Engineering Test Report No. 2103900-01		
Report Date	February 22, 2022	
Manufacturer Name	JR Automation	
Manufacturer Address	1000 Brown Rd Auburn Hills, MI 48326	
Product Name Brand/Model No.	TPM Activators: TPM-SA-300-000 TPM-LA-300-000 TPM-LA-200-000 TPM-SA-200-000	
Date Received	December 28, 2021	
Test Dates	December 28, 2021 - January 19, 2022	
Specifications	FCC "Code of Federal Regulations" Title 47 Part 15, Subpart B and C Innovation, Science, and Economic Development Canada, ICES-003 and 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	Nathaniel Bouchie	
Signature		
Approved by	Raymond J. Klouda, Registered Professional Engineer of Illinois – 44894	
PO Number	423749-0510	

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 B and C and Innovation, Science, and Economic Development Canada, ICES-003 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
–	28 FEB 2022	Initial Release of Engineering Test Report No. 2103900-01

2. Introduction

This document presents the results of a series of electromagnetic compatibility (EMC) tests that were performed on four (4) TPM Activators (hereinafter referred to as the Equipment Under Test (EUT)).

The EUTs were identified as follows:

EUT Identification	
EUT #1	
Description	White Circular Antenna
Model/Part No.	TPM-SA-300-000
Serial No.	N/a
Software/Firmware Version	Test Firmware
Size of EUT	1.04 m x 1.04 m x 0.05 m
Number of Interconnection Wires	2
Type of Interconnection Wires	Fiber Optic, I/O
Tx Frequency	125 kHz
Rx Frequency	315 MHz and 433.92 MHz
Highest Internal Frequency of the EUT	433.92 MHz
EUT #2	
Description	White Rectangular Antenna
Model/Part No.	TPM-LA-300-000
Serial No.	N/a
Software/Firmware Version	Test Firmware
Size of EUT	1.44 m x 0.95 m x 0.08 m
Number of Interconnection Wires	2
Type of Interconnection Wires	Fiber Optic, I/O
Tx Frequency	125 kHz
Rx Frequency	315 MHz and 433.92 MHz
Highest Internal Frequency of the EUT	433.92 MHz
EUT #3	
Description	Black Ovular Antenna
Model/Part No.	TPM-LA-200-000
Serial No.	N/a
Software/Firmware Version	Test Firmware
Size of EUT	1.21 m x 0.78 m x 0.04 m
Number of Interconnection Wires	2
Type of Interconnection Wires	Fiber Optic, I/O
Tx Frequency	125 kHz
Rx Frequency	315 MHz and 433.92 MHz
Highest Internal Frequency of the EUT	433.92 MHz
EUT #4	
Description	Black Circular Antenna
Model/Part No.	TPM-SA-200-000
Serial No.	N/a
Software/Firmware Version	Test Firmware
Size of EUT	0.78 m x 0.78 m x 0.04m
Number of Interconnection Wires	2
Type of Interconnection Wires	Fiber Optic, I/O
Tx Frequency	125 kHz
Rx Frequency	315 MHz and 433.92 MHz
Highest Internal Frequency of the EUT	433.92 MHz

The EUTs listed on the previous page were used throughout the test series.

3. Power Input

The EUTs obtained 24VDC power through two leads from the secondary of a step-down transformer. The primary of this transformer received 115V 60Hz power through low-pass powerline filters on the wall of the shielded enclosure.

4. Grounding

The EUTs were connected to ground through the third wire of the input power cord.

The EUTs were also connected via a ground strap tied to the power supply.

5. Support Equipment

The EUTs were submitted for testing along with the following support equipment:

Description	Model #	S/N
Support Laptop	---	---
Fiber Optic to USB Transceiver	---	---

6. Interconnect Leads

The following interconnect cables were submitted with the test items:

Item	Description
USB	Connects Support Laptop to Fiber/USB Transceiver
Fiber Optic	Connects Fiber/USB Transceiver to Control Box
I/O Bundle	Connects Control Box to Antenna

7. Modifications Made to the EUT

The following modifications were made to the EUTs to meet the specification requirements:

- For Radiated Emissions on TPM-SA-300-000 (White Circle Antenna):
    - Inside black box:
        - 2x differential mode: 0431164951
            - One on each antenna output wire, 1 turn each.
        - 1x common mode: ESD-R-38D-B
            - Around each antenna wire & ground wire (3 wires total), 3 turns around all.
    - On conduit tubing:
        - 1x common mode: 2643626202
            - Around conduit tube, 1 turn.
- For Radiated Emissions on TPM-LA-300-000 (White Rectangle Antenna):
    - Inside black box:
        - 1x common mode: ESD-R-38D-B
            - Around each antenna wire (not including ground wire – 2 wires total), 3 turns around all.
    - On conduit tubing:
        - 1x common mode: 2643626202
            - Around conduit tube, 1 turn.
    - Inside top cavity of antenna (each of these does NOT include the ground wire):

- 1x common mode: ESD-R-38D-B
  - Around 2 antenna wires, 2 turns.
- 2x differential mode: 7427155
  - One on each antenna wire, 1 turn each.
- 1x common mode: ESD-R-38D-B
  - Around 2 antenna wires, 5 turns.
- 2x differential mode: 7427155
  - One on each antenna wire, 2 turns each.

8. Modes of Operation

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

8.1. Tx On

This mode was achieved by applying 24VDC to the EUT with the support equipment attached. The support equipment software was used to configure the EUT into the proper operating mode.

8.2. Tx Off, Rx Only

This mode was achieved by applying 24VDC to the EUT with the support equipment attached. The support equipment software was used to configure the EUT into the proper operating mode.

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 B

- ICES-003, Issue 7, October 15, 2020, “Information Technology Equipment (including Digital Apparatus)”

- RSS-Gen, Issue 5, February 2021, Amendment 2, “General Requirements for Compliance of Radio Apparatus”

- RSS-012, Issue 5, February 2021, Amendment 1, “Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)”

- 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"

10. Test Plan

No test plan was provided. Instructions were provided by personnel from JR Automation and used in conjunction with the FCC "Code of Federal Regulations" Title 47 Part 15, Subpart B and C, Innovation, Science, and Economic Development Canada, ICES-003 and RSS-GEN, 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 laboratory conditions were present while the EMC tests were performed:

Ambient Parameters	Value
Temperature	23.1°C
Relative Humidity	17%
Atmospheric Pressure	1015.3mb

13. Summary

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

Test Description	Test Requirements	Test Methods	Results
Radiated Emissions (Transmitter) in the Spurious Domain	FCC 15C 15.209 RSS-GEN Section 6.13 ISED ICES-003, Section 3.2.2	ANSI C63.10:2013	Conforms
RF Conducted Emissions (AC Mains)	FCC 15B 15.107 FCC 15C 15.207 RSS-GEN Section 7.2 ISED ICES-003, Section 3.2.1	ANSI C63.4:2014 ANSI C63.10:2013	Conforms
RF Radiated Emissions	FCC 15B 15.109 ISED ICES-003, Section 3.2.2	ANSI C63.4:2014	Conforms
Occupied Bandwidth (99%)	RSS-GEN Section 6.7	ANSI C63.10:2013	Conforms
Nerve Stimulation Evaluation	RSS-102 (SPR-002)	RSS-102 (SPR-002)	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 (dBµV) = MTR (dBµV) + CF (dB).

For Radiated Emissions:

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

Formula 1: FS (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]

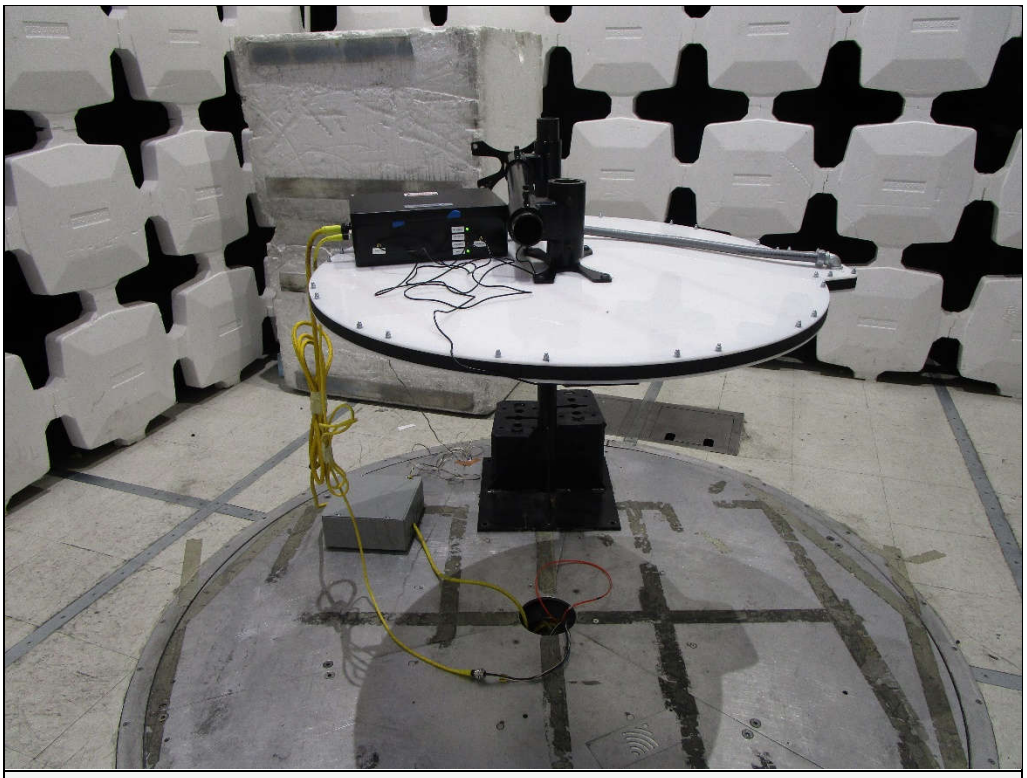
15. Statement of Conformity

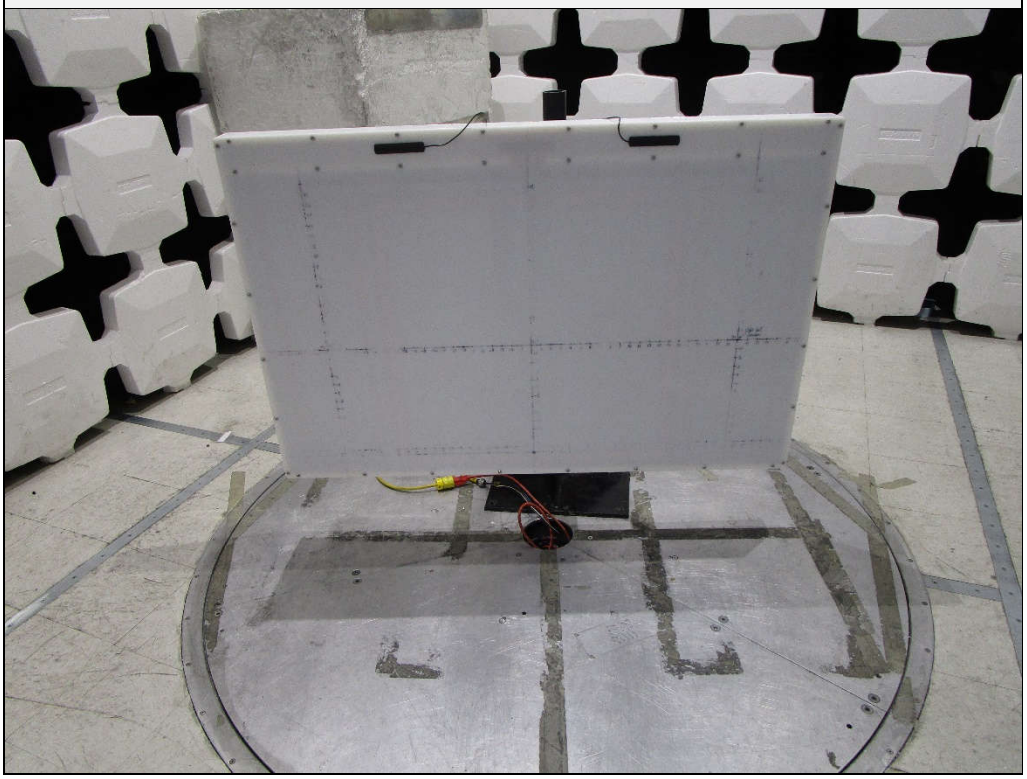
The JR Automation TPM Activator, Model Numbers TPM-SA-300-000, TPM-LA-300-000, TPM-LA-200-000, and TPM-SA-200-000 did fully conform to the selected requirements of FCC "Code of Federal Regulations" Title 47 Part 15, Subpart B and C and Innovation, Science, and Economic Development Canada, ICES-003 and RSS-GEN.

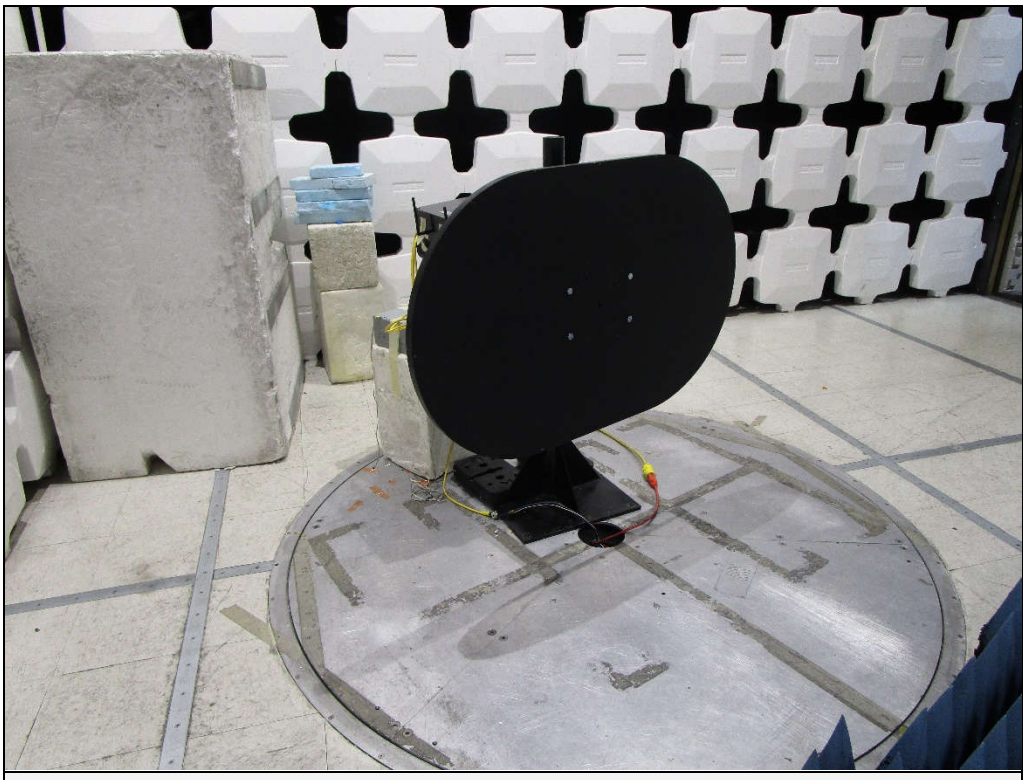
16. Certification

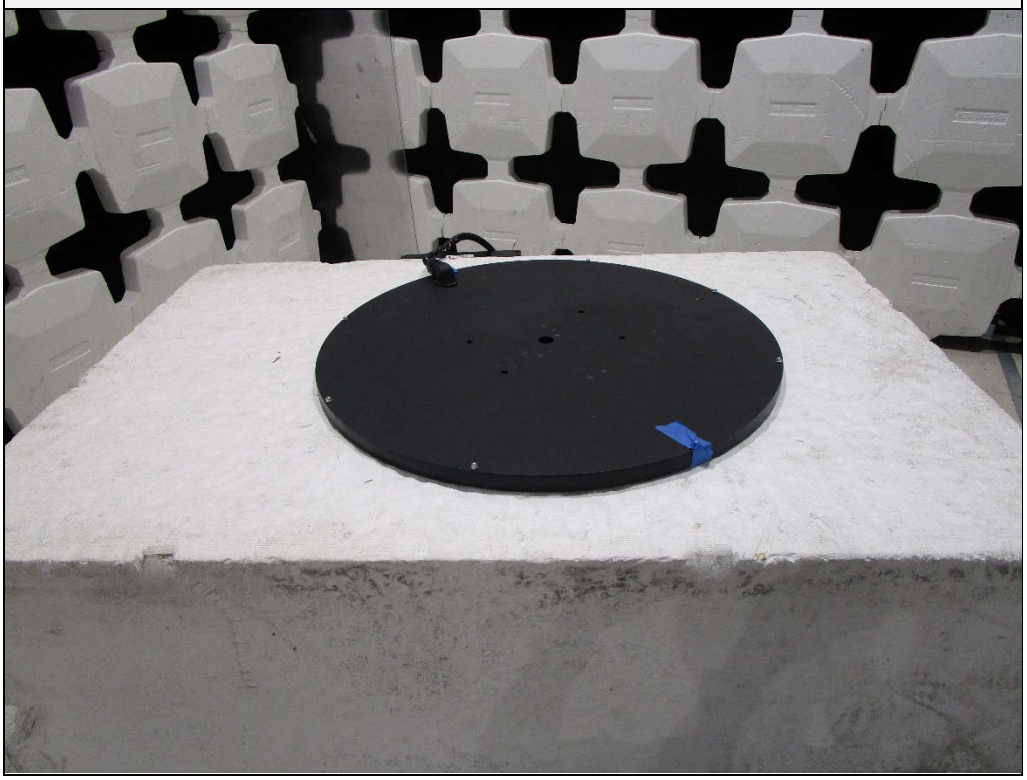
Elite Electronic Engineering Incorporated certifies that the information contained in this report was obtained under conditions which meet or exceed those specified in the FCC "Code of Federal Regulations" Title 47 Part 15, Subpart B and C and Innovation, Science, and Economic Development Canada, ICES-003 and RSS-GEN test specifications. The data presented in this test report pertains to the EUTs on the test date specified. Any electrical or mechanical modifications made to the EUTs subsequent to the specified test date will serve to invalidate the data and void this certification.

17. Photographs of EUT







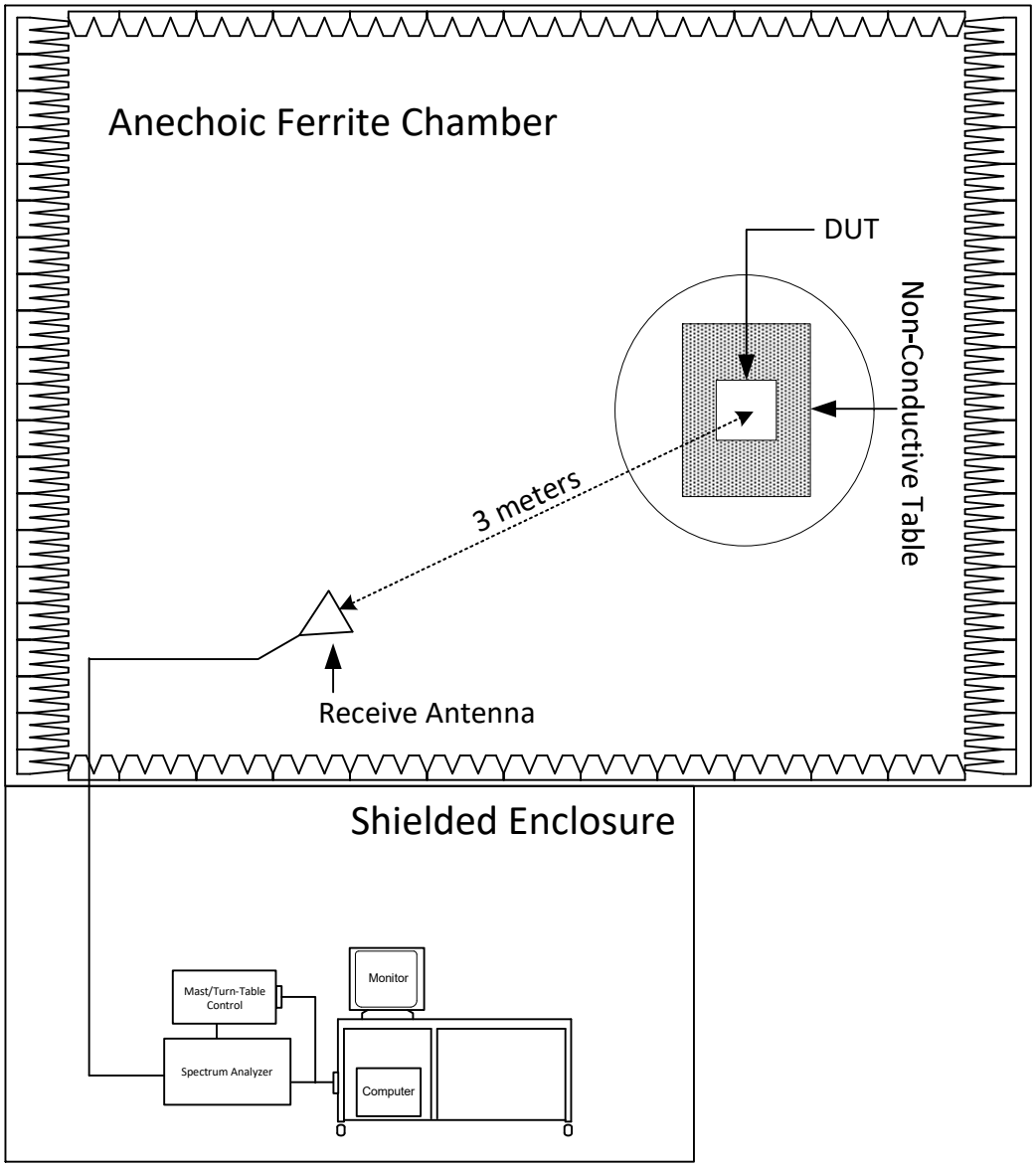


18. Equipment List

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	9/21/2021	9/21/2022
CDU4	LAPTOP COMPUTER	HP				N/A	
CDZ3	LAB WORKSTATION	ELITE	LWS-10		WINDOWS 10	CNR	
CDZ4	LAB WORKSTATION	ELITE	LWS-10		WINDOWS 10	CNR	
NLS0	24" ACTIVE LOOP ANTENNA	EMCO	6502	89979	10KHZ-30MHZ	9/11/2020	9/11/2022
NTA4	BILOG ANTENNA	TESEQ	6112D	46660	20-2000GHZ	10/5/2020	10/5/2022
NWQ2	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS LINDGREN	3117	66659	1GHZ-18GHZ	4/7/2020	4/7/2022
PLF1	CISPR16 50UH LISN	ELITE	CISPR16/70A	001	.15-30MHz	4/8/2021	4/8/2022
PLF3	CISPR16 50UH LISN	ELITE	CISPR16/70A	003	.15-30MHz	4/8/2021	4/8/2022
R29F	3M ANECHOIC CHAMBER NSA	EMC TEST SYSTEMS	3M ANECHOIC		30MHZ-18GHZ	3/13/2021	3/13/2022
RBG2	EMI ANALYZER	ROHDE & SCHWARZ	ESW44	101591	2HZ-44GHZ	3/11/2021	3/11/2022
RBG3	EMI ANALYZER	ROHDE & SCHWARZ	ESW44	101592	2HZ-44GHZ	7/12/2021	7/12/2022
RESS0	EM FIELD METER/ISOTROPIC PROBE	WAVECONTROL	SMP2/WPF3-HP	21SN1576/21WP030398	---	4/27/2021	4/27/2022
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	
WKA1	SOFTWARE, UNIVERSAL RCV EMI	ELITE	UNIV_RCV_EMI	1	---	I/O	
XLQ9	5W, 50 OHM TERMINATION	JFW INDUSTRIES	50T-052	---	DC-2GHZ	1/5/2022	1/5/2024

N/A: Not Applicable I/O: Initial Only CNR: Calibration Not Required
NOTE 1: For the purpose of this test, the equipment was calibrated over the specified frequency range, pulse rate, or modulation prior to the test or monitored by a calibrated instrument.

19. Block Diagram of Test Setup



Radiated Measurements Test Setup

20. Radiated Emissions (Transmitter)

Test Information	
Manufacturer	JR Automation
Product	TPM Activator
Model	TPM-SA-300-000 TPM-LA-300-000 TPM-LA-200-000 TPM-SA-200-000
Serial No	N/a
Mode	Tx On

Test Setup Details	
Setup Format	Floor Standing
Height of Support	100cm for TPM-SA-300-000 (White Circle) and TPM-SA-200-000 (Black Circle) 0cm for TPM-LA-300-000 (White Rectangle) and TPM-LA-200-000 (Black Oval)
Test Method	Radiated
Type of Test Site	OTA Open Field
Test Distance	30m
Type of Antenna Used	Loop Antenna (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

Test Setup for Radiated Spurious Emissions – 150kHz – 30MHz X-Axis Polarization

Test Setup for Radiated Spurious Emissions – 150kHz – 30MHz Y-Axis Polarization

Test Setup for Radiated Spurious Emissions – 150kHz – 30MHz Z-Axis Polarization

Data Page	
Manufacturer	JR Automation
Test Item	TPM Activator
Model No.	TPM-SA-300-000
Test	Transmitter Unwanted Emissions in the Spurious Domain
Mode	Tx On
Carrier Frequency	125kHz
Test Distance	30m
Date Tested	December 28th, 2021
Notes	X-axis Frequency range up to 10th harmonic scanned, no significant emissions detected above ambient.

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)	Specified Test Distance (meters)	Margin (dB)
0.125	X	23.4		0.0	10.7	0.0	-40.0	-5.9	0.5	19.2	300.0	-31.6
0.250	X	39.5	*	0.0	10.6	0.0	-40.0	10.1	3.2	9.6	300.0	-9.5
0.375	X	34.8	*	0.0	10.7	0.0	-40.0	5.5	1.9	6.4	300.0	-10.6

Data Page	
Manufacturer	JR Automation
Test Item	TPM Activator
Model No.	TPM-SA-300-000
Test	Transmitter Unwanted Emissions in the Spurious Domain
Mode	Tx On
Carrier Frequency	125kHz
Test Distance	30m
Date Tested	December 28th, 2021
Notes	Y-axis Frequency range up to 10th harmonic scanned, no significant emissions detected above ambient.

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)	Specified Test Distance (meters)	Margin (dB)
0.125	Y	23.5		0.0	10.7	0.0	-40.0	-5.8	0.5	19.2	300.0	-31.5
0.250	Y	42.9	*	0.0	10.6	0.0	-40.0	13.5	4.7	9.6	300.0	-6.1
0.375	Y	33.6	*	0.0	10.7	0.0	-40.0	4.3	1.6	6.4	300.0	-11.8

Data Page	
Manufacturer	JR Automation
Test Item	TPM Activator
Model No.	TPM-SA-300-000
Test	Transmitter Unwanted Emissions in the Spurious Domain
Mode	Tx On
Carrier Frequency	125kHz
Test Distance	30m
Date Tested	December 28th, 2021
Notes	Z-axis Frequency range up to 10th harmonic scanned, no significant emissions detected above ambient.

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)	Specified Test Distance (meters)	Margin (dB)
0.125	Z	23.7		0.0	10.7	0.0	-40.0	-5.6	0.5	19.2	300.0	-31.3
0.250	Z	36.6	*	0.0	10.6	0.0	-40.0	7.2	2.3	9.6	300.0	-12.4
0.375	Z	33.1	*	0.0	10.7	0.0	-40.0	3.8	1.5	6.4	300.0	-12.3

Data Page	
Manufacturer	JR Automation
Test Item	TPM Activator
Model No.	TPM-LA-300-000
Test	Transmitter Unwanted Emissions in the Spurious Domain
Mode	Tx On
Carrier Frequency	125kHz
Test Distance	30m
Date Tested	December 28th, 2021
Notes	X-axis Frequency range up to 10th harmonic scanned, no significant emissions detected above ambient.

