harmonic of 914.75MHz (3659MHz).



Note	Description
1	Plot shows the 2nd harmonic of 914.75MHz (1829.5MHz).
2	Plot shows BLE emissions at 2480MHz.
3	Plot shows the 3rd harmonic of 914.75MHz (2744.25MHz).



Note	Description
1	Plot shows the 6th harmonic of 914.75MHz (5488.5MHz).
2	Plot shows the 8th harmonic of 914.75MHz (7318MHz).



Note	Description
1	Plot shows the 6th harmonic of 914.75MHz (5488.5MHz).
2	Plot shows the 7th harmonic of 914.75MHz (6403.25MHz).
3	Plot shows the 8th harmonic of 914.75MHz (7318MHz).
4	Plot shows the 9th harmonic of 914.75MHz (8232.75MHz).

24. Scope of Accreditation

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

ELITE ELECTRONIC ENGINEERING, INC.
1516 Centre Circle
Downers Grove, IL 60515
Robert Bugielski (QA Manager) Phone: 630 495 9770 ext. 168
Email: rbugielski@elitetest.com
Craig Fanning (EMC Lab Manager) Phone: 630 495 9770 ext. 112
Email: cfanning@elitetest.com
Brandon Lugo (Automotive Team Leader) Phone: 630 495 9770 ext. 163
Email: blugo@elitetest.com
Richard King (FCC/Commercial Team Leader) Phone: 630 495 9770 ext. 123
Email: reking@elitetest.com
Website: www.elitetest.com

ELECTRICAL

Valid to: June 30, 2021 Certificate Number: 1786.01

In recognition of the successful completion of the A2LA Accreditation Program evaluation process, accreditation is granted to this laboratory to perform the following automotive electromagnetic compatibility and other electrical tests:

Test Technology:	Test Method(s) [1]:
Transient Immunity	ISO 7637-2 (including emissions); ISO 7637-3; ISO 16750-2:2012, Sections 4.6.3 and 4.6.4; CS-11979, Section 6.4; CS.00054, Section 5.9; EMC-CS-2009.1 (CI220); FMC1278 (CI220, CI221, CI222); GMW 3097, Section 3.5; SAE J1113-11; SAE J1113-12; ECE Regulation 10.06 Annex 10
Electrostatic Discharge (ESD)	ISO 10605 (2001, 2008); CS-11979 Section 7.0; CS.00054, Section 5.10; EMC-CS-2009.1 (CI 280); FMC1278 (CI280); SAE J1113-13; GMW 3097 Section 3.6
Conducted Emissions	CISPR 25 (2002, 2008), Sections 6.2 and 6.3; CISPR 25 (2016), Sections 6.3 and 6.4; CS-11979, Section 5.1; CS.00054, Sections 5.6.1 and 5.6.2; GMW 3097, Section 3.3.2; EMC-CS-2009.1 (CE 420); FMC1278 (CE420, CE421)

5202 Presidents Court, Suite 220 | Frederick, MD 21703-8515 | Phone: 301 644 3248 | Fax: 240 454 9449 | www.A2LA.org

Test Technology:	Test Method(s) [1]:
Radiated Emissions Anechoic	CISPR 25 (2002, 2008), Section 6.4; CISPR 25 (2016), Section 6.5; CS-11979, Section 5.3; CS.00054, Section 5.6.3; GMW 3097, Section 3.3.1; EMC-CS-2009.1 (RE 310); FMC1278 (RE310); ECE Regulation 10.06 Annex 7 (Broadband) ECE Regulation 10.06 Annex 8 (Narrowband)
Vehicle Radiated Emissions	CISPR 12; ICES-002; ECE Regulation 10.06 Annex 5
Bulk Current Injection (BCI)	ISO 11452-4; CS-11979, Section 6.1; CS.00054, Section 5.8.1; GMW 3097, Section 3.4.1; SAE J1113-4; EMC-CS-2009.1 (RI112); FMC1278 (RI112); ECE Regulation 10.06 Annex 9
Bulk Current Injections (BCI) *(Closed Loop Method)*	ISO 11452-4; SAE J1113-4
Radiated Immunity Anechoic *(Including Radar Pulse)*	ISO 11452-2; ISO 11452-5; CS-11979, Section 6.2; CS.00054, Section 5.8.2; GMW 3097, Section 3.4.2; EMC-CS-2009.1 (RI114); FMC1278 (RI114); SAE J1113-21; ECE Regulation 10.06 Annex 9
Radiated Immunity Magnetic Field	ISO 11452-8
Radiated Immunity Reverb	ISO/IEC 61000-4-21; GMW 3097, Section 3.4.3; EMC-CS-2009.1 (RI114); FMC1278 (RI114); ISO 11452-11
Radiated Immunity *(Portable Transmitters)*	ISO 11452-9; EMC-CS-2009.1 (RI115); FMC1278 (RI115)
Vehicle Radiated Immunity (ALSE)	ISO 11451-2; ECE Regulation 10.06 Annex 6
Electrical Loads	ISO 16750-2, Sections 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 4.11, and 4.12
Dielectric Withstand Voltage	MIL-STD-202, Method 301; EIA-364-20D
Insulation Resistance	MIL-STD-202, Method 302; SAE/USCAR-2, Revision 6, Section 5.5.1; EIA-364-21D
Contact Resistance	MIL-STD-202, Method 307; SAE/USCAR-2, Revision 6, Section 5.3.1; EIA-364-23C; USCAR21-3 Section 4.5.3

