



Environmental Tests on NPD MM5G

For	Airgain Inc 7860 E McClain Dr Ste 2 Scottsdale, AZ 85260
P.O. Number	4000078977
Date Tested	June 5, 2023 to June 7, 2023
Test Personnel	Kyle Hewitt, Michael Tegeler
Test Specification	ISO 20653 (2013-02-15)

Test Report By:

Kyle Hewitt
ENV Engineer

Requested By:

Randy Cozzolino
Airgain Inc

Approved By:

Mark Gabalewicz
Environmental Team Leader
Senior Mechanical Engineer

Elite Electronic Engineering Inc.

1516 CENTRE CIRCLE
DOWNERS GROVE, IL 60515

TEL: 630 - 495 - 9770

FAX: 630 - 495 - 9785

www.elitetest.com

Table of Contents

- 1. Report Revision History 3
- 2. Introduction 4
- 3. Test Specification 4
- 4. Modifications Made to DUT and/or Deviations to the Test Specification During Testing 4
- 5. Summary 4
- 6. Operation States 4
- 6.1. Unpowered 4
- 7. Performance Monitoring 4
- 8. Acceptance Criteria 4
- 9. Certification 4
- 10. Device Under Test 5
- 11. Test Sections 6
- 11.1. Dust (IP6K) 6
- 11.1.1. Requirements: 6
- 11.1.2. Test Procedure: 6
- 11.1.3. Description of Test Apparatus: 6
- 11.1.4. Test Results: 6
- 11.2. Pressure Spray (IPX9K) 9
- 11.2.1. Requirements: 9
- 11.2.2. Test Procedure: 9
- 11.2.3. Description of Test Apparatus: 9
- 11.2.4. Test Results: 9

**This report shall not be reproduced, except in full,
without the written approval of Elite Electronic Engineering Inc.**



1. REPORT REVISION HISTORY

Revision	Date	Description
-	June 15, 2023	Initial release

2. INTRODUCTION

This document presents the results of a series of environmental (ENV) tests that were performed on (2) NPD MM5G (hereinafter referred to as the Device Under Test (DUT)). The DUTs were identified as follows:

Part ID: AP-MF5G-C2W4G-Q-B1	Enclosure: Flat	S/N F1
Part ID: AP-MF5G-C2W4G-Q-B1	Enclosure: Ribbed	S/N R1

3. TEST SPECIFICATION

The tests were performed in accordance with ISO 20653 (2013-02-15).

4. MODIFICATIONS MADE TO DUT AND/OR DEVIATIONS TO THE TEST SPECIFICATION DURING TESTING

No modifications were made to the DUTs during the testing. No deviations from the test specification were made during the testing.

5. SUMMARY

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

Test Description	Specification Section	Test Results	S/N	Date Tested
Dust (IP6K)	ISO 20653 (2013-02-15), IP6K	Compliant	F1, R1	6/5/23
Pressure Spray (IPX9K)	ISO 20653 (2013-02-15), IPX9K	Compliant	F1, R1	6/7/23

6. OPERATION STATES

The ENV tests were performed with the DUTs operating in one or more of the test modes described below.

6.1. Unpowered

The DUTs were not powered throughout the testing.

7. PERFORMANCE MONITORING

The DUTs were not monitored during the testing.