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)	Specified Test Distance (meters)	Margin (dB)
0.125	X	54.6		0.0	10.7	0.0	-40.0	25.3	18.4	19.2	300.0	-0.4
0.250	X	48.7		0.0	10.6	0.0	-40.0	19.4	9.3	9.6	300.0	-0.3
0.375	X	46.6	*	0.0	10.7	0.0	-40.0	17.3	7.3	6.4	300.0	1.2

Data Page	
Manufacturer	JR Automation
Test Item	TPM Activator
Model No.	TPM-LA-300-000
Test	Transmitter Unwanted Emissions in the Spurious Domain
Mode	Tx On
Carrier Frequency	125kHz
Test Distance	30m
Date Tested	December 28th, 2021
Notes	Y-axis Frequency range up to 10th harmonic scanned, no significant emissions detected above ambient.

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)	Specified Test Distance (meters)	Margin (dB)
0.125	Y	54.5		0.0	10.7	0.0	-40.0	25.2	18.1	19.2	300.0	-0.5
0.250	Y	46.5		0.0	10.6	0.0	-40.0	17.2	7.2	9.6	300.0	-2.5
0.375	Y	42.8	*	0.0	10.7	0.0	-40.0	13.5	4.7	6.4	300.0	-2.7

Data Page	
Manufacturer	JR Automation
Test Item	TPM Activator
Model No.	TPM-LA-300-000
Test	Transmitter Unwanted Emissions in the Spurious Domain
Mode	Tx On
Carrier Frequency	125kHz
Test Distance	30m
Date Tested	December 28th, 2021
Notes	Z-axis Frequency range up to 10th harmonic scanned, no significant emissions detected above ambient.

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)	Specified Test Distance (meters)	Margin (dB)
0.125	Z	54.2		0.0	10.7	0.0	-40.0	24.8	17.4	19.2	300.0	-0.8
0.250	Z	44.8		0.0	10.6	0.0	-40.0	15.4	5.9	9.6	300.0	-4.3
0.375	Z	41.4	*	0.0	10.7	0.0	-40.0	12.0	4.0	6.4	300.0	-4.1

Data Page	
Manufacturer	JR Automation
Test Item	TPM Activator
Model No.	TPM-LA-200-000
Test	Transmitter Unwanted Emissions in the Spurious Domain
Mode	Tx On
Carrier Frequency	125kHz
Test Distance	30m
Date Tested	December 28th, 2021
Notes	Per customer guidance, only the X-axis orientation was recorded. Antenna was assumed to have symmetrical emissions within the plane of measurement. Frequency range up to 10th harmonic scanned, no significant emissions detected above ambient.

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)	Specified Test Distance (meters)	Margin (dB)
0.125	X	27.5		0.0	10.7	0.0	-40.0	-1.8	0.8	19.2	300.0	-27.5
0.250	X	39.7	*	0.0	10.6	0.0	-40.0	10.3	3.3	9.6	300.0	-9.3
0.375	X	35.2	*	0.0	10.7	0.0	-40.0	5.9	2.0	6.4	300.0	-10.2

Data Page	
Manufacturer	JR Automation
Test Item	TPM Activator
Model No.	TPM-SA-200-000
Test	Transmitter Unwanted Emissions in the Spurious Domain
Mode	Tx On
Carrier Frequency	125kHz
Test Distance	30m
Date Tested	December 28th, 2021
Notes	Per customer guidance, only the X-axis orientation was recorded. Antenna was assumed to have symmetrical emissions within the plane of measurement. Frequency range up to 10th harmonic scanned, no significant emissions detected above ambient.

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)	Specified Test Distance (meters)	Margin (dB)
0.125	X	24.5		0.0	10.7	0.0	-40.0	-4.8	0.6	19.2	300.0	-30.5
0.250	X	39.8	*	0.0	10.6	0.0	-40.0	10.4	3.3	9.6	300.0	-9.2
0.375	X	34.8	*	0.0	10.7	0.0	-40.0	5.5	1.9	6.4	300.0	-10.6

21. RF Conducted Emissions (AC Mains)

EUT Information	
Manufacturer	JR Automation
Product	TPM Activator
Model No.	TPM-SA-300-000 TPM-LA-300-000 TPM-LA-200-000 TPM-SA-200-000
Serial No.	N/a
Mode	Tx On

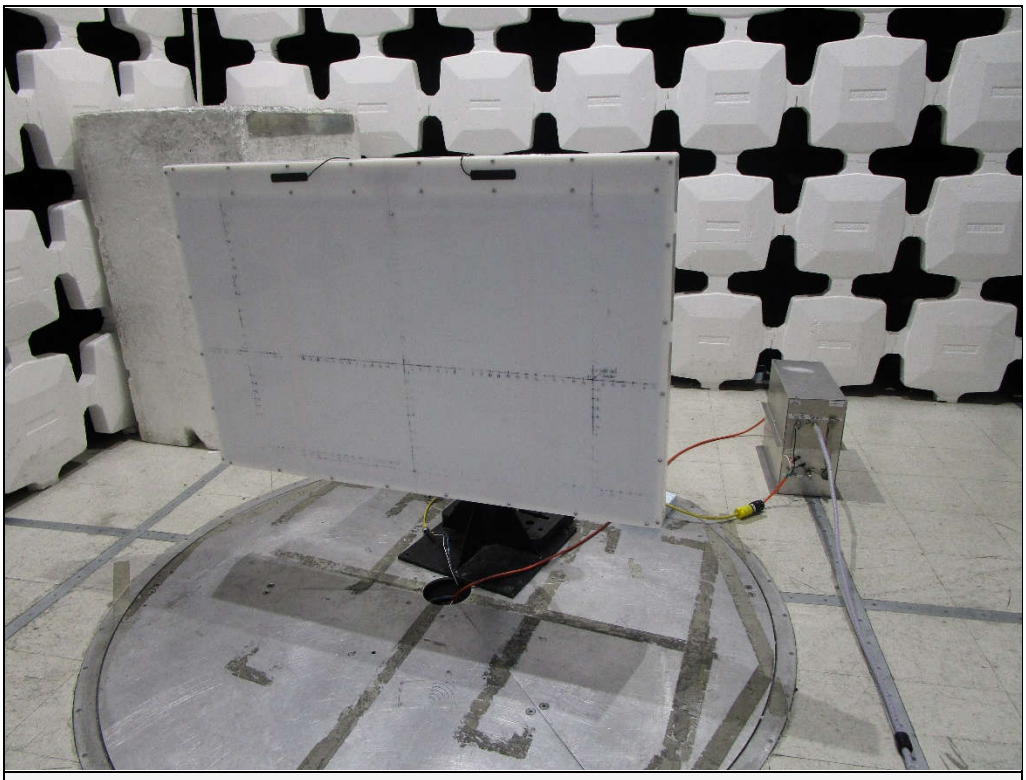
Test Site Information	
Setup Format	Tabletop and Floor Standing
Height of Support	N/a for TPM-SA-300-000 (White Circle) and TPM-SA-200-000 (Black Circle) 30 cm for TPM-LA-300-000 (White Rectangle) and TPM-LA-200-000 (Black Oval)
Type of Test Site	Semi-Anechoic
Test Site Used	R29A
Note	N/A

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

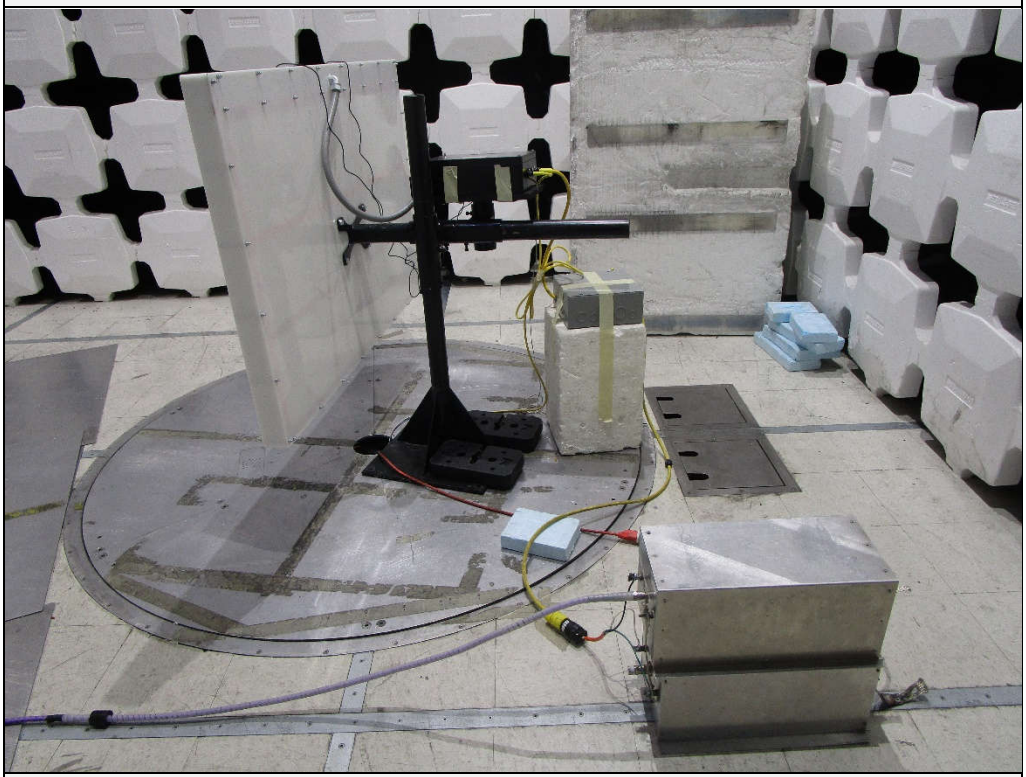
Requirements
For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150kHz to 30MHz shall not exceed the limits in the following table.

Conducted Emissions Limits		
Frequency (MHz)	Conducted limit (dBµV)	
	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 Tx On mode. 2) Measurements were first made on the 24VDC 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). Formula 1: VL (dBµV) = MTR (dBµV) + CF (dB) 7) Steps (3) through (6) were repeated on the 24VDC return line. 8) Steps (3) through (7) were repeated for the TPM-LA-200-000 unit. As the control box for the TPM-LA-200-000 and TPM-SA-200-000 were the same, the customer only requested testing of the TPM-LA-200-000 unit. The TPM-SA-300-000 unit and TPM-LA-300-000 unit also had identical control boxes, so only the TPM-LA-300-000 unit was tested.



Test Setup for RF Conducted Emissions (AC Mains)



Test Setup for RF Conducted Emissions (AC Mains)

FCC Part 15 Conducted Emissions Test

Significant Emissions Data

VBR8 05/14/2020

Manufacturer	:	Esys
Model	:	White Rectangle, TPM-LA-300-000
DUT Revision	:	
Serial Number	:	N/a
DUT Mode	:	CW Tx On, Datalink On
Line Tested	:	High
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	
Test Engineer	:	N. Bouchie
Limit	:	Tx and Rx
Test Date	:	Dec 30, 2021 11:49:05 AM
Data Filter	:	Up to 80 maximum levels detected with 6 dB level excursion threshold over 10 dB margin below limit

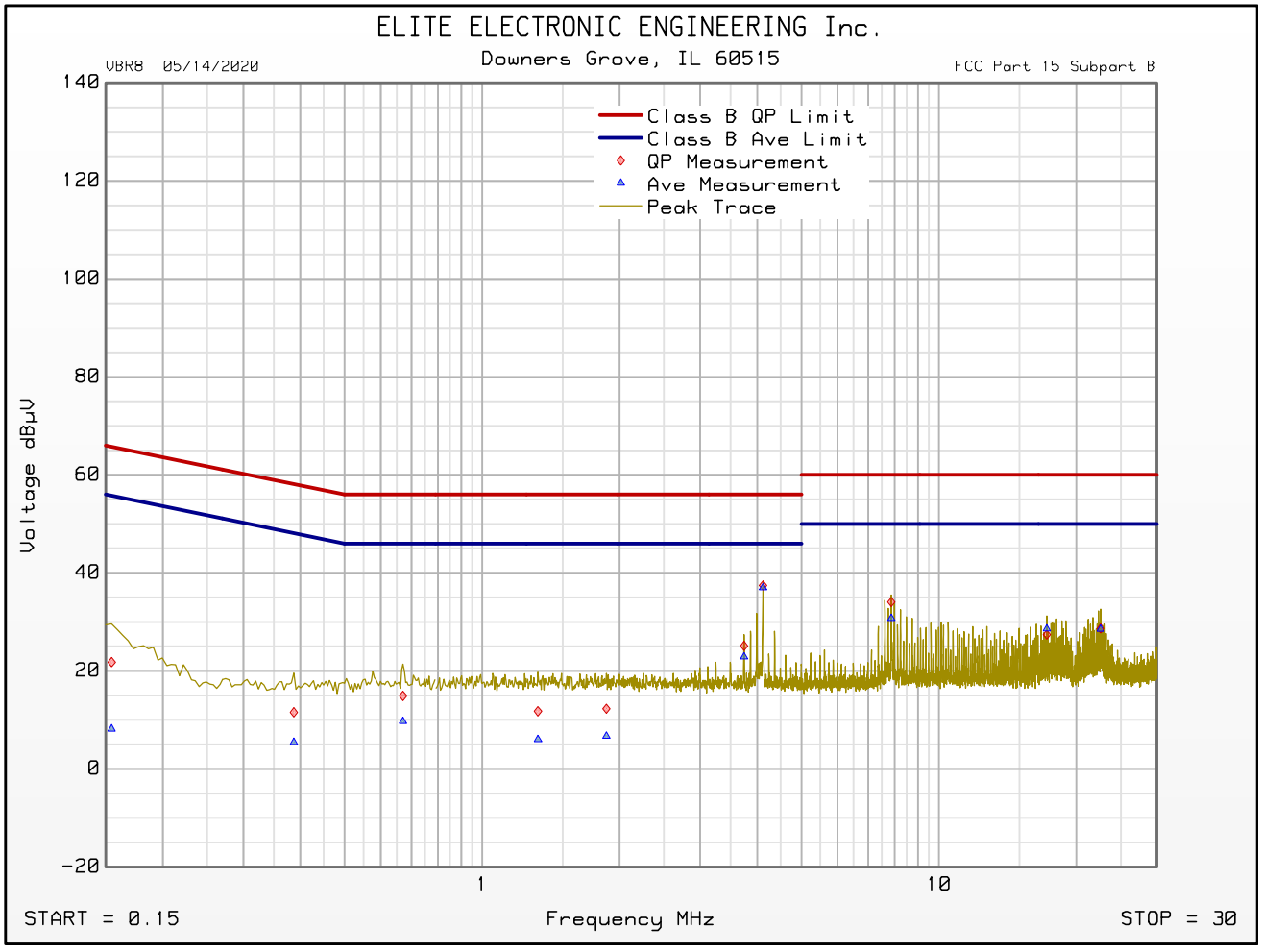
Freq MHz	Quasi-peak Level dBµV	Quasi-peak Limit dBµV	Excessive Quasi-peak Emissions	Average Level dBµV	Average Limit dBµV	Excessive Average Emissions
0.155	21.8	65.8		8.2	55.8	
0.387	11.6	58.1		5.4	48.1	
0.671	14.9	56.0		9.7	46.0	
1.871	12.3	56.0		6.7	46.0	
4.119	37.4	56.0		37.0	46.0	
7.864	34.0	60.0		30.7	50.0	
22.596	28.7	60.0		28.5	50.0	

FCC Part 15 Conducted Emissions Test

Cumulative Data

VBR8 05/14/2020

Manufacturer	:	Esys
Model	:	White Rectangle, TPM-LA-300-000
DUT Revision	:	
Serial Number	:	N/a
DUT Mode	:	CW Tx On, Datalink On
Line Tested	:	High
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	
Test Engineer	:	N. Bouchie
Limit	:	Tx and Rx
Test Date	:	Dec 30, 2021 11:49:05 AM



Emissions Meet QP Limit
Emissions Meet Ave Limit

FCC Part 15 Conducted Emissions Test

Significant Emissions Data

VBR8 05/14/2020

Manufacturer	:	Esys
Model	:	White Rectangle, TPM-LA-300-000
DUT Revision	:	
Serial Number	:	N/a
DUT Mode	:	CW Tx On, Datalink On
Line Tested	:	Neutral
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	
Test Engineer	:	N. Bouchie
Limit	:	Tx and Rx
Test Date	:	Dec 30, 2021 12:34:36 PM
Data Filter	:	Up to 80 maximum levels detected with 6 dB level excursion threshold over 10 dB margin below limit

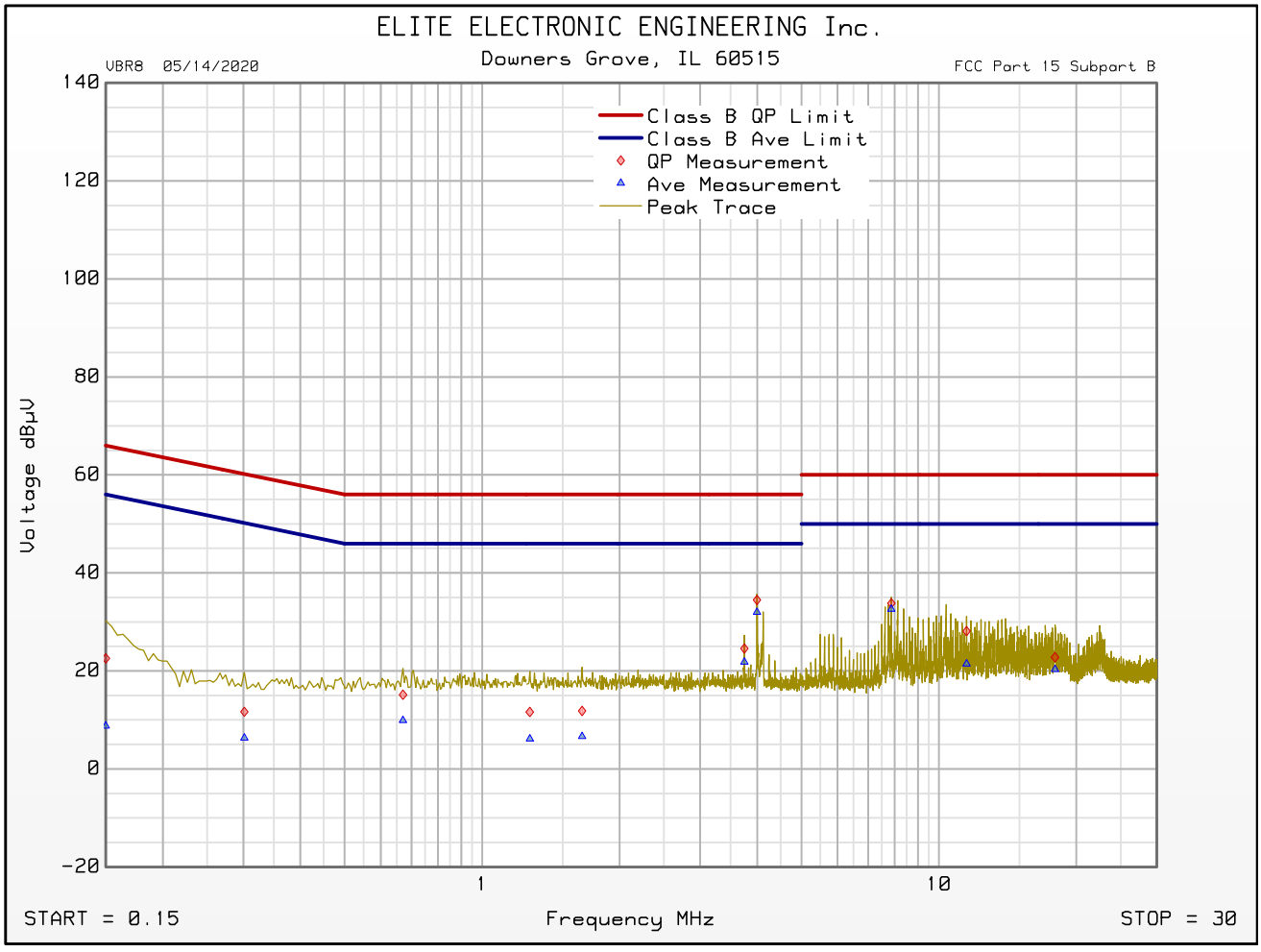
Freq MHz	Quasi-peak Level dBµV	Quasi-peak Limit dBµV	Excessive Quasi-peak Emissions	Average Level dBµV	Average Limit dBµV	Excessive Average Emissions
0.150	22.5	66.0		8.8	56.0	
0.302	11.6	60.2		6.3	50.2	
0.671	15.1	56.0		9.9	46.0	
1.655	11.8	56.0		6.7	46.0	
3.998	34.5	56.0		32.0	46.0	
7.868	33.8	60.0		32.6	50.0	
11.496	28.1	60.0		21.5	50.0	
17.952	22.8	60.0		20.3	50.0	

FCC Part 15 Conducted Emissions Test

Cumulative Data

VBR8 05/14/2020

Manufacturer	:	Esys
Model	:	White Rectangle, TPM-LA-300-000
DUT Revision	:	
Serial Number	:	N/a
DUT Mode	:	CW Tx On, Datalink On
Line Tested	:	Neutral
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	
Test Engineer	:	N. Bouchie
Limit	:	Tx and Rx
Test Date	:	Dec 30, 2021 12:34:36 PM



Emissions Meet QP Limit
Emissions Meet Ave Limit

FCC Part 15 Conducted Emissions Test

Significant Emissions Data

VBR8 05/14/2020

Manufacturer	:	Esys
Model	:	Black Oval Antenna, TPM-LA-200-000
DUT Revision	:	
Serial Number	:	N/a
DUT Mode	:	CW Tx On, Datalink On
Line Tested	:	High
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	
Test Engineer	:	N. Bouchie
Limit	:	Tx and Rx
Test Date	:	Dec 30, 2021 03:34:25 PM
Data Filter	:	Up to 80 maximum levels detected with 6 dB level excursion threshold over 10 dB margin below limit

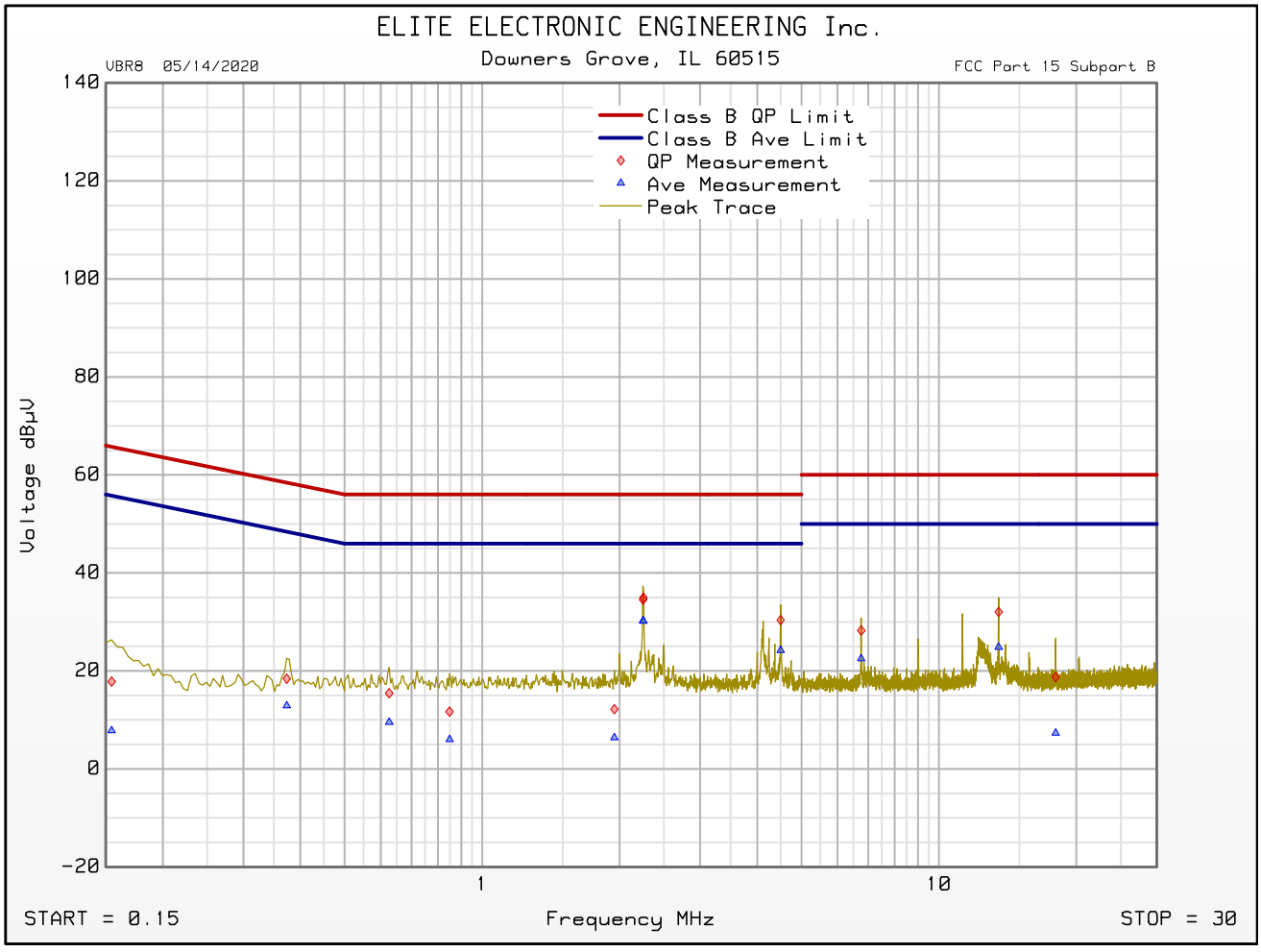
Freq MHz	Quasi-peak Level dBµV	Quasi-peak Limit dBµV	Excessive Quasi-peak Emissions	Average Level dBµV	Average Limit dBµV	Excessive Average Emissions
0.155	17.8	65.8		7.8	55.8	
0.374	18.4	58.4		12.9	48.4	
0.626	15.4	56.0		9.5	46.0	
0.849	11.7	56.0		6.0	46.0	
1.948	12.2	56.0		6.4	46.0	
2.255	34.9	56.0		30.2	46.0	
4.504	30.4	56.0		24.2	46.0	
6.760	28.2	60.0		22.5	50.0	
13.514	32.0	60.0		24.9	50.0	
18.005	18.7	60.0		7.3	50.0	

FCC Part 15 Conducted Emissions Test

Cumulative Data

VBR8 05/14/2020

Manufacturer	:	Esys
Model	:	Black Oval Antenna, TPM-LA-200-000
DUT Revision	:	
Serial Number	:	N/a
DUT Mode	:	CW Tx On, Datalink On
Line Tested	:	High
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	
Test Engineer	:	N. Bouchie
Limit	:	Tx and Rx
Test Date	:	Dec 30, 2021 03:34:25 PM



Emissions Meet QP Limit
Emissions Meet Ave Limit

FCC Part 15 Conducted Emissions Test

Significant Emissions Data

VBR8 05/14/2020

Manufacturer	:	Esys
Model	:	Black Oval Antenna, TPM-LA-200-000
DUT Revision	:	
Serial Number	:	N/a
DUT Mode	:	CW Tx On, Datalink On
Line Tested	:	Neutral
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	
Test Engineer	:	N. Bouchie
Limit	:	Tx and Rx
Test Date	:	Dec 30, 2021 03:39:21 PM
Data Filter	:	Up to 80 maximum levels detected with 6 dB level excursion threshold over 10 dB margin below limit