Test Technology:	Test Method(s) [1]:
DC Resistance	MIL-STD-202, Method 303
Contact Chatter	MIL-STD-202, Method 310; SAE/USCAR-2, Revision 6, Section 5.1.9
Voltage Drop	SAE/USCAR-2, Revision 6, Section 5.3.2; USCAR21-3 Section 4.5.6
Emissions	
Radiated and Conducted (3m Semi-anechoic chamber, up to 40 GHz)	47 CFR, FCC Part 15 B (using ANSI C63.4:2014); 47 CFR, FCC Part 18 (using FCC MP-5:1986); ICES-001; ICES-003; ICES-005; IEC/CISPR 11, Ed. 4.1 (2004-06); AS/NZS CISPR 11 (2004); IEC/CISPR 11 Ed 5 (2009-05) + A1 (2010); KN 11 (2008-5) with RRL Notice No. 2008-3 (May 20, 2008); CISPR 11; EN 55011; KN 11; CNS 13803 (1997, 2003); CISPR 14-1; EN 55014-1; AS/NZS CISPR 14.1; KN 14-1; IEC/CISPR 22 (1997); EN 55022 (1998) + A1(2000); EN 55022 (1998) + A1(2000) + A2(2003); EN 55022 (2006); IEC/CISPR 22 (2008-09); AS/NZS CISPR 22 (2004); AS/NZS CISPR 22, 3rd Edition (2006); KN 22 (up to 6 GHz); CNS 13438 (up to 6 GHz); VCCI V-3 (up to 6 GHz); CISPR 32; EN 55032; KN 32; ECE Regulation 10.06 Annex 14
Current Harmonics	IEC 61000-3-2; EN 61000-3-2; KN 61000-3-2; ECE Regulation 10.06 Annex 11
Flicker and Fluctuations	IEC 61000-3-3; EN 61000-3-3; KN 61000-3-3; ECE Regulation 10.06 Annex 12
Immunity	
Electrostatic Discharge	IEC 61000-4-2, Ed. 1.2 (2001); IEC 61000-4-2 (1995) + A1(1998) + A2(2000); EN 61000-4-2 (1995); EN 61000-4-2 (2009-05); KN 61000-4-2 (2008-5); RRL Notice No. 2008-4 (May 20, 2008); IEC 61000-4-2; EN 61000-4-2; KN 61000-4-2; IEEE C37.90.3 2001
Radiated Immunity	IEC 61000-4-3 (1995) + A1(1998) + A2(2000); IEC 61000-4-3, Ed. 3.0 (2006-02); IEC 61000-4-3, Ed. 3.2 (2010); KN 61000-4-3 (2008-5); RRL Notice No. 2008-4 (May 20, 2008); IEC 61000-4-3; EN 61000-4-3; KN 61000-4-3; IEEE C37.90.2 2004
Electrical Fast Transient/Burst	IEC 61000-4-4, Ed. 2.0 (2004-07); IEC 61000-4-4, Ed. 2.1 (2011); IEC 61000-4-4 (1995) + A1(2000) + A2(2001); KN 61000-4-4 (2008-5); RRL Notice No. 2008-5 (May 20, 2008); IEC 61000-4-4; EN 61000-4-4; KN 61000-4-4; ECE Regulation 10.06 Annex 15

