Engineering Test Report No. 2101890-04 Rev. A		
Report Date	7/13/2021	
Manufacturer Name	Accutech Security LLC.	
Manufacturer Address	10125 S 52nd Street Franklin, WI 53132	
Product Name Brand/Model No.	BR5230LF	
Date Received	6/7/2021	
Test Dates	6/7/2021 – 7/13/2021	
Specifications	FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C FCC “Code of Federal Regulations” Title 47, Part 15, Subpart C 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	Ian F Carnegie	
Signature		
Approved by	Raymond J. Klouda, Registered Professional Engineer of Illinois – 44894	
PO Number	P028343	

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1. Report Revision History

Revision	Date	Description
–	06 Aug 2021	Initial Release of Engineering Test Report No. 2101890-04 Rev. A
A	06 AUG 2021 By Ian Carnegie	- Added Rev. A to the report number in the header throughout the report. - Updated the Manufacturer name from “Accutech, A division of Innovative Control System” to “Accutech Security LLC” throughout the report.

2. Introduction

This document presents the results of a series of electromagnetic compatibility (EMC) tests that were performed on the Low Frequency Exciter Antenna (hereinafter referred to as the Equipment Under Test (EUT)). The EUT was identified as follows:

EUT Identification	
Description	Low Frequency Exciter Antenna
Model/Part No.	BR5230LF
S/N	1
Software/Firmware Version	1.0.1.20
Transmit Frequency of the EUT:	127 KHz

The EUT listed above was used throughout the test series.

3. Power Input

The EUT obtained 115V 60Hz power via a 3-wire, 2-meter, unshielded power cord, which was attached to the system's power supply.

4. Grounding

The EUT's power supply portion of the system was connected to ground through the third wire of its input power cord. The other parts of the system were not grounded.

5. Support Equipment

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

Description	Model #	S/N
Door Controller	BR5200DC	1
418MHz Receiver	BR5240RX	1
Tag Sensor	BR52TAG	143

6. Interconnect Leads

No interconnect leads were used during the tests.

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. Normal Operation

The EUT was powered by applying 120VAC to its power supply unit. After a short boot up time, the EUT went into a normal operation state searching for tags to track.

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, 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 9 kHz to 40 GHz"

- ANSI C63.10-2013, “American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices”

- ICES-003, Issue 6, January 2016, “Spectrum Management and Telecommunications, Interference-Causing Equipment Standard, Information Technology Equipment (Including Digital Apparatus) – Limits and methods of measurement”

- RSS-Gen Issue 5, March 2019, Amendment 1, Innovation, Science, and Economic Development Canada, “Spectrum Management and Telecommunications, Radio Standards Specification, General Requirements for Compliance of Radio Apparatus”

10. Test Plan

No test plan was provided. Instructions were provided by personnel from Accutech Security LLC. and used in conjunction with the FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C, Innovation, Science, and Economic Development Canada, RSS-GEN, ANSI C63.4-2014, and ANSI C63.10-2013 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°C
Relative Humidity	21%
Atmospheric Pressure	1013.8 mb

13. Summary

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

Test Description	Test Requirements	Test Methods	Equipment Class	EUT S/N	Results
RF Conducted Emissions Test (AC Mains)	FCC 15C 15.207 ISED ICES-003, Section 6.1	ANSI C63.10: 2013	-	1	Conforms
Radiated Emissions	FCC 15C 15.209 ISED RSS-GEN	ANSI C63.10: 2013	-	1	Conforms

14. Sample Calculations

For Powerline Conducted Emissions:

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

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

For Radiated Emissions:

The resultant field strength (FS) is a summation in decibels (dB) of the receiver meter reading (MTR), the antenna correction factor (AF), and the cable loss factor (CF). If an external preamplifier is used,

the total is reduced by its gain (-PA). If a distance extrapolation (DE) is required, it is added to the total.

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

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

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

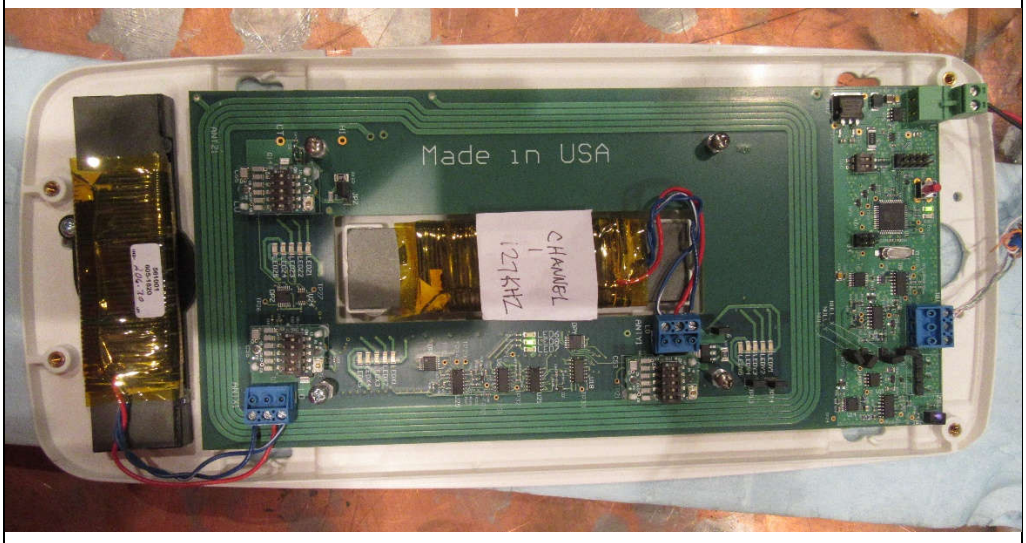
15. Statement of Conformity

The Accutech Security LLC. Low Frequency Exciter Antenna, Model No. BR5230LF, Serial No. 1, fully conforms to the selected requirements of FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C and Innovation, Science, and Economic Development Canada, RSS-GEN.