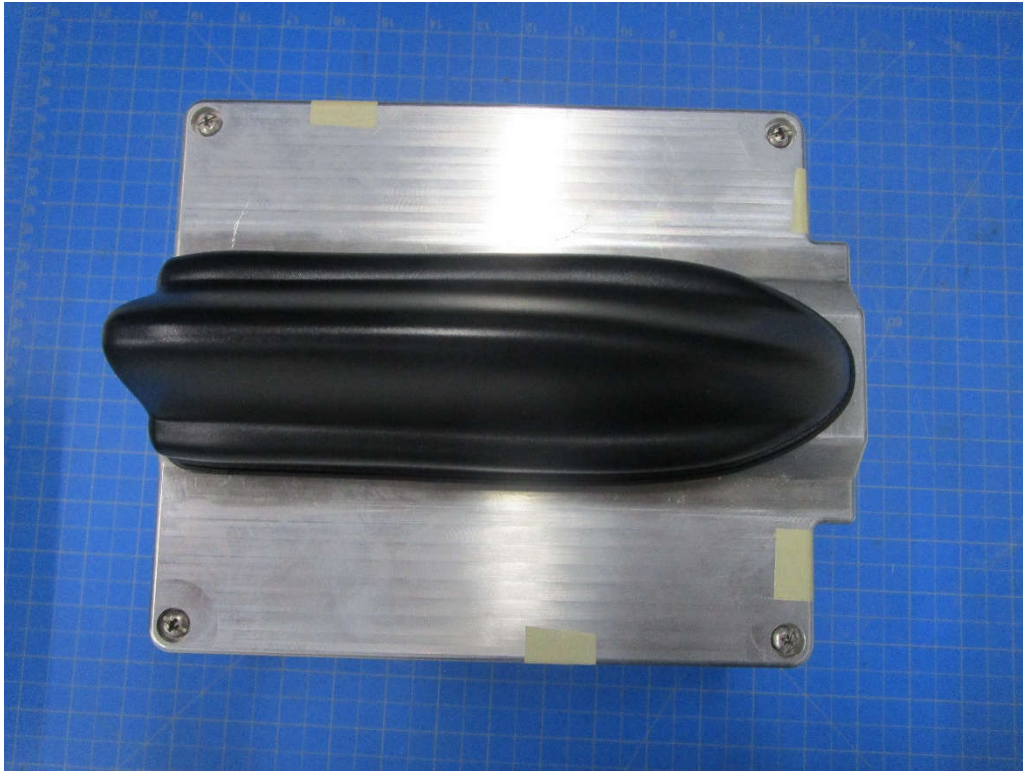
8. ACCEPTANCE CRITERIA

The DUTs shall meet all requirements as listed in test sections 11.1.1 and 11.2.1.

9. 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 test specification, except if noted otherwise. The data presented in this test report pertains to the DUTs as provided by the customer at the test date as operated and monitored by Elite personnel. Any electrical or mechanical modification made to the DUTs subsequent to the specified test date will serve to invalidate the data and void this certification.

10. DEVICE UNDER TEST



Ribbed Enclosure



Flat Enclosure

11. TEST SECTIONS

11.1. Dust (IP6K)

11.1.1. Requirements:

The DUTs shall satisfactorily withstand exposure to dust without physical damage or dust intrusion.

11.1.2. Test Procedure:

The test was conducted in accordance with ISO 20653 (2013-02-15), IP6K. The DUTs were then placed inside the chamber.

The chamber conditions were maintained for a period of five (5) hours at ambient room temperature. The dust was agitated for six (6) seconds every 15 minutes for a total duration of 5 hours (20 cycles). The chamber temperature, duration and dust density were adjusted as follows:

Step	Temperature	Dust Density (kg/M3)	Duration (Hours)
1	Room Ambient	2	5

The dust used was A2 Arizona dust.

11.1.3. Description of Test Apparatus:

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
ENVC12	SETTLING DUST CHAMBER	LINEAR KINETICS	JAL 2011	1001	---	7/8/2022	7/8/2023
EWS1	WEIGHT SCALE	HANSON		70418-32	0 TO 200LBS	8/27/2022	8/27/2023