Test Technology:	Test Method(s) [1]:
Immunity (cont'd)	
Surge	IEC 61000-4-5 (1995) + A1(2000); IEC 61000-4-5, Ed 1.1 (2005-11); EN 61000-4-5 (1995) + A1(2001); KN 61000-4-5 (2008-5); RRL Notice No. 2008-4 (May 20, 2008); IEC 61000-4-5; EN 61000-4-5; KN 61000-4-5; IEEE C37.90.1 2012; IEEE STD C62.41.2 2002; ECE Regulation 10.06 Annex 16
Conducted Immunity	IEC 61000-4-6 (1996) + A1(2000); IEC 61000-4-6, Ed 2.0 (2006-05); IEC 61000-4-6 Ed. 3.0 (2008); KN 61000-4-6 (2008-5); RRL Notice No. 2008-4 (May 20, 2008); EN 61000-4-6 (1996) + A1(2001); IEC 61000-4-6; EN 61000-4-6; KN 61000-4-6
Power Frequency Magnetic Field Immunity	IEC 61000-4-8 (1993) + A1(2000); IEC 61000-4-8 (2009); EN 61000-4-8 (1994) + A1(2000); KN 61000-4-8 (2008-5); RRL Notice No. 2008-4 (May 20, 2008); IEC 61000-4-8; EN 61000-4-8; KN 61000-4-8
Voltage Dips, Short Interrupts, and Line Voltage Variations	IEC 61000-4-11, Ed. 2 (2004-03); KN 61000-4-11 (2008-5); RRL Notice No. 2008-4 (May 20, 2008); IEC 61000-4-11; EN 61000-4-11; KN 61000-4-11
Ring Wave	IEC 61000-4-12, Ed. 2 (2006-09); EN 61000-4-12:2006; IEC 61000-4-12; EN 61000-4-12; KN 61000-4-12; IEEE STD C62.41.2 2002
Generic and Product Specific EMC Standards	IEC/EN 61000-6-1; AS/NZS 61000-6-1; KN 61000-6-1; IEC/EN 61000-6-2; AS/NZS 61000-6-2; KN 61000-6-2; IEC/EN 61000-6-3; AS/NZS 61000-6-3; KN 61000-6-3; IEC/EN 61000-6-4; AS/NZS 61000-6-4; KN 61000-6-4; EN 50130-4; EN 61326-1; IEC/CISPR 14-2; EN 55014-2; AS/NZS CISPR 14.2; KN 14-2; IEC/CISPR 24; AS/NZS CISPR 24; EN 55024; KN 24; IEC 60601-1-2; JIS T0601-1-2
TxRx EMC Requirements	EN 301 489-1; EN 301 489-3; EN 301 489-9; EN 301 489-17; EN 301 489-19
European Radio Test Standards	ETSI EN 300 086-1; ETSI EN 300 086-2; ETSI EN 300 113-1; ETSI EN 300 113-2; ETSI EN 300 220-1; ETSI EN 300 220-2; ETSI EN 300 330-1; ETSI EN 300 330-2; ETSI EN 300 440-1; ETSI EN 300 440-2; ETSI EN 300 422-1; ETSI EN 300 422-2;

Test Technology:	Test Method(s) [1]:
European Radio Test Standards (cont'd)	ETSI EN 300 328; ETSI EN 301 893; ETSI EN 301 511; ETSI EN 301 908-1; ETSI EN 908-2; ETSI EN 908-13; ETSI EN 303 413; ETSI EN 302 502
Canadian Radio Tests	RSS-102 (RF Exposure Evaluation only); RSS-111; RSS-112; RSS-117; RSS-119; RSS-123; RSS-125; RSS-127; RSS-130; RSS-131; RSS-132; RSS-133; RSS-134; RSS-135; RSS-137; RSS-139; RSS-140; RSS-141; RSS-142; RSS-170; RSS-181; RSS-182; RSS-191; RSS-192; RSS-194; RSS-195; RSS-196; RSS-197; RSS-199; RSS-210; RSS-211; RSS-213; RSS-215; RSS-216; RSS-220; RSS-222; RSS-236; RSS-238; RSS-243; RSS-244; RSS-247; RSS-251; RSS-252; RSS-287; RSS-288; RSS-310; RSS-GEN
Mexico Radio Tests	IFT-008-2015; NOM-208-SCFI-2016
Japan Radio Tests	Radio Law No. 131, Ordinance of MPT No. 37, 1981, MIC Notification No. 88:2004, Table No. 22-11; ARIB STD-T66, Regulation 18
Taiwan Radio Tests	LP-0002
Australia/New Zealand Radio Tests	AS/NZS 4268; Radiocommunications (Short Range Devices) Standard (2014)
Hong Kong Radio Tests	HKCA 1039 Issue 6; HKCA 1042; HKCA 1033 Issue 7; HKCA 1061; HKCA 1008; HKCA 1043; HKCA 1057; HKCA 1073
Korean Radio Test Standards	KN 301 489-1; KN 301 489-3; KN 301 489-9; KN 301 489-17; KN 301 489-52
Unlicensed Radio Frequency Devices *(3 Meter Semi-Anechoic Room)*	47 CFR FCC Part 15C, 15D, 15E, 15F, 15G, 15H (using ANSI C63.10:2013, ANSI C63.17:2013 and FCC KDB 905462 D02 (v02))
Licensed Radio Service Equipment	47 CFR FCC Parts 20, 22, 24, 25, 27, 30, 73, 74, 80, 87, 90, 95, 96, 97, 101; ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015;
OTA (Over the Air) Performance GSM, GPRS, EGPRS UMTS (W-CDMA) LTE including CAT M1 A-GPS for UMTS/GSM LTS A-GPS, A-GLONASS, SIB8/SIB16 Large Device/Laptop/Tablet Testing Integrated Device Testing WiFi 802.11 a/b/g/n/a	CTIA Test Plan for Wireless Device Over-the-Air Performance (Method for Measurement for Radiated Power and Receiver Performance) V3.8.2; CTIA Test Plan for RF Performance Evaluation of WiFi Mobile Converged Devices V2.1.0