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 and Innovation, Science, and Economic Development Canada, RSS-GEN 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

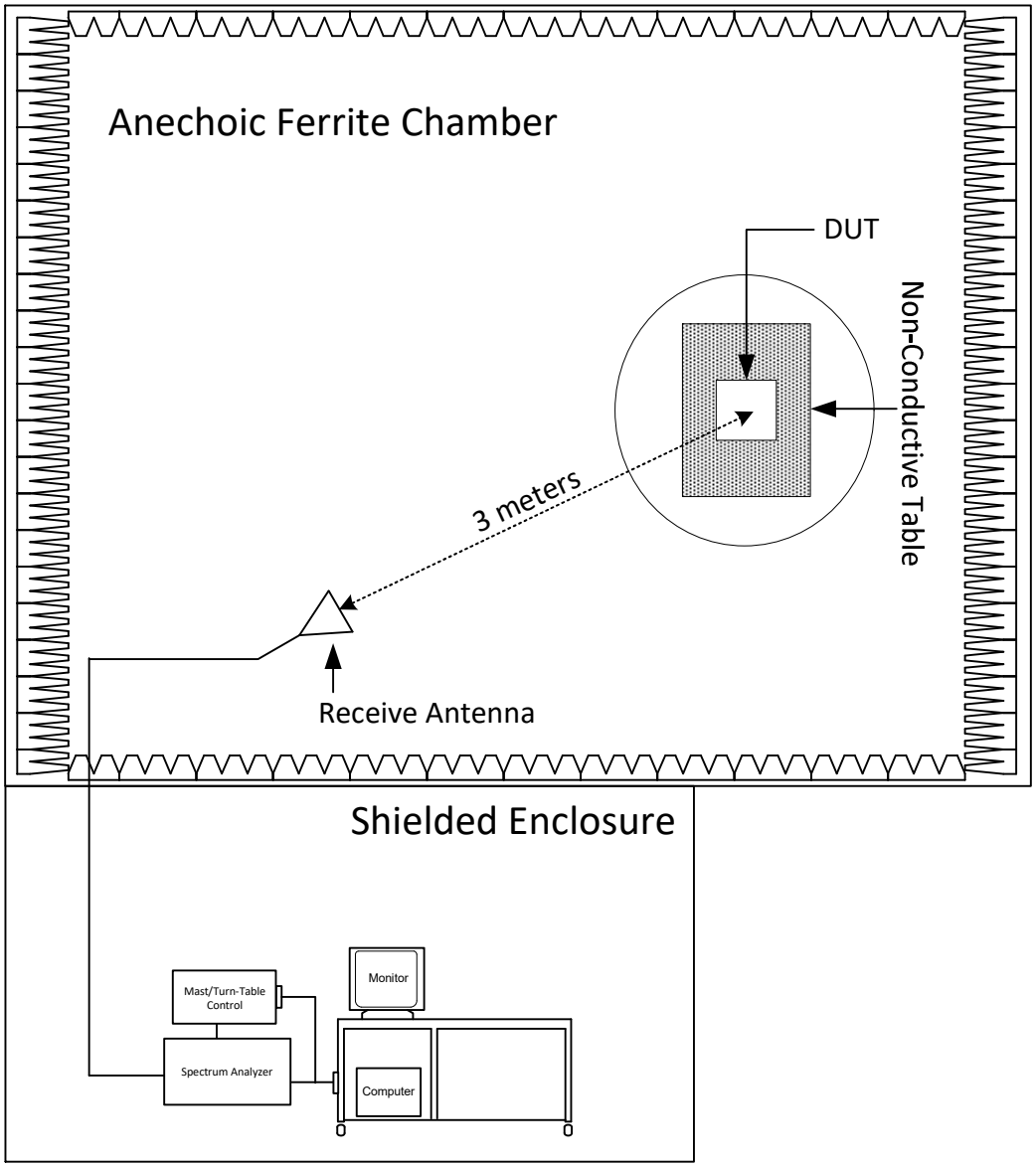


18. Equipment List

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
APW14	PREAMPLIFIER	PLANAR	PE2-35-120-5R0-10-12-SFF	PL22671	1-20GHz	9/24/2020	9/24/2021
CDW5	DESKTOP COMPUTER	ELITE	PENTIUM 4	006	3.8GHZ	N/A	
NTA4	BILOG ANTENNA	TESEQ	6112D	46660	20-2000GHZ	10/5/2020	10/5/2021
PLF2	CISPR16 50UH LISN	ELITE	CISPR16/70A	002	.15-30MHz	4/7/2021	4/7/2022
PLF4	CISPR16 50UH LISN	ELITE	CISPR16/70A	003	.15-30MHz	4/7/2021	4/7/2022
RBG0	EMI ANALYZER	ROHDE & SCHWARZ	ESW44	101533	10HZ-44GHZ	3/2/2021	3/2/2022
RBH0	EMI RECEIVER	ROHDE & SCHWARZ	ESW26	101265	2HZ-26GHZ	7/21/2020	7/21/2021
T1EM	10DB 25W ATTENUATOR	WEINSCHEL	46-10-34	CD6796	DC-18GHZ	3/19/2020	3/19/2022
VBR8	CISPR EN FCC CE VOLTAGE.exe					N/A	
VBV2	CISPR EN FCC ICES RE.EXE	ELITE	CISPR EN FCC ICES RE.EXE	---	---	N/A	
XLJ9	5W, 50 OHM TERMINATION	JFW INDUSTRIES	50T-052	---	DC-2GHZ	1/10/2020	1/10/2022

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 Test (AC Mains)

Manufacturer	Accutech Security LLC.
Product	Low Frequency Exciter Antenna
Model	BR5230LF
Serial No	1
Mode	Normal Operation

