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Report On

EMC Testing of the
SRT Marine Technology Ltd
AtoN TRS-418-0003

COMMERCIAL-IN-CONFIDENCE

Document 75917597 Report 09 Issue 2

November 2012



Product Service

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COMMERCIAL-IN-CONFIDENCE

REPORT ON

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SRT Marine Technology Ltd
AtoN TRS-418-0003


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DATED

12 November 2012

This report has been up-issued to Issue 2 to correct the model number.





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Product Service

SECTION 1

REPORT SUMMARY

EMC Testing of the
SRT Marine Technology Ltd
AtoN TRS-418-0003



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the SRT Marine Technology Ltd, AtoN TRS-418-0003 to the requirements of IEC 60945: C1 2008.

Objective	To perform Electromagnetic Compatibility (EMC) Qualification Approval Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	SRT Marine Technology Limited
Model Number(s)	TRS-418-0003
Customer Declared Variant(s)	TR-418-0001
Part No(s)	TRS-418-0003 & TR-418-0001
Serial Number(s)	P216FTU-30, P216FTU-39
Software Version	080200.00.09.11
Number of Samples Tested	2
Test Specification/Issue/Date	IEC 60945: C1 2008
Incoming Release Date	Declaration of Build Status 12 October 2012
Order Number Date	POR003047 22 March 2012
Start of Test	09 October 2012
Finish of Test	01 November 2012
Name of Engineer(s)	P Joynson A R Hubbard
Related Document(s)	CISPR 16-1-2 : 2006 CISPR 16-1-2 : 2006 CISPR 16-1-4 : 2006 IEC 61000-4-6 : 2006 IEC 61000-4-3 : 2006 IEC 61000-4-11 : 2004 IEC 61000-4-2 : 2001 IEC 61000-4-4 : 2004 + A1 : 2010



1.2 BRIEF SUMMARY OF RESULTS

A brief summary of results in accordance with IEC 60945: C1 2008.is shown below.


Configuration 1 - As supplied						
Section	Spec Clause	Test Description	Mode	Mod State	Result	Base Standard
	Table 5, 9.2	Conducted Emissions (AC Power Port)	No GPS signal, waiting to TX		N/A	CISPR 16-1-2
			GPS signal present and TX		N/A	
2.1	Table 5, 9.2	Conducted Emissions (DC Power Port)	No GPS signal, waiting to TX	0	Pass	CISPR 16-1-2
			GPS signal present and TX	0	Pass	
	Table 5, 9.3	Enclosure Port Magnetic Emissions - Field Strength	No GPS signal, waiting to TX		N/R	CISPR 16-1-2
			GPS signal present and TX		N/R	
	Table 5, 9.3	Radiated Emissions (Enclosure Port)	No GPS signal, waiting to TX		N/R	CISPR 16-1-4
			GPS signal present and TX		N/R	
	Table 6, 10.3	Immunity to Radio Frequency Common Mode (AC Power Port)	No GPS signal, waiting to TX		N/A	IEC 61000-4-6
			GPS signal present and TX		N/A	
2.2	Table 6, 10.3	Immunity to Radio Frequency Common Mode (DC Power Port)	No GPS signal, waiting to TX	0	Pass	IEC 61000-4-6
			GPS signal present and TX	0	Pass	
2.3	Table 6, 10.3	Immunity to Radio Frequency Common Mode (Signal, Control and Telecommunications Port)	No GPS signal, waiting to TX	0	Pass	IEC 61000-4-6
			GPS signal present and TX	0	Pass	
2.4	Table 6, 10.4	Immunity to Radio Frequency Electromagnetic Field (Enclosure Port)	No GPS signal, waiting to TX	0	Pass	IEC 61000-4-3
			GPS signal present and TX	0	Pass	



Configuration 1 - As supplied						
Section	Spec Clause	Test Description	Mode	Mod State	Result	Base Standard
	Table 6, 10.5	Immunity to Fast Transient Bursts Common Mode (AC Power Port)	No GPS signal, waiting to TX		N/A	IEC 61000-4-4
			GPS signal present and TX		N/A	
2.5	Table 6, 10.5	Immunity to Fast Transient Bursts Common Mode (Signal, Control and Telecommunications Port)	No GPS signal, waiting to TX	0	Pass	IEC 61000-4-4
			GPS signal present and TX	0	Pass	
	Table 6, 10.6	Immunity to Surges (AC Power Port)	No GPS signal, waiting to TX		N/A	IEC 61000-4-5
			GPS signal present and TX		N/A	
	Table 6, 10.7	Immunity to Power Supply Short Term Variation (AC Power Ports)	No GPS signal, waiting to TX		N/A	IEC 61000-4-11
			GPS signal present and TX		N/A	
	Table 6, 10.8	Immunity to Interruptions (AC Power Port)	No GPS signal, waiting to TX		N/A	IEC 61000-4-11
			GPS signal present and TX		N/A	
2.6	Table 6, 10.8	Immunity to Interruptions (DC Power Port)	No GPS signal, waiting to TX	0	Pass	IEC 61000-4-11
			GPS signal present and TX	0	Pass	
2.7	Table 6, 10.9	Immunity to Electrostatic Discharge (Enclosure Port)	No GPS signal, waiting to TX	0	Pass	IEC 61000-4-2
			GPS signal present and TX	0	Pass	

N/A – Not Applicable; N/R – Not Requested; N/T – Not Tested

1.3 DECLARATION OF BUILD STATUS

Manufacturer	<u>SRT Marine Ltd</u>
Country of origin	<u>United Kingdom</u>
UK Agent	<u>SRT Marine Ltd</u>
Technical Description	<u>AtoN (Aids to Navigation)</u>
Model No	<u>TRS & TR</u>
Part No	<u>418-0003 & 418-0001</u>
Serial No	<u>Sample 1- P216-FTU-20, Sample 2- P216-FTU-21, Sample 3- P216-FTU-30.</u>
Drawing Number	<u>418-0003 & 418-0001</u>
Build Status	<u>Mod 11 (supplied)</u>
Software Issue	<u>080200.00.09.11</u>
IC ID	<u>7075A-4180003</u>
FCC ID	<u>UYW-418-0003</u>
Signature	
	<u>Richard McMahon</u>
Date	<u>12th October 2012</u>

Note: This document has been prepared to enable manufacturers with no mechanism for producing their own Declaration of Build Status, to declare the build state of the equipment submitted for test.

No responsibility will be accepted by TÜV Product Service as to the accuracy of the information declared in this document by the manufacturer.

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a SRT Marine Technology Ltd, AtoN TRS-418-0003 as shown in the photograph below. A full technical description can be found in the manufacturer's documentation.



