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Report Type: DO-STD
Reference Standard: DO-160G
Date of Report: 7 April 2017
Product Name: ARS-700 (Atom/Ion)
Model Number: Atom Ion-R
Serial Number: Atom 160010. Ion 110101
Manufacturer: Churchill Navigation
Representative: Jordan Heintz
Approved By: 

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Rev. A	Initial Release	7 April 2017
Rev. B	Correction to model #s and update block diagram.	12 April 2017

TABLE OF CONTENTS

	Section #
Scope.....	1.0
Applicable Documents	2.0
Requirements.....	3.0
EMI Emissions and Immunity Software	4.0
Magnetic Field Effect (DO-160G SEC 15) Test Results	5.0
Power Input (DO-160G SEC 16) Test Results	6.0
Voltage Spike (DO-160G SEC 17) Test Results	7.0
Radiated E-field Emissions (DO-160G SEC 21) Test Results	8.0
Electrostatic Discharge (RTCA-DO-160G SEC 25) Test Results	9.0

APPENDIX LISTING

Magnetic Field Effect (DO-160G SEC 15)	APPENDIX A
Power Input (DO-160G SEC 16).....	APPENDIX B
Voltage Spike (DO-160G SEC 17).....	APPENDIX C
Radiated E-field Emissions (DO-160G SEC 21)	APPENDIX D
Electrostatic Discharge (RTCA-DO-160G SEC 25)	APPENDIX E
EMI Test Log	APPENDIX F
Laboratory Accreditations	APPENDIX G

1.0 SCOPE

1.1 Purpose

This test report documents electromagnetic interference (EMI) characteristics (susceptibility) of the ARS-700 (Atom/Ion). The model number tested was the Atom Ion-R, and the serial numbers tested were Atom 160010 and Ion 110101.

1.2 Description of Unit Under Test

The ARS-700 (Atom/Ion) is a mission computer for real time video overlay and video recorder. The UUT was tested with both systems on, streaming video and not streaming video.

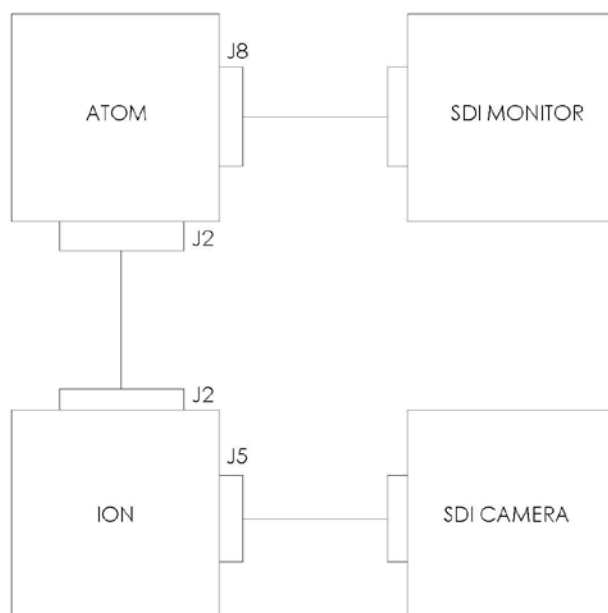


Figure 1. Block Diagram of Unit Under Test.

1.3 Format

The test method contained in this report is designated by section numbers that are defined in the standard; DO-160G. Sections 15, 16, 17, 21 and 25 are the sections tested to for this report.

1.4 Units

This report uses the International System of Units as adopted by the United States Bureau of Standards. A more complete description of this system of units, in addition to the meanings of terms used in this report, is given in DO-160G in the appropriate sections.

1.5 Summary of Test Results

Results of this testing are summarized in Table 1-1. The EUT was tested to the limits specified by Churchill Navigation's internal requirements.

Test	Description	Result
DO-160G SEC 15	Class Z	Pass
DO-160G SEC 16	EUT continued to function as intended following testing	Pass
DO-160G SEC 17	EUT continued to function as intended following testing	Pass
DO-160G SEC 21	EUT complies with limits	Pass
DO-160G SEC 25	EUT continued to function as intended following testing	Pass

Table 1-1. Summary of Test Results.

1.6 Modifications

For Section 21 test, EMI gaskets added to ATOM unit, External ferrite added to the video cables.

2.0 APPLICABLE DOCUMENTS

The following documents apply to this report to the extent specified herein. Unless a specific issue or revision is listed, the applicable issue shall be that in effect on the date of release of this document. In conflicts between the listed documents and the contents of this report, this report shall take precedence.

2.1 Government Documents

DO-160G	Environmental conditions and test procedures for Airborne Equipment.
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2.2 Client Documents

Product Data Sheet.

3.0 REQUIREMENTS

3.1 General Requirements

General requirements pertaining to the application of this standard, the applicable test limits, and the measuring test equipment to be used for the performance of the tests included in this report are contained in the referenced documents. Details pertaining to the performance of the tests outlined in this document are contained in the following sections. All operation of the EUT's support equipment was performed by the customer. The EMI measurements were performed in accordance with the methods specified in DO-160G .

3.2 Test Conditions

3.2.1 Ground Plane. - A solid plate of copper was used as the ground/reference plane. The copper plane had a thickness of greater than 0.25 mm and an area of at least 2.25 m², with no side being less than 0.76 m. The ground plane was bonded to the enclosure such that the dc bonding resistance was 1.6 mΩ, thus complying with the requirement of <2.5 mΩ. In addition, the bonds between the ground plane and the shielded enclosure were spaced no greater than 0.9 meters apart.

3.2.2 Accessory Equipment Precaution. - Care was taken to insure that accessory equipment used in conjunction with the interference meters did not affect the integrity of the measurements. Care was also taken to ensure that any support equipment used was electromagnetically isolated from the EUT such that it did not confound measurements..

3.2.3 Support Equipment. – No external support equipment was used during testing.

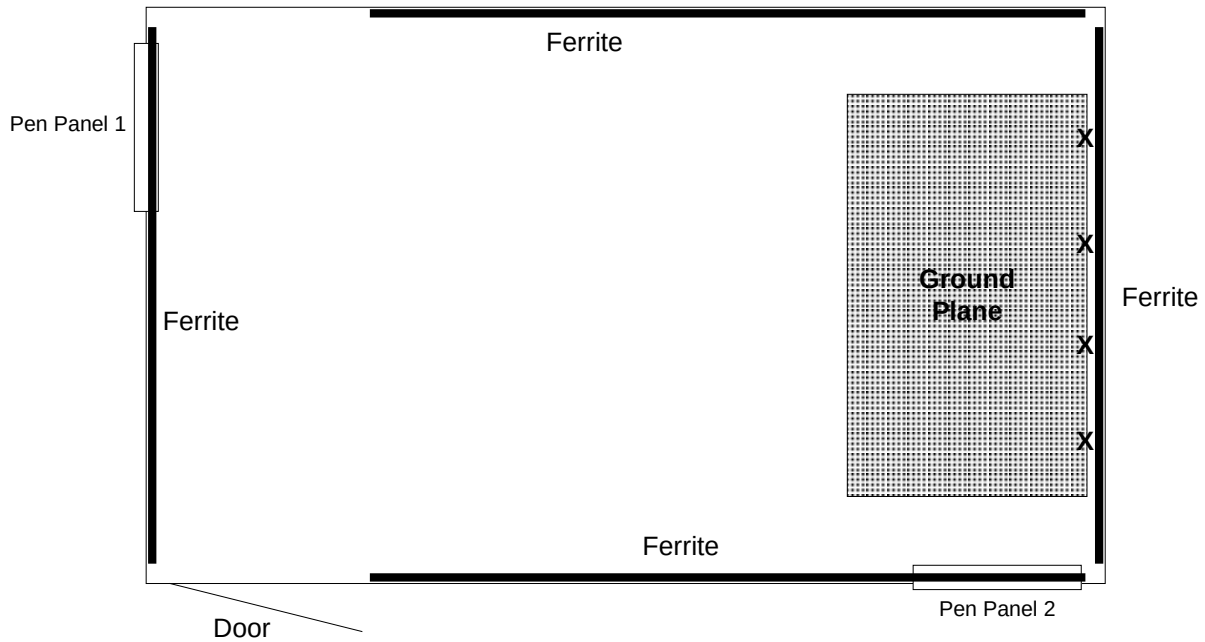
3.2.4 Excess Personnel and Equipment. - The shielded enclosure was kept free of unnecessary equipment, cable racks and desks. Only the equipment essential to the test being performed was in the enclosure or in the test area. Personnel not actively involved in the test were not permitted in the enclosure.

3.2.5 Equipment Calibration. - All test equipment was calibrated traceable to the National Institute of Standards and Technology (NIST).

3.2.6 RF Shielded Enclosure - The RF shielded enclosure used for the EUT testing was 16 feet long, 12 feet wide and 8 feet tall. It was equipped with two penetration panels: one for interfacing to the test equipment and one for interfacing to the support equipment. The room is also equipped with two honeycomb filters for ventilation and filtered AC power (both 120 Vac, single-phase and 208 Vac, three-phase). An overview of the room is shown in Figure 3-1.

3.2.7 RF Absorber Material. - RF absorber material was used in the shielded enclosure during the EMI testing to reduce reflections from conductive surfaces within the enclosure. This is shown in Figure 3-2.

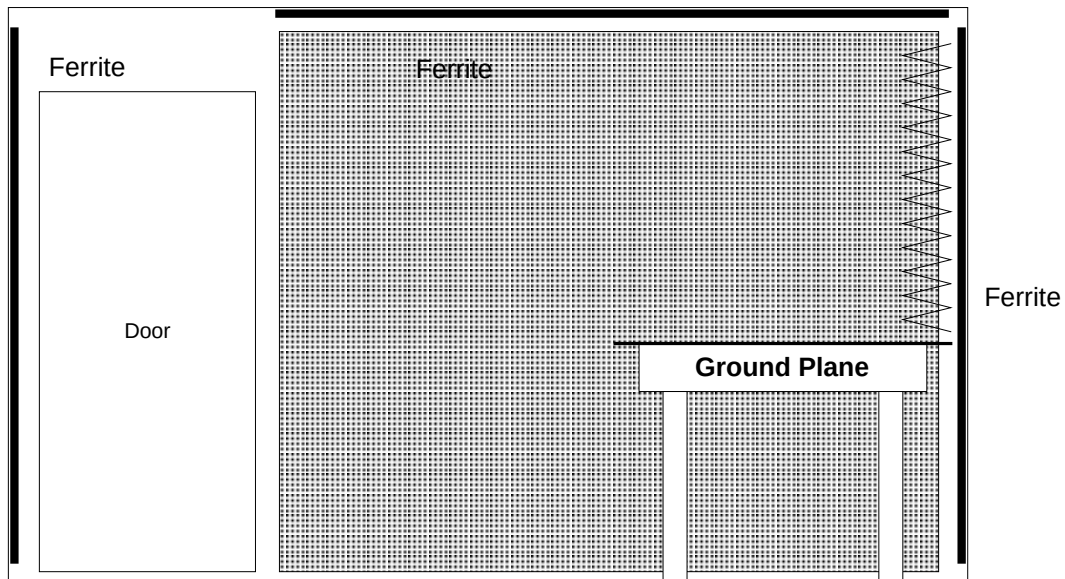
NTS-Longmont
Test Report # TR-PR058945



Notes

1. "X" indicates point at which ground plane is bonded to shield room wall with 2" braid.

Figure 3-1. Top View of RF Shielded Enclosure.



Notes

1. Ferrite tile covers both end walls, as well as 75% of side walls and ceiling.
2. The back wall above the ground plane is covered with 4" cones.
3. Ground plane is bonded to the end wall of the enclosure with an impedance of less than 2.5 milliohms.
4. Ground plane is positioned 80 cm above the floor of the chamber.

Figure 3-2. Side View of EMI Test Environment.

3.2.8 Use of Measuring Equipment. - The measuring equipment used to perform the tests described in this standard met the requirements of DO-160G. All laboratory equipment was operated as prescribed by the manufacturers' instruction manual unless otherwise specified by DO-160G

3.2.9 Grounding of Measuring Equipment. - The grounding of EMI instrumentation was implemented in accordance with the following rules to avoid false data that might be introduced by ground loops, etc.

- (a) the antenna shall be remote from the measuring equipment.
- (b) the EMI measuring instrument shall be physically grounded with only one connection.
- (c) the EMI measuring instrument shall be connected to the ac power mains through an isolation transformer. This will break the chassis ground connection and ensure that rf currents do not circulate through the test equipment.

3.2.10 EMI Test Data Sheets. - All specific information pertaining to the EMI test of the EUT was recorded on the appropriate test data sheet. The susceptibility data sheets contain information regarding injection level, step size, dwell time and sweep rate. All test data sheets are contained in the appropriate appendix.

3.2.11 Measurement Tolerances. - Unless otherwise stated for a particular measurement, the tolerance was as follows:

- a. Distance: $\pm 5\%$
- b. Frequency: $\pm 2\%$
- c. Amplitude, measurement receiver: ± 2 dB
- d. Amplitude measurement system: ± 3 dB
- e. Time (waveforms): $\pm 5\%$
- f. Resistors: $\pm 5\%$
- g. Capacitors: $\pm 20\%$

5.0 Magnetic Field Effect (DO-160G SEC 15) Test Results

5.1 PURPOSE

The purpose of this test was to verify that the EUT complied with the magnetic field effect limits specified by the DO-160G SEC 15 test of DO-160G .

5.2 REQUIREMENTS

With D being the distance at which the 1 degree (1°) deflection is observed, the following category designation is given to the equipment:

Category Z: $0 < D \leq 0.3\text{m}$. The deflection of the compass is equal to 1° when measured $>0.0\text{m}$ to $\leq 0.3\text{m}$ to the equipment.

All data for this testing is contained in Appendix A of this report.

5.3 TEST FACILITY

The facility used for this testing is outlined in Section 3.0 of this report. It complies with the requirements outlined for EMI/EMC testing, as defined in DO-160G .

5.4 TEST SETUP

Testing was performed in accordance with DO-160G. Testing was performed by moving the EUT to the compass until the deflection was noticed. The EUT was powered with the cable harness and extended power leads all placed in one bundle to be routed along the east to west axis of the compass.

5.5 TEST EQUIPMENT

Details of the equipment used for this testing are contained on the test data sheet. The equipment list shows the manufacturer, the model number, the serial number, whether or not calibration is required on a particular piece of hardware, when the equipment was last calibrated and when it is next due for calibration.

5.6 TEST RESULTS

The EUT **complied** with the DO-160G SEC 15 requirements defined in DO-160G . The data documenting the results of this testing are contained in Appendix A of this report.

6.0 Power Input (DO-160G SEC 16) Test Results

6.1 PURPOSE

The purpose of this test was to verify that the EUT complied with the Power Input limits specified by the DO-160G SEC 16 test of DO-160G .

6.2 REQUIREMENTS

For the EUT the category reference will be A. Test was set up in accordance with 16.6.1. All data for this testing is contained in Appendix B of this report.

6.3 TEST FACILITY

The facility used for this testing is outlined in Section 3.0 of this report. It complies with the requirements outlined for EMI/EMC testing, as defined in DO-160G .

6.4 TEST SETUP

Testing was performed in accordance with DO-160G. The EUT was subjected to various power interrupts as well as normal and abnormal operating voltages.

6.5 TEST EQUIPMENT

Details of the equipment used for this testing are contained on the test data sheet. The equipment list shows the manufacturer, the model number, the serial number, whether or not calibration is required on a particular piece of hardware, when the equipment was last calibrated and when it is next due for calibration.

6.6 TEST RESULTS

The EUT **complied** with the DO-160G SEC 16 requirements defined in DO-160G . The data documenting the results of this testing are contained in Appendix B of this report.

7.0 Voltage Spike (DO-160G SEC 17) Test Results

7.1 PURPOSE

The purpose of this test was to verify that the EUT complied with the Power Input limits specified by the DO-160G SEC 17 test of DO-160G .

7.2 REQUIREMENTS

The EUT is tested to determine if it can withstand the effects of voltage spikes, arriving at the equipment on its dc power leads. The EUT is identified as Category B equipment.

All data for this testing is contained in Appendix C of this report.

7.3 TEST FACILITY

The facility used for this testing is outlined in Section 3.0 of this report. It complies with the requirements outlined for EMI/EMC testing, as defined in DO-160G .

7.4 TEST SETUP

Testing was performed in accordance with DO-160G. The EUT was subjected to a series of positive and negative spikes as described in DO-160G section 17.4, Figure 17-1. Details of the test setup are contained on the test data sheet in the appropriate appendices.

7.5 TEST EQUIPMENT

Details of the equipment used for this testing are contained on the test data sheet. The equipment list shows the manufacturer, the model number, the serial number, whether or not calibration is required on a particular piece of hardware, when the equipment was last calibrated and when it is next due for calibration.

7.6 TEST RESULTS

The EUT **complied** with the DO-160G SEC 17 requirements defined in DO-160G . The data documenting the results of this testing are contained in Appendix C of this report.

8.0 Radiated E-field Emissions (DO-160G SEC 21) Test Results

8.1 PURPOSE

The purpose of this test was to verify that the EUT complied with the Power Input limits specified by the DO-160G SEC 21 test of DO-160G .

8.2 REQUIREMENTS

The requirements of this test is to ensure the EUT does not emit undesired RF noise in excess of the levels specified in Category M as defined in DO-160G SEC 21.2.

All data for this testing is contained in Appendix D of this report.

8.3 TEST FACILITY

The facility used for this testing is outlined in Section 3.0 of this report. It complies with the requirements outlined for EMI/EMC testing, as defined in DO-160G .

8.4 TEST SETUP

Testing was performed in accordance with DO-160G SEC 21.3.

The setup for this testing is shown in the photographs, which may be found on the data sheets contained in Appendix D of this report.

8.5 TEST EQUIPMENT

Details of the equipment used for this testing are contained on the test data sheet. The equipment list shows the manufacturer, the model number, the serial number, whether or not calibration is required on a particular piece of hardware, when the equipment was last calibrated and when it is next due for calibration.

8.6 TEST RESULTS

The EUT **complied** with the DO-160G SEC 21 requirements defined in DO-160G . The data documenting the results of this testing are contained in Appendix D of this report.

9.0 Electrostatic Discharge (DO-160G SEC 25) Test Results

8.1 PURPOSE

The purpose of this test was to verify that the EUT complied with the Electrostatic Discharge limits specified by the DO-160G SEC 25 test of DO-160G .

8.2 REQUIREMENTS

The EUT is expected to perform its intended function without permanent degradation of performance as a result of an air discharged electrostatic pulse.

All data for this testing is contained in Appendix E of this report.

8.3 TEST FACILITY

The facility used for this testing is outlined in Section 3.0 of this report. It complies with the requirements outlined for EMI/EMC testing, as defined in DO-160G .

8.4 TEST SETUP

Testing was performed in accordance with DO-160G. The EUT was subject to a series of electrostatic discharge pulses at a test level of 15K volts, directed at specific human contact locations on the EUT.

The setup for this testing is shown in the photographs, which may be found on the data sheets contained in Appendix E of this report.

8.5 TEST EQUIPMENT

Details of the equipment used for this testing are contained on the test data sheet. The equipment list shows the manufacturer, the model number, the serial number, whether or not calibration is required on a particular piece of hardware, when the equipment was last calibrated and when it is next due for calibration.

8.6 TEST RESULTS

The EUT **complied** with the DO-160G SEC 25 requirements defined in DO-160G . The data documenting the results of this testing are contained in Appendix E of this report.

Appendix A

Magnetic Effect (DO-160G SEC 15) Test Data



Magnetic Field Effect per DO-160G Section 15

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	160010(ATOM) 110101 (ION)
Standard Referenced:	DO-160G	Date:	March 6, 2017
Temperature:	20.2°C	Humidity:	30.5%
Input Voltage:	28VDC	Pressure:	834mb
Configuration of Unit:	Both systems active, Streaming video / Map overlay		
Test Engineer:	Mike Jasiewicz		

PR058945-DO-160G Sec 15.doc FR0100

Measured HCAFS at test location =	183 mG
DC =	0.989 deg
Distance measured to DC =	22cm
Category Designation =	Z



Magnetic Field Effect per DO-160G Section 15

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	160010(ATOM) 110101 (ION)
Standard Referenced:	DO-160G	Date:	March 6, 2017
PR058945-DO-160G Sec 15.doc		FR0100	



Photo 1. Test Location



Magnetic Field Effect per DO-160G Section 15

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	160010(ATOM) 110101 (ION)
Standard Referenced:	DO-160G	Date:	March 6, 2017
PR058945-DO-160G Sec 15.doc		FR0100	



Photo 2. Measured HCAFS at compass location



Magnetic Field Effect per DO-160G Section 15

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	160010(ATOM) 110101 (ION)
Standard Referenced:	DO-160G	Date:	March 6, 2017
PR058945-DO-160G Sec 15.doc		FR0100	

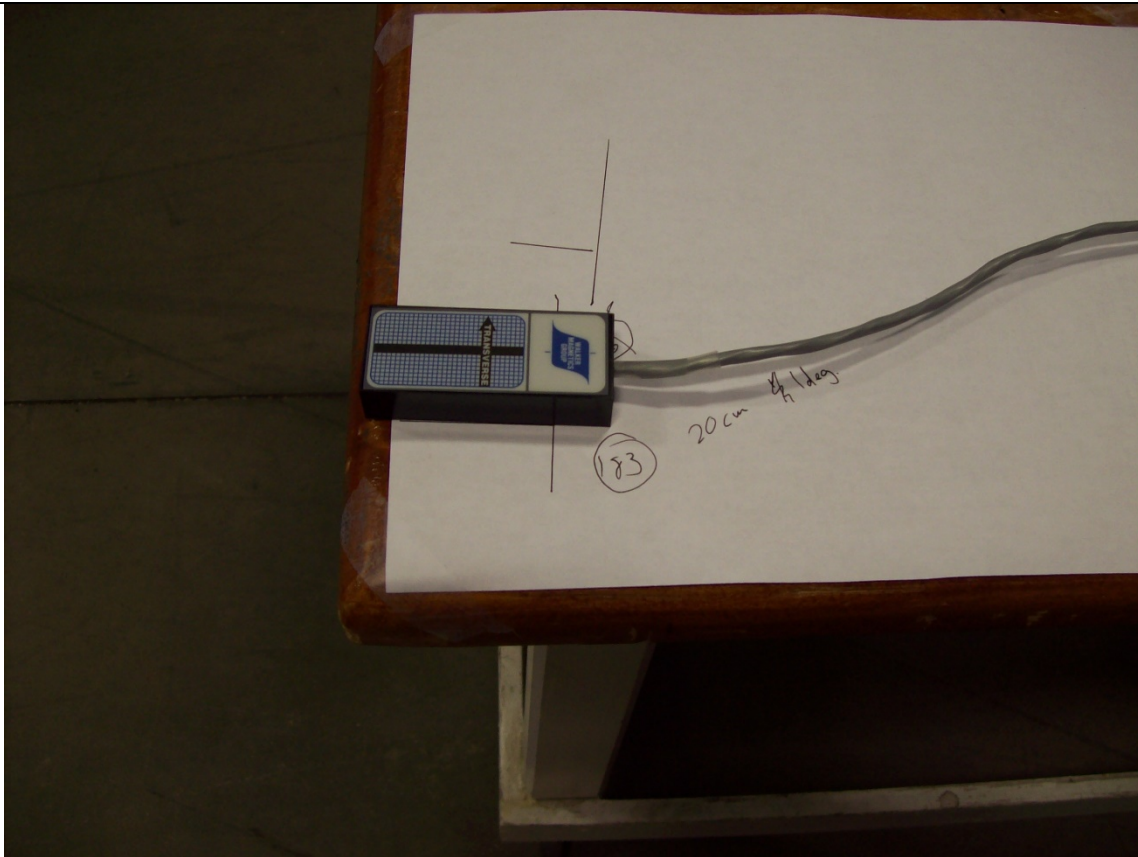


Photo 3. Measured HCAFS at compass location



Magnetic Field Effect per DO-160G Section 15

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	160010(ATOM) 110101 (ION)
Standard Referenced:	DO-160G	Date:	March 6, 2017
PR058945-DO-160G Sec 15.doc		FR0100	

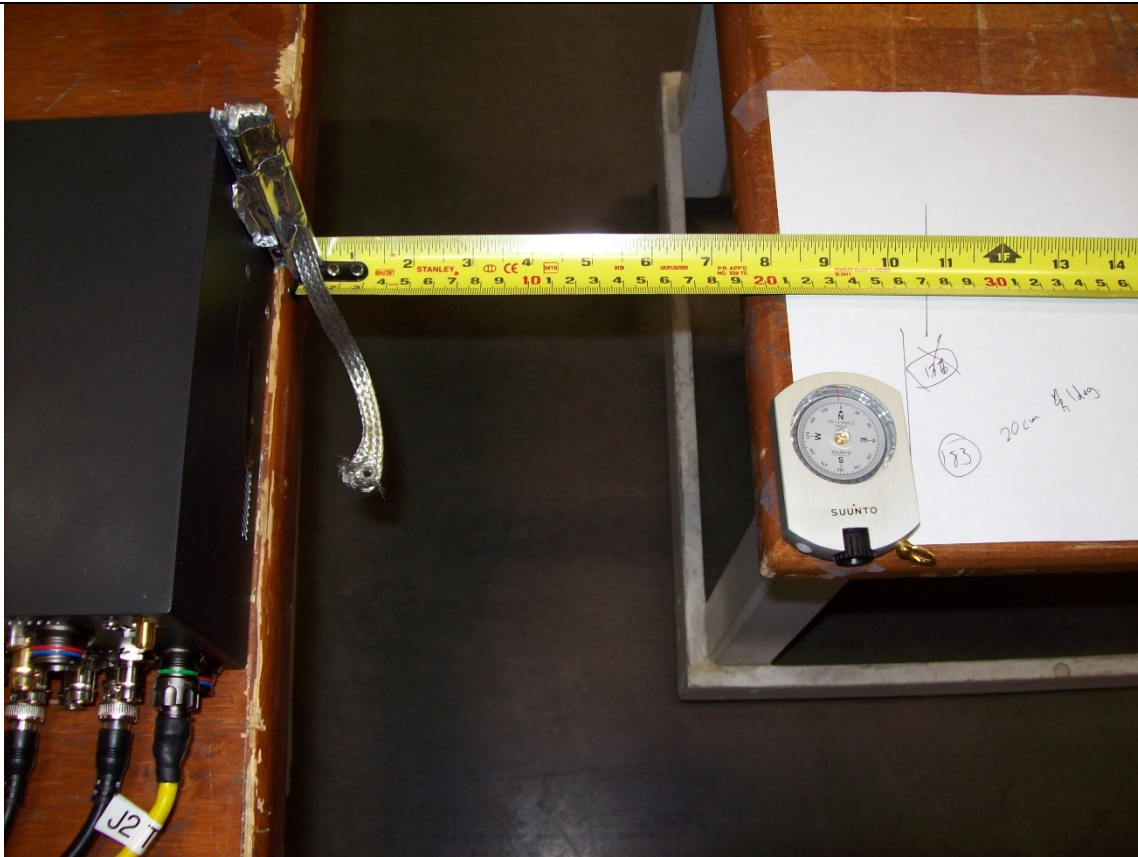


Photo 4. Measure DC distance



Magnetic Field Effect per DO-160G Section 15

Manufacturer: Churchill Navigation
Customer Representative: Jordan Heintz
Model: ATOM, ION-R
Standard Referenced: DO-160G

Project Number: PR058945
Test Area: Shield Room
S/N: 160010(ATOM)
110101 (ION)
Date: March 6, 2017

PR058945-DO-160G Sec 15.doc

FR0100

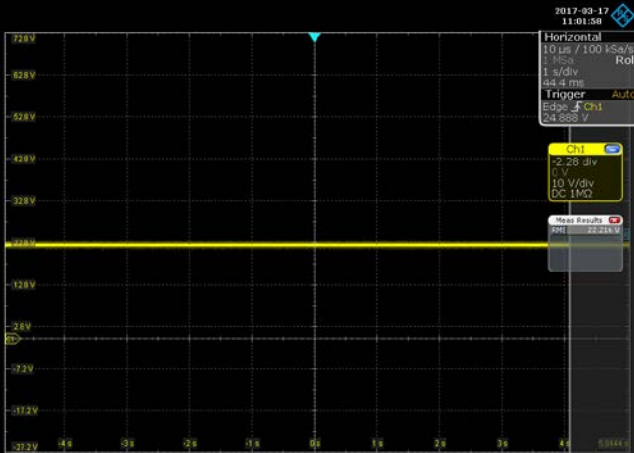
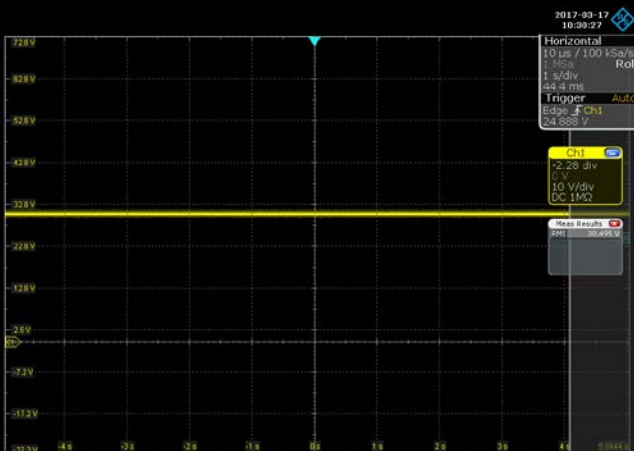
Test Equipment List

ID Number	Manufacturer	Model #	Serial #	Description	Cal Date	Cal Due
1714	Walker Scientific	FGM-3D2T	6476	Magnetometer	11/04/2016	11/04/2017
1716	Suunto	KB-143/360R G	16409949	compass	NA	NA
-	Stanley	33-726	-	Tape Measure	N/A	N/A
-	-	-	-	Wooden Table (80cm)	N/A	N/A
-	-	-	-	Wooden Table (80cm)	N/A	N/A