Information	
Setup Format	Tabletop
Type of Test Site	Reverberation Chamber

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

Requirements

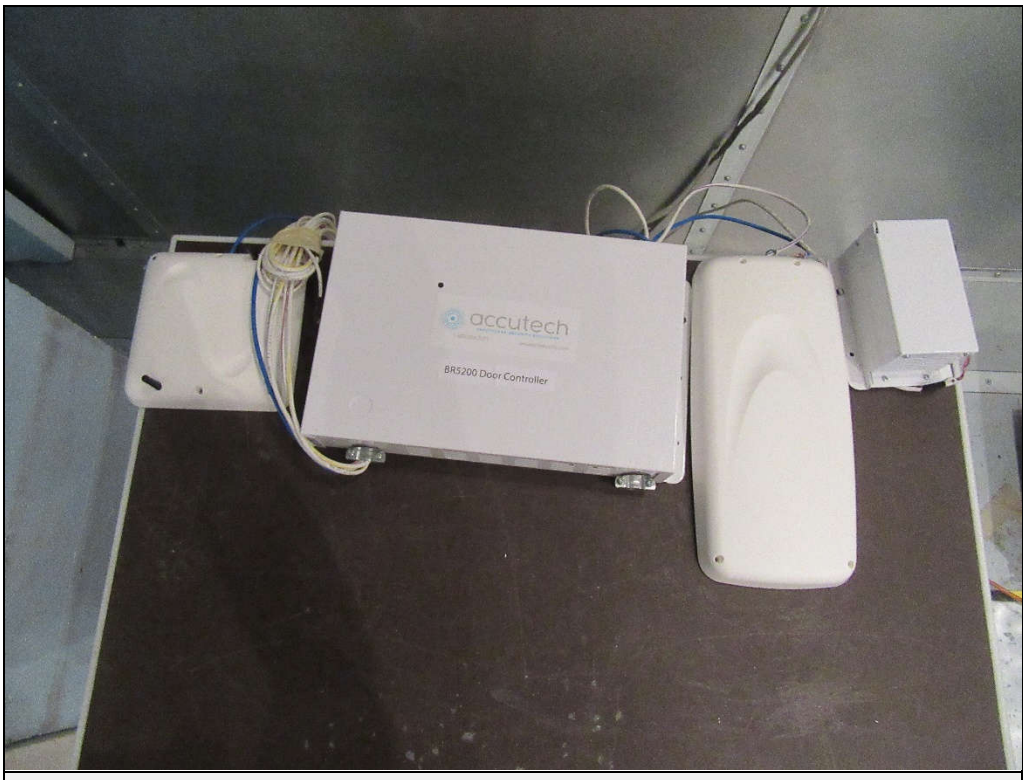
For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

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

Procedures

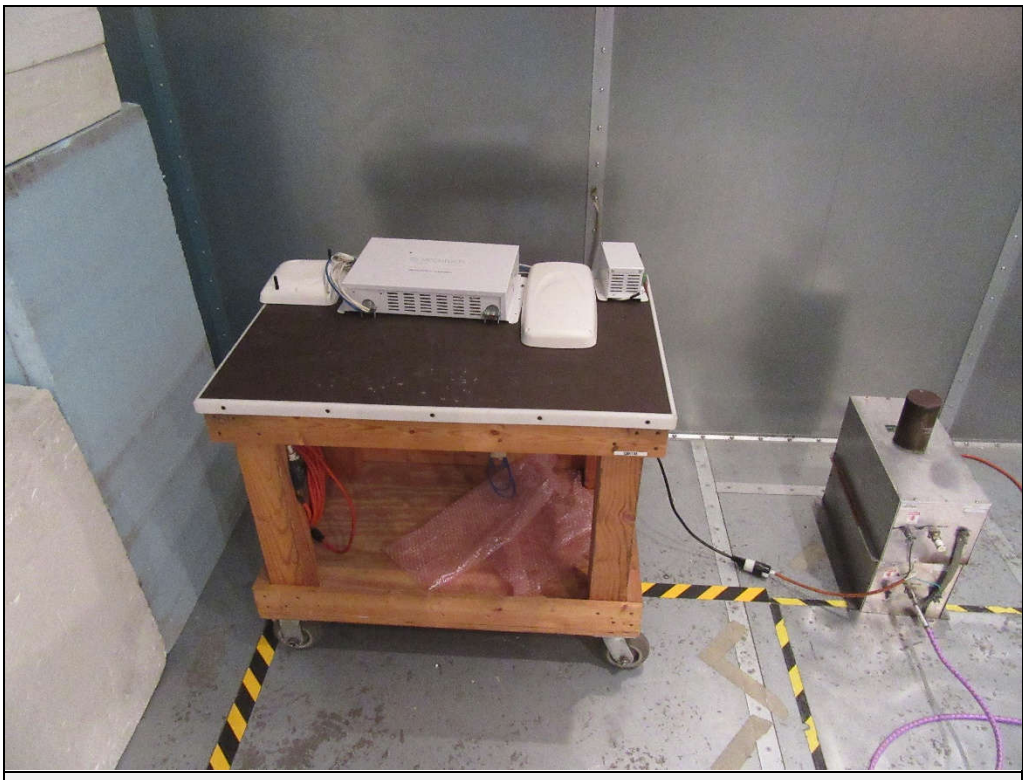
The interference on each power lead of the EUT was measured by connecting the measuring equipment to the appropriate meter terminal of the Line Impedance Stabilization Network (LISN). The meter terminal of the LISN not under test was terminated with 50 ohms.