CNR: Calibration Not Required

CBU: Calibrate Before Use

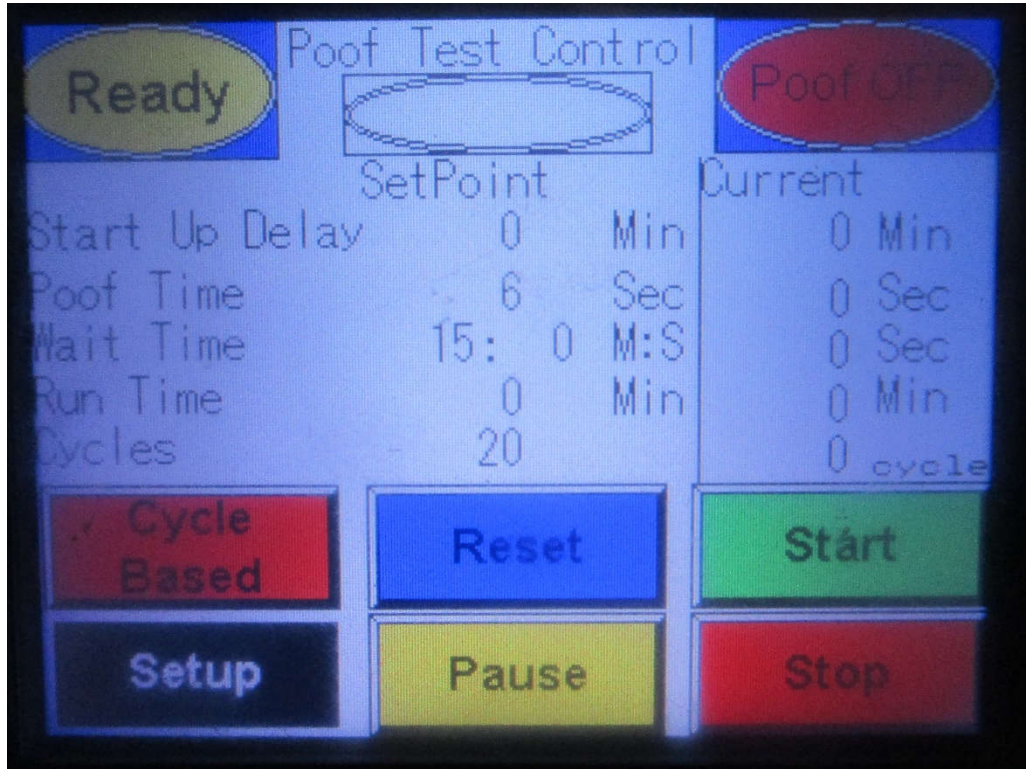
I/O: Initial Only

N/A: Not Applicable

Note 1: For the purpose of this test, the equipment was calibrated prior to the test or monitored by a calibrated instrument.

11.1.4. Test Results:

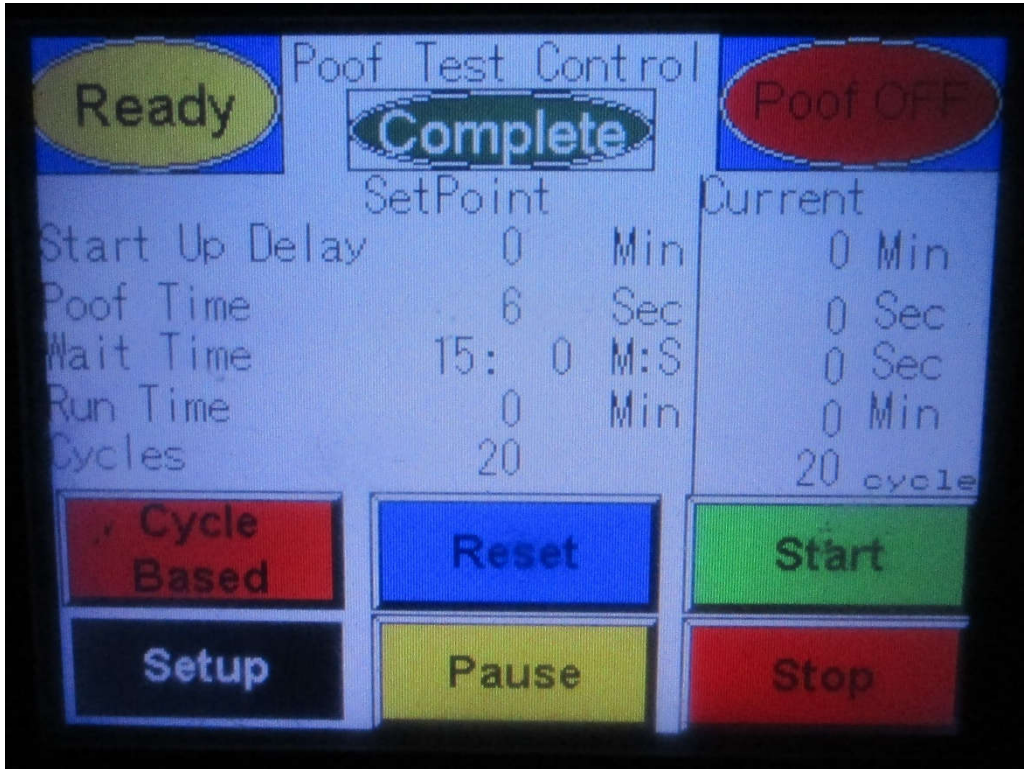
The DUTs completed the Dust testing per ISO 20653 (2013-02-15), IP6K. Following the test, the DUTs were visually inspected for physical damage and were later inspected for dust intrusion following the Pressure Spray (IPX9K) testing (Section 11.2). The DUT had no evidence of physical damage or dust intrusion. The DUTs were then retained at Elite for further testing.



