

Report on the EMC Testing of:

Ocean Signal
Class A Transceiver, Model: ATA100
Part: 760S-02697
GPS antenna (763S-02845)

In accordance with IEC 60945

Prepared for: Ocean Signal Limited
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Document Number: 75936860-04 | Issue: 01

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NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Andy Lawson	Senior Engineer	Authorised Signatory	18 December 2019

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD document control rules.

EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with IEC 60945: 2002 C1:2008



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1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	18 December 2019

Table 1

1.2 Introduction

Applicant	Ocean Signal Limited
Manufacturer	Ocean Signal Limited
Model Number(s)	ATA100
Serial Number(s)	TA008
Hardware Version(s)	01.00
Software Version(s)	0.2.00
Number of Samples Tested	1
Test Specification/Issue/Date	IEC 60945: 2002 C1:2008
Order Number	3123-00
Date	31-October-2016
Date of Receipt of EUT	03-April-2017 24-April-2017 31-January-2018 01-April-2019
Start of Test	29-March-2019
Finish of Test	12-April-2019
Name of Engineer(s)	Francis Kane, Matthew Dawkins, Thomas Mockett and Jack Tuckwell
Related Document(s)	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 CISPR 16-1-2: 2006 CISPR 16-1-4: 2007 ISO 694; 2000



1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with IEC 60945 is shown below.

Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configuration and Mode: DC Powered - Operating				
2.1	9.2	Conducted emissions	Pass	CISPR 16-1-2:2006
2.2	9.3	Radiated emissions	Pass	CISPR 16-1-4:2007
2.3	10.3	Immunity to conducted radio frequency disturbance	Pass	IEC 61000-4-6: 2006
2.4	10.4	Immunity to radiated radiofrequencies	Pass	IEC 61000-4-3: 2006
2.5	10.7	Immunity to power supply short-term variation	Not applicable	Test not applicable to DC powered equipment. IEC 61000-4-11: 2004
2.6	10.8	Immunity to power supply failure	Pass	IEC 61000-4-11: 2004
2.7	10.9	Immunity to electrostatic discharge	Pass	IEC 61000-4-2: 2001
2.8	11.2	Compass safe distance	Pass	ISO 694; 2000
2.9	10.5	Immunity to fast transients on DC power, signal and control lines	Pass	IEC 61000-4-4: 2004

Table 2



1.4 Declaration of Build Status

MAIN EUT	
MANUFACTURING-DESCRIPTION	Class-A AIS-transponder
MANUFACTURER	Ocean-Signal-Ltd
MODEL-NAME/NUMBER	ATA100
PART-NUMBER	780S-02897
SERIAL-NUMBER	N/A
HARDWARE-VERSION	TBD
SOFTWARE-VERSION	TBD
PSU-VOLTAGE/FREQUENCY/CURRENT	10.8-31.2Volts-DSC, 6-amps
HIGHEST-INTERNALLY-GENERATED-/USED-FREQUENCY	207.025MHz
FCC-ID (if applicable)	N/A
INDUSTRY-CANADA-ID (if applicable)	N/A
TECHNICAL-DESCRIPTION (a brief description of the intended use and operation)	Class-A AIS-transponder ¶
COUNTRY-OF-ORIGIN	United-Kingdom
RF-CHARACTERISTICS (if applicable)	
TRANSMITTER-FREQUENCY-OPERATING-RANGE (MHz)	156.025--162.025-MHz
RECEIVER-FREQUENCY-OPERATING-RANGE (MHz)	156.025--162.025-MHz
INTERMEDIATE-FREQUENCIES	38.85/30.875/21.4MHz, 455kHz
EMISSION-DESIGNATOR(S) ¶ (i.e. -G1D, -GXW)	18K0GXW
MODULATION-TYPES: ¶ (i.e. -GMSK, -QPSK)	GMSK
OUTPUT-POWER (W or dBm)	12.5W
SEPARATE-BATTERY/POWER-SUPPLY (if applicable)	
MANUFACTURING-DESCRIPTION	*****
MANUFACTURER	*****
TYPE	*****
PART-NUMBER	*****
PSU-VOLTAGE/FREQUENCY/CURRENT	*****
COUNTRY-OF-ORIGIN	*****
MODULES (if applicable)	
MANUFACTURING-DESCRIPTION	*****
MANUFACTURER	*****
TYPE	*****
POWER	*****
FCC-ID	*****
INDUSTRY-CANADA-ID	*****
EMISSION-DESIGNATOR	*****
DHSS/FHSS/COMBINED-OR-OTHER	*****
COUNTRY-OF-ORIGIN	*****
ANCILLARIES (if applicable)	
MANUFACTURING-DESCRIPTION	*****
MANUFACTURER	*****
TYPE	*****
PART-NUMBER	*****
SERIAL-NUMBER	*****
COUNTRY-OF-ORIGIN	*****

I hereby declare that the information supplied is correct and complete. ¶

Name: → David Sheekey → Position held: → Type-Approval-Manager
 Date: → 5/4/18 ¶

1.5 Product Information

1.5.1 Technical Description

The Equipment Under Test was an Ocean Signal ATA100 Class A AIS Transponder.