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

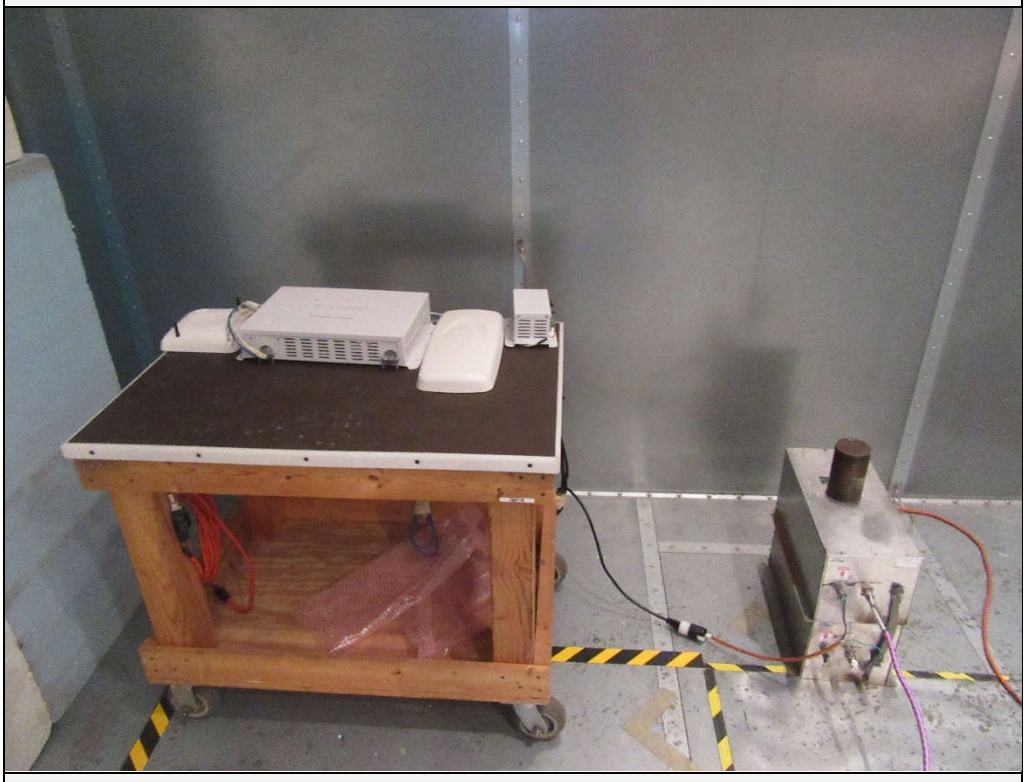


Test Setup for RF Conducted Emissions (AC Mains)

Test Setup for RF Conducted Emissions (AC Mains)



Test Setup for RF Conducted Emissions (AC Mains)



Test Setup for RF Conducted Emissions (AC Mains)

FCC Part 15 Subpart C Conducted Emissions Test

Significant Emissions Data

VBR8 05/14/2020

Manufacturer	:	Accutech
Model	:	BR5200DC/BR5230LF/BR5240RX/BR52195PS
DUT Revision	:	
Serial Number	:	1
DUT Mode	:	Normal Operation
Line Tested	:	Line
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	
Test Engineer	:	I. Carnegie
Limit	:	15.207
Test Date	:	Jun 07, 2021 11:11:54 AM
Data Filter	:	Up to 80 maximum levels detected with 6 dB level excursion threshold over 10 dB margin below limit

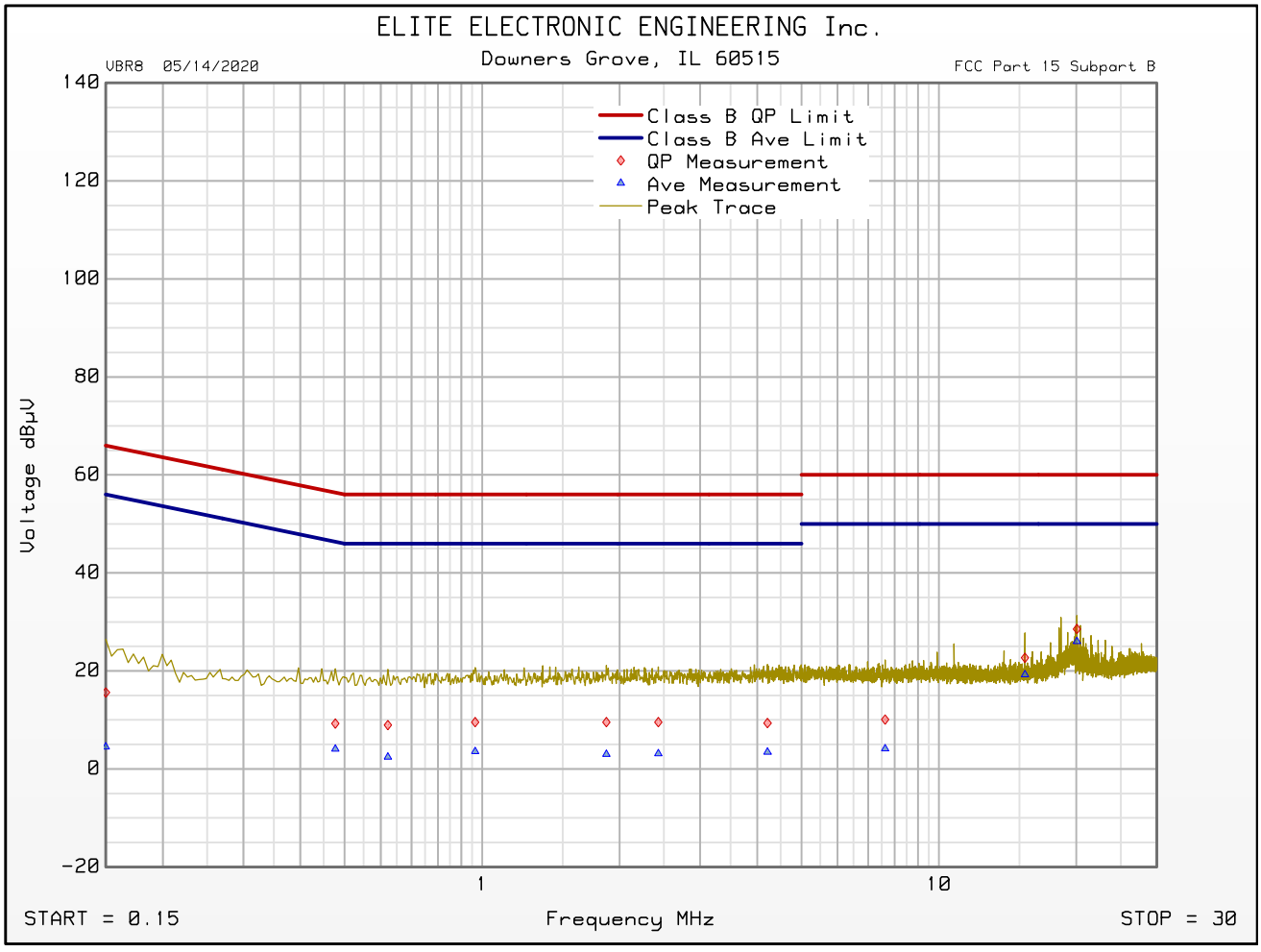
Freq MHz	Quasi-peak Level dBµV	Quasi-peak Limit dBµV	Excessive Quasi-peak Emissions	Average Level dBµV	Average Limit dBµV	Excessive Average Emissions
0.150	15.6	66.0		4.5	56.0	
0.477	9.3	56.4		4.1	46.4	
0.622	8.9	56.0		2.4	46.0	
0.966	9.6	56.0		3.6	46.0	
1.871	9.6	56.0		3.0	46.0	
2.430	9.5	56.0		3.2	46.0	
4.216	9.4	56.0		3.4	46.0	
7.624	10.1	60.0		4.1	50.0	
15.426	22.7	60.0		19.3	50.0	
20.053	28.6	60.0		26.0	50.0	