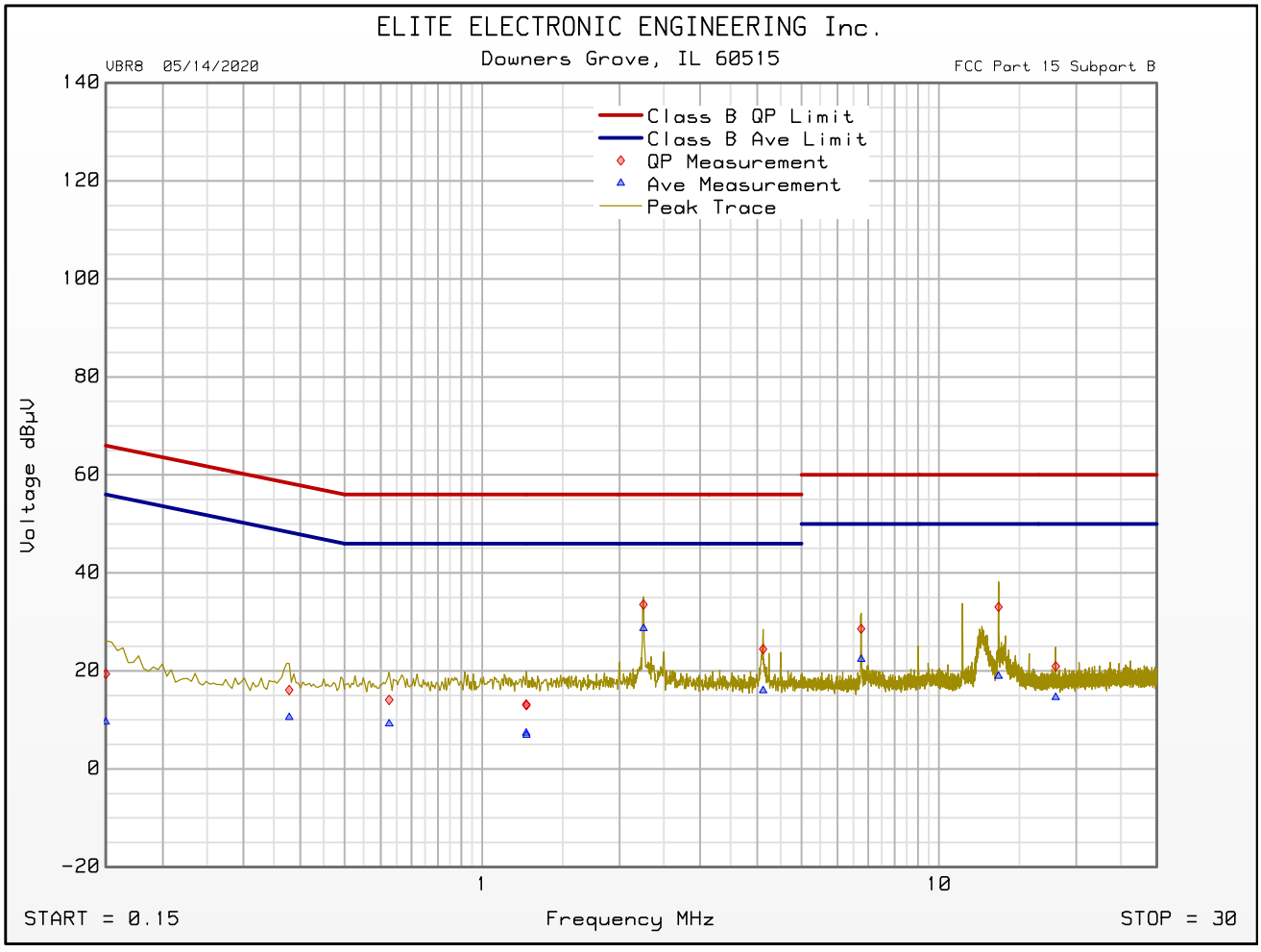
Freq MHz	Quasi-peak Level dBµV	Quasi-peak Limit dBµV	Excessive Quasi-peak Emissions	Average Level dBµV	Average Limit dBµV	Excessive Average Emissions
0.150	19.4	66.0		9.6	56.0	
0.378	16.1	58.3		10.5	48.3	
0.626	14.1	56.0		9.2	46.0	
1.249	13.2	56.0		7.3	46.0	
1.250	13.0	56.0		6.9	46.0	
2.255	33.5	56.0		28.7	46.0	
4.121	24.4	56.0		16.0	46.0	
6.755	28.6	60.0		22.4	50.0	
13.505	33.1	60.0		18.9	50.0	
18.023	20.9	60.0		14.6	50.0	

FCC Part 15 Conducted Emissions Test

Cumulative Data

VBR8 05/14/2020

Manufacturer	:	Esys
Model	:	Black Oval Antenna, TPM-LA-200-000
DUT Revision	:	
Serial Number	:	N/a
DUT Mode	:	CW Tx On, Datalink On
Line Tested	:	Neutral
Scan Step Time [ms]	:	30
Meas. Threshold [dB]	:	-10
Notes	:	
Test Engineer	:	N. Bouchie
Limit	:	Tx and Rx
Test Date	:	Dec 30, 2021 03:39:21 PM



Emissions Meet QP Limit
Emissions Meet Ave Limit

22. RF Radiated Emissions

EUT Information	
Manufacturer	JR Automation
Product	TPM Activator
Model No.	TPM-SA-300-000 TPM-LA-300-000 TPM-LA-200-000 TPM-SA-200-000
Serial No.	N/a
Mode	Tx On

Test Site Information	
Setup Format	Tabletop and Floor Standing
Height of Support	N/a for TPM-SA-300-000 (White Circle) and TPM-SA-200-000 (Black Circle) 30 cm for TPM-LA-300-000 (White Rectangle) and TPM-LA-200-000 (Black Oval)
Type of Test Site	Semi-Anechoic Chamber
Test Site Used	R29A
Type of Antennas Used	Below 1GHz: Bilog (or equivalent) Above 1GHz: Double-ridged waveguide (or equivalent)
Highest Internal Frequency	433.92 MHz
Highest Measurement Frequency	4.0 GHz
Notes	The cables were manually maximized during the preliminary emissions sweeps. The cable arrangement which resulted in the worst-case emissions was utilized.

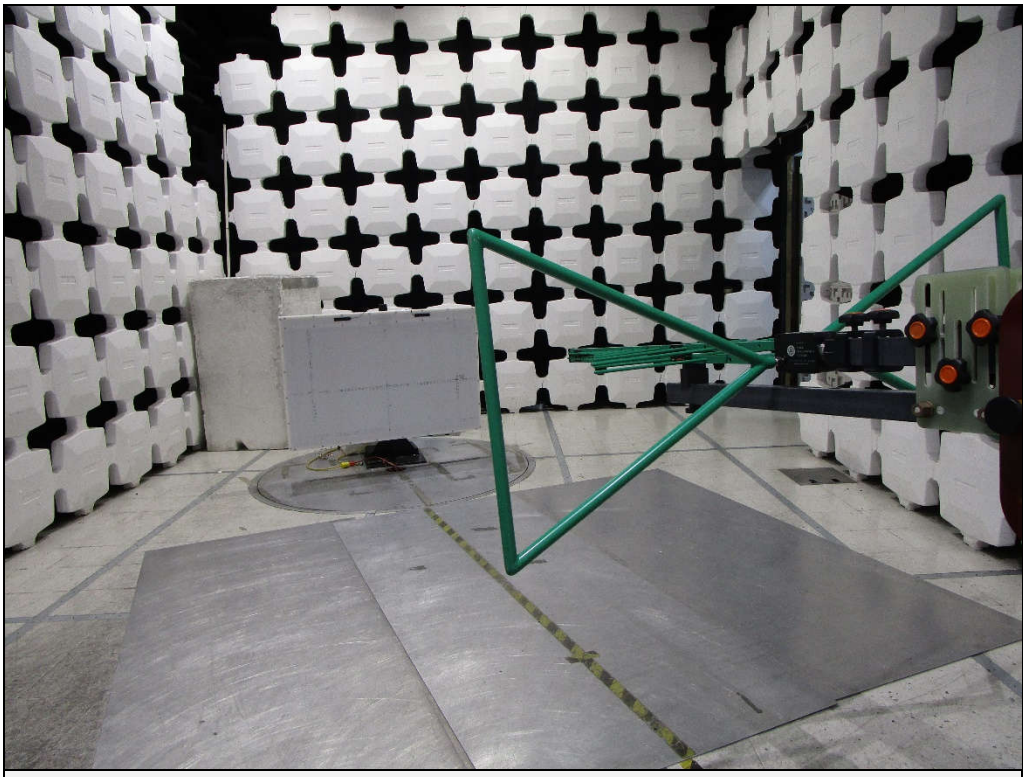
Measurement Uncertainty	
Measurement Type	Expanded Measurement Uncertainty
Radiated disturbance (electric field strength on an open area test site or alternative test site) (30 MHz – 1000 MHz)	4.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (1 GHz – 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
The field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the values in the following tables.

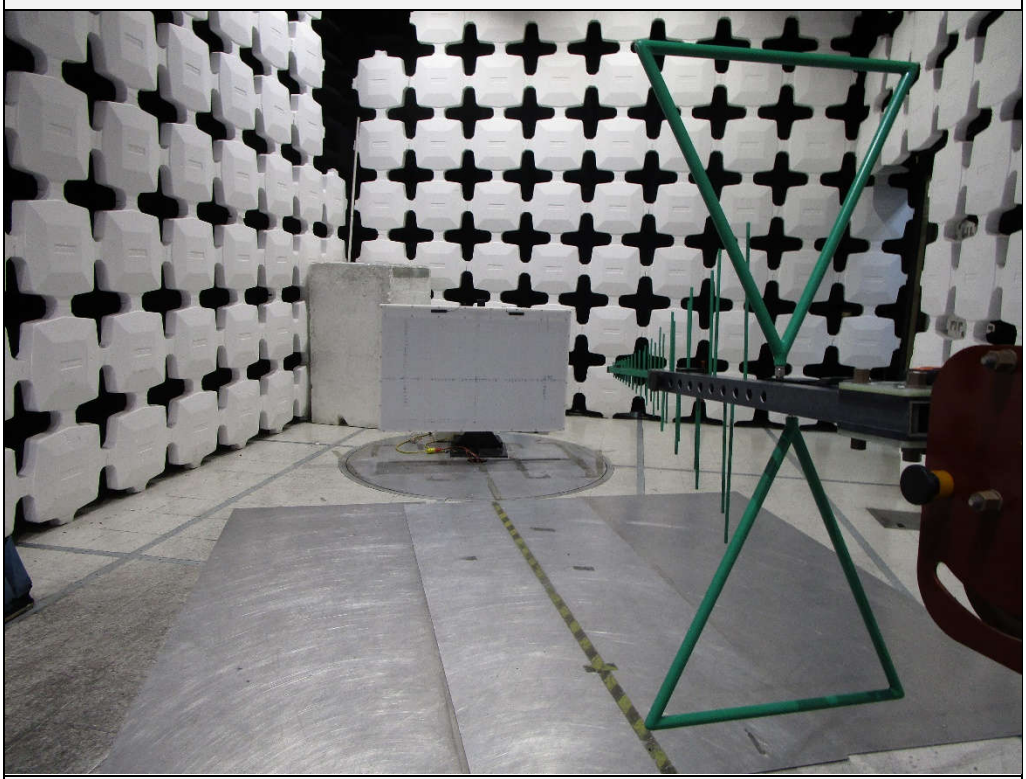
FCC Part 15 Radiated Emissions Limits (30MHz to 1GHz)		
Frequency of Emission (MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)
30 – 88	100	40
88 – 216	150	43.5
216 – 960	200	46
Above 960	500	54
FCC Part 15 Radiated Emissions Limits (Above 1GHz)		
Frequency of Emission (MHz)	Peak Limit (dBµV/m)	Average Limit (dBµV/m)
Above 1000	74	54

ICES-003 Radiated Emissions Limits (30MHz to 1GHz)		
Frequency Range (MHz)	Field Strength at 3 meters (dBµV/m)	Field Strength at 10 meters (dBµV/m)
30 – 88	40	30
88 – 216	43.5	33.1
216 – 230	46	35.6
230 – 960	47	37
960 – 1000	54	43.5
ICES-003 Radiated Emissions Limits (At and Above 1GHz)		
Frequency Range (GHz)	Average (dBµV/m)	Peak (dBµV/m)
1 – F_M	54	74
F_M = highest measurement frequency		

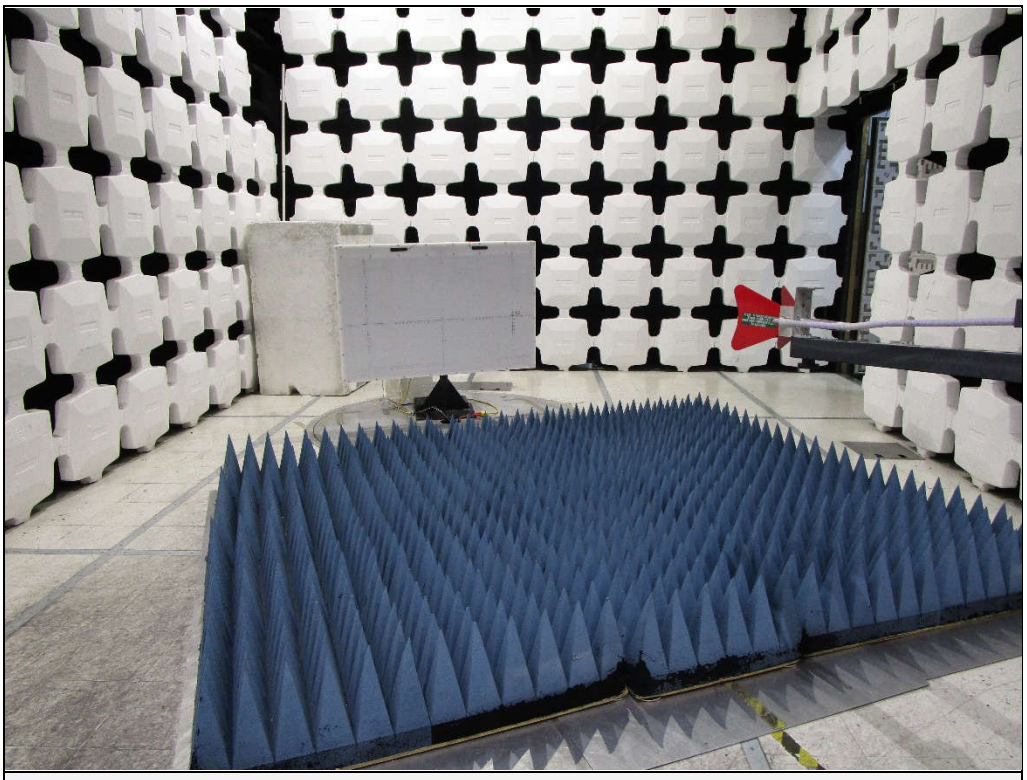
Procedure
Since a quasi-peak detector and an average detector requires long integration times, it is not practical to automatically sweep through the quasi-peak and average levels. Therefore, radiated emissions from the EUT were first scanned using a peak detector and automatically plotted. The frequencies where significant emission levels were noted were then remeasured using the quasi-peak detector or average detector. The EUT and all peripheral equipment were placed on an 80cm high non-conductive stand. When testing the White Rectangle and Black Oval antennae, the EUT was mounted on its stand and centered on the turntable. The broadband measuring antenna was positioned at a 3 meter distance from the EUT. The frequency range from 30MHz to 1GHz was investigated using a peak detector function with the bilog antenna at several heights, horizontal and vertical polarization, and with several different orientations of the EUT with respect to the antenna. The frequency range from 1GHz to 4.0GHz 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. The data was then processed by the computer to equivalent field intensity at 10 meters using linear extrapolation. A -10.5dB (-10.5dB = 20 * Log (3m/10m)) distance correction factor has automatically been applied to the plotted emissions data. Final radiated emissions were performed on all significant broadband and narrowband emissions found in the exploratory sweeps using the following methods: 1) Measurements from 30MHz to 1GHz were made using a quasi-peak detector and a broadband bilog antenna. Measurements above 1GHz were made using an average detector and a broadband double ridged waveguide antenna. 2) To ensure that maximum or worst case, emission levels were measured, the following steps were taken: a) The EUT was rotated so that all sides were exposed to the receiving antenna. b) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured. c) The measuring antenna was raised and lowered from 1 to 4 meters for each antenna polarization to maximize the readings. d) For hand-held or body-worn devices, the EUT was rotated through three orthogonal axes to determine which orientation produces the highest emission relative to the limit. 3) Steps (b) through (d) were repeated with the EUT operated in the Tx Off, Rx Only mode.



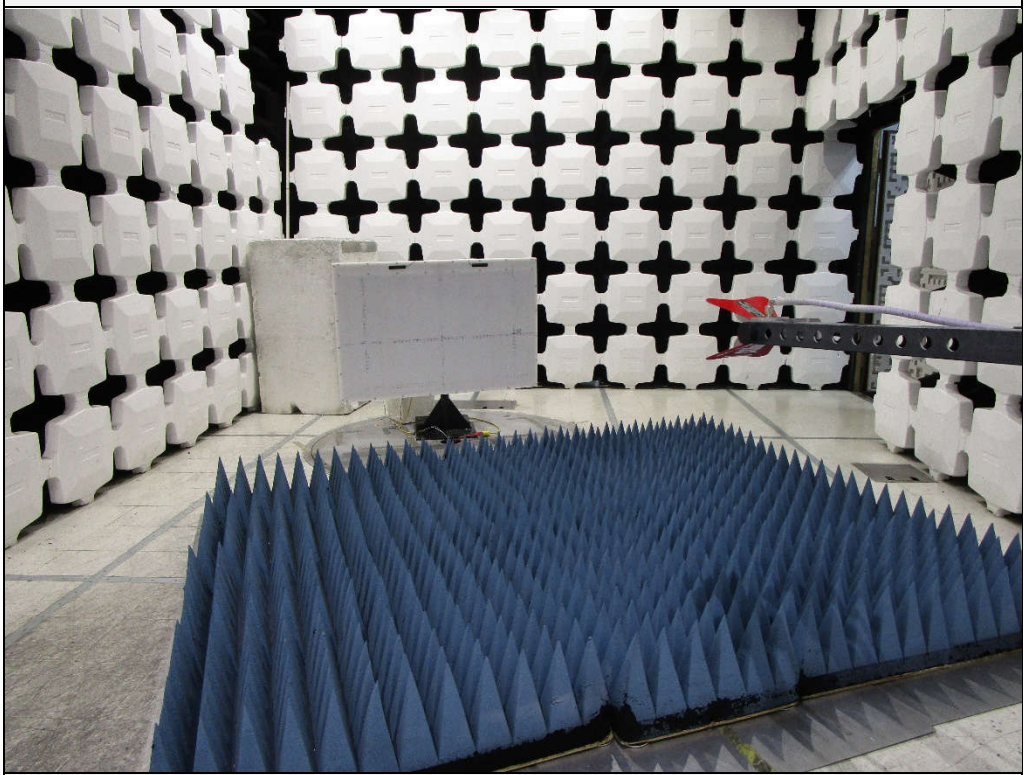
Test Setup for Radiated Emissions: 30MHz to 1GHz, Horizontal Polarization



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



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



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

FCC Part 15.209
Radiated RF Emissions Test

SW ID/Rev: VBV2 11/20/2021

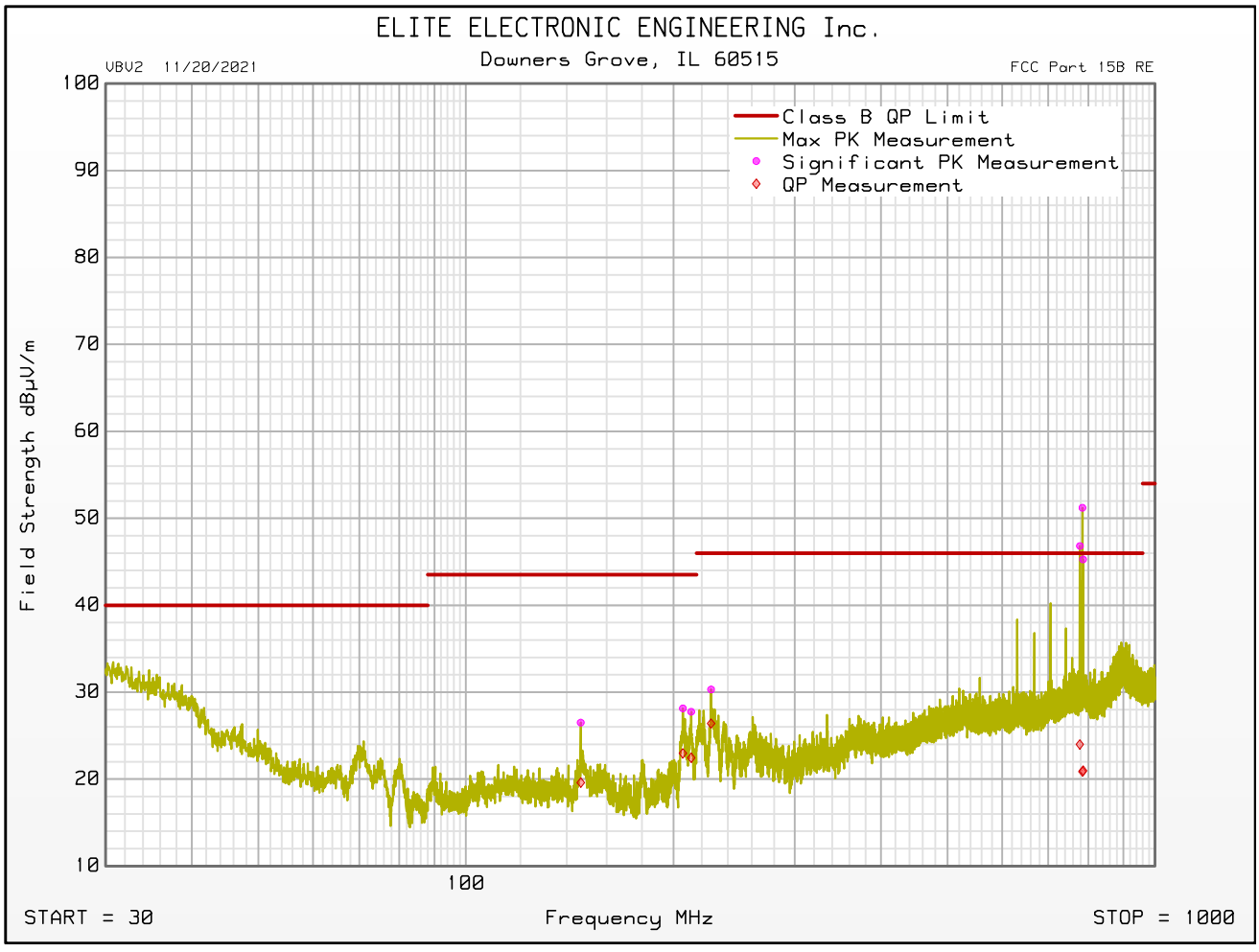
Manufacturer	:	Esys
Model	:	White Circle, TPM-SA-300-000
Serial Number	:	N/a
DUT Mode	:	Tx On
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	Test 8
Test Engineer	:	N. Bouchie
Test Date	:	Jan 17, 2022 01:19:44 PM

Freq MHz	Peak Mtr Rdg dBuV	QP Mtr Rdg dBuV	Ant Fac dB/m	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Peak Total dBµV/m	QP Total dBµV/m	QP Limit dBµV/m	QP Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °	Excessive QP Level
32.220	16.6	13.8	23.6	0.0	0.5	0.0	40.7	37.9	40.0	-2.1	Vertical	120	180	
79.680	9.1	1.5	13.2	0.0	0.5	0.0	22.8	15.2	40.0	-24.8	Vertical	340	0	
84.540	8.4	1.7	13.9	0.0	0.5	0.0	22.8	16.1	40.0	-23.9	Vertical	120	0	
102.220	7.1	0.6	17.1	0.0	0.5	0.0	24.7	18.2	43.5	-25.3	Vertical	120	180	
146.740	8.8	1.9	16.9	0.0	0.8	0.0	26.5	19.6	43.5	-23.9	Horizontal	200	315	
206.440	11.7	6.6	15.4	0.0	1.0	0.0	28.1	23.0	43.5	-20.5	Horizontal	200	45	
212.260	11.6	6.4	15.1	0.0	1.0	0.0	27.7	22.5	43.5	-21.1	Horizontal	200	45	
226.860	13.5	9.6	15.8	0.0	1.0	0.0	30.3	26.4	46.0	-19.6	Horizontal	200	315	
334.140	11.4	7.1	19.8	0.0	1.2	0.0	32.4	28.1	46.0	-17.9	Vertical	120	315	
371.160	6.6	-1.9	20.8	0.0	1.4	0.0	28.8	20.2	46.0	-25.8	Vertical	200	270	
777.840	19.1	-3.7	25.8	0.0	2.0	0.0	46.8	24.0	46.0	-22.0	Horizontal	120	315	
784.620	23.4	-7.0	25.9	0.0	2.0	0.0	51.2	20.9	46.0	-25.1	Horizontal	340	270	
786.240	17.4	-6.9	25.9	0.0	2.0	0.0	45.3	21.0	46.0	-25.0	Horizontal	340	270	

FCC Part 15.209
Radiated RF Emissions Test

SW ID/Rev: VBV2 11/20/2021

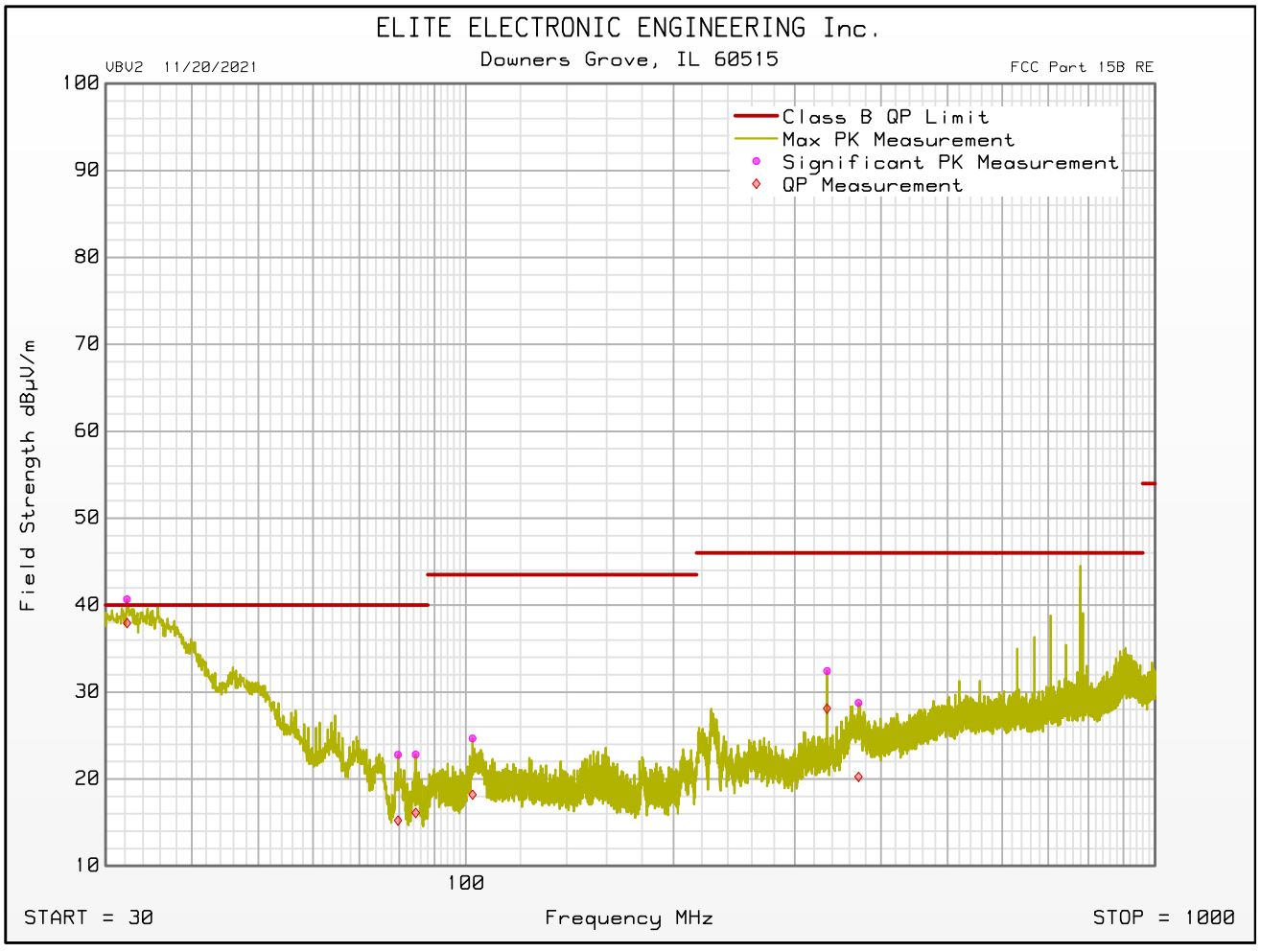
Manufacturer	:	Esys
Model	:	White Circle, TPM-SA-300-000
Serial Number	:	N/a
DUT Mode	:	Tx On
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Antenna Polarization	:	Horizontal
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	Test 8
Test Engineer	:	N. Bouchie
Test Date	:	Jan 17, 2022 01:19:44 PM