Equipment Under Test (AtoN)

1.4.2 Test Configuration

Configuration 1: EUT

The EUT was powered by a 24V DC supply for all tests with the exception of DC voltage interrupts that was performed at the lower voltage range of 12V DC.

A GPS simulator was used for mode 2. A class A AIS receiver was connected to a laptop to monitor and record all transmission data (AIVDM and AIVDO).

1.4.3 EUT Cable / Port Identification

Port	Max Cable Length specified	Usage	Type	Screened
Power / Data	1.5m	DC / Data	Multi-core	Yes

1.4.4 Modes of Operation

Mode 1 - No GPS signal, waiting to TX

Mode 2 - GPS signal present and TX

1.4.5 Monitoring of Performance

The EUT was monitored via a class A AIS receiver connected to a laptop and all transmission data was recorded.

1.4.6 Performance Criteria

IEC 60945

Performance criterion A: the EUT shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed, as defined in the relevant equipment standard and in the technical specification published by the manufacturer.

Performance criterion B: the EUT shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed, as defined in the relevant equipment standard and in the technical specification published by the manufacturer. During the test, degradation or loss of function or performance which is self-recoverable is however, allowed, but no change of actual operating state or stored data is allowed.

Performance criterion C: temporary degradation or loss of function or performance is allowed during the test, provided the function is self-recoverable, or can be restored at the end of the test by the operation of the controls, as defined in the relevant equipment standard and in the technical specification published by the manufacturer.

1.5 TEST CONDITIONS

For all tests the EUT was set up in accordance with the relevant test standard and to represent typical operating conditions. Tests were applied with the EUT situated in a shielded enclosure, test laboratories or an open test area as appropriate.

The EUT was powered from a 24V DC supply.

Test Results

EN 60945, Clause 5.3 states:

The measured test results shall be compared with the corresponding acceptable performance limits and the EUT shall pass the test only if the measured performance margin is favourable and greater than the measurement uncertainty. The test report shall show, for each test measurement, the test result, its associated measurement uncertainty, the acceptable performance limits, and the acceptable performance margin, as applicable.

The tests detailed in this report met the above test requirements.

1.6 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standards or test plan were made during testing.

1.7 MODIFICATION RECORD

No modifications were made to the EUT during testing.

SECTION 2

TEST DETAILS

EMC Testing of the
SRT Marine Technology Ltd
AtoN TRS-418-0003

2.1 CONDUCTED EMISSIONS (DC POWER PORT)

2.1.1 Specification Reference

IEC 60945. Table 5, Clause 9.2

2.1.2 Equipment Under Test

AtoN, S/N: P216FTU030.

2.1.3 Date of Test and Modification State

12 to 19 October 2012 - Modification State 0

2.1.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of CISPR 16-1-2.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1
- Mode 2

2.1.6 Environmental Conditions

	12 October 2012	19 October 2012
Ambient Temperature	19.8°C	18°C
Relative Humidity	44%	48%
Atmospheric Pressure	1006mbar	1002mbar

2.1.7 Test Results

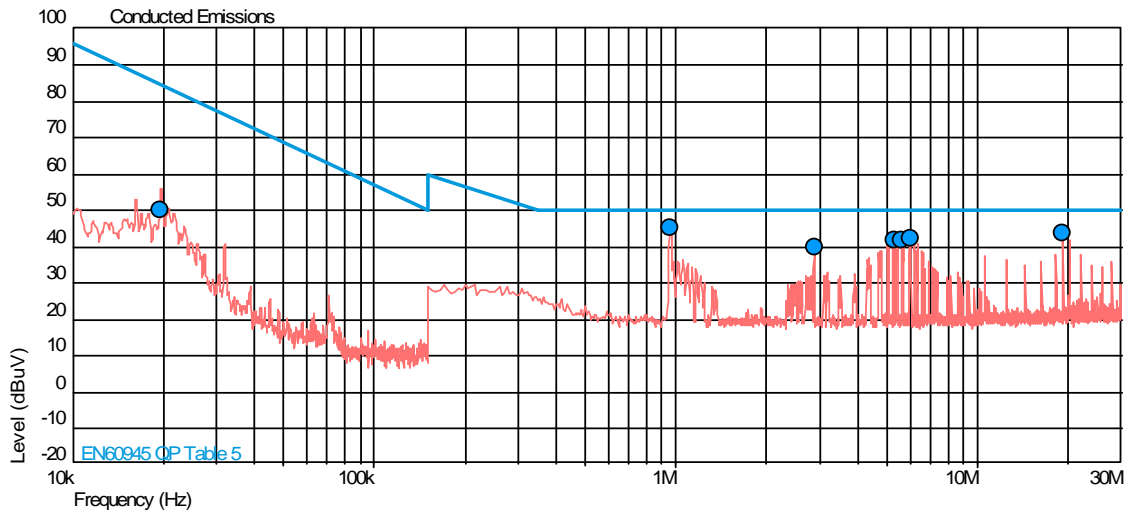
For the period of test the EUT met the requirements of IEC 60945 for Conducted Emissions (DC Power Port)

The EUT was powered by 24V DC

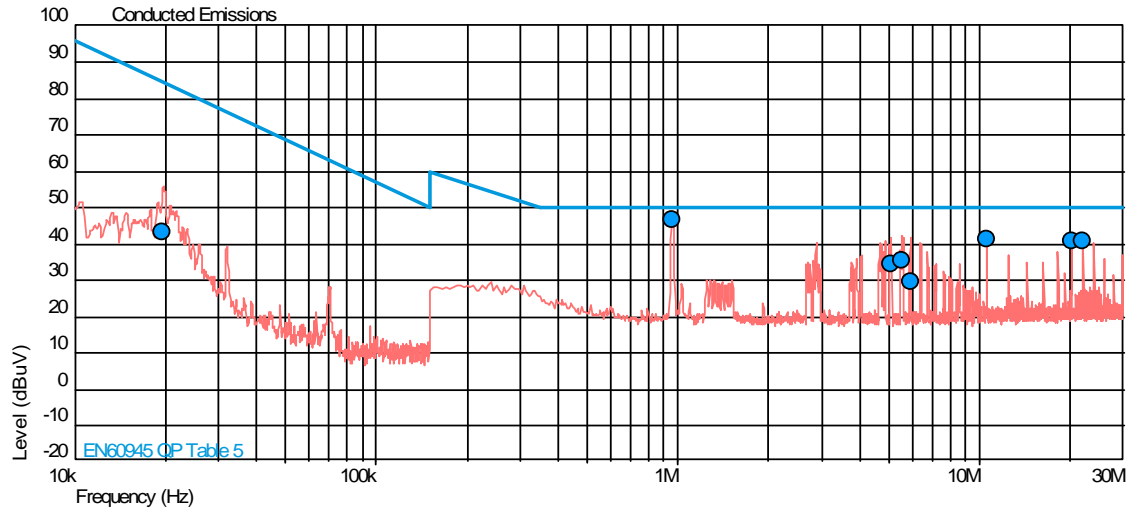
The test results are shown below.