FCC Part 15 Subpart C Conducted Emissions Test

Cumulative Data

VBR8 05/14/2020

Manufacturer	:	Accutech
Model	:	BR5200DC/BR5230LF/BR5240RX/BR52195PS
DUT Revision	:	
Serial Number	:	1
DUT Mode	:	Normal Operation
Line Tested	:	Line
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	
Test Engineer	:	I. Carnegie
Limit	:	15.207
Test Date	:	Jun 07, 2021 11:11:54 AM



Emissions Meet QP Limit
Emissions Meet Ave Limit

FCC Part 15 Subpart C Conducted Emissions Test

Significant Emissions Data

VBR8 05/14/2020

Manufacturer	:	Accutech
Model	:	BR5200DC/BR5230LF/BR5240RX/BR52195PS
DUT Revision	:	
Serial Number	:	1
DUT Mode	:	Normal Operation
Line Tested	:	Return
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	
Test Engineer	:	I. Carnegie
Limit	:	15.207
Test Date	:	Jun 07, 2021 12:52:41 PM
Data Filter	:	Up to 80 maximum levels detected with 6 dB level excursion threshold over 10 dB margin below limit

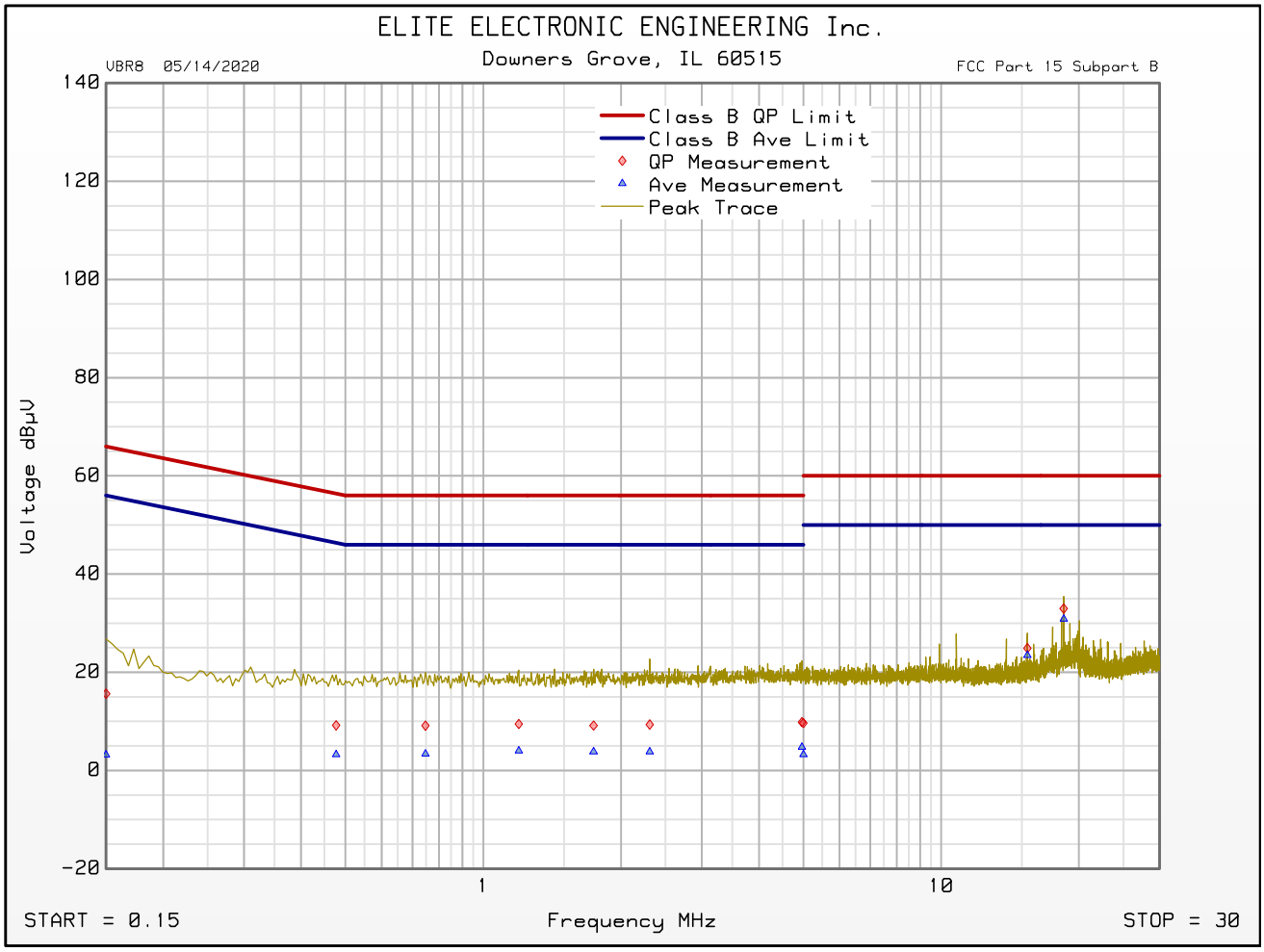
Freq MHz	Quasi-peak Level dBµV	Quasi-peak Limit dBµV	Excessive Quasi-peak Emissions	Average Level dBµV	Average Limit dBµV	Excessive Average Emissions
0.150	15.6	66.0		3.2	56.0	
0.477	9.2	56.4		3.3	46.4	
0.748	9.1	56.0		3.4	46.0	
1.195	9.5	56.0		4.0	46.0	
1.741	9.1	56.0		3.8	46.0	
2.309	9.4	56.0		3.8	46.0	
4.967	9.8	56.0		4.8	46.0	
5.000	9.7	56.0		3.3	46.0	
15.426	24.9	60.0		23.4	50.0	
18.514	33.0	60.0		30.9	50.0	