The primary function of the EUT is to combine SOLAS and Inland approved solutions capable of exchanging dynamic and static ship data with other AIS systems to aid collision-avoidance and improve safety for both commercial and recreational vessels.

A full description and detailed product specification details are available from the manufacturer.



Figure 1 - General View



Figure 2 - Rear View



Figure 3 - Rating Plate



1.5.2 EUT Port/Cable Identification

Port	Max Cable Length specified	Usage	Type	Screened
Configuration and Mode: DC Powered - Operating				
DC Power Port	2 Meters	12 V DC Power Supply Line	2 Core Cable	No
RF Port	over 3 meters	AIS	Co-axial Cable	Yes
Sensor 1 2 and 3 cable	1.7 meters	Unknown	Multi Core Cable	No
LR Cable	1.7 meters	Unknown	Multi Core Cable	No
GPS Antenna	>3 meters	GPS Antenna Signal	Co-axial Cable	No
DGPS	1.7 meters	DGPS Data	Multi Core	No
Pilot Port	1.7 meters	Data	Data	No
ECDIS	1.7 meters	Data	Multi Core Cable	No

Table 3

1.5.3 Test Configuration

Configuration	Description
DC Powered	The EUT was powered from a 12 V DC Supply. The EUT had a GPS antenna connected to it. The EUT had a laptop connected to the EUTs RS422 port. The EUT VHF antenna port was connected to a reference class A transceiver via a power attenuator. All other cables were connected to the EUT but were unterminated during testing.

Table 4

1.5.4 Modes of Operation

Mode	Description
Operating	The EUT was powered and receiving a GPS signal from a GPS simulator. A laptop was used to compare AIS data from the EUT directly with AIS data received from the EUT by the AIS transceiver.

Table 5

1.5.5 Monitoring of Performance

The reference AIS Class A transceiver was used to monitor transmissions from the EUT. It was also used to provide transmissions to the EUT to allow monitoring of the EUT receivers.

The laptop was decoding the details of the transmission and reception data from the EUT and comparing this to the transmission and reception data from the reference transceiver.



1.5.6 Performance Criteria

Performance Criteria A

The apparatus shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

The manufacturers specified performance level is detailed as:

The content of the log reports and the reporting intervals shall not be degraded during or after the test. A packet error rate degradation of up to 20% is acceptable for both transmitter and receiver performance. No change of operating state is allowed, and the display shall continue to operate without degradation

Performance Criteria B

The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed. No change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

Performance Criteria C

Temporary loss of function is allowed, provided the function is self-recoverable.

1.6 Deviations from the Standard

No deviations from the applicable test standard were made during testing.

1.7 EUT Modification Record

The table below details modifications made to the EUT during the test programme. The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
Serial Number: TA008			
0	As supplied by the customer	Not Applicable	Not Applicable
1	Spring fingers added to keypad PCB to connect overall shield to 0V (radiated emissions)	Manufacturer	Supplied 11 April 2019

Table 6

1.8 Test Location

TÜV SÜD Product Service conducted the following tests at our Fareham Test Laboratory.



Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: DC Powered - Operating		
Conducted emissions	Francis Kane	UKAS
Radiated emissions	Matthew Dawkins and Thomas Mockett	UKAS
Immunity to conducted radio frequency disturbance	Francis Kane	UKAS
Immunity to radiated radiofrequencies	Matthew Dawkins and Francis Kane	UKAS
Immunity to power supply short-term variation	Francis Kane	UKAS
Immunity to power supply failure	Francis Kane	UKAS
Immunity to electrostatic discharge	Francis Kane	UKAS
Compass safe distance	Francis Kane	UKAS
Immunity to fast transients on DC power, signal and control lines	Francis Kane	UKAS

Table 7

Office Address:

Octagon House
Concorde Way
Segensworth North
Fareham
Hampshire
PO15 5RL
United Kingdom



2 Test Details

2.1 Conducted emissions

2.1.1 Specification Reference

IEC 60945, Clause 9.2

2.1.2 Equipment Under Test and Modification State

ATA100, S/N: TA008 - Modification State 0

2.1.3 Date of Test

12-April-2019

2.1.4 Test Method

The EUT was powered from an artificial Mains Network.

Measurements were made with all measuring equipment and the EUT mounted on and bonded to an earth plane. Where provision of an earth plane was not practicable, equivalent arrangements were made using the metallic frame or mass of the EUT as the earth reference.

The power input cables between the power ports of the EUT and the artificial mains network were screened and 0.8 m in length.

If the EUT consisted of more than one unit with individual power ports, power ports of identical nominal supply voltage were connected in parallel to the artificial mains supply network.

2.1.5 Environmental Conditions

Ambient Temperature 21.0 °C
 Relative Humidity 35.0 %

2.1.6 Specification Limits

Required Specification Limits		
Line Under Test	Frequency Range (MHz)	Quasi-peak (dBμV)
Power Input	0.01 to 0.15	96 to 50*
	0.15 to 0.35	60 to 50*
	0.35 to 30	50*
Supplementary information:		
Note 1: The emission shall be measured by means of the quasi-peak measuring receiver only.		
The power input cables between the DC power ports of the EUT and the artificial mains network shall be screened and not exceed 0,8 m in length. If the EUT consists of more than one unit with individual DC and/or DC power ports, power ports of identical nominal supply voltage may be connected in parallel to the artificial mains supply network.		
*As detailed in specification clause 5.3 Test results, the EUT shall pass the test only if the measured performance margin is favourable and greater than the test measurement uncertainty.		