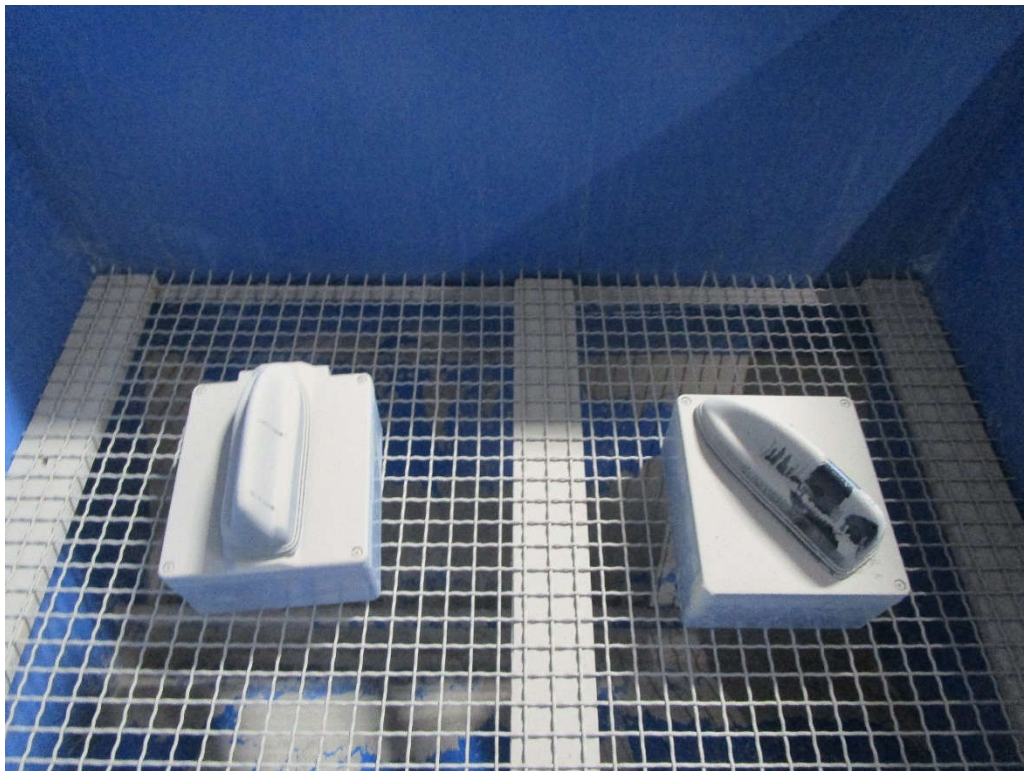
Test Profile



Test Setup Photograph



Completed Profile



Post-Test Photograph

11.2. Pressure Spray (IPX9K)

11.2.1. Requirements:

The DUTs shall satisfactorily withstand exposure to a pressurized stream of water without physical damage or water intrusion that shall interfere with normal operation.

11.2.2. Test Procedure:

The test was conducted in accordance with ISO 20653 (2013-02-15), IPX9K. The DUTs were then placed inside the test area.

The DUTs were then subjected to water spray from a distance of 100 to 150 mm (4-6 inches). The water was sprayed through a 35° (±5°) fan nozzle at a pressure of 8,000kPa to 10,000kPa (1160PSI to 1450PSI) with a flow rate of 3.69GPM to 4.22GPM (14 Liters/Minute to 16 Liters/Minute). The water was heated and maintained at a temperature of 80°C ± 5°C throughout the entire exposure. The DUTs were subjected to the water spray for a period of 30 seconds per position (90°, 60°, 30°, 0°) with the DUTs rotating at 5 rpm for a total exposure of 2 minutes. Following the exposure, the DUTs were visually inspected for physical damage and water intrusion.

