



Engineering Test Report No. 2402438-06				
Report Date	April 25, 2025			
Manufacturer Name	The Chamberlain Group LLC			
Manufacturer Address	300 Windsor Dr Oak Brook, IL 60523			
Test Item Name Model No.	Vulcan – 900-15607 Rev F Model No. – 900-15607-11			
Date Received	March 7, 2025			
Test Dates	March 18, 2025 – March 20, 2025			
Specifications	FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C, Section 15.207 FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C, Section 15.247 Innovation, Science, and Economic Development Canada, RSS-GEN Innovation, Science, and Economic Development Canada, RSS-247			
Test Facility	Elite Electronic Engineering, Inc. 1516 Centre Circle, Downers Grove, IL 60515	FCC Reg. Number: 269750 IC Reg. Number: 2987A CAB Identifier: US0107		
Signature				
Tested by	Nathaniel Bouchie			
Signature				
Approved by	Raymond J. Klouda, Registered Professional Engineer of Illinois – 44894			
PO Number	4900099030			
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1. Report Revision History

Revision	Date	Description
–	25 APR 2025	Initial Release of Engineering Test Report No. 2402438-06

2. Introduction

This document presents the results of a series of electromagnetic compatibility (EMC) tests that were performed on one (1) Vulcan – 900-15607 Rev F (hereinafter referred to as the Equipment Under Test (EUT)).

Additionally, this document presents the results of conducted and spurious emissions measurements performed on the EUT.

The nature of these measurements is to ensure that the host remain in compliance with the emissions requirements of the FCC and Innovation, Science, and Economic Development Canada.

The EUT was identified as follows:

EUT Identification	
Description	Vulcan – 900-15607 Rev F
Model/Part No.	900-15607-11
Serial No.	Radiated Sample
Software/Firmware Version	FW Version 2.11
Size of EUT	13 in x 9 in x 8 in
Number of Interconnection Wires	1
Type of Interconnection Wires	USB
Highest Internal Frequency of the EUT	2480MHz

The EUT listed above was used throughout the test series.

3. Power Input

The EUT obtained 115V 60Hz power via a 3 wire, unshielded power cord.

4. Grounding

The EUT was connected to ground through the third wire of the input power cord.

5. Support Equipment

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

Description	Model #	S/N
Support Laptop	---	---

6. Interconnect Leads

The following interconnect cables were submitted with the test item:

Item	Description
USB	Connects laptop to EUT

7. Modifications Made to the EUT

No modifications were made to the EUT during the testing.

8. Modes of Operation

The EMC tests were performed with the EUT operating in one or more of the test modes described below. See the specific test section for the applicable test modes.

8.1. MultiTx w/ Realtek WiFi

This mode was achieved by applying 120VAC 60Hz to the EUT with the support equipment attached. The support equipment software was used to configure the EUT into the proper operating mode. The following transmitters were enabled:

- Sub1GHz Tx at 902.25MHz
- Realtek WiFi/BLE Tx/Rx with WiFi at 2412MHz
- Security 3.0 BLE at 2480MHz

8.2. MultiTx w/ Realtek BLE

This mode was achieved by applying 120VAC 60Hz to the EUT with the support equipment attached. The support equipment software was used to configure the EUT into the proper operating mode. The following transmitters were enabled:

- Sub1GHz Tx at 902.25MHz
- Realtek WiFi/BLE Tx/Rx with BLE at 2402MHz
- Security 3.0 BLE at 2480MHz

9. Test Specifications

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

- Federal Communications Commission "Code of Federal Regulations", Title 47, Chapter I, Subchapter A, Part 15, Subpart C
- ANSI C63.4-2014, "American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz"
- 996369 D04 Module Integration Guide v02, October 13, 2020
- ANSI C63.10-2013, "American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices"
- Federal Communications Commission Office of Engineering and Technology Laboratory Division, Guidance For Compliance Measurements On Digital Transmission Systems, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under Section 15.247 April 2, 2019 KDB 558074 D01v05r02
- RSS-Gen Issue 5, February 2020, Amendment 2, Innovation, Science, and Economic Development Canada, "General Requirements for Compliance of Radio Apparatus"
- RSS-247 Issue 3, August 2023, "Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices"

10. Test Plan

No test plan was provided. Instructions were provided by personnel from The Chamberlain Group LLC and used in conjunction with the FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C, Section 15.207; FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C, Section 15.247; Innovation, Science, and Economic Development Canada, ICES-003; Innovation, Science, and Economic Development Canada, RSS-GEN; Innovation, Science, and Economic Development Canada, RSS-247; and ANSI C63.4-2014 specifications.

11. Deviation, Additions to, or Exclusions from Test Specifications

There were no deviations, additions to, or exclusions from the test specifications during this test series.

12. Laboratory Conditions

The following were the laboratory conditions while the EMC tests were performed:

Ambient Parameters	Value
Temperature	23.1°C
Relative Humidity	19%
Atmospheric Pressure	1009mb

13. Summary

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

Test Description	Test Requirements	Test Methods	EUT S/N	Results
RF Conducted Emissions (AC Mains)	FCC 15C 15.207 RSS-Gen	ANSI C63.10:2013	Radiated Sample	Conforms
Multi-Tx Spurious Emissions	FCC 15B 15.247, RSS-247	ANSI C63.10:2013	Radiated Sample	Conforms

14. Sample Calculations

For Powerline Conducted Emissions:

The resultant voltage level (VL) is a summation in decibels (dB) of the receiver meter reading (MTR) and the cable loss factor (CF).

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

For Radiated Emissions:

The resultant field strength (FS) is a summation in decibels (dB) of the receiver meter reading (MTR), the antenna correction factor (AF), and the cable loss factor (CF). If an external preamplifier is used, the total is reduced by its gain (-PA). If a distance correction (DC) is required, it is added to the total.

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

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

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

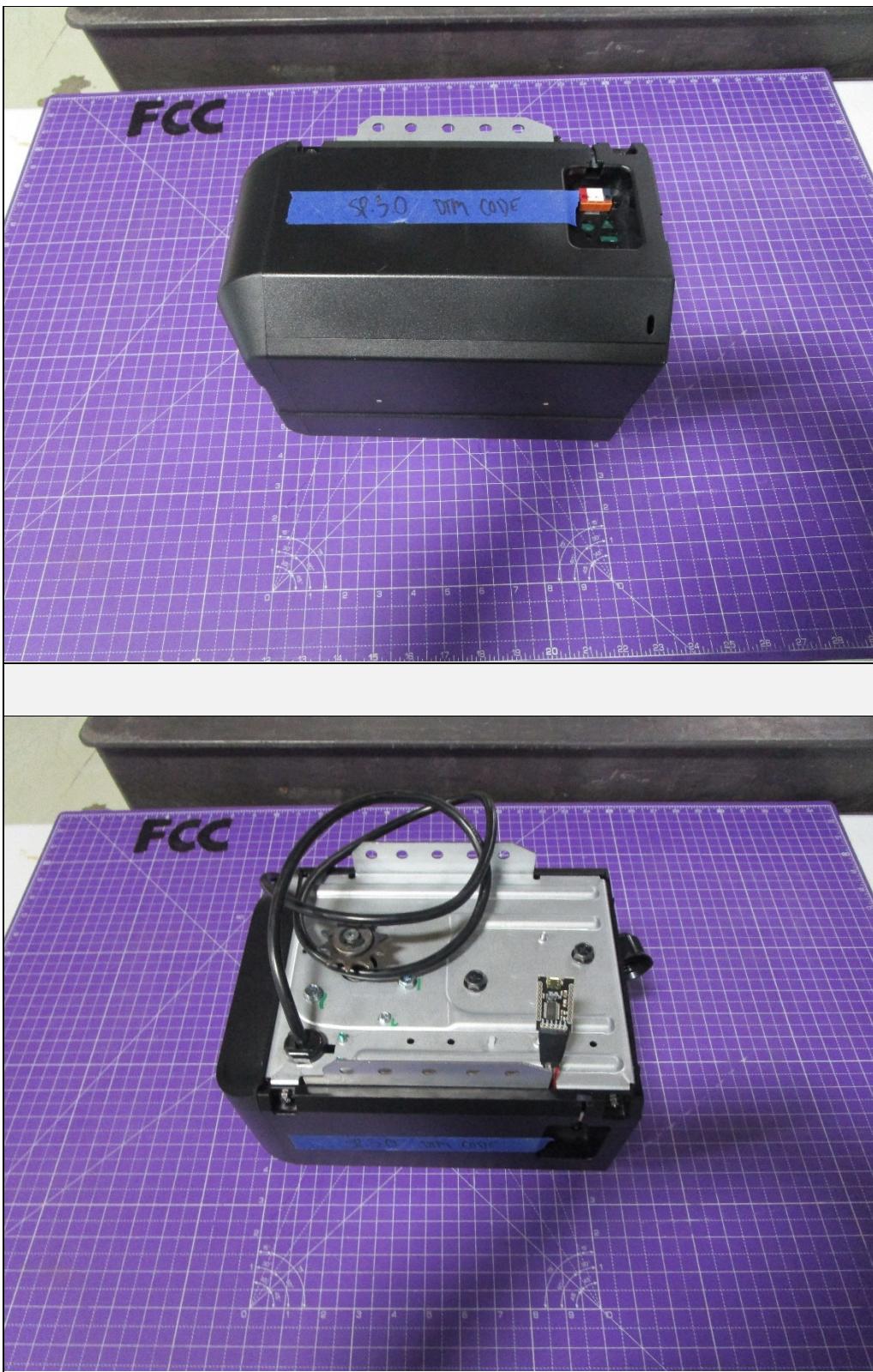
15. Statement of Conformity

The Chamberlain Group LLC Vulcan – 900-15607 Rev F, Model No. 900-15607-11, Serial No. Radiated Sample, did fully conform to the selected requirements of FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C, Section 15.207; FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C, Section 15.247; Innovation, Science, and Economic Development Canada, ICES-003; Innovation, Science, and Economic Development Canada, RSS-GEN; 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 15.207; FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C, Section 15.247; Innovation, Science, and Economic Development Canada, ICES-003; Innovation, Science, and Economic Development Canada, RSS-GEN; Innovation, Science, and Economic Development Canada, RSS-247 test specifications. The data presented in this test report pertains to the EUT as received by the customer 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
APW18	PREAMPLIFER	PLANAR ELECTRONICS	PE2-30-20G20R6G-3R0-10-12-SFF	PL34312/2148	18-26.5GHz	2/11/2025	2/11/2026
APW3	PREAMPLIFIER	PLANAR ELECTRONICS	PE2-35-120-5R0-10-12	PL2924	1-20GHz	3/24/2025	3/24/2026
CDZ4	LAB WORKSTATION	ELITE	LWS-10		WINDOWS 10	CNR	
GRB0	1MHZ, LISN SIGNAL CHECKER	ELITE	LISNCHKR1M	1	1MHZ	2/11/2025	2/11/2027
GSE3	SIGNAL GENERATOR (40GHZ)	ROHDE & SCHWARZ	SMB100A	183294	100KHZ-40GHZ	3/23/2025	3/23/2027
GSFB	OSP120 BASE UNIT	ROHDE & SCHWARZ	OSP120	101071	---	3/30/2023	4/30/2025
GSFE	OSP120	ROHDE & SCHWARZ	OSP120	101288	.01-40GHz	4/4/2023	4/30/2025
NSDS1	UNIVERSAL SPHERICAL DIPOLE SOURCE	AET	USDS-H	AET-1116		NOTE 1	
NTA3	BILOG ANTENNA	TESEQ	6112D	32853	25-2000MHz	10/3/2024	10/3/2026
NWN1	DOUBLE RIDGED GUIDE ANTENNA	ETS LINDGREN	3116C	227802	10GHz-40GHz	9/16/2024	9/16/2026
NWQ2	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS LINDGREN	3117	66659	1GHz-18GHz	4/26/2024	4/26/2026
PLF2	CISPR16 50UH LISN	ELITE	CISPR16/70A	002	150kHz-30MHz	3/28/2025	3/28/2026
PLF4	CISPR16 50UH LISN	ELITE	CISPR16/70A	003	150kHz-30MHz	3/28/2025	3/28/2026
R21F	3M ANECHOIC CHAMBER NSA	EMC TEST SYSTEMS	3M ANECHOIC		30MHz-18GHz	3/1/2025	3/1/2026
RBG3	EMI ANALYZER	ROHDE & SCHWARZ	ESW44	101592	2Hz-44GHz	3/7/2024	5/7/2025
RBG4	EMI ANALYZER	ROHDE & SCHWARZ	ESW44	103007	2Hz-44GHz	4/5/2025	4/5/2026
SHC2	Power Supplies	HENGFU	HF60W-SL-24	A11372702	24V	NOTE 1	
T1EA	10DB 25W ATTENUATOR	WEINSCHEL	46-10-34	BN2316	DC-18GHz	2/4/2025	2/4/2027
T2S2	20DB 25W ATTENUATOR	WEINSCHEL	46-20-34	BV3540	DC-18GHz	12/19/2023	12/19/2025
T6A3	6DB, 2W ATTENUATOR	KEYSIGHT TECHNOLOGIES	8491B	MY39269623	DC-18GHz	3/6/2025	3/6/2027
VBR8	COMMERCIAL CONDUCTED EMISSIONS.EXE	ELITE				N/A	
WKA1	SOFTWARE, UNIVERSAL RCV EMI	ELITE	UNIV_RCV_EMI	1	---	I/O	
XLT26	5W, 50Ω TERMINATION	JFW INDUSTRIES	50T-199 N M	---	DC-18 GHz	12/20/2023	12/20/2025