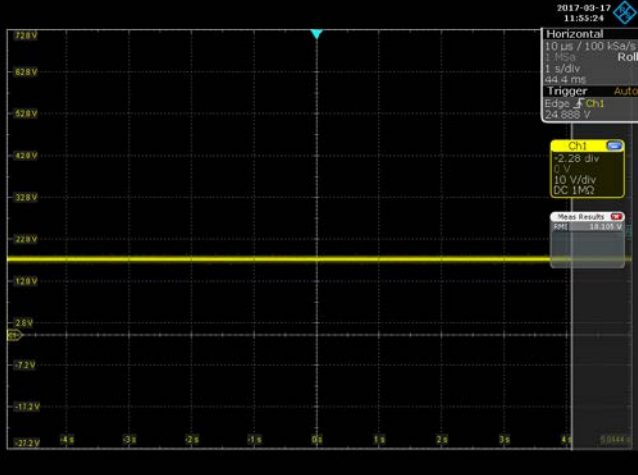
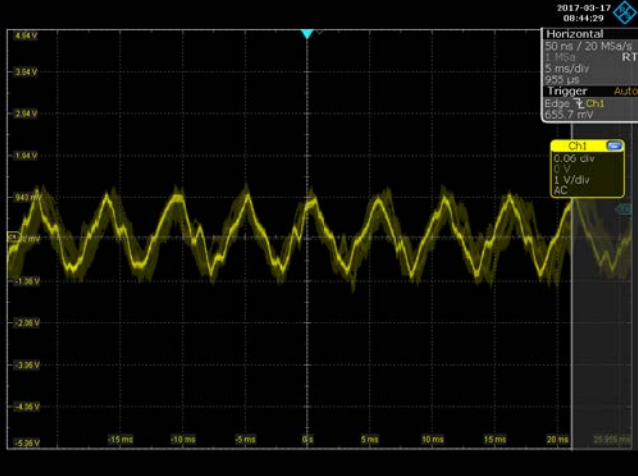
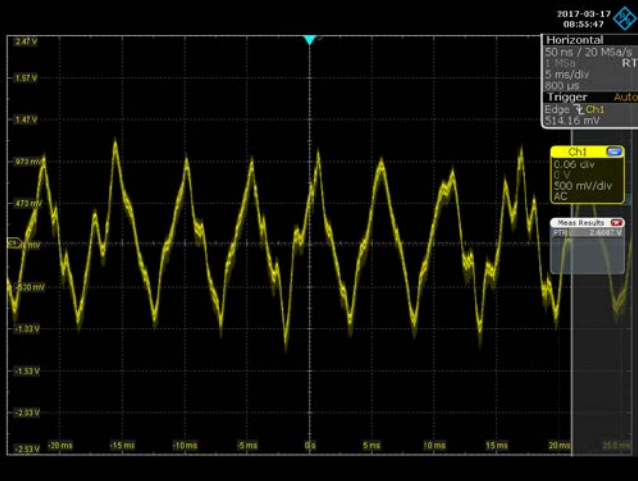
Appendix B

Power Input (DO-160G SEC 16) Test Data

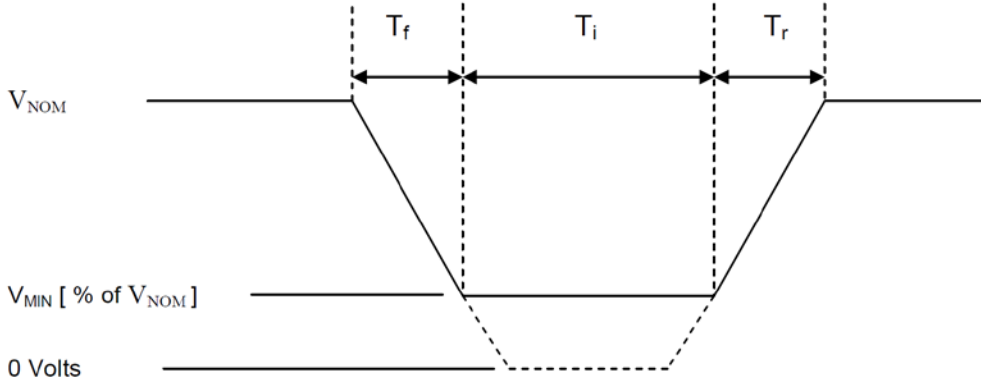
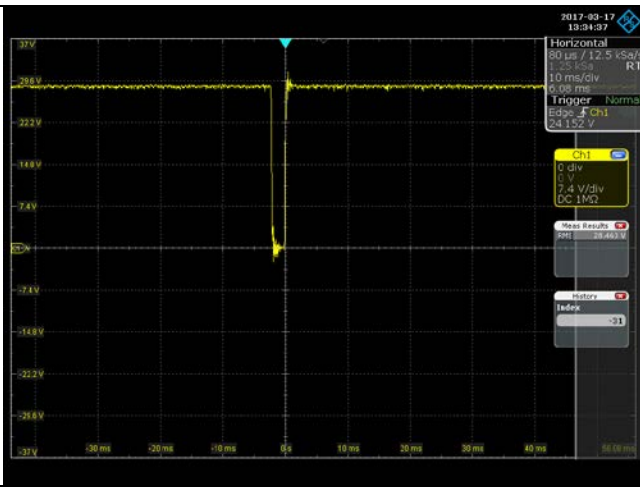
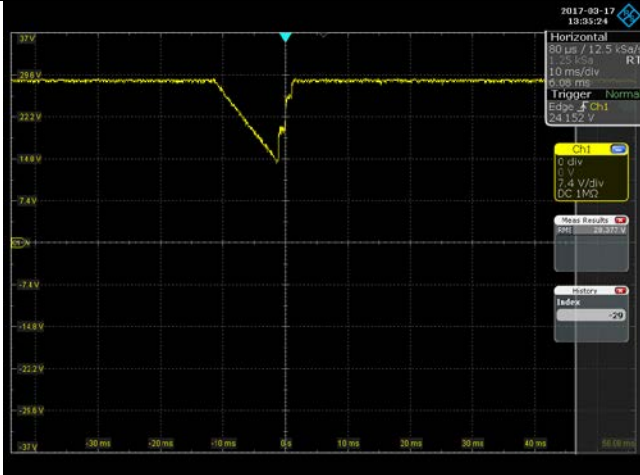
Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	160010(ATOM) 110101 (ION)
Standard Referenced:	DO-160G Section 16	Date:	March 17, 2017
Temperature:	20.6°C	Humidity:	31.5%
Input Voltage:	28VDC	Pressure:	841mb
Configuration of Unit:	Both systems active, Streaming video / Map overlay		
Test Engineer:	Mike Jasiewicz		
PR058945-DO-160G Sec 16.doc			FR0100

Test ID	Description	Scope capture	Results
DO160G Section 16.6.1.1b	Normal operation conditions, 22VDC		PASS
	Normal operation conditions, 30.3VDC		PASS

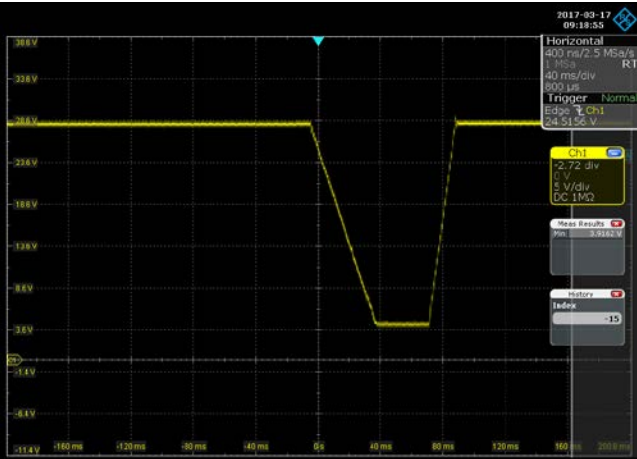
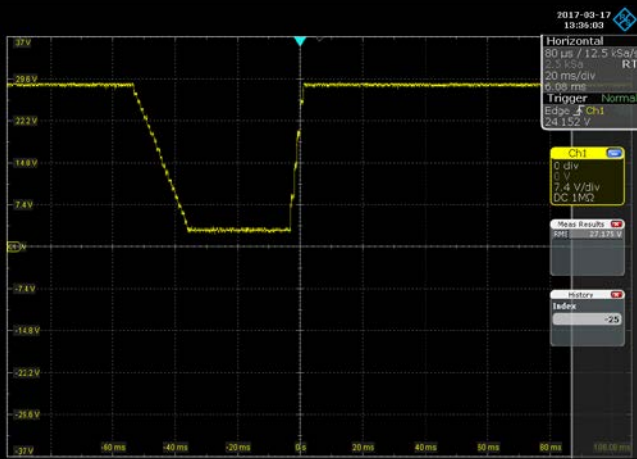
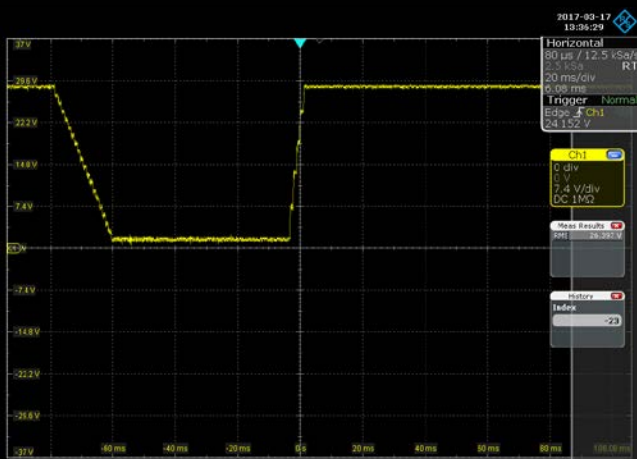
NTS-Longmont
Test Report # TR-PR058945

DO160G Section 16.6.1.1b(3)	Emergency operating conditions, 18VDC		PASS
DO160G Section 16.6.1.2	Ripple Voltage 0.6Vp, 10HZ		PASS
	Ripple Voltage 0.6Vp, 200HZ		
	Ripple Voltage 1.6Vp, 200HZ		

NTS-Longmont
Test Report # TR-PR058945

DO160G Section 16.6.1.3b				
DO160G Section 16.6.1.3b	Momentary power interrupts Test #1, $T_f < 1\text{ms}$ $T_i = 2\text{mS}$ $T_r = < 1\text{mS}$ $\% V_{nom} = 0$			
	Momentary power interrupts Test #2 $T_f = 10\text{mS}$ $T_i = 0\text{mS}$ $T_r = 3\text{mS}$ $\% V_{nom} = 50$			PASS

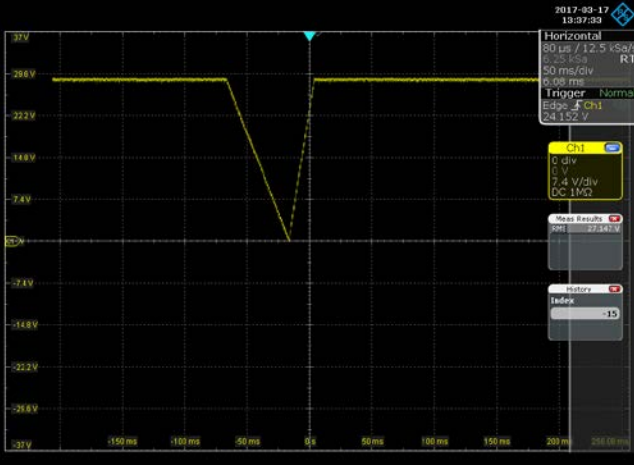
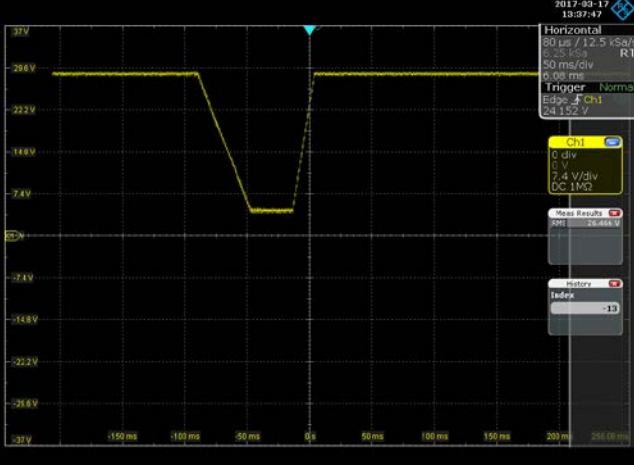
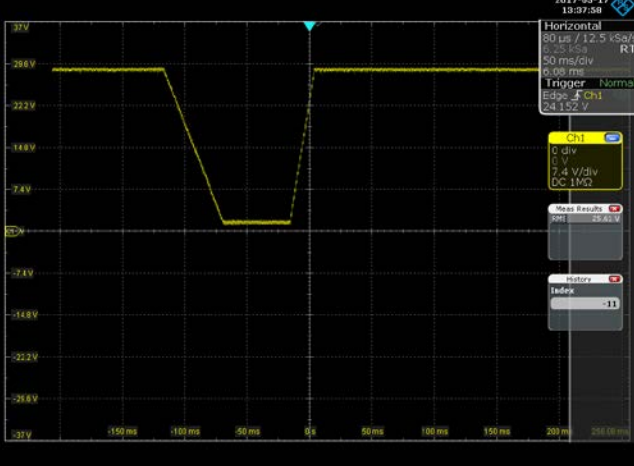
NTS-Longmont
Test Report # TR-PR058945

DO160G Section 16.6.1.3b	Momentary power interrupts Test #3 T_f 17mS T_i = 8mS T_r = 4mS % Vnom = 15		PASS
	Momentary power interrupts Test #4 T_f 18mS T_i = 32mS T_r = 5mS % Vnom = 10		PASS
	Momentary power interrupts Test #5 T_f 19mS T_i = 56mS T_r = 5mS % Vnom = 5		PASS

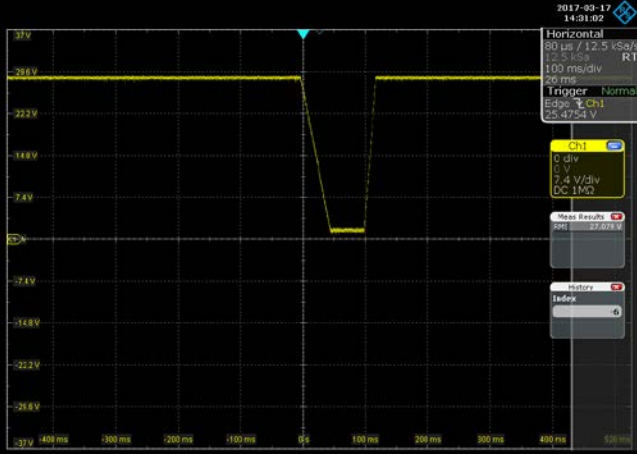
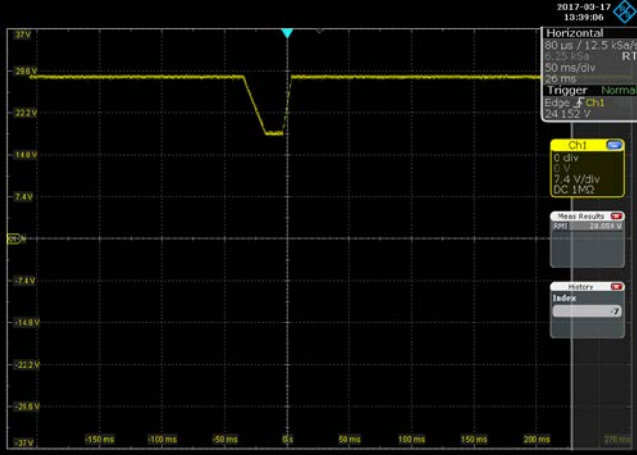
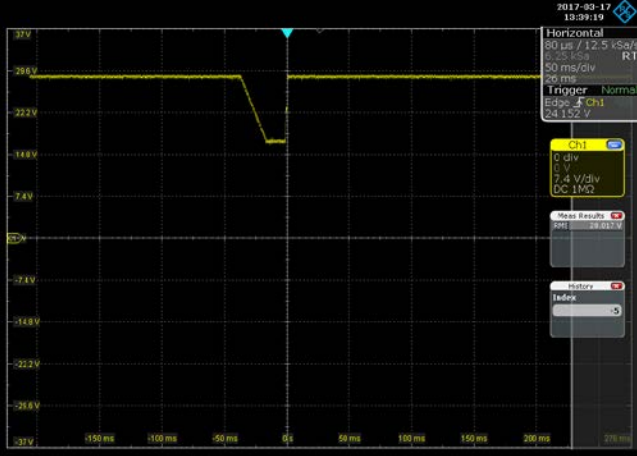
NTS-Longmont
Test Report # TR-PR058945

DO160G Section 16.6.1.3b	Momentary power interrupts Test #6 T_f 20mS T_i = 80mS T_r = 5mS % Vnom = 0		PASS
	Momentary power interrupts Test #7 T_f 20mS T_i = 180mS T_r = 5mS % Vnom = 0		PASS
	Momentary power interrupts Test #9 T_f 25mS T_i = 0mS T_r = 10mS % Vnom = 50		PASS

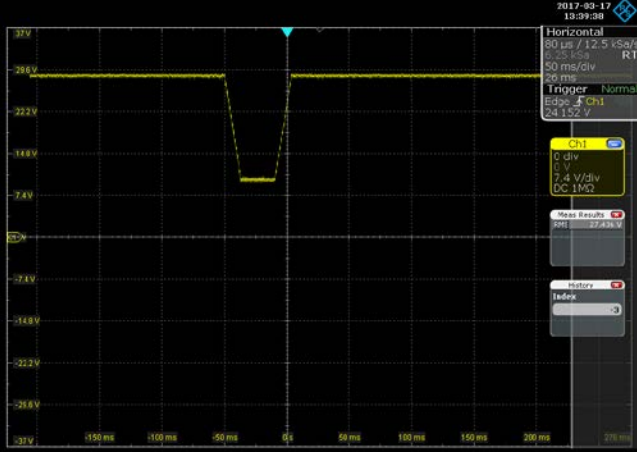
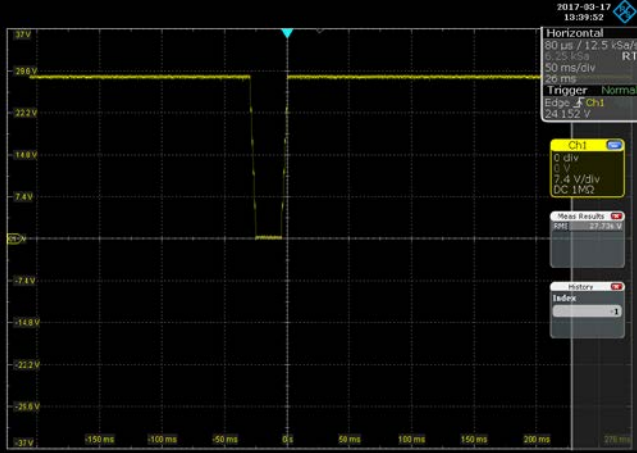
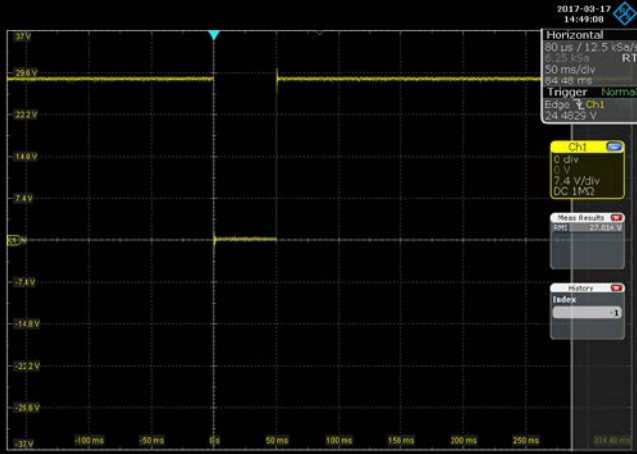
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Test Report # TR-PR058945

DO160G Section 16.6.1.3b	Momentary power interrupts Test #10 T_f 20mS T_i = 0mS T_r = 20mS % Vnom = 0		PASS
	Momentary power interrupts Test #11 T_f 43mS T_i = 33mS T_r = 17mS % Vnom = 15		PASS
	Momentary power interrupts Test #12 T_f 48mS T_i = 53mS T_r = 19mS % Vnom = 5		PASS

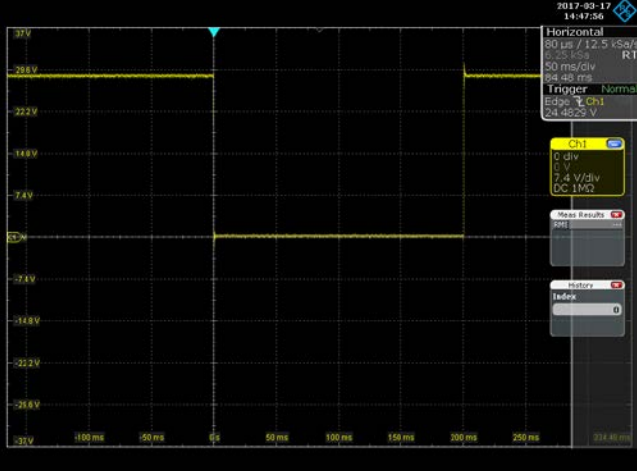
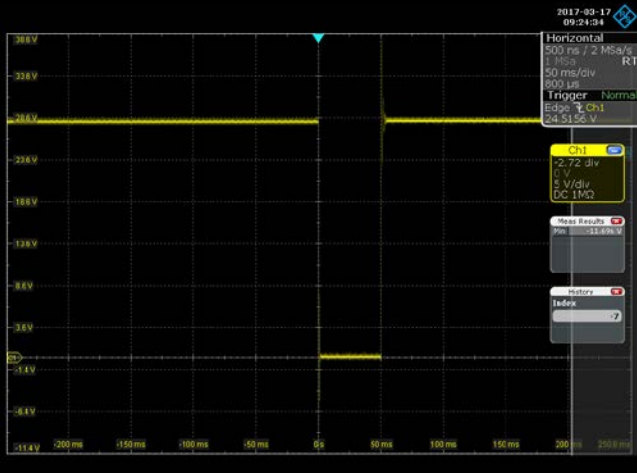
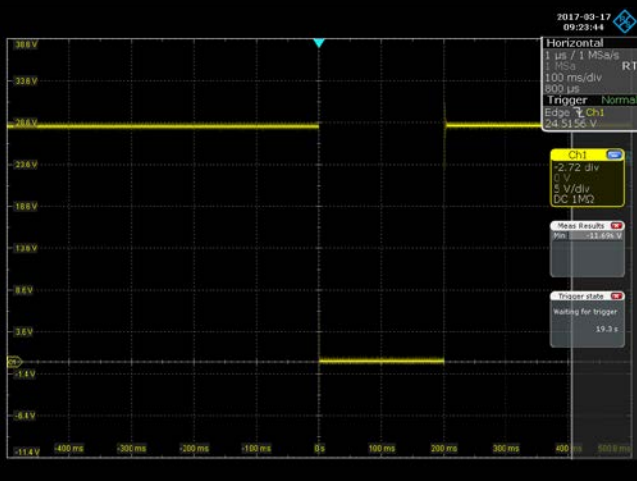
NTS-Longmont
Test Report # TR-PR058945

DO160G Section 16.6.1.3b	Momentary power interrupts Test #13 T_f 50mS T_i 150mS T_r 20mS % Vnom = 0		PASS
	Momentary power interrupts Test #14 T_f 18mS T_i 13mS T_r 7mS % Vnom = 65		PASS
	Momentary power interrupts Test #15 T_f 20mS T_i 15mS T_r 2mS % Vnom = 60		PASS

NTS-Longmont
Test Report # TR-PR058945

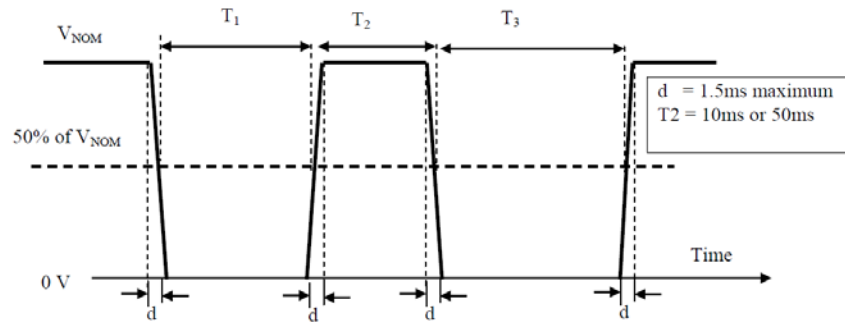
DO160G Section 16.6.1.3b	Momentary power interrupts Test #16 T_f 13mS T_i = 27mS T_r = 13mS % Vnom = 35		PASS
	Momentary power interrupts Test #17 T_f 5mS T_i = 20mS T_r = 5mS % Vnom = 0		PASS
	Momentary power interrupts Test #18 T_f <1mS T_i = 50mS T_r = <1mS % Vnom = 0		PASS

NTS-Longmont
Test Report # TR-PR058945

DO160G Section 16.6.1.3b	Momentary power interrupts Test #19 $T_f < 1\text{mS}$ $T_i = 200\text{mS}$ $T_r < 1\text{mS}$ $\% V_{nom} = 0$		PASS
DO160G Section 16.6.1.3c	Momentary power interrupts		PASS
	Momentary power interrupts		PASS

NTS-Longmont
Test Report # TR-PR058945

Table 16-7 Test Conditions for DC Equipment with Digital and Memory Circuits



DO160G
Section
16.6.1.3d

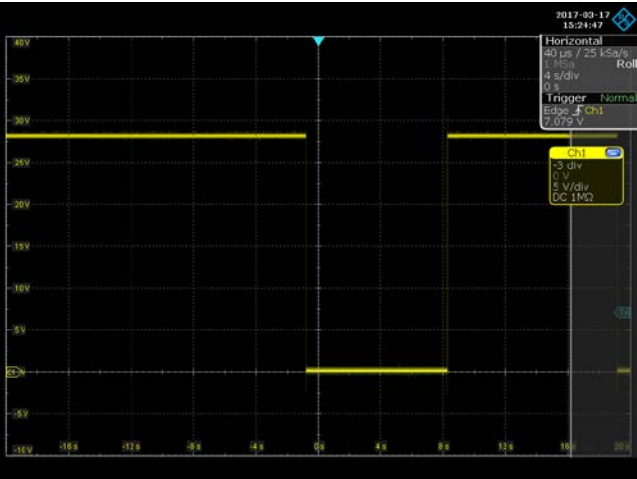
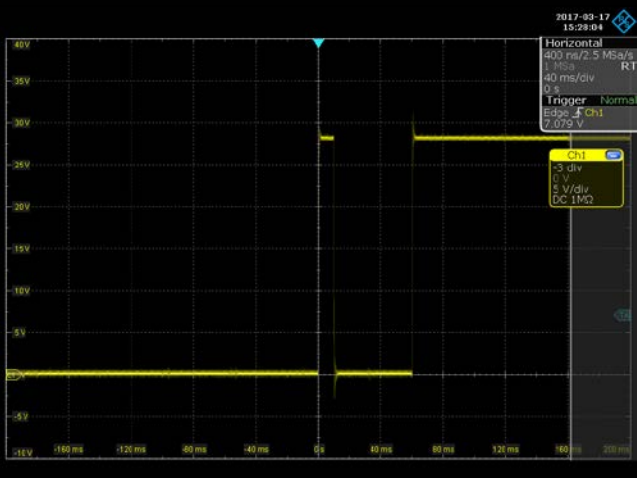
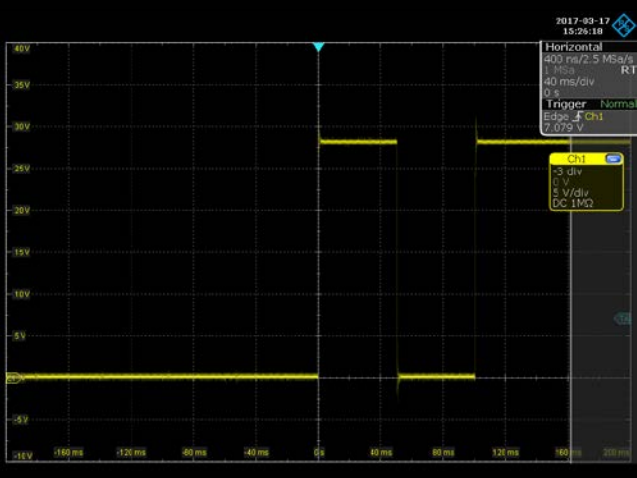
Test #1
 $T_1 = 9000\text{mS}$
 $T_2 = 10\text{ms}$
 $T_2 = 50\text{ms}$
 $T_3 = 20\text{ms}$



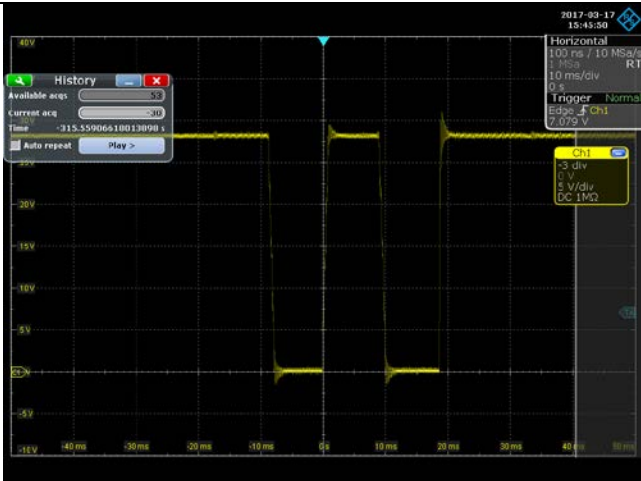
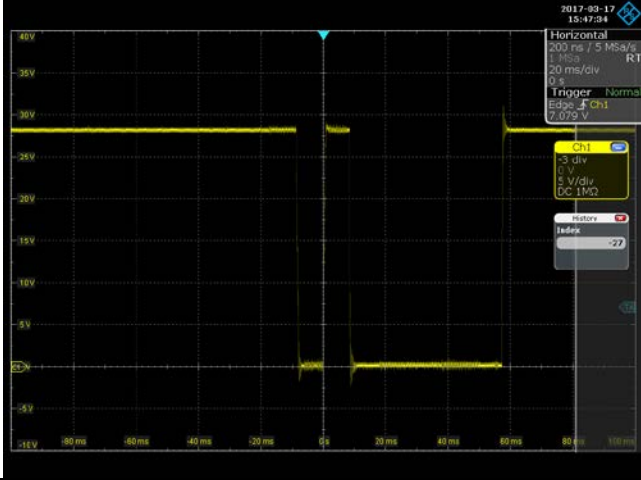
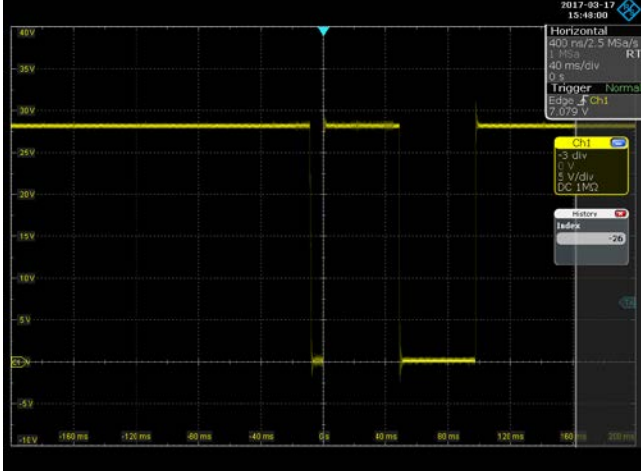
PASS