Configuration 1 - Mode 1

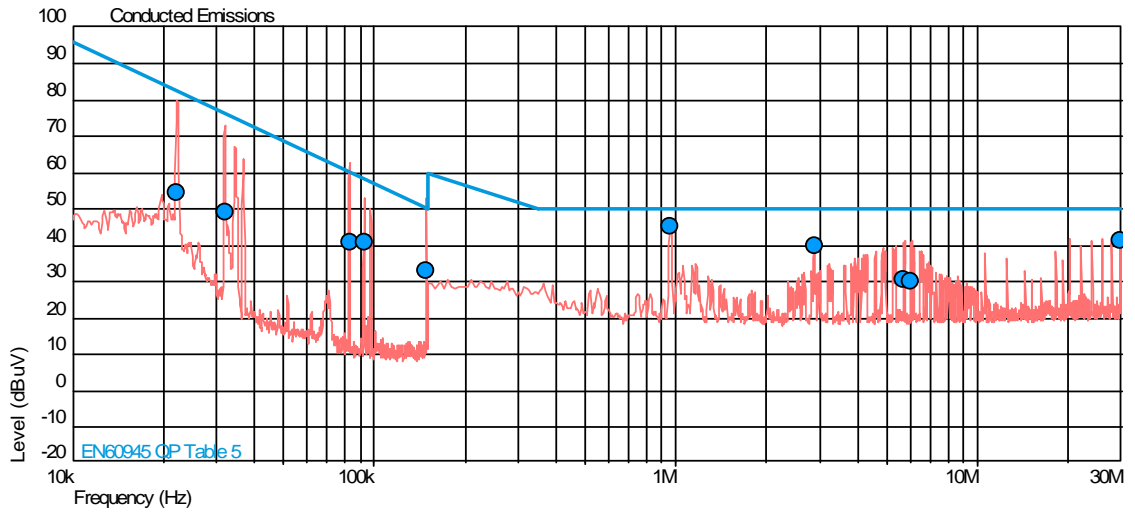
+24V DC Line Results



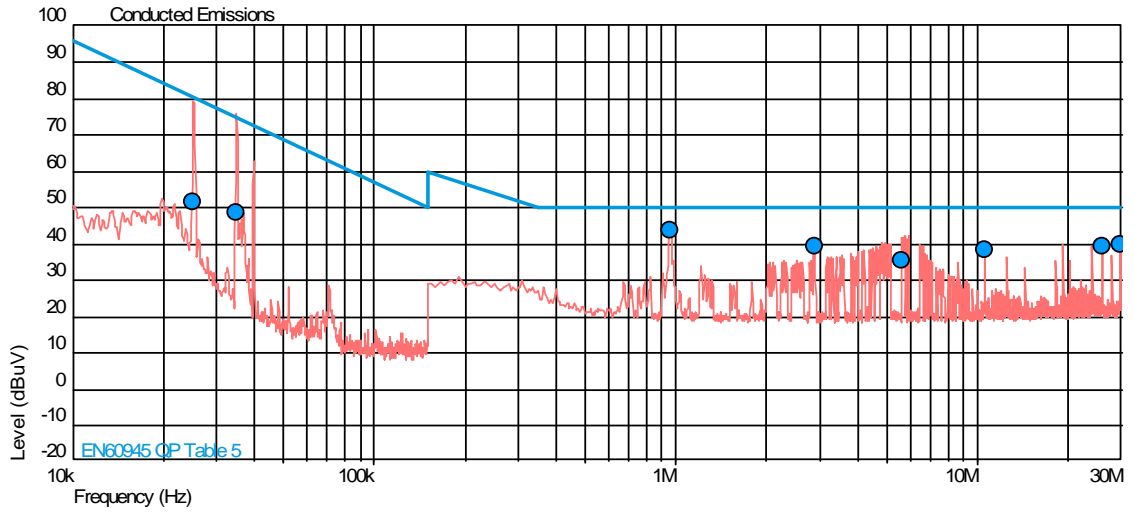
Frequency (MHz)	QP Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)
0.020	50.2	84.6	-34.4
0.960	45.2	50.0	-4.8
2.880	39.8	50.0	-10.2
5.280	41.5	50.0	-8.5
5.585	41.7	50.0	-8.3
5.970	42.1	50.0	-7.9
19.200	43.6	50.0	-6.4

0V DC Line Results

Frequency (MHz)	QP Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)
0.020	43.4	84.6	-41.2
0.960	46.6	50.0	-3.4
5.085	34.4	50.0	-15.6
5.510	35.5	50.0	-14.5
5.890	29.5	50.0	-20.5
10.559	41.2	50.0	-8.8
20.161	40.6	50.0	-9.4
22.081	40.6	50.0	-9.4

Configuration 1 - Mode 2+24V DC Line Results

Frequency (MHz)	QP Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)
0.022	54.3	82.5	-28.2
0.032	49.0	76.2	-27.3
0.083	40.5	60.1	-19.6
0.093	40.8	58.2	-17.4
0.149	33.1	50.1	-16.9
0.960	44.9	50.0	-5.1
2.880	39.7	50.0	-10.3
5.660	30.5	50.0	-19.5
6.010	29.9	50.0	-20.1
29.759	41.2	50.0	-8.8

0V DC Line Results

Frequency (MHz)	QP Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)
0.025	51.7	80.3	-28.6
0.035	48.6	74.7	-26.2
0.960	43.9	50.0	-6.1
2.880	39.2	50.0	-10.8
5.625	35.4	50.0	-14.6
10.559	38.3	50.0	-11.7
25.919	39.0	50.0	-11.0
29.759	39.7	50.0	-10.3

2.2 IMMUNITY TO RADIO FREQUENCY COMMON MODE (DC POWER PORT)

2.2.1 Specification Reference

IEC 60945. Table 6, Clause 10.3

2.2.2 Equipment Under Test

AtoN, S/N: P216FTU030

2.2.3 Date of Test and Modification State

09 October 2012 - Modification State 0

2.2.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of IEC 61000-4-6.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1
 - Mode 2

2.2.6 Environmental Conditions

	09 October 2012
Ambient Temperature	21.3°C
Relative Humidity	47%
Atmospheric Pressure	1010mbar

2.2.7 Test Results

For the period of test the EUT continued to operate as intended and therefore met the requirements of IEC 60945 for Immunity to Radio Frequency Common Mode (DC Power Port).

Note that this test was performed using an EM Clamp to the combined Power/Control Cable.

The applied test levels are shown below.