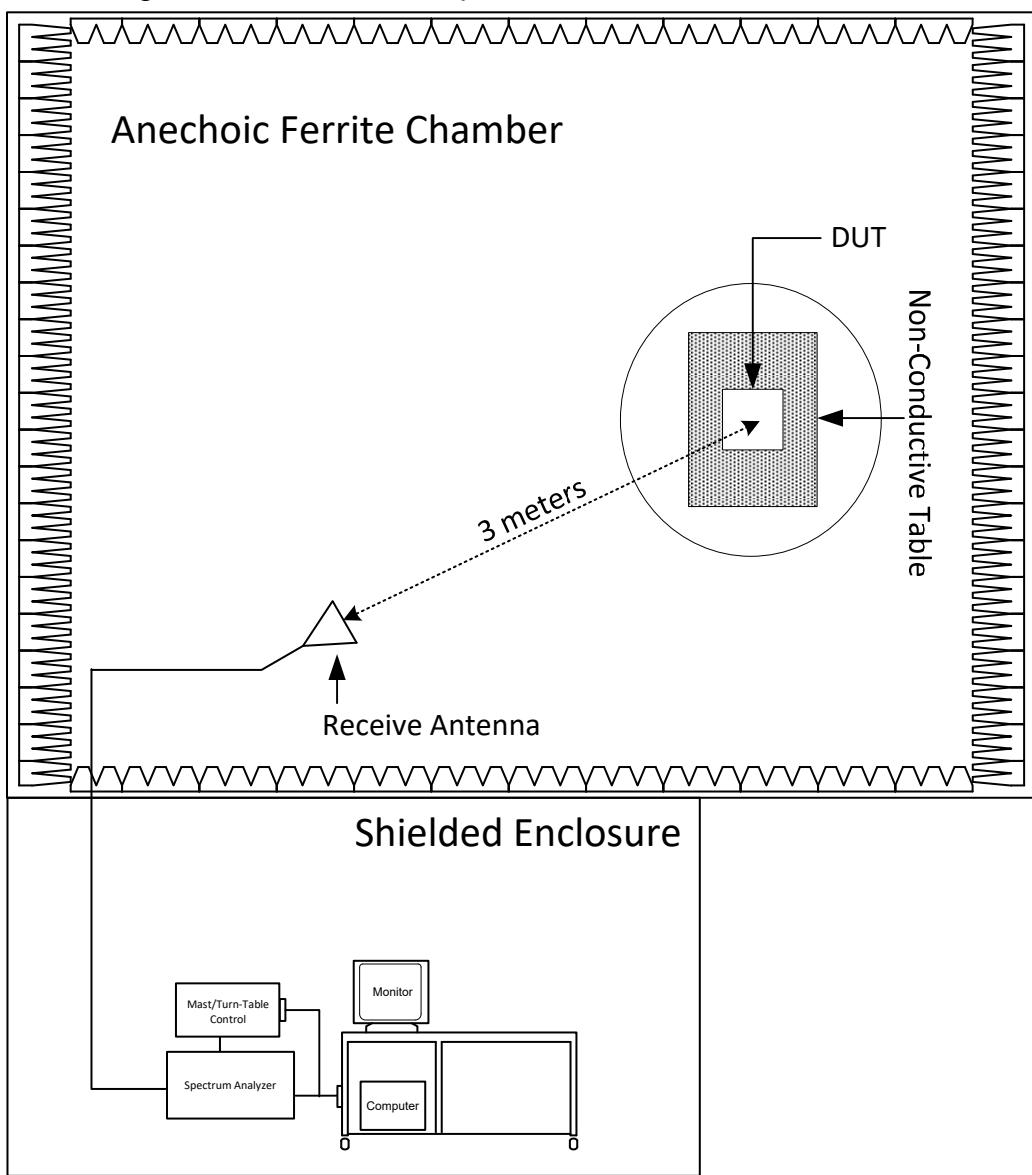
N/A: Not Applicable

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. RF Conducted Emissions (AC Mains)

EUT Information	
Manufacturer	The Chamberlain Group LLC
Product	Vulcan – 900-15607 Rev F
Model No.	900-15607-11
Serial No.	Radiated Sample
Mode	MultiTx w/ Realtek WiFi MultiTx w/ Realtek BLE

Test Site Information	
Setup Format	Tabletop
Height of Support	NA
Type of Test Site	Shielded Enclosure
Test Site Used	R23P
Note	None

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

Requirements	
For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150kHz to 30MHz shall not exceed the limits in the following table.	

Conducted Emissions Limits		
Frequency (MHz)	Conducted limit (dB μ V)	
	Quasi-Peak	Average
0.15 – 0.5	66 decreasing with logarithm of frequency to 56	56 decreasing with logarithm of frequency to 46
0.5 – 5	56	46
5 – 30	60	50

Note 1: The lower limit shall apply at the transition frequencies.

Note 2: If the levels measured using the QP detector meet both the QP and the Average limits, the EUT is considered to have met both requirements and measurements do not need to be performed using the Average detector.

Procedure

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

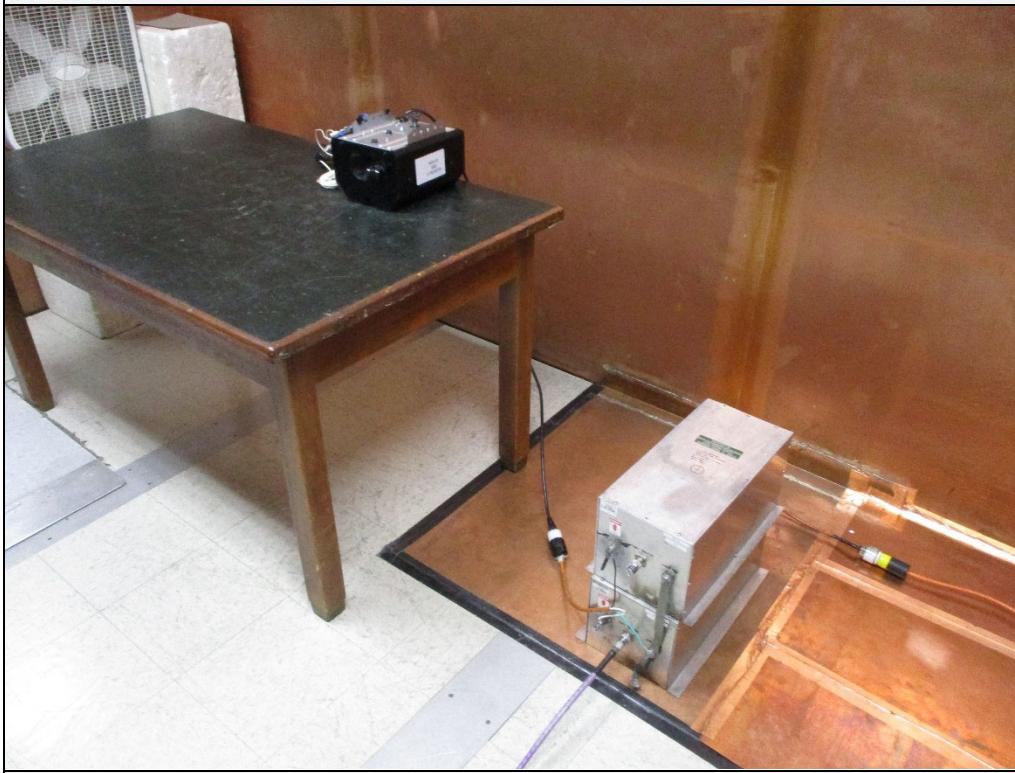
- 1) The EUT was operated in the MultiTx w/ Realtek WiFi mode, combination 1.
- 2) Measurements were first made on the 120VAC 60Hz high line.
- 3) The frequency range from 150kHz to 30MHz was broken up into smaller frequency sub-bands.
- 4) Conducted emissions measurements were taken on the first frequency sub-band using a peak detector.
- 5) The data thus obtained was then searched by the computer for the highest levels. Any emissions levels that were within 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. The resultant voltage level (VL) is a summation in decibels (dB) of the receiver meter reading (MTR) and the cable loss factor (CF).

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

- 7) Steps (3) through (6) were repeated on the neutral line.
- 8) Steps (2) through (7) were repeated with the EUT operated in the MultiTx w/ Realtek BLE mode, combination 2.



Test Setup for RF Conducted Emissions (AC Mains)



Test Setup for RF Conducted Emissions (AC Mains)

FCC Part 15 Subpart B Conducted Emissions Test

Significant Emissions Data

VBR8 12/06/2024

Manufacturer : The Chamberlain Group LLC
 Model : 900-15607-11
 DUT Revision : 900MHz ON, WiFi ON, Sec+3.0 ON
 Serial Number : Radiated Sample
 DUT Mode : MultiTx w/ Realtek WiFi
 Line Tested : Line
 Scan Step Time [ms] : 30
 Meas. Threshold [dB] : -10
 Notes : 902.25MHz ON, 11b 2412MHz ON, 2480MHz ON
 Test Engineer : J. Cardenas
 RBW : 9 kHz
 Limit : FCC 15.207 / RSS GEN SECTION 8.8
 Test Date : Mar 18, 2025 09:04:20 AM
 Data Filter : Up to 80 maximum levels detected with 6 dB level excursion threshold over 10 dB margin below limit

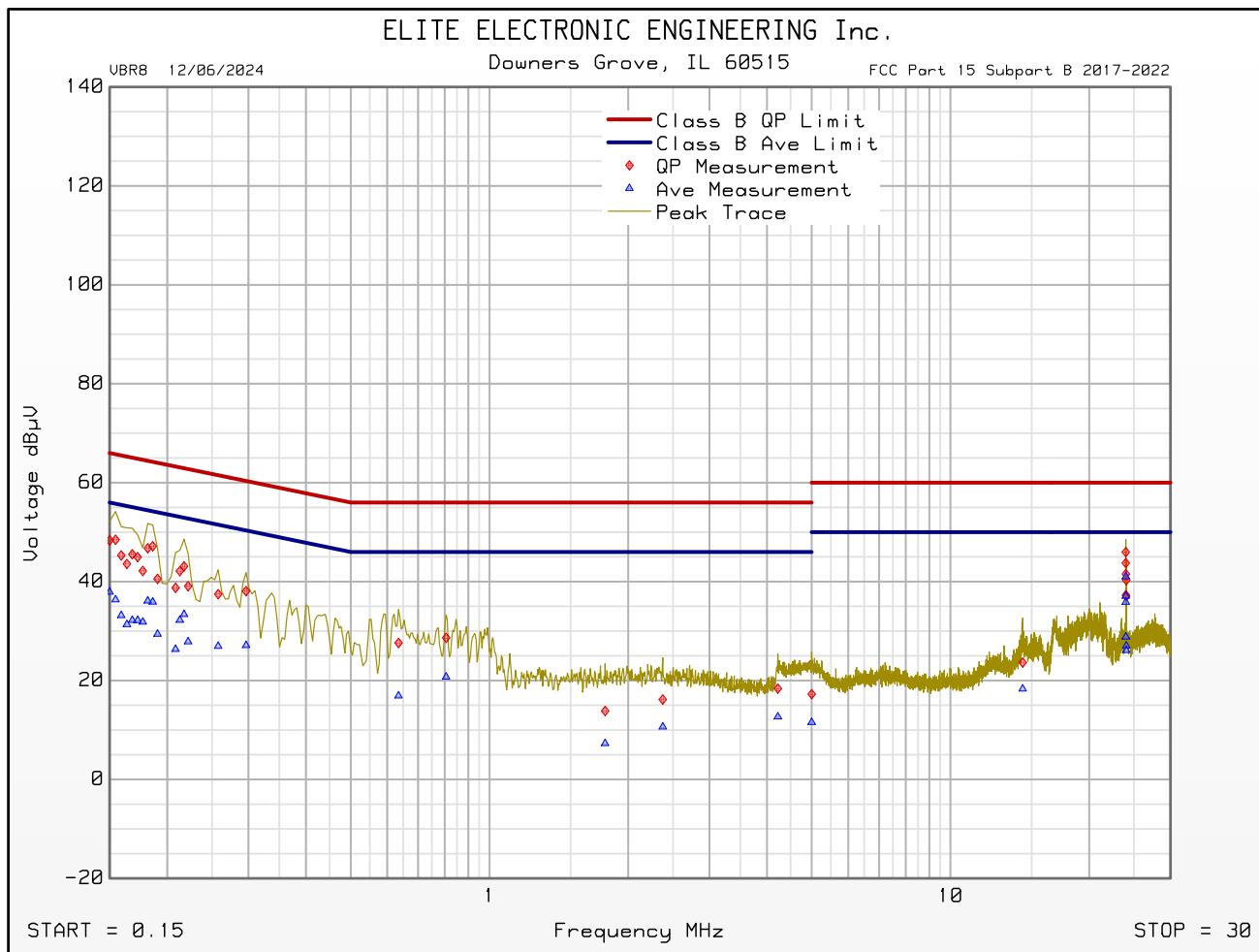
Freq MHz	Quasi-peak Level dB μ V	Quasi-peak Limit dB μ V	Excessive Quasi-peak Emissions	Average Level dB μ V	Average Limit dB μ V	Excessive Average Emissions
0.186	47.1	64.2		35.9	54.2	
0.297	38.1	60.3		27.1	50.3	
0.635	27.6	56.0		16.9	46.0	
0.806	28.6	56.0		20.7	46.0	
1.782	13.9	56.0		7.3	46.0	
2.376	16.2	56.0		10.6	46.0	
4.223	18.4	56.0		12.7	46.0	
5.000	17.3	56.0		11.5	46.0	
14.342	23.6	60.0		18.3	50.0	
24.003	46.0	60.0		41.0	50.0	

FCC Part 15 Subpart B Conducted Emissions Test

Cumulative Data

VBR8 12/06/2024

Manufacturer : The Chamberlain Group LLC
Model : 900-15607-11
DUT Revision : 900MHz ON, WiFi ON, Sec+3.0 ON
Serial Number : Radiated Sample
DUT Mode : MultiTx w/ Realtek WiFi
Line Tested : Line
Scan Step Time [ms] : 30
Meas. Threshold [dB] : -10
Notes : 902.25MHz ON, 11b 2412MHz ON, 2480MHz ON
Test Engineer : J. Cardenas
RBW : 9 kHz
Limit : FCC 15.207 / RSS GEN SECTION 8.8
Test Date : Mar 18, 2025 09:04:20 AM



Emissions Meet QP Limit
Emissions Meet Ave Limit

FCC Part 15 Subpart B Conducted Emissions Test

Significant Emissions Data

VBR8 12/06/2024

Manufacturer : The Chamberlain Group LLC
 Model : 900-15607-11
 DUT Revision : 900MHz ON, WiFi ON, Sec+3.0 ON
 Serial Number : Radiated Sample
 DUT Mode : MultiTx w/ Realtek WiFi
 Line Tested : Neutral
 Scan Step Time [ms] : 30
 Meas. Threshold [dB] : -10
 Notes : 902.25MHz ON, 11b 2412MHz ON, 2480MHz ON
 Test Engineer : J. Cardenas
 RBW : 9 kHz
 Limit : FCC 15.207 / RSS GEN SECTION 8.8
 Test Date : Mar 18, 2025 08:43:23 AM
 Data Filter : Up to 80 maximum levels detected with 6 dB level excursion threshold over 10 dB margin below limit