PASS

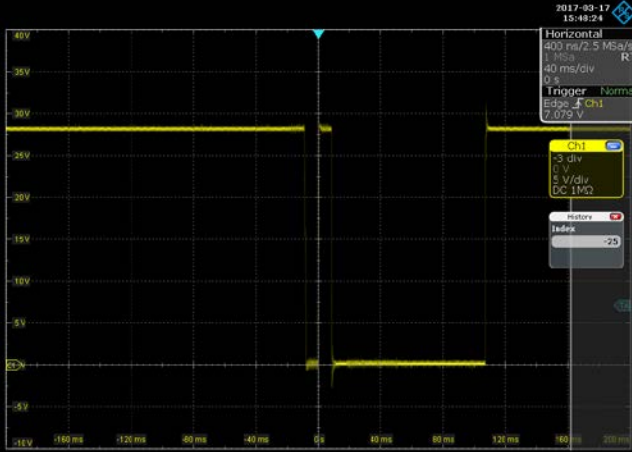
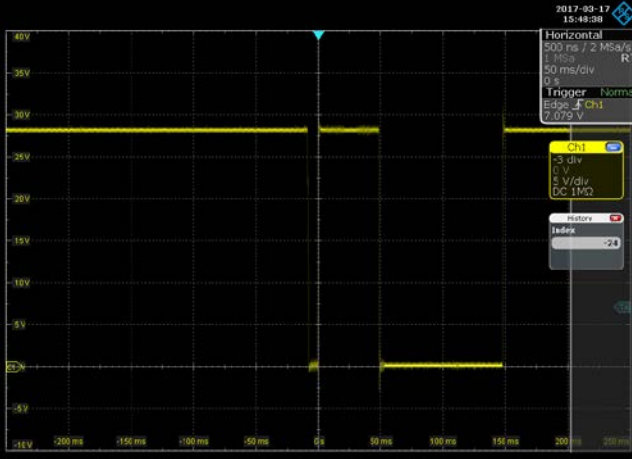
NTS-Longmont
Test Report # TR-PR058945

DO160G Section 16.6.1.3d	Test #2 T1 = 9000mS T2 = 10ms T2 = 50ms T3 = 500ms		PASS
			PASS
			PASS

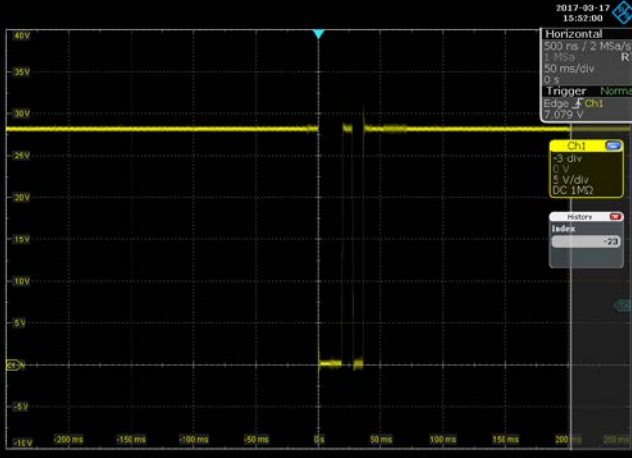
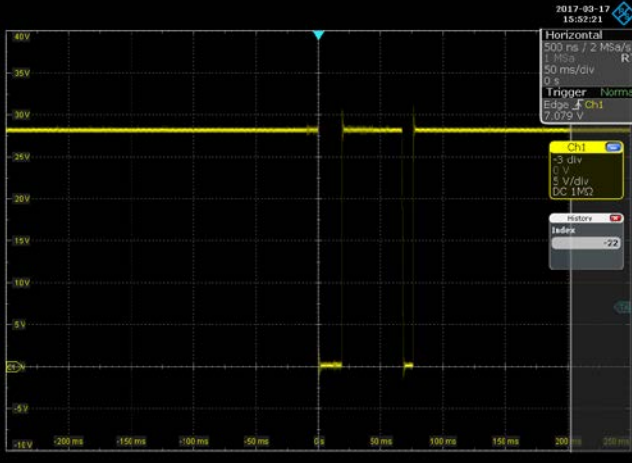
NTS-Longmont
Test Report # TR-PR058945

DO160G Section 16.6.1.3d	Test #3 T1 = 10mS T2 = 10ms T2 = 50ms T3 = 10ms		PASS
	Test #4 T1 = 10mS T2 = 10ms T2 = 50ms T3 = 50ms		PASS
			PASS

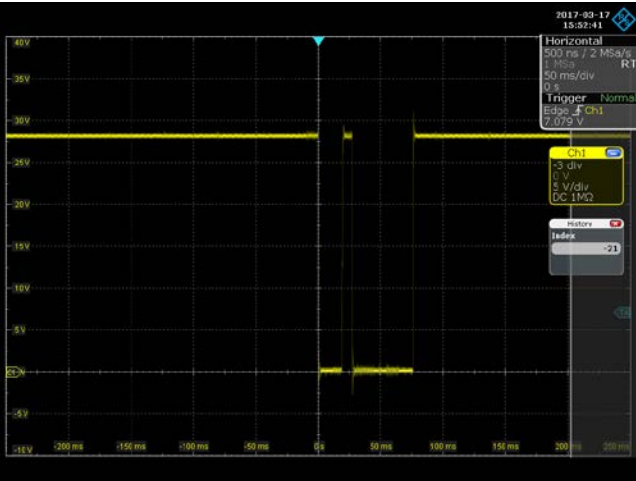
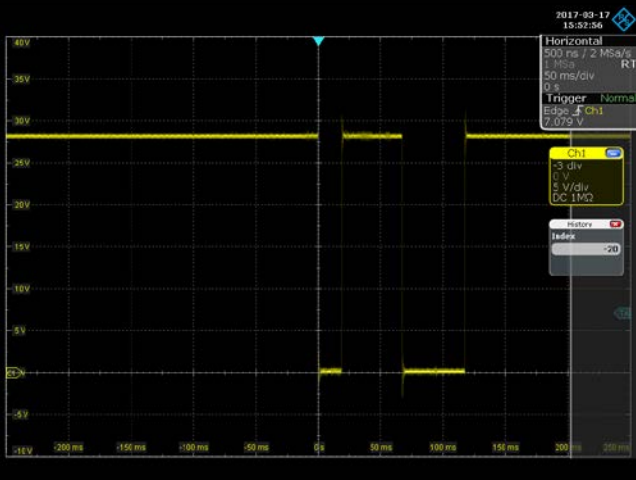
NTS-Longmont
Test Report # TR-PR058945

DO160G Section 16.6.1.3d	Test #5 T1 = 10mS T2 = 10ms T2 = 50ms T3 = 100ms		PASS
			PASS

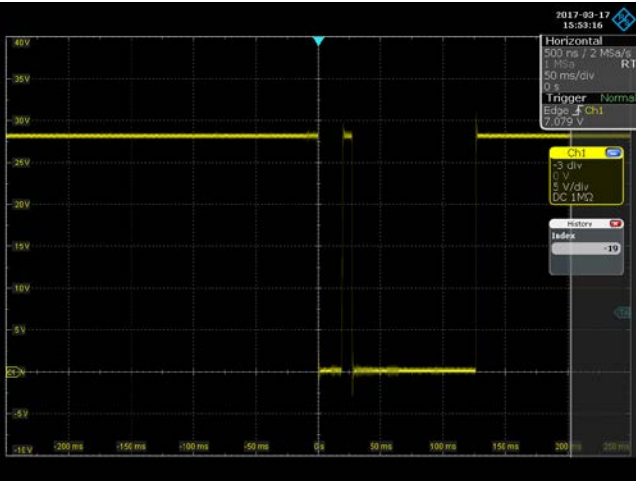
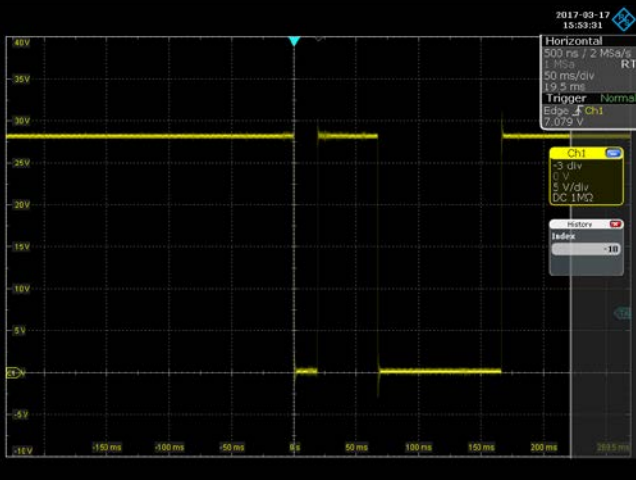
NTS-Longmont
Test Report # TR-PR058945

DO160G Section 16.6.1.3d	Test #6		PASS
	T1 = 20mS T2 = 10ms T2 = 50ms T3 = 10ms		PASS

NTS-Longmont
Test Report # TR-PR058945

DO160G Section 16.6.1.3d	Test #7 T1 = 20mS T2 = 10ms T2 = 50ms T3 = 50ms		PASS
			PASS

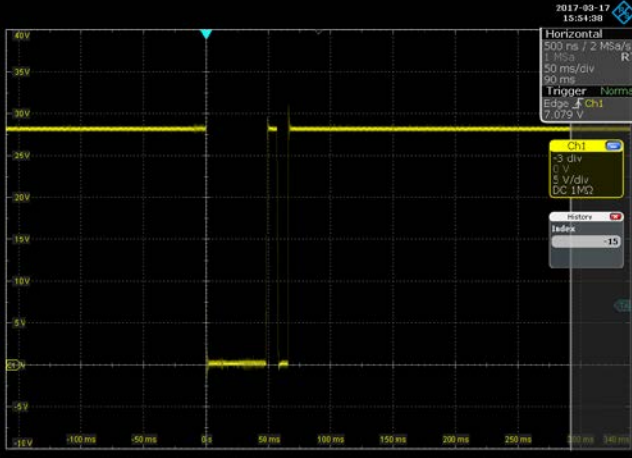
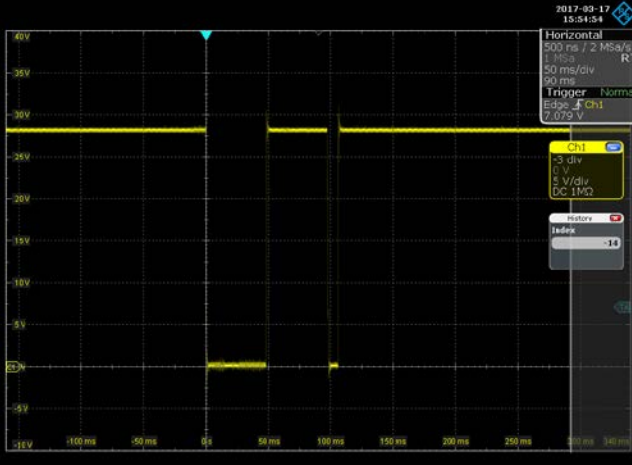
NTS-Longmont
Test Report # TR-PR058945

DO160G Section 16.6.1.3d	Test #8 T1 = 20mS T2 = 10ms T2 = 50ms T3 = 100ms		PASS
			PASS

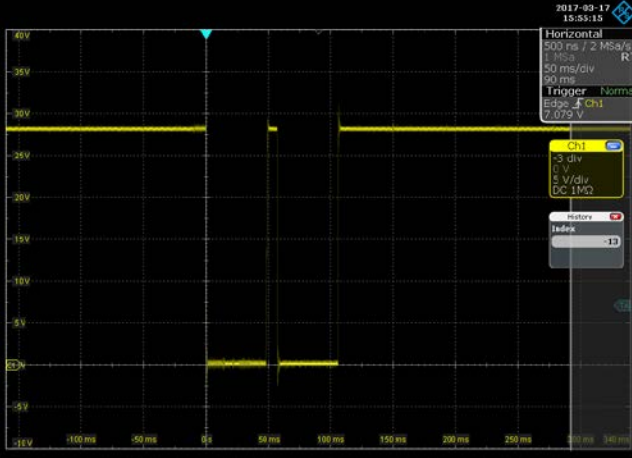
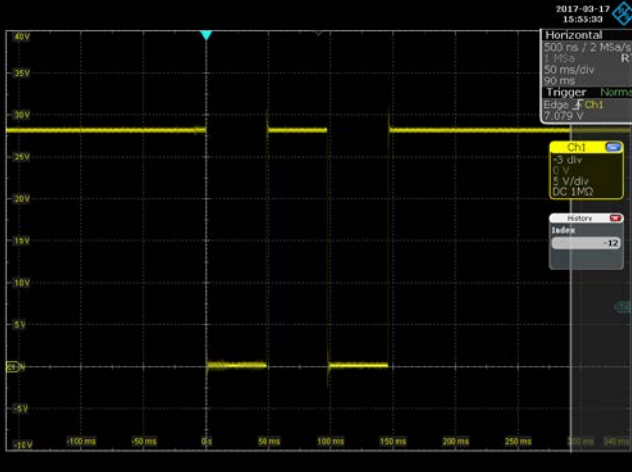
NTS-Longmont
Test Report # TR-PR058945

[illegible]

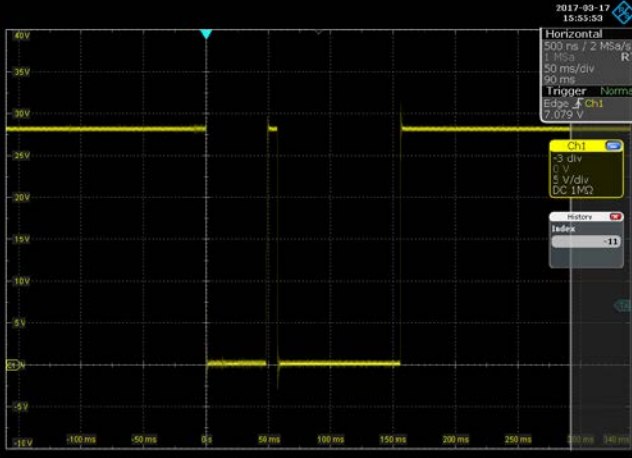
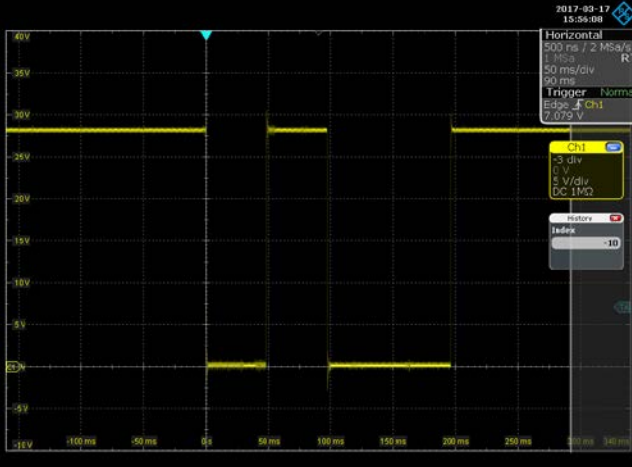
NTS-Longmont
Test Report # TR-PR058945

DO160G Section 16.6.1.3d	Test #10 T1 = 50mS T2 = 10ms T3 = 50ms T3 = 10ms		PASS
			PASS

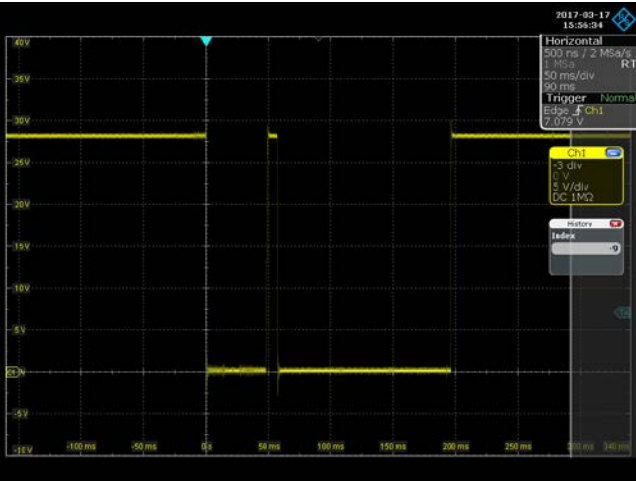
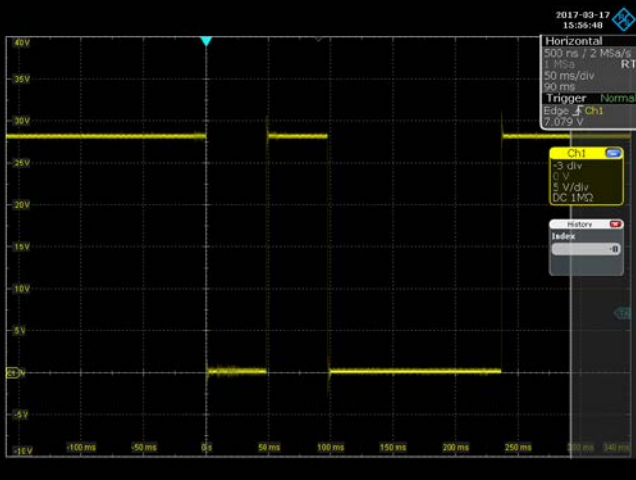
NTS-Longmont
Test Report # TR-PR058945

DO160G Section 16.6.1.3d	Test #11 T1 = 50mS T2 = 10ms T3 = 50ms		PASS
			PASS

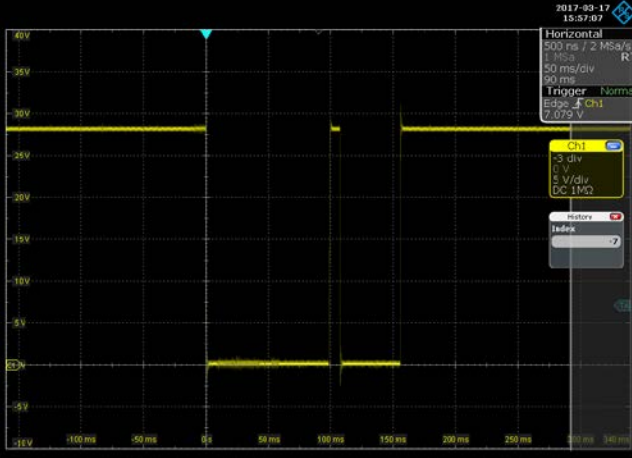
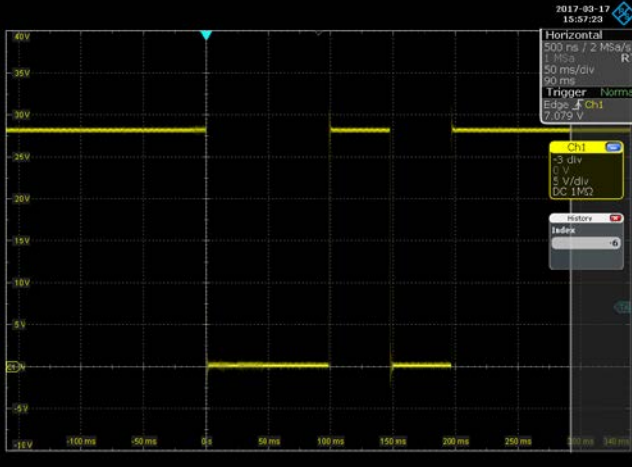
NTS-Longmont
Test Report # TR-PR058945

DO160G Section 16.6.1.3d	Test #12 T1 = 50mS T2 = 10ms T3 = 50ms		PASS
	T2 = 50ms T3 = 100ms		PASS

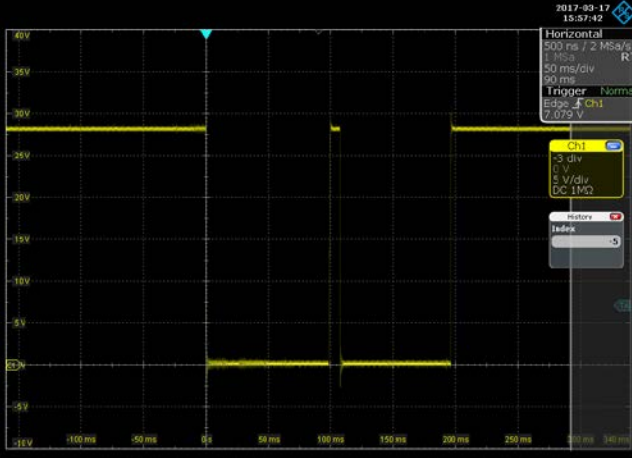
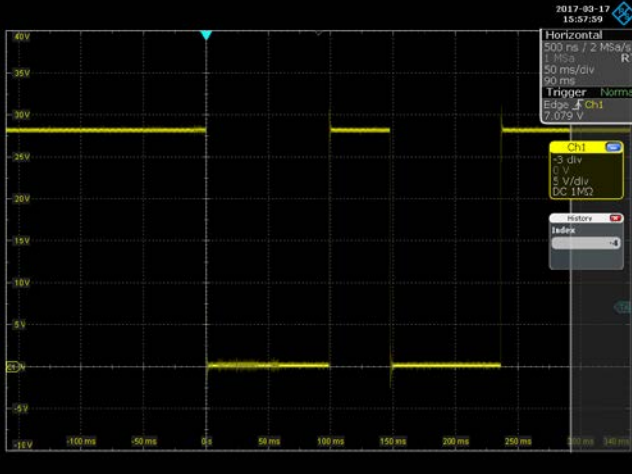
NTS-Longmont
Test Report # TR-PR058945

DO160G Section 16.6.1.3d	Test #13 T1 = 50mS T2 = 10ms T2 = 50ms T3 = 140ms		PASS
			PASS

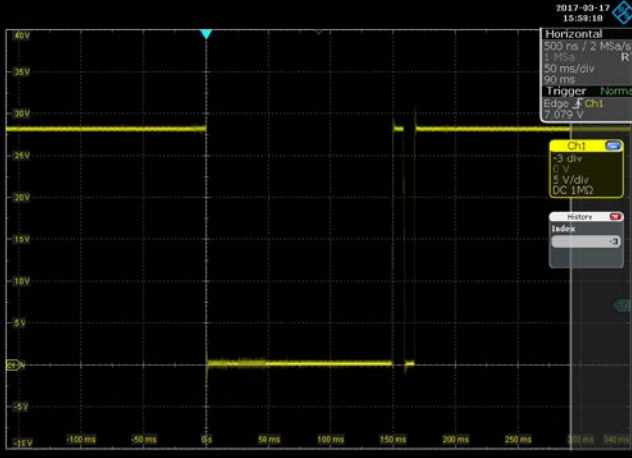
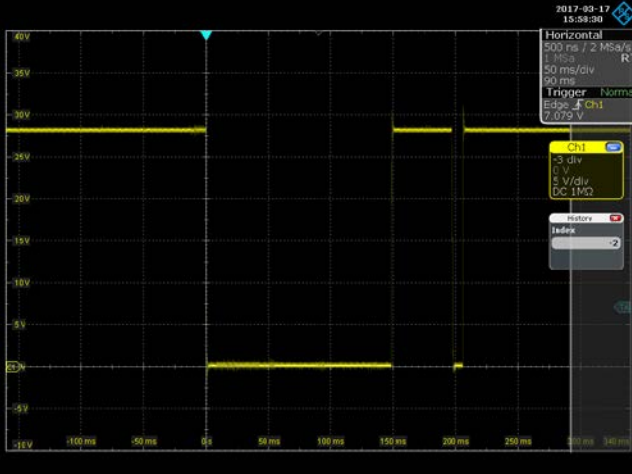
NTS-Longmont
Test Report # TR-PR058945

DO160G Section 16.6.1.3d	Test #14 T1 = 100mS T2 = 10ms T2 = 50ms T3 = 50ms		PASS
			PASS

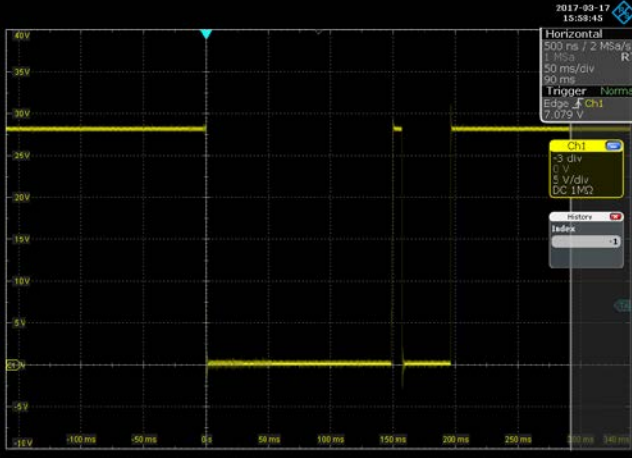
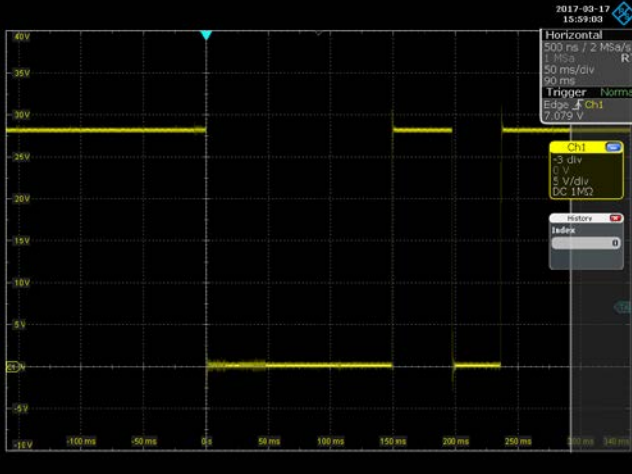
NTS-Longmont
Test Report # TR-PR058945

DO160G Section 16.6.1.3d	Test #15 T1 = 100mS T2 = 10ms T3 = 50ms T3 = 90ms		PASS
			PASS

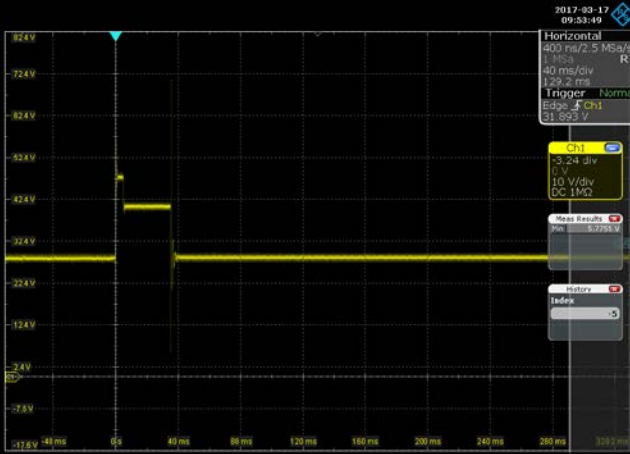
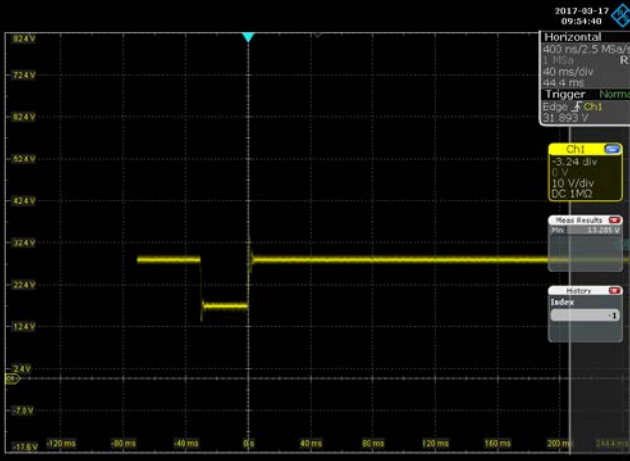
NTS-Longmont
Test Report # TR-PR058945

DO160G Section 16.6.1.3d	Test #16 T1 = 150mS T2 = 10ms T3 = 50ms		PASS
	T2 = 10ms T3 = 10ms		PASS

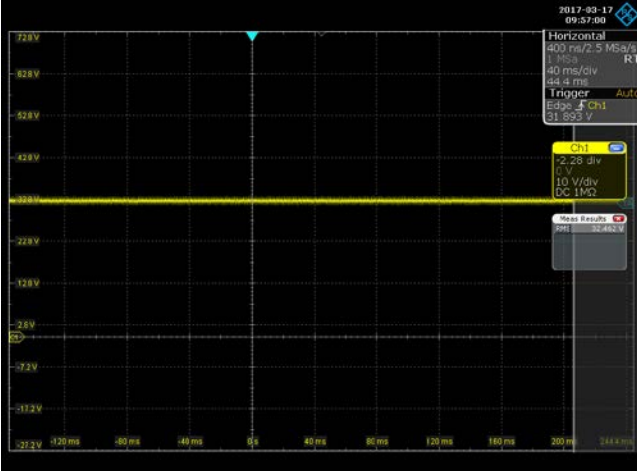
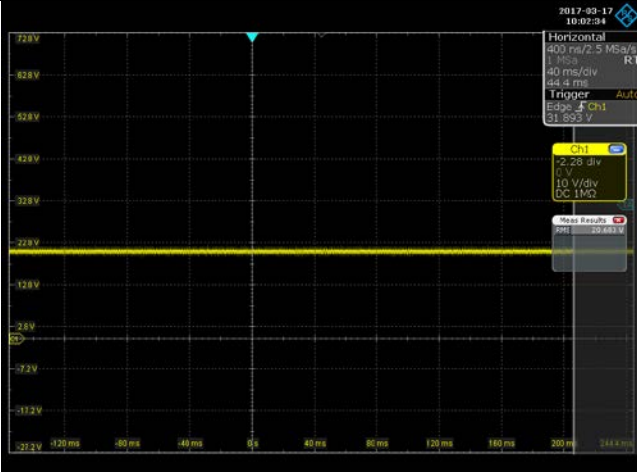
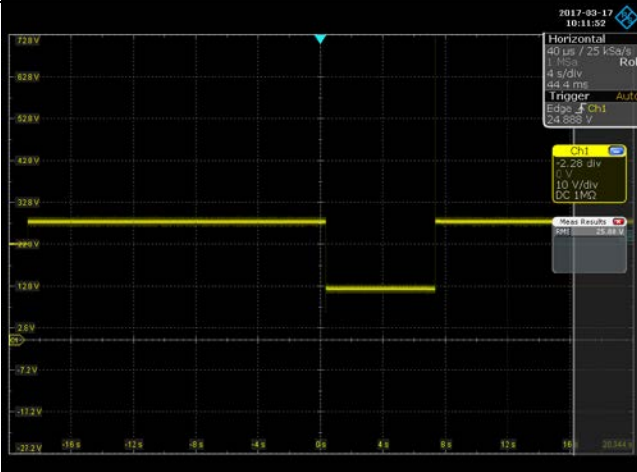
NTS-Longmont
Test Report # TR-PR058945

DO160G Section 16.6.1.3d	Test #17 T1 = 150mS T2 = 10ms T3 = 50ms T3 = 40ms		PASS
			PASS