11.2.3. Description of Test Apparatus:

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
EHW0	HOT WATER HEATER	CHROMALOX	MICROTHERM CMX SERIES	PC03804	20-100C	NOTE 1	
EMS2	METER STICK (1M)	FAIRGATE	33-300		1M	2/27/2023	2/27/2025
EPT16	PRESSURE TRANSDUCER	GP:50	211CRX7FJGS	188375	0-7500 PSIG	4/20/2023	4/20/2024
EPW0	POWER WASHER	ALL PRESSURE WASHERS	5000	F0910016462	5000psi @ 4.5 GPM	NOTE 1	
EST0	STAINLESS STEEL IMMERSION TANK	LOMAX	ST500	2293	---	N/A	
EWT0	WATER TURNTABLE	ELITE	WT-001	001	1RPM-5RPM	10/10/2022	10/10/2024
EWT1	IPX9K TEST SET UP	ELITE	IPX9K FIXTURE	001	IPX9K	NOTE 1	
MDP3	20 CHANNEL MULTIPLEXER (2/4 WIRE)	KEYSIGHT	DAQM901A	MY58033128	---	9/15/2022	9/15/2023
MDR9	DATA ACQUISTION SYSTEM	KEYSIGHT	DAQ970A	MY58018784	---	6/1/2022	7/1/2023
MZD6	STOPWATCH/TIMER	EXTECH	365510	---	---	8/27/2022	8/27/2023
XFG11	FLOW GAUGE	HEDLAND	H705B-010	102715	.5-10GPM	3/9/2023	3/9/2025

CNR: Calibration Not Required

CBU: Calibrate Before Use

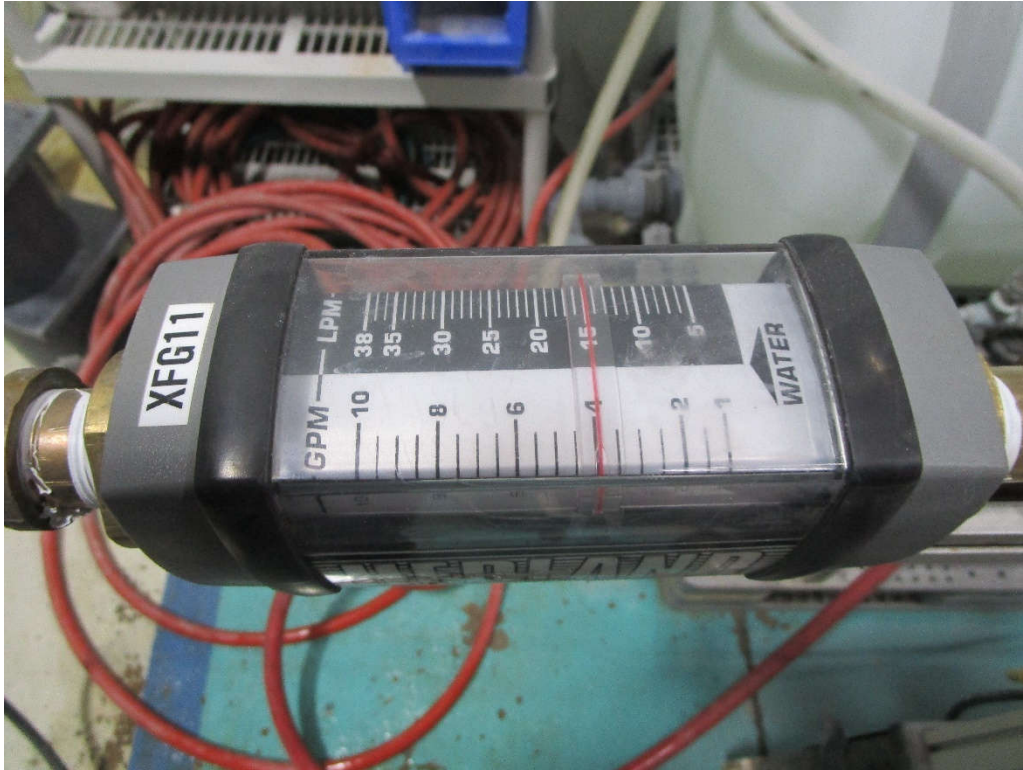
I/O: Initial Only

N/A: Not Applicable

Note 1: For the purpose of this test, the equipment was calibrated prior to the test or monitored by a calibrated instrument.