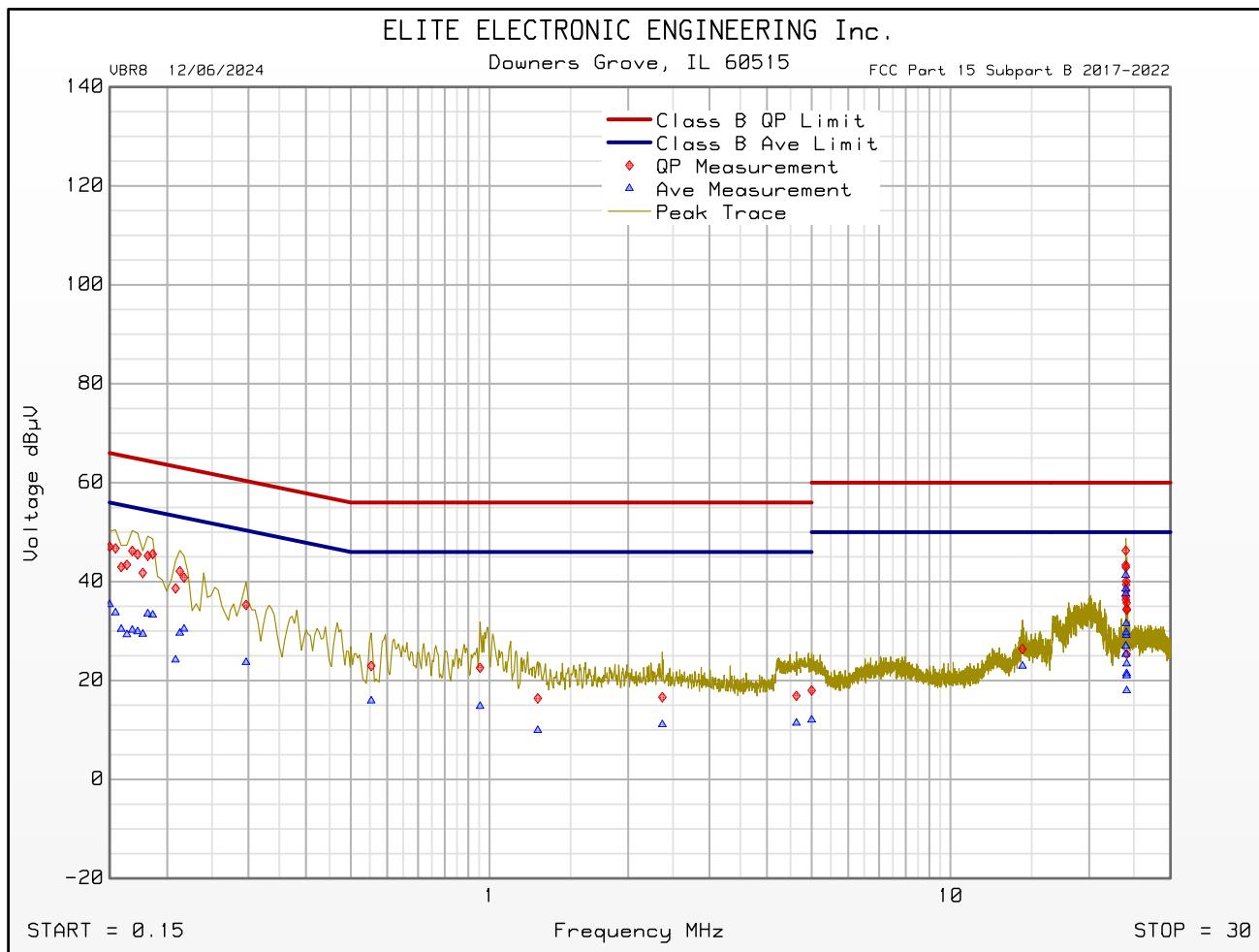
Freq MHz	Quasi-peak Level dB μ V	Quasi-peak Limit dB μ V	Excessive Quasi-peak Emissions	Average Level dB μ V	Average Limit dB μ V	Excessive Average Emissions
0.186	45.6	64.2		33.3	54.2	
0.297	35.3	60.3		23.7	50.3	
0.554	23.0	56.0		15.9	46.0	
0.954	22.6	56.0		14.8	46.0	
1.273	16.4	56.0		9.9	46.0	
2.372	16.6	56.0		11.1	46.0	
5.000	18.0	56.0		12.0	46.0	
14.329	26.4	60.0		22.9	50.0	
24.003	46.3	60.0		41.3	50.0	

FCC Part 15 Subpart B Conducted Emissions Test

Cumulative Data

VBR8 12/06/2024

Manufacturer : The Chamberlain Group LLC
 Model : 900-15607-11
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 Serial Number : Radiated Sample
 DUT Mode : MultiTx w/ Realtek WiFi
 Line Tested : Neutral
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 Meas. Threshold [dB] : -10
 Notes : 902.25MHz ON, 11b 2412MHz ON, 2480MHz ON
 Test Engineer : J. Cardenas
 RBW : 9 kHz
 Limit : FCC 15.207 / RSS GEN SECTION 8.8
 Test Date : Mar 18, 2025 08:43:23 AM



Emissions Meet QP Limit
 Emissions Meet Ave Limit

FCC Part 15 Subpart B Conducted Emissions Test

Significant Emissions Data

VBR8 12/06/2024

Manufacturer : The Chamberlain Group LLC
 Model : 900-15607-11
 DUT Revision : 900MHz ON, BLE ON, Sec+3.0 ON
 Serial Number : Radiated Sample
 DUT Mode : MultiTx w/ Realtek BLE
 Line Tested : Line
 Scan Step Time [ms] : 30
 Meas. Threshold [dB] : -10
 Notes : 902.25MHz ON, 2480MHz ON, 2402MHz ON
 Test Engineer : J. Cardenas
 RBW : 9 kHz
 Limit : FCC 15.207 / RSS GEN SECTION 8.8
 Test Date : Mar 18, 2025 09:16:26 AM
 Data Filter : Up to 80 maximum levels detected with 6 dB level excursion threshold over 10 dB margin below limit

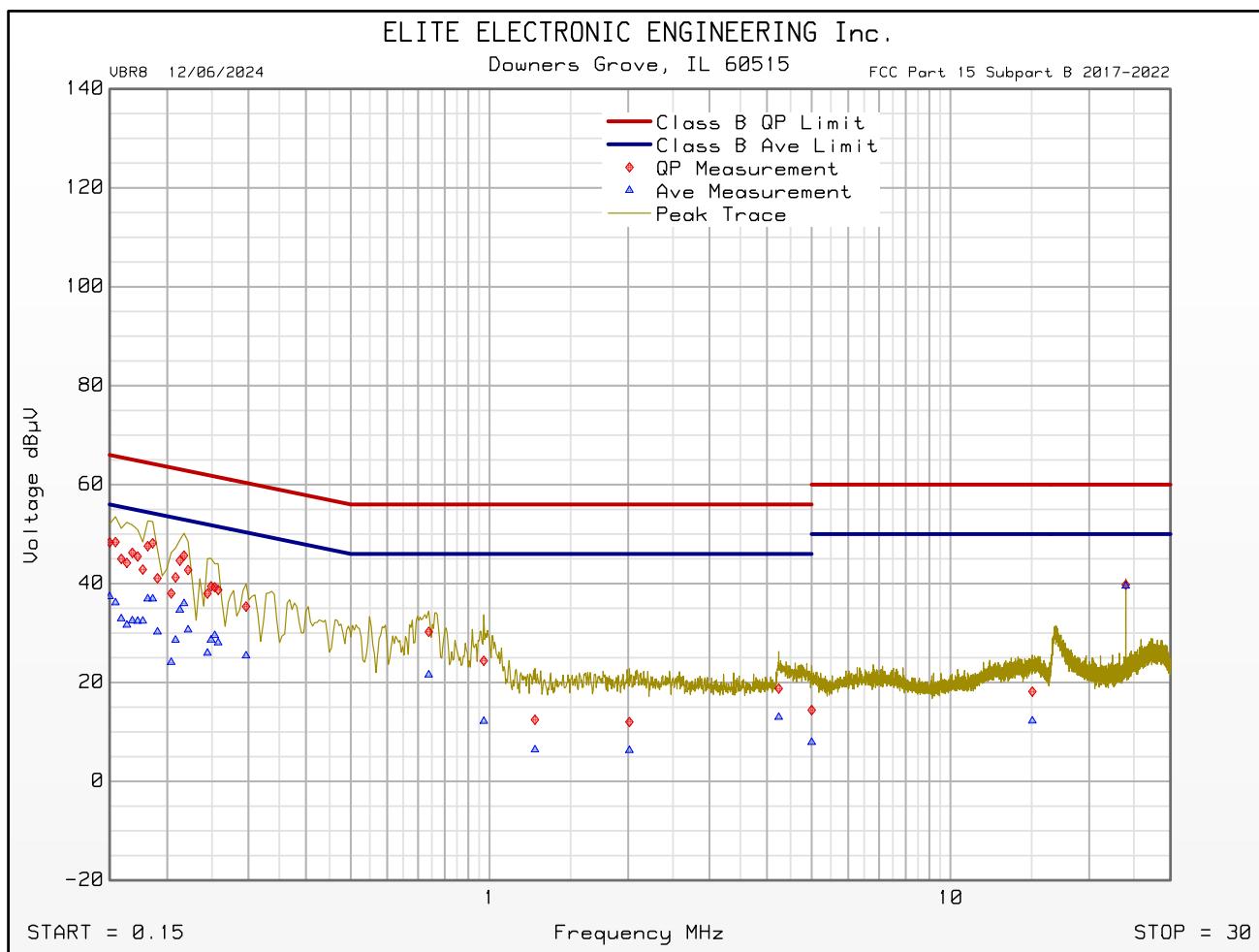
Freq MHz	Quasi-peak Level dB μ V	Quasi-peak Limit dB μ V	Excessive Quasi-peak Emissions	Average Level dB μ V	Average Limit dB μ V	Excessive Average Emissions
0.186	48.2	64.2		36.9	54.2	
0.297	35.4	60.3		25.4	50.3	
0.739	30.2	56.0		21.5	46.0	
0.972	24.4	56.0		12.2	46.0	
1.255	12.5	56.0		6.4	46.0	
2.012	12.0	56.0		6.3	46.0	
4.241	18.8	56.0		13.0	46.0	
5.000	14.4	56.0		7.9	46.0	
15.053	18.2	60.0		12.2	50.0	
24.003	39.8	60.0		39.5	50.0	

FCC Part 15 Subpart B Conducted Emissions Test

Cumulative Data

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 Line Tested : Line
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 Notes : 902.25MHz ON, 2480MHz ON, 2402MHz ON
 Test Engineer : J. Cardenas
 RBW : 9 kHz
 Limit : FCC 15.207 / RSS GEN SECTION 8.8 / RSS GEN SECTION 8.8
 Test Date : Mar 18, 2025 09:16:26 AM



Emissions Meet QP Limit
 Emissions Meet Ave Limit

FCC Part 15 Subpart B Conducted Emissions Test

Significant Emissions Data

VBR8 12/06/2024

Manufacturer : The Chamberlain Group LLC
 Model : 900-15607-11
 DUT Revision : 900MHz ON, BLE ON, Sec+3.0 ON
 Serial Number : Radiated Sample
 DUT Mode : MultiTx w/ Realtek BLE
 Line Tested : Neutral
 Scan Step Time [ms] : 30
 Meas. Threshold [dB] : -10
 Notes : 902.25MHz ON, 2480MHz ON, 2402MHz ON
 Test Engineer : J. Cardenas
 RBW : 9 kHz
 Limit : FCC 15.207 / RSS GEN SECTION 8.8
 Test Date : Mar 18, 2025 09:34:34 AM
 Data Filter : Up to 80 maximum levels detected with 6 dB level excursion threshold over 10 dB margin below limit

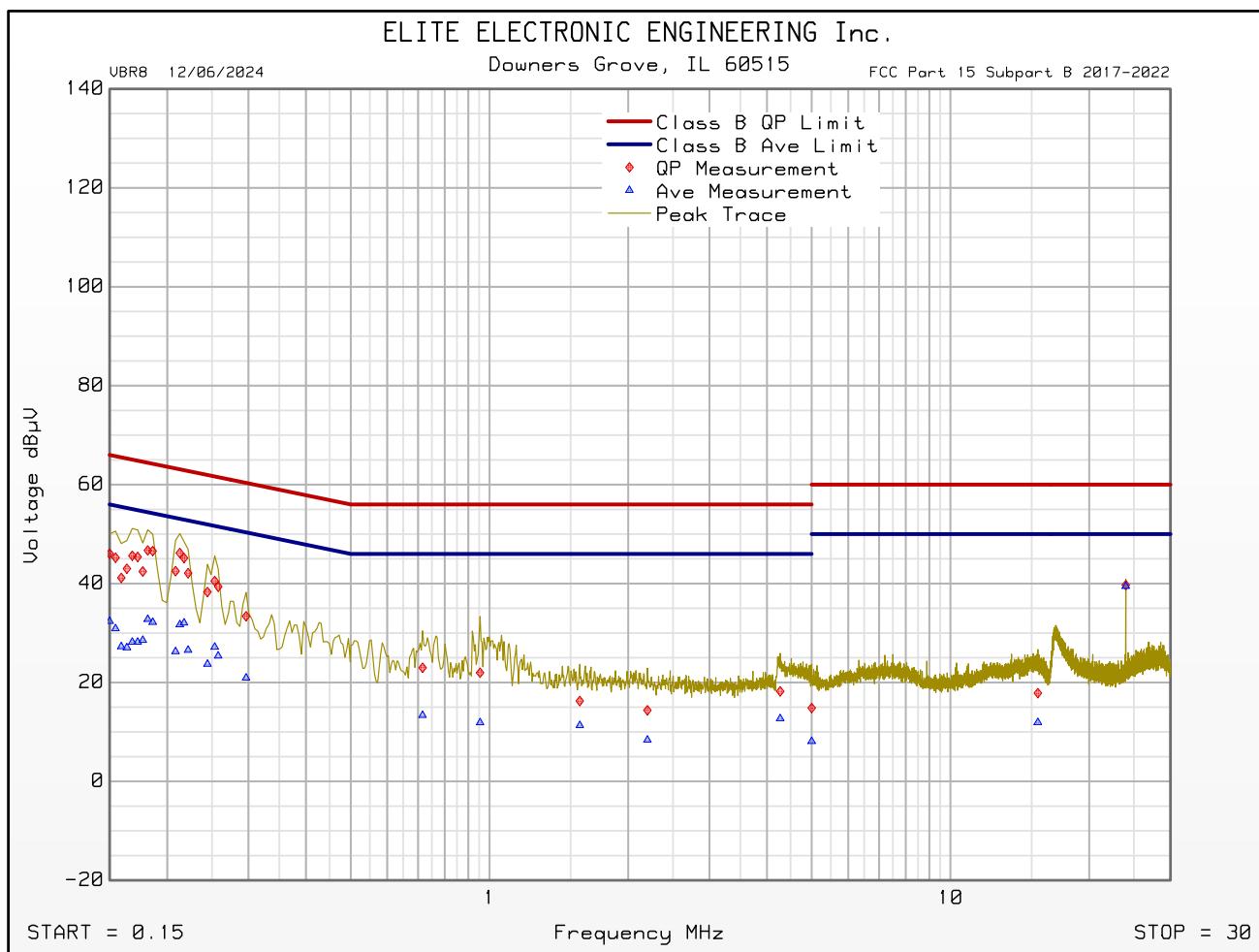
Freq MHz	Quasi-peak Level dB μ V	Quasi-peak Limit dB μ V	Excessive Quasi-peak Emissions	Average Level dB μ V	Average Limit dB μ V	Excessive Average Emissions
0.213	46.2	63.1		31.7	53.1	
0.297	33.4	60.3		20.9	50.3	
0.716	23.0	56.0		13.4	46.0	
0.954	22.0	56.0		11.9	46.0	
1.570	16.3	56.0		11.3	46.0	
2.201	14.4	56.0		8.4	46.0	
4.273	18.2	56.0		12.7	46.0	
5.000	14.8	56.0		8.1	46.0	
15.467	17.8	60.0		11.9	50.0	
24.003	39.7	60.0		39.5	50.0	

FCC Part 15 Subpart B Conducted Emissions Test

Cumulative Data

VBR8 12/06/2024

Manufacturer : The Chamberlain Group LLC
 Model : 900-15607-11
 DUT Revision : 900MHz ON, BLE ON, Sec+3.0 ON
 Serial Number : Radiated Sample
 DUT Mode : MultiTx w/ Realtek BLE
 Line Tested : Neutral
 Scan Step Time [ms] : 30
 Meas. Threshold [dB] : -10
 Notes : 902.25MHz ON, 2480MHz ON, 2402MHz ON
 Test Engineer : J. Cardenas
 RBW : 9 kHz
 Limit : FCC 15.207 / RSS GEN SECTION 8.8
 Test Date : Mar 18, 2025 09:34:34 AM



Emissions Meet QP Limit
 Emissions Meet Ave Limit

21. Multi-Tx Spurious Emissions

EUT Information	
Manufacturer	The Chamberlain Group LLC
Product	Vulcan – 900-15607 Rev F
Model No.	900-15607-11
Serial No.	Radiated Sample
Mode	MultiTx w/ Realtek WiFi MultiTx w/ Realtek BLE

Test Site Information	
Setup Format	Tabletop
Type of Test Site	Semi-Anechoic Chamber
Test Site Used	Room 21
Type of Antennas Used	Below 1GHz: Bilog (or equivalent) Above 1GHz: Double-ridged waveguide (or equivalent)
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

Requirements

Per 996369 D04 Module Integration Guide v01:

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).