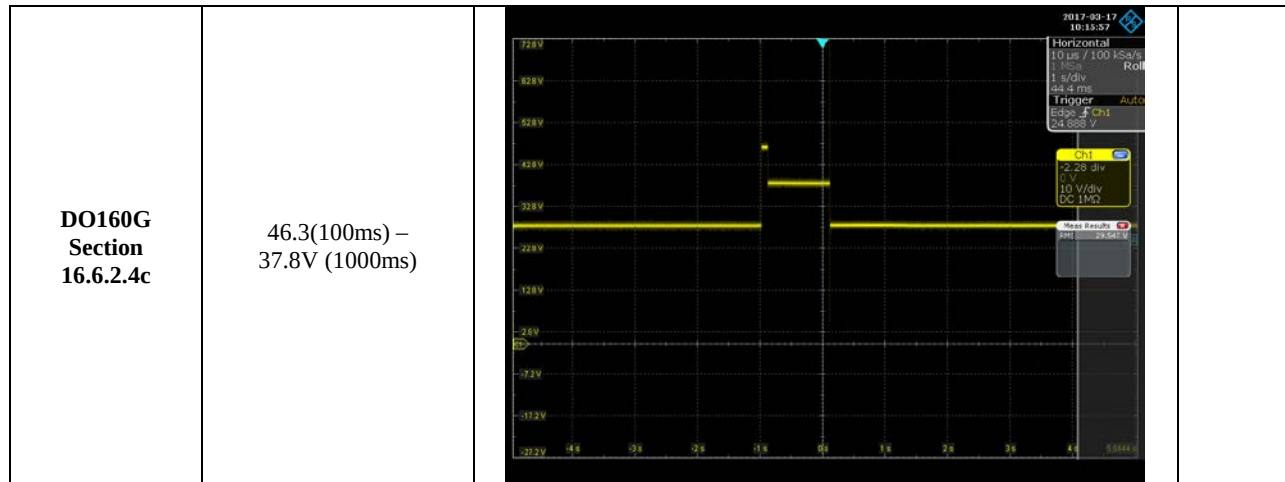
NTS-Longmont
Test Report # TR-PR058945

DO160G Section 16.6.1.4	28V nom – 47V (5mS)- 40V(30mS)- 28V nom		
	28V nom – 17V(30mS)		

NTS-Longmont
Test Report # TR-PR058945

DO160G Section 16.6.2.1	32.2V max		
	20.5V min		
DO160G Section 16.6.2.3	12V(7000mS)		

NTS-Longmont
Test Report # TR-PR058945





Magnetic Field Effect per DO-160G Section 15

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	160010(ATOM) 110101 (ION)
Standard Referenced:	DO-160G	Date:	March 17, 2017
PR058945-DO-160G Sec 15.doc		FR0100	



Photo 1



Magnetic Field Effect per DO-160G Section 15

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	160010(ATOM) 110101 (ION)
Standard Referenced:	DO-160G	Date:	March 17, 2017
PR058945-DO-160G Sec 15.doc		FR0100	



Photo 2



Magnetic Field Effect per DO-160G Section 15

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	160010(ATOM) 110101 (ION)
Standard Referenced:	DO-160G	Date:	March 17, 2017
PR058945-DO-160G Sec 15.doc		FR0100	

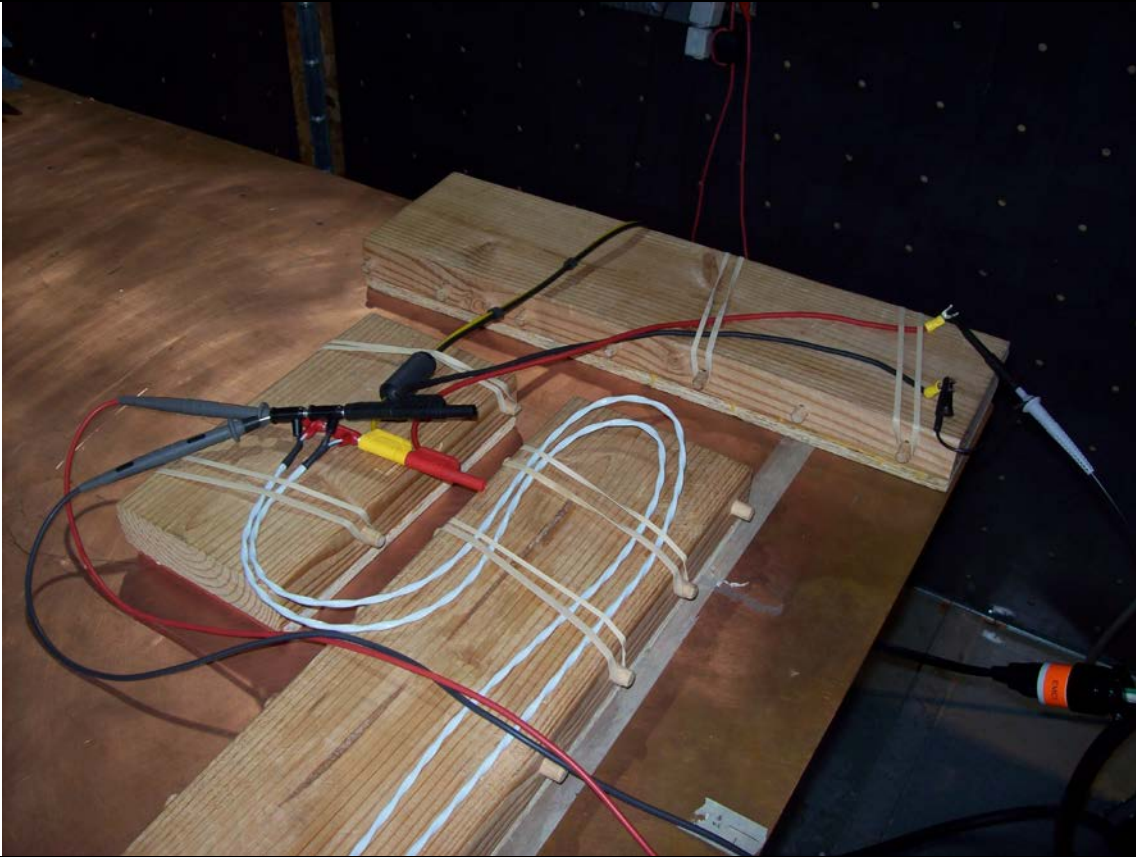


Photo 3



Magnetic Field Effect per DO-160G Section 15

Manufacturer: Churchill Navigation
Customer Representative: Jordan Heintz
Model: ATOM, ION-R
Standard Referenced: DO-160G

Project Number: PR058945
Test Area: Shield Room
S/N: 160010(ATOM)
110101 (ION)
Date: March 17, 2017

PR058945-DO-160G Sec 15.doc

FR0100

Test Equipment List

ID Number	Manufacturer	Model #	Serial #	Description	Cal Date	Cal Due
1605	ROHDE & SCHWARZ	RTE 1104	101491	Oscilloscope (1GHz 5GSa/s)	07/11/2016	07/11/2017
1520	California Instruments (AMETEK)	5001IX-CTS	1341A03198	5kVA AC Power Source	03/30/2016	03/30/2017

Appendix C

Voltage Spike (DO-160G SEC 17) Test Data



Voltage Spike per DO-160G Section 17

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	160010(ATOM) 110101 (ION)
Standard Referenced:	DO-160G	Date:	March 6, 2017
Temperature:	20.6°C	Humidity:	31.5%
Input Voltage:	28VDC	Pressure:	834mb
Configuration of Unit:	Both systems active, Streaming video/Map overlay		
Test Engineer:	Mike Jasiewicz		

PR058945-DO-160G Sec 17.doc

FR0100

Spike Voltage	Polarity		Pulses per Second	Duration (sec)	Comments	Pass / Fail
	+	-				
56	+		10	60	Injecting Positive 56V pulse on primary high line of ATOM	Pass
56		-	10	60	Injecting Negative 56 V pulse on primary high line ATOM	Pass
56	+		10	60	Injecting Positive 56 V pulse on primary high line of ION	Pass
56		-	10	60	Injecting Negative 56 V pulse on primary high line of ION	Pass



Voltage Spike per DO-160G Section 17

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	160010(ATOM) 110101 (ION)
Standard Referenced:	DO-160G	Date:	March 6, 2017
PR058945-DO-160G Sec 17.doc		FR0100	



Photo 1.



Voltage Spike per DO-160G Section 17

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	160010(ATOM) 110101 (ION)
Standard Referenced:	DO-160G	Date:	March 6, 2017
PR058945-DO-160G Sec 17.doc		FR0100	



Photo 2.



Voltage Spike per DO-160G Section 17

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	160010(ATOM) 110101 (ION)
Standard Referenced:	DO-160G	Date:	March 6, 2017
PR058945-DO-160G Sec 17.doc		FR0100	



Photo 3



Voltage Spike per DO-160G Section 17

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	160010(ATOM) 110101 (ION)
Standard Referenced:	DO-160G	Date:	March 6, 2017
PR058945-DO-160G Sec 17.doc		FR0100	

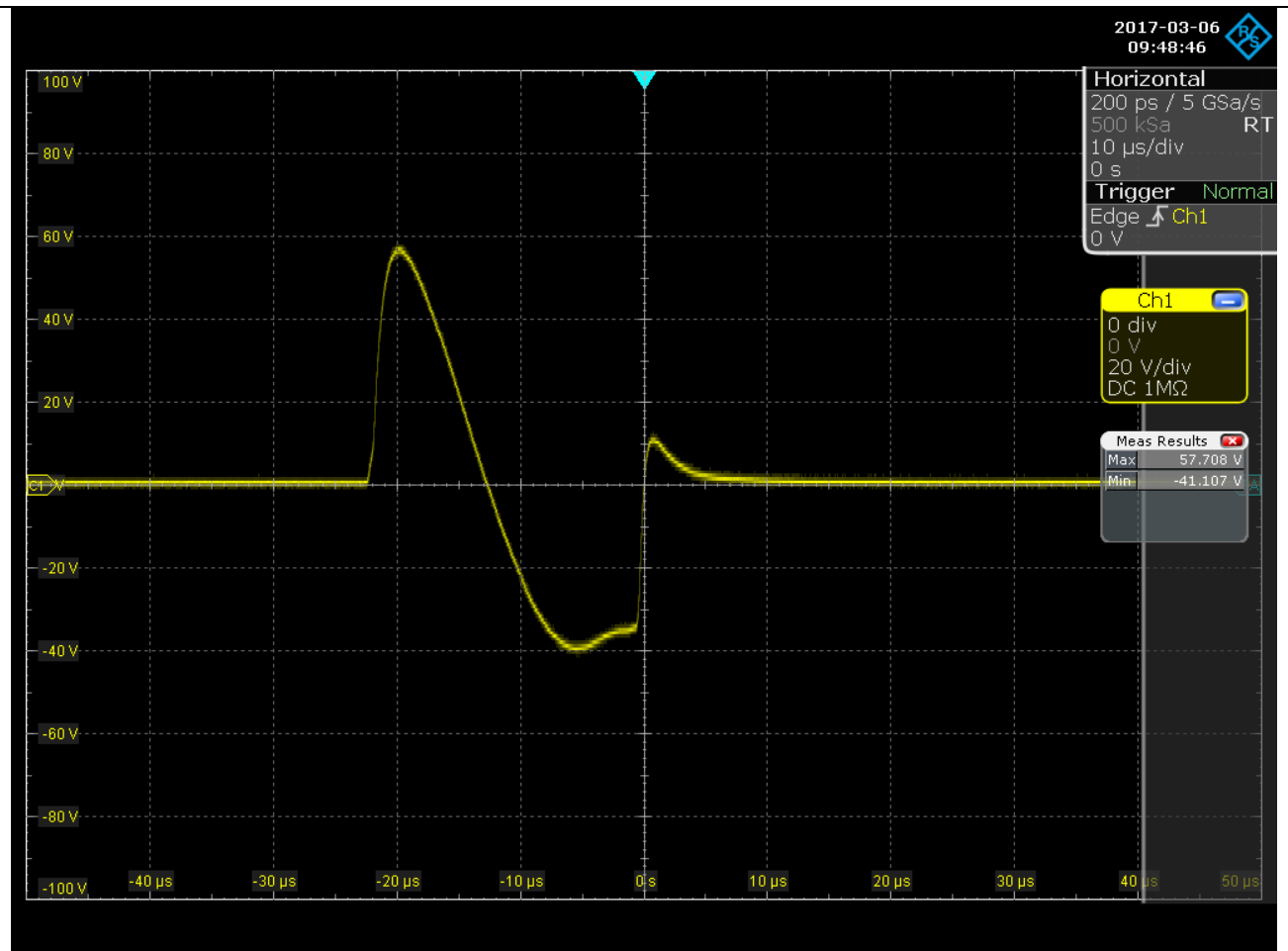


Photo 4



Voltage Spike per DO-160G Section 17

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	160010(ATOM) 110101 (ION)
Standard Referenced:	DO-160G	Date:	March 6, 2017
PR058945-DO-160G Sec 17.doc		FR0100	

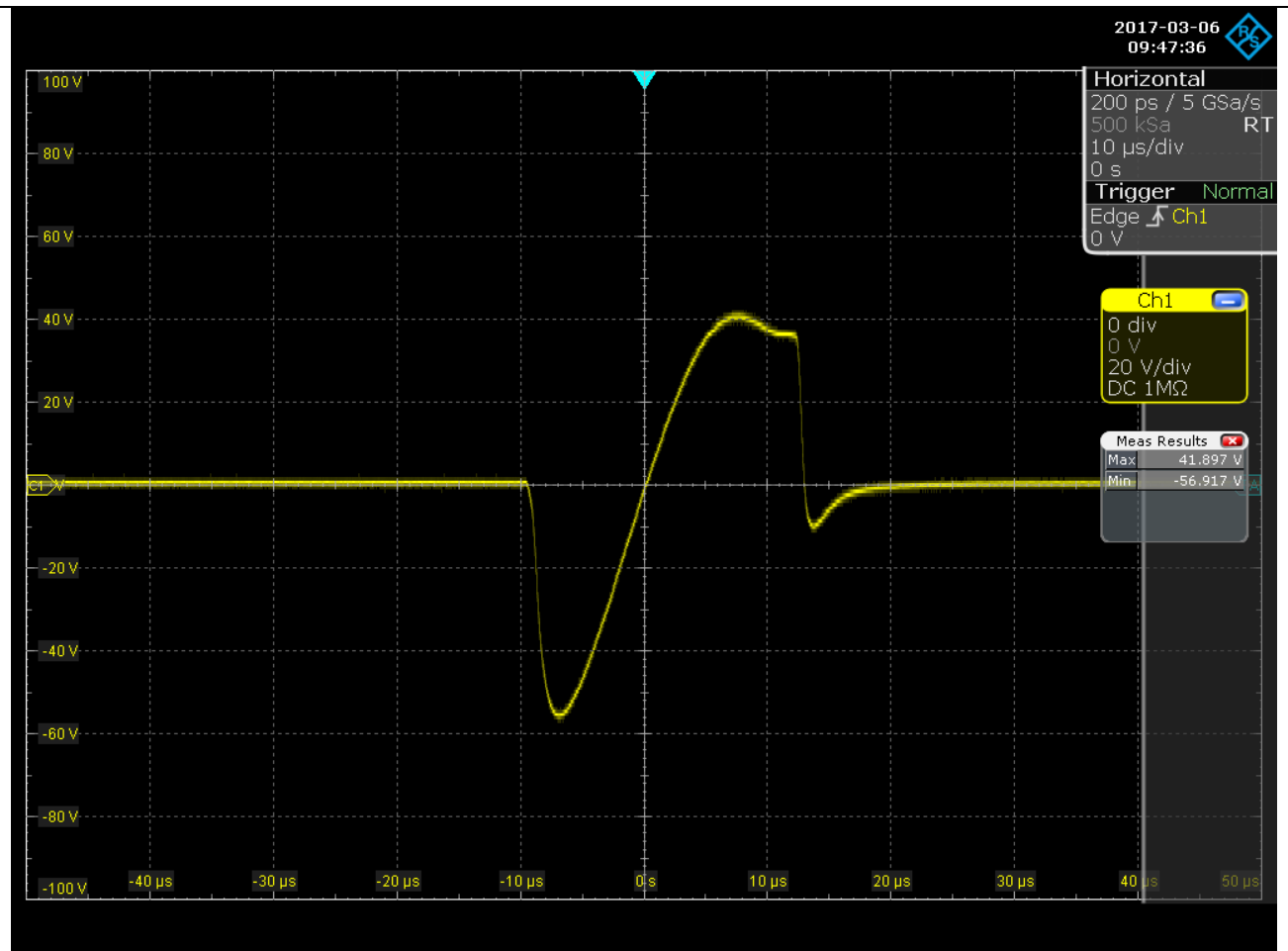


Photo 5.



Voltage Spike per DO-160G Section 17

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	160010(ATOM) 110101 (ION)
Standard Referenced:	DO-160G	Date:	March 6, 2017

PR058945-DO-160G Sec 17.doc

FR0100

Test Equipment List

ID Number	Manufacturer	Model #	Serial #	Description	Cal Date	Cal Due
1105	Solar	6220-1A	EMCI 001	CS01 Audio Isolation Transformer	NA	NA
1221	EMCI	Mil-Std-461DE/LISN	007/008	LISN, Mil-Std-461 D&E, 500 VDC / 250 VAC, 16 Amps,	06/02/2016	06/02/2017
1222	EMCI	Mil-Std-461DE/LISN	009/010	LISN, Mil-Std-461 D&E, 500 VDC / 250 VAC, 16 Amps,	06/02/2016	06/02/2017
1190	Hewlett Packard	6268A	6M1425	DC Power Supply 40V/30A	NA	NA
1104	Ray Proof	RF Shield Room	SL2384	Semi Anechoic Lined Chamber	NA	NA
1605	ROHDE & SCHWARZ	RTE 1104	101491	Oscilloscope (1GHz 5GSa/s)	07/11/2016	07/11/2017
1122	Solar	8282-1	851051	Transient Pulse Generator	NA	NA
1539	Extech Instruments	445715	Z316007	Hygro-Thermometer	04/19/2016	04/19/2017

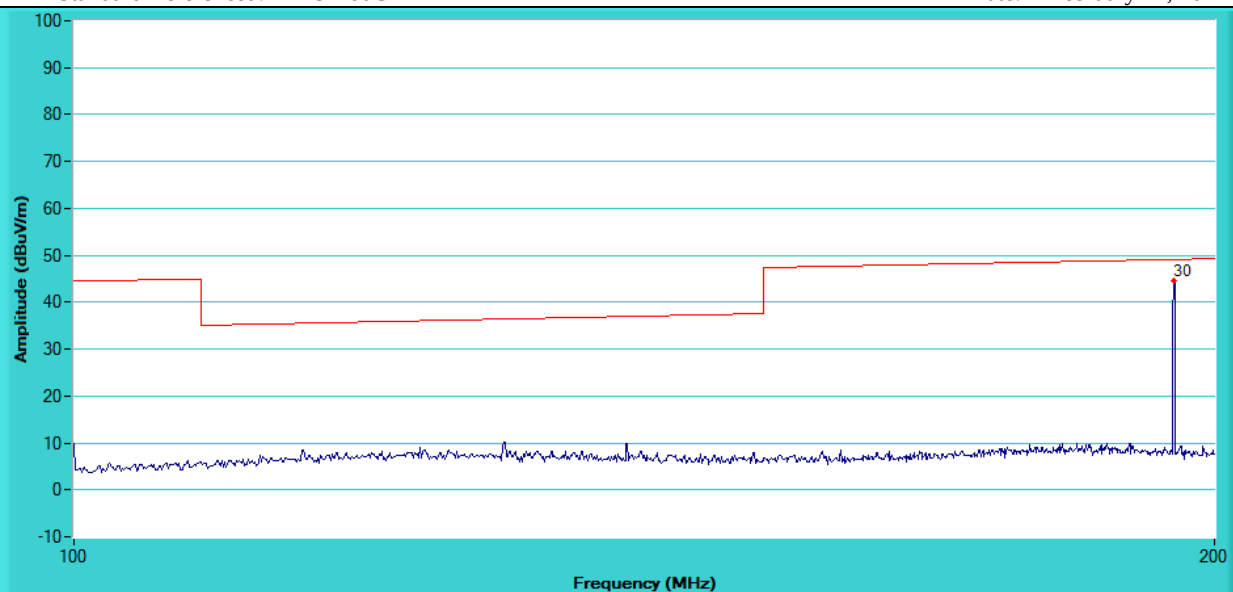
Appendix D

Emission of Radio Frequency Energy (DO-160G SEC 21) Test Data



Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	Atom-160010 ION - 110100
Standard Referenced:	DO-160G	Date:	February 27, 2017



Monday, February 27, 2017 PROJECT#: B70216 LIMIT: RTCA DO-160G, Sec 21, Cat M, RE DATE: 01:02PM Monday, February 27, 2017
MN: ARS-700 (ATOM/ION), SN: 160010 / 110101 . Description
Configuration:
Modifications: EMI Gaskets added
Signal Check, Target 195 MHz @ limit -6 dB (+/-3dB)

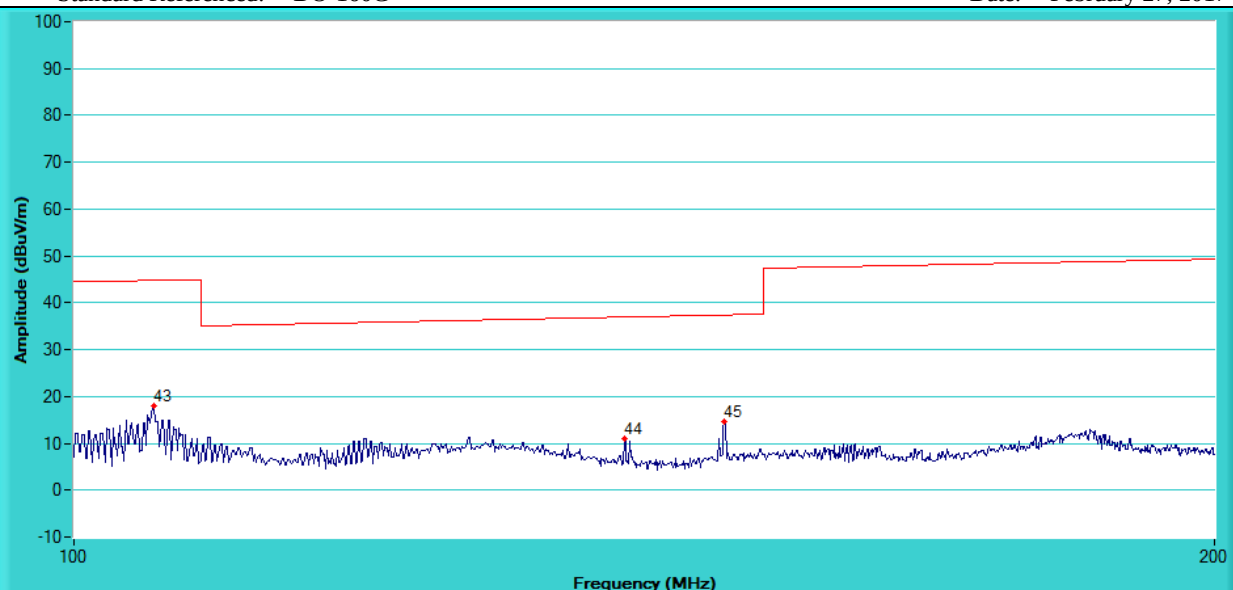
Scan 1. Signal Check, Target 195 MHz @ limit -6 dB (+/-3dB)

#	Freq (MHz)	Level (dBuV)	Xducer (dB/m)	Gain/Loss (dB)	Final (dBuV/m)	Margin (dB)
30	195.100000	60.20	14.41	30.10	44.51	4.72



Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	Atom-160010 ION - 110101
Standard Referenced:	DO-160G	Date:	February 27, 2017



Monday, February 27, 2017 PROJECT#: B70216 LIMIT: RTCA DO-160G, Sec 21, Cat M, RE DATE: 01:02PM Monday, February 27, 2017
MN: ARS-700 (ATOM/ION). SN: 160010 / 110101 . Description
Configuration:
Modifications: EMI Gaskets added
V-Pole - Ambient Scan, EUT OFF, SUPPORT ON

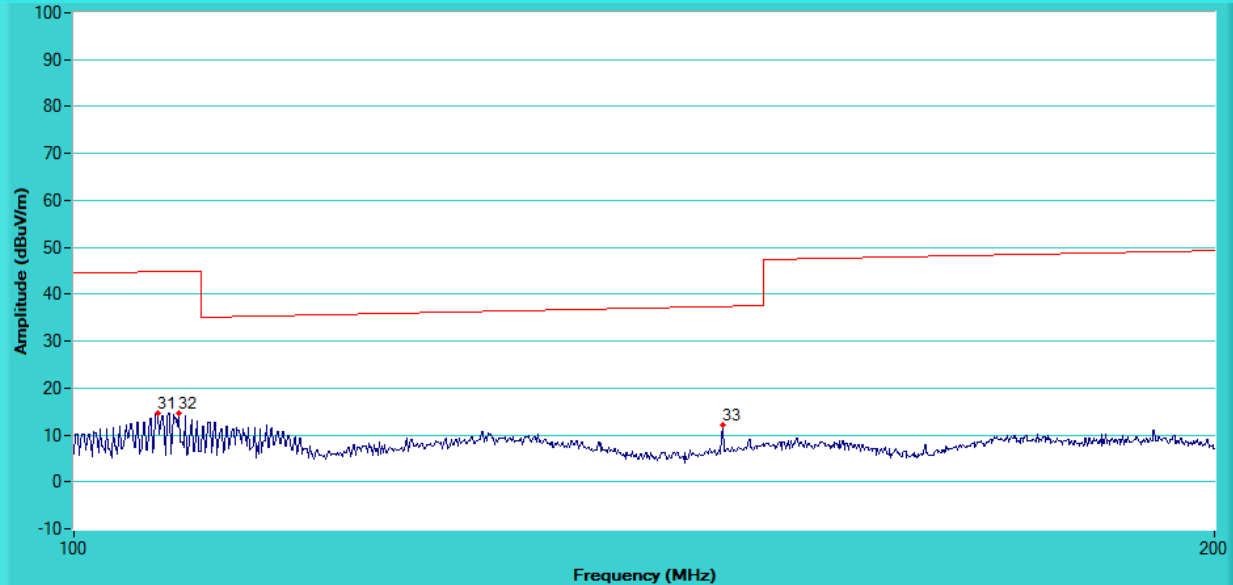
Scan 2. V-Pole - Ambient Scan, EUT OFF, SUPPORT ON

#	Freq (MHz)	Level (dBuV)	Xducer (dB/m)	Gain/Loss (dB)	Final (dBuV/m)	Margin (dB)
43	105.000000	37.90	10.59	30.50	17.99	26.86
44	139.700000	28.10	13.23	30.30	11.03	25.85
45	148.500000	32.10	12.76	30.30	14.56	22.77



Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	Atom-160010 ION - 110100
Standard Referenced:	DO-160G	Date:	February 27, 2017



Monday, February 27, 2017 PROJECT#: B70216 LIMIT: RTCA DO-160G, Sec 21, Cat M, RE DATE: 01:02PM Monday, February 27, 2017
MN: ARS-700 (ATOM/ION). SN: 160010 / 110101 . Description
Configuration:
Modifications: EMI Gaskets added
H-pole - Ambient Scan, EUT OFF, SUPPORT on

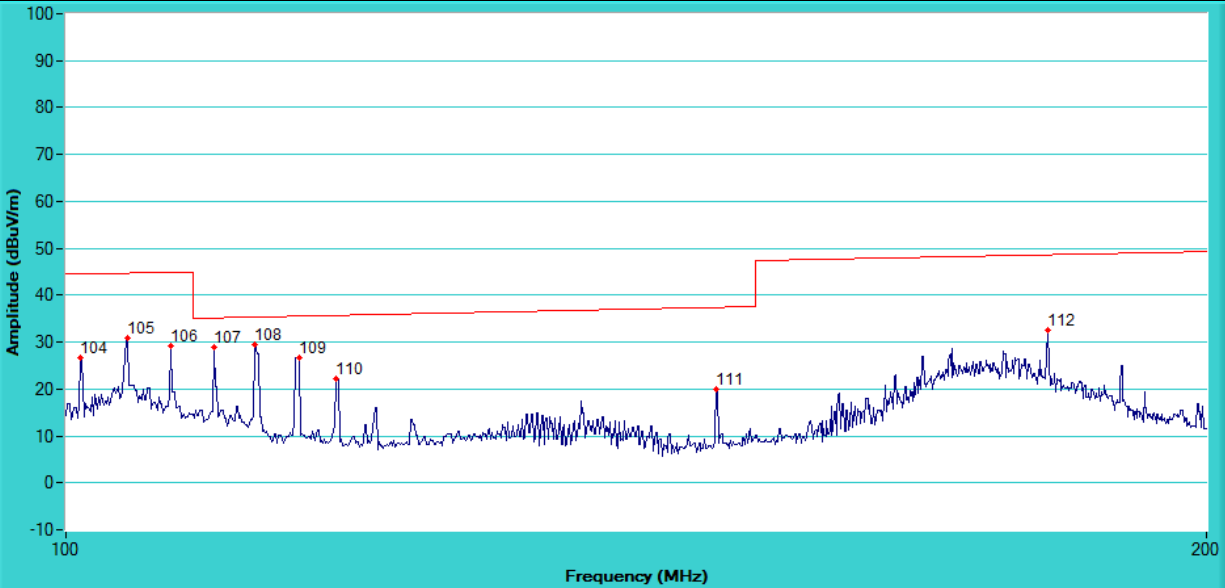
Scan 3. H-pole - Ambient Scan, EUT OFF, SUPPORT on

#	Freq (MHz)	Level (dBuV)	Xducer (dB/m)	Gain/Loss (dB)	Final (dBuV/m)	Margin (dB)
31	105.200000	34.50	10.62	30.50	14.62	30.24
32	106.600000	34.20	10.87	30.50	14.57	30.37
33	148.400000	29.70	12.76	30.30	12.16	25.16



Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	Atom-160010 ION - 110101
Standard Referenced:	DO-160G	Date:	February 27, 2017



Monday, February 27, 2017 PROJECT#: B70216 LIMIT: RTCA DO-160G, Sec 21, Cat M, RE DATE: 01:02PM Monday, February 27, 2017
MN: ARS-700 (ATOM/ION), SN: 160010 / 110100, Description
Configuration:
Modifications: EMI Gaskets on ATOM ONLY, Added external ferrite on Video
V-Pole - EUT Scan, ION SN/ 110100

Scan 4. V-Pole - EUT Scan EMI Gaskets on ATOM ONLY, Added external ferrite on Video, ION SN/ 110100

#	Freq (MHz)	Level (dBuV)	Xducer (dB/m)	Gain/Loss (dB)	Final (dBuV/m)	Margin (dB)
104	100.900000	47.30	9.99	30.50	26.79	17.86
105	103.800000	51.00	10.41	30.50	30.91	13.88
106	106.600000	48.90	10.87	30.50	29.27	15.67
107	109.400000	48.00	11.35	30.50	28.85	6.25
108	112.200000	47.90	11.93	30.48	29.36	5.92
109	115.200000	44.60	12.58	30.45	26.74	8.74
110	117.800000	39.60	13.01	30.42	22.19	13.44
111	148.500000	37.60	12.76	30.30	20.06	17.27
112	181.600000	47.80	14.99	30.18	32.61	16.13