Configuration 1 - Mode 1

Port Under Test	Test Level (Vrms)	Freq. Range	Modulation/Freq Depth	Step Size	Dwell Time	Coupling Method	Interference Return Path	Result
Power/Control	3V	150kHz to 80MHz	AM, 400Hz, 80%	1%	3 s	EM Clamp	None	Pass
Power/Control	10V	Spot Frequencies	AM, 400Hz, 80%	1%	3 s	EM Clamp	None	Pass
Spot Frequencies: 2 MHz, 3 MHz, 4 MHz, 6,2 MHz, 8,2 MHz, 12,6 MHz, 16,5 MHz, 18,8 MHz, 22 MHz and 25 MHz.								

Configuration 1 - Mode 2

Port Under Test	Test Level (Vrms)	Freq. Range	Modulation/Freq Depth	Step Size	Dwell Time	Coupling Method	Interference Return Path	Result
Power/Control	3V	150kHz to 80MHz	AM, 400Hz, 80%	1%	3 s	EM Clamp	None	Pass
Power/Control	10V	Spot Frequencies	AM, 400Hz, 80%	1%	3 s	EM Clamp	None	Pass
Spot Frequencies: 2 MHz, 3 MHz, 4 MHz, 6,2 MHz, 8,2 MHz, 12,6 MHz, 16,5 MHz, 18,8 MHz, 22 MHz and 25 MHz.								

**2.3 IMMUNITY TO RADIO FREQUENCY COMMON MODE
(SIGNAL, CONTROL AND TELECOMMUNICATIONS PORT)**

2.3.1 Specification Reference

IEC 60945. Table 6, Clause 10.3

2.3.2 Equipment Under Test

AtoN, S/N: P216FTU030

2.3.3 Date of Test and Modification State

09 October 2012 - Modification State 0

2.3.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.3.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of IEC 61000-4-6.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1
 - Mode 2

2.3.6 Environmental Conditions

09 October 2012

Ambient Temperature 21.3°C

Relative Humidity 47%

Atmospheric Pressure 1010mbar

2.3.7 Test Results

For the period of test the EUT continued to operate as intended and therefore met the requirements of IEC 60945 for Immunity to Radio Frequency Common Mode (Signal, Control and Telecommunications Port).

The applied test levels are shown below.

Configuration 1 - Mode 1

Port Under Test	Test Level (Vrms)	Freq. Range	Modulation/Freq Depth	Step Size	Dwell Time	Coupling Method	Interference Return Path	Result
Power/Control	3V	150kHz to 80MHz	AM, 400Hz, 80%	1%	3 s	EM Clamp	None	Pass
Power/Control	10V	Spot Frequencies	AM, 400Hz, 80%	1%	3 s	EM Clamp	None	Pass
Spot Frequencies: 2 MHz, 3 MHz, 4 MHz, 6,2 MHz, 8,2 MHz, 12,6 MHz, 16,5 MHz, 18,8 MHz, 22 MHz and 25 MHz.								

Configuration 1 - Mode 2

Port Under Test	Test Level (Vrms)	Freq. Range	Modulation/Freq Depth	Step Size	Dwell Time	Coupling Method	Interference Return Path	Result
Power/Control	3V	150kHz to 80MHz	AM, 400Hz, 80%	1%	3 s	EM Clamp	None	Pass
Power/Control	10V	Spot Frequencies	AM, 400Hz, 80%	1%	3 s	EM Clamp	None	Pass
Spot Frequencies: 2 MHz, 3 MHz, 4 MHz, 6,2 MHz, 8,2 MHz, 12,6 MHz, 16,5 MHz, 18,8 MHz, 22 MHz and 25 MHz.								

2.4 IMMUNITY TO RADIO FREQUENCY ELECTROMAGNETIC FIELD (ENCLOSURE PORT)**2.4.1 Specification Reference**

IEC 60945. Table 6, Clause 10.4

2.4.2 Equipment Under Test

AtoN, S/N: P216FTU030, P216FTU039

2.4.3 Date of Test and Modification State

10 October to 01 November 2012 - Modification State 0

2.4.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.4.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of IEC 61000-4-3.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1
- Mode 2

2.4.6 Environmental Conditions

	10 October 2012	23 October 2012	24 October 2012
Ambient Temperature	22.9°C	22°C	23°C
Relative Humidity	45%	52%	40%
Atmospheric Pressure	1010mbar	1017mbar	1017mbar
	31 October 2012	01 November 2012	
Ambient Temperature	19°C	21°C	
Relative Humidity	42%	41%	
Atmospheric Pressure	1017mbar	997mbar	

2.4.7 Test Results

For the period of test the EUT continued to operate as intended and therefore met the requirements of IEC 60945 for Immunity to Radio Frequency Electromagnetic Field (Enclosure Port).

The applied test levels are shown below.

Configuration 1 - Mode 1

Amplitude Modulation	Frequency	400Hz	
	Depth	80%	
Stepped Frequency Increments		1% with respect to last momentary frequency	
Dwell Time		3 Seconds (80-1000MHz) 9 seconds (1-2GHz)	
Frequency Range (MHz)		80 – 1000	
Field Strength (V/m)		10 + MU	
Frequency Range (MHz)		1000 – 2000	
Field Strength (V/m)		10 + MU	
		Result	
Orientation of EUT		Vertical Polarisation	Horizontal Polarisation
Front (inc cables)		Pass	Pass
Right		Pass	Pass
Rear		Pass	Pass
Left		Pass	Pass
Top		Pass	Pass

Configuration 1 - Mode 2

Amplitude Modulation	Frequency	400Hz	
	Depth	80%	
Stepped Frequency Increments		1% with respect to last momentary frequency	
Dwell Time		3 Seconds (80-1000MHz) 9 seconds (1-2GHz)	
Frequency Range (MHz)		80 – 1000	
Field Strength (V/m)		10 + MU	
Frequency Range (MHz)		1000 – 2000	
Field Strength (V/m)		10 + MU	
		Result	
Orientation of EUT		Vertical Polarisation	Horizontal Polarisation
Front (inc cables)		Pass	Pass
Right		Pass	Pass
Rear		Pass	Pass
Left		Pass	Pass
Top		Pass	Pass

2.5 IMMUNITY TO FAST TRANSIENT BURSTS COMMON MODE (SIGNAL, CONTROL AND TELECOMMUNICATIONS PORT)

2.5.1 Specification Reference

IEC 60945. Table 6, Clause 10.5

2.5.2 Equipment Under Test

AtoN, S/N: P216FTU030

2.5.3 Date of Test and Modification State

11 October 2012 - Modification State 0

2.5.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.5.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of IEC 61000-4-4.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1
- Mode 2

2.5.6 Environmental Conditions

11 October 2012

Ambient Temperature 25.2°C

Relative Humidity 47.4%

Atmospheric Pressure 997mbar

2.5.7 Test Results

For the period of test the EUT continued to operate as intended and therefore met the requirements of IEC 60945 for Immunity to Fast Transient Bursts Common Mode (Signal, Control and Telecommunications Port).