11.2.4. Test Results:

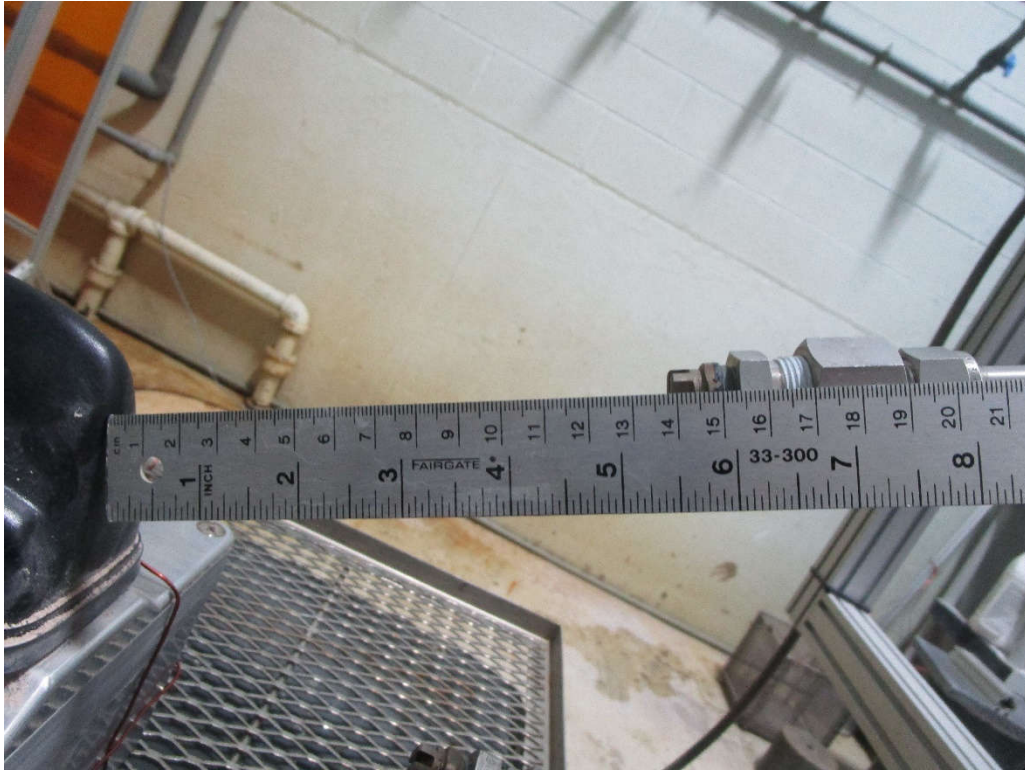
The DUTs were subjected to and completed the Pressure Spray testing per ISO 20653 (2013-02-15), IPX9K. Following the test, the DUTs were visually inspected for physical damage or water intrusion. The DUTs had no evidence of physical damage or water intrusion. The DUTs were then returned to the customer for further evaluation.



Test Setup Photograph - Flow



Test Setup Photograph (Distance - 0°)



Test Setup Photograph (Distance - 30°)