FCC Part 15.209
Radiated RF Emissions Test

SW ID/Rev: VBV2 11/20/2021

Manufacturer	:	Esys
Model	:	White Circle, TPM-SA-300-000
Serial Number	:	N/a
DUT Mode	:	Tx On
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Antenna Polarization	:	Vertical
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	Test 8
Test Engineer	:	N. Bouchie
Test Date	:	Jan 17, 2022 01:19:44 PM



FCC Part 15.109
Radiated RF Emissions Test

SW ID/Rev: VBV2 11/20/2021

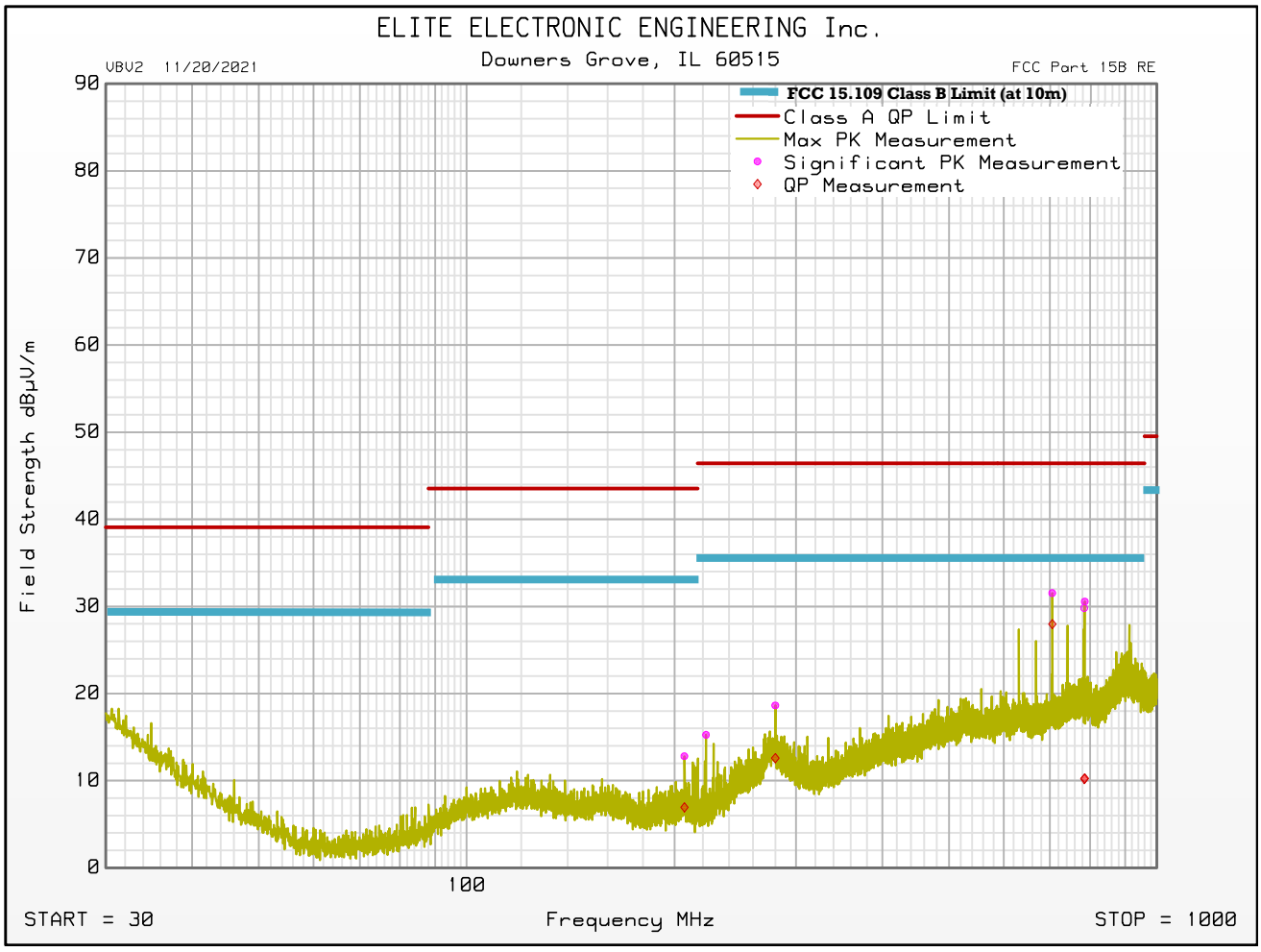
Manufacturer	:	Esys
Model	:	White Circle, TPM-SA-300-000
Serial Number	:	N/a
DUT Mode	:	Rx ONLY
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	Test 9
Test Engineer	:	N. Bouchie
Test Date	:	Jan 17, 2022 01:55:30 PM

Freq MHz	Peak Mtr Rdg dBuV	QP Mtr Rdg dBuV	Ant Fac dB/m	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Peak Total dBµV/m	QP Total dBµV/m	QP Limit dBµV/m	QP Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °	Excessive QP Level
30.240	5.2	-5.2	24.8	0	0.5	0	30.5	20.1	40.0	-19.9	Vertical	120	180	
58.980	9.8	5.5	12.6	0	0.5	0	22.9	18.6	40.0	-21.4	Vertical	200	270	
59.820	9.5	5.0	12.4	0	0.5	0	22.4	17.9	40.0	-22.1	Vertical	120	0	
61.380	10.0	6.2	12.4	0	0.5	0	22.9	19.1	40.0	-20.9	Vertical	200	270	
155.500	5.9	-0.2	17.2	0	0.8	0	23.9	17.8	43.5	-25.7	Vertical	200	0	
206.740	6.9	1.0	15.4	0	1.0	0	23.3	17.4	43.5	-26.1	Horizontal	200	315	
222.180	9.4	-7.0	15.3	0	1.0	0	25.7	9.3	46.0	-36.7	Horizontal	120	0	
279.960	9.5	3.4	18.6	0	1.0	0	29.1	23.0	46.0	-23.0	Horizontal	340	0	
334.140	11.5	7.5	19.8	0	1.2	0	32.5	28.5	46.0	-17.5	Vertical	120	315	
705.360	15.0	11.5	25.2	0	1.8	0	42.0	38.5	46.0	-7.5	Horizontal	200	315	
784.740	12.5	-7.2	25.9	0	2.0	0	40.4	20.7	46.0	-25.3	Horizontal	200	0	
786.300	13.2	-7.1	25.9	0	2.0	0	41.1	20.8	46.0	-25.2	Horizontal	200	0	

FCC Part 15.109
Radiated RF Emissions Test

SW ID/Rev: VBV2 11/20/2021

Manufacturer	:	Esys
Model	:	White Circle, TPM-SA-300-000
Serial Number	:	N/a
DUT Mode	:	Rx ONLY
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Antenna Polarization	:	Horizontal
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	Test 9
Test Engineer	:	N. Bouchie
Test Date	:	Jan 17, 2022 01:55:30 PM

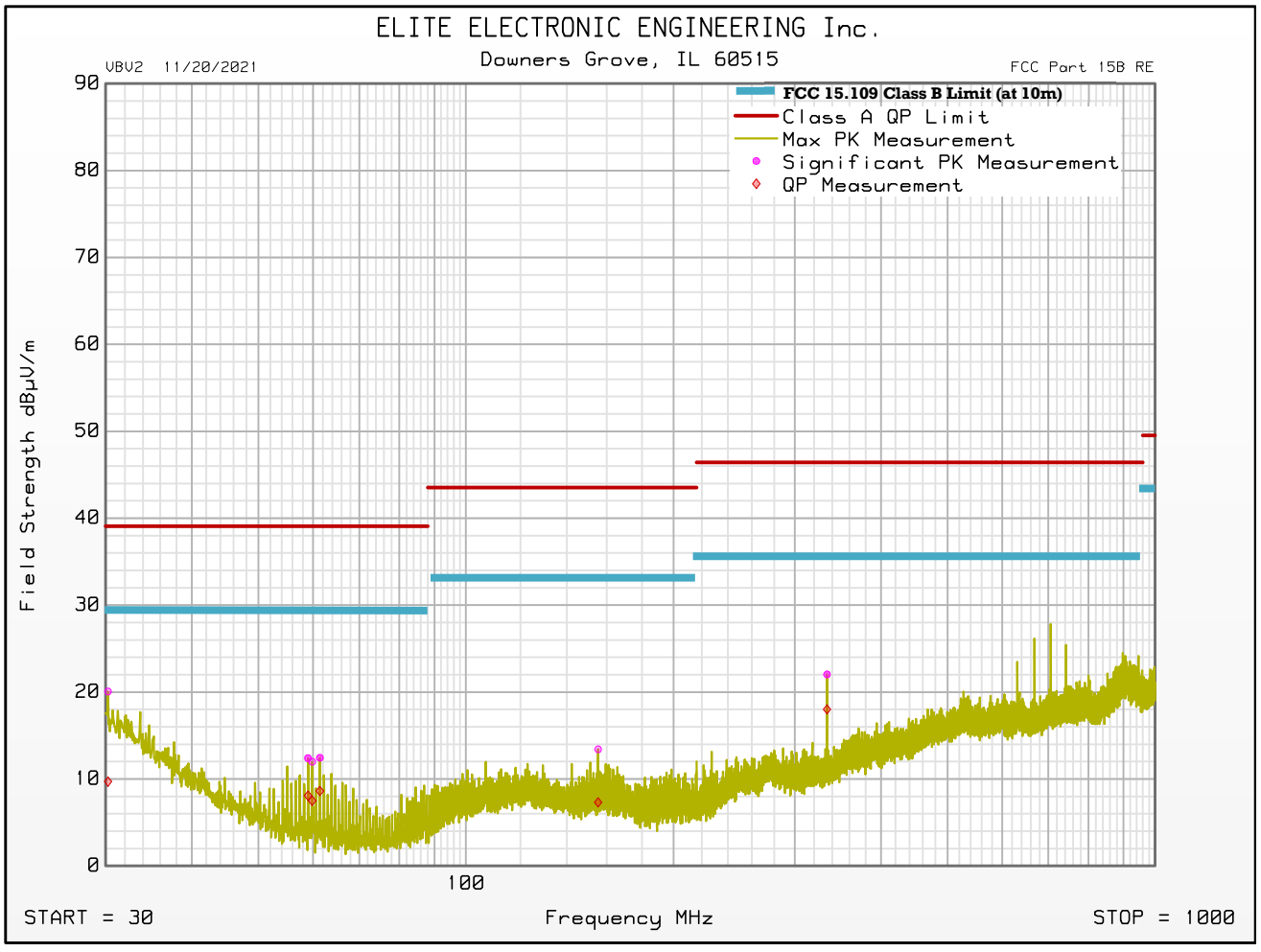


This plot is a preliminary scan to identify significant emissions. Final measurements are recorded in the table

FCC Part 15.109
Radiated RF Emissions Test

SW ID/Rev: VBV2 11/20/2021

Manufacturer	:	Esys
Model	:	White Circle, TPM-SA-300-000
Serial Number	:	N/a
DUT Mode	:	Rx ONLY
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Antenna Polarization	:	Vertical
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	Test 9
Test Engineer	:	N. Bouchie
Test Date	:	Jan 17, 2022 01:55:30 PM



This plot is a preliminary scan to identify significant emissions. Final measurements are recorded in the table

FCC Part 15.109
Radiated RF Emissions Test

SW ID/Rev: VBV2 11/20/2021

Manufacturer	:	Esys
Model	:	White Circle, TPM-SA-300-000
Serial Number	:	N/a
DUT Mode	:	Rx ONLY
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Scan Type	:	Stepped Scan
Test RBW	:	1 MHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	Test 10
Test Engineer	:	N. Bouchie
Test Date	:	Jan 17, 2022 02:35:41 PM

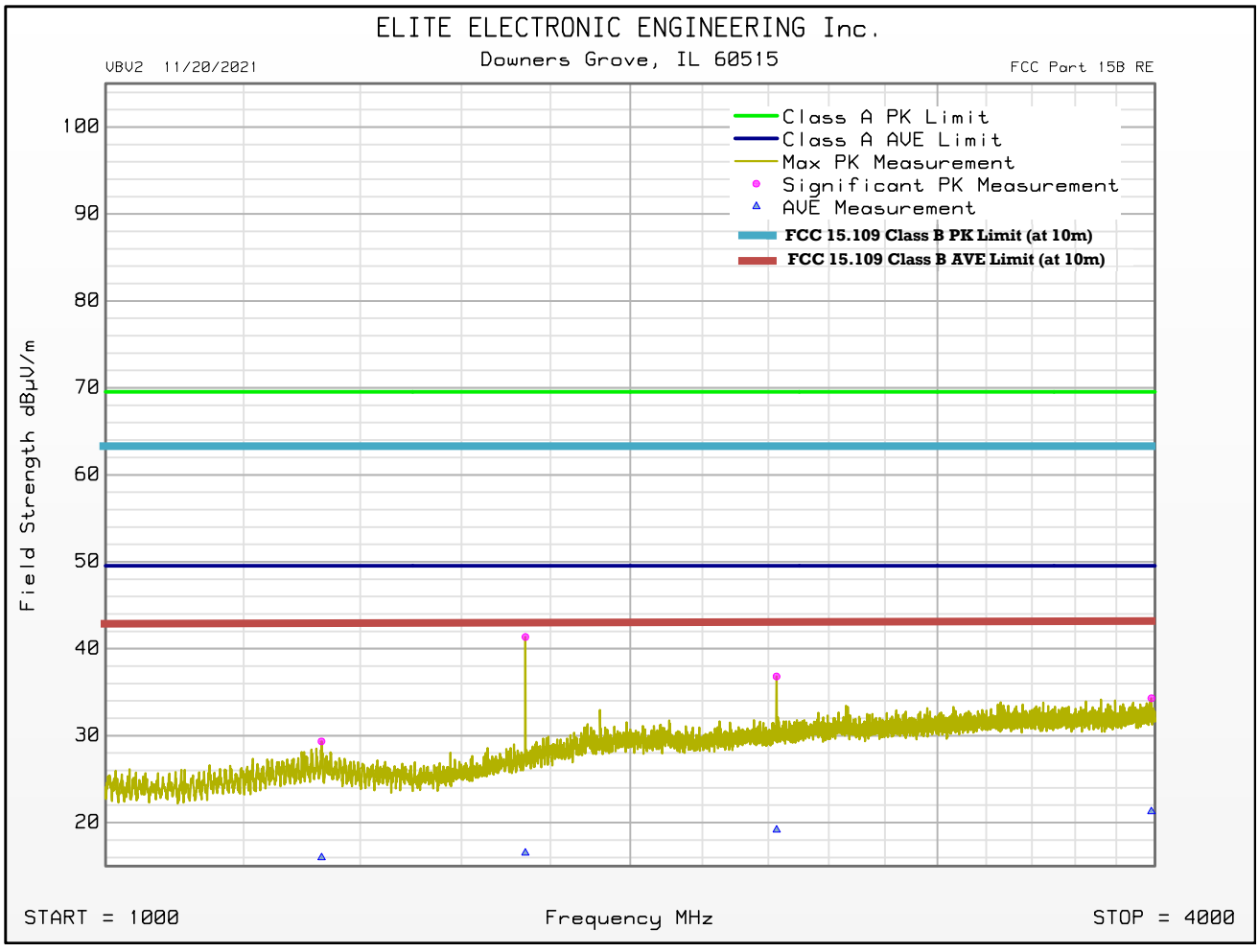
Freq MHz	Peak Mtr Rdg dBuV	Ant Fac dB/m	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Peak Total dBµV/m	Peak Limit dBµV/m	Peak Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °	Excessive Peak Level
1246.000	50.0	29.1	-42.1	2.3	0	39.3	74.0	-34.7	Vertical	120	225	
1330.000	50.3	29.0	-42.0	2.4	0	39.7	74.0	-34.3	Horizontal	200	90	
1741.000	60.8	29.8	-41.6	2.8	0	51.8	74.0	-22.2	Horizontal	200	90	
2426.000	53.0	32.3	-41.4	3.4	0	47.3	74.0	-26.7	Horizontal	120	0	
2480.000	59.4	32.5	-41.5	3.5	0	53.9	74.0	-20.1	Vertical	340	315	
3167.500	48.5	32.8	-40.8	4.0	0	44.5	74.0	-29.5	Vertical	120	225	
3981.000	47.4	33.4	-40.6	4.5	0	44.7	74.0	-29.3	Horizontal	200	225	

Freq MHz	Average Mtr Rdg dBuV	Ant Fac dB/m	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Average Total dBµV/m	Average Limit dBµV/m	Average Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °	Excessive Average Level
1246.000	36.2	29.1	-42.1	2.3	0	25.5	54.0	-28.5	Vertical	120	225	
1330.000	36.9	29.0	-42.0	2.4	0	26.3	54.0	-27.7	Horizontal	200	90	
1741.000	36.0	29.8	-41.6	2.8	0	27.0	54.0	-27.0	Horizontal	200	90	
2426.000	35.3	32.3	-41.4	3.4	0	29.6	54.0	-24.4	Horizontal	120	0	
2480.000	35.3	32.5	-41.5	3.5	0	29.8	54.0	-24.2	Vertical	340	315	
3167.500	35.0	32.8	-40.8	4.0	0	31.0	54.0	-23.0	Vertical	120	225	
3981.000	34.4	33.4	-40.6	4.5	0	31.7	54.0	-22.3	Horizontal	200	225	

FCC Part 15.109
Radiated RF Emissions Test

SW ID/Rev: VBV2 11/20/2021

Manufacturer	:	Esys
Model	:	White Circle, TPM-SA-300-000
Serial Number	:	N/a
DUT Mode	:	Rx ONLY
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Antenna Polarization	:	Horizontal
Scan Type	:	Stepped Scan
Test RBW	:	1 MHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	Test 10
Test Engineer	:	N. Bouchie
Test Date	:	Jan 17, 2022 02:35:41 PM

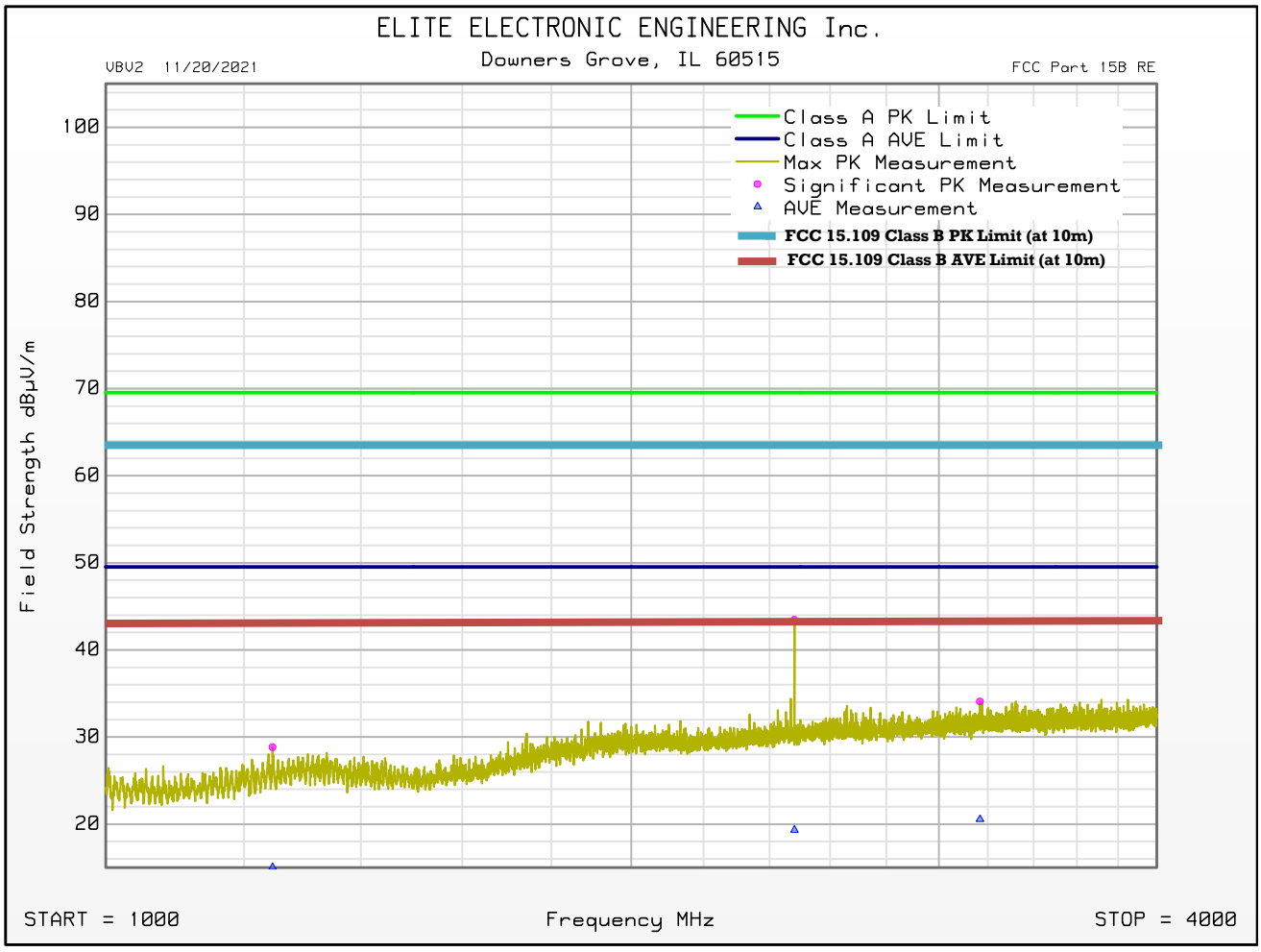


This plot is a preliminary scan to identify significant emissions. Final measurements are recorded in the table

FCC Part 15.109
Radiated RF Emissions Test

SW ID/Rev: VBV2 11/20/2021

Manufacturer	:	Esys
Model	:	White Circle, TPM-SA-300-000
Serial Number	:	N/a
DUT Mode	:	Rx ONLY
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Antenna Polarization	:	Vertical
Scan Type	:	Stepped Scan
Test RBW	:	1 MHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	Test 10
Test Engineer	:	N. Bouchie
Test Date	:	Jan 17, 2022 02:35:41 PM



This plot is a preliminary scan to identify significant emissions. Final measurements are recorded in the table

FCC Part 15.209
Radiated RF Emissions Test

SW ID/Rev: VBV2 11/20/2021

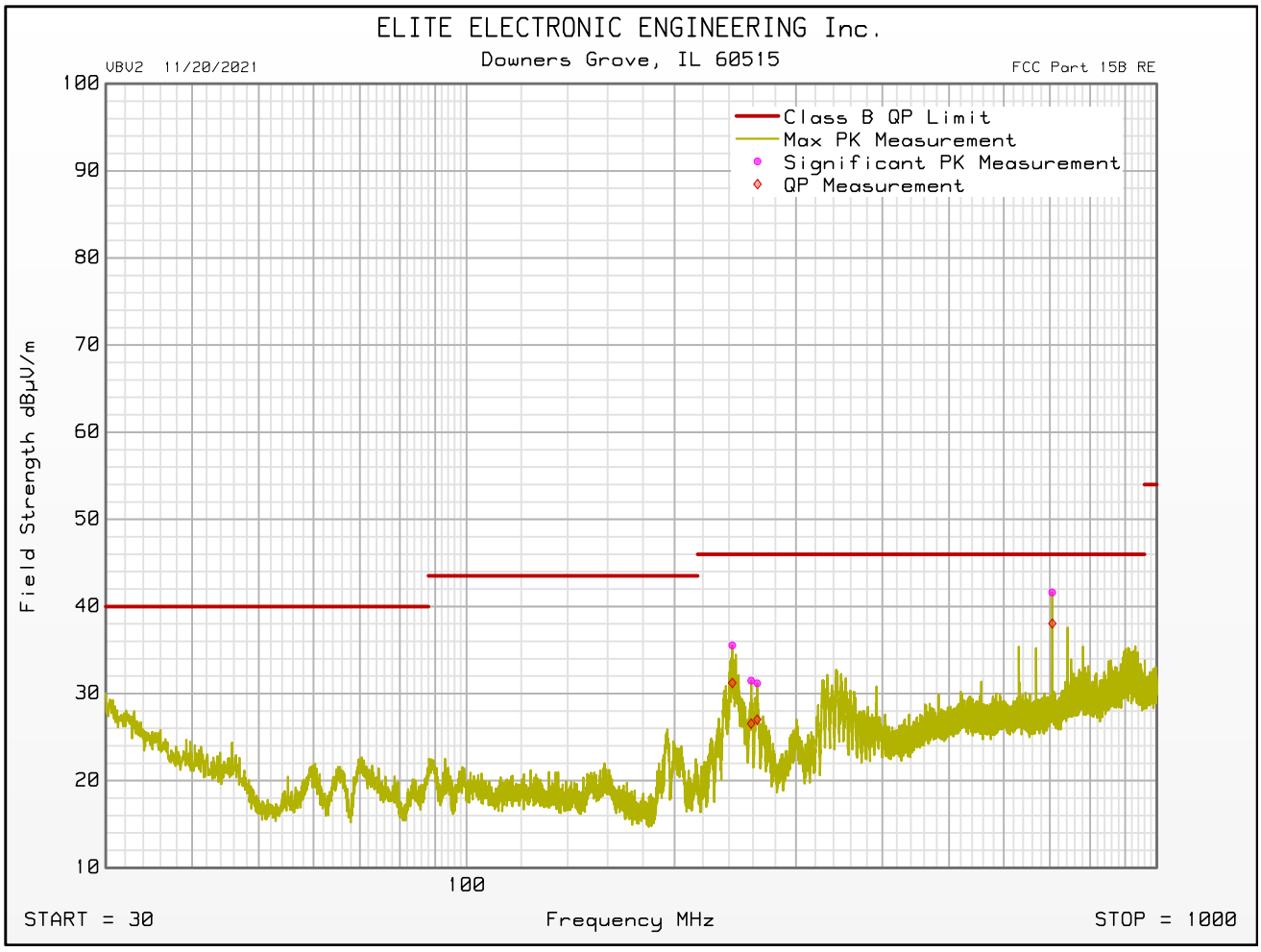
Manufacturer	:	Esys
Model	:	White Rectangle
Serial Number	:	
DUT Mode	:	Tx On, See Section 7
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	Test 12
Test Engineer	:	N. Bouchie
Test Date	:	Jan 17, 2022 04:50:30 PM