Table 8



2.1.7 Test Results

Results for Configuration and Mode: DC Powered - Operating

Performance assessment of the EUT made during this test: *Pass*.

Detailed results are shown below.

Line Under Test: 12 V DC Power Supply Line

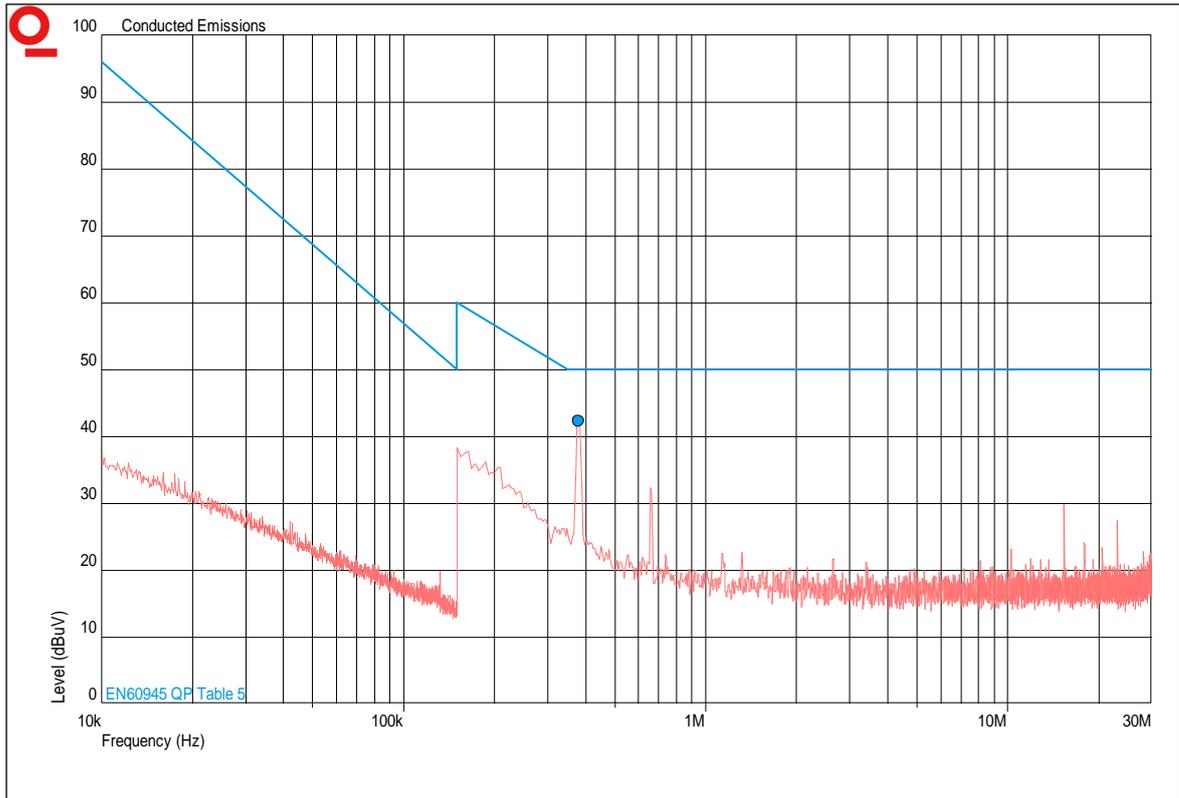


Figure 4 - Graphical Results - 12 V DC Power Supply Line

Frequency (MHz)	QP Level (dBμV)	QP Limit (dBμV)	QP Margin (dB)
0.379	42.3	50.0	-7.7

Table 9

All other emissions seen were greater than 10dB below the test limit.