FCC Part 15 Subpart C Conducted Emissions Test

Cumulative Data

VBR8 05/14/2020

Manufacturer	:	Accutech
Model	:	BR5200DC/BR5230LF/BR5240RX/BR52195PS
DUT Revision	:	
Serial Number	:	1
DUT Mode	:	Normal Operation
Line Tested	:	Return
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	
Test Engineer	:	I. Carnegie
Limit	:	15.207
Test Date	:	Jun 07, 2021 12:52:41 PM



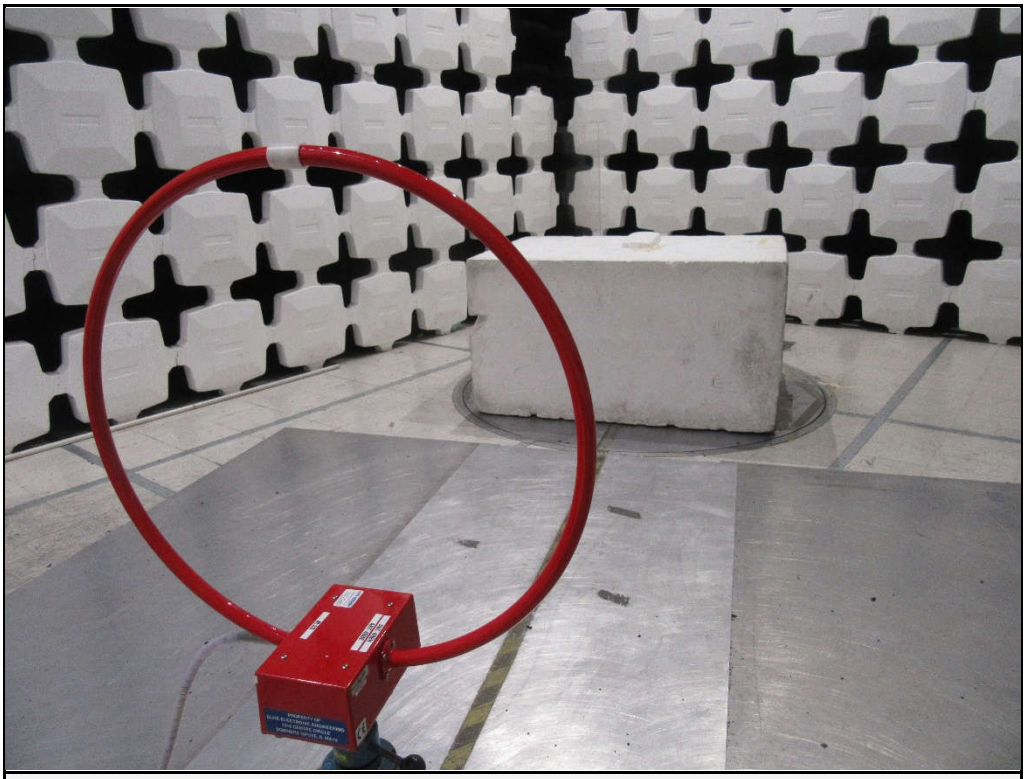
Emissions Meet QP Limit
Emissions Meet Ave Limit