FCC 15.247:

In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30dB instead of 20dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Procedures

Radiated measurements were performed in a 32ft. x 20ft. x 18ft. hybrid ferrite-tile/anechoic absorber lined test chamber. The walls and ceiling of the shielded chamber are lined with ferrite tiles and anechoic absorber material is installed over the ferrite tiles. The floor of the chamber is used as the ground plane. The chamber complies with ANSI C63.4-2014 for site attenuation.

The shielded enclosure prevents emissions from other sources, such as radio and TV stations, from interfering with the measurements. All power lines and signal lines entering the enclosure pass through filters on the enclosure wall. The powerline filters prevent extraneous signals from entering the enclosure on these leads.

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

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

- 1) For all harmonics not in the restricted bands, the following procedure was used:
 - a) The field strength of the fundamental was measured using a double ridged waveguide antenna. The waveguide antenna was positioned at a 3 meter distance from the EUT. The EUT was placed on a 1.5 meter high non-conductive stand. A peak detector with a resolution bandwidth of 100 kHz was used on the spectrum analyzer.
 - b) The field strengths of all of the harmonics not in the restricted band were then measured using a double-ridged waveguide antenna. The waveguide antenna was positioned at a 3 meter distance from the EUT. The EUT was placed on a 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 20dB below levels measured at the fundamental. However, attenuation below the general limits specified in §15.209(a) is not required.
- 2) For all emissions in the restricted bands, the following procedure was used:
 - a) The field strengths of all emissions below 1GHz were measured using a bi-log antenna. The bi-log antenna was positioned at a 3 meter distance from the EUT. The EUT was placed on an 80cm high non-conductive stand. A peak detector with a resolution bandwidth of 100kHz was used on the spectrum analyzer.
 - b) The field strengths of all emissions above 1GHz were measured using a double-ridged waveguide antenna. The waveguide antenna was positioned at a 3 meter distance from the EUT. The EUT was placed on a 1.5 meter high non-conductive stand. A peak detector with a resolution bandwidth of 1MHz was used on the spectrum analyzer.

- c) To ensure that maximum (or worst case) emission levels were measured, the following steps were taken when taking all measurements:
 - i. The EUT was rotated so that all of its sides were exposed to the receiving antenna.
 - ii. Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
 - iii. The measuring antenna was raised and lowered for each antenna polarization to maximize the readings.
 - iv. In instances where it was necessary to use a shortened cable between the measuring antenna and the spectrum analyzer, the measuring antenna was not raised or lowered to ensure maximized readings. Instead, the EUT was rotated through all axis to ensure the maximum readings were recorded.
- d) For all radiated emissions measurements below 1GHz, if the peak reading is below the limits listed in §15.209(a), no further measurements are required. If, however, the peak readings exceed the limits listed in 15.209(a), then the emissions are remeasured using a quasi-peak detector.
- e) For all radiated emissions measurements above 1GHz, the peak readings must comply with the §15.35(b) limits. §15.35(b) states that when average radiated emissions measurements are specified, there also is a limit on the peak level of the radiated emissions. The limit on the peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. Therefore, all peak readings above 1GHz must be no greater than 20dB above the limits specified in §15.209(a).
- f) Next, for all radiated emissions measurements above 1GHz, the resolution bandwidth was set to 1MHz. The analyzer was set to linear mode with a 10Hz video bandwidth in order to simulate an average detector and an average reading was taken.



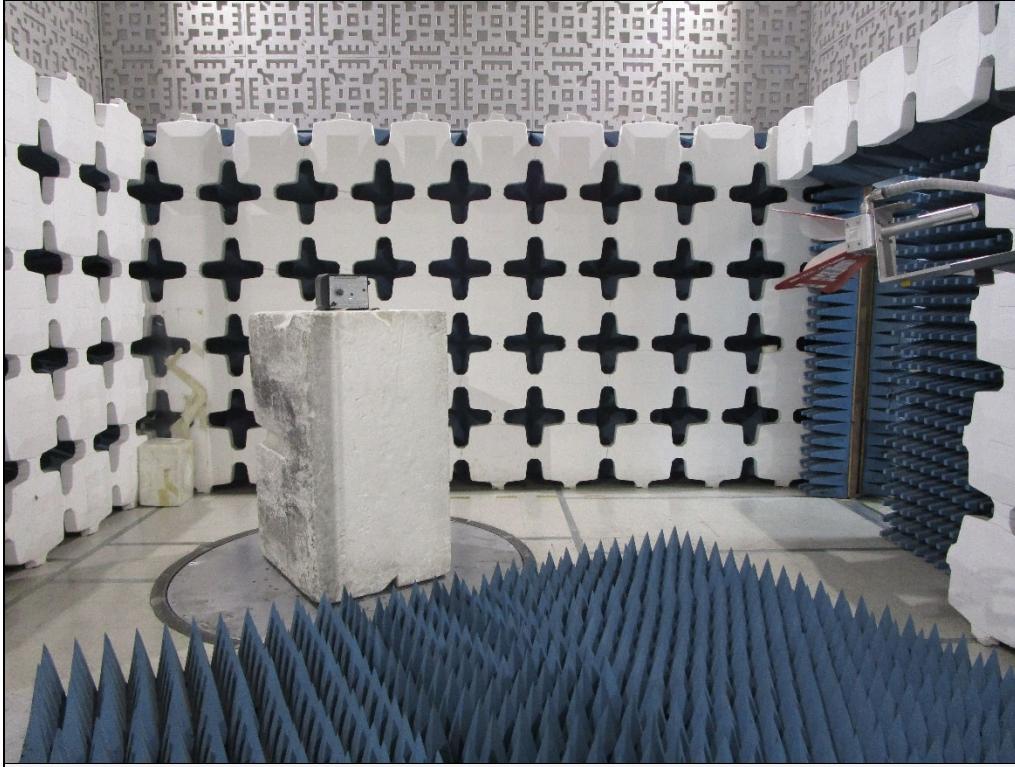
Test Setup for Spurious Emissions: 30MHz to 1GHz, Horizontal Polarization



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

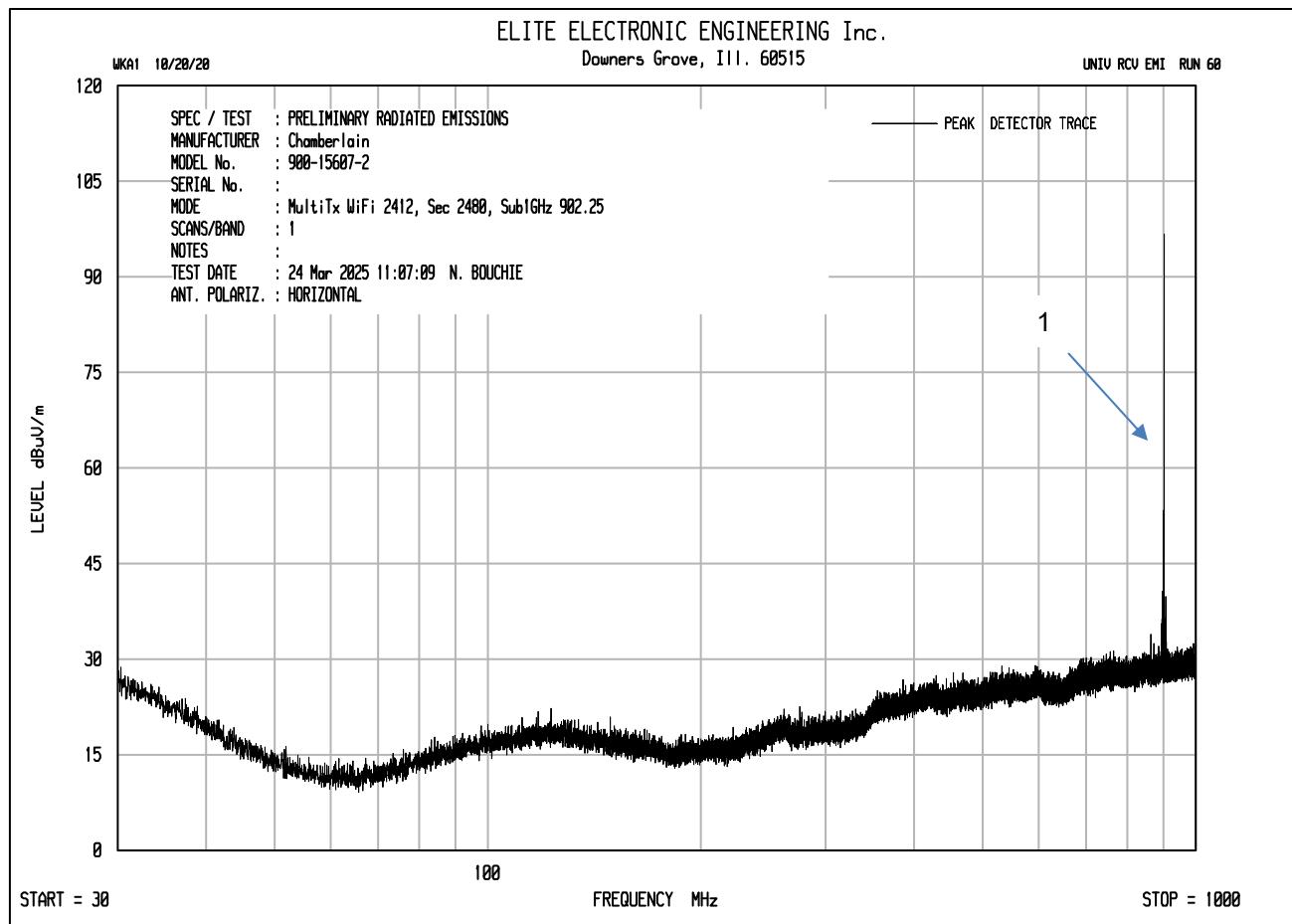


Test Setup for Spurious Radiated Emissions, 1 – 18MHz – Antenna Polarization
Horizontal



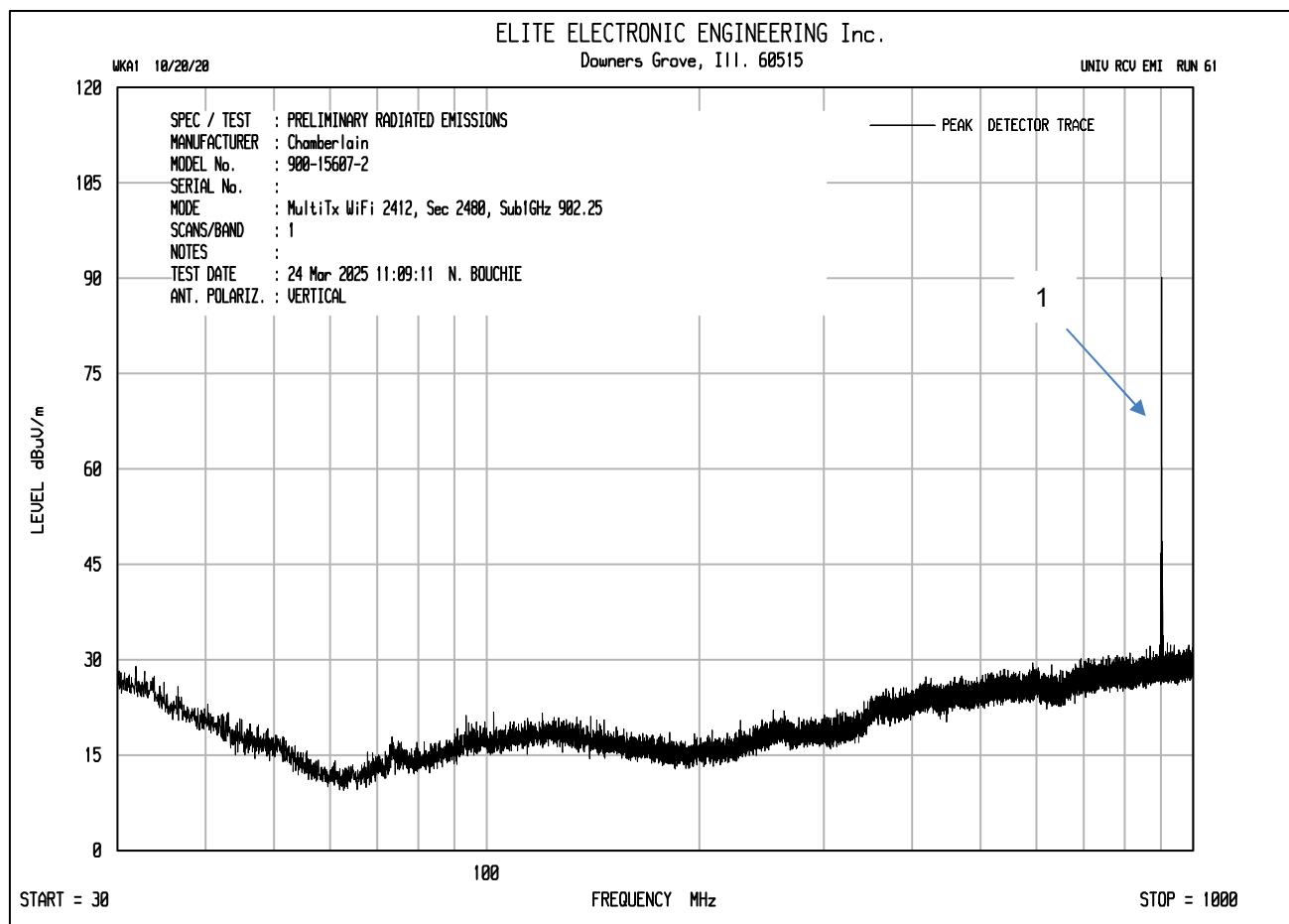
Test Setup for Spurious Radiated Emissions, 1 – 18MHz – Antenna Polarization
Vertical