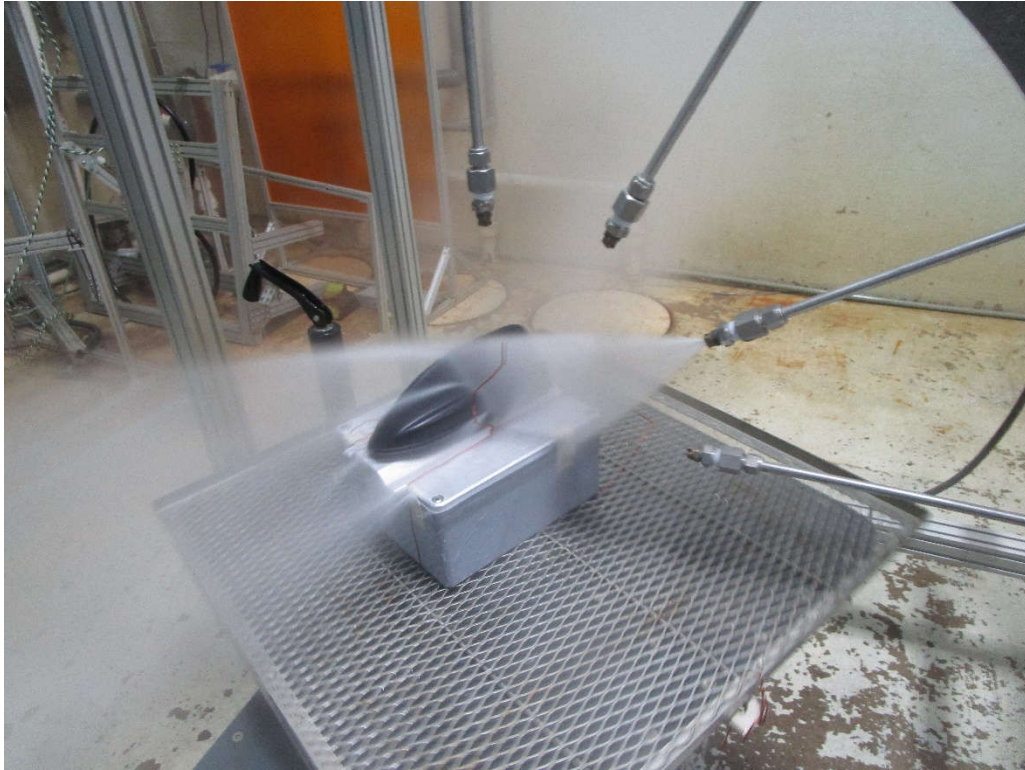
Test Setup Photograph (Distance - 60°)



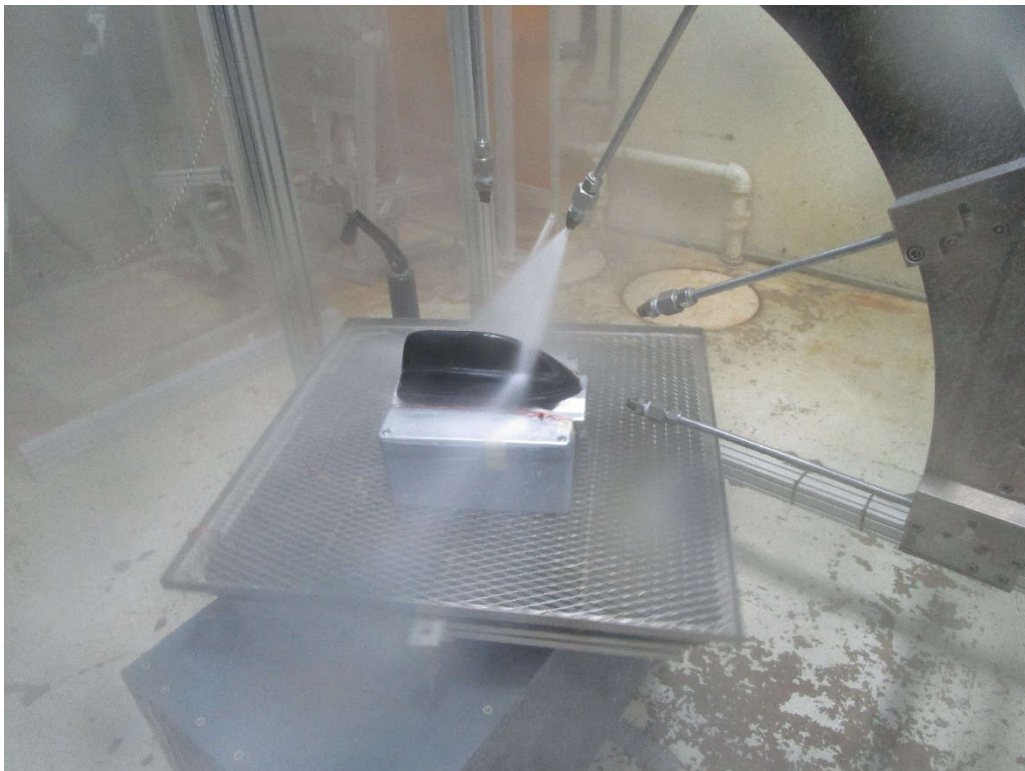
Test Setup Photograph (Distance - 90°)



Test in Progress Photograph (0°)



Test in Progress Photograph (30°)



Test in Progress Photograph (60°)



Test in Progress Photograph (90°)



Post-Test Photograph – DUT F1



Post-Test Photograph – DUT R1