21. Radiated Emissions

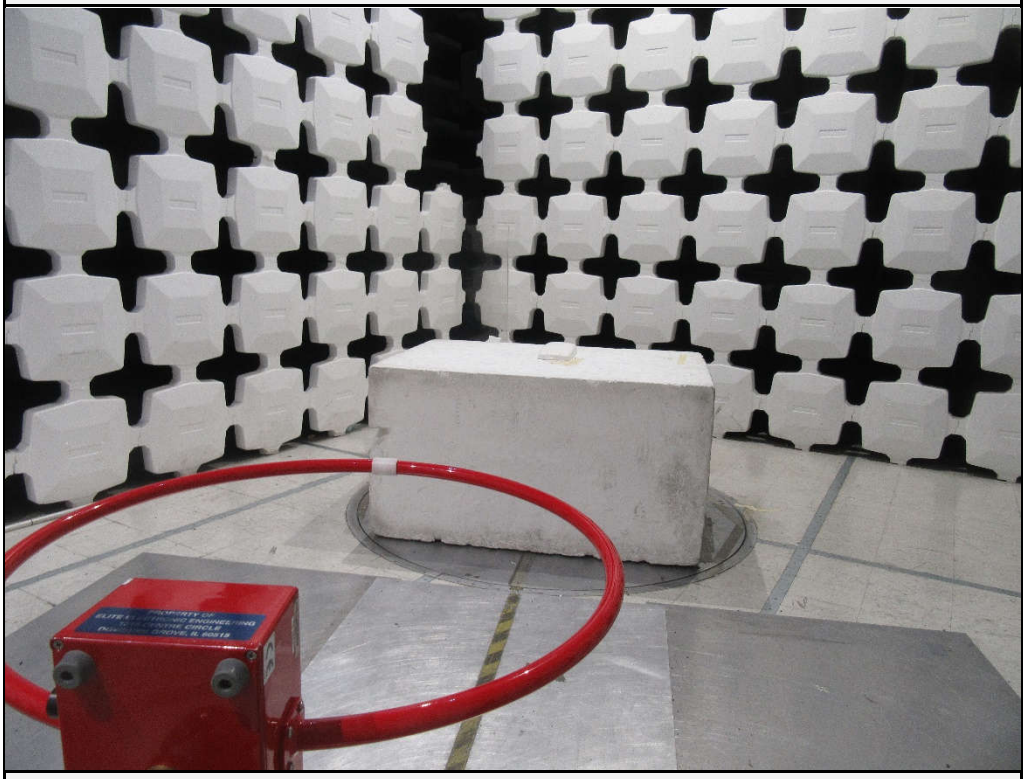
Test Information	
Manufacturer	Accutech Security LLC.
Product	Low Frequency Exciter Antenna
Model	BR5230LF
Serial No	1
Mode	Normal Operation

Measurement Uncertainty	
Measurement Type	Expanded Measurement Uncertainty
Radiated disturbance (electric field strength on an open area test site or alternative test site)	4.3

Procedures
All tests 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. Anechoic absorber material is installed over the ferrite tile. The floor of the chamber is used as the ground plane. The chamber complies with ANSI C63.4-2014 for site attenuation. The radiated emissions measurements were manually performed over the frequency range from the fundamental frequency (127 kHz) up to the 10th harmonic. A Loop antenna was used as the pick-up device. The measuring antenna was maintained at a height of 1m and test distance of 3m from the EUT. To ensure that maximum or worst case, emission levels were measured, the following steps were taken: • The EUT was rotated so that all of its sides were exposed to the receiving antenna. • Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured. Measurements were extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade).



Test Setup for Radiated Emissions – Antenna Polarization Horizontal



Test Setup for Radiated Emissions – Antenna Polarization Vertical

Test Details	
Manufacturer	Accutech Security LLC.
Model	BR5230LF
S/N	1
Mode	Normal Operation
Carrier Frequency	127kHz
Notes	FCC15.209
Date	7/13/2021

Tx @CH1 (127kHz)

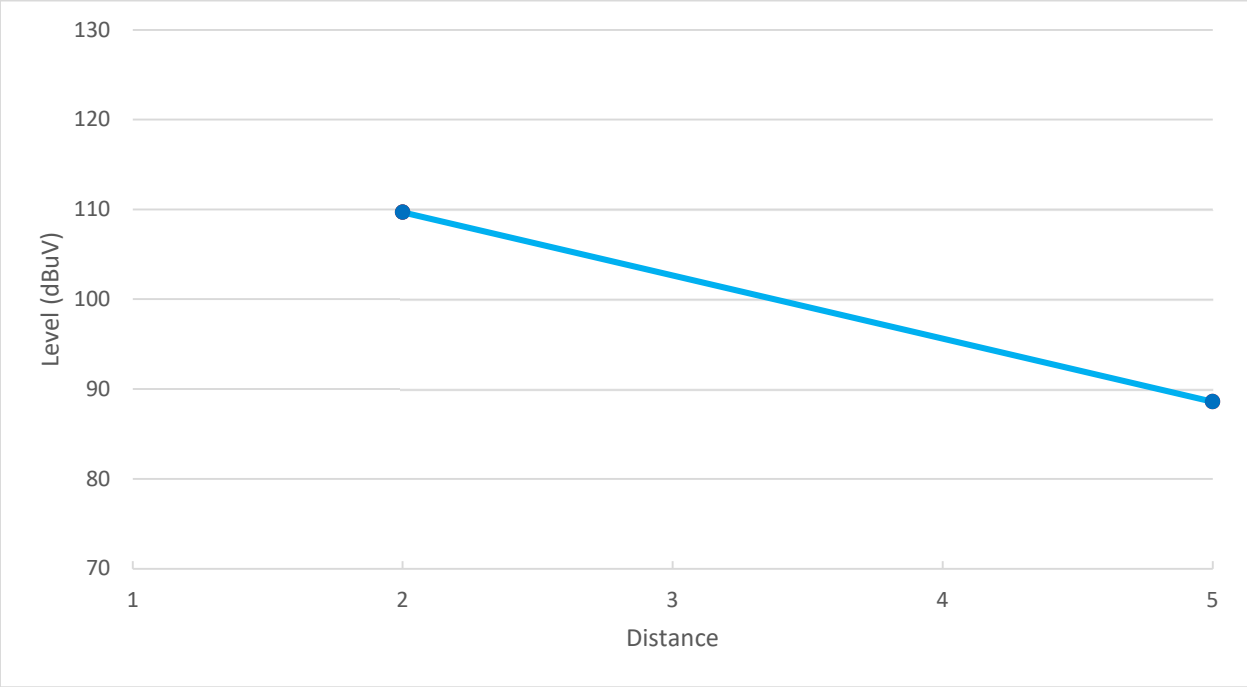
Freq. (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Dist. Corr. (dB)	Total (dBuV/m)	Total (uV/m)	Limit (uV/m)	Margin (dB)
0.127	H	101.2		0.0	11.1	0.0	-103.6	8.6	2.7	18.9	-16.9
0.127	V	97.6		0.0	11.1	0.0	-103.6	5.0	1.8	18.9	-20.5
0.254	H	49.5		0.0	11.1	0.0	-103.6	-43.1	0.0	9.4	-62.6
0.254	V	50.3		0.0	11.1	0.0	-103.6	-42.2	0.0	9.4	-61.8
0.381	H	38.2		0.0	11.1	0.0	-103.6	-54.4	0.0	6.3	-70.4
0.381	V	41.5		0.0	11.1	0.0	-103.6	-51.1	0.0	6.3	-67.1
0.508	H	36.5		0.0	11.1	0.0	-40.0	7.6	2.4	47.2	-25.9
0.508	V	31.6		0.0	11.1	0.0	-40.0	2.6	1.4	47.2	-30.8
0.635	H	29.2		0.0	11.1	0.0	-40.0	0.2	1.0	37.8	-31.3
0.635	V	28.5		0.0	11.1	0.0	-40.0	-0.4	1.0	37.8	-32.0
0.762	H	24.7		0.0	11.1	0.0	-40.0	-4.3	0.6	31.5	-34.2
0.762	V	23.7		0.0	11.1	0.0	-40.0	-5.2	0.5	31.5	-35.2
0.889	H	27.0		0.0	11.1	0.0	-40.0	-1.9	0.8	27.0	-30.5
0.889	V	25.5		0.0	11.1	0.0	-40.0	-3.4	0.7	27.0	-32.0
1.016	H	20.2		0.0	11.1	0.0	-40.0	-8.7	0.4	23.6	-36.2
1.016	V	23.2		0.0	11.1	0.0	-40.0	-5.7	0.5	23.6	-33.1
1.143	H	22.5		0.0	11.1	0.0	-40.0	-6.4	0.5	21.0	-32.8
1.143	V	22.7		0.0	11.1	0.0	-40.0	-6.2	0.5	21.0	-32.6
1.270	H	23.5		0.0	11.1	0.0	-40.0	-5.4	0.5	18.9	-30.9
1.270	V	23.2		0.0	11.1	0.0	-40.0	-5.7	0.5	18.9	-31.2