The applied test levels are shown below.

Configuration 1 - Mode 1

Cables Under Test	Test Level (±kV)	Repetition Rate (kHz)	Test Duration (seconds)	Coupling Method	Result
Power/Control	0.5	5	4 each polarity	Capacitive Clamp	Pass
Power/Control	1.0	5	4 each polarity	Capacitive Clamp	Pass

Configuration 1 - Mode 2

Cables Under Test	Test Level (±kV)	Repetition Rate (kHz)	Test Duration (minutes)	Coupling Method	Result
Power/Control	0.5	5	4 each polarity	Capacitive Clamp	Pass
Power/Control	1.0	5	4 each polarity	Capacitive Clamp	Pass

2.6 IMMUNITY TO INTERRUPTIONS (DC POWER PORT)

2.6.1 Specification Reference

IEC 60945. Table 6, Clause 10.8

2.6.2 Equipment Under Test

AtoN, S/N: P216FTU030

2.6.3 Date of Test and Modification State

11 October 2012 - Modification State 0

2.6.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.6.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of IEC 61000-4-11.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1
 - Mode 2

2.6.6 Environmental Conditions

11 October 2012

Ambient Temperature 25.2°C

Relative Humidity 47.4%

Atmospheric Pressure 997mbar

2.6.7 Test Results

For the period of test the EUT continued to operate as intended and therefore met the requirements of IEC 60945 for Immunity to Interruptions (DC Power Port).

The applied test levels are shown below.

Configuration 1 - Mode 1

Operating Voltage - Vnom V	Operating Frequency Hz	Duration		Performance Criteria	Result
		Periods	ms		
12V DC	N/A	N/A	1000	C	Pass

Configuration 1 - Mode 2

Operating Voltage - Vnom V	Operating Frequency Hz	Duration		Performance Criteria	Result
		Periods	ms		
12V DC	N/A	N/A	1000	C	Pass

2.7 IMMUNITY TO ELECTROSTATIC DISCHARGE (ENCLOSURE PORT)

2.7.1 Specification Reference

IEC 60945. Table 6, Clause 10.9

2.7.2 Equipment Under Test

AtoN, S/N: P216FTU030

2.7.3 Date of Test and Modification State

11 October 2012 - Modification State 0

2.7.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.7.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of IEC 61000-4-2.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1
 - Mode 2

2.7.6 Environmental Conditions

11 October 2012

Ambient Temperature 26.5°C

Relative Humidity 45.35 - 45.5%

Atmospheric Pressure 995mbar

2.7.7 Test Results

For the period of test the EUT continued to operate as intended and therefore met the requirements of IEC 60945 for Immunity to Electrostatic Discharge (Enclosure Port).

The applied test levels are shown below.

Configuration 1 - Mode 1

		Contact Discharges (kV)								Air Discharge (kV)							
		2		4		6		8		2		4		8		15	
Test Points		+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-
Horizontal Coupling Plane		✓	✓	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vertical Coupling Plane		✓	✓	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
A	Fixing Screws	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
B	Fixing Screws	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C	Bird Deflectors	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D	Cables	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A
E	Case Seams	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A
F	Case Seams	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A
G	Case Seams	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A

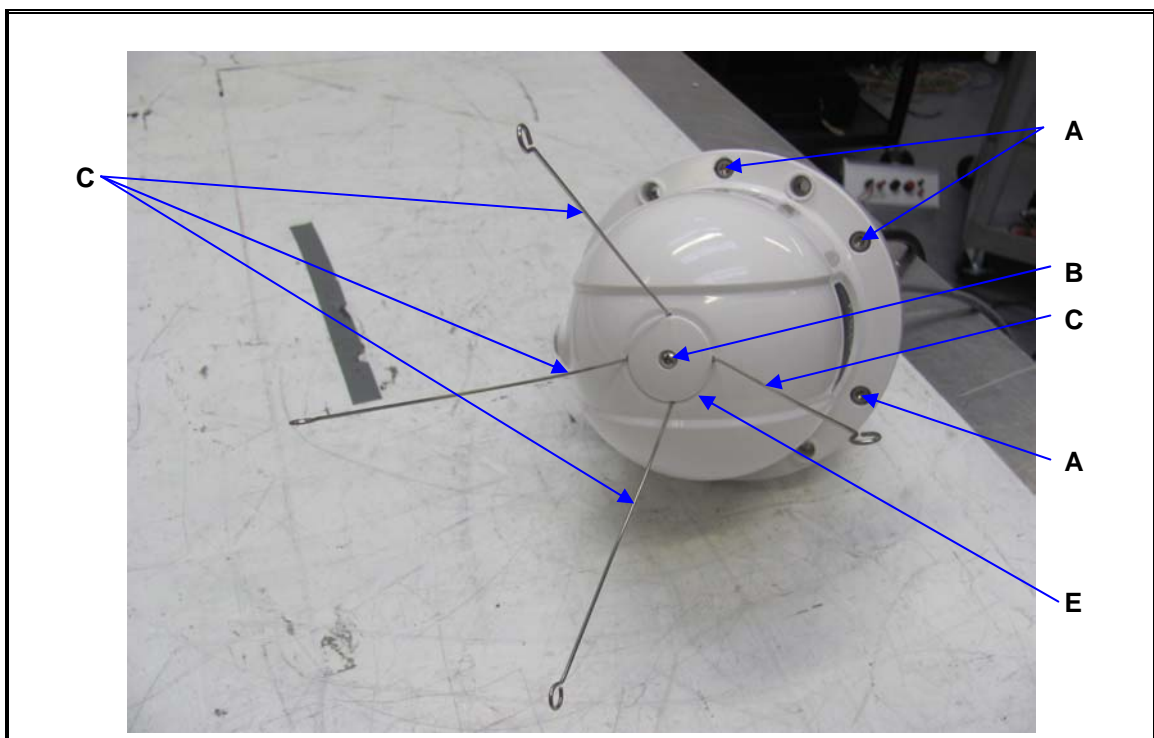
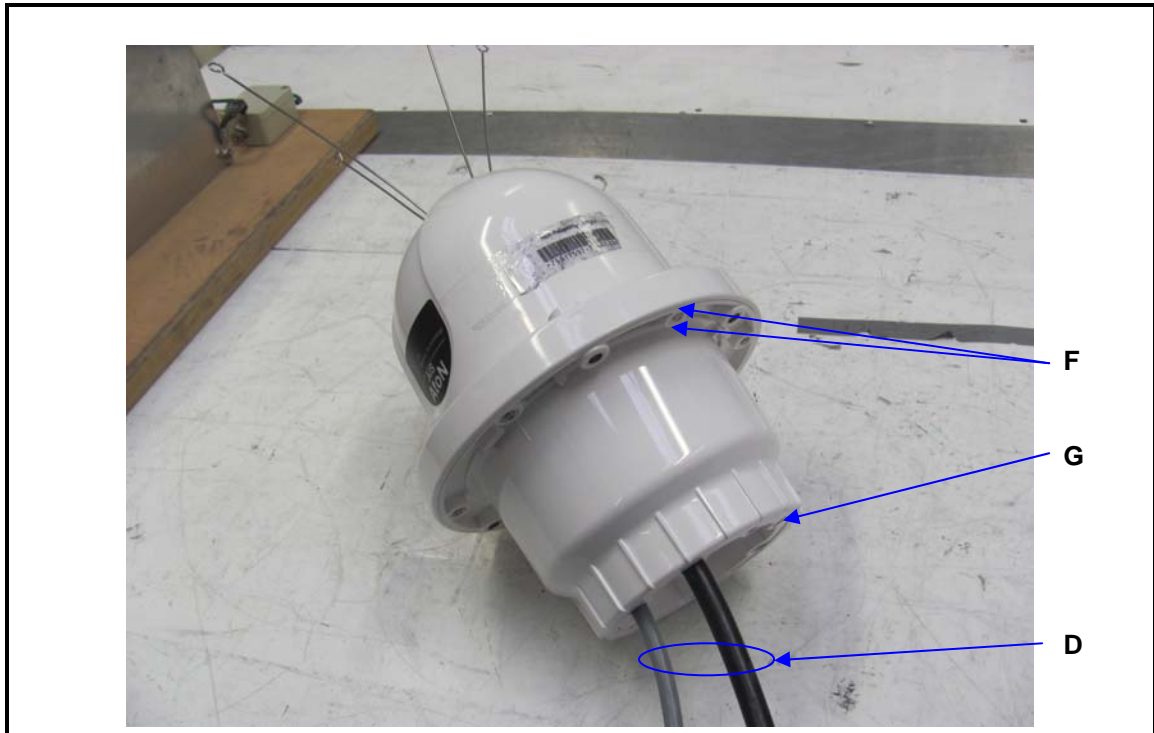
Configuration 1 - Mode 2