Line Under Test: 0 V DC Return Line

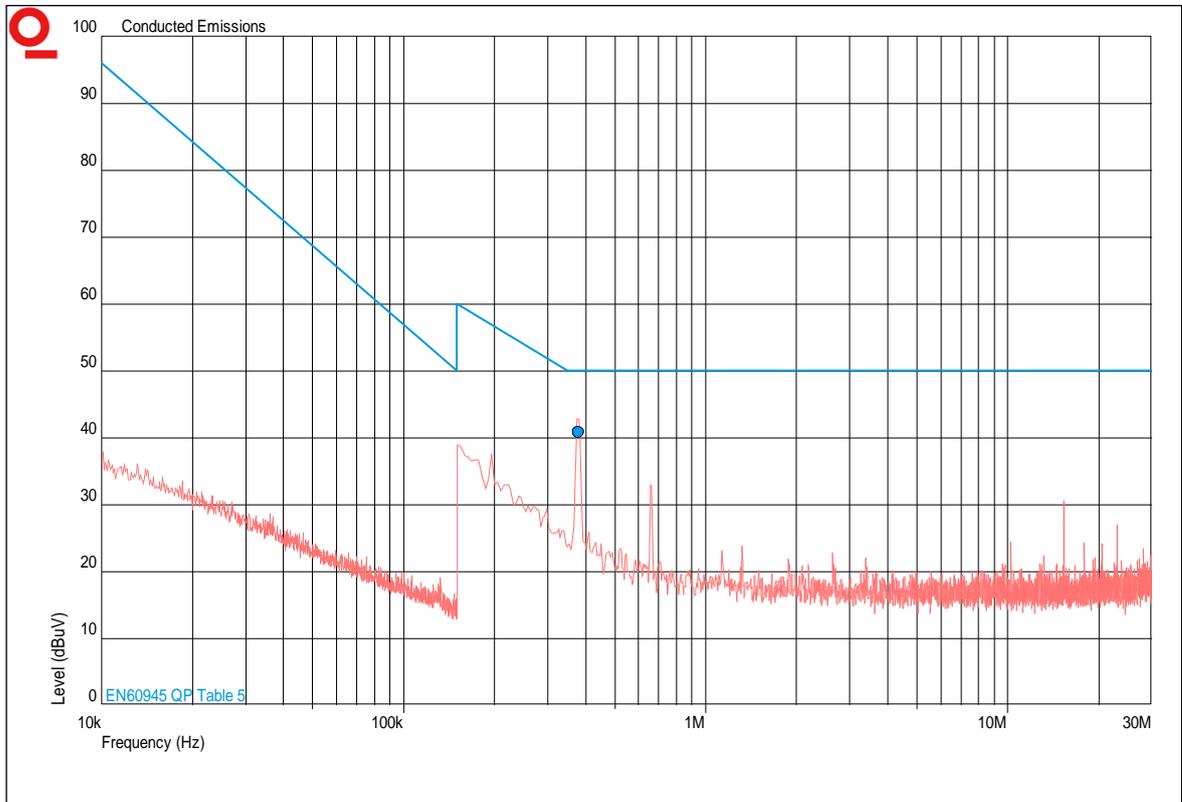


Figure 5 - Graphical Results - 0 V DC Return Line

Frequency (MHz)	QP Level (dB μ V)	QP Limit (dB μ V)	QP Margin (dB)
0.379	40.8	50.0	-9.2

Table 10

All other emissions seen were greater than 10dB below the test limit.

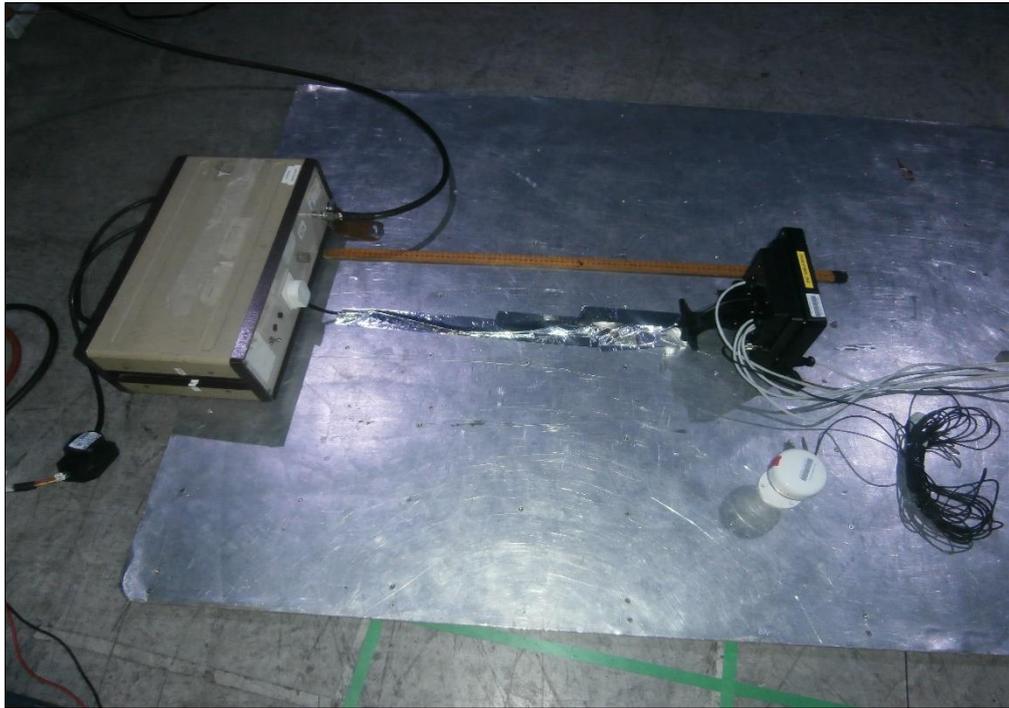


Figure 6 - Test Setup - Conducted Emissions

2.1.8 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Compliance 5 Emissions	Teseq	V5.26.51	3275	-	Software
EMI Receiver	Keysight Technologies	N9038A MXE	4629	12	09-Oct-2019
Transient Limiter	Hewlett Packard	11947A	2378	12	21-Jul-2019
LISN (1 Phase)	Chase	MN 2050	336	12	28-May-2019
8 Meter Cable	Teledyne	PR90-088-8MTR	5212	6	28-Jul-2019

Table 11



2.2 Radiated emissions

2.2.1 Specification Reference

IEC 60945, Clause 9.3

2.2.2 Equipment Under Test and Modification State

ATA100, S/N: TA008 - Modification State 1

2.2.3 Date of Test

11-April-2019

2.2.4 Test Method

The EUT was set up in a semi-anechoic chamber on a remotely controlled turntable and placed on a non-conductive table 0.8 m above a reference ground plane.