Test Details	
Manufacturer	The Chamberlain Group LLC
Model No.	900-15607-11
Serial No.	Radiated Sample
Test	Host Product Testing – Case Spurious Emissions
Mode	MultiTx w/ Realtek WiFi
Frequencies Tested	902.25MHz, 2412MHz, and 2480MHz
Notes	None



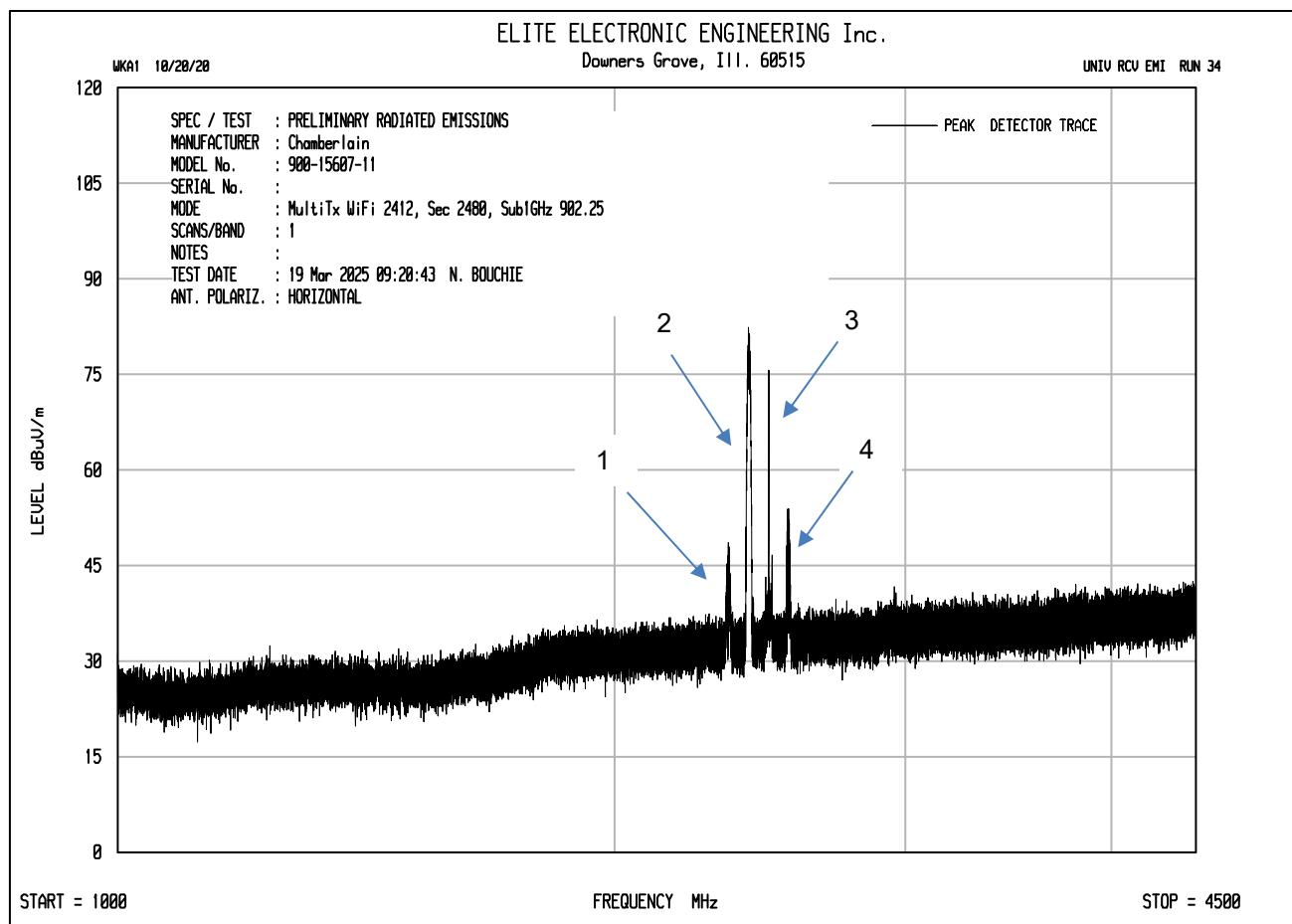
1 = 902.25MHz Fundamental

Test Details	
Manufacturer	The Chamberlain Group LLC
Model No.	900-15607-11
Serial No.	Radiated Sample
Test	Host Product Testing – Case Spurious Emissions
Mode	MultiTx w/ Realtek WiFi
Frequencies Tested	902.25MHz, 2412MHz, and 2480MHz
Notes	None



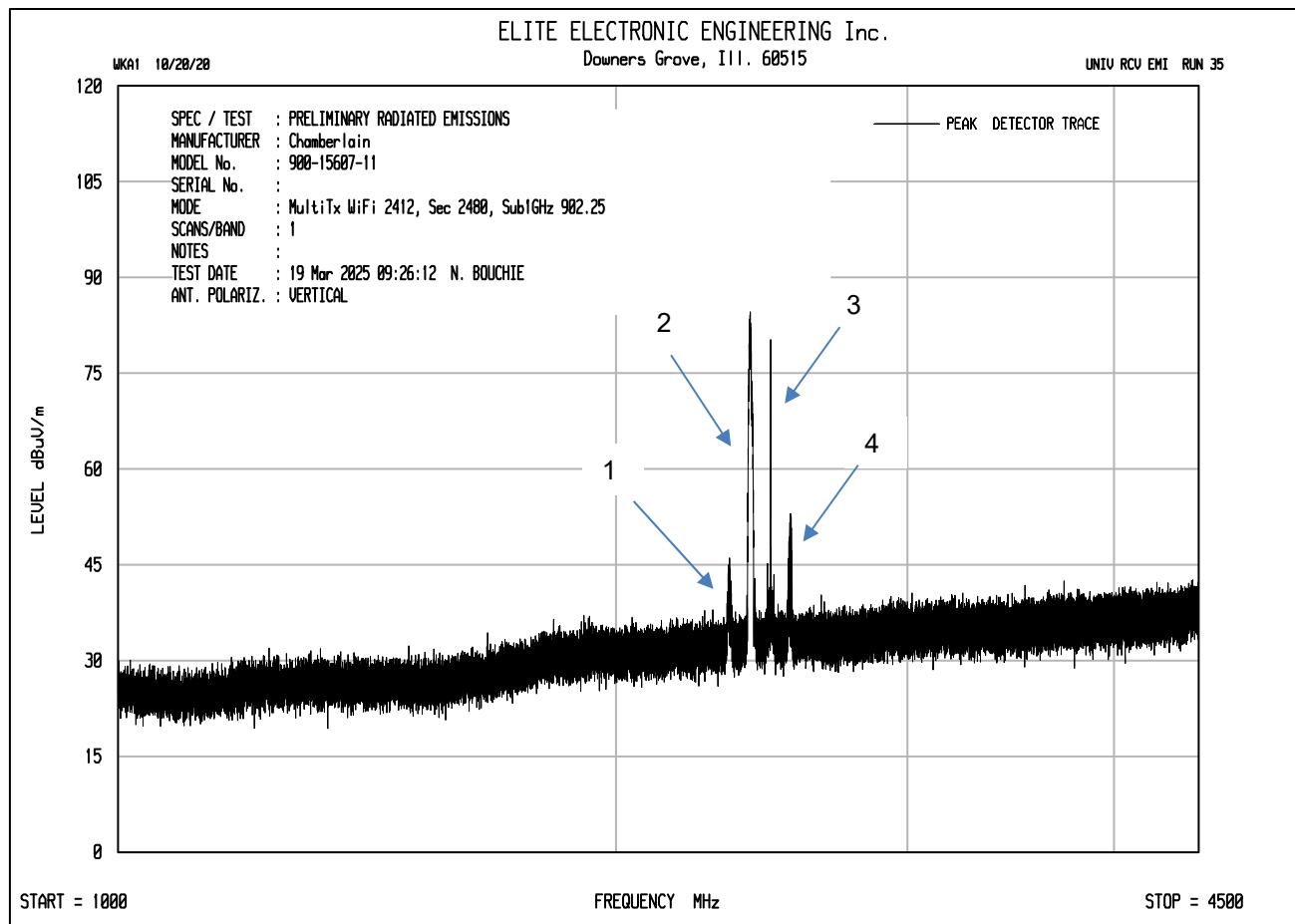
1 = 902.25MHz Fundamental

Test Details	
Manufacturer	The Chamberlain Group LLC
Model No.	900-15607-11
Serial No.	Radiated Sample
Test	Host Product Testing – Case Spurious Emissions
Mode	MultiTx w/ Realtek WiFi
Frequencies Tested	902.25MHz, 2412MHz, and 2480MHz
Notes	None



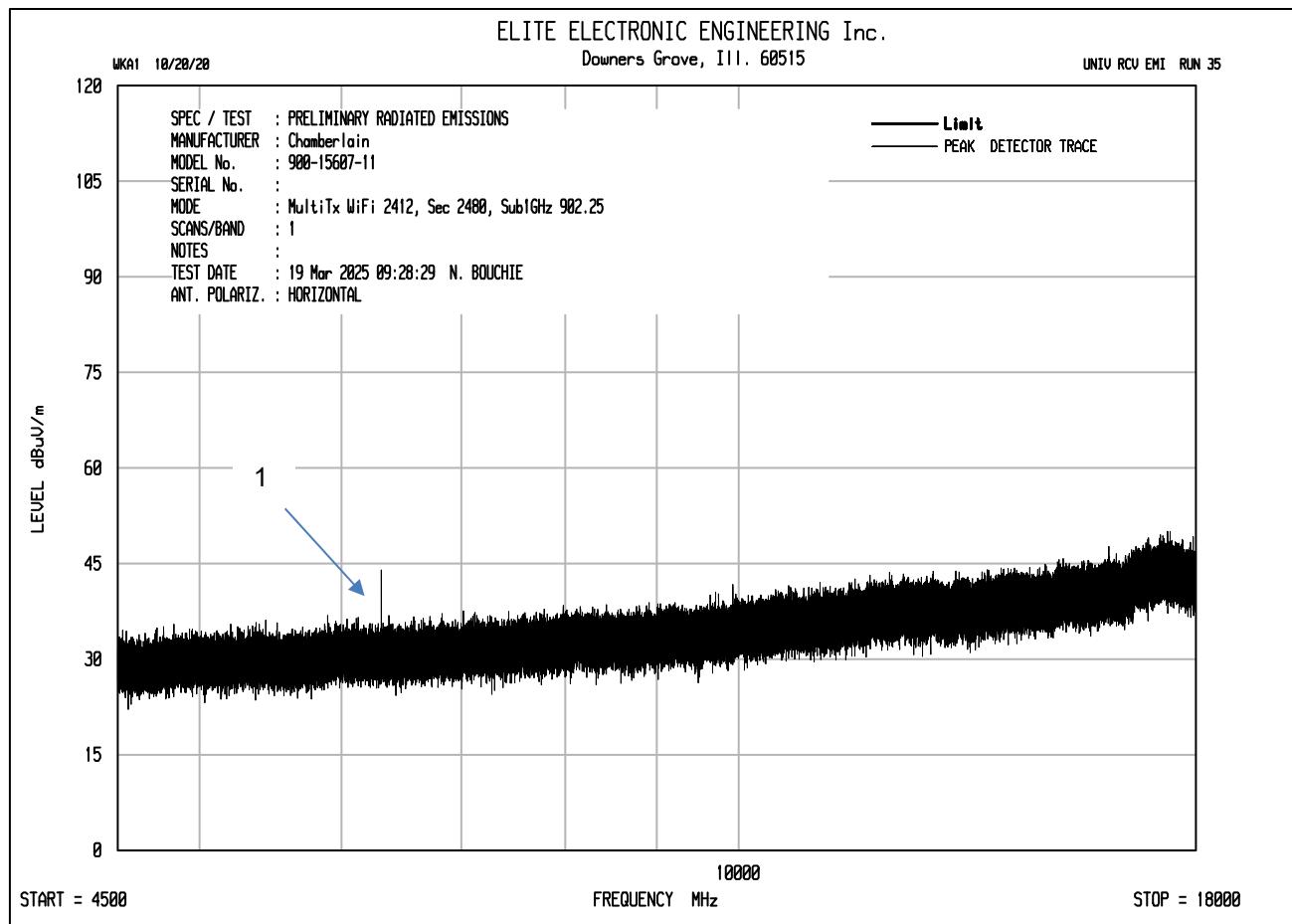
1 = 2 * 2412 - 1 * 2480 = 2344MHz
 2 = 2412MHz Fundamental
 3 = 2480MHz Fundamental
 4 = 2 * 2480 - 1 * 2412 = 2548MHz

Test Details	
Manufacturer	The Chamberlain Group LLC
Model No.	900-15607-11
Serial No.	Radiated Sample
Test	Host Product Testing – Case Spurious Emissions
Mode	MultiTx w/ Realtek WiFi
Frequencies Tested	902.25MHz, 2412MHz, and 2480MHz
Notes	None



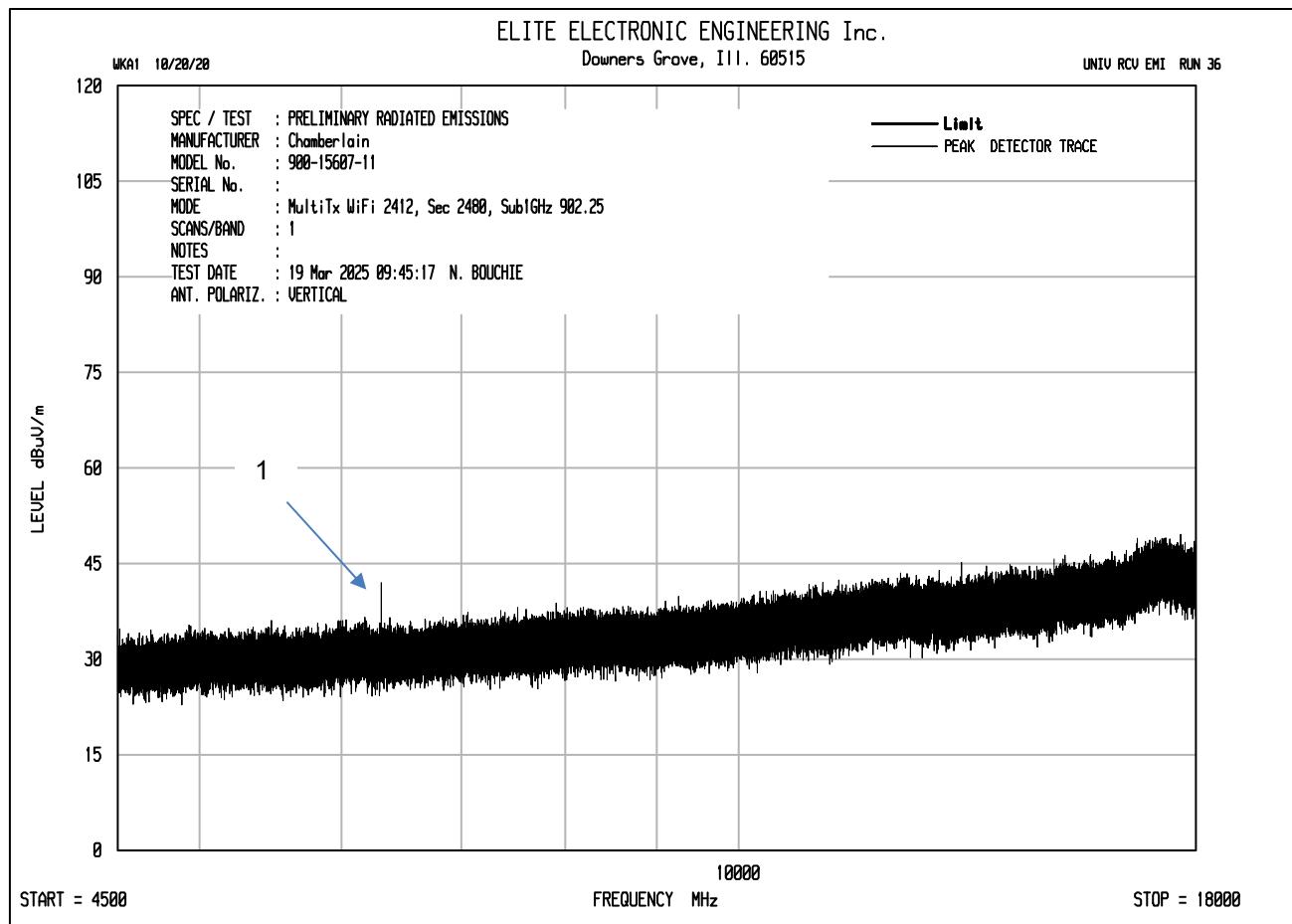
1 = 2 * 2412 - 1 * 2480 = 2344MHz
 2 = 2412MHz Fundamental
 3 = 2480MHz Fundamental
 4 = 2 * 2480 - 1 * 2412 = 2548MHz