Freq MHz	Peak Mtr Rdg dBuV	QP Mtr Rdg dBuV	Ant Fac dB/m	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Peak Total dBµV/m	QP Total dBµV/m	QP Limit dBµV/m	QP Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °	Excessive QP Level
30.060	10.1	4.6	25.0	0.0	0.5	0.0	35.5	30.0	40.0	-10.0	Vertical	120	45	
55.800	19.0	16.4	13.1	0.0	0.5	0.0	32.6	30.0	40.0	-10.0	Vertical	120	0	
83.160	13.9	10.7	13.7	0.0	0.5	0.0	28.1	24.9	40.0	-15.1	Vertical	120	315	
98.860	8.2	2.6	16.7	0.0	0.5	0.0	25.3	19.8	43.5	-23.8	Vertical	120	315	
242.580	16.9	12.6	17.6	0.0	1.0	0.0	35.5	31.2	46.0	-14.8	Horizontal	120	180	
258.300	11.7	6.8	18.8	0.0	1.0	0.0	31.5	26.6	46.0	-19.4	Horizontal	120	180	
263.640	11.8	7.7	18.4	0.0	1.0	0.0	31.2	27.0	46.0	-19.0	Horizontal	120	180	
328.080	14.1	10.5	19.7	0.0	1.2	0.0	34.9	31.3	46.0	-14.7	Vertical	200	135	
333.240	14.3	11.1	19.8	0.0	1.2	0.0	35.3	32.0	46.0	-14.0	Vertical	200	135	
338.040	13.3	9.8	19.8	0.0	1.2	0.0	34.3	30.8	46.0	-15.2	Vertical	200	135	
631.140	15.6	12.0	25.0	0.0	1.6	0.0	42.2	38.5	46.0	-7.5	Vertical	340	0	
705.360	14.6	11.1	25.2	0.0	1.8	0.0	41.6	38.0	46.0	-8.0	Horizontal	120	45	
910.080	10.3	2.3	26.4	0.0	2.0	0.0	38.7	30.8	46.0	-15.2	Vertical	200	45	

FCC Part 15.209
Radiated RF Emissions Test

SW ID/Rev: VBV2 11/20/2021

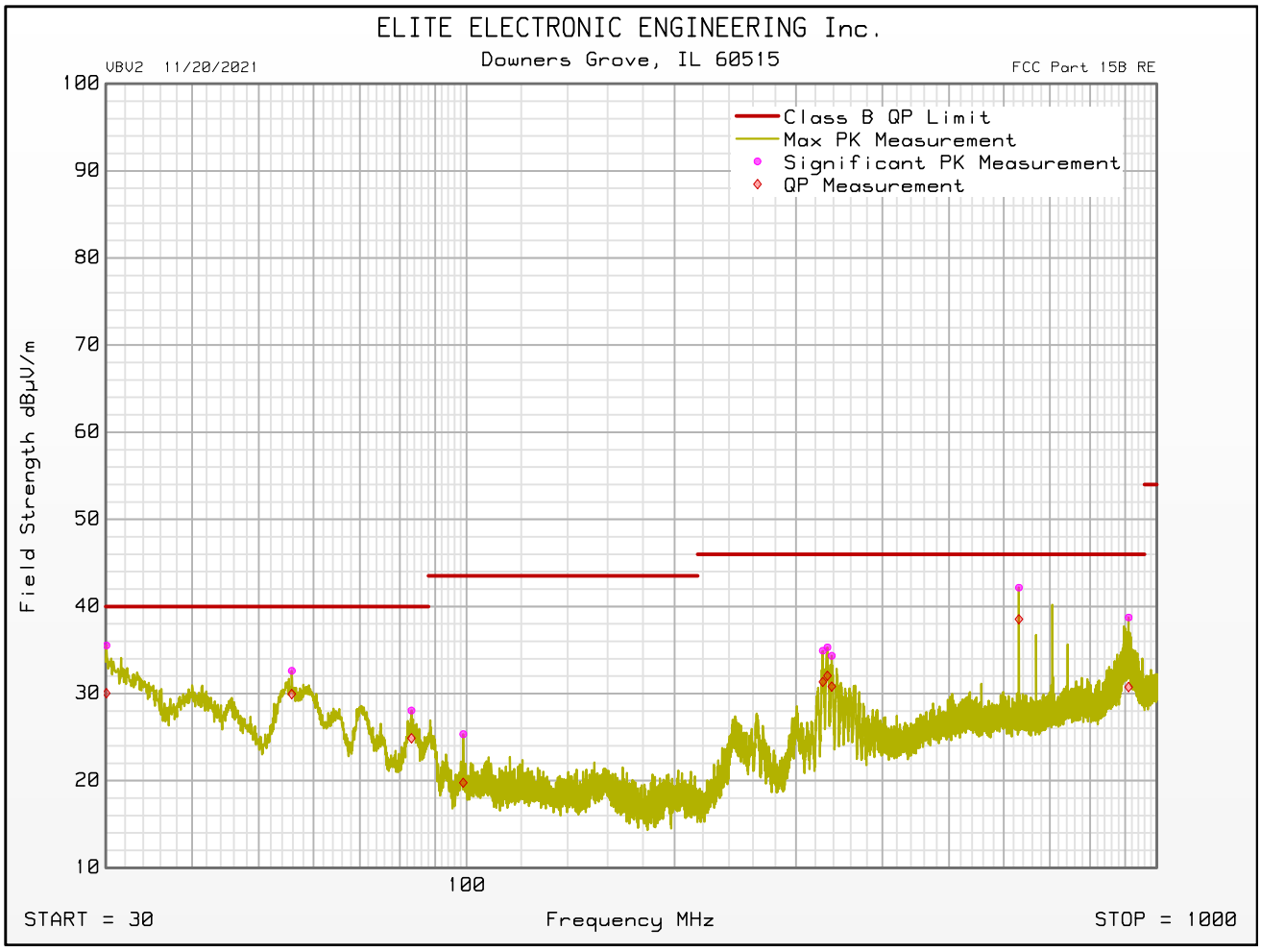
Manufacturer	:	Esys
Model	:	White Rectangle
Serial Number	:	
DUT Mode	:	Tx On, See Section 7
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Antenna Polarization	:	Horizontal
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	Test 12
Test Engineer	:	N. Bouchie
Test Date	:	Jan 17, 2022 04:50:30 PM



FCC Part 15.209
Radiated RF Emissions Test

SW ID/Rev: VBV2 11/20/2021

Manufacturer	:	Esys
Model	:	White Rectangle
Serial Number	:	
DUT Mode	:	Tx On, See Section 7
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Antenna Polarization	:	Vertical
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	Test 12
Test Engineer	:	N. Bouchie
Test Date	:	Jan 17, 2022 04:50:30 PM



FCC Part 15.109
Radiated RF Emissions Test

SW ID/Rev: VBV2 06/29/2021

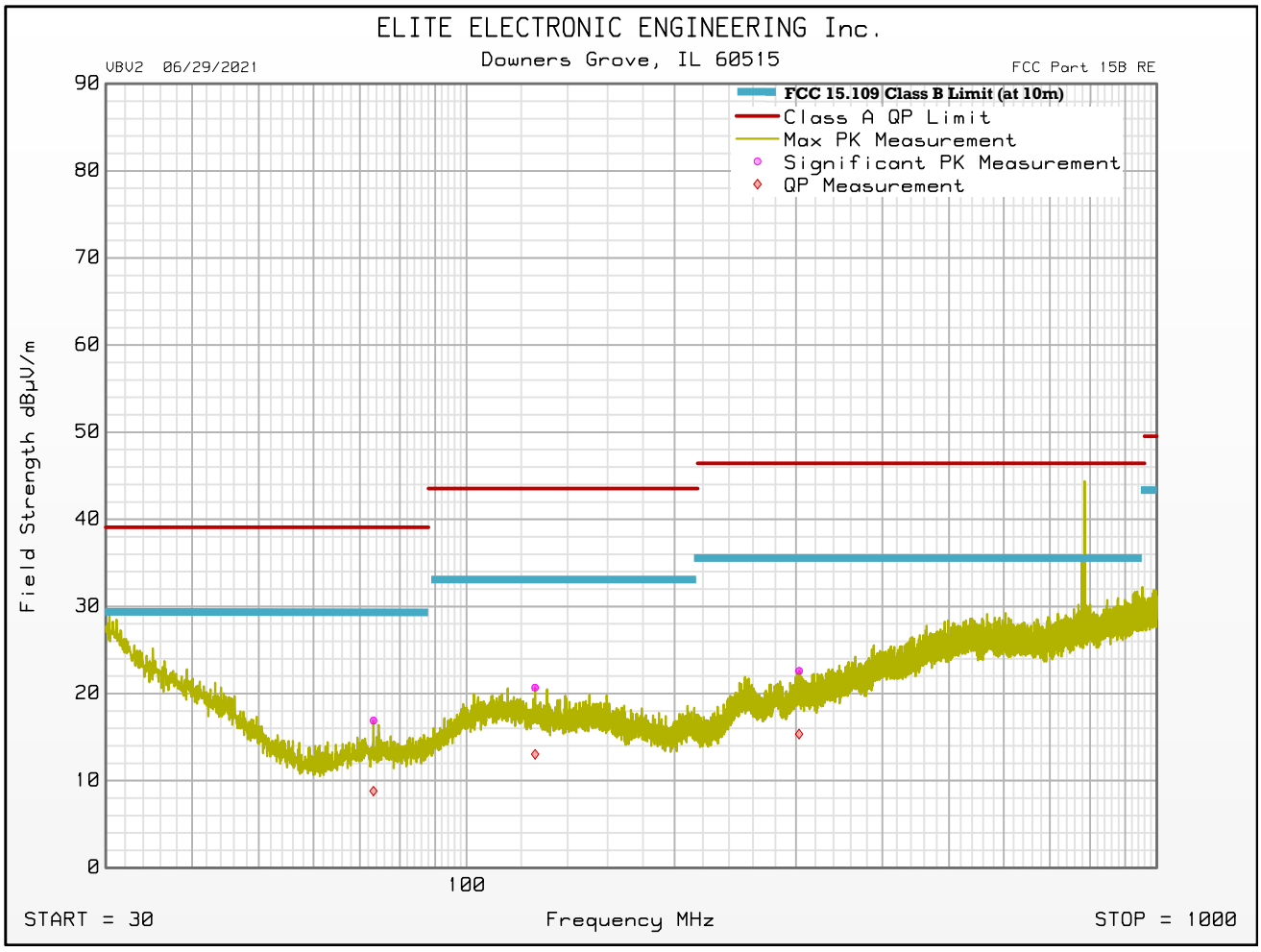
Manufacturer	:	JR Automation, Esys
Model	:	White Rectangular Antenna
Serial Number	:	Differential Filter on Output w_ 0461164181 3t Common Mode towards antenna
DUT Mode	:	Rx ONLY, Tuned, Antenna Raised to 37cm
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	N. Bouchie
Test Date	:	Dec 30, 2021 01:01:06 PM

Freq MHz	Peak Mtr Rdg dBuV	QP Mtr Rdg dBuV	Ant Fac dB/m	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Peak Total dBµV/m	QP Total dBµV/m	QP Limit dBµV/m	QP Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °	Excessive QP Level
30.480	5.2	-2.3	24.7	0	0.4	0	30.3	22.8	40.0	-17.2	Vertical	200	180	
73.260	3.7	-4.4	12.8	0	0.4	0	16.9	8.8	40.0	-31.2	Horizontal	340	45	
125.620	2.1	-5.6	18.1	0	0.5	0	20.7	13.0	43.5	-30.5	Horizontal	200	315	
303.120	2.6	-4.6	19.2	0	0.8	0	22.6	15.4	46.0	-30.6	Horizontal	120	315	
547.320	2.8	-4.4	24.7	0	1.1	0	28.6	21.4	46.0	-24.6	Vertical	340	90	
779.460	27.3	-5.1	25.8	0	1.5	0	54.6	22.2	46.0	-23.8	Vertical	340	45	
779.640	29.4	-5.2	25.8	0	1.5	0	56.7	22.1	46.0	-23.9	Vertical	340	45	
780.000	28.0	-5.2	25.8	0	1.5	0	55.3	22.1	46.0	-23.9	Vertical	340	45	

FCC Part 15.109
Radiated RF Emissions Test

SW ID/Rev: VBV2 06/29/2021

Manufacturer	:	JR Automation, Esys
Model	:	White Rectangular Antenna
Serial Number	:	Differential Filter on Output w_ 0461164181 3t Common Mode towards antenna
DUT Mode	:	Rx ONLY, Tuned, Antenna Raised to 37cm
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Antenna Polarization	:	Horizontal
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	N. Bouchie
Test Date	:	Dec 30, 2021 01:01:06 PM

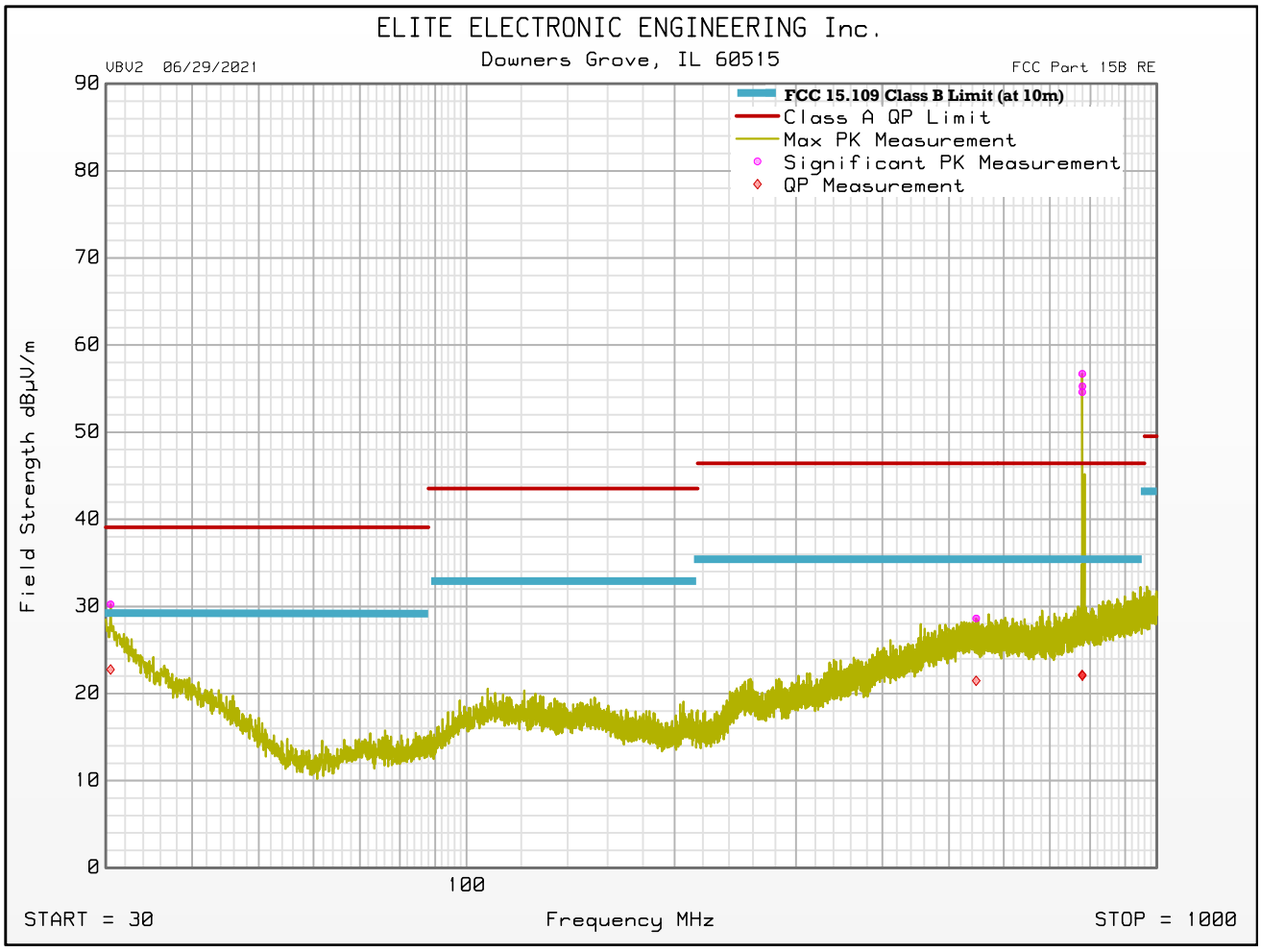


This plot is a preliminary scan to identify significant emissions. Final measurements are recorded in the table

FCC Part 15.109
Radiated RF Emissions Test

SW ID/Rev: VBV2 06/29/2021

Manufacturer	:	JR Automation, Esys
Model	:	White Rectangular Antenna
Serial Number	:	Differential Filter on Output w_ 0461164181 3t Common Mode towards antenna
DUT Mode	:	Rx ONLY, Tuned, Antenna Raised to 37cm
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Antenna Polarization	:	Vertical
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	N. Bouchie
Test Date	:	Dec 30, 2021 01:01:06 PM



This plot is a preliminary scan to identify significant emissions. Final measurements are recorded in the table

FCC Part 15.109
Radiated RF Emissions Test

SW ID/Rev: VBV2 06/29/2021

Manufacturer	:	JR Automation, Esys
Model	:	White Rectangular Antenna
Serial Number	:	Differential Filter on Output w_ 0461164181 3t Common Mode towards antenna
DUT Mode	:	Rx ONLY, Tuned, Antenna Raised to 37cm
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Scan Type	:	Stepped Scan
Test RBW	:	1 MHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	N. Bouchie
Test Date	:	Dec 30, 2021 01:31:03 PM

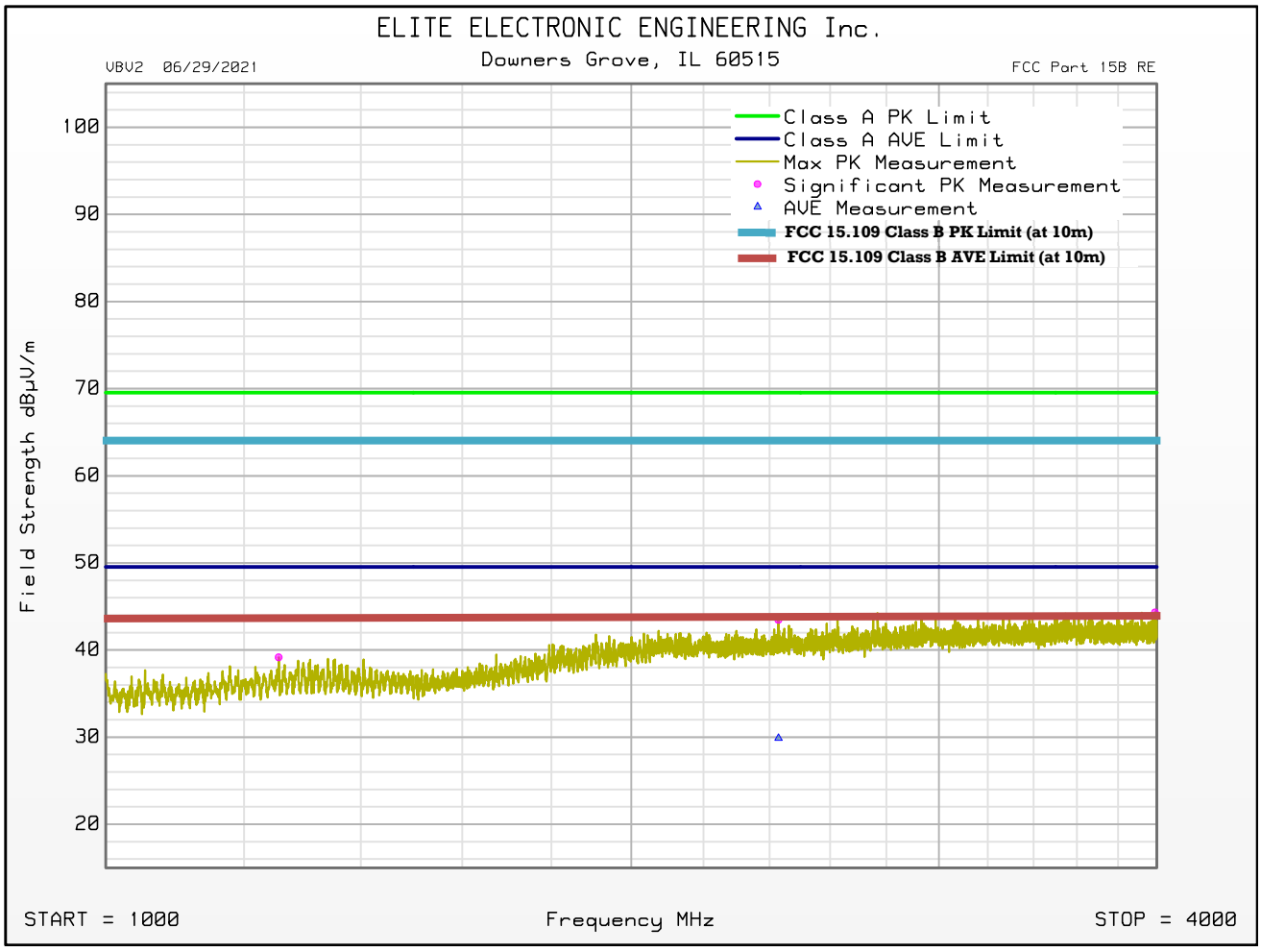
Freq MHz	Peak Mtr Rdg dBuV	Ant Fac dB/m	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Peak Total dBµV/m	Peak Limit dBµV/m	Peak Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °	Excessive Peak Level
1256.000	48.9	29.2	-40.7	1.8	0	39.2	74.0	-34.8	Horizontal	200	270	
1296.500	49.2	29.0	-40.6	1.8	0	39.4	74.0	-34.6	Vertical	200	270	
1920.000	48.7	31.5	-40.0	2.2	0	42.4	74.0	-31.6	Vertical	200	0	
2428.000	48.8	32.2	-40.2	2.6	0	43.4	74.0	-30.6	Horizontal	120	225	
2951.500	49.3	32.8	-40.0	2.9	0	45.0	74.0	-29.0	Vertical	200	270	
3990.000	46.9	33.5	-39.5	3.4	0	44.3	74.0	-29.7	Horizontal	120	90	

Freq MHz	Average Mtr Rdg dBuV	Ant Fac dB/m	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Average Total dBµV/m	Average Limit dBµV/m	Average Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °	Excessive Average Level
1256.000		29.2	-40.7	1.8	0		54.0		Horizontal	200	270	
1296.500	36.3	29.0	-40.6	1.8	0	26.5	54.0	-27.5	Vertical	200	270	
1920.000		31.5	-40.0	2.2	0		54.0		Vertical	200	0	
2428.000	35.2	32.2	-40.2	2.6	0	29.8	54.0	-24.2	Horizontal	120	225	
2951.500	35.2	32.8	-40.0	2.9	0	30.9	54.0	-23.1	Vertical	200	270	
3990.000		33.5	-39.5	3.4	0		54.0		Horizontal	120	90	

FCC Part 15.109
Radiated RF Emissions Test

SW ID/Rev: VBV2 06/29/2021

Manufacturer	:	JR Automation, Esys
Model	:	White Rectangular Antenna
Serial Number	:	Differential Filter on Output w_ 0461164181 3t Common Mode towards antenna
DUT Mode	:	Rx ONLY, Tuned, Antenna Raised to 37cm
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Antenna Polarization	:	Horizontal
Scan Type	:	Stepped Scan
Test RBW	:	1 MHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	N. Bouchie
Test Date	:	Dec 30, 2021 01:31:03 PM

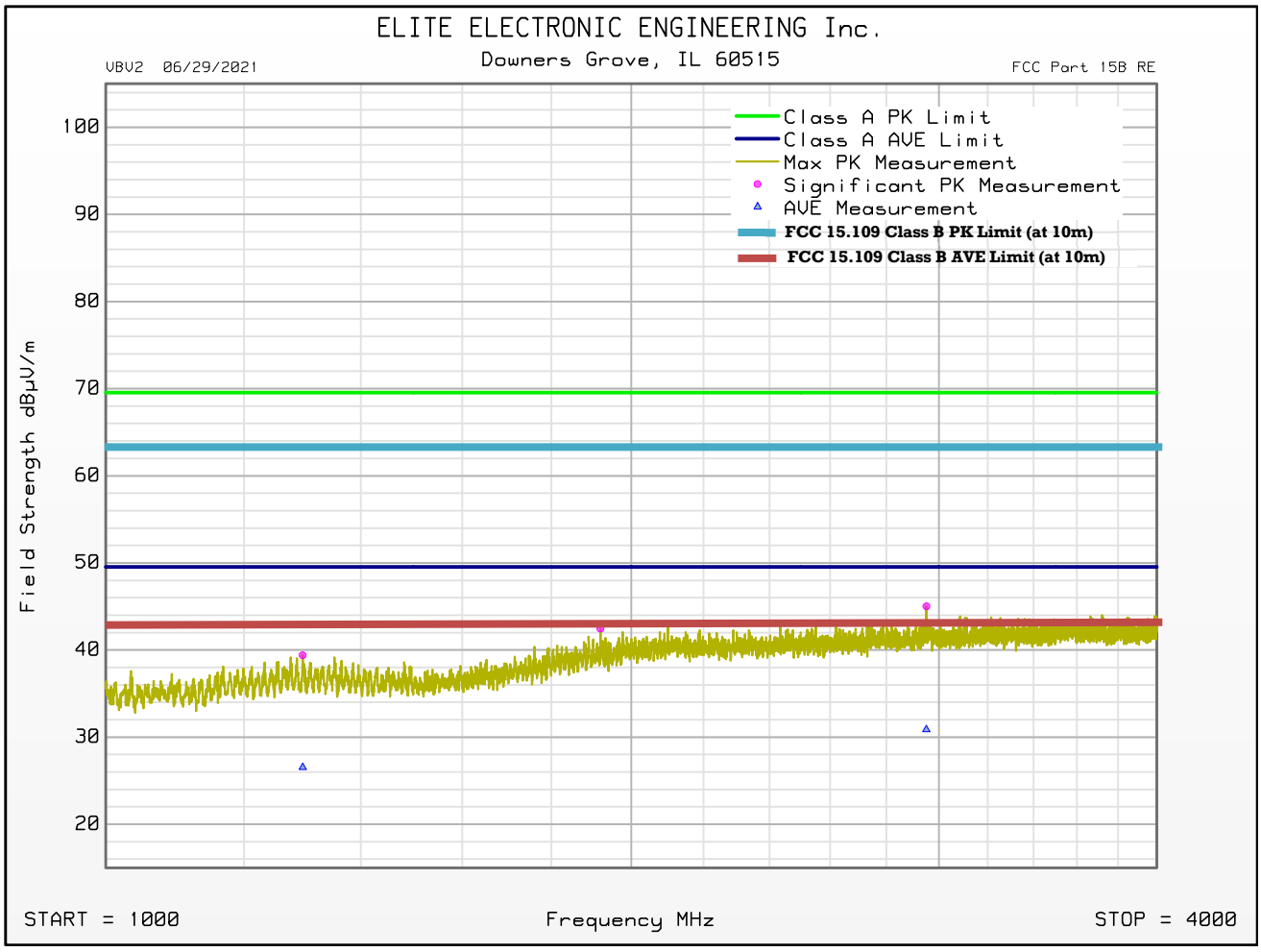


This plot is a preliminary scan to identify significant emissions. Final measurements are recorded in the table

FCC Part 15.109
Radiated RF Emissions Test

SW ID/Rev: VBV2 06/29/2021

Manufacturer	:	JR Automation, Esys
Model	:	White Rectangular Antenna
Serial Number	:	Differential Filter on Output w_ 0461164181 3t Common Mode towards antenna
DUT Mode	:	Rx ONLY, Tuned, Antenna Raised to 37cm
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Antenna Polarization	:	Vertical
Scan Type	:	Stepped Scan
Test RBW	:	1 MHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	N. Bouchie
Test Date	:	Dec 30, 2021 01:31:03 PM



This plot is a preliminary scan to identify significant emissions. Final measurements are recorded in the table