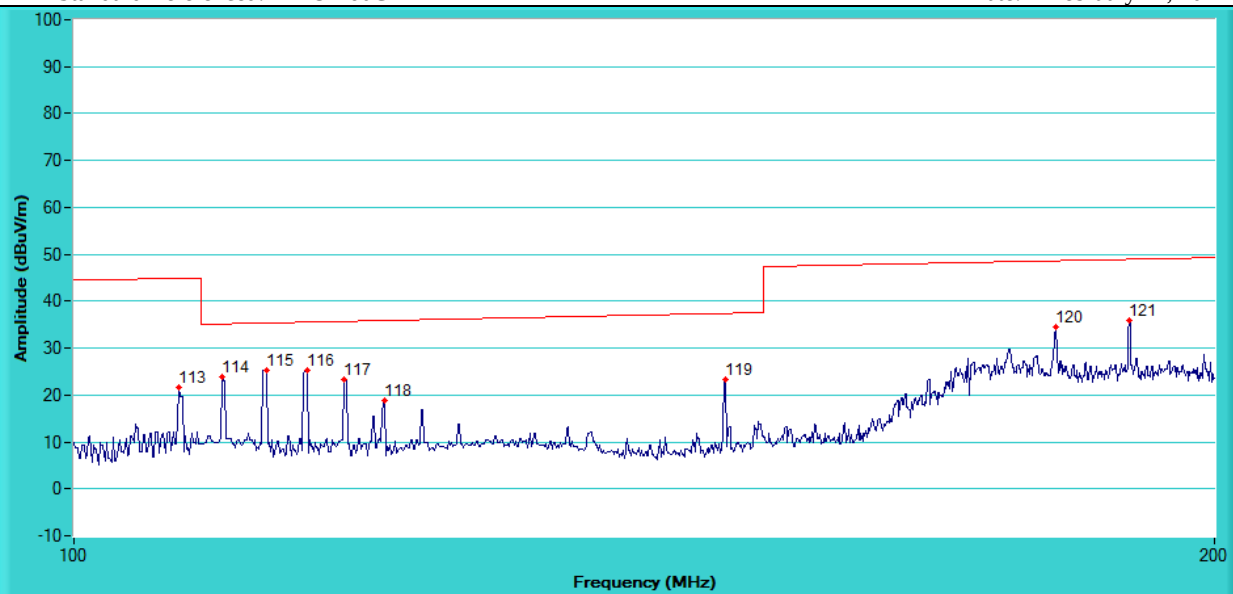
Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

Manufacturer: Churchill Navigation
Customer Representative: Jordan Heintz
Model: ATOM, ION-R Model# 160020 / 110101

Project Number: PR058945
Test Area: Shield Room
S/N: Atom-160010
ION - 110101

Standard Referenced: DO-160G

Date: February 27, 2017



Monday, February 27, 2017 PROJECT#: B70216 LIMIT: RTCA DO-160G, Sec 21, Cat M, RE DATE: 01:02PM Monday, February 27, 2017
MN: ARS-700 (ATOM/ION), SN: 160010 / 110100, Description
Configuration:
Modifications: EMI Gaskets on ATOM ONLY, Added external ferrite on Video
H-pole -EUT Scan - ION SN/ 110100

Scan 5. H-pole -EUT Scan - EMI Gaskets on ATOM ONLY, Added external ferrite on Video, ION SN/ 110100

#	Freq (MHz)	Level (dBuV)	Xducer (dB/m)	Gain/Loss (dB)	Final (dBuV/m)	Margin (dB)
113	106.600000	41.30	10.87	30.50	21.67	23.27
114	109.400000	43.00	11.35	30.50	23.85	11.25
115	112.400000	43.80	11.98	30.48	25.30	9.99
116	115.200000	43.00	12.58	30.45	25.14	10.34
117	117.800000	40.80	13.01	30.42	23.39	12.24
118	120.800000	35.80	13.44	30.39	18.85	16.97
119	148.600000	40.90	12.76	30.30	23.36	13.98
120	181.600000	49.60	14.99	30.18	34.41	14.33
121	189.900000	51.20	14.85	30.10	35.95	13.10



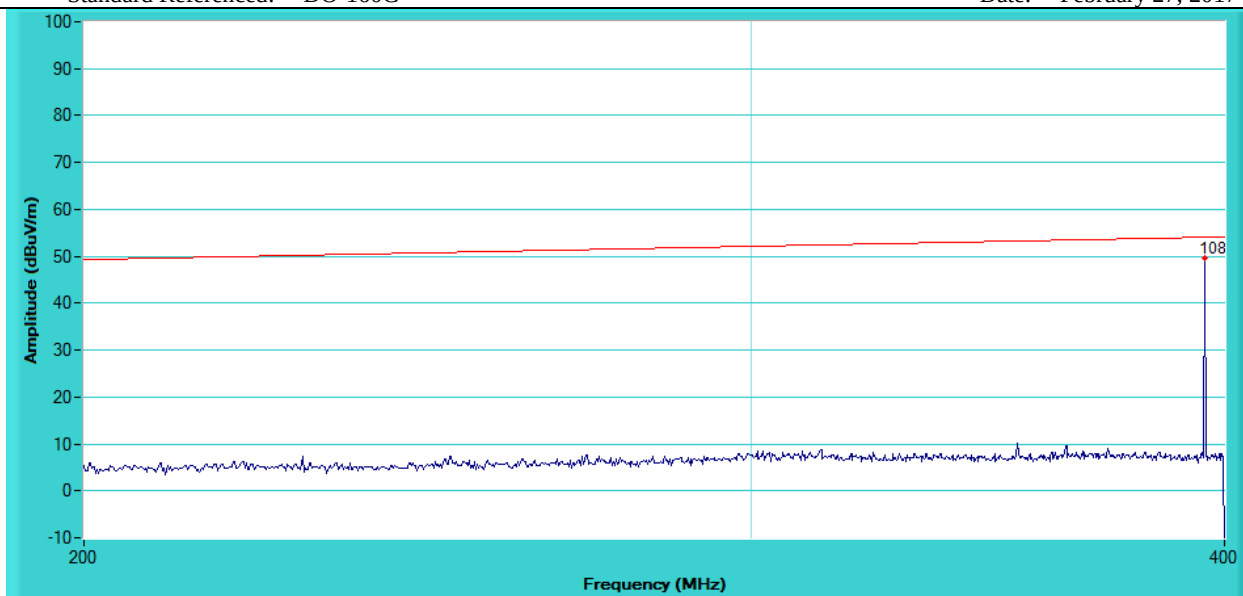
Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

Manufacturer: Churchill Navigation
Customer Representative: Jordan Heintz
Model: ATOM, ION-R Model# 160020 / 110100

Project Number: PR058945
Test Area: Shield Room
S/N: Atom-160010
ION - 110101

Standard Referenced: DO-160G

Date: February 27, 2017



Monday, February 27, 2017 PROJECT#: B70216 LIMIT: RTCA DO-160G, Sec 21, Cat M, RE DATE: 11:37AM Monday, February 27, 2017
MN: ARS-700 (ATOM/ION) . SN: 110100 / 160010 . Description
Configuration:
Modifications:
V-Pole- Signal Check , Target 395MHz @limit -6dB (+/- 3dB)

Scan 6. V-Pole- Signal Check , Target 395MHz @limit -6dB (+/- 3dB)

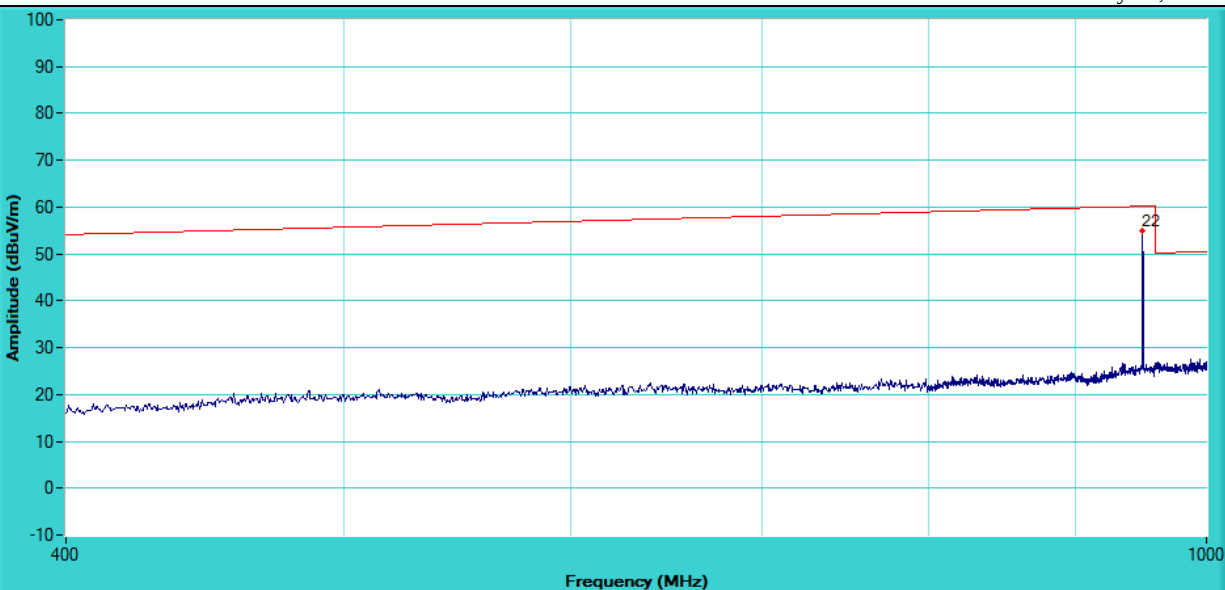
#	Freq (MHz)	Level (dBuV)	Xducer (dB/m)	Gain/Loss (dB)	Final (dBuV/m)	Margin (dB)
108	395.404595	66.00	13.62	30.05	49.58	4.56



Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

Manufacturer: Churchill Navigation
Customer Representative: Jordan Heintz
Model: ATOM, ION-R Model# 160020 / 110100
Standard Referenced: DO-160G

Project Number: PR058945
Test Area: Shield Room
S/N: Atom-160010
ION - 110101
Date: February 27, 2017



Manufacturer, Churchill Nav PROJECT#: B70216 LIMIT: RTCA DO-160G, Sec 21, Cat M, RE DATE: 12:06PM Monday, February 27, 2017
MN: . SN: . Description
Configuration:
Modifications:
H-Pole- Signal Check, Target 950MHz at limit -6DB (+/-3dB)

Scan 7. Signal Check, Target 950MHz at limit -6DB (+/-3dB)

#	Freq (MHz)	Level (dBuV)	Xducer (dB/m)	Gain/Loss (dB)	Final (dBuV/m)	Margin (dB)
22	950.000000	61.20	22.23	28.40	55.03	5.20



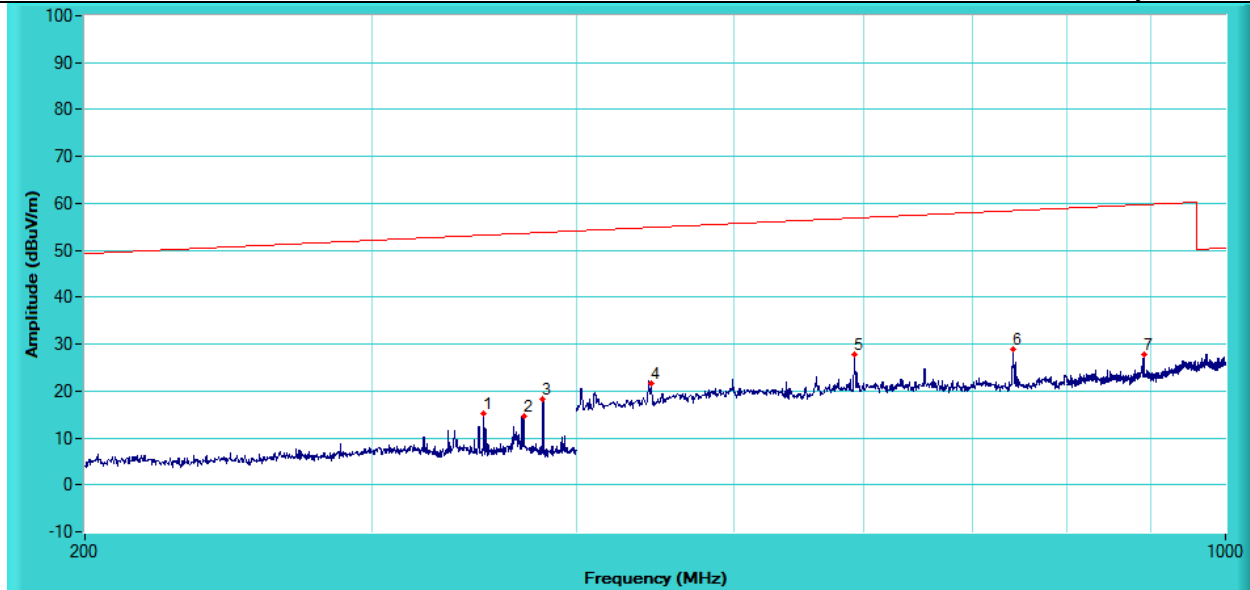
Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

Manufacturer: Churchill Navigation
Customer Representative: Jordan Heintz
Model: ATOM, ION-R Model# 160020 / 110100

Project Number: PR058945
Test Area: Shield Room
S/N: Atom-160010
ION - 110101

Standard Referenced: DO-160G

Date: February 27, 2017



Manufacturer, Churchill Nav PROJECT#: B70216 LIMIT: RTCA DO-160G, Sec 21, Cat M, RE DATE: 12:06PM Monday, February 27, 2017
MN: . SN: . Description
Configuration:
Modifications:
V-Pole - Ambient Scan

Scan 8. V-Pole - Ambient Scan

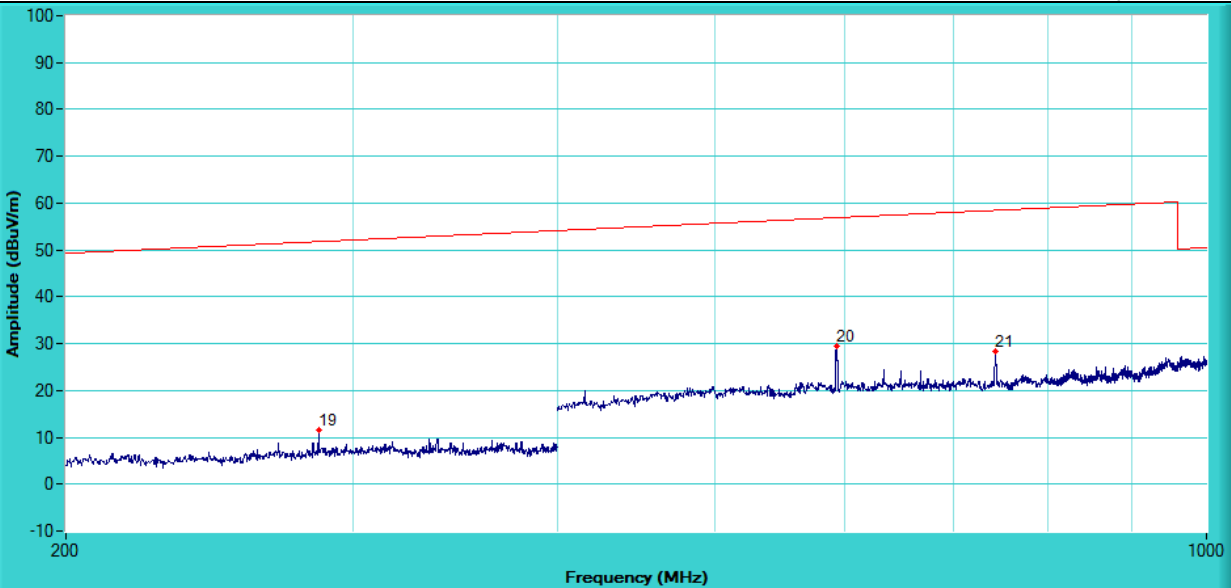
#	Freq (MHz)	Level (dBuV)	Xducer (dB/m)	Gain/Loss (dB)	Final (dBuV/m)	Margin (dB)
1	351.200000	31.80	13.50	30.01	15.29	38.03
2	371.600000	31.00	13.50	29.90	14.60	39.11
3	381.600000	34.60	13.54	29.93	18.21	35.69
4	444.800000	36.80	14.77	29.80	21.76	33.19
5	592.800000	39.90	17.21	29.37	27.74	29.21
6	740.800000	39.60	18.18	28.80	28.98	29.52
7	891.200000	36.10	19.97	28.28	27.80	31.99



Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

Manufacturer: Churchill Navigation
Customer Representative: Jordan Heintz
Model: ATOM, ION-R Model# 160020 / 110100
Standard Referenced: DO-160G

Project Number: PR058945
Test Area: Shield Room
S/N: Atom-160010
ION - 110101
Date: February 27, 2017



Manufacturer, Churchill Nav PROJECT#: B70216 LIMIT: RTCA DO-160G, Sec 21, Cat M, RE DATE: 12:06PM Monday, February 27, 2017
MN: . SN: . Description
Configuration:
Modifications:
H-Pole- Ambient Scan, EUT OFF, SUPPORT ON

Scan 9. H-Pole- Ambient Scan, EUT OFF, SUPPORT ON

#	Freq (MHz)	Level (dBuV)	Xducer (dB/m)	Gain/Loss (dB)	Final (dBuV/m)	Margin (dB)
19	285.600000	28.90	12.60	30.06	11.44	40.44
20	593.600000	41.70	17.22	29.36	29.56	27.40
21	742.400000	39.10	18.18	28.80	28.48	30.04



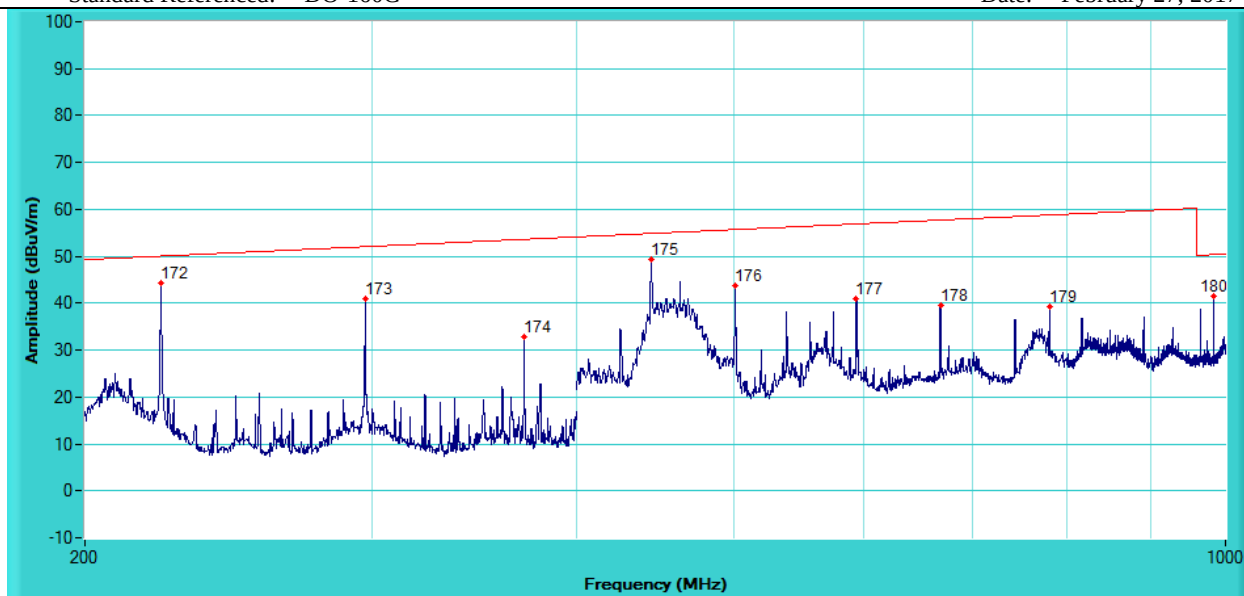
Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

Manufacturer: Churchill Navigation
Customer Representative: Jordan Heintz
Model: ATOM, ION-R Model# 160020 / 110101

Project Number: PR058945
Test Area: Shield Room
S/N: Atom-160010
ION - 110101

Standard Referenced: DO-160G

Date: February 27, 2017



Monday, February 27, 2017 PROJECT#: B70216 LIMIT: RTCA DO-160G, Sec 21, Cat M, RE DATE: 01:02PM Monday, February 27, 2017
MN: ARS-700 (ATOM/ION), SN: 160010 / 110100, Description
Configuration:
Modifications: EMI Gaskets on ATOM Only, Added external ferrite on Video
V-Pole - EUT Scan, ION SN/ 110100

Scan 10. V-Pole - EUT Scan, ION SN/ 110100

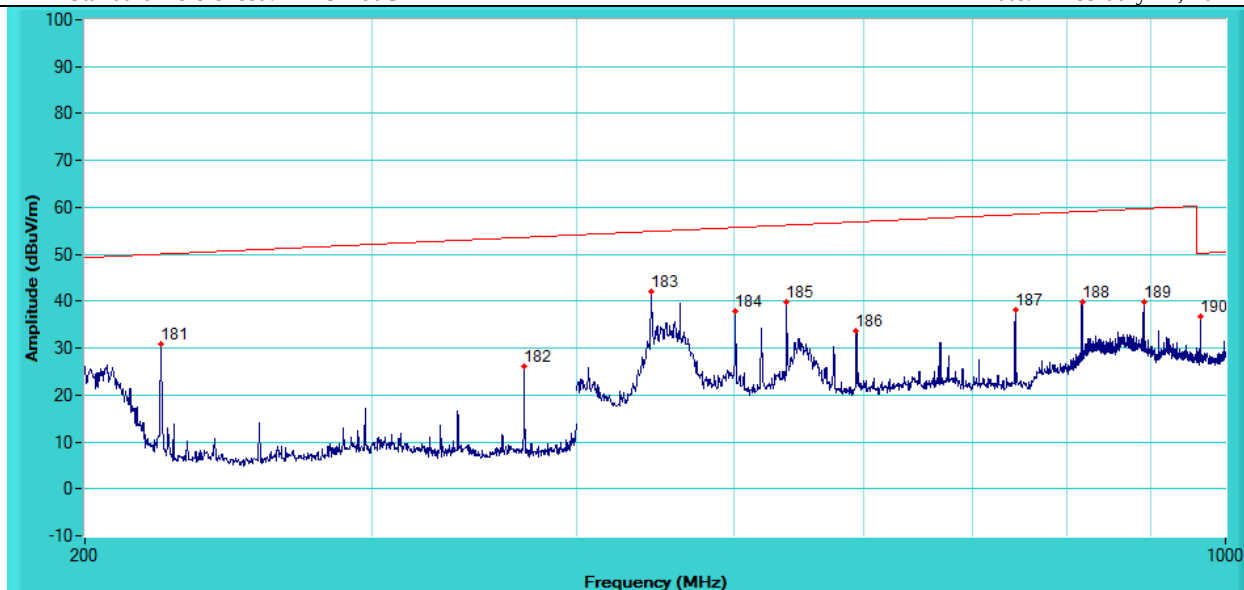
#	Freq (MHz)	Level (dBuV)	Xducer (dB/m)	Gain/Loss (dB)	Final (dBuV/m)	Margin (dB)
172	222.800000	63.30	11.00	30.10	44.20	5.95
173	297.200000	57.60	13.21	29.96	40.86	11.30
174	371.600000	49.30	13.50	29.90	32.90	20.81
175	444.800000	64.40	14.77	29.80	49.36	5.59
176	500.800000	57.20	16.38	29.79	43.79	11.99
177	594.000000	53.10	17.23	29.36	40.97	15.99
178	668.800000	50.60	17.85	29.02	39.43	18.36
179	780.000000	49.40	18.43	28.70	39.13	19.72
180	984.000000	47.10	22.70	28.18	41.62	8.85



Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

Manufacturer: Churchill Navigation
Customer Representative: Jordan Heintz
Model: ATOM, ION-R Model# 160020 / 110101
Standard Referenced: DO-160G

Project Number: PR058945
Test Area: Shield Room
S/N: Atom-160010
ION - 110101
Date: February 27, 2017



Monday, February 27, 2017 PROJECT#: B70216 LIMIT: RTCA DO-160G, Sec 21, Cat M, RE DATE: 01:02PM Monday, February 27, 2017
MN: ARS-700 (ATOM/ION), SN: 160010 / 110100, Description
Configuration:
Modifications: , EMI Gasket on ATOM only, Added external ferrite on Video
H-pole -EUT Scan - ION SN/ 110100

Scan 11. H-pole -EUT Scan - ION SN/ 110100

#	Freq (MHz)	Level (dBuV)	Xducer (dB/m)	Gain/Loss (dB)	Final (dBuV/m)	Margin (dB)
181	222.800000	50.10	11.00	30.10	31.00	19.15
182	371.600000	42.60	13.50	29.90	26.20	27.51
183	444.800000	57.20	14.77	29.80	42.16	12.79
184	500.800000	51.30	16.38	29.79	37.89	17.89
185	538.400000	53.40	16.04	29.67	39.77	16.52
186	594.000000	45.70	17.23	29.36	33.57	23.39
187	743.200000	48.80	18.17	28.80	38.17	20.35
188	816.800000	49.40	19.11	28.63	39.89	19.29
189	891.200000	48.00	19.97	28.28	39.70	20.09
190	965.600000	42.10	22.60	27.99	36.71	13.63

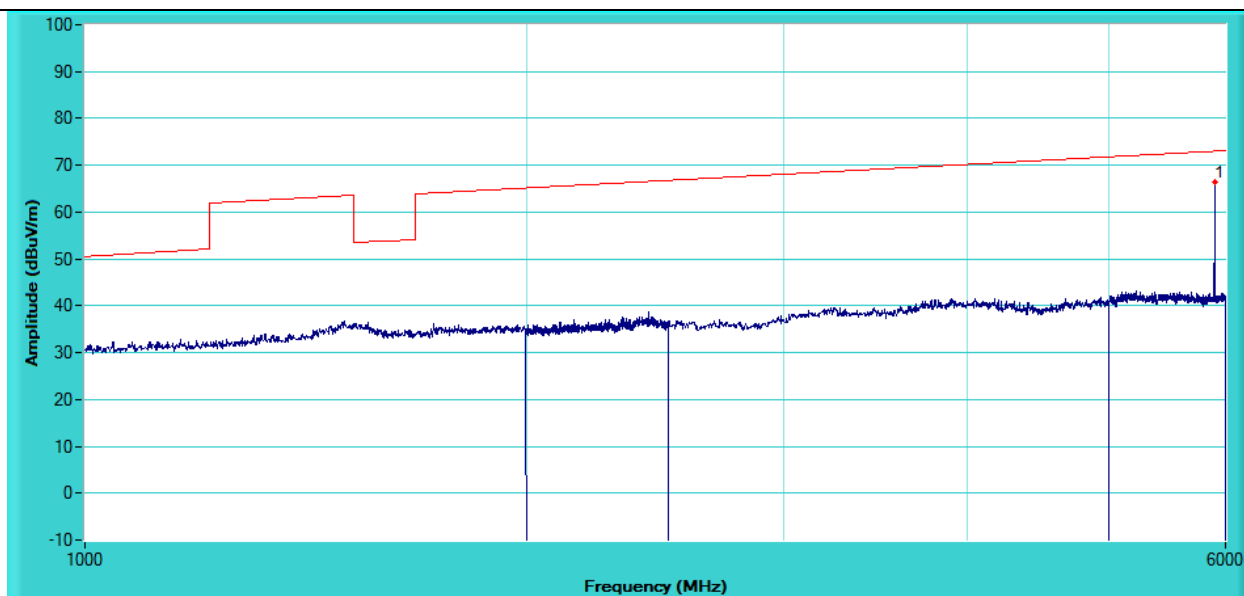


Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

Manufacturer: Churchill Navigation
Customer Representative: Jordan Heintz
Model: ATOM, ION-R Model# 160020 / 110101
Standard Referenced: DO-160G

Project Number: PR058945
Test Area: Shield Room
S/N: Atom-160010
ION - 110101
Date: February 27, 2017

FR0100



Monday, February 27, 2017 PROJECT#: B70216 LIMIT: RTCA DO-160G, Sec 21, Cat M, RE DATE: 09:08AM Monday, February 27, 2017
MN: ARS-700 (ATOM/ION) . SN: 110100 / 160010 . Description
Configuration:
Modifications:
V-Pole - Signal Check, Target 5.9GHz @ limit -6dB (+/- 3dB)

Scan 12. V-Pole - Signal Check, Target 5.9GHz @ limit -6dB (+/- 3dB)

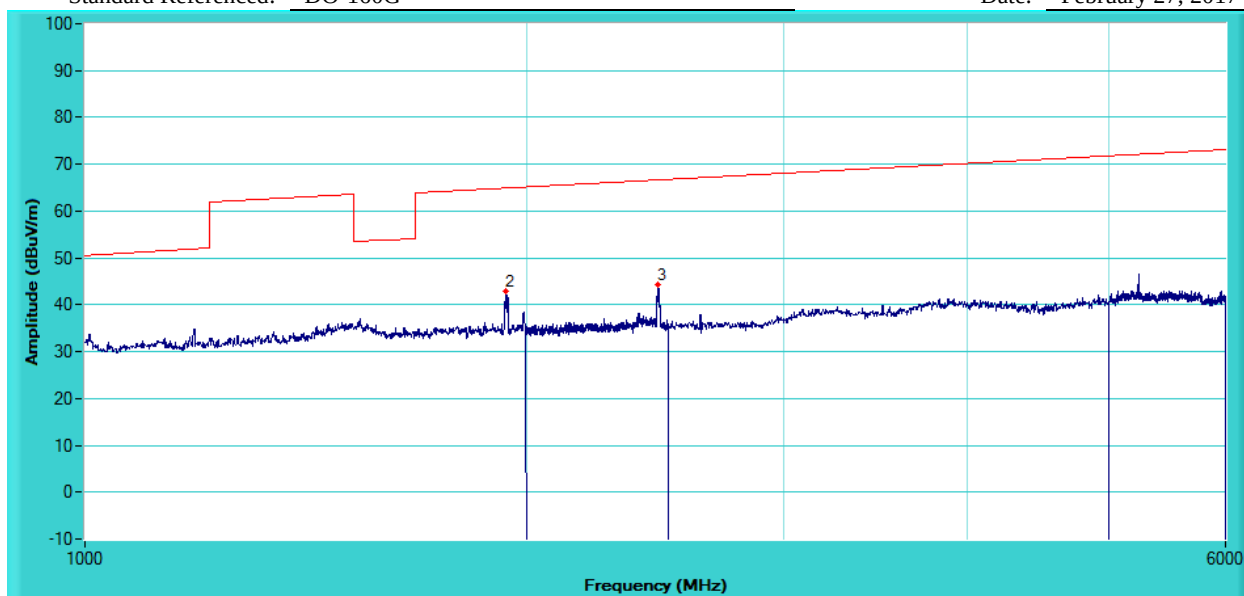
#	Freq (MHz)	Level (dBuV)	Xducer (dB/m)	Gain/Loss (dB)	Final (dBuV/m)	Margin (dB)
1	5898.101898	86.90	35.31	55.80	66.41	6.47



Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

Manufacturer: Churchill Navigation
Customer Representative: Jordan Heintz
Model: ATOM, ION-R Model# 160020 / 110100
Standard Referenced: DO-160G

Project Number: PR058945
Test Area: Shield Room
S/N: Atom-160010
ION - 110100
Date: February 27, 2017