A pre-scan of the EUT emissions profile was made while varying the antennae-to-EUT azimuth and antennae-to-EUT polarization using a peak detector; measurements were taken at a 3m distance.

Using the pre-scan list of the highest emissions detected, their bearing and associated antenna polarisation, the EUT was then formally measured using Quasi-Peak and Average detectors, as appropriate. The readings were maximised by adjusting the antenna height, polarisation and turntable azimuth, in accordance with the specification.

2.2.5 Environmental Conditions

Ambient Temperature 18.0 °C
 Relative Humidity 43.0 %

2.2.6 Specification Limits

150 kHz to 30 MHz

Required Specification Limits (@ 3m)	
Frequency Range (MHz)	Quasi-peak (dBµV/m)
0.15 to 0.3	80 - 52*
0.3 to 30	52 - 34*

Supplementary Information:
 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 test measurement uncertainty.
 *As detailed in specification clause 5.3 Test results, the EUT shall pass the test only if the measured performance margin is favourable and greater than the test measurement uncertainty.

Table 12



30 MHz to 2 GHz

Required Specification Limits (@ 3m)		
Frequency Range (MHz)	Quasi-peak (dBµV/m)	Peak (dBµV/m)
30 to 2000 ⁽¹⁾	54*	N/A
156 to 165 ⁽²⁾	24*	30*

Supplementary Information:
 *As detailed in specification clause 5.3 Test results, the EUT shall pass the test only if the measured performance margin is favourable and greater than the test measurement uncertainty.
⁽¹⁾ In addition, for the frequency band 156 MHz to 165 MHz, the measurement shall be repeated with a receiver bandwidth of 9 kHz, all other conditions hereinbefore remaining unchanged.
⁽²⁾ Alternatively, for the frequency band 156 MHz to 165 MHz, a peak receiver or a frequency analyser may be used, in accordance with the agreement between the manufacturer and the test house.

Table 13



2.2.7 Test Results

Results for Configuration and Mode: DC Powered - Operating

Performance assessment of the EUT made during this test: *Pass*.

Detailed results are shown below.