FCC Part 15.209
Radiated RF Emissions Test

SW ID/Rev: VBV2 06/29/2021

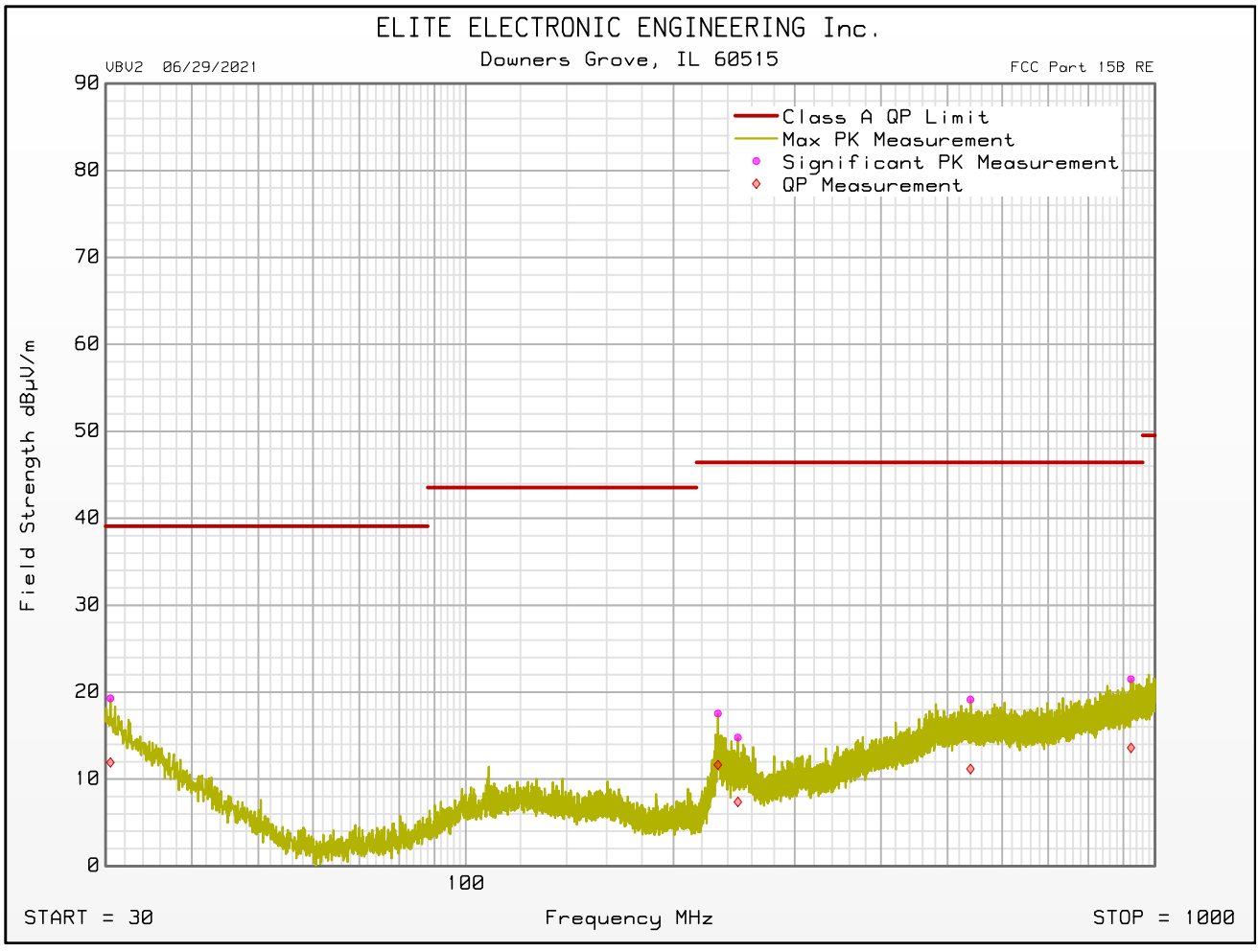
Manufacturer	:	Esys
Model	:	Black Oval Antenna, TPM-LA-200-000
Serial Number	:	N/a
DUT Mode	:	Tx ON
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	N. Bouchie
Test Date	:	Dec 30, 2021 03:19:37 PM

Freq MHz	Peak Mtr Rdg dBuV	QP Mtr Rdg dBuV	Ant Fac dB/m	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Peak Total dBµV/m	QP Total dBµV/m	QP Limit dBµV/m	QP Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °	Excessive QP Level
30.480	4.7	-2.7	24.7	0	0.4	0	29.8	22.4	39.1	-16.7	Horizontal	120	180	
46.860	8.6	0.1	16.2	0	0.4	0	25.2	16.7	39.1	-22.4	Vertical	120	180	
48.900	9.4	1.5	15.4	0	0.4	0	25.2	17.3	39.1	-21.8	Vertical	120	180	
58.320	12.5	5.4	12.7	0	0.4	0	25.6	18.5	39.1	-20.6	Vertical	120	0	
60.000	8.4	5.0	12.4	0	0.4	0	21.2	17.8	39.1	-21.3	Vertical	120	180	
99.640	8.3	2.0	16.8	0	0.4	0	25.5	19.2	43.5	-24.3	Vertical	120	180	
232.08	10.8	4.9	16.4	0	0.8	0	28.0	22.1	46.4	-24.3	Horizontal	200	225	
248.10	6.3	-1.1	18.2	0	0.8	0	25.3	17.9	46.4	-28.5	Horizontal	120	270	
279.96	7.9	4.1	18.6	0	0.8	0	27.3	23.5	46.4	-22.9	Vertical	200	270	
539.64	3.7	-4.3	24.8	0	1.1	0	29.6	21.6	46.4	-24.8	Horizontal	120	90	
922.74	3.8	-4.1	26.6	0	1.5	0	31.9	24.0	46.4	-22.4	Horizontal	120	180	

FCC Part 15.209
Radiated RF Emissions Test

SW ID/Rev: VBV2 06/29/2021

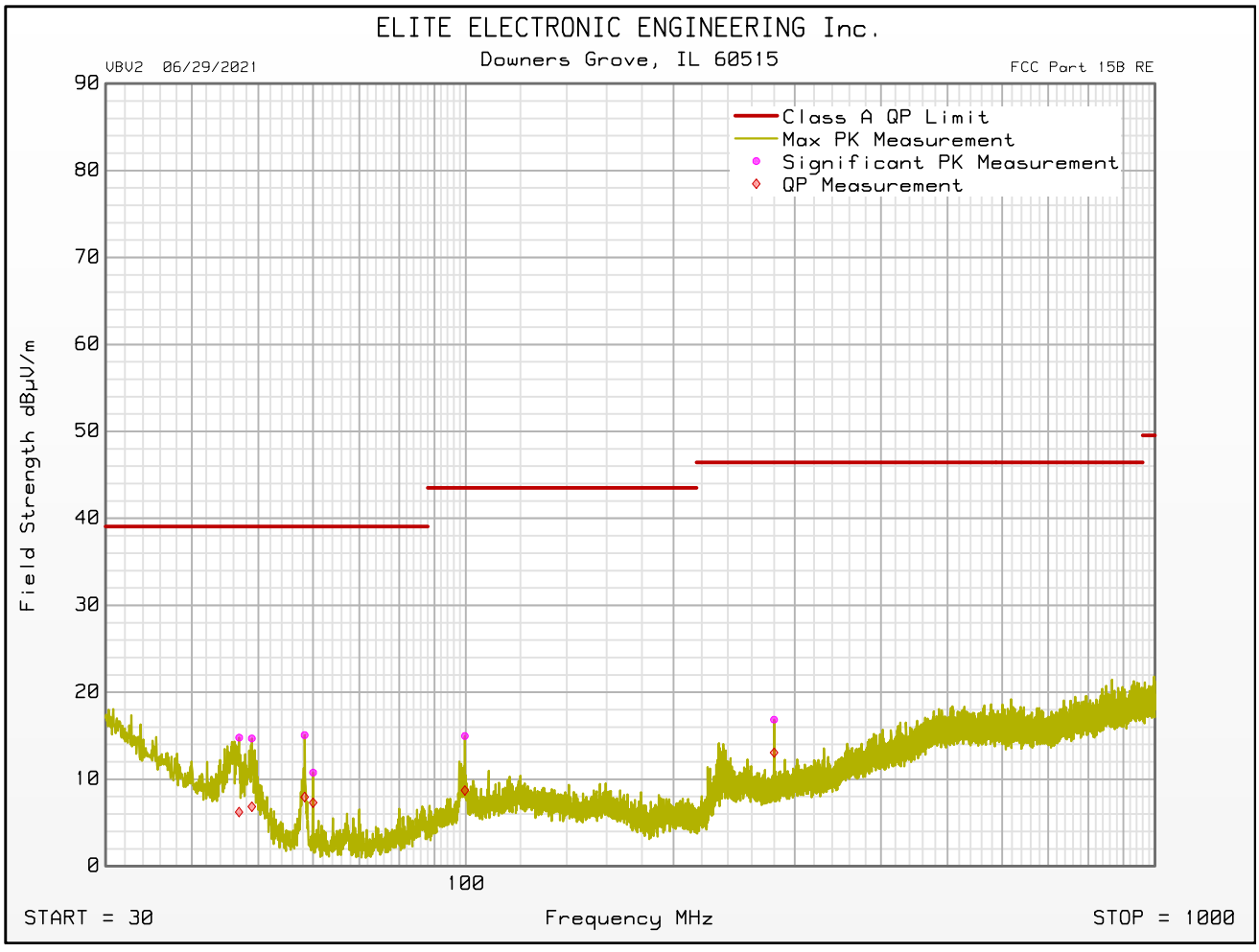
Manufacturer	:	Esys
Model	:	Black Oval Antenna, TPM-LA-200-000
Serial Number	:	N/a
DUT Mode	:	Tx ON
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Antenna Polarization	:	Horizontal
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	N. Bouchie
Test Date	:	Dec 30, 2021 03:19:37 PM



FCC Part 15.209
Radiated RF Emissions Test

SW ID/Rev: VBV2 06/29/2021

Manufacturer	:	Esys
Model	:	Black Oval Antenna, TPM-LA-200-000
Serial Number	:	N/a
DUT Mode	:	Tx ON
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Antenna Polarization	:	Vertical
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	N. Bouchie
Test Date	:	Dec 30, 2021 03:19:37 PM



FCC Part 15.109
Radiated RF Emissions Test

SW ID/Rev: VBV2 06/29/2021

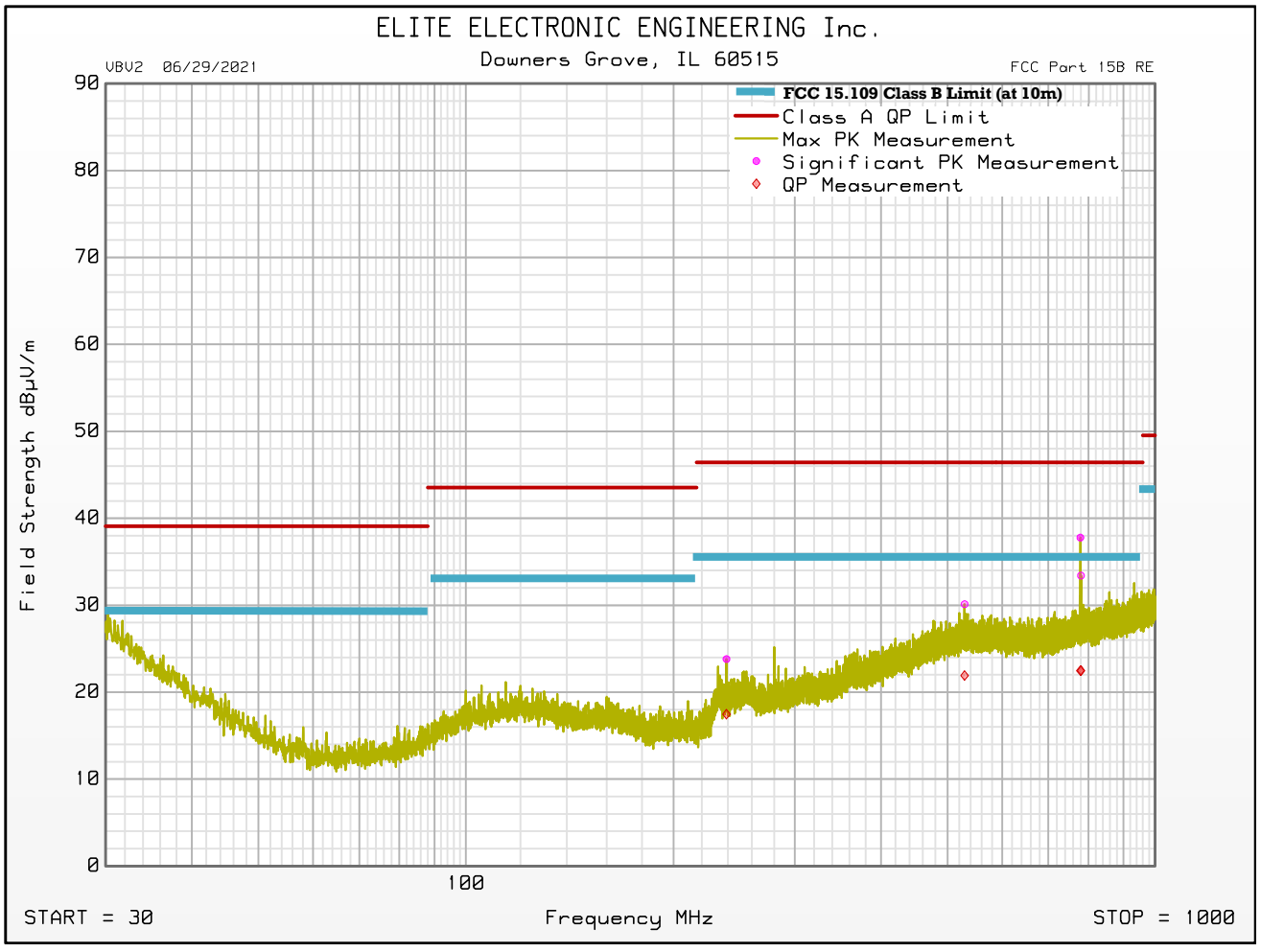
Manufacturer	:	JR Automation, Esys
Model	:	Black Oval Antenna, TPM-LA-200-000
Serial Number	:	N/a
DUT Mode	:	Rx ONLY
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	N. Bouchie
Test Date	:	Dec 30, 2021 03:01:25 PM

Freq MHz	Peak Mtr Rdg dBuV	QP Mtr Rdg dBuV	Ant Fac dB/m	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Peak Total dBµV/m	QP Total dBµV/m	QP Limit dBµV/m	QP Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °	Excessive QP Level
30.480	4.8	-2.6	24.7	0	0.4	0	29.9	22.5	40.0	-17.5	Vertical	120	45	
48.900	8.3	1.9	15.4	0	0.4	0	24.1	17.7	40.0	-22.3	Vertical	120	45	
58.020	12.0	6.6	12.7	0	0.4	0	25.1	19.7	40.0	-20.3	Vertical	120	135	
60.000	8.8	5.3	12.4	0	0.4	0	21.6	18.1	40.0	-21.9	Vertical	200	180	
69.180	10.3	-5.0	12.6	0	0.4	0	23.3	8.0	40.0	-32.0	Vertical	120	315	
98.800	9.7	2.8	16.7	0	0.4	0	26.8	19.9	43.5	-23.6	Vertical	120	180	
238.800	5.9	-0.5	17.2	0	0.8	0	23.9	17.5	46.0	-28.5	Horizontal	120	315	
279.960	10.4	7.7	18.6	0	0.8	0	29.8	27.1	46.0	-18.9	Vertical	200	270	
529.140	4.2	-4.0	24.8	0	1.1	0	30.1	21.9	46.0	-24.1	Horizontal	200	90	
779.040	10.5	-4.8	25.8	0	1.5	0	37.8	22.5	46.0	-23.5	Horizontal	200	45	
780.720	6.1	-4.8	25.8	0	1.5	0	33.4	22.5	46.0	-23.5	Horizontal	200	135	
947.820	4.7	-4.4	27.0	0	1.5	0	33.2	24.1	46.0	-21.9	Vertical	120	135	

FCC Part 15.109
Radiated RF Emissions Test

SW ID/Rev: VBV2 06/29/2021

Manufacturer	:	JR Automation, Esys
Model	:	Black Oval Antenna, TPM-LA-200-000
Serial Number	:	N/a
DUT Mode	:	Rx ONLY
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Antenna Polarization	:	Horizontal
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	N. Bouchie
Test Date	:	Dec 30, 2021 03:01:25 PM

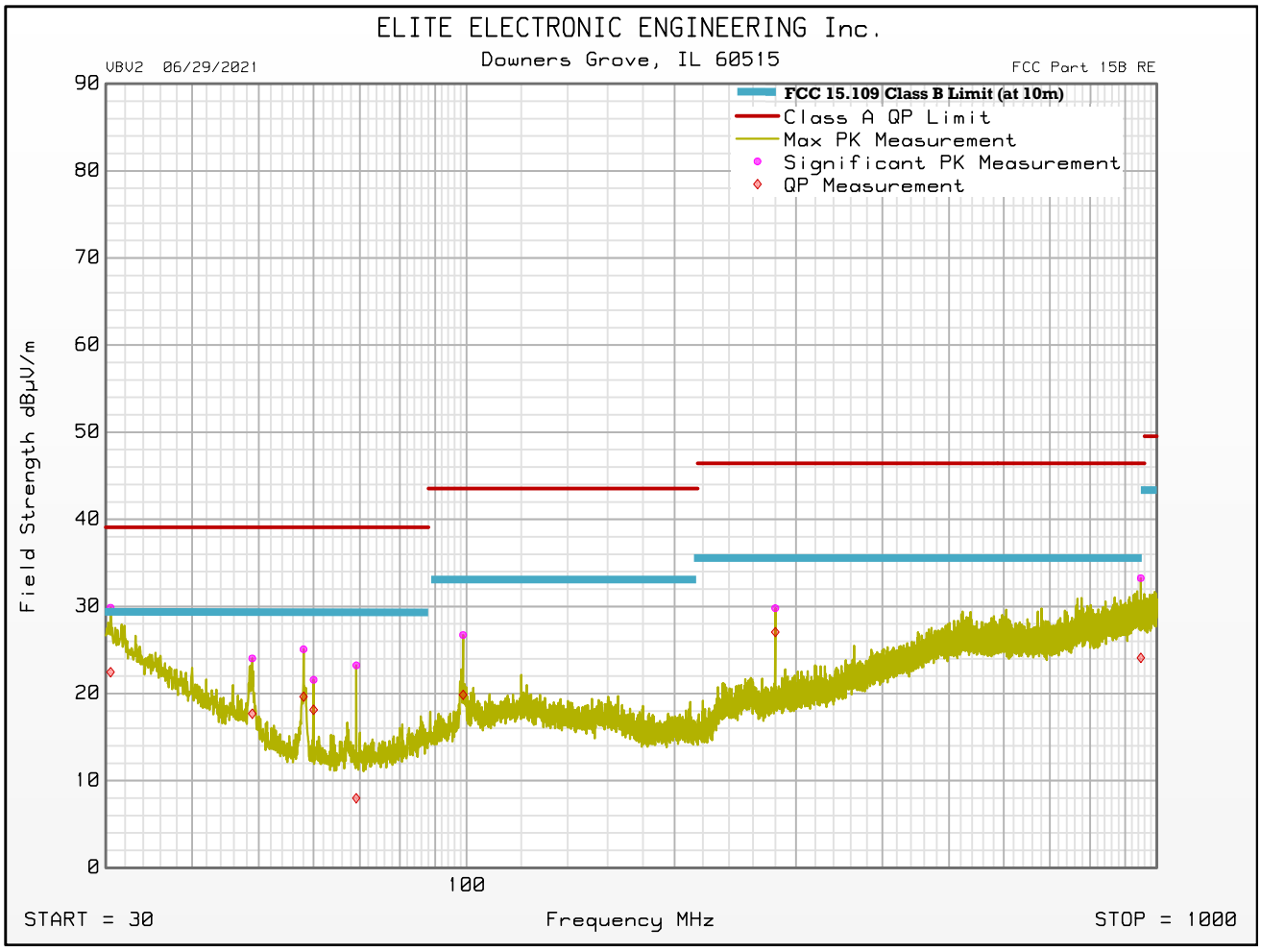


This plot is a preliminary scan to identify significant emissions. Final measurements are recorded in the table

FCC Part 15.109
Radiated RF Emissions Test

SW ID/Rev: VBV2 06/29/2021

Manufacturer	:	JR Automation, Esys
Model	:	Black Oval Antenna, TPM-LA-200-000
Serial Number	:	N/a
DUT Mode	:	Rx ONLY
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Antenna Polarization	:	Vertical
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	N. Bouchie
Test Date	:	Dec 30, 2021 03:01:25 PM



This plot is a preliminary scan to identify significant emissions. Final measurements are recorded in the table

FCC Part 15.109
Radiated RF Emissions Test

SW ID/Rev: VBV2 06/29/2021

Manufacturer	:	JR Automation, Esys
Model	:	Black Oval Antenna, TPM-LA-200-000
Serial Number	:	N/a
DUT Mode	:	Rx ONLY
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Scan Type	:	Stepped Scan
Test RBW	:	1 MHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	N. Bouchie
Test Date	:	Dec 30, 2021 02:35:42 PM

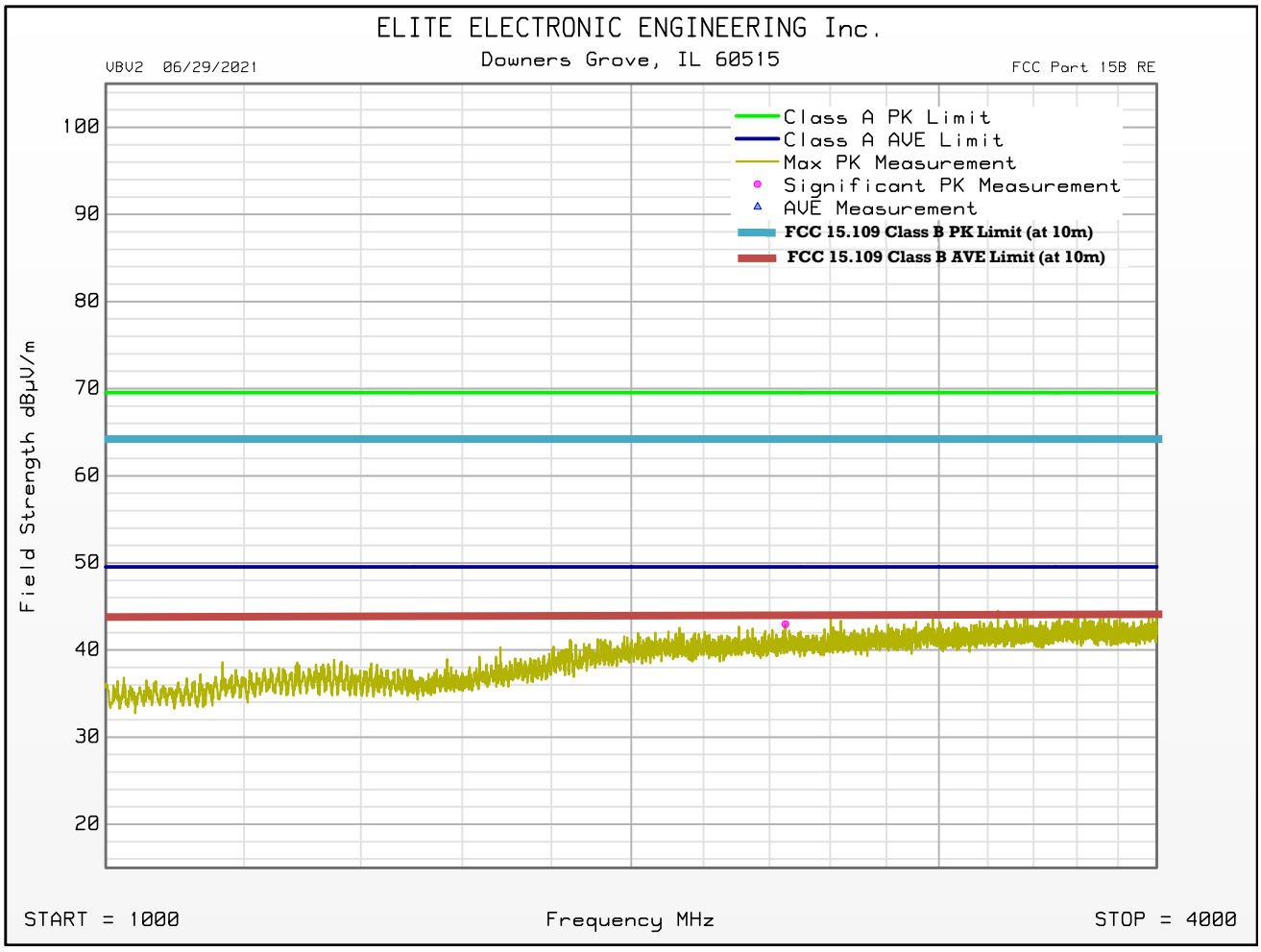
Freq MHz	Peak Mtr Rdg dBuV	Ant Fac dB/m	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Peak Total dBµV/m	Peak Limit dBµV/m	Peak Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °	Excessive Peak Level
1253.000	48.9	29.2	-40.7	1.8	0	39.2	74.0	-34.8	Vertical	200	225	
1330.500	49.9	29.0	-40.5	1.8	0	40.2	74.0	-33.8	Vertical	340	45	
1999.500	47.6	32.0	-39.9	2.3	0	42.0	74.0	-32.0	Vertical	120	90	
2450.500	48.3	32.3	-40.2	2.6	0	43.0	74.0	-31.0	Horizontal	340	180	
2954.000	48.0	32.8	-40.0	2.9	0	43.7	74.0	-30.3	Vertical	200	225	
3659.500	47.9	33.2	-39.5	3.3	0	44.9	74.0	-29.1	Vertical	120	315	

Freq MHz	Average Mtr Rdg dBuV	Ant Fac dB/m	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Average Total dBµV/m	Average Limit dBµV/m	Average Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °	Excessive Average Level
1253.000		29.2	-40.7	1.8	0		54.0		Vertical	200	225	
1330.500	36.4	29.0	-40.5	1.8	0	26.7	54.0	-27.3	Vertical	340	45	
1999.500		32.0	-39.9	2.3	0		54.0		Vertical	120	90	
2450.500		32.3	-40.2	2.6	0		54.0		Horizontal	340	180	
2954.000		32.8	-40.0	2.9	0		54.0		Vertical	200	225	
3659.500	34.5	33.2	-39.5	3.3	0	31.5	54.0	-22.5	Vertical	120	315	

FCC Part 15.109
Radiated RF Emissions Test

SW ID/Rev: VBV2 06/29/2021

Manufacturer	:	JR Automation, Esys
Model	:	Black Oval Antenna, TPM-LA-200-000
Serial Number	:	N/a
DUT Mode	:	Rx ONLY
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Antenna Polarization	:	Horizontal
Scan Type	:	Stepped Scan
Test RBW	:	1 MHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	N. Bouchie
Test Date	:	Dec 30, 2021 02:35:42 PM