Monday, February 27, 2017 PROJECT#: B70216 LIMIT: RTCA DO-160G, Sec 21, Cat M, RE DATE: 09:08AM Monday, February 27, 2017
MN: ARS-700 (ATOM/ION) . SN: 110100 / 160010 . Description
Configuration:
Modifications:
V-Pole -Ambient Scan. EUT OFF, Support ON

Scan 13. V-Pole -Ambient Scan, EUT OFF, Support ON

#	Freq (MHz)	Level (dBuV)	Xducer (dB/m)	Gain/Loss (dB)	Final (dBuV/m)	Margin (dB)
2	1937.062937	73.40	28.24	58.80	42.84	22.16



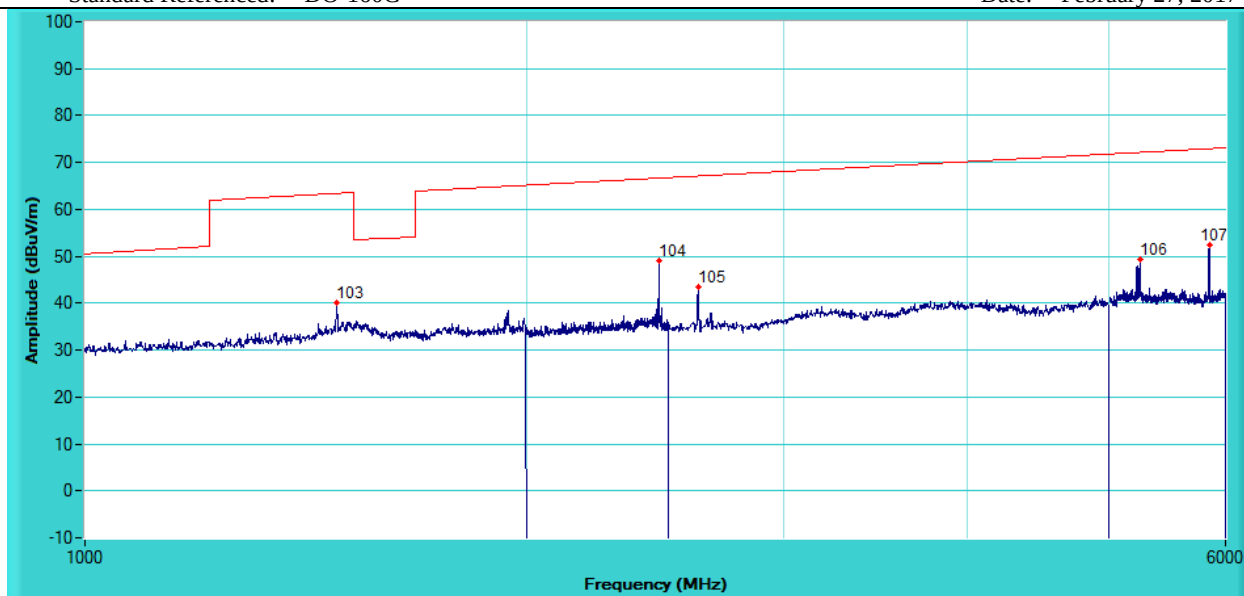
Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

Manufacturer: Churchill Navigation
Customer Representative: Jordan Heintz
Model: ATOM, ION-R Model# 160020 / 110100

Project Number: PR058945
Test Area: Shield Room
S/N: Atom-160010
ION - 110101

Standard Referenced: DO-160G

Date: February 27, 2017



Monday, February 27, 2017 PROJECT#: B70216 LIMIT: RTCA DO-160G, Sec 21, Cat M, RE DATE: 09:32AM Monday, February 27, 2017
MN: ARS-700 (ATOM/ION) . SN: 110100 / 160010 . Description
Configuration:
Modifications:
H-Pole - Ambient Scan, EUT OFF, SUPPORT ON

Scan 14. H-Pole - Ambient Scan, EUT OFF, SUPPORT ON

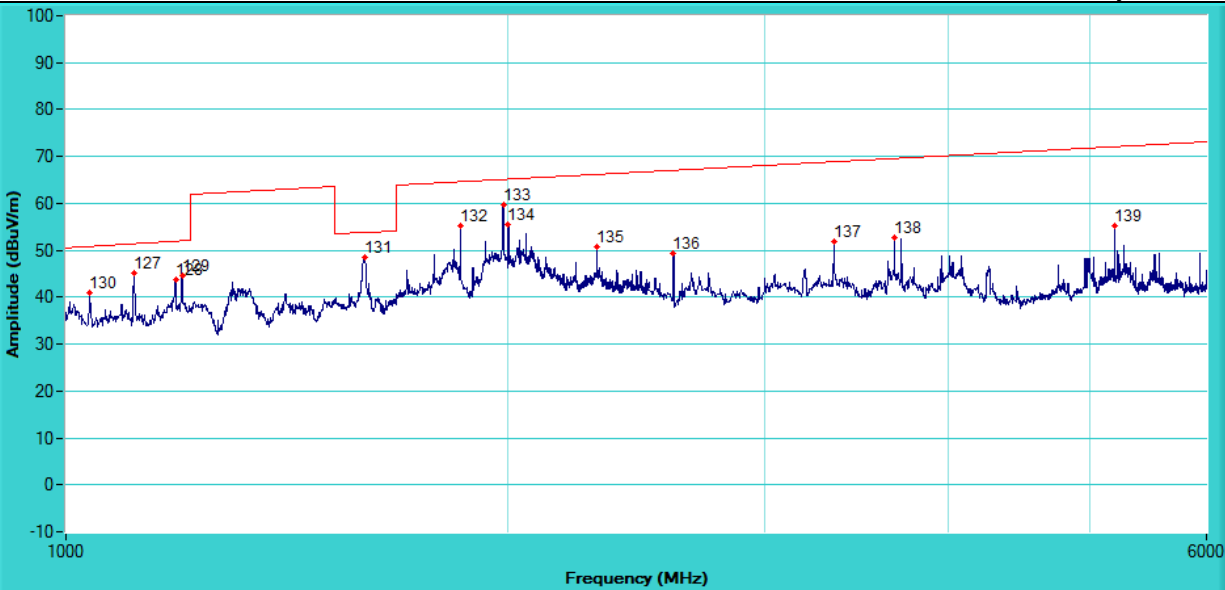
#	Freq (MHz)	Level (dBuV)	Xducer (dB/m)	Gain/Loss (dB)	Final (dBuV/m)	Margin (dB)
103	1485.514486	69.80	25.52	55.16	40.17	23.16
104	2464.535465	78.30	29.78	58.98	49.10	17.61
105	2619.880120	73.30	29.86	59.57	43.60	23.54
106	5245.754246	71.40	34.67	56.69	49.39	22.66
107	5849.150849	73.10	35.12	55.71	52.50	20.32



Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

Manufacturer: Churchill Navigation
Customer Representative: Jordan Heintz
Model: ATOM, ION-R Model# 160020 / 110101
Standard Referenced: DO-160G

Project Number: PR058945
Test Area: Shield Room
S/N: Atom-160010
ION - 110101
Date: February 27, 2017



Monday, February 27, 2017 PROJECT#: B70216 LIMIT: RTCA DO-160G, Sec 21, Cat M, RE DATE: 01:02PM Monday, February 27, 2017
MN: ARS-700 (ATOM/ION), SN: 160010 / 110100, Description
Configuration:
Modifications: EMI Gaskets on ATOM ONLY, Added external ferrite on Video
V-Pole - EUT Scan, ION SN/ 110100

Scan 15. V-Pole - EUT Scan, EMI Gaskets on ATOM ONLY, Added external ferrite on Video, ION SN/ 110100

#	Freq (MHz)	Level (dBuV)	Xducer (dB/m)	Gain/Loss (dB)	Final (dBuV/m)	Margin (dB)
127	1112.000000	76.60	24.42	55.80	45.23	6.13
128	1188.000000	75.60	24.73	56.57	43.76	8.08
129	1200.000000	76.20	24.78	56.52	44.46	7.45
130	1038.000000	71.80	24.05	55.04	40.81	10.06
131	1600.000000	79.50	26.04	57.00	48.54	5.21
132	1858.000000	86.30	27.71	58.66	55.35	9.36
133	1988.000000	90.40	28.12	58.80	59.72	5.47
134	2003.000000	86.30	28.06	58.80	55.56	9.68
135	2303.000000	81.00	28.91	59.07	50.84	15.39
136	2597.500000	78.90	29.85	59.48	49.27	17.81
137	3340.000000	77.40	32.11	57.65	51.86	17.00
138	3675.000000	77.30	32.41	56.94	52.77	16.76
139	5196.000000	77.60	34.41	56.94	55.08	16.91



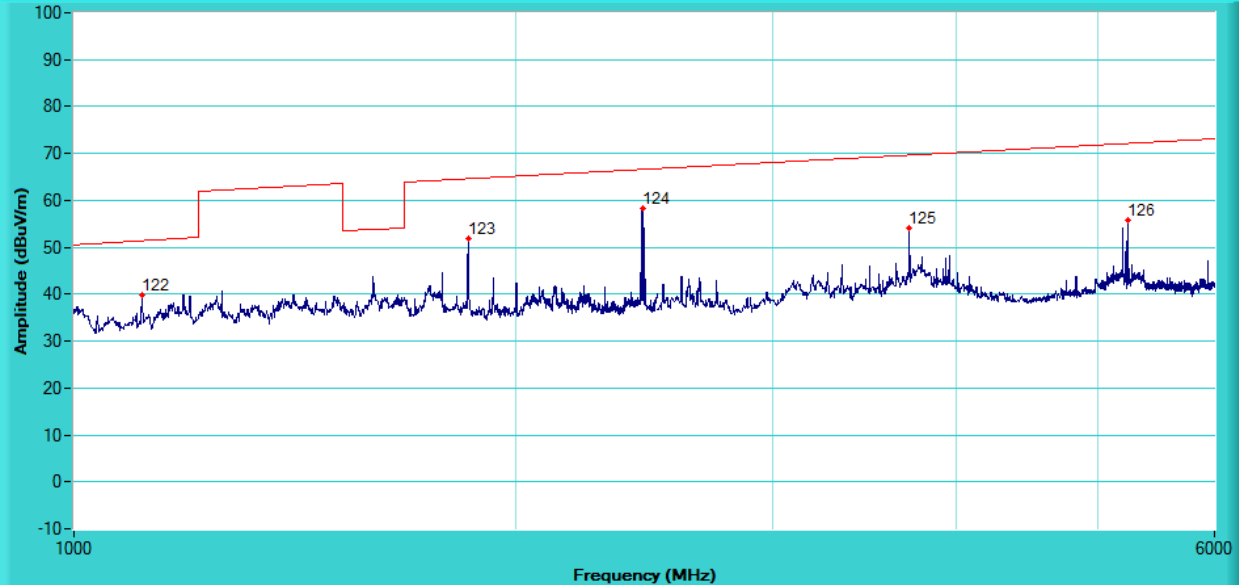
Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

Manufacturer: Churchill Navigation
Customer Representative: Jordan Heintz
Model: ATOM, ION-R Model# 160020 / 110101

Project Number: PR058945
Test Area: Shield Room
S/N: Atom-160010
ION - 110101

Standard Referenced: DO-160G

Date: February 27, 2017



Monday, February 27, 2017 PROJECT#: B70216 LIMIT: RTCA DO-160G, Sec 21, Cat M, RE DATE: 01:02PM Monday, February 27, 2017
MN: ARS-700 (ATOM/ION), SN: 160010 / 110100, Description
Configuration:
Modifications: EMI Gaskets on ATOM ONLY, Added external ferrite on Video
H-pole -EUT Scan - ION SN/ 110100

Scan 16. H-pole -EUT Scan - ION SN/ 110100

#	Freq (MHz)	Level (dBuV)	Xducer (dB/m)	Gain/Loss (dB)	Final (dBuV/m)	Margin (dB)
122	1112.000000	71.20	24.42	55.80	39.83	11.53
123	1858.000000	82.70	27.71	58.66	51.75	12.96
124	2442.000000	87.30	29.80	58.83	58.26	8.38
125	3715.000000	78.30	32.62	56.83	54.09	15.52
126	5236.000000	78.00	34.62	56.72	55.90	16.14



Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	Atom-160010 ION - 110100
Standard Referenced:	DO-160G	Date:	February 27, 2017
PR058945-RE102.doc		FR0100	

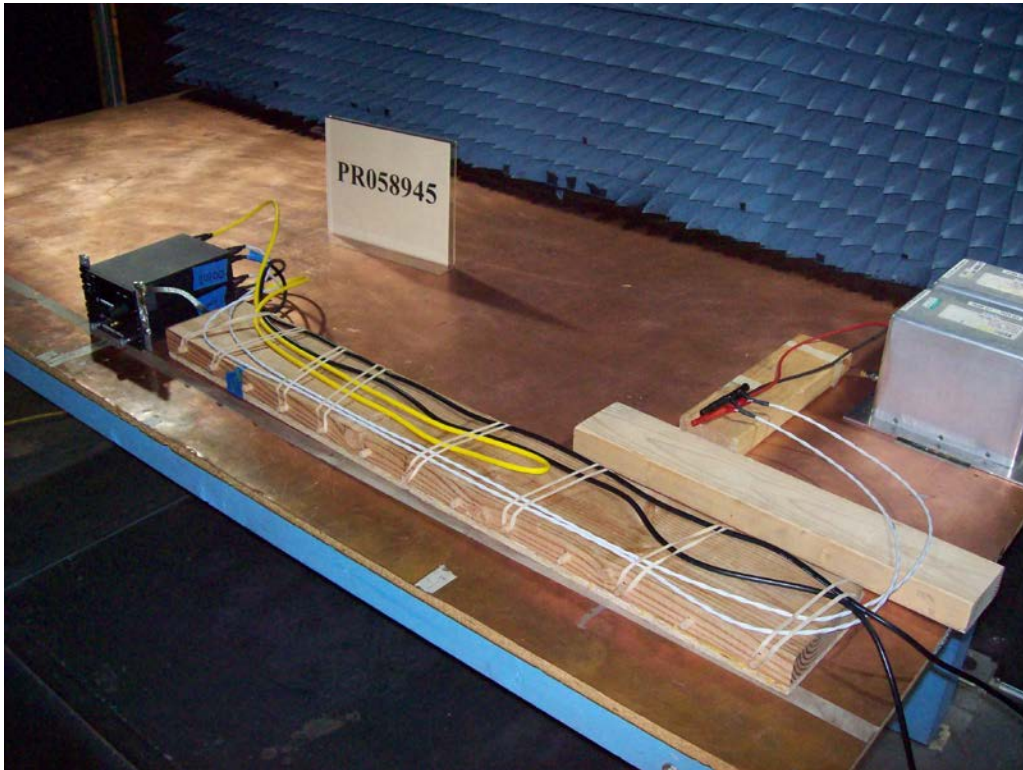


Photo 1. RE102 Test Setup.



Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	Atom-160010 ION - 110100
Standard Referenced:	DO-160G	Date:	February 27, 2017
PR058945-RE102.doc			FR0100

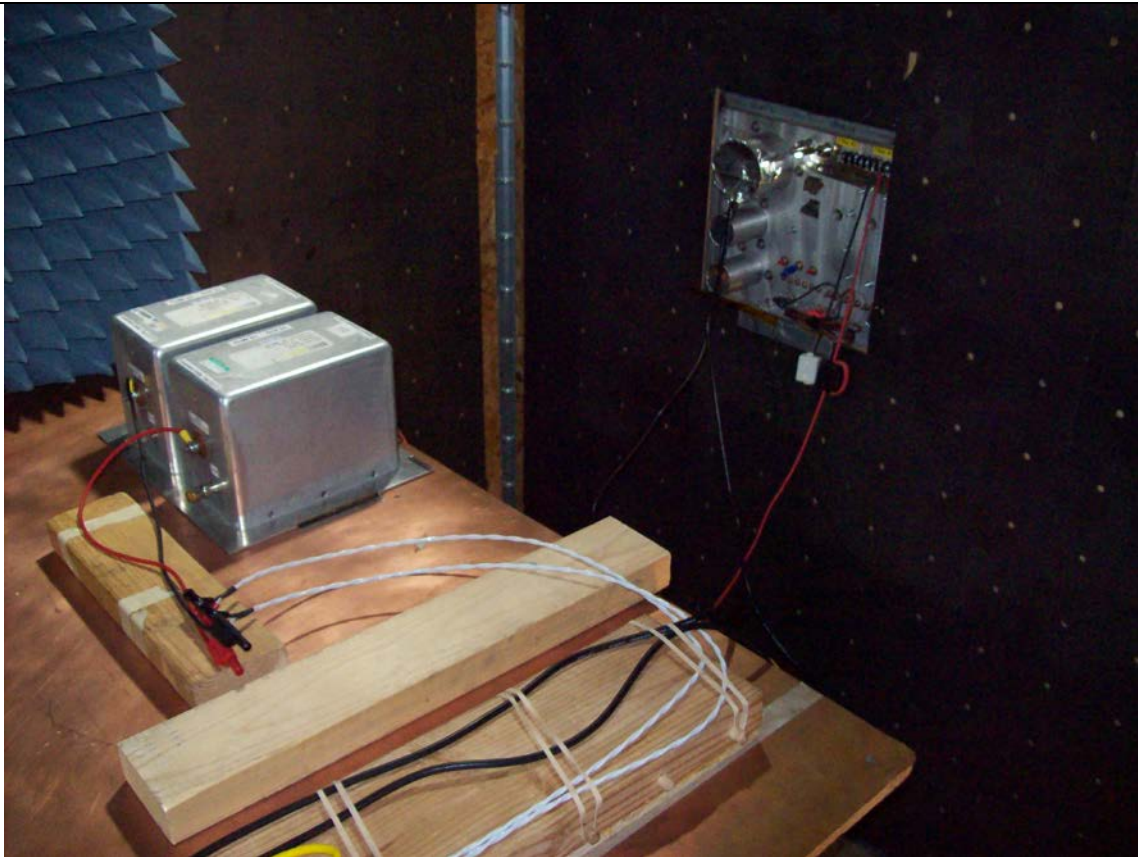


Photo 2. RE102 Test Setup.



Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	Atom-160010 ION - 110100
Standard Referenced:	DO-160G	Date:	February 27, 2017
PR058945-RE102.doc		FR0100	

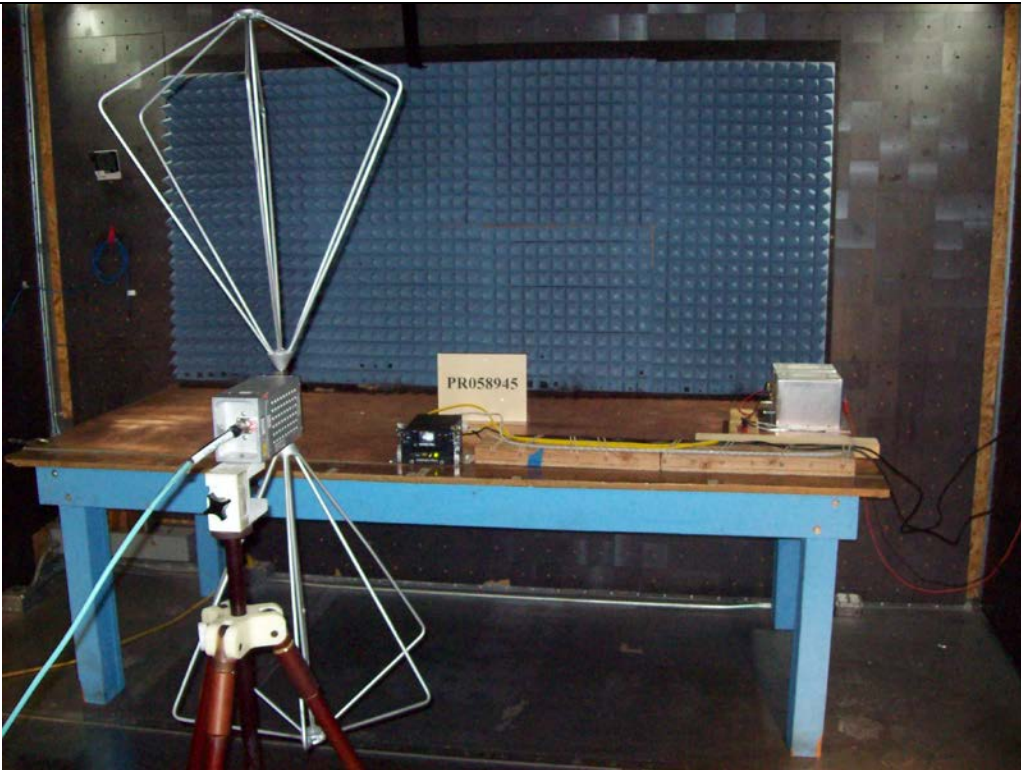


Photo 3. RE102 Test Setup. **100-200 MHz Vertical**



Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	Atom-160010 ION - 110100
Standard Referenced:	DO-160G	Date:	February 27, 2017
PR058945-RE102.doc		FR0100	

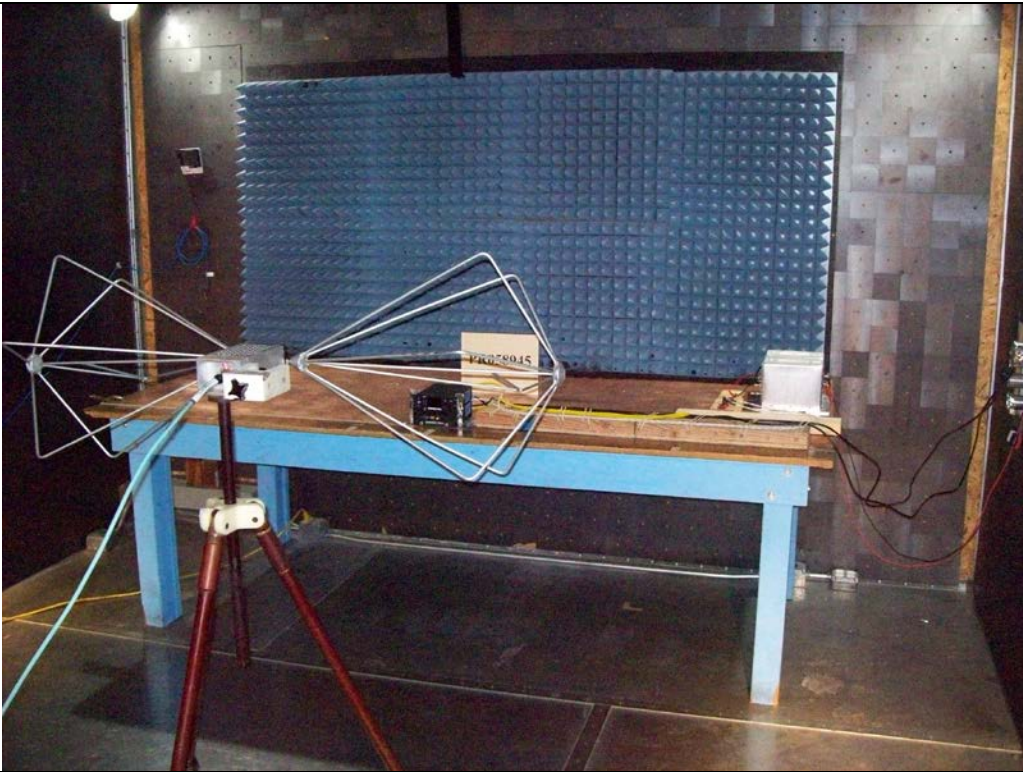


Photo 4. RE102 Test Setup. 100-200 MHZ Horizontal



Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	Atom-160010 ION - 110100
Standard Referenced:	DO-160G	Date:	February 27, 2017
PR058945-RE102.doc		FR0100	



Photo 5. RE102 Test Setup. 200-1000 MHz Vertical



Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	Atom-160010 ION - 110100
Standard Referenced:	DO-160G	Date:	February 27, 2017
PR058945-RE102.doc		FR0100	

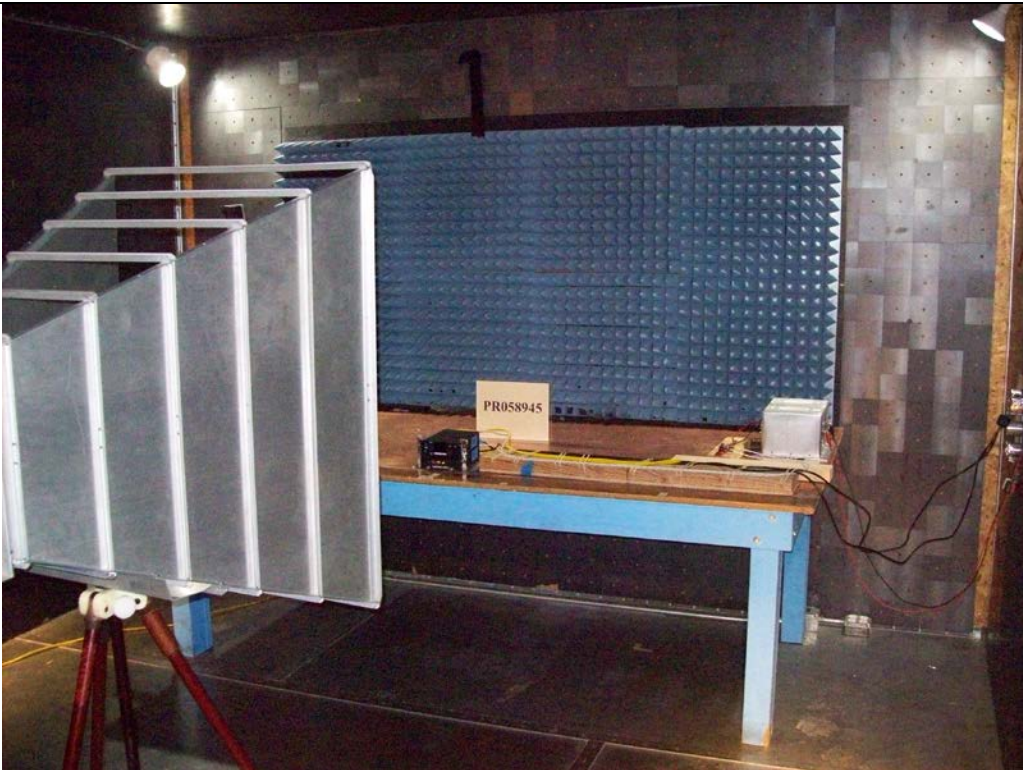


Photo 6. RE102 Test Setup. 200-1000 MHz Horizontal



Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	Atom-160010 ION - 110100
Standard Referenced:	DO-160G	Date:	February 27, 2017
PR058945-RE102.doc		FR0100	



Photo 7. RE102 Test Setup. **Sig Check**



Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	Atom-160010 ION - 110100
Standard Referenced:	DO-160G	Date:	February 27, 2017
PR058945-RE102.doc		FR0100	



Photo 8. RE102 Test Setup. 1000 – 6000 MHz Vertical



Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	Atom-160010 ION - 110100
Standard Referenced:	DO-160G	Date:	February 27, 2017
PR058945-RE102.doc		FR0100	



Photo 9. RE102 Test Setup. 1000 – 6000 MHz Horizontal



Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	Atom-160010 ION - 110100
Standard Referenced:	DO-160G	Date:	February 27, 2017
PR058945-RE102.doc			FR0100



Photo 10. RE102 Test Setup. Ferrite installed on video cables



Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	Atom-160010 ION - 110101
Standard Referenced:	DO-160G	Date:	February 27, 2017
PR058945-RE102.doc		FR0100	

Test Equipment List

ID Number	Manufacturer	Model #	Serial #	Description	Cal Date	Cal Due
1046	Hewlett Packard	8566B	2403A08106	Spectrum Analyzer Display	06/30/2016	06/30/2017
1045	Hewlett Packard	8566B	2403A08106	Spectrum Analyzer with Display SN 2403A08106	06/30/2016	06/30/2017
1104	Ray Proof	RF Shield Room	SL2384	Semi Anechoic Lined Chamber	NA	NA
1139	Wiltron	68369B	675016	Synthesized Signal Generator, 10 MHz - 40 GHz	08/05/2016	08/05/2017
1248	Mini-Circuits	ZKL-2	062907	Preamp, 10 - 2000 MHz, 30 dB	06/22/2016	06/22/2017
1075	EMCO	3106	9906-2748	Double-ridged Horn (200 MHz - 2 GHz)	09/03/2015	09/03/2017
1031	EMCO	3109	9607-3006	High Field Biconical Antenna (20 MHz - 300 MHz)	04/26/2016	04/26/2017
1392	Sunol	DRH-118	A020311	1-18 GHz Double-Ridged Horn Antenna	12/22/2016	12/22/2017
1452	Ciao Wireless	CA118-3010	112 & 113	1 GHz to 18 GHz Preamplifier	05/04/2016	05/04/2017
1539	Extech Instruments	445715	Z316007	Hygro-Thermometer	04/19/2016	04/19/2017



Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	Atom-160010 ION - 110101
Standard Referenced:	DO-160G	Date:	February 27, 2017

Emissions Software Configuration

RTCA DO 160G

RTCA DO-160F/G, Sec 21, Cat M, RE

Range Number:	1	Range Number:	2
Start Frequency (MHz):	100.0	Start Frequency (MHz):	100.0
Stop Frequency (MHz):	200.0	Stop Frequency (MHz):	200.0
Transducer:	1076, EMCO, 3109	Transducer:	1076, EMCO, 3109
Gain/Loss:	1248, Mini-Circuits, ZKL-2	Gain/Loss:	1248, Mini-Circuits, ZKL-2
Measurement Type:	Narrow-Band	Measurement Type:	Narrow-Band
Quasi-Peak Adapter:	Bypass	Quasi-Peak Adapter:	Bypass
BandWidth / Meas. Time:	Other, RBW: 10 kHz, MeasTime: 1.5 s/MHz	BandWidth / Meas. Time:	Other, RBW: 10 kHz, MeasTime: 1.5 s/MHz
Reference Level (dB):	80.0	Reference Level (dB):	80.0
Internal Attenuation:	0 dB	Internal Attenuation:	0 dB
External Attenuation (dB):	0.0	External Attenuation (dB):	0.0
# Sweeps:	5	# Sweeps:	5
Window Size (Octaves):	1.0	Window Size (Octaves):	1.0
Message:	Biconical Antenna Vertical with Preamp	Message:	Biconical Antenna Horizontal with Preamp
Plot Title:	V-Pole	Plot Title:	H-Pole
Range Number:	3	Range Number:	4
Start Frequency (MHz):	200.0	Start Frequency (MHz):	400.0
Stop Frequency (MHz):	400.0	Stop Frequency (MHz):	1000.0
Transducer:	1075, EMCO, 3106	Transducer:	1075, EMCO, 3106
Gain/Loss:	1248, Mini-Circuits, ZKL-2	Gain/Loss:	1248, Mini-Circuits, ZKL-2
Measurement Type:	Narrow-Band	Measurement Type:	Narrow-Band
Quasi-Peak Adapter:	Bypass	Quasi-Peak Adapter:	Bypass
BandWidth / Meas. Time:	Other, RBW: 10 kHz, MeasTime: 1.5 s/MHz	BandWidth / Meas. Time:	Other, RBW: 100 kHz, MeasTime: 0.15 s/MHz
Reference Level (dB):	80.0	Reference Level (dB):	80.0
Internal Attenuation:	0 dB	Internal Attenuation:	0 dB
External Attenuation (dB):	0.0	External Attenuation (dB):	0.0
# Sweeps:	5	# Sweeps:	5
Window Size (Octaves):	1.0	Window Size (Octaves):	1.0
Message:	Connect horn antenna vertical w/ preamp	Message:	None
Plot Title:	V-Pole	Plot Title:	V-Pole
Range Number:	5	Range Number:	6
Start Frequency (MHz):	200.0	Start Frequency (MHz):	400.0
Stop Frequency (MHz):	400.0	Stop Frequency (MHz):	1000.0
Transducer:	1075, EMCO, 3106	Transducer:	1075, EMCO, 3106
Gain/Loss:	1248, Mini-Circuits, ZKL-2	Gain/Loss:	1248, Mini-Circuits, ZKL-2
Measurement Type:	Narrow-Band	Measurement Type:	Narrow-Band
Quasi-Peak Adapter:	Bypass	Quasi-Peak Adapter:	Bypass



Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	Atom-160010 ION - 110101
Standard Referenced:	DO-160G	Date:	February 27, 2017

Emissions Software Configuration

BandWidth / Meas. Time:	Other, RBW: 10 kHz, MeasTime: 1.5 s/MHz	BandWidth / Meas. Time:	Other, RBW: 100 kHz, MeasTime: 0.15 s/MHz
Reference Level (dB):	80.0	Reference Level (dB):	80.0
Internal Attenuation:	0 dB	Internal Attenuation:	0 dB
External Attenuation (dB):	0.0	External Attenuation (dB):	0.0
# Sweeps:	5	# Sweeps:	5
Window Size (Octaves):	1.0	Window Size (Octaves):	1.0
Message:	Connect horn antenna horizontal w/ preamp	Message:	None
Plot Title:	H-Pole	Plot Title:	H-Pole
Range Number:	7	Range Number:	8
Start Frequency (MHz):	1000.0	Start Frequency (MHz):	1000.0
Stop Frequency (MHz):	6000.0	Stop Frequency (MHz):	6000.0
Transducer:	1392, Sunol, DRH-118	Transducer:	1392, Sunol, DRH-118
Gain/Loss:	1452, Ciao Wireless, CA118- 3010	Gain/Loss:	1452, Ciao Wireless, CA118- 3010
Measurement Type:	Narrow-Band	Measurement Type:	Narrow-Band
Quasi-Peak Adapter:	Bypass	Quasi-Peak Adapter:	Bypass
BandWidth / Meas. Time:	Other, RBW: 1 MHz, MeasTime: 15 s/GHz	BandWidth / Meas. Time:	Other, RBW: 1 MHz, MeasTime: 15 s/GHz
Reference Level (dB):	107.0	Reference Level (dB):	107.0
Internal Attenuation:	10 dB	Internal Attenuation:	10 dB
External Attenuation (dB):	0.0	External Attenuation (dB):	0.0
# Sweeps:	20	# Sweeps:	20
Window Size (Octaves):	1.0	Window Size (Octaves):	1.0
Message:	Horn Broadband Antenna V-Pole with Preamp	Message:	Horn Broadband Antenna H- Pole with Preamp
Plot Title:	V-Pole	Plot Title:	H-Pole



Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

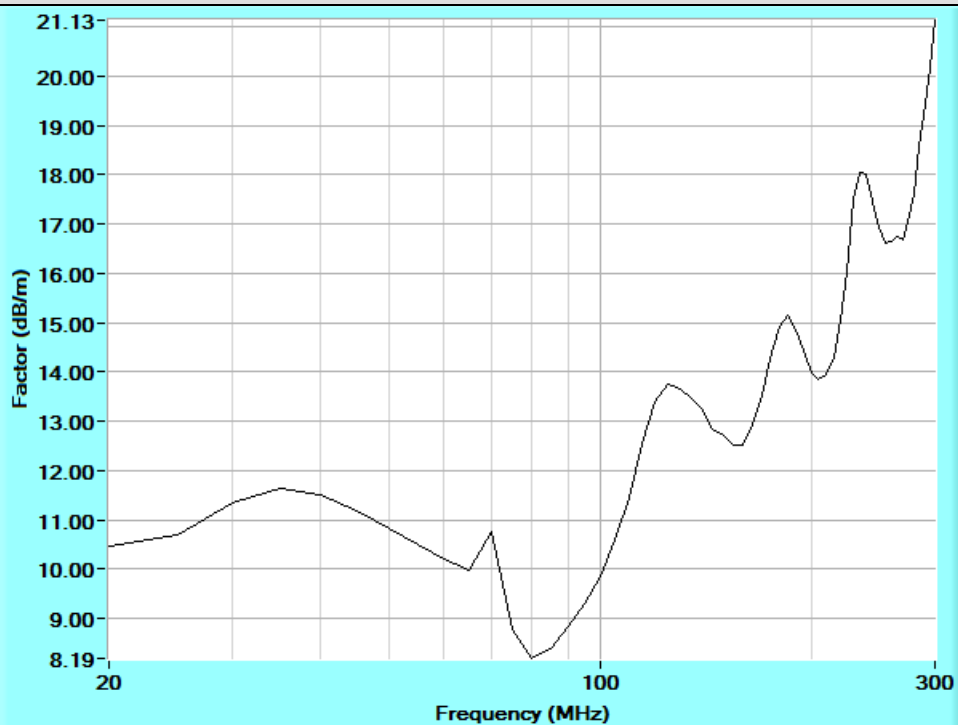
Manufacturer: Churchill Navigation
Customer Representative: Jordan Heintz
Model: ATOM, ION-R

Project Number: PR058945
Test Area: Shield Room
S/N: Atom-160010
ION - 110101

Standard Referenced: DO-160G

Date: February 27, 2017

Transducer Factors



1076, EMCO, 3109



Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

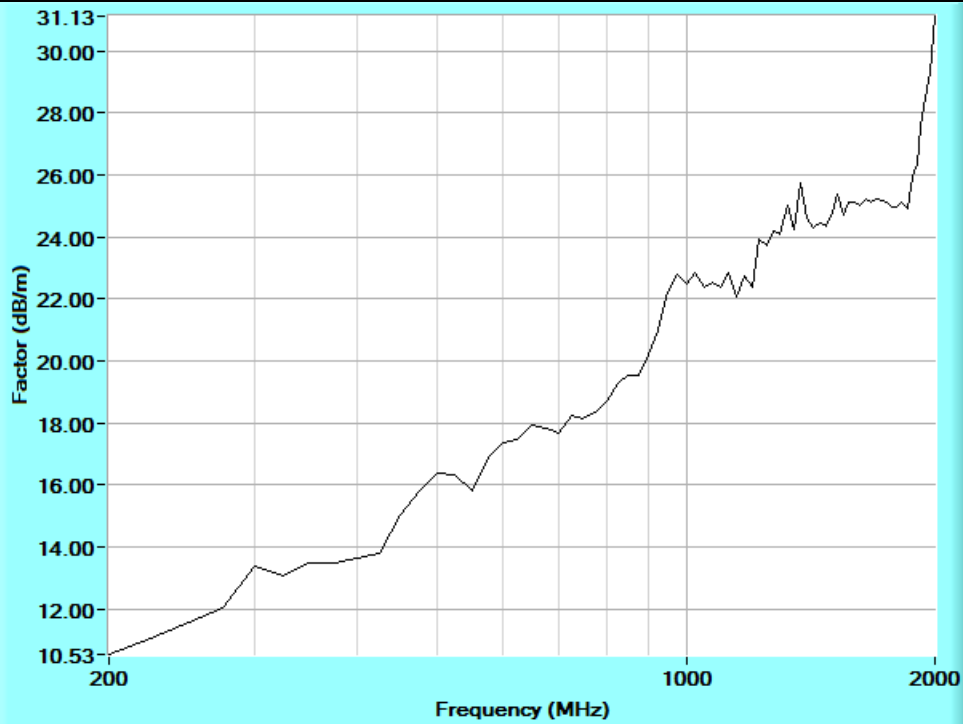
Manufacturer: Churchill Navigation
Customer Representative: Jordan Heintz
Model: ATOM, ION-R

Project Number: PR058945
Test Area: Shield Room
S/N: Atom-160010
ION - 110101

Standard Referenced: DO-160G

Date: February 27, 2017

Transducer Factors



1075, EMCO, 3106



Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

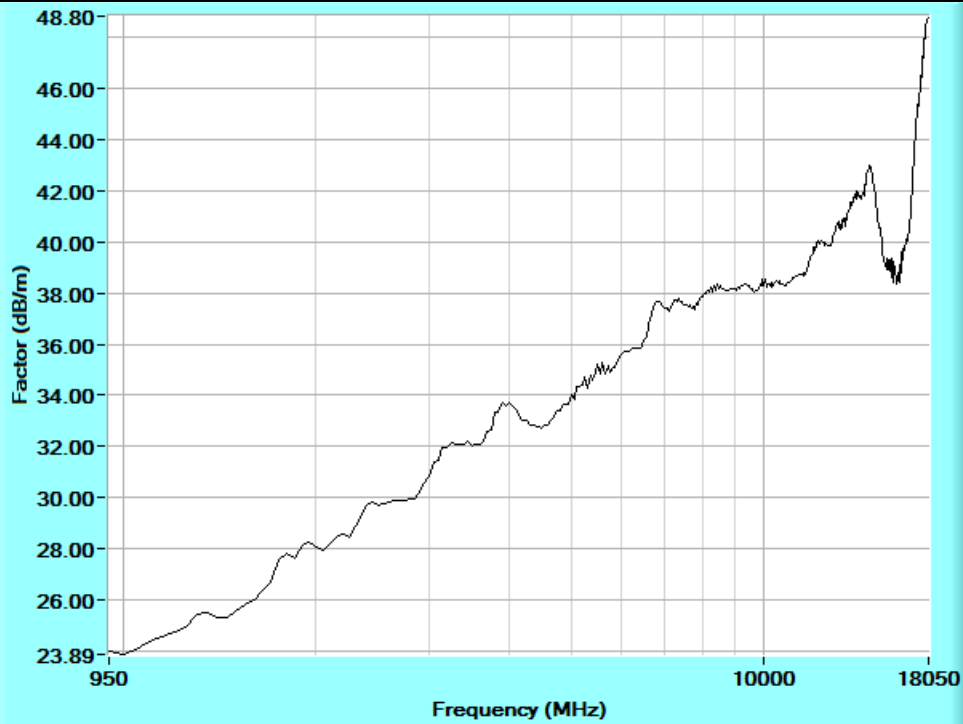
Manufacturer: Churchill Navigation
Customer Representative: Jordan Heintz
Model: ATOM, ION-R

Project Number: PR058945
Test Area: Shield Room
S/N: Atom-160010
ION - 110101

Standard Referenced: DO-160G

Date: February 27, 2017

Transducer Factors



1392, Sunol, DRH-118



Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

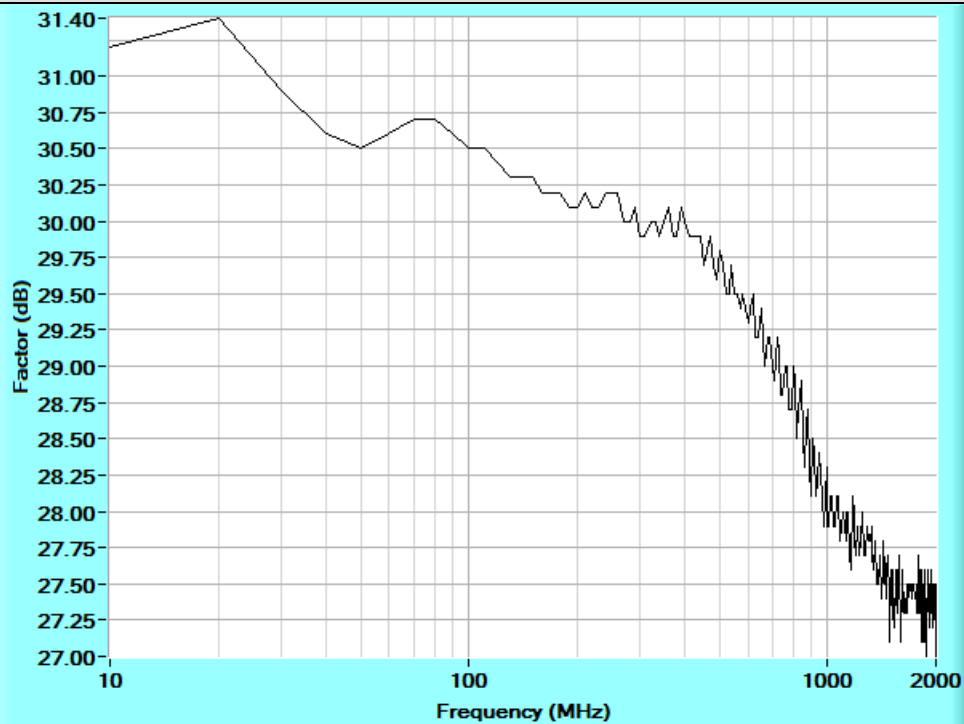
Manufacturer: Churchill Navigation
Customer Representative: Jordan Heintz
Model: ATOM, ION-R

Project Number: PR058945
Test Area: Shield Room
S/N: Atom-160010
ION - 110101

Standard Referenced: DO-160G

Date: February 27, 2017

Transducer Factors



1248, Mini-Circuits, ZKL-2



Radiated Emissions, Electric Field, 100 MHz – 6000 MHz, DO-160G, Section 21

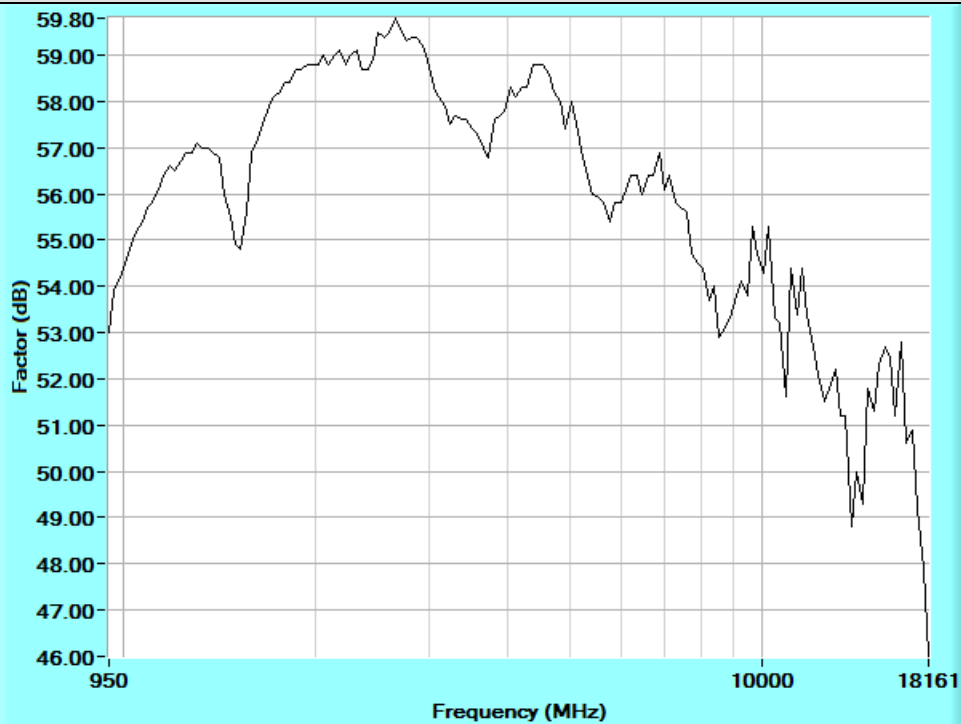
Manufacturer: Churchill Navigation
Customer Representative: Jordan Heintz
Model: ATOM, ION-R

Project Number: PR058945
Test Area: Shield Room
S/N: Atom-160010
ION - 110101

Standard Referenced: DO-160G

Date: February 27, 2017

Transducer Factors



1452, Ciao Wireless, CA118-3010

Appendix E

Electrostatic Discharge (DO-160G SEC 25) Test Data

NTS-Longmont
Test Report # TR-PR058945



Electrostatic Discharge per RTCA/DO-160G Section 25

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	160010(ATOM) / 110101 (ION)
Standard Referenced:	DO-160G	Date:	March 6, 2017
Temperature:	20.6°C	Humidity:	31.5%
Input Voltage:	28VDC	Pressure:	820 mb
Configuration of Unit:	Both systems active, Streaming video/Map overlay		
Test Engineer:	Mike Jasiewicz		
PR058945-DO-160G Sec 25.doc			FR0100

Test Location	Voltage Level (kV)	Polarity +	Polarity -	Number of Pulses	Pulses Per Second	Comments	Criteria Met	Pass / Fail
Air Discharge Points - Blue Arrows.								
ATOM								
USB left	15	x	x	10	-	-		PASS
USB right	15	x	x	10	-	-		PASS
WiFi connector	15	x	x	10	-	-		PASS
Hard drive mounting screw left	15	x	x	10	-	-		PASS
Hard drive mounting screw right	15	x	x	10	-	-		PASS
Chassis top	15	x	x	10	-	-		PASS
Chassis left side	15	x	x	10	-	-		PASS
Chassis right side	15	x	x	10	-	-		PASS
Left mounting screw	15	x	x	10	-	-		PASS
Right mounting screw	15	x	x	10	-	-		PASS
J1 connector	15	x	x	10	-	-		PASS
LED indicator	15	x	x	10	-	1 of 10 discharges had a monitor flicker at (-) 15KV, Self-recoverable		PASS
J2 connector	15	x	x	10	-	-		PASS
J3 connector	15	x	x	10	-	-		PASS
J4 connector	15	x	x	10	-	-		PASS



Electrostatic Discharge per RTCA/DO-160G Section 25

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Jordan Heintz	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	160010(ATOM) / 110101 (ION)
Standard Referenced:	DO-160G	Date:	March 6, 2017
Temperature:	20.6°C	Humidity:	31.5%
Input Voltage:	28VDC	Pressure:	820 mb
Configuration of Unit:	Both systems active, Streaming video/Map overlay		
Test Engineer:	Mike Jasiewicz		

PR058945-DO-160G Sec 25.doc

FR0100

J5 connector	15	x	x	10	-	-	PASS
J6 connector	15	x	x	10	-	-	PASS
J7 connector	15	x	x	10	-	-	PASS
J8 connector	15	x	x	10	-	-	PASS
J9 connector	15	x	x	10	-	-	PASS
Display port shield	15	x	x	10	-	-	PASS
ION							
USB 1	15	x	x	10	-	-	PASS
USB 2	15	x	x	10	-	-	PASS
Mounting screw left	15	x	x	10	-	-	PASS
Mounting screw right	15	x	x	10	-	-	PASS
Record button	15	x	x	10	-	-	PASS
Mute Button	15	x	x	10	-	-	PASS
Adjustment Knob	15	x	x	10	-	-	PASS
J1 connector	15	x	x	10	-	2 of 10 discharges had a monitor flicker at (+) 15KV, Self-recoverable	PASS
J2 connector	15	x	x	10	-	-	PASS
J3 connector	15	x	x	10	-	1 of 10 discharges had a monitor flicker at (+) 15KV, Self-recoverable	PASS
J4 connector	15	x	x	10	-	-	PASS
J5 connector	15	x	x	10	-	-	PASS
J6 connector	15	x	x	10	-	-	PASS



Electrostatic Discharge per RTCA/DO-160G Section 25

Manufacturer: Churchill Navigation
Customer Representative: Jordan Heintz
Model: ATOM, ION-R
Standard Referenced: DO-160G
Temperature: 20.6°C Humidity: 31.5%
Input Voltage: 28VDC
Configuration of Unit: Both systems active, Streaming video/Map overlay
Test Engineer: Mike Jasiewicz

Project Number: PR058945
Test Area: Shield Room
S/N: 160010(ATOM) / 110101 (ION)
Date: March 6, 2017
Pressure: 820 mb

PR058945-DO-160G Sec 25.doc

FR0100

J7 connector	15	x	x	10	-	-	PASS
J8 connector	15	x	x	10	-	-	PASS
J9 connector	15	x	x	10	-	-	PASS
J10 connector	15	x	x	10	-	-	PASS
Chassis left side	15	x	x	10	-	-	PASS
Chassis right side	15	x	x	10	-	-	PASS
LCD display	15	x	x	10	-	During both positive and negative air discharges the display shut down. 2 of 20 events, the system was still functioning without the LCD display working. 18-20 events the whole system was locked up. Both conditions required a manual power reset.	-



Electrostatic Discharge per RTCA/DO-160G Section 25

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Bill Bobrin	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	160010(ATOM) 110101 (ION)
Standard Referenced:	DO-160G	Date:	March 6, 2017

PR058945-DO-160G Sec 25.doc FR0100



Photo 1. Electrostatic Discharge Test Setup.



Electrostatic Discharge per RTCA/DO-160G Section 25

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Bill Bobrin	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	160010(ATOM) 110101 (ION)
Standard Referenced:	DO-160G	Date:	March 6, 2017
PR058945-DO-160G Sec 25.doc		FR0100	

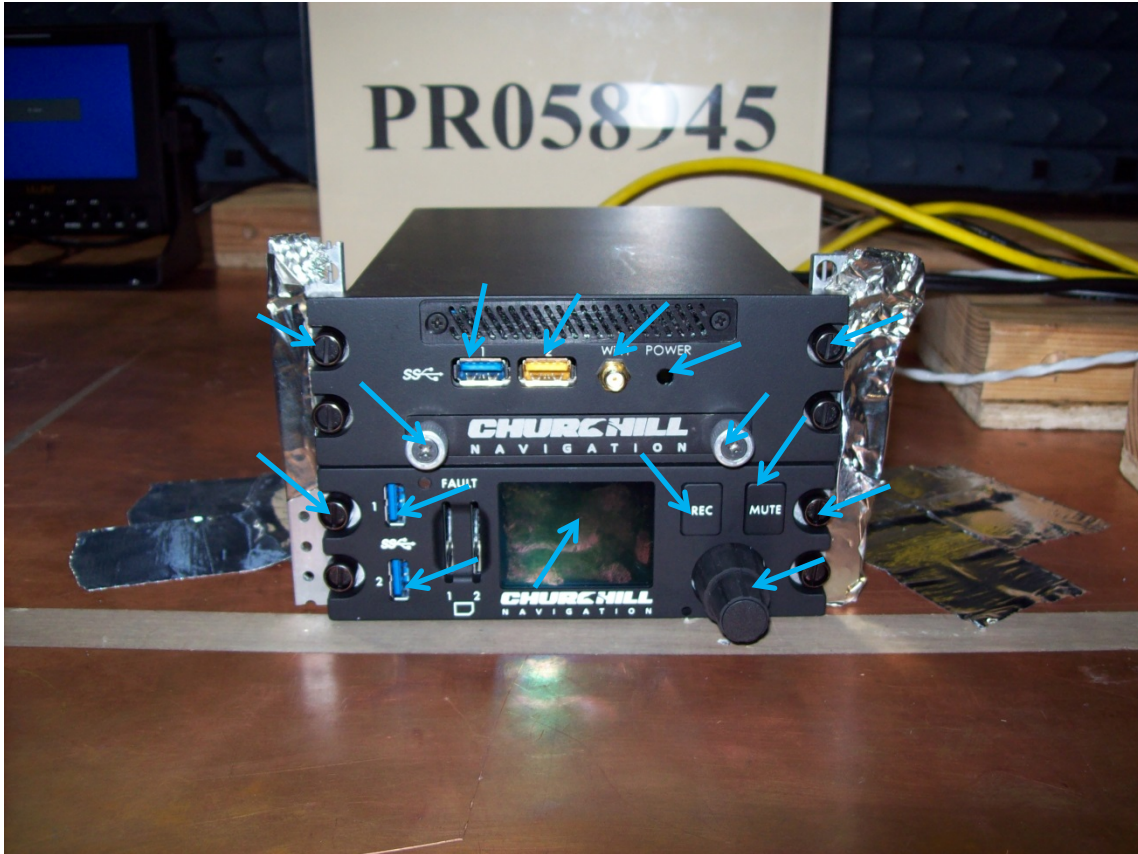


Photo 2. Electrostatic Discharge Test Setup.



Electrostatic Discharge per RTCA/DO-160G Section 25

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Bill Bobrin	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	160010(ATOM) 110101 (ION)
Standard Referenced:	DO-160G	Date:	March 6, 2017
PR058945-DO-160G Sec 25.doc		FR0100	

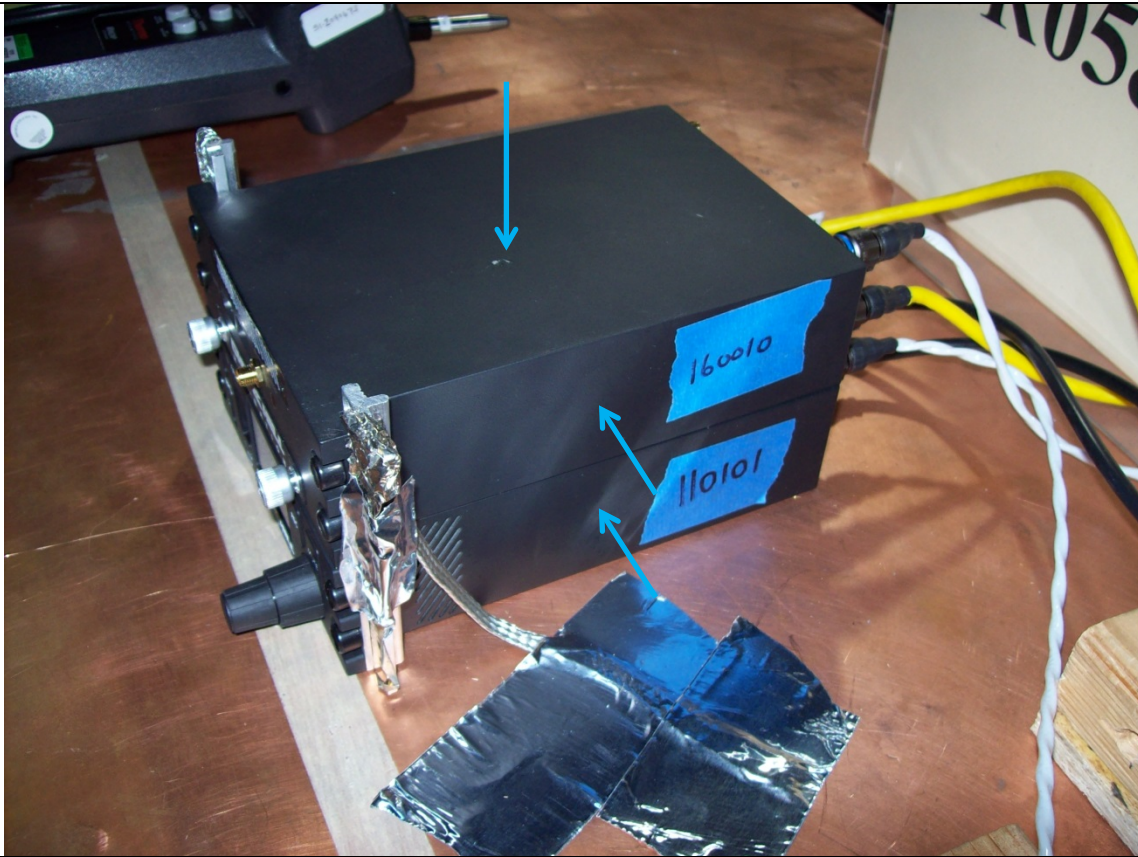


Photo 3. Electrostatic Discharge Test Setup.



Electrostatic Discharge per RTCA/DO-160G Section 25

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Bill Bobrin	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	160010(ATOM) 110101 (ION)
Standard Referenced:	DO-160G	Date:	March 6, 2017
PR058945-DO-160G Sec 25.doc		FR0100	

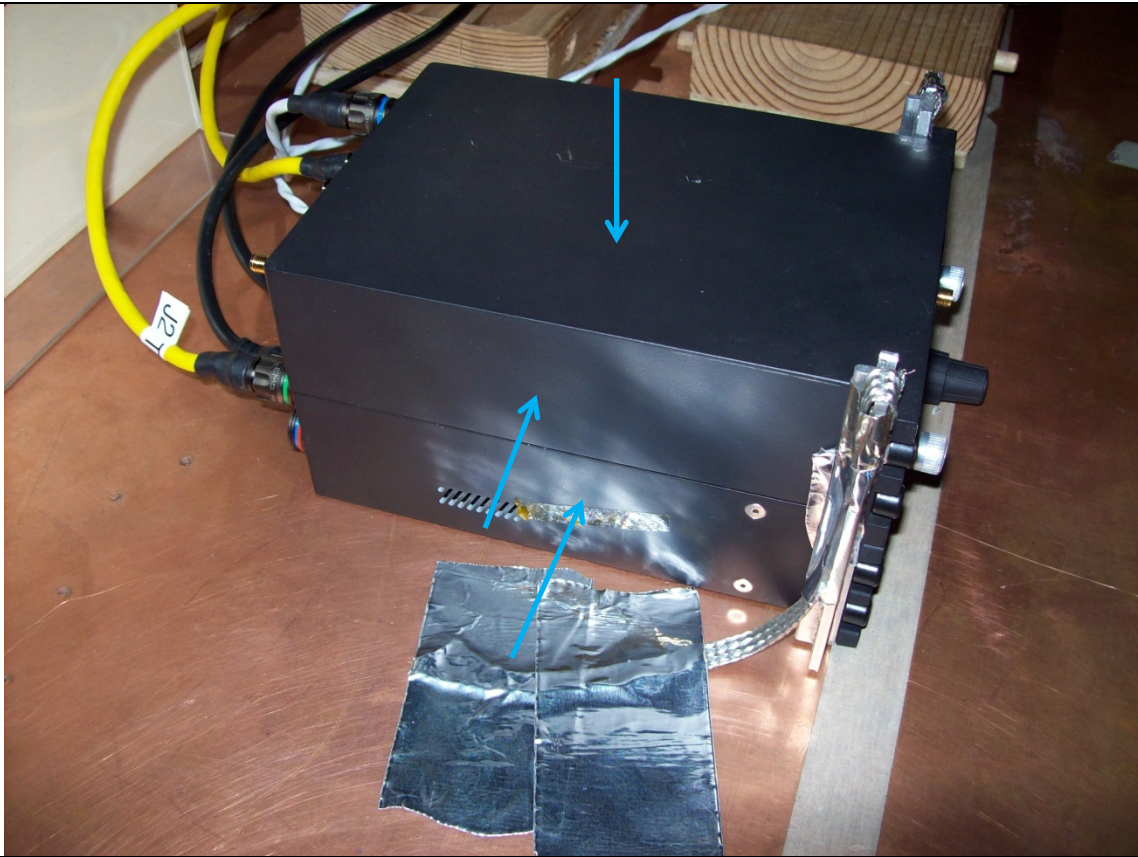


Photo 4. Electrostatic Discharge Test Setup.