Test Details	
Manufacturer	The Chamberlain Group LLC
Model No.	900-15607-11
Serial No.	Radiated Sample
Test	Host Product Testing – Case Spurious Emissions
Mode	MultiTx w/ Realtek WiFi
Frequencies Tested	902.25MHz, 2412MHz, and 2480MHz
Notes	None



$$1 = 7 * 902.25\text{MHz} = 6315.75\text{MHz}$$

Test Details	
Manufacturer	The Chamberlain Group LLC
Model No.	900-15607-11
Serial No.	Radiated Sample
Test	Host Product Testing – Case Spurious Emissions
Mode	MultiTx w/ Realtek WiFi
Frequencies Tested	902.25MHz, 2412MHz, and 2480MHz
Notes	None



$$1 = 7 * 902.25\text{MHz} = 6315.75\text{MHz}$$

Test Details										
Manufacturer	The Chamberlain Group LLC									
Model No.	900-15607-11									
Serial No.	Radiated Sample									
Test	Host Product Testing – Case Spurious Emissions									
Mode	MultiTx w/ Realtek WiFi									
Frequencies Tested	902.25MHz, 2412MHz, and 2480MHz									
Notes	None									

Peak Measurements in the Restricted Bands

Freq (MHz)	Ant Pol	Meter Reading (dB μ V)	Ambient	Cable Factor (dB)	Antenna Factor (dB/m)	Pre Amp (dB)	Peak Total at 3m (dB μ V/m)	Peak Total at 3m (μ V/m)	Peak Limit at 3m (μ V/m)	Margin (dB)
2344.00	H	37.4		3.4	32.5	0.0	73.3	4622.2	5000.0	-0.7
	V	33.5		3.4	32.5	0.0	69.3	2929.8	5000.0	-4.6

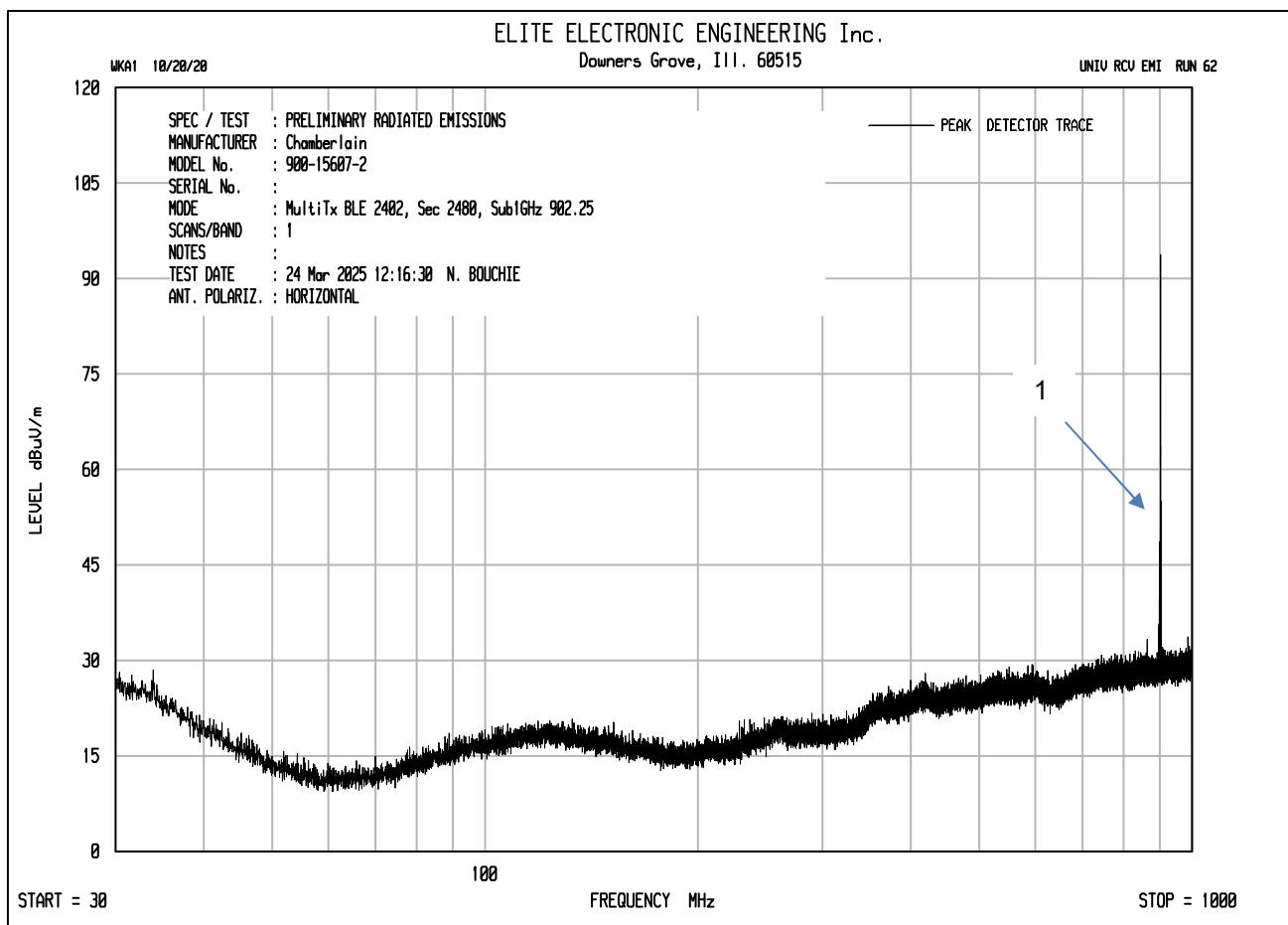
Average Measurements in the Restricted Bands

Freq (MHz)	Ant Pol	Meter Reading (dB μ V)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Duty Cycle Factor (dB)	Average Total at 3m (dB μ V/m)	Average Total at 3m (μ V/m)	Average Limit at 3m (μ V/m)	Margin (dB)
2344.00	H	24.08		3.4	32.5	0.0	-18.9	41.0	112.4	500.0	-13.0
	V	19.96		3.4	32.5	0.0	-18.9	36.9	70.0	500.0	-17.1

Peak Measurements in the Non-Restricted Bands

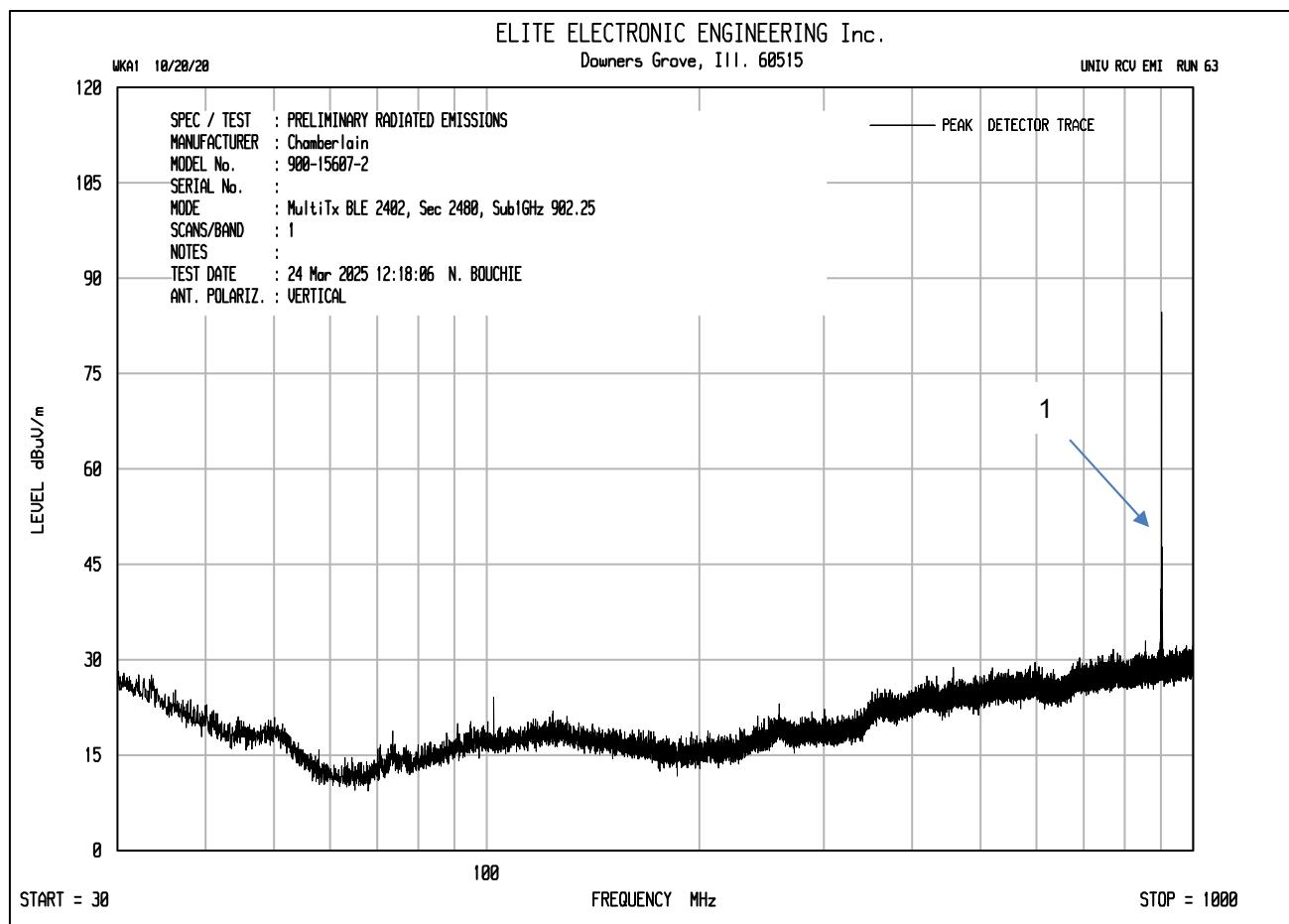
Freq (MHz)	Ant Pol	Meter Reading (dB μ V)	Ambient	Cable Factor (dB)	Antenna Factor (dB/m)	Pre Amp (dB)	Peak Total at 3m (dB μ V/m)	Peak Total at 3m (μ V/m)	Peak Limit at 3m (μ V/m)	Margin (dB)
2548.00	H	34.28		3.6	32.8	0.0	70.6	3391.8	15548.2	-13.2
	V	32.32		3.6	32.8	0.0	68.6	2706.6	15548.2	-15.2

Test Details	
Manufacturer	The Chamberlain Group LLC
Model No.	900-15607-11
Serial No.	Radiated Sample
Test	Host Product Testing – Case Spurious Emissions
Mode	MultiTx w/ Realtek BLE
Frequencies Tested	902.25MHz, 2480MHz, and 2402MHz
Notes	None



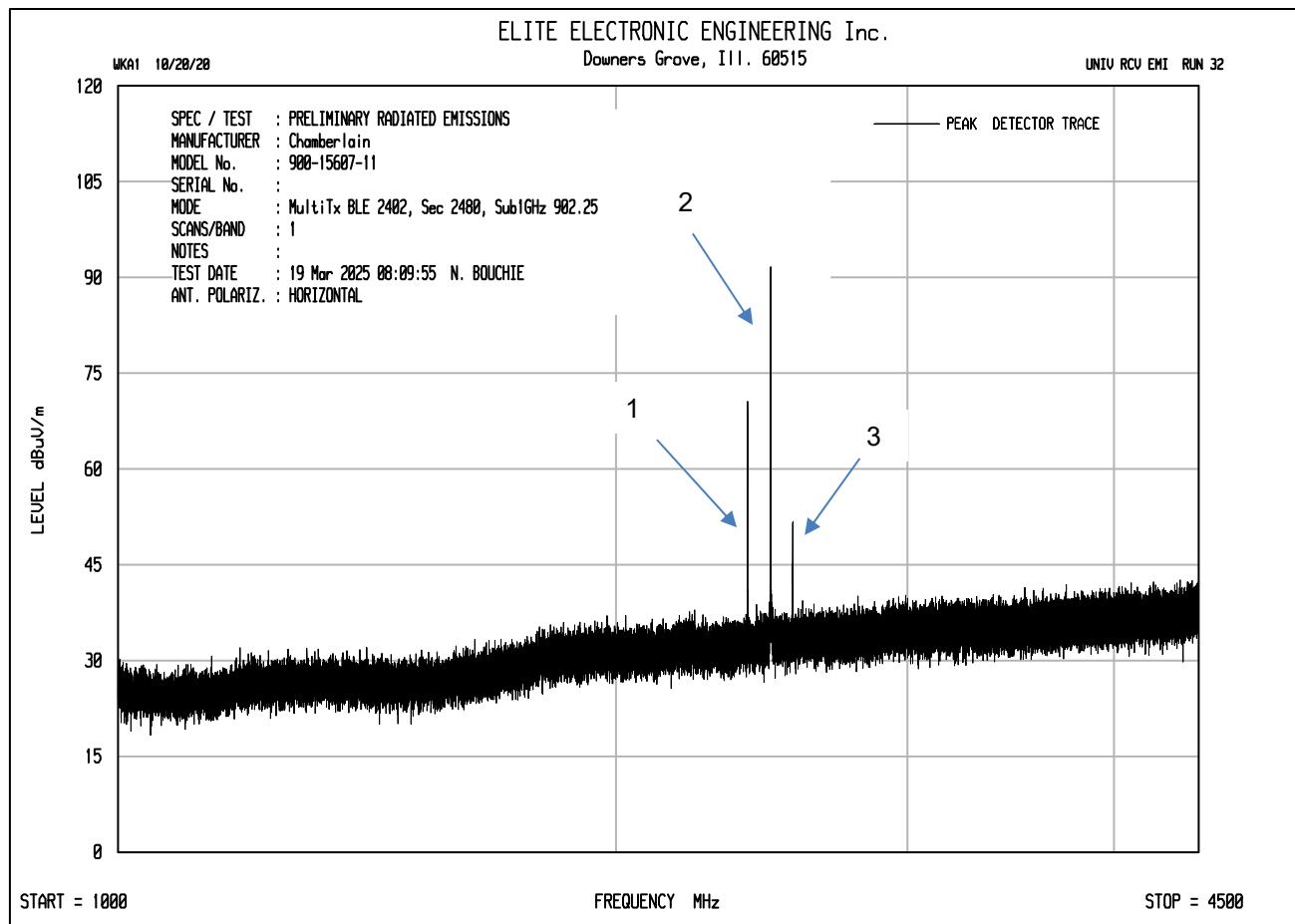
1 = 902.25MHz Fundamental

Test Details	
Manufacturer	The Chamberlain Group LLC
Model No.	900-15607-11
Serial No.	Radiated Sample
Test	Host Product Testing – Case Spurious Emissions
Mode	MultiTx w/ Realtek BLE
Frequencies Tested	902.25MHz, 2480MHz, and 2402MHz
Notes	None