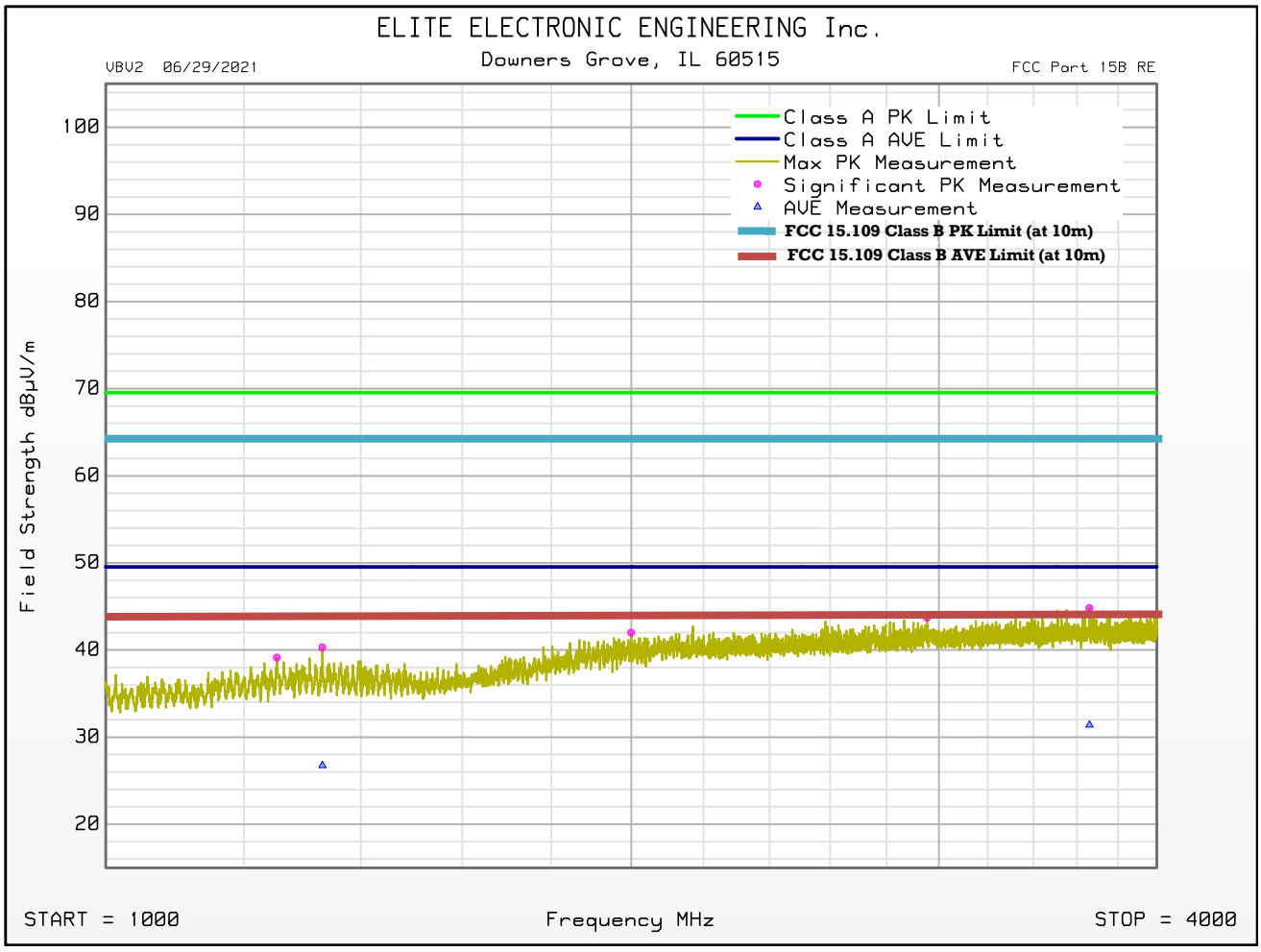


This plot is a preliminary scan to identify significant emissions. Final measurements are recorded in the table

FCC Part 15.109
Radiated RF Emissions Test

SW ID/Rev: VBV2 06/29/2021

Manufacturer	:	JR Automation, Esys
Model	:	Black Oval Antenna, TPM-LA-200-000
Serial Number	:	N/a
DUT Mode	:	Rx ONLY
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Antenna Polarization	:	Vertical
Scan Type	:	Stepped Scan
Test RBW	:	1 MHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	N. Bouchie
Test Date	:	Dec 30, 2021 02:35:42 PM



This plot is a preliminary scan to identify significant emissions. Final measurements are recorded in the table

FCC Part 15.209
Radiated RF Emissions Test

SW ID/Rev: VBV2 06/29/2021

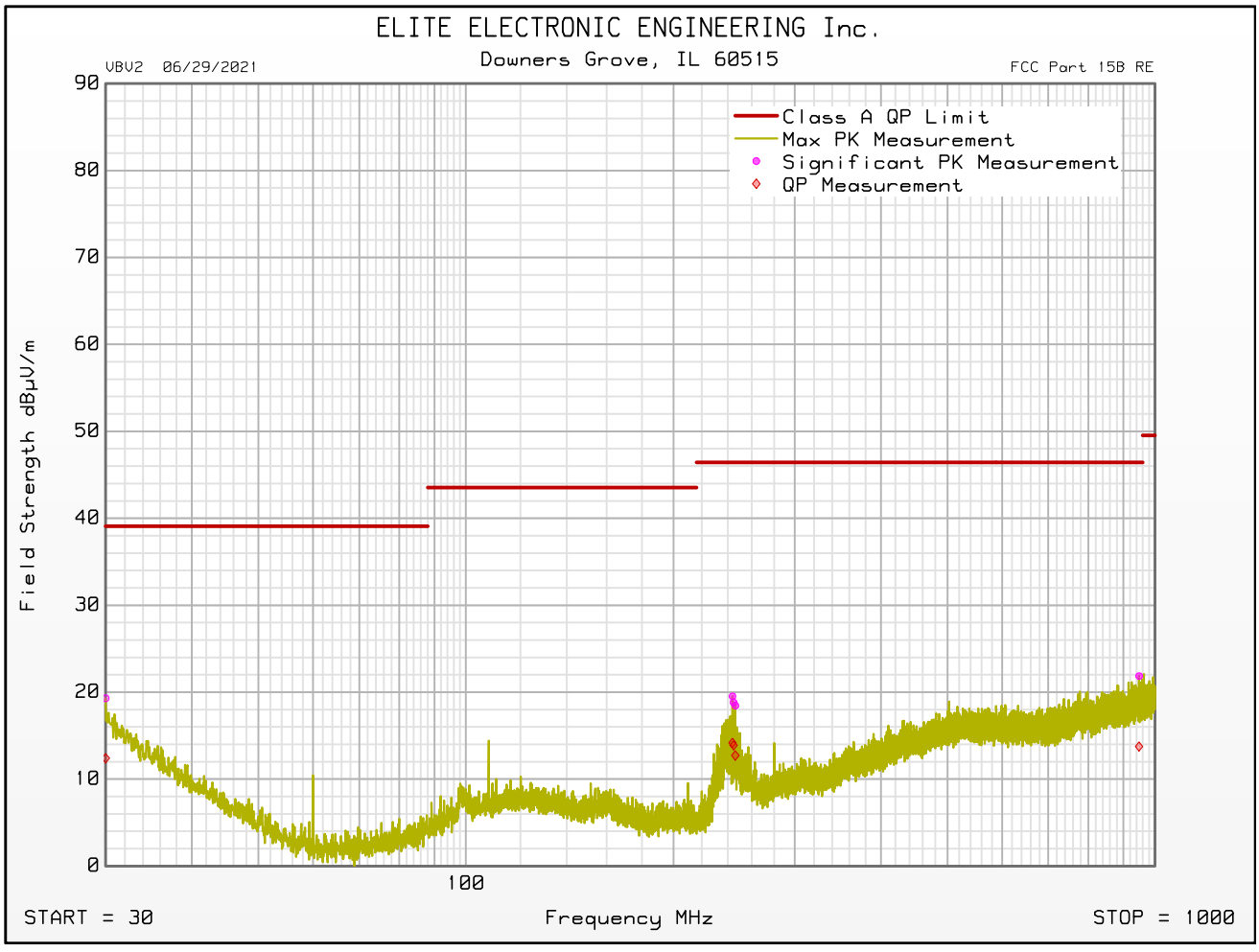
Manufacturer	:	Esys
Model	:	Black Circle Antenna, TPM-SA-200-000
Serial Number	:	N/a
DUT Mode	:	Tx ON
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	N. Bouchie
Test Date	:	Dec 30, 2021 04:43:12 PM

Freq MHz	Peak Mtr Rdg dBuV	QP Mtr Rdg dBuV	Ant Fac dB/m	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Peak Total dBµV/m	QP Total dBµV/m	QP Limit dBµV/m	QP Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °	Excessive QP Level
30.000	4.4	-2.5	25.0	0	0.4	0	29.8	22.9	39.1	-16.2	Horizontal	340	0	
57.780	9.1	2.6	12.7	0	0.4	0	22.2	15.7	39.1	-23.4	Vertical	120	135	
60.000	16.2	14.5	12.4	0	0.4	0	29.0	27.3	39.1	-11.8	Vertical	120	225	
79.980	10.6	6.9	13.3	0	0.4	0	24.3	20.6	39.1	-18.5	Vertical	120	270	
98.080	11.0	4.9	16.5	0	0.4	0	27.9	21.8	43.5	-21.7	Vertical	120	180	
107.920	9.5	6.6	17.5	0	0.4	0	27.4	24.5	43.5	-19.0	Vertical	120	45	
243.660	11.5	6.2	17.7	0	0.8	0	30.0	24.7	46.4	-21.7	Horizontal	120	180	
244.560	10.7	5.8	17.8	0	0.8	0	29.3	24.4	46.4	-22.0	Horizontal	120	180	
246.000	10.2	4.4	18.0	0	0.8	0	29.0	23.2	46.4	-23.2	Horizontal	120	180	
523.080	3.9	-3.8	24.6	0	1.1	0	29.6	21.9	46.4	-24.5	Vertical	200	315	
656.400	4.5	-4.8	24.8	0	1.3	0	30.6	21.3	46.4	-25.1	Vertical	340	135	
948.000	3.8	-4.3	27.0	0	1.5	0	32.3	24.2	46.4	-22.2	Horizontal	340	135	

FCC Part 15.209
Radiated RF Emissions Test

SW ID/Rev: VBV2 06/29/2021

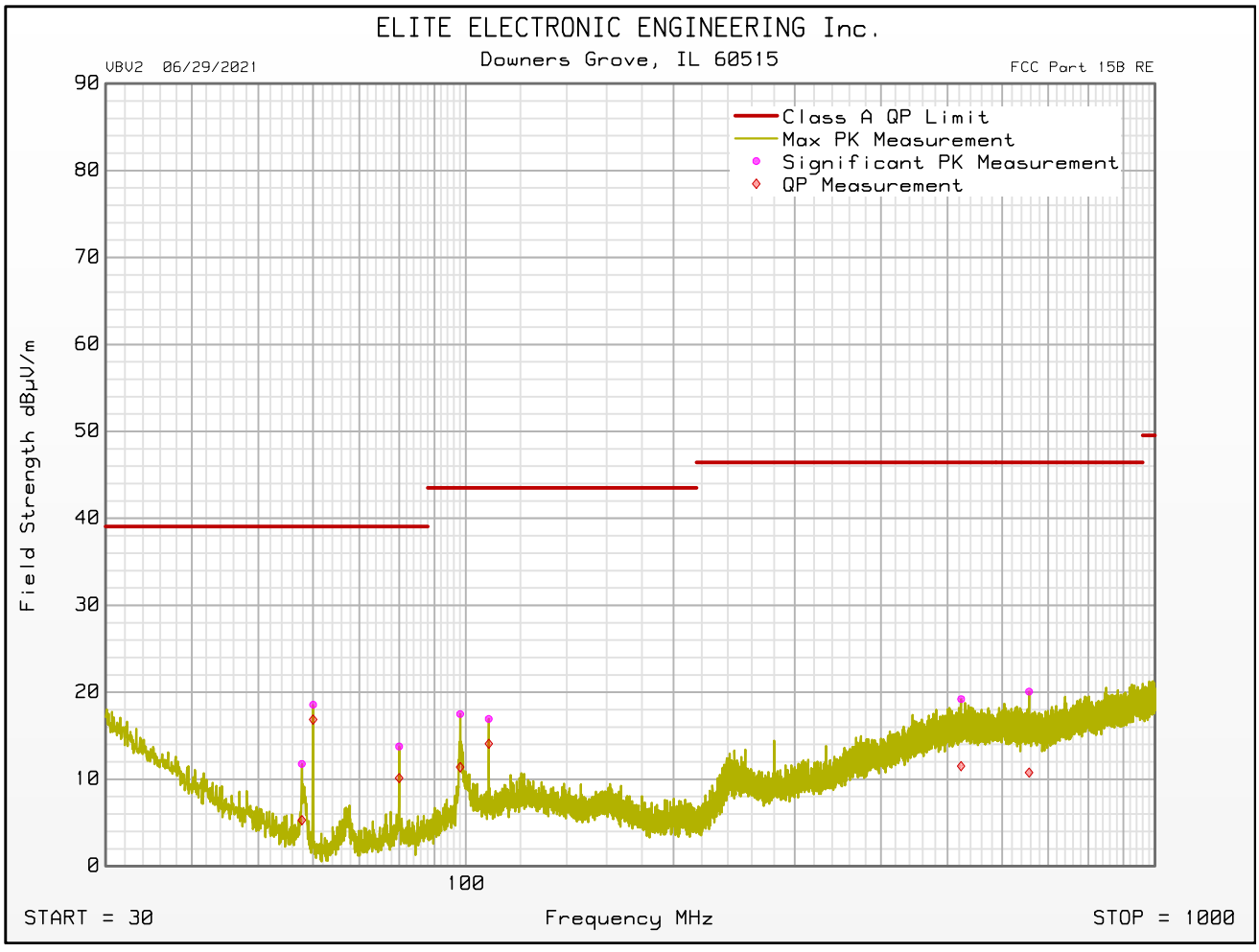
Manufacturer	:	Esys
Model	:	Black Circle Antenna, TPM-SA-200-000
Serial Number	:	N/a
DUT Mode	:	Tx ON
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Antenna Polarization	:	Horizontal
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	N. Bouchie
Test Date	:	Dec 30, 2021 04:43:12 PM



FCC Part 15.209
Radiated RF Emissions Test

SW ID/Rev: VBV2 06/29/2021

Manufacturer	:	Esys
Model	:	Black Circle Antenna, TPM-SA-200-000
Serial Number	:	N/a
DUT Mode	:	Tx ON
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Antenna Polarization	:	Vertical
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	N. Bouchie
Test Date	:	Dec 30, 2021 04:43:12 PM



FCC Part 15.109
Radiated RF Emissions Test

SW ID/Rev: VBV2 06/29/2021

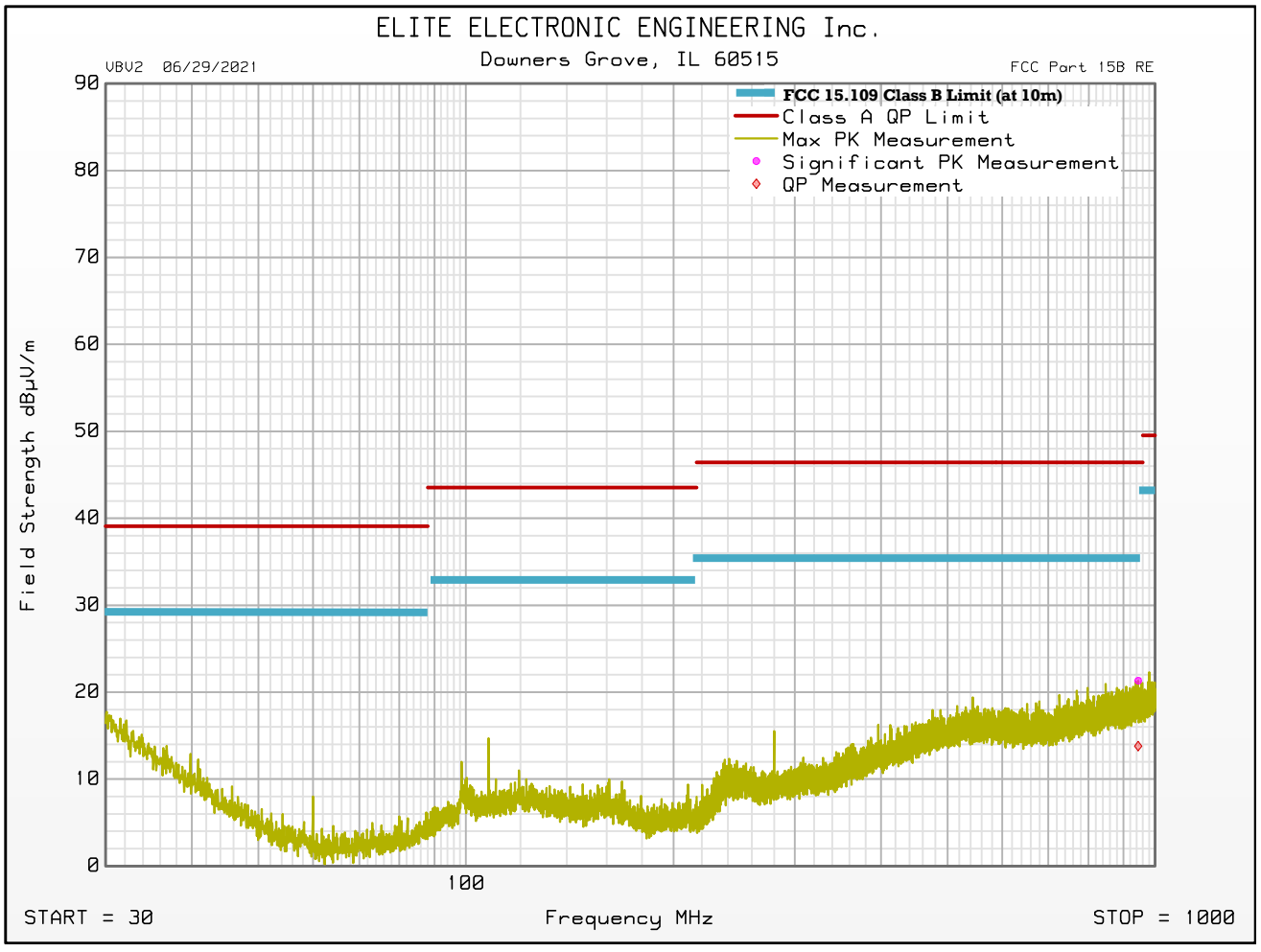
Manufacturer	:	Esys
Model	:	Black Circle Antenna, TPM-SA-200-000
Serial Number	:	N/a
DUT Mode	:	Rx ONLY
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	N. Bouchie
Test Date	:	Dec 30, 2021 04:10:00 PM

Freq MHz	Peak Mtr Rdg dBuV	QP Mtr Rdg dBuV	Ant Fac dB/m	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Peak Total dBµV/m	QP Total dBµV/m	QP Limit dBµV/m	QP Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °	Excessive QP Level
30.480	4.7	-2.6	24.7	0	0.4	0	29.8	22.5	40.0	-17.5	Vertical	340	0	
58.080	17.1	7.0	12.7	0	0.4	0	30.2	20.1	40.0	-19.9	Vertical	120	180	
60.000	13.4	11.4	12.4	0	0.4	0	26.2	24.2	40.0	-15.8	Vertical	200	225	
79.980	6.1	0.8	13.3	0	0.4	0	19.8	14.5	40.0	-25.5	Vertical	120	90	
98.620	10.2	4.0	16.6	0	0.4	0	27.2	21.0	43.5	-22.5	Vertical	120	225	
107.920	9.1	3.6	17.5	0	0.4	0	27.0	21.5	43.5	-22.0	Vertical	340	135	
280.020	11.1	8.2	18.6	0	0.8	0	30.5	27.6	46.0	-18.4	Vertical	200	315	
508.080	5.1	-3.9	24.0	0	1.1	0	30.2	21.2	46.0	-24.8	Vertical	120	45	
945.060	3.3	-4.3	27.0	0	1.5	0	31.8	24.2	46.0	-21.8	Horizontal	120	45	

FCC Part 15.109
Radiated RF Emissions Test

SW ID/Rev: VBV2 06/29/2021

Manufacturer	:	Esys
Model	:	Black Circle Antenna, TPM-SA-200-000
Serial Number	:	N/a
DUT Mode	:	Rx ONLY
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Antenna Polarization	:	Horizontal
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	N. Bouchie
Test Date	:	Dec 30, 2021 04:10:00 PM

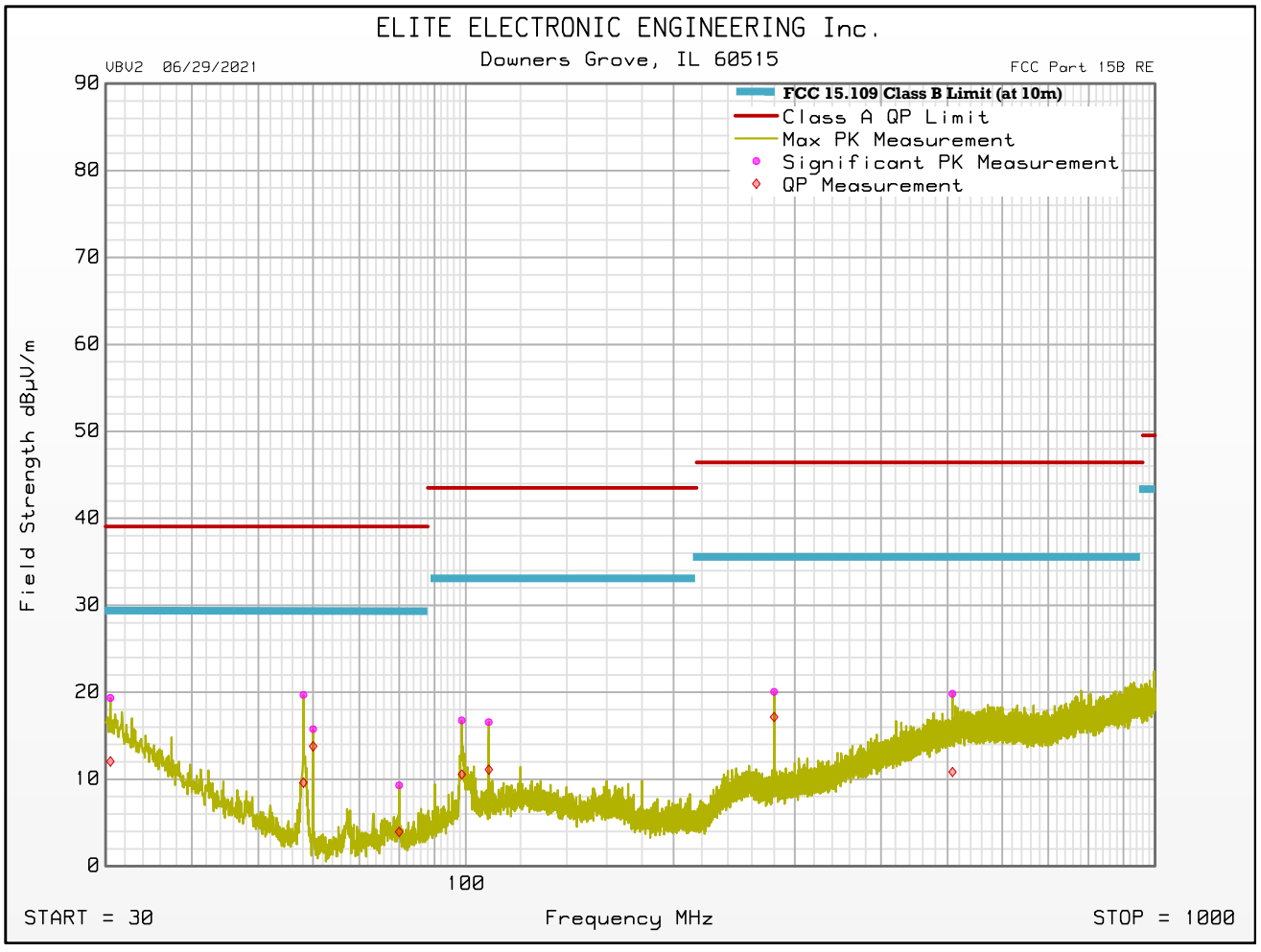


This plot is a preliminary scan to identify significant emissions. Final measurements are recorded in the table

FCC Part 15.109
Radiated RF Emissions Test

SW ID/Rev: VBV2 06/29/2021

Manufacturer	:	Esys
Model	:	Black Circle Antenna, TPM-SA-200-000
Serial Number	:	N/a
DUT Mode	:	Rx ONLY
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Antenna Polarization	:	Vertical
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	N. Bouchie
Test Date	:	Dec 30, 2021 04:10:00 PM



This plot is a preliminary scan to identify significant emissions. Final measurements are recorded in the table

FCC Part 15.109
Radiated RF Emissions Test

SW ID/Rev: VBV2 06/29/2021

Manufacturer	:	Esys
Model	:	Black Circle Antenna, TPM-SA-200-000
Serial Number	:	N/a
DUT Mode	:	Rx ONLY
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Scan Type	:	Stepped Scan
Test RBW	:	1 MHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	N. Bouchie
Test Date	:	Dec 30, 2021 05:03:04 PM

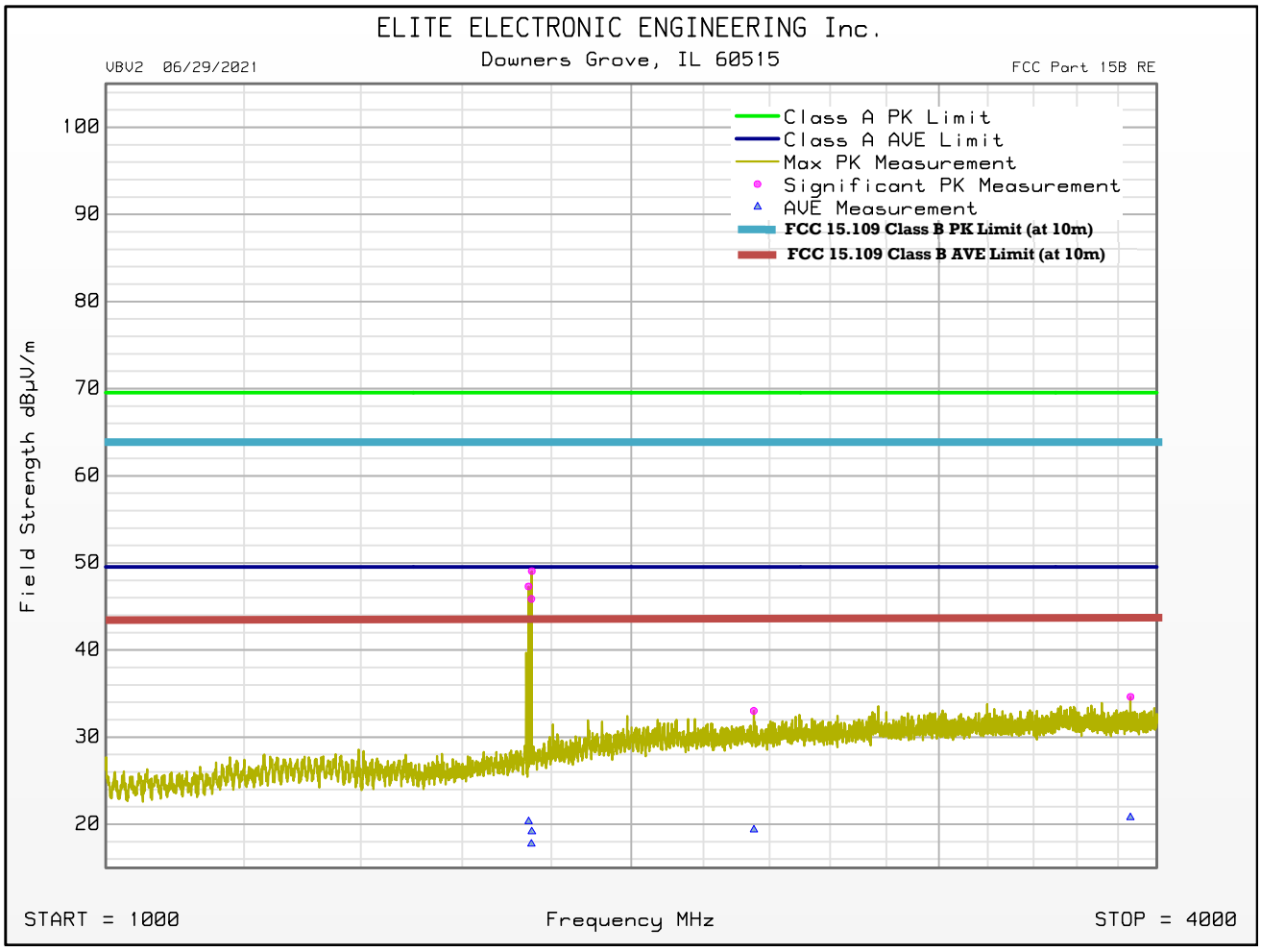
Freq MHz	Peak Mtr Rdg dBuV	Ant Fac dB/m	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Peak Total dBµV/m	Peak Limit dBµV/m	Peak Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °	Excessive Peak Level
1253.500	50.3	29.2	-40.7	1.8	0	40.6	74.0	-33.4	Vertical	200	0	
1329.000	49.3	29.0	-40.5	1.8	0	39.6	74.0	-34.4	Vertical	200	270	
1746.500	65.6	30.2	-40.1	2.1	0	57.8	74.0	-16.2	Horizontal	340	225	
1753.000	64.1	30.3	-40.1	2.1	0	56.4	74.0	-17.6	Horizontal	120	180	
1754.000	67.3	30.3	-40.1	2.1	0	59.6	74.0	-14.4	Horizontal	200	270	
2350.500	49.1	32.0	-40.1	2.5	0	43.5	74.0	-30.5	Horizontal	120	270	
3107.500	48.1	32.9	-39.8	3.0	0	44.2	74.0	-29.8	Vertical	120	225	
3863.000	47.9	33.4	-39.5	3.4	0	45.2	74.0	-28.8	Horizontal	120	270	