		Contact Discharges (kV)								Air Discharge (kV)							
		2		4		6		8		2		4		8		15	
Test Points		+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-
Horizontal Coupling Plane		✓	✓	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vertical Coupling Plane		✓	✓	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
A	Fixing Screws	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
B	Fixing Screws	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C	Bird Deflectors	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
D	Cables	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A
E	Case Seams	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A
F	Case Seams	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A
G	Case Seams	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A

Key to Results

- ✓ The EUT's performance was not impaired at this test point when the ESD pulse was applied.
- ✓* No discharge occurred at this test point when the ESD pulse was applied.
- N/A Test not applicable as defined in the specification.

ESD TEST POINTS – CONFIGURATION 1



SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.1 EMC - Conducted Emissions					
3 Phase Artificial Mains Network (LISN)	Rohde & Schwarz	ESH2-Z5	16	12	17-Apr-2013
3 phase LISN	Rohde & Schwarz	ESH2-Z5	323	12	13-Jan-2013
Transient Limiter	Hewlett Packard	11947A	1032	12	28-Jun-2013
Screened Room (2)	Rainford	Rainford	1542	-	TU
Screened Room (5)	Rainford	Rainford	1545	36	25-Dec-2013
Test Receiver	Rohde & Schwarz	ESIB40	1934	12	25-Oct-2012
Transient Limiter	Hewlett Packard	11947A	2377	12	20-Dec-2012
Termination (50ohm)	JFW	50T-054	3952	12	13-Jun-2013
Section 2.3 & 2.3 EMC - Conducted Immunity					
Load (50ohm)	Diamond Antenna	DL-30N	217	12	8-May-2013
Calibration Fixture (x2)	MEB Messelektronik	KEMZ-801	229	-	TU
EMI RF Generator	Schaffner	NSG2070-400	2215	12	12-Jul-2013
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3162	12	27-Jun-2013
EM Clamp	Teseq	KEMZ 801S	3373	-	TU
CDN, 16A, switchable M2 or M3	Teseq	CDN M016	3666	12	12-Oct-2012
Attenuator	Teseq	ATN 6075	3979	12	3-Aug-2013
Section 2.7 EMC - Electrostatic Discharges					
ESD Simulator	Schaffner	NSG 435+SL 171-504	552	12	22-Aug-2013
Digital Multimeter	Iso-tech	IDM-101	2895	12	18-Apr-2013
Section 2.5 EMC - Fast Transient Bursts					
Capacitive Coupling Clamp	Omiran	EFTC 105	298	-	TU
Conducted Immunity Test System	Schaffner	BEST EMC	1935	12	4-Nov-2012
Section 2.4 EMC - Radiated Immunity					
Load (50ohm, 30W)	Weinschel	50T-054	275	-	TU
Directional Coupler	Amp Research	DC6180	283	-	TU
Antenna (Bilog)	Schaffner	CBL6143	316	-	TU
Antenna	Schaffner	CBL6143	322	-	TU
Termination (50ohm)	Meca	405-1	718	12	13-Jun-2013
Power Meter	Rohde & Schwarz	NRVD	748	-	TU
Screened Room (1)	Rainford	Rainford	1541	-	TU
Screened Room (2)	Rainford	Rainford	1542	-	TU
CW TWT (1-2.5GHz)	Thorn	PTC6341	2069	-	TU
Laser Powered Electric Field Sensor	Dare Development	RadiSense VI - CTR1001A	2149	12	2-Aug-2013
RF Power Amplifier	Amp Research	250W1000A	2844	-	TU
Amplifier (250W, 80MHz)	Amp Research	250W1000A	3029	-	TU

- 1GHz)					
Signal Generator, 9kHz to 6GHz	Rohde & Schwarz	SMB 100A	3499	12	29-May-2013
Microwave Amplifier 1GHz - 2.5GHz; 500W; CW	Thorn	PTC6440	3736	-	TU
Power Sensor; 100kHz - 6GHz/500pW - 20mW	Rohde & Schwarz	NRV-Z4	3815	-	TU
Power Sensor: 100kHz - 6GHz/100pW - 20mW	Rohde & Schwarz	NRV-Z4	3816	-	TU
Section 2.6 EMC - Voltage Dips, Interruptions and Variations					
DC Power Supply	Hewlett Packard	6269B	742	-	TU
All Sections - Used As EUT Drive Equipment					
Attenuator 30dB 250W	Weinschel	45-30-43	382	12	7-Feb-2013
Attenuator 20dB 250W	Weinschel	45-20-43	388	12	27-Jun-2013
GPS/SBAS Simulator	Spirent	STR4500	3056	-	TU
Attenuator (30dB, 250W)	Weinschel	45-30-43	3071	12	14-Jun-2013