Frequency Range of Test: 30 MHz to 2 GHz

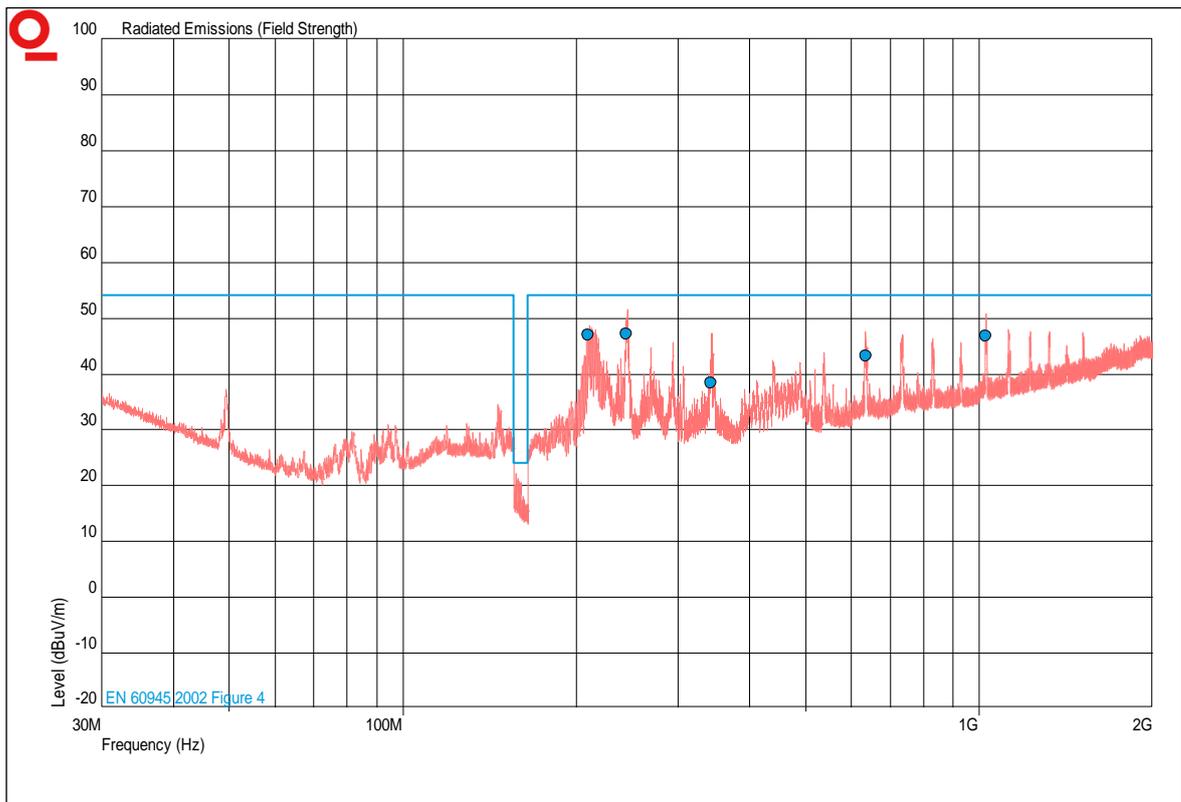


Figure 7 - Graphical Results - Horizontal and Vertical Polarity

Frequency (MHz)	QP Level (dBµV/m)	QP Limit (dBµV/m)	QP Margin (dB)	Angle (Deg)	Height (m)	Polarity
210.188	47.0	54.0	-7.0	184	1.00	Vertical
244.567	47.1	54.0	-6.9	338	1.00	Horizontal
342.997	38.2	54.0	-15.8	54	1.47	Horizontal
638.045	43.1	54.0	-10.9	25	1.00	Vertical
1029.808	46.7	54.0	-7.3	277	1.00	Vertical

Table 14



Frequency Range of Test: 156MHz to 165MHz

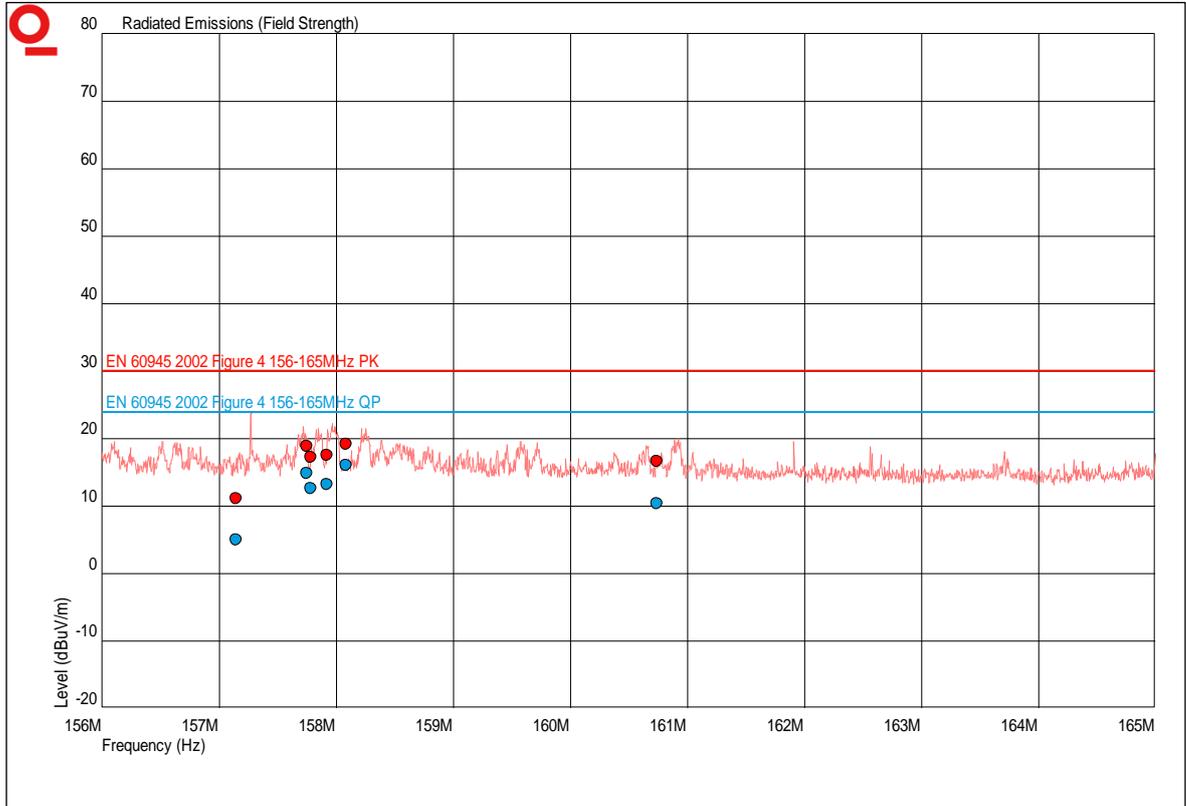


Figure 8 - Graphical Results - Horizontal and Vertical Polarity

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dB)	Peak Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Angle (Deg)	Height (m)	Polarity
157.150	5.0	24.0	-19.0	11.2	30.0	-18.8	262	3.61	Vertical
157.758	14.9	24.0	-9.1	18.9	30.0	-11.1	126	1.00	Vertical
157.792	12.6	24.0	-11.4	17.2	30.0	-12.8	271	1.00	Vertical
157.929	13.2	24.0	-10.8	17.5	30.0	-12.5	126	1.00	Vertical
158.090	16.1	24.0	-7.9	19.1	30.0	-10.9	78	2.71	Vertical
160.743	10.3	24.0	-13.7	16.6	30.0	-13.4	113	1.00	Vertical