1 = 902.25MHz Fundamental

Test Details	
Manufacturer	The Chamberlain Group LLC
Model No.	900-15607-11
Serial No.	Radiated Sample
Test	Host Product Testing – Case Spurious Emissions
Mode	MultiTx w/ Realtek BLE
Frequencies Tested	902.25MHz, 2480MHz, and 2402MHz
Notes	None

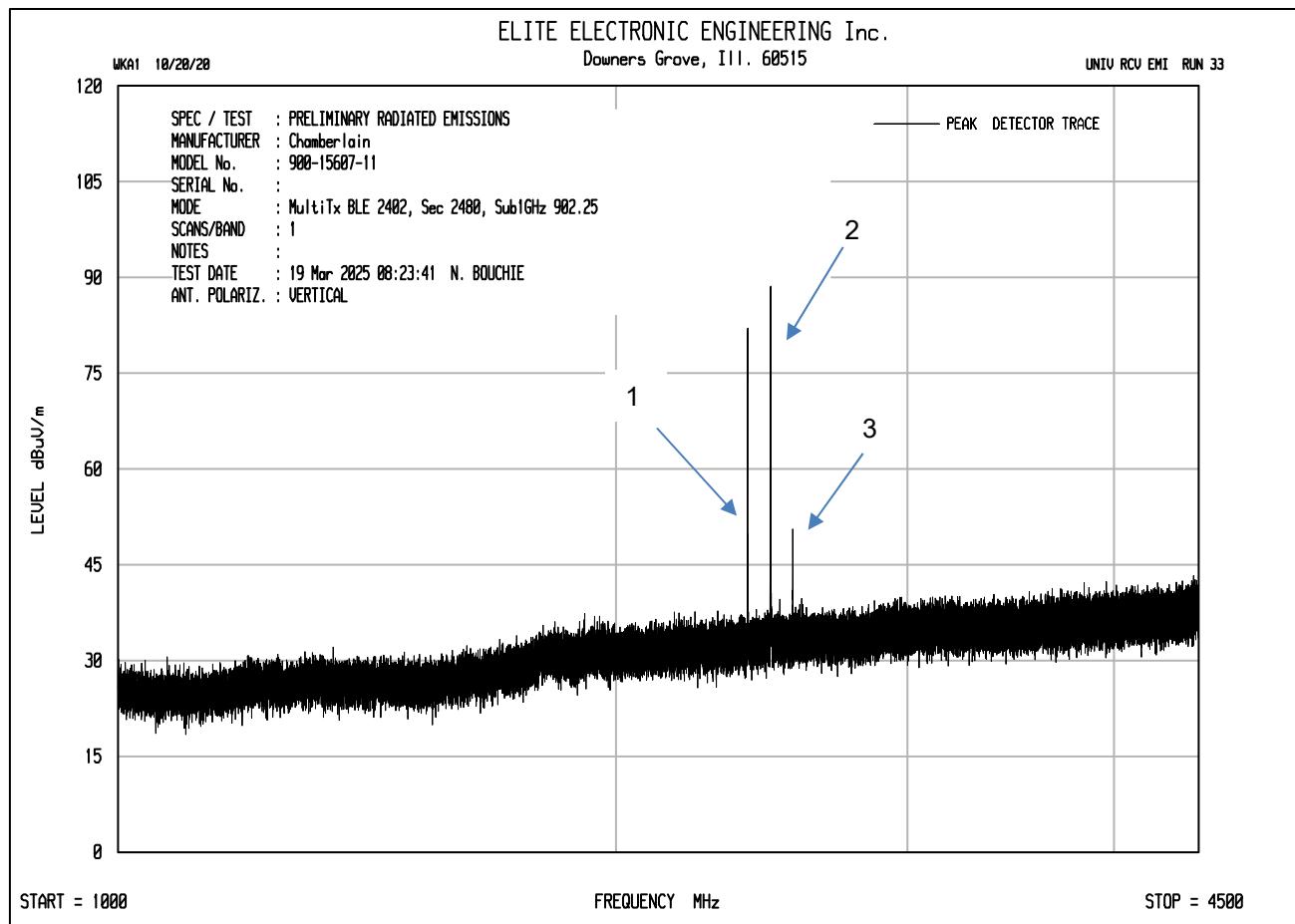


1 = 2402MHz Fundamental

2 = 2480MHz Fundamental

3 = 2 * 2480 - 1 * 2402 = 2558MHz

Test Details	
Manufacturer	The Chamberlain Group LLC
Model No.	900-15607-11
Serial No.	Radiated Sample
Test	Host Product Testing – Case Spurious Emissions
Mode	MultiTx w/ Realtek BLE
Frequencies Tested	902.25MHz, 2480MHz, and 2402MHz
Notes	None

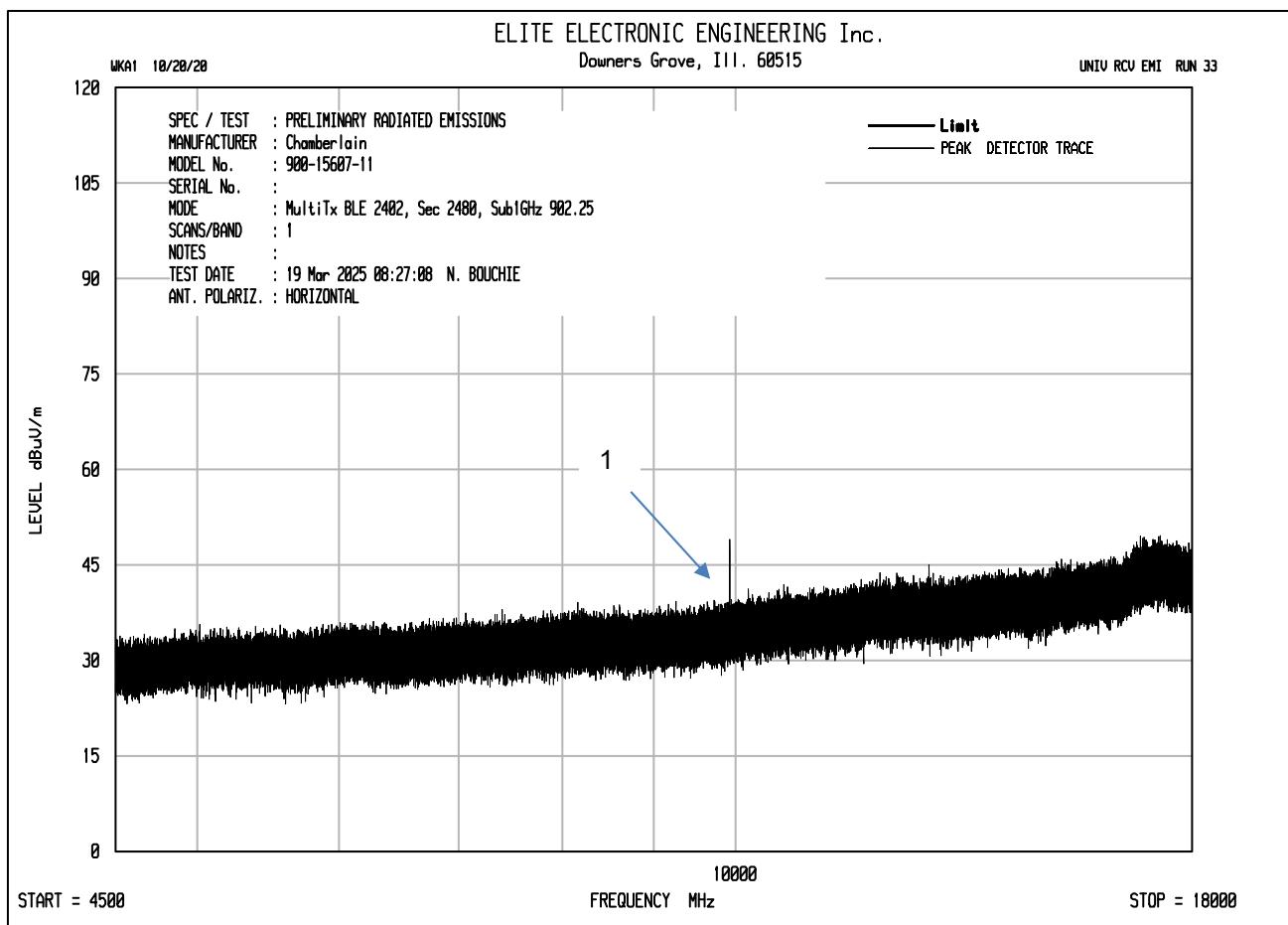


1 = 2402MHz Fundamental

2 = 2480MHz Fundamental

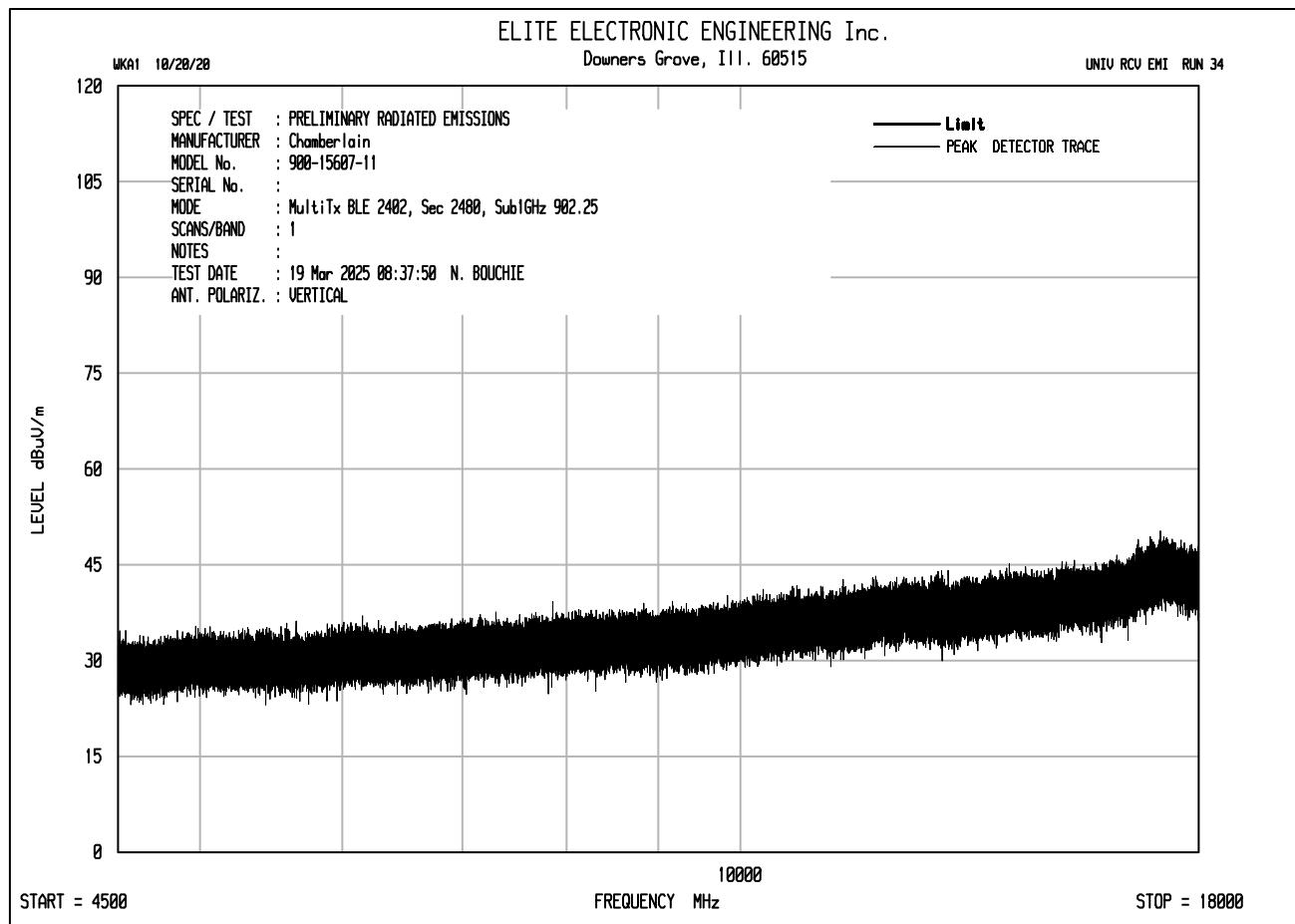
3 = 2 * 2480 - 1 * 2402 = 2558MHz

Test Details	
Manufacturer	The Chamberlain Group LLC
Model No.	900-15607-11
Serial No.	Radiated Sample
Test	Host Product Testing – Case Spurious Emissions
Mode	MultiTx w/ Realtek BLE
Frequencies Tested	902.25MHz, 2480MHz, and 2402MHz
Notes	None



$$1 = 7 * 902.25\text{MHz} = 6315.75\text{MHz}$$

Test Details	
Manufacturer	The Chamberlain Group LLC
Model No.	900-15607-11
Serial No.	Radiated Sample
Test	Host Product Testing – Case Spurious Emissions
Mode	MultiTx w/ Realtek BLE
Frequencies Tested	902.25MHz, 2480MHz, and 2402MHz
Notes	None



Test Details	
Manufacturer	The Chamberlain Group LLC
Model No.	900-15607-11
Serial No.	Radiated Sample
Test	Host Product Testing – Case Spurious Emissions
Mode	MultiTx w/ Realtek BLE
Frequencies Tested	902.25MHz, 2480MHz, and 2402MHz
Notes	None