TU – Traceability Unscheduled

OP MON – Output Monitored with Calibrated Equipment

3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:-

Test Discipline	Frequency / Parameter	MU
Radiated Emissions, Bilog Antenna, AOATS	30MHz to 1GHz Amplitude	5.2dB*
Radiated Emissions, Horn Antenna, AOATS	1GHz to 40GHz Amplitude	6.3dB*
Conducted Emissions, LISN	150kHz to 30MHz Amplitude	3.2dB*
Conducted Emissions, ISN	150kHz to 30MHz Amplitude	2.1dB
Substitution Antenna, Radiated Field	30MHz to 18GHz Amplitude	2.6dB
Discontinuous Interference	150kHz to 30MHz Amplitude	3.0dB*
Interference Power	30MHz to 300MHz Amplitude	3.0dB*
Radiated E-Field Susceptibility	10MHz to 6GHz Test Amplitude	2.0dB†
Conducted Susceptibility RF	50kHz to 1000MHz Amplitude	3.1dB•
	EM Clamp Method of Test	1.2dB•
	CDN Method of Test	1.1dB•
	BCI Clamp Method of Test	1.2dB•
Conducted Susceptibility LF	DC to 150kHz	1.0%†
Power Frequency Magnetic Field	50Hz/60Hz Amplitude	0.45%
Magnetic Emissions	9kHz to 30MHz Amplitude	3.4dB*
Magnetic Field/Flux iaw EN 50366	10Hz to 400kHz	2.64%
Harmonics and Flicker	The test was applied using proprietary equipment that meets the requirements of EN 61000-3-2 and EN 61000-3-3	—
Mains Voltage Variations and Interrupts	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-11	—
Fast Transient Burst	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-4	—
Electrostatic Discharge	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-2	—
Surge	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-5	—
Vehicle Transients	The test was applied using proprietary equipment that meets the requirements of ISO 7637-1 and 2	—
Compass Safe Distance	Azimuth Accuracy	0.10°

Worst case error for both Time and Frequency measurement 12 parts in 10^6 .

- * In accordance with CISPR 16-4-2
- † In accordance with UKAS Lab 34
- In accordance with EN 61000-4-6: 2009

SECTION 4

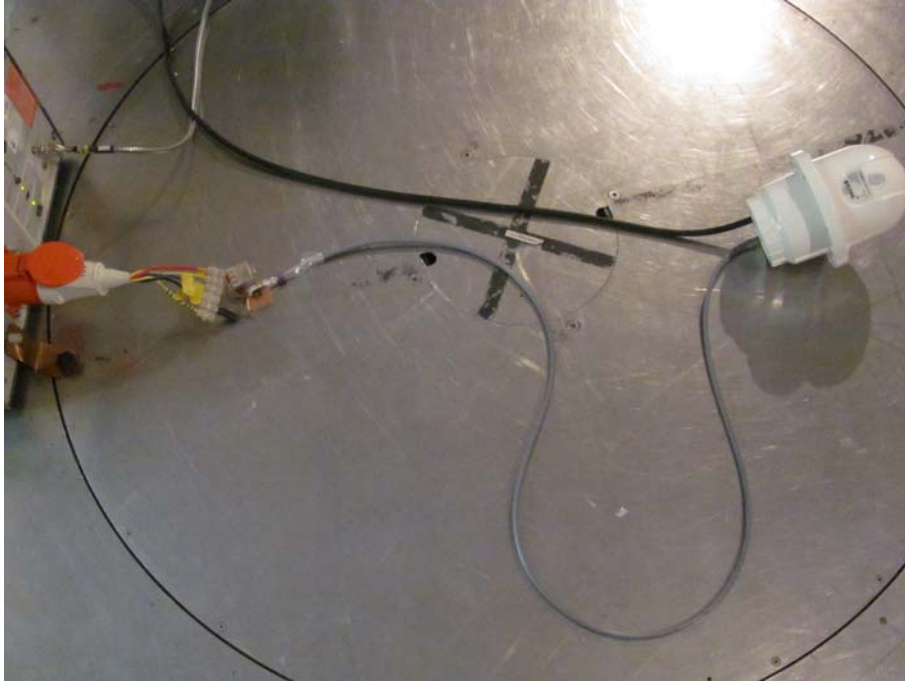
PHOTOGRAPHS

4.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)