Table 15



Frequency Range of Test: 150kHz to 30MHz

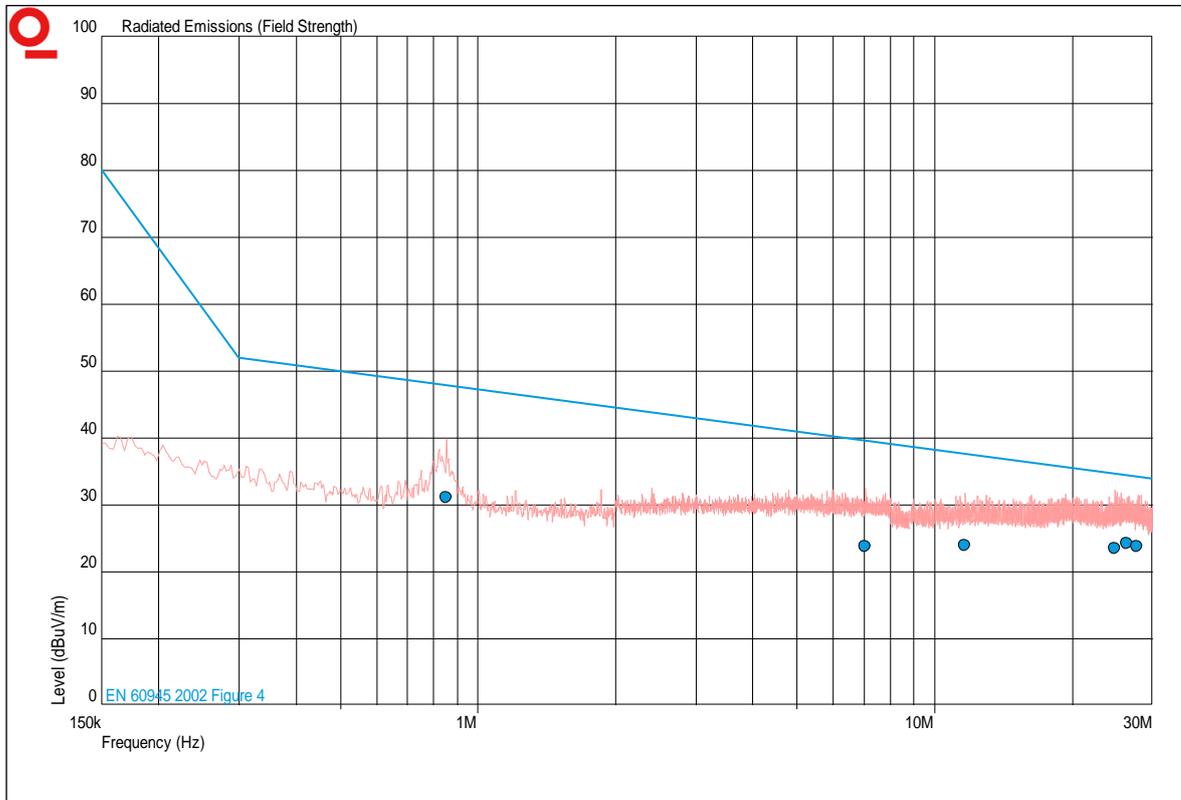


Figure 9 - Graphical Results - Horizontal and Vertical Polarity

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dB)	Angle (Deg)	Height (m)	Polarity
0.851	31.2	47.9	-16.8	288	1.50	Edge On
7.028	23.8	39.7	-15.8	144	1.50	Face On
11.638	24.0	37.7	-13.7	360	1.50	Edge On
24.803	23.5	34.7	-11.2	74	1.50	Face On
26.323	24.2	34.5	-10.3	54	1.50	Edge On
27.775	23.9	34.3	-10.4	294	1.50	Face On