Test Technology:	Test Method(s) [1]:
Electrical Measurements and Simulation	
AC Voltage / Current	FAA AC 150/5345-10H
(1mV to 5kV) 60 Hz	FAA AC 150/5345-43J
(0.1V to 250V) up to 500 MHz	FAA AC 150/5345-44K
(1µA to 150A) 60 Hz	FAA AC 150/5345-46E
DC Voltage / Current	FAA AC 150/5345-47C
(1mV to 15-kV) / (1µA to 10A)	FAA EB 67D
Power Factor / Efficiency / Crest Factor	
(Power to 30kW)	
Resistance	
(1mΩ to 4000MΩ)	
Surge	
(Up to 10 kV / 5 kA) (Combination Wave and Ring Wave)	

On the following products and materials:
Telecommunications Terminal Equipment (TTE), Radio Equipment, Network Equipment, Information Technology Equipment (ITE), Automotive Electronic Equipment, Automotive Hybrid Electronic Devices, Maritime Navigation and Radio Communication Equipment and Systems, Vehicles, Boats and Internal Combustion Engine Driven Devices, Automotive, Aviation, and General Lighting Products, Medical Electrical Equipment, Motors, Industrial, Scientific and Medical (ISM) Radio-Frequency Equipment, Household Appliances, Electric Tools, Low-voltage Switchgear and Control gear, Programmable Controllers, Electrical Equipment for Measurement, Control and Laboratory Use, Base Materials, Power and Data Transmission Cables and Connectors

[1] When the date, revision or edition of a test method standard is not identified on the scope of accreditation, the laboratory is expected to be using the current version within one year of the date of publication, per part C., Section 1 of A2LA *R101 - General Requirements - Accreditation of ISO-IEC 17025 Laboratories*.

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

Rule Subpart/Technology	Test Method	Maximum Frequency (MHz)
Unintentional Radiators Part 15B	ANSI C63.4:2014	40000
Industrial, Scientific, and Medical Equipment Part 18	FCC MP-5 (February 1986)	40000
Intentional Radiators Part 15C	ANSI C63.10:2013	40000
Unlicensed Personal Communication Systems Devices Part 15D	ANSI C63.17:2013	40000

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

Rule Subpart/Technology	Test Method	Maximum Frequency (MHz)
U-NII without DFS Intentional Radiators Part 15E	ANSI C63.10:2013	40000
U-NII with DFS Intentional Radiators Part 15E	FCC KDB 905462 D02 (v02)	40000
UWB Intentional Radiators Part 15F	ANSI C63.10:2013	40000
BPL Intentional Radiators Part 15G	ANSI C63.10:2013	40000
White Space Device Intentional Radiators Part 15H	ANSI C63.10:2013	40000
Commercial Mobile Services (FCC Licensed Radio Service Equipment) Parts 22 (cellular), 24, 25 (below 3 GHz), and 27	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	40000
General Mobile Radio Services (FCC Licensed Radio Service Equipment) Parts 22 (non-cellular), 90 (below 3 GHz), 95, 97, and 101 (below 3 GHz)	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	40000
Citizens Broadband Radio Services (FCC Licensed Radio Service Equipment) Part 96	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	40000
Maritime and Aviation Radio Services Parts 80 and 87	ANSI/TIA-603-E; ANSI C63.26:2015	40000
Microwave and Millimeter Bands Radio Services Parts 25, 30, 74, 90 (above 3 GHz), 97 (above 3 GHz), and 101	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	40000
Broadcast Radio Services Parts 73 and 74 (below 3 GHz)	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	40000

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

Rule Subpart/Technology	Test Method	Maximum Frequency (MHz)
Signal Boosters Part 20 (Wideband Consumer Signal Boosters, Provider-specific signal boosters, and Industrial Signal Boosters) Section 90.219	ANSI C63.26:2015	40000

[2]Accreditation does not imply acceptance to the FCC equipment authorization program. Please see the FCC website (https://apps.fcc.gov/oetcf/eas/) for a listing of FCC approved laboratories.

Accredited Laboratory

A2LA has accredited

ELITE ELECTRONIC ENGINEERING INC.

Downers Grove, IL

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories.* This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).

Presented this 8th day of August 2019.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 1786.01
Valid to June 30, 2021

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