Test Details	
Manufacturer	Accutech Security LLC.
Model	BR5230LF
S/N	1
Mode	Normal Operation
Carrier Frequency	127kHz
Notes	FCC "Code of Federal Regulations" Title 47 Part 15, Subpart C
Date	7/13/2021

Freq. (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Dist. Extr. (dB)	Total (dBuV/m)	Total (uV/m)	Limit (uV/m)	Margin (dB)
0.127	H	49.7		0.0	11.1	0.0	-103.6	-42.9	0.0	0.050	-16.9
0.127	V	46.1		0.0	11.1	0.0	-103.6	-46.5	0.0	0.050	-20.5
0.254	H	-2.0		0.0	11.1	0.0	-103.6	-94.6	0.0	0.025	-62.6
0.254	V	-1.2		0.0	11.1	0.0	-103.6	-93.7	0.0	0.025	-61.7
0.381	H	-13.4		0.0	11.1	0.0	-103.6	-105.9	0.0	0.017	-70.4
0.381	V	-10.0		0.0	11.1	0.0	-103.6	-102.6	0.0	0.017	-67.0
0.508	H	-15.0		0.0	11.1	0.0	-40.0	-43.9	0.0	0.125	-25.9
0.508	V	-19.9		0.0	11.1	0.0	-40.0	-48.9	0.0	0.125	-30.8
0.635	H	-22.4		0.0	11.1	0.0	-40.0	-51.3	0.0	0.100	-31.3
0.635	V	-23.0		0.0	11.1	0.0	-40.0	-51.9	0.0	0.100	-31.9
0.762	H	-26.8		0.0	11.1	0.0	-40.0	-55.8	0.0	0.084	-34.2
0.762	V	-27.8		0.0	11.1	0.0	-40.0	-56.7	0.0	0.084	-35.2
0.889	H	-24.5		0.0	11.1	0.0	-40.0	-53.4	0.0	0.072	-30.5
0.889	V	-26.0		0.0	11.1	0.0	-40.0	-54.9	0.0	0.072	-32.0
1.016	H	-31.3		0.0	11.1	0.0	-40.0	-60.2	0.0	0.063	-36.2
1.016	V	-28.3		0.0	11.1	0.0	-40.0	-57.2	0.0	0.063	-33.1
1.143	H	-29.0		0.0	11.1	0.0	-40.0	-57.9	0.0	0.056	-32.8
1.143	V	-28.8		0.0	11.1	0.0	-40.0	-57.7	0.0	0.056	-32.6
1.270	H	-28.0		0.0	11.1	0.0	-40.0	-56.9	0.0	0.050	-30.9
1.270	V	-28.3		0.0	11.1	0.0	-40.0	-57.2	0.0	0.050	-31.2

Propagation Loss Measurements and Calculations

TEST DISTANCE (m)	METER READING (dBµV)
2	109.7
4	94.1



$$\text{Roll} - \text{off Factor (N)} = (\text{Level}_{\text{near}} - \text{Level}_{\text{far}})/20\log(\text{d}_{\text{far}}/\text{d}_{\text{near}})$$

$$\text{N} = (109.7 - 94.1)/20\log\left(\frac{4}{2}\right) = 2.59$$

$$\text{Distance Extrapolation Factor} = 20\log(\text{d}_{\text{test}}/\text{d}_{\text{limit}})^{\text{N}}$$

$$\text{Distance Extrapolation Factor} = 20\log(3/300)^{2.59} = 103.6\text{dB}$$

22. Scope of Accreditation

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

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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)

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 15kV) / (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.