Table 16



Figure 10 - Test Setup - Radiated Emissions - 30 MHz to 2 GHz

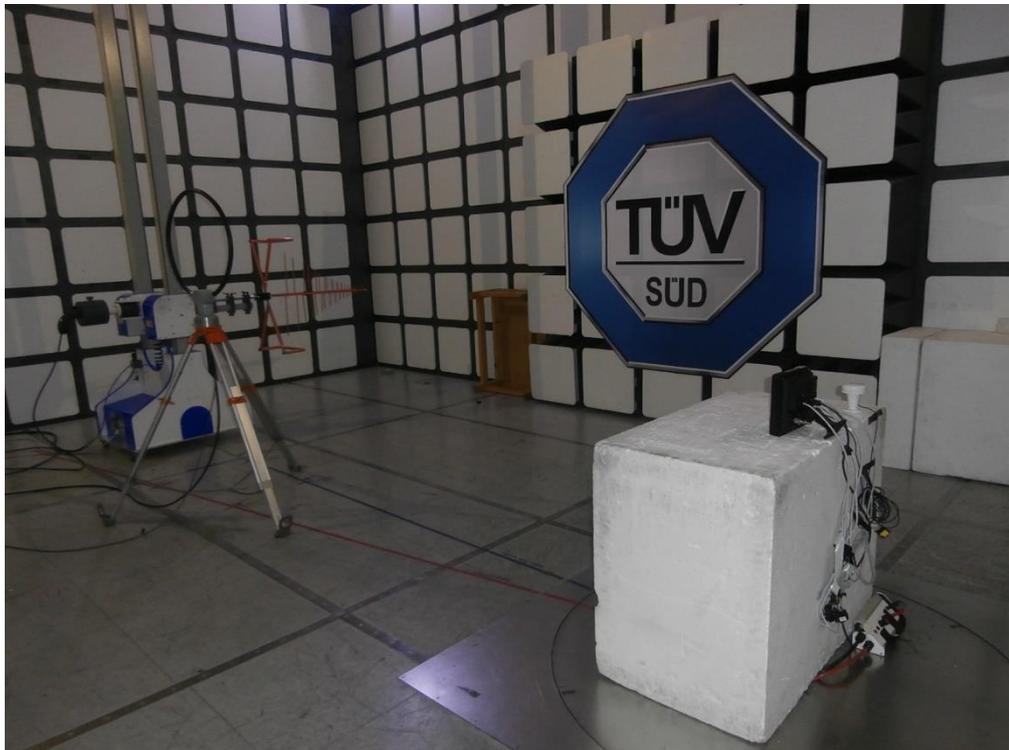


Figure 11 - Test Setup - Radiated Emissions - 150 kHz to 30 MHz



2.2.8 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 5.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Screened Room 5	Rainford	Rainford	1545	36	21-Jan-2021
Compliance 5 Emissions	Teseq	V5.26.51	3275	-	Software
EMI Receiver	Keysight Technologies	N9038A MXE	4629	12	09-Oct-2019
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Mast Controller	Maturo GmbH	NCD	4810	-	TU
Tilt Antenna Mast	Maturo GmbH	TAM 4.0-P	4811	-	TU
Antenna (Active Loop, 9kHz-30MHz)	Rohde & Schwarz	HFH2-Z2	333	24	11-Jan-2019
Antenna with permanent attenuator (Bilog)	Chase	CBL6143	2904	24	08-Aug-2019
Cable (Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4526	6	26-Apr-2019
8m N-Type RF Cable	Teledyne	PR90-088-8MTR	5093	12	04-Oct-2019

Table 17

TU - Traceability Unscheduled



2.3 Immunity to conducted radio frequency disturbance

2.3.1 Specification Reference

IEC 60945, Clause 10.3

2.3.2 Equipment Under Test and Modification State

ATA100, S/N: TA008 - Modification State 0

2.3.3 Date of Test

01-April-2019 to 02-April-2019

2.3.4 Test Method

The equipment under test was configured on, but insulated from, using a 0.1 m isolator, a ground reference plane within a test laboratory.

All associated cabling was configured, on but insulated from, using a 50 mm isolator, the same horizontal coupling plane as the equipment under test.

Using CDNs, EM Clamps or current clamps as appropriate, the power ports and applicable signal and control ports were subjected to the required, pre-calibrated RF injected signal strength, modulated as described, swept over the frequency range of test.

During this test, any anomalies in the equipment under tests performance were recorded.

2.3.5 Environmental Conditions

Ambient Temperature 21.0 °C
 Relative Humidity 35.0 %

2.3.6 Specification Limits

Required Test Levels						Performance Criteria
Line Under Test	Frequency Range (MHz)	Level (V)	Modulation	Step Size (%)	Dwell (s)	
Power Port Signal / Control Port	0.15 to 80	3	AM (80 %,400 Hz, sine wave)	1	3	A
	Spot Frequencies	10	AM (80 %,400 Hz, sine wave)	-	3	A
Supplementary information:						
Note 1. EUT powered at one of the Nominal input voltages and frequencies						
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.						

Table 18



2.3.7 Test Results

Results for Configuration and Mode: DC Powered - Operating

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

Tabulated Results for Conducted Radio Frequency Interference					
Modulation = 80 % AM (400 Hz)		Step Size = 1 %		Dwell = 3 s	
Line Under Test	Frequency Range	Test Level (V)	Coupling Method	Interference Return Path	Result
12 VDC Power Supply Line	150kHz to 80MHz	3 + MU	M2 CDN	M2 CDN	Pass
12 VDC Power Supply Line	Spot Frequencies	10 + MU	M2 CDN	M2 CDN	
RF Cable	150kHz to 80MHz	3 + MU	EM Clamp	M2 CDN	Pass
RF Cable	Spot Frequencies	10 + MU	EM Clamp	M2 CDN	Pass
Sensor 1 2 and 3 cable	150kHz to 80MHz	3 + MU	EM Clamp	M2 CDN	Pass
Sensor 1 2 and 3 cable	Spot Frequencies	10 + MU	EM Clamp	M2 CDN	Pass
LR Cable	150kHz to 80MHz	3 + MU	EM Clamp	M2 CDN	Pass
LR Cable	Spot Frequencies	10 + MU	EM Clamp	M2 CDN	Pass
GPS Antenna Cable	150kHz to 80MHz	3 + MU	EM Clamp	M2 CDN	Pass
GPS Antenna Cable	Spot Frequencies	10 + MU	EM Clamp	M2 CDN	Pass
DGPS	150kHz to 80MHz	3 + MU	EM Clamp	M2 CDN	Pass
DGPS	Spot Frequencies	10 + MU	EM Clamp	M2 CDN	Pass
Pilot Port	150kHz to 80MHz	3 + MU	EM Clamp	M2 CDN	Pass
Pilot Port	Spot Frequencies	10 + MU	EM Clamp	M2 CDN	Pass
ECDIS	150kHz to 80MHz	3 + MU	EM Clamp	M2 CDN	Pass
ECDIS	Spot Frequencies	10 + MU	EM Clamp	M2 CDN	Pass

Table 19