Electrostatic Discharge per RTCA/DO-160G Section 25

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Bill Bobrin	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	160010(ATOM) 110101 (ION)
Standard Referenced:	DO-160G	Date:	March 6, 2017
PR058945-DO-160G Sec 25.doc		FR0100	

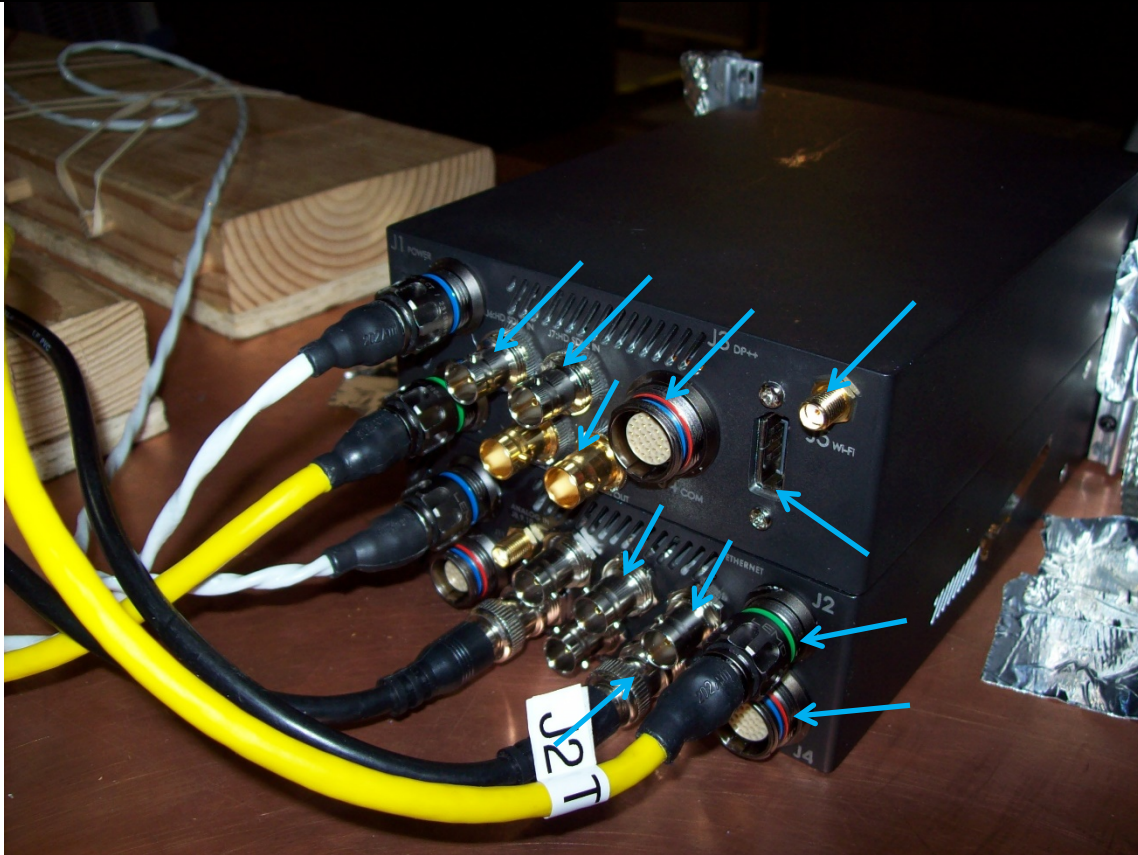


Photo 5. Electrostatic Discharge Test Setup.



Electrostatic Discharge per RTCA/DO-160G Section 25

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Bill Bobrin	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	160010(ATOM) 110101 (ION)
Standard Referenced:	DO-160G	Date:	March 6, 2017
PR058945-DO-160G Sec 25.doc		FR0100	

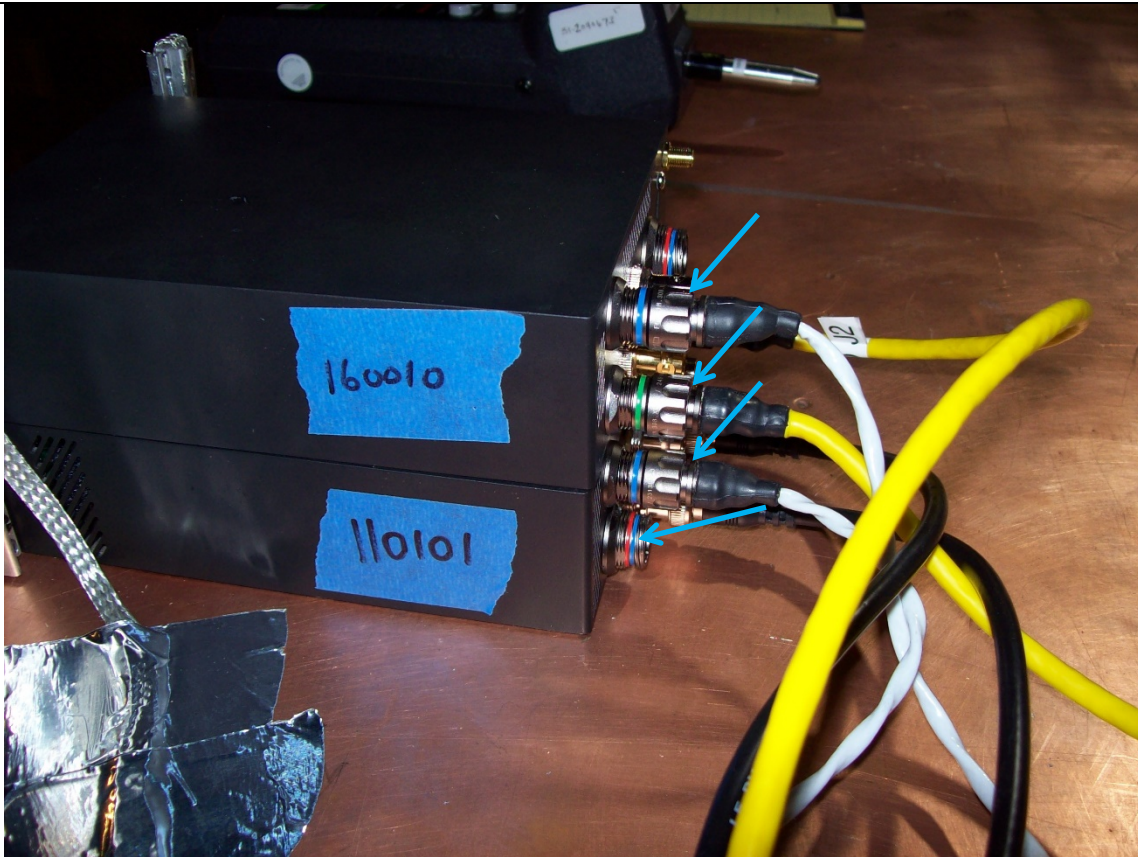


Photo 6. Electrostatic Discharge Test Setup.



Electrostatic Discharge per RTCA/DO-160G Section 25

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Customer Representative:	Bill Bobrin	Test Area:	Shield Room
Model:	ATOM, ION-R	S/N:	160010(ATOM) / 110101 (ION)
Standard Referenced:	DO-160G	Date:	March 6, 2017

PR058945-DO-160G Sec 25.doc FR0100

Test Equipment List

ID Number	Manufacturer	Model #	Serial #	Description	Cal Date	Cal Due
1190	Hewlett Packard	6268A	6M1425	DC Power Supply 40V/30A	NA	NA
1539	Extech Instruments	445715	Z316007	Hygro-Thermometer	04/19/2016	04/19/2017
1104	Ray Proof	RF Shield Room	SL2384	Semi Anechoic Lined Chamber	NA	NA
1221	EMCI	Mil-Std-461DE/LISN	007/008	LISN, Mil-Std-461 D&E, 500 VDC / 250 VAC, 16 Amps,	06/02/2016	06/02/2017
1015	KeyTek	MZ-15/EC	0010280/0010279	Mini Zap ESD Gun	08/25/2016	08/25/2017

Appendix F

EMI Test Log



EMI/ENV Test Log

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Model:	ATOM, ION-R	S/N:	ATOM - 160010 ION - 110101
Customer Representative:	Bill Kobrin		
Standard Referenced:	DO-160G		

FR0105

Shield Room

Test	Test Code	Date	Event	O T	Time (hrs)	Result	Initials
<i>The PDS incorrectly lists the EUT serial numbers as model numbers. This is not correct.</i>							
		February 27, 2017 8:12	Customer arrives.			---	MEJ
		8:13	Customer setup EUT			---	MEJ
709	DO-160G Sec 21	8:45	Begin Setup of DO-160G Section 21 Class M 1-6 GHz Vertical			---	MEJ
709	DO-160G Sec 21	9:09	Begin Signal Check DO-160G Section 21 Class M 1-6 GHz,			Good	MEJ
709	DO-160G Sec 21	9:15	Begin Ambient DO-160G Section 21 Class M 1-6 GHz,			---	MEJ
709	DO-160G Sec 21	9:25	Begin EUT Scan DO-160G Section 21 Class M 1-6 GHz, Vertical			Fail -3.34 dBuV @ 1113.886 MHz	MEJ
709	DO-160G Sec 21	9:35	Begin EUT Scan DO-160G Section 21 Class M 1-6 GHz, Horizontal			Fail -0.24 dBuV @ 1113.886 MHz	MEJ
709	DO-160G Sec 21	9:45	Begin EUT Scan DO-160G Section 21 Class M 1-6 GHz, Horizontal, ION ONLY			PASS	MEJ
709	DO-160G Sec 21	9:48	Begin EUT Scan DO-160G Section 21 Class M 1-6 GHz, Vertical, ION ONLY			PASS <1dB Margin	MEJ
709	DO-160G Sec 21	9:55	Begin EUT Scan DO-160G Section 21 Class M 1-6 GHz, Vertical, ATOM ONLY			PASS	MEJ
709	DO-160G Sec 21	9:59	Begin EUT Scan DO-160G Section 21 Class M 1-6 GHz, Horizontal, ATOM ONLY			PASS	MEJ
709	DO-160G Sec 21	10:00	Customer modifying EUT			---	MEJ
709	DO-160G Sec 21	10:33	Begin EUT Scan DO-160G Section 21 Class M 1-6 GHz, Horizontal, ATOM ONLY- Added EMI gasket			PASS	MEJ
709	DO-160G Sec 21	10:40	Begin EUT Scan DO-160G Section 21 Class M 1-6 GHz, Vertical, ATOM ONLY- Added EMI gasket			PASS	MEJ
709	DO-160G Sec 21	11:00	Begin EUT Scan DO-160G Section 21 Class M 1-6 GHz, Vertical, ION ONLY- Added EMI gasket / ION SN/ 110101			PASS	MEJ

NTS-Longmont
Test Report # TR-PR058945



EMI/ENV Test Log

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Model:	ATOM, ION-R	S/N:	ATOM – 160010 ION - 110101
Customer Representative:	Bill Kobrin		
Standard Referenced:	DO-160G		

FR0105

Shield Room

Test	Test Code	Date	Event	O T	Time (hrs)	Result	Initials
709	DO-160G Sec 21	11:06	Begin EUT Scan DO-160G Section 21 Class M 1-6 GHz, Horizontal, ION ONLY- Added EMI gasket, ION SN/ 110101			PASS	MEJ
709	DO-160G Sec 21	11:11	Begin EUT Scan DO-160G Section 21 Class M 1-6 GHz, Horizontal, Added EMI gasket, ION SN/ 110101			PASS	MEJ
709	DO-160G Sec 21	11:19	Begin EUT Scan DO-160G Section 21 Class M 1-6 GHz, Vertical, Added EMI gasket, ION SN/ 110101			PASS	MEJ
709	DO-160G Sec 21		Begin Setup of DO-160G Section 21 Class M 200-1000 MHz				MEJ
709	DO-160G Sec 21	11:39	Begin Signal Check, @ 395 MHz 200-400 MHz			Good	MEJ
709	DO-160G Sec 21		Begin Signal Check, @ 995 MHz 400-1000 MHz			Good	MEJ
709	DO-160G Sec 21		Begin Ambient Scan DO-160G Section 21 Class M 200-1000 MHz, Vertical, Added EMI gasket, ION SN/ 110101			Good	MEJ
709	DO-160G Sec 21		Begin EUT Scan DO-160G Section 21 Class M 200-1000 MHz, Vertical, Added EMI gasket, ION SN/ 110101			PASS	MEJ
709	DO-160G Sec 21	12:28	Begin Ambient Scan DO-160G Section 21 Class M 200-1000 MHz, Horizontal, Added EMI gasket, ION SN/ 110101			Good	MEJ
709	DO-160G Sec 21	12:33	Begin EUT Scan DO-160G Section 21 Class M, 200-1000 MHz, Horizontal, Added EMI gasket, ION SN/ 110101			PASS	MEJ
709	DO-160G Sec 21	12:55	Begin Signal Check, @ 195 MHz 100-200 MHz			Good	MEJ
709	DO-160G Sec 21	1:05	Begin Ambient Scan DO-160G Section 21 Class M, 100-200 MHz, Horizontal,			Good	MEJ
709	DO-160G Sec 21	1:12	Begin EUT Scan DO-160G Section 21 Class M, 100-200 MHz, Horizontal, Added EMI gasket, ION SN/ 110101			PASS	MEJ
	DO-160G Sec 21	1:20	Begin Ambient Scan DO-160G Section 21 Class M, 100-200 MHz, Vertical,			Good	MEJ
	DO-160G Sec 21						
	DO-160G Sec 21						
	DO-160G Sec 21						
709	DO-160G Sec 21	1:28	Begin EUT Scan DO-160G Section 21 Class M, 100-200 MHz, Vertical, Added EMI gasket, ION SN/ 110101			Fail	MEJ
709	DO-160G Sec 21	1:38	Begin EUT Scan DO-160G Section 21 Class M, 100-200 MHz, Vertical, Added EMI gasket ATOM only, no ferrite on 28VDC & VIB ION SN/ 110100			PASS <1dB margin	MEJ
709	DO-160G Sec 21	1:45	Begin EUT Scan DO-160G Section 21 Class M, 100-200 MHz, Vertical, Added EMI gasket, ATOM ONLY TESTED			PASS	MEJ

NTS-Longmont
Test Report # TR-PR058945



EMI/ENV Test Log

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Model:	ATOM, ION-R	S/N:	ATOM – 160010 ION - 110101
Customer Representative:	Bill Kobrin		
Standard Referenced:	DO-160G		

FR0105

Shield Room

Test	Test Code	Date	Event	O T	Time (hrs)	Result	Initials
709	DO-160G Sec 21	1:52	Begin EUT Scan DO-160G Section 21 Class M, 100-200 MHz, Vertical, <i>Added EMI gasket , ION SN/ 110101,</i> <i>Added external ferrite on Power and Video out</i>			Pass	MEJ
709	DO-160G Sec 21	2:00	Begin EUT Scan DO-160G Section 21 Class M, 100-200 MHz, Vertical, <i>Added EMI gasket , ION SN/ 110101,</i> <i>Added external ferrite on Power</i>			PASS	MEJ
709	DO-160G Sec 21	2:06	Begin EUT Scan DO-160G Section 21 Class M, 100-200 MHz, Vertical, <i>Added EMI gasket , ION SN/ 110101,</i> <i>Added external ferrite on Video out</i>			PASS	MEJ
709	DO-160G Sec 21	2:14	Begin EUT Scan DO-160G Section 21 Class M, 100-200 MHz, Vertical, <i>Added EMI gasket on ATOM , ION SN/ 110100,</i> <i>Added external ferrite on Video out</i>			PASS	MEJ
709	DO-160G Sec 21	2:19	Begin EUT Scan DO-160G Section 21 Class M, 100-200 MHz, Horizontal, <i>Added EMI gasket on ATOM , ION SN/ 110100,</i> <i>Added external ferrite on Video out</i>			PASS	MEJ
709	DO-160G Sec 21	2:30	Begin EUT Scan DO-160G Section 21 Class M, 1000-6000 MHz, Horizontal, <i>Added EMI gasket on ATOM , ION SN/ 110100,</i> <i>Added external ferrite on Video out</i>			PASS	MEJ
709	DO-160G Sec 21	2:40	Begin EUT Scan DO-160G Section 21 Class M, 1000-6000 MHz, Vertical, <i>Added EMI gasket on ATOM , ION SN/ 110100,</i> <i>Added external ferrite on Video out</i>			PASS	MEJ
709	DO-160G Sec 21	2:49	Begin EUT Scan DO-160G Section 21 Class M, 1000-6000 MHz, Vertical, <i>ION SN/ 110100,</i> <i>Added external ferrite on Video out</i>			PASS	MEJ
709	DO-160G Sec 21	2:54	Begin EUT Scan DO-160G Section 21 Class M, 1000-6000 MHz, Horizontal, <i>ION SN/ 110100,</i> <i>Added external ferrite on Video out</i>			PASS	MEJ

NTS-Longmont
Test Report # TR-PR058945



EMI/ENV Test Log

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Model:	ATOM, ION-R	S/N:	ATOM – 160010 ION - 110101
Customer Representative:	Bill Kobrin		
Standard Referenced:	DO-160G		

FR0105

Shield Room

Test	Test Code	Date	Event	O T	Time (hrs)	Result	Initials
709	DO-160G Sec 21	3:13	Begin EUT Scan DO-160G Section 21 Class M, 200-1000 MHz, Vertical, <i>ION SN/ 110100,</i> <i>Added external ferrite on Video out</i>			FAIL	MEJ
709	DO-160G Sec 21	3:35	Begin EUT Scan DO-160G Section 21 Class M, 200-1000 MHz, Vertical, <i>ION ONLY ION SN/ 110100,</i> <i>Added external ferrite on Video out</i>			PASS	MEJ
709	DO-160G Sec 21	3:48	Begin EUT Scan DO-160G Section 21 Class M, 200-1000 MHz, Vertical, <i>Added EMI gasket on ATOM , ION SN/ 110100,</i> <i>Added external ferrite on Video</i>			---	MEJ
709	DO-160G Sec 21	3:55	Begin EUT Scan DO-160G Section 21 Class M, 200-1000 MHz, Horizontal, <i>Added EMI gasket on ATOM , ION SN/ 110100,</i> <i>Added external ferrite on Video</i>			---	MEJ
709	DO-160G Sec 21	4:30	END OF DAY		8	---	MEJ
		March 6, 2017 31.2 % 8:30	Customer arrives			----	MEJ
		8:35	Begin Test setup <i>ATOM SN/ 160010 ION SN/ 110101</i>			---	MEJ
709	DO-160G Sec 17	8:45	Begin Section 17 Test Setup			---	MEJ
709	DO-160G Sec 17	9:30	Begin Section 17 Test Positive - ATOM			PASS	MEJ
709	DO-160G Sec 17	9:32	Begin Section 17 Test Negative - ATOM			PASS	MEJ
709	DO-160G Sec 17	9:36	Begin Section 17 Test Positive - ION			PASS	MEJ
709	DO-160G Sec 17	9:38	Begin Section 17 Test Negative - ION			PASS	MEJ
709	DO-160G Sec 25	9:53	Begin Setup Section 25			---	MEJ

NTS-Longmont
Test Report # TR-PR058945



EMI/ENV Test Log

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Model:	ATOM, ION-R	S/N:	ATOM – 160010 ION - 110101
Customer Representative:	Bill Kobrin		
Standard Referenced:	DO-160G		

FR0105

Shield Room

Test	Test Code	Date	Event	O T	Time (hrs)	Result	Initials
709	DO-160G Sec 25	10:00	Begin ESD Testing			System locked up during LCD discharges + & -. Manual power reset needed	MEJ
709	DO-160G Sec 25	11:35	End ESD Testing			---	MEJ
		11:40	Compiling ESD datasheet			---	MEJ
		12:00	LUNCH			---	MEJ
		12:30	Begin DO-160G Sec 15 test setup			---	MEJ
		12:50	Run DO-160G Sec 15 test			----	MEJ
		1:00	End of Sec 15 testing			Unit classified as cat Z. <30cm	MEJ
		1:15	Customer leaves		4		
		March 17, 2017 8:15am 841mbar	Customer arrives.			---	MEJ
		8:20	Begin EUT Setup				MEJ
		8:40	Begin DO160G Section 16.6.1.2. ripple,			PASS	MEJ
			Begin DO160G Section 16.6.1.3b. Momentary Power interrupts			Pass	MEJ
		9:20	Begin DO160G Section 16.6.1.3c. Momentary Power interrupts			PASS	MEJ
		9:23	Begin DO160G Section 16.6.1.3d. Momentary Power interrupts			PASS	MEJ
		9:44	Begin DO160G Section 16.6.1.4b. Momentary Power interrupts			PASS	MEJ
		9:55	Begin DO160G Section 16.6.2.1. Abnormal operating voltage			PASS	MEJ
		10:07	Begin DO160G Section 16.6.2.3. Momentary Under voltage			PASS	MEJ
		10:12	Begin DO160G Section 16.6.2.4c. Abnormal Surge Voltage			PASS	MEJ
		10:23	Begin DO160G Section 16.6.1.1b. Normal operating Voltage			PASS	MEJ



EMI/ENV Test Log

Manufacturer:	Churchill Navigation	Project Number:	PR058945
Model:	ATOM, ION-R	S/N:	ATOM – 160010 ION - 110101
Customer Representative:	Bill Kobrin		
Standard Referenced:	DO-160G		

FR0105

Shield Room

Test	Test Code	Date	Event	O T	Time (hrs)	Result	Initials
		11:28	Begin DO160G Section 16.6.1.1b (3). Emergency operating Voltage			PASS	MEJ
		12:04	END OF DAY		4		MEJ

Regular hours:	
Overtime/Prem hours:	
Total hours:	

Appendix G

Laboratory Accreditations

NTS-Longmont
Test Report # TR-PR058945

American Association for Laboratory Accreditation



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

NATIONAL TECHNICAL SYSTEMS (NTS) - LONGMONT
1736 Vista View Drive
Longmont, CO 80504-5242
Mr. Eric Loucks Phone: 303 776 7249

ELECTRICAL

Valid To: February 28, 2018

Certificate Number: 0214.43

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following Electromagnetic Compatibility/Interference (EMC/EMI), Lightning, Transient, Surge, and Product Safety tests:

Test Technology:

Test Method(s)^{1,2}:

Emissions

Radiated and Conducted

CFR 47 FCC, Parts 15B (using ANSI C63.4:2003, 2009, and 2014),
15C (using ANSI C63.10:2013), and 18 (using MP-5);
CISPR 32, Ed. 1 (2012-01); EN 55032:2012/AC:2013;
AS/NZS CISPR 22 (2002); AS/NZS 3548 (1997);
AS/NZS CISPR 14-1 (2003); IEC/CISPR 14-1, Ed. 4 (2003);
IEC 61000-3-12, Ed. 2.0 (2011); EN 61000-3-12 (2011);
IEC 61000-6-1, Ed. 2 (2005-03); IEC 61000-6-2, Ed. 2.0 (2005-01);
IEC 61000-6-3 (1996); EN 61000-6-3 (2001) + A1 (2004);
EN 61000-6-4 (2007); KN 32:2015 (Annex 11); KN 22; KN 11

Harmonics

IEC 61000-3-2, Ed. 2.2 (2004-11);
IEC 61000-3-2, Ed. 3.0 (2005) + A1 (2008) + A2 (2009);
IEC 61000-3-2, Ed. 4.0 (2014-05)

Flicker

IEC 61000-3-3, Ed. 1.1 (2002-03); EN 61000-3-3 + A1 (2001);
IEC 61000-3-3, Ed. 1.1 (2003) + A2 (2005);
IEC 61000-3-3, Ed. 3.0 (2013-05)

Immunity

Electrostatic Discharge (ESD)

IEC 61000-4-2 (2001); EN 61000-4-2 (2001) + A2 (2001);
EN 61000-4-2 + A1 (1998) + A2 (2001);
IEC 61000-4-2, Ed. 2.0 (2008-12); EN 61000-4-2 (2009-05);
KN 61000-4-2; KN 61000-4-2 (2008-5); KN 61000-4-2 (Annex 1-1)

Radiated

IEC/EN 61000-4-3, Ed. 2.1 (2002) + A1 (2002); EN 61000-4-3;
IEC 61000-4-3 (1995) + A1 (1998) + A2 (2000);
EN 61000-4-3 (2002) + A1 (2002);
IEC 61000-4-3, Ed. 3.0 (2006-02) + A1 (2007) + A2 (2010);
EN 61000-4-3 (2006) + A1 (2008) + A2 (2010);
KN 61000-4-3; KN 61000-4-3 (2008-5); KN 61000-4-3 (Annex 1-2)

(A2LA Cert. No. 0214.43) 10/28/2016

Page 1 of 3

5202 Presidents Court, Suite 220 | Frederick, MD 21703-8398 | Phone: 301 644 3248 | Fax: 240 454 9449 | www.A2LA.org

NTS-Longmont
Test Report # TR-PR058945

Test Technology:

Test Method(s)^{1,2}:

Immunity (cont'd)

Electrical Fast Transient/Burst

IEC 61000-4-4, Ed. 2.0 (2004-07); EN 61000-4-4 (2004);
EN 61000-4-4:2012; IEC 61000-4-4 (2012-04);
KN 61000-4-4; KN 61000-4-4 (2008-5);
KN 61000-4-4 (Annex 1-3)

Surge

IEC 61000-4-5, Ed. 2.0 (2005-11); EN 61000-4-5;
IEC 61000-4-5, Ed. 3.0 (May 2014); BS EN 61000-4-5 (2006);
EN 61000-4-5: 2014; KN 61000-4-5; KN 61000-4-5 (2008-5);
KN 61000-4-5 (Annex 1-4)

Conducted

IEC 61000-4-6, Ed. 2.1 (2004); EN 61000-4-6;
EN 61000-4-6 (1996) + A1 (2001);
IEC 61000-4-6, Ed. 2.2 (2006-05); IEC 61000-4-6, Ed. 3.0 (2008);
IEC 61000-4-6, Ed. 4.0 (2013); EN 61000-4-6 (2009);
EN 61000-4-6 (2014); KN 61000-4-6; KN 61000-4-6 (2008-5);
KN 61000-4-6 (Annex 1-5)

Power Frequency Magnetic Field

IEC 61000-4-8 (2001) + A1 (2000);
EN 61000-4-8 (2001) + A1 (2000);
EN 61000-4-8 (1993) + A1 (2001); IEC 61000-4-8 (2009);
EN 61000-4-8:2010; KN 61000-4-8; KN 61000-4-8 (2008-5);
KN 61000-4-8 (Annex 1-6)

Voltage Dips, Short
Interruptions, and Voltage
Variations

IEC 61000-4-11, Ed. 2 (2004-03); EN 61000-4-11;
EN 61000-4-11 (1994) + A1 (2001); EN 61000-4-11 (2004);
KN 61000-4-11; KN 61000-4-11 (2008-5);
KN 61000-4-11 (Annex 1-7)

Product Safety

Medical Electrical
Equipment

IEC 60601-1-2, Ed. 3.0 (2007); KN 60601-1-2 (2008-5);
IEC 60601-1-2, Ed. 4, (2014-02); EN 60601-1-2 (2007);
EN 60601-1-2 (2015)

***Generic/Product Family Standards
and Industry Standards***

Generic Standards

EN 61326-1: 2013; KN 35: 2015

Information Technology
Equipment

IEC/CISPR 22 (1997); EN 55022 (1998) + A1 (2000);
IEC/CISPR 22 (1993); EN 55022 (1994);
IEC/CISPR 22 (1993); EN 55022 (1994) + A1 (1995) + A2 (1997);
CNS 13438 (1997);
IEC/CISPR 22, Ed. 4 (2003-04); EN 55022 (1998);
IEC/CISPR 22, Ed. 5 (2005); EN 55022 (1998);
IEC/CISPR 22, Ed. 5 (2005) + A1 (2005);
EN 55022 (1998) + A1 (2000) + A2 (2003);
CNS 13438 (2006) (up to 6GHz);
IEC/CISPR 22, Edition 5.2 (2006-03); EN 55022 (2006);
EN 55022 (2006) + A1 (2007); EN 55022:2010;

(A2LA Cert. No. 0214.43) 10/28/2016



Page 2 of 3

NTS-Longmont
Test Report # TR-PR058945

Test Technology:

Test Method(s)^{1,2}:

***Generic/Product Family Standards
and Industry Standards (cont'd)***

Information Technology
Equipment (cont'd)

IEC/CISPR 22 (2008-09); AS/NZS CISPR 22 (2009);
TCVN 7189:2009 (CISPR 22:2006);
VCCI V-3 (2009.04, 2011.04, 2013.04, 2014.04, 2015.04) (up to 6
GHz); CISPR 24 Ed 2.0 (2010-08); EN 55024 (2010);
KN 24

Industrial, Scientific, and
Medical (ISM) Equipment

AS/NZS CISPR 11 (2002); IEC/CISPR 11, Ed. 4.1 (2004-06);
AS/NZS CISPR 11 (2004);
IEC/CISPR 11, Ed. 4.1 (2004-06) + A1 (2004);
EN 55011 (1998) + A1 (1999) + A2 (2002);
IEC/CISPR 11 (2003); EN 55011 (1998) + A2(2002);
EN 55011 (2009) + A1 (2010); IEC/CISPR 11 Ed. 5 (2009-05);
CISPR 11 Ed. 5.1 (2010)

Measure

IEC 61326-1 Ed. 2.0 (2012)

Military/Defense

MIL-STD-461F Method CE101 (30 Hz to 10 kHz);
MIL-STD-461F Method CE102 (10 kHz to 10 MHz);
MIL-STD-461F Method CE106 (10 kHz to 40 GHz);
MIL-STD-461F Method CS101 (30 Hz to 150 kHz);
MIL-STD-461F Method CS106;
MIL-STD-461F Method CS114 (10 kHz to 200 MHz);
MIL-STD-461F Method CS116 (10 kHz to 100 MHz);
MIL-STD-461F Method RE101 (30 Hz to 100 kHz);
MIL-STD-461F Method RE102 (10 kHz to 18 GHz);
MIL-STD-461F Method RE103 (10 kHz to 40 GHz);
MIL-STD-461F Method RS101 (30 Hz to 100 kHz);
MIL-STD-461F Method RS103 (2 MHz to 40 GHz)

¹ When the date, revision or edition of a test method standard is not identified on the scope of accreditation, the laboratory is required to be using the current version within one year of the date of publication, per part C., Section 1 of A2LA R101 - *General Requirements- Accreditation of ISO-IEC 17025 Laboratories*. If a specifier/regulator imposes a different transition period, this will supersede the A2LA one-year implementation period.

² The laboratory is only accredited for testing activities outlined within the test methods listed above. Reference to any other activity within these standards, such as risk management or risk assessment, does not fall within the laboratory's accredited capabilities.

On the following types of products:

Telecommunication Equipment, Network Equipment, Industrial and Commercial Equipment, Electronic (Digital) Equipment, Medical, Aerospace, Military. Information Technology Equipment, Multimedia Equipment, Scientific Equipment

(A2LA Cert. No. 0214.43) 10/28/2016



Page 3 of 3



Accredited Laboratory

A2LA has accredited

NATIONAL TECHNICAL SYSTEMS (NTS) - LONGMONT

Longmont, CO

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *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 8 January 2009).



Presented this 28th day of October 2016.

A handwritten signature in blue ink, appearing to read 'J. C. Burt'.

Senior Director of Quality and Communications
For the Accreditation Council
Certificate Number 0214.43
Valid to February 28, 2018

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

End of Report