Peak Measurements in the Non-Restricted Bands

Freq (MHz)	Ant Pol	Meter Reading (dB μ V)	Ambient	Cable Factor (dB)	Antenna Factor (dB/m)	Pre Amp (dB)	Peak Total at 3m (dB μ V/m)	Peak Total at 3m (μ V/m)	Peak Limit at 3m (μ V/m)	Margin (dB)
2558.00	H	29.86		3.6	32.8	0.0	66.2	2037.4	15686.8	-17.7
	V	29.19		3.6	32.8	0.0	65.5	1886.2	15686.8	-18.4

22. 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, 2025

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:*Transient Immunity**(Max Voltage 60V/Max current 100A)*Test Method(s)¹:

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)**(Up to +/-25kV)*

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, CE 430, CE440)

(A2LA Cert. No. 1786.01) 08/15/2023



Page 1 of 9

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

Test Technology:

Radiated Emissions Anechoic
(Up to 6GHz)

Test Method(s)¹:

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, RE320);

Vehicle Radiated Emissions

CISPR 12; CISPR 36; ICES-002;
ECE Regulation 10.06 Annex 5

Bulk Current Injection (BCI)
(1 to 400MHz 500mA)

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

Radiated Immunity Anechoic
(Up to 6GHz and 200V/m)
(Including Radar Pulse 600V/m)

ISO 11452-2;
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; FMC 1278 (RI140)

Radiated Immunity Reverb
(360MHz to 6GHz and 100V/m)

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)
(Up to 6GHz and 20W)

ISO 11452-9;
EMC-CS-2009.1 (RI115); FMC1278 (RI115);
GMW 3097, Sec 3.4.4

Vehicle Radiated Immunity (ALSE)

ISO 11451-2; ECE Regulation 10.06 Annex 6

Vehicle Product Specific EMC Standards

EN 14982; EN ISO 13309; ISO 13766; EN 50498;
EC Regulation No. 2015/208; EN 55012

Electrical Loads

ISO 16750-2

Stripline

ISO 11452-5

Transverse Electromagnetic (TEM) Cell

ISO 11452-3

Test Technology:
Test Method(s)¹:
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; KS C 9811; CNS 13803 (1997, 2003);
CISPR 14-1; EN 55014-1; AS/NZS CISPR 14.1;
CISPR 16-2-1 (2008); CISPR 16-2-1; KS C 9814-1; KN 14-1;
IEC/CISPR 22 (1997);
EN 55022 (1998) + A1(2000);
EN 55022 (1998) + A1(2000) + A2(2003); EN 55022 (2006);
IEC/CISPR 22 (2008-09); AS/NZS CISPR 22 (2004);
AS/NZS CISPR 22, 3rd Edition (2006); KN 22 (up to 6 GHz);
CNS 13438 (up to 6 GHz); VCCI V-3 (up to 6 GHz);
CISPR 32; EN 55032; KS C 9832; KN 32;
ECE Regulation 10.06 Annex 7 (Broadband);
ECE Regulation 10.06 Annex 8 (Narrowband);
ECE Regulation 10.06 Annex 14 (Conducted)

Cellular Radiated Spurious Emissions

ETSI TS 151 010-1 GSM; 3GPP TS 51.010-1, Sec 12;
ETSI TS 134 124 UMTS; 3GPP TS 34.124;
ETSI TS 136 124 LTE; E-UTRA; 3GPP TS 36.124

Current Harmonics

IEC 61000-3-2; IEC 61000-3-12;
EN 61000-3-2; KN 61000-3-2;
KS C 9610-3-2; ECE Regulation 10.06 Annex 11

Flicker and Fluctuations

IEC 61000-3-3; IEC 61000-3-11;
EN 61000-3-3; KN 61000-3-3;
KS C 9610-3-3; ECE Regulation 10.06 Annex 12

Immunity

Electrostatic Discharge

IEC 61000-4-2, Ed. 1.2 (2001);
IEC 61000-4-2 (1995) + A1(1998) + A2(2000);
EN 61000-4-2 (1995); EN 61000-4-2 (2009-05);
KN 61000-4-2 (2008-5);
RRL Notice No. 2008-4 (May 20, 2008);
IEC 61000-4-2; EN 61000-4-2; KN 61000-4-2;
KS C 9610-4-2; IEEE C37.90.3 2001

Radiated Immunity

IEC 61000-4-3 (1995) + A1(1998) + A2(2000);
IEC 61000-4-3, Ed. 3.0 (2006-02);
IEC 61000-4-3, Ed. 3.2 (2010);
KN 61000-4-3 (2008-5);
RRL Notice No. 2008-4 (May 20, 2008);
IEC 61000-4-3; EN 61000-4-3; KN 61000-4-3;
KS C 9610-4-3; IEEE C37.90.2 2004

<u>Test Technology:</u>	<u>Test Method(s)¹:</u>
Immunity (cont'd)	
Electrical Fast Transient/Burst	IEC 61000-4-4, Ed. 2.0 (2004-07); IEC 61000-4-4, Ed. 2.1 (2011); IEC 61000-4-4 (1995) + A1(2000) + A2(2001); KN 61000-4-4 (2008-5); RRL Notice No. 2008-5 (May 20, 2008); IEC 61000-4-4; EN 61000-4-4; KN 61000-4-4; KS C 9610-4-4; ECE Regulation 10.06 Annex 15
Surge	IEC 61000-4-5 (1995) + A1(2000); IEC 61000-4-5, Ed 1.1 (2005-11); EN 61000-4-5 (1995) + A1(2001); KN 61000-4-5 (2008-5); RRL Notice No. 2008-4 (May 20, 2008); IEC 61000-4-5; EN 61000-4-5; KN 61000-4-5; KS C 9610-4-5; IEEE C37.90.1 2012; IEEE STD C62.41.2 2002; ECE Regulation 10.06 Annex 16
Conducted Immunity	IEC 61000-4-6 (1996) + A1(2000); IEC 61000-4-6, Ed 2.0 (2006-05); IEC 61000-4-6 Ed. 3.0 (2008); KN 61000-4-6 (2008-5); RRL Notice No. 2008-4 (May 20, 2008); EN 61000-4-6 (1996) + A1(2001); IEC 61000-4-6; EN 61000-4-6; KN 61000-4-6; KS C 9610-4-6
Power Frequency Magnetic Field Immunity (<i>Down to 3 A/m</i>)	IEC 61000-4-8 (1993) + A1(2000); IEC 61000-4-8 (2009); EN 61000-4-8 (1994) + A1(2000); KN 61000-4-8 (2008-5); RRL Notice No. 2008-4 (May 20, 2008); IEC 61000-4-8; EN 61000-4-8; KN 61000-4-8; KS C 9610-4-8
Voltage Dips, Short Interrupts, and Line Voltage Variations	IEC 61000-4-11, Ed. 2 (2004-03); KN 61000-4-11 (2008-5); RRL Notice No. 2008-4 (May 20, 2008); IEC 61000-4-11; EN 61000-4-11; KN 61000-4-11; KS C 9610-4-11
Ring Wave	IEC 61000-4-12, Ed. 2 (2006-09); EN 61000-4-12:2006; IEC 61000-4-12; EN 61000-4-12; KN 61000-4-12; IEEE STD C62.41.2 2002

Test Technology:

Generic and Product Specific EMC Standards

Test Method(s)¹:

IEC/EN 61000-6-1; AS/NZS 61000-6-1; KN 61000-6-1;
 KS C 9610-6-1; IEC/EN 61000-6-2; AS/NZS 61000-6-2;
 KN 61000-6-2; KS C 9610-6-2; IEC/EN 61000-6-3;
 AS/NZS 61000-6-3; KN 61000-6-3; KS C 9610-6-3;
 IEC/EN 61000-6-4; AS/NZS 61000-6-4; KN 61000-6-4;
 KS C 9610-6-4; EN 50130-4; EN 61326-1; EN 50121-3-2;
 EN 12895; EN 50270; EN 50491-1; EN 50491-2; EN 50491-3;
 EN 55015; EN 60730-1; EN 60945; IEC 60533;
 EN 61326-2-6; EN 61800-3; IEC/CISPR 14-2; EN 55014-2;
 AS/NZS CISPR 14.2; KN 14-2; KS C 9814-2;
 IEC/CISPR 24; AS/NZS CISPR 24; EN 55024; KN 24;
 IEC/CISPR 35; AS/NZS CISPR 35; EN 55035; KN 35;
 KS C 9835; IEC 60601-1-2; JIS T0601-1-2

TxRx EMC Requirements

EN 301 489-1; EN 301 489-3; EN 301 489-9;
 EN 301 489-17; EN 301 489-19; EN 301 489-20

European Radio Test Standards

ETSI EN 300 086-1; ETSI EN 300 086-2;
 ETSI EN 300 113-1; ETSI EN 300 113-2;
 ETSI EN 300 220-1; ETSI EN 300 220-2;
 ETSI EN 300 220-3-1; ETSI EN 300 220-3-2;
 ETSI EN 300 330-1; ETSI EN 300 330-2;
 ETSI EN 300 440-1; ETSI EN 300 440-2;
 ETSI EN 300 422-1; ETSI EN 300 422-2;
 ETSI EN 300 328; ETSI EN 301 893;
 ETSI EN 301 511; ETSI EN 301 908-1;
 ETSI EN 908-2; ETSI EN 908-13;
 ETSI EN 303 413; ETSI EN 302 502;
 EN 303 340; EN 303 345-2; EN 303 345-3; EN 303 345-4

Canadian Radio Tests

RSS-102 measurement (RF Exposure Evaluation);
 RSS-102 measurement (Nerve Stimulation);
 SPR-002; RSS-111; RSS-112; RSS-117; RSS-119; RSS-123;
 RSS-125; RSS-127; RSS-130; RSS-131; RSS-132; RSS-133;
 RSS-134; RSS-135; RSS-137; RSS-139; RSS-140; RSS-141;
 RSS-142; RSS-170; RSS-181; RSS-182; RSS-191; RSS-192;
 RSS-194; RSS-195; RSS-196; RSS-197; RSS-199; RSS-210;
 RSS-211; RSS-213; RSS-215; RSS-216; RSS-220; RSS-222;
 RSS-236; RSS-238; RSS-243; RSS-244; RSS-247; RSS-248;
 RSS-251; RSS-252; RSS-287; RSS-288; RSS-310; RSS-GEN

Mexico Radio Tests

IFT-008-2015; NOM-208-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 (July 15, 2020)

<u>Test Technology:</u>	<u>Test Method(s)¹:</u>
<i>Australia/New Zealand Radio Tests</i>	AS/NZS 4268; Radiocommunications (Short Range Devices) Standard (2014)
<i>Hong Kong Radio Tests</i>	HKCA 1039 Issue 6; HKCA 1042; HKCA 1033 Issue 7; HKCA 1061; HKCA 1008; HKCA 1043; HKCA 1057; HKCA 1073
<i>Korean Radio Test Standards</i>	KN 301 489-1; KN 301 489-3; KN 301 489-9; KN 301 489-17; KN 301 489-52; KS X 3124; KS X 3125; KS X 3130; KS X 3126; KS X 3129
<i>Vietnam Radio Test Standards</i>	QCVN 47:2015/BTTTT; QCVN 54:2020/BTTTT; QCVN 55:2011/BTTTT; QCVN 65:2013/BTTTT; QCVN 73:2013/BTTTT; QCVN 74:2020/BTTTT; QCVN 112:2017/BTTTT; QCVN 117:2020/BTTTT
<i>Vietnam EMC Test Standards</i>	QCVN 18:2014/BTTTT; QCVN 86:2019/BTTTT; QCVN 96:2015/BTTTT; QCVN 118:2018/BTTTT
<i>Unlicensed Radio Frequency Devices (3 Meter Semi-Anechoic Room)</i>	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))
<i>Licensed Radio Service Equipment</i>	47 CFR FCC Parts 20, 22, 24, 25, 27, 30, 73, 74, 80, 87, 90, 95, 96, 97, 101 (using ANSI/TIA-603-E, TIA-102.CAAA-E, ANSI C63.26:2015)
<i>OIA (Over the Air) Performance</i> 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

(1mV to 5kV) 60 Hz
 (0.1V to 250V) up to 500 MHz
 (1µA to 150A) 60 Hz

FAA AC 150/5345-10H;
 FAA AC 150/5345-43J;
 FAA AC 150/5345-44K;
 FAA AC 150/5345-46E;
 FAA AC 150/5345-47C;
 FAA EB 67D

DC Voltage / Current

(1mV to 15 kV) / (1µA to 10A)

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, edition, version, etc. is not identified in the scope of accreditation, laboratories may use the version that immediately precedes the current version for a period of one year from the date of publication of the standard measurement method, per part C., Section 1 of A2LA R101 - *General Requirements- Accreditation of ISO-IEC 17025 Laboratories*.

Testing Activities Performed in Support of FCC Certification in Accordance with 47 Code of Federal Regulations and FCC KDB 974614, Appendix A, Table A.1²

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

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Testing Activities Performed in Support of FCC Certification in Accordance with 47 Code of Federal Regulations and FCC KDB 974614, Appendix A, Table A.1²

Rule Subpart/Technology	Test Method	Maximum Frequency (MHz)
<u>Unlicensed Personal Communication Systems Devices</u>		
Part 15D	ANSI C63.17:2013	40000
<u>U-NII without DFS Intentional Radiators</u>		
Part 15E	ANSI C63.10:2013	40000
<u>U-NII with DFS Intentional Radiators</u>		
Part 15E	FCC KDB 905462 D02 (v02)	40000
<u>UWB Intentional Radiators</u>		
Part 15F	ANSI C63.10:2013	40000
<u>BPL Intentional Radiators</u>		
Part 15G	ANSI C63.10:2013	40000
<u>White Space Device Intentional Radiators</u>		
Part 15H	ANSI C63.10:2013	40000
<u>Commercial Mobile Services (FCC Licensed Radio Service Equipment)</u>		
Parts 22 (cellular), 24, 25 (below 3 GHz), and 27	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	40000
<u>General Mobile Radio Services (FCC Licensed Radio Service Equipment)</u>		
Parts 22 (non-cellular), 90 (below 3 GHz), 95, 97, and 101 (below 3 GHz)	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	40000
<u>Citizens Broadband Radio Services (FCC Licensed Radio Service Equipment)</u>		
Part 96	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	40000
<u>Maritime and Aviation Radio Services</u>		
Parts 80 and 87	ANSI/TIA-603-E; ANSI C63.26:2015	40000
<u>Microwave and Millimeter Bands Radio Services</u>		
Parts 25, 30, 74, 90 (above 3 GHz), 97 (above 3 GHz), and 101	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	40000

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Testing Activities Performed in Support of FCC Certification in Accordance with 47 Code of Federal Regulations and FCC KDB 974614, Appendix A, Table A.1²

Rule Subpart/Technology	Test Method	Maximum Frequency (MHz)
<u>Broadcast Radio Services</u>		
Parts 73 and 74 (below 3 GHz)	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	40000
<u>Signal Boosters</u>		
Part 20 (Wideband Consumer Signal Boosters, Provider-specific signal boosters, and Industrial Signal Boosters) Section 90.219	ANSI C63.26:2015	40000

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 15th day of August 2023.



Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 1786.01
Valid to June 30, 2025

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