Freq MHz	Average Mtr Rdg dBuV	Ant Fac dB/m	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Average Total dBµV/m	Average Limit dBµV/m	Average Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °	Excessive Average Level
1253.500	36.7	29.2	-40.7	1.8	0	27.0	54.0	-27.0	Vertical	200	0	
1329.000	36.4	29.0	-40.5	1.8	0	26.7	54.0	-27.3	Vertical	200	270	
1746.500	38.6	30.2	-40.1	2.1	0	30.8	54.0	-23.2	Horizontal	340	225	
1753.000	36.0	30.3	-40.1	2.1	0	28.3	54.0	-25.7	Horizontal	120	180	
1754.000	37.3	30.3	-40.1	2.1	0	29.6	54.0	-24.4	Horizontal	200	270	
2350.500	35.5	32.0	-40.1	2.5	0	29.9	54.0	-24.1	Horizontal	120	270	
3107.500	35.0	32.9	-39.8	3.0	0	31.1	54.0	-22.9	Vertical	120	225	
3863.000	34.0	33.4	-39.5	3.4	0	31.3	54.0	-22.7	Horizontal	120	270	

FCC Part 15.109
Radiated RF Emissions Test

SW ID/Rev: VBV2 06/29/2021

Manufacturer	:	Esys
Model	:	Black Circle Antenna, TPM-SA-200-000
Serial Number	:	N/a
DUT Mode	:	Rx ONLY
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Antenna Polarization	:	Horizontal
Scan Type	:	Stepped Scan
Test RBW	:	1 MHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	N. Bouchie
Test Date	:	Dec 30, 2021 05:03:04 PM

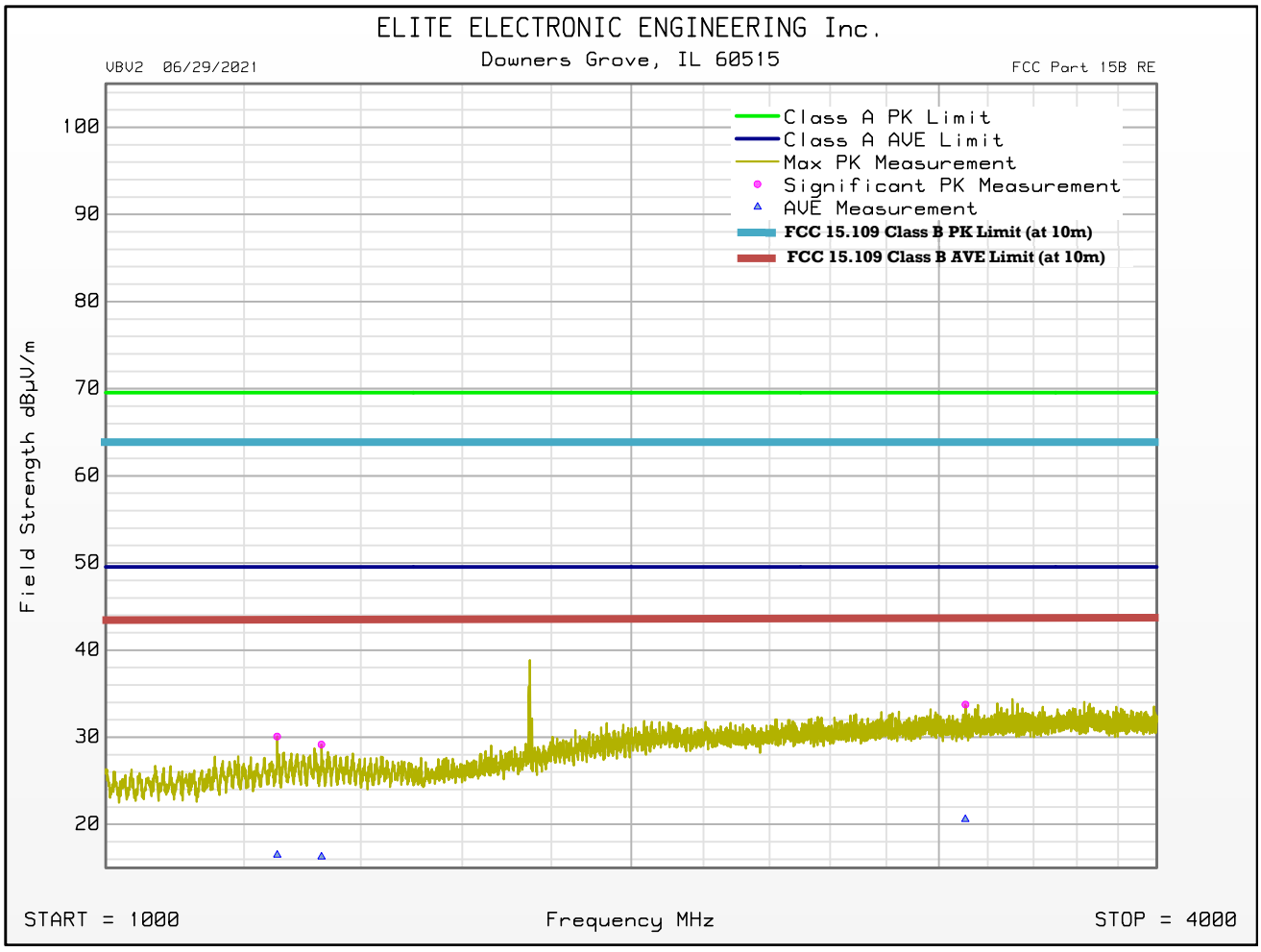


This plot is a preliminary scan to identify significant emissions. Final measurements are recorded in the table

FCC Part 15.109
Radiated RF Emissions Test

SW ID/Rev: VBV2 06/29/2021

Manufacturer	:	Esys
Model	:	Black Circle Antenna, TPM-SA-200-000
Serial Number	:	N/a
DUT Mode	:	Rx ONLY
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Antenna Polarization	:	Vertical
Scan Type	:	Stepped Scan
Test RBW	:	1 MHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	N. Bouchie
Test Date	:	Dec 30, 2021 05:03:04 PM



This plot is a preliminary scan to identify significant emissions. Final measurements are recorded in the table

23. Occupied Bandwidth (99%)

Test Information	
Manufacturer	JR Automation
Product	TPM Activator
Model	TPM-SA-300-000
Serial No	N/a
Mode	Transmit at 125kHz, CW (Unmodulated) Transmit at 125kHz, Modulated

Test Setup Details	
Setup Format	Tabletop
Height of Support	N/a
Measurement Method	Radiated
Type of Test Site	Semi-Anechoic Chamber
Test site used	Room 29
Type of Antennas Used	Active Loop Antenna
Notes	None

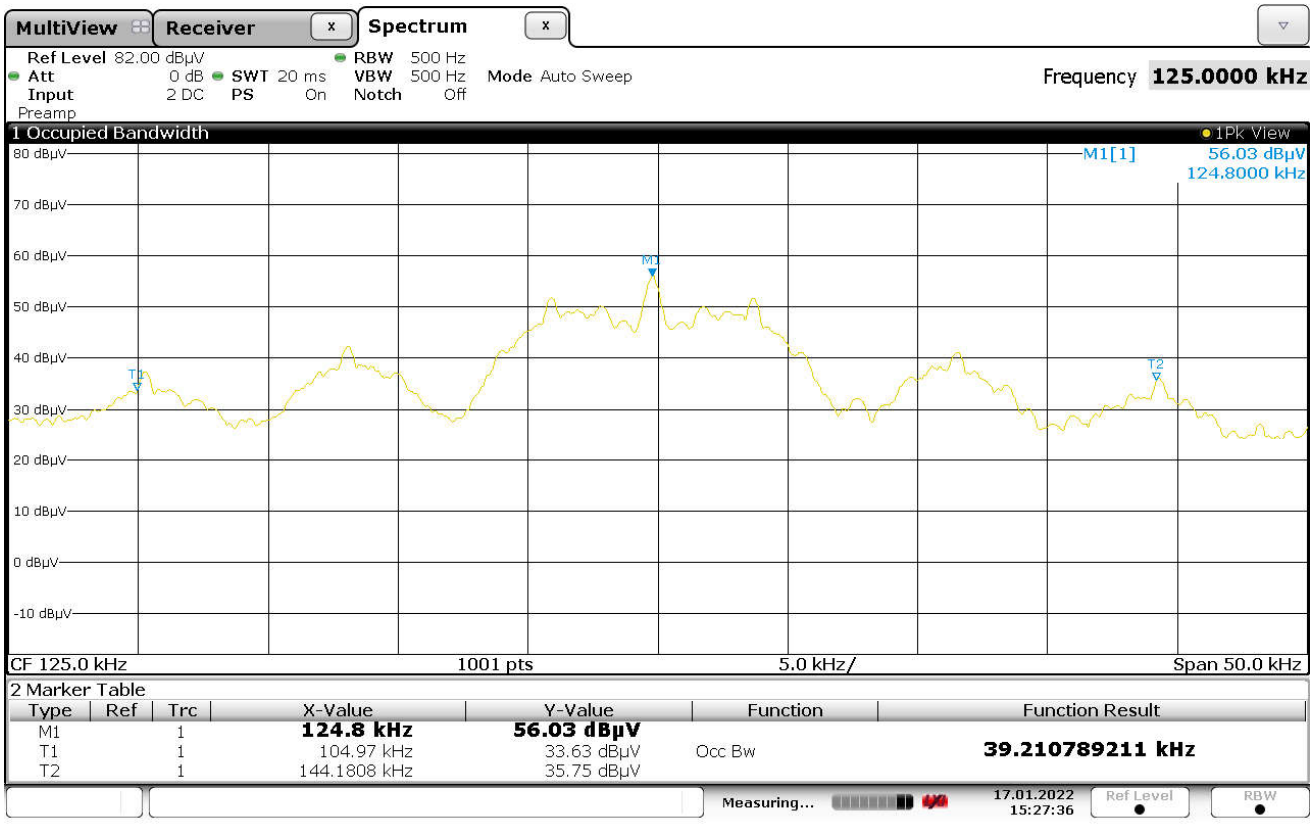
Procedures
The EUT was setup inside the chamber. The EUT was allowed to transmit continuously. The resolution bandwidth (RBW) was set to 1% to 5% of the actual occupied / x dB bandwidth, the video bandwidth (VBW) was set 3 times greater than the RBW, and the span was set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency. The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined. The analyzer's display was plotted using a 'screen dump' utility.

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

Test Details	
Manufacturer	JR Automation
Model	TPM-SA-300-000
S/N	N/a
Mode	Transmit at 125kHz, CW (Unmodulated)
Carrier Frequency	125kHz
Parameters	OBW = 233.8 Hz
Notes	None

Date: 18.JAN.2022 08:06:46

Test Details	
Manufacturer	JR Automation
Model	TPM-SA-300-000
S/N	N/a
Mode	Transmit at 125kHz, Modulated
Carrier Frequency	125kHz
Parameters	OBW = 39.2kHz
Notes	None



Date: 17.JAN.2022 15:27:36

24. Nerve Stimulation Evaluation Test

Test Information	
Manufacturer	JR Automation
Product	TPM Activator
Model	TPM-SA-300-000 TPM-LA-300-000 TPM-LA-200-000 TPM-SA-200-000
Serial No	N/a
Mode	Tx On

Information	
Field Strength Limit	170 V/m rms
Distance Limit	20 cm
Positions Measured	Front Back Top Bottom Left Right
Test Duration	10s
Operating conditions of EUT	Tx On

Procedures

a) The EUT was powered on and configured to the Tx On mode. This resulted in the maximum field strength that the EUT could emit.

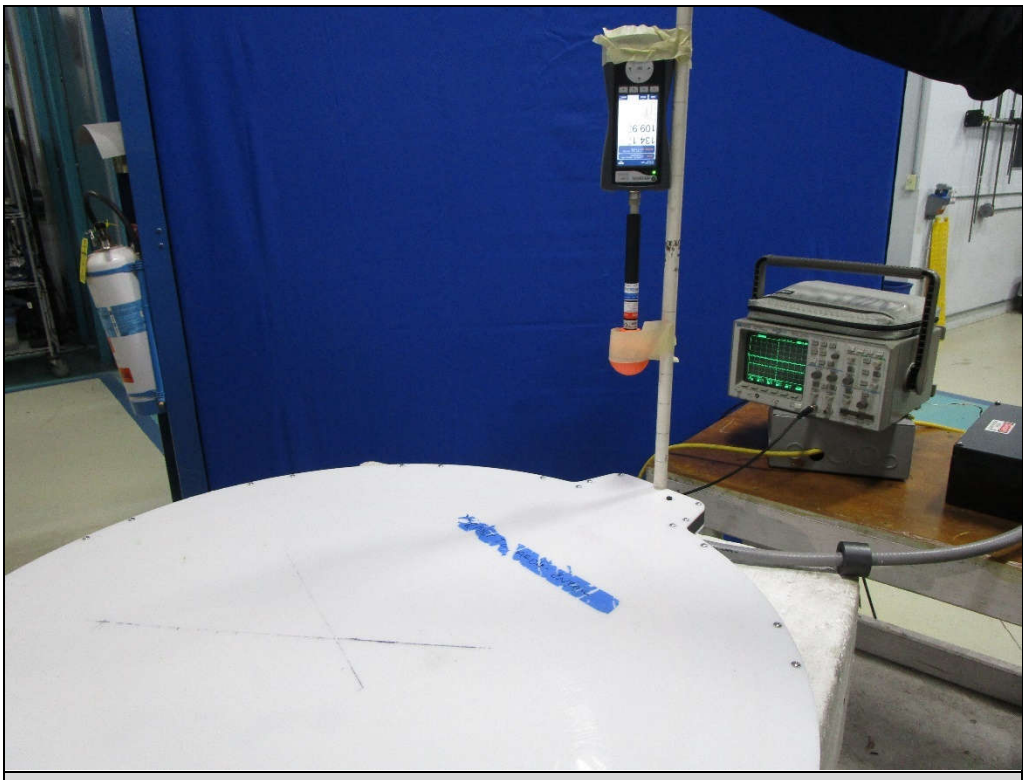
b) An isotropic field probe was placed 20cm from the front side of the EUT. The probe was moved along the entire face of the EUT at the 20cm distance to find the point of maximum field strength.

c) Where the field was maximized, the probe was moved away from the EUT until the 170 V/m rms field strength limit was attained.

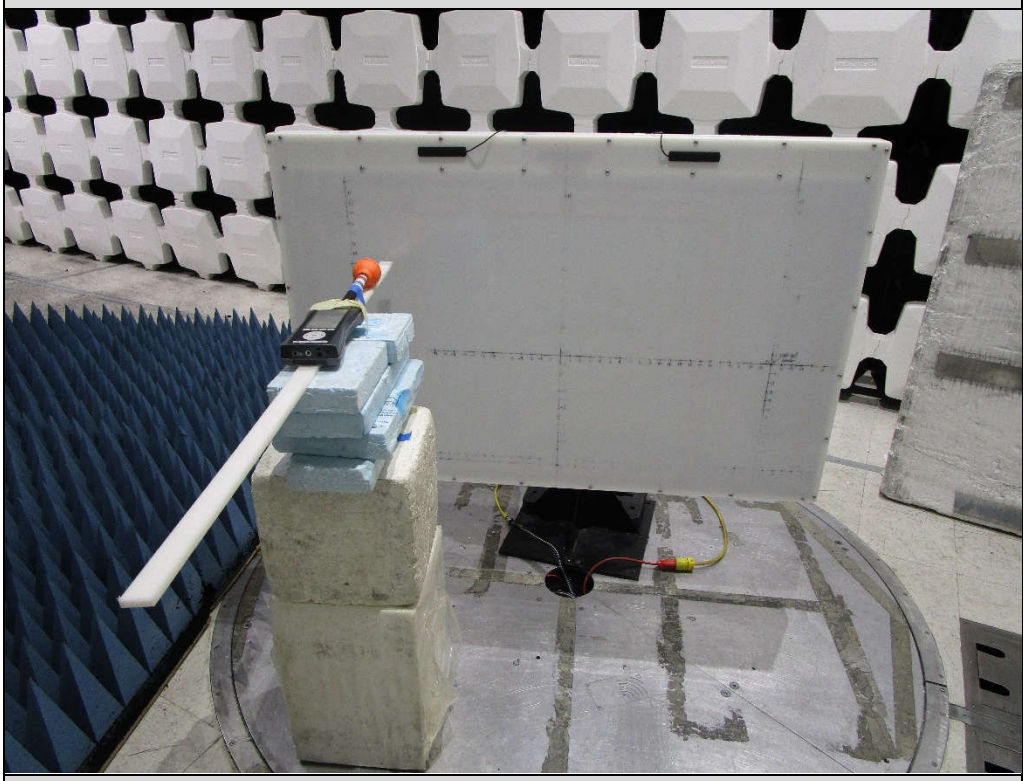
d) The distance from the EUT was recorded.

e) If the 170 V/m rms limit could not be found, the position where the field was maximized was recorded.

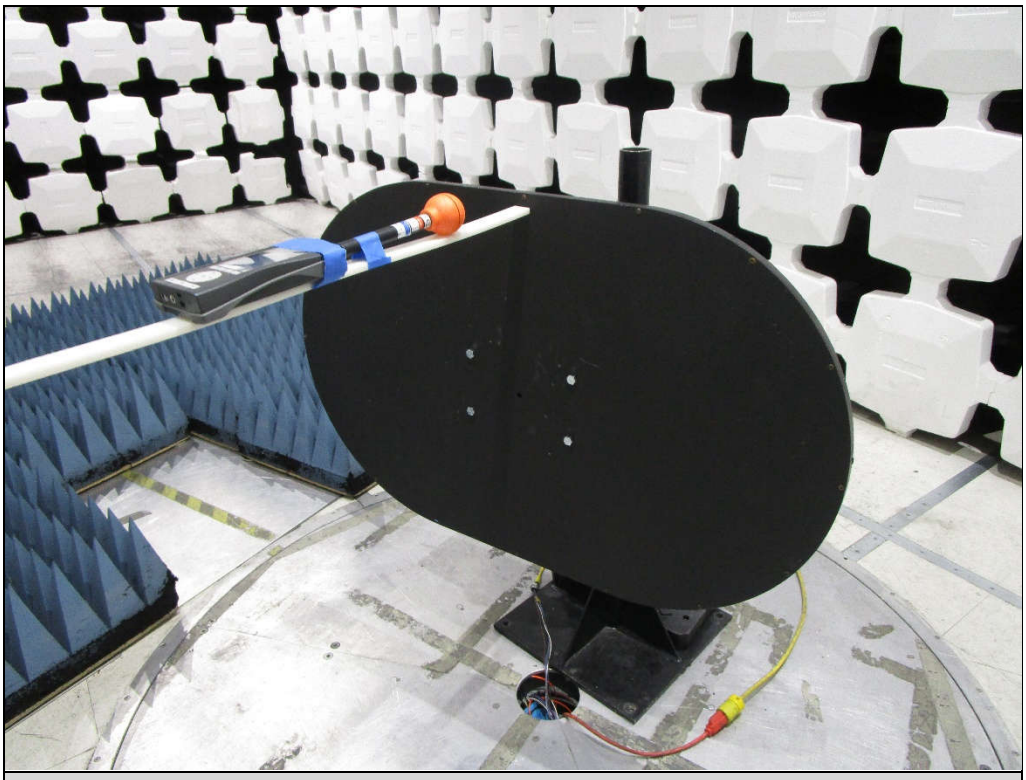
f) Steps b through e were repeated for the remaining sides of the EUT.



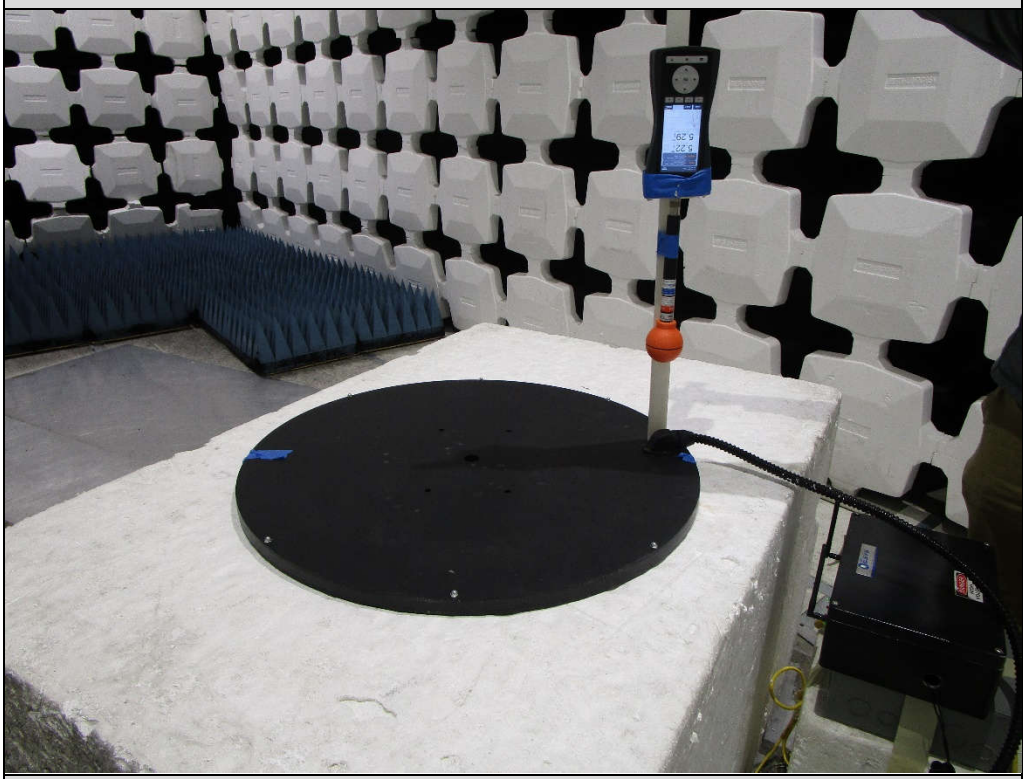
Test Setup for Nerve Stimulation Evaluation (TPM-SA-300-000)



Test Setup for Nerve Stimulation Evaluation (TPM-LA-300-000)



Test Setup for Nerve Stimulation Evaluation (TPM-LA-200-000)



Test Setup for Nerve Stimulation Evaluation (TPM-SA-200-000)

Manufacturer	JR Automation
Product	TPM Activator
Model	TPM-SA-300-000
Serial No	N/a
Mode	Tx On
Date Tested	January 18, 2022

Face Tested	Limit (V/m rms)	Distance where limit was found (cm)	Duration (seconds)	Notes
Front	170	N/a	10	1
Back	170	N/a	10	1
Top	170	N/a	10	1
Bottom	170	N/a	10	1
Left	170	N/a	10	1
Right	170	N/a	10	1

The EUT conforms

Note 1: The 170 V/m rms limit could not be reached. The output was maximized below 30 V/m rms with the probe 20cm away from the EUT.

Tested by: Nathaniel Bouchie

Manufacturer	JR Automation
Product	TPM Activator
Model	TPM-LA-300-000
Serial No	N/a
Mode	Tx On
Date Tested	December 12, 2021

Face Tested	Limit (V/m rms)	Distance where limit was found (cm)	Duration (seconds)	Notes
Front	170	22.86	10	---
Back	170	N/a	10	1
Top	170	N/a	10	1
Bottom	170	N/a	10	1
Left	170	N/a	10	1
Right	170	N/a	10	1

The EUT conforms (at a separation of 22.86cm away from the Front of the EUT)

Note 1: The 170 V/m rms limit could not be reached. The output was maximized below 30 V/m rms with the probe 20cm away from the EUT.

Tested by: Nathaniel Bouchie

Manufacturer	JR Automation
Product	TPM Activator
Model	TPM-LA-200-000
Serial No	N/a
Mode	Tx On
Date Tested	December 12, 2021

Face Tested	Limit (V/m rms)	Distance where limit was found (cm)	Duration (seconds)	Notes
Front	170	N/a	10	1
Back	170	N/a	10	1
Top	170	N/a	10	1
Bottom	170	N/a	10	1
Left	170	N/a	10	1
Right	170	N/a	10	1

The EUT conforms

Note 1: The 170 V/m rms limit could not be reached. The output was maximized below 30 V/m rms with the probe 20cm away from the EUT.

Tested by: Nathaniel Bouchie

Manufacturer	JR Automation
Product	TPM Activator
Model	TPM-SA-200-000
Serial No	N/a
Mode	Tx On
Date Tested	December 12, 2021

Face Tested	Limit (V/m rms)	Distance where limit was found (cm)	Duration (seconds)	Notes
Front	170	N/a	10	1
Back	170	N/a	10	1
Top	170	N/a	10	1
Bottom	170	N/a	10	1
Left	170	N/a	10	1
Right	170	N/a	10	1

The EUT conforms

Note 1: The 170 V/m rms limit could not be reached. The output was maximized below 30 V/m rms with the probe 20cm away from the EUT.

Tested by: Nathaniel Bouchie

25. Scope of Accreditation

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

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ELECTRICAL

Valid To: June 30, 2023 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)
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)

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]:
Vehicle Radiated Emissions	CISPR 12; CISPR 36; 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
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
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
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; 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 14
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

Test Technology:	Test Method(s) [1]:
Emissions (cont'd)	
Current Harmonics	IEC 61000-3-2; 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; 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
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

Test Technology:	Test Method(s) [1]:
Immunity (cont'd)	
Power Frequency Magnetic Field Immunity (*Down to 3 A/m*)	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
Generic and Product Specific EMC Standards	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

Test Technology:	Test Method(s) [1]:
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 (July 15, 2020)
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; KS X 3124; KS X 3125; KS X 3130; KS X 3126; KS X 3129
Vietnam Radio Test Standards	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
Vietnam EMC Test Standards	QCVN 18:2014/BTTTT; QCVN 86:2019/BTTTT; QCVN 96:2015/BTTTT; QCVN 118:2018/BTTTT
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 (using ANSI/TIA-603-E, TIA-102.CAAA-E, ANSI C63.26:2015)

Test Technology:	Test Method(s) [1]:
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
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 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)	 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

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.1[2]

Rule Subpart/Technology	Test Method	Maximum Frequency (MHz)
Unintentional Radiators Part 15B	ANSI C63.4:2014	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)
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
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

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)
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
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 19th day of May 2021.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 1786.01
Valid to June 30, 2023

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