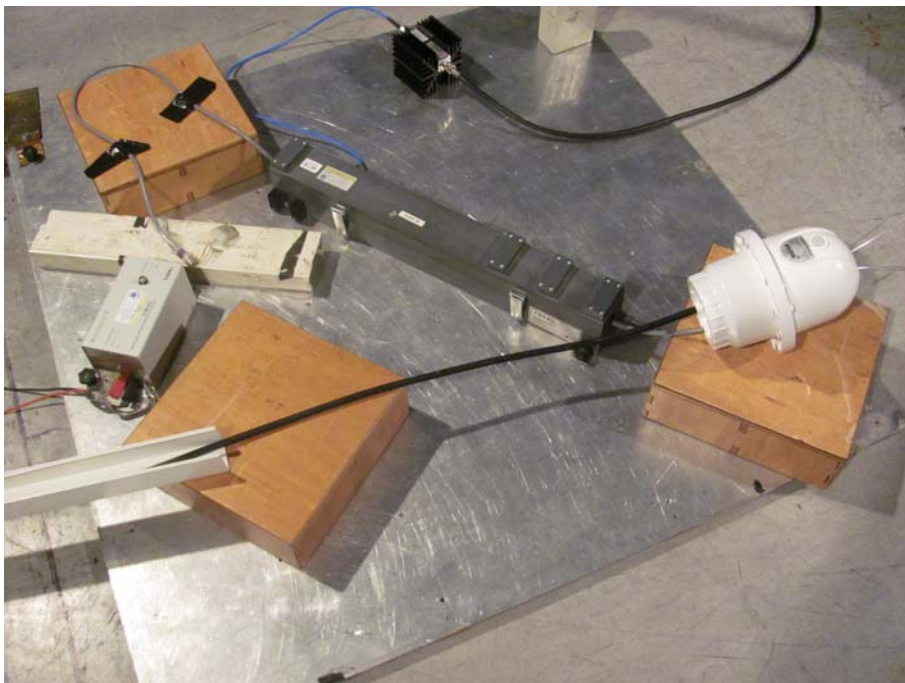


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4.2 TEST SET UP PHOTOGRAPHS



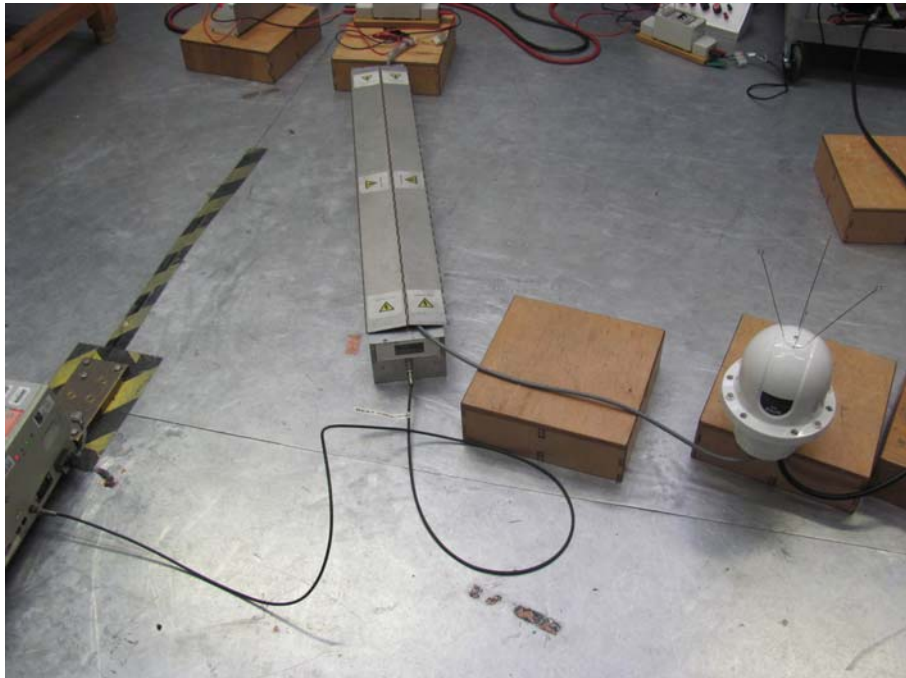
Conducted Emissions (DC Power Port)



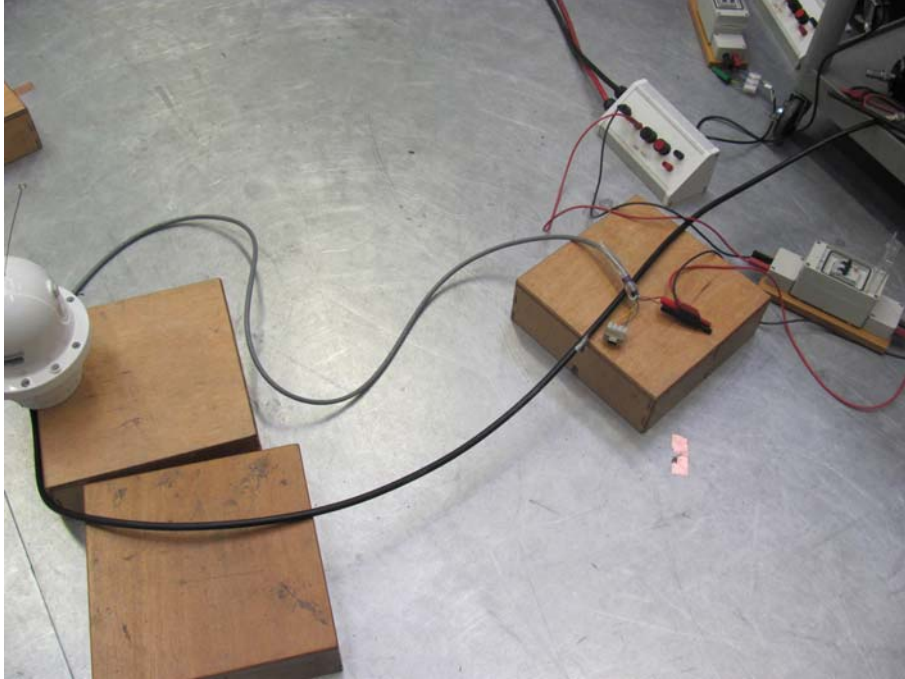
Immunity to Radio Frequency Common Mode (Signal, Control and Telecommunications Port)



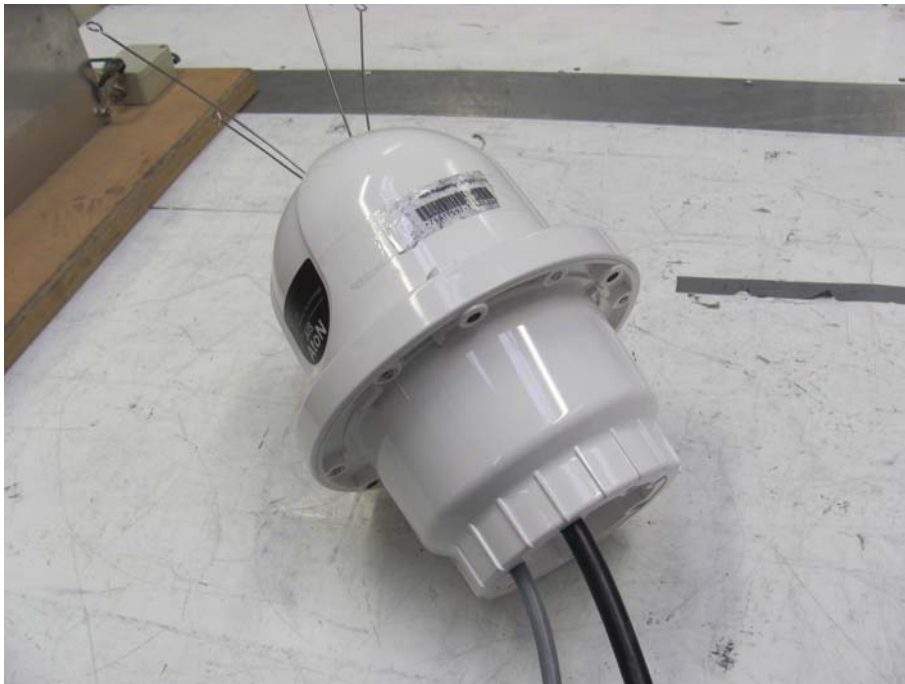
Immunity to Radio Frequency Electromagnetic Field (Enclosure Port)



Immunity to Fast Transient Bursts Common Mode (Signal, Control and Telecommunications Port)



Immunity to Interruptions (DC Power Port)



Immunity to Electrostatic Discharge (Enclosure Port)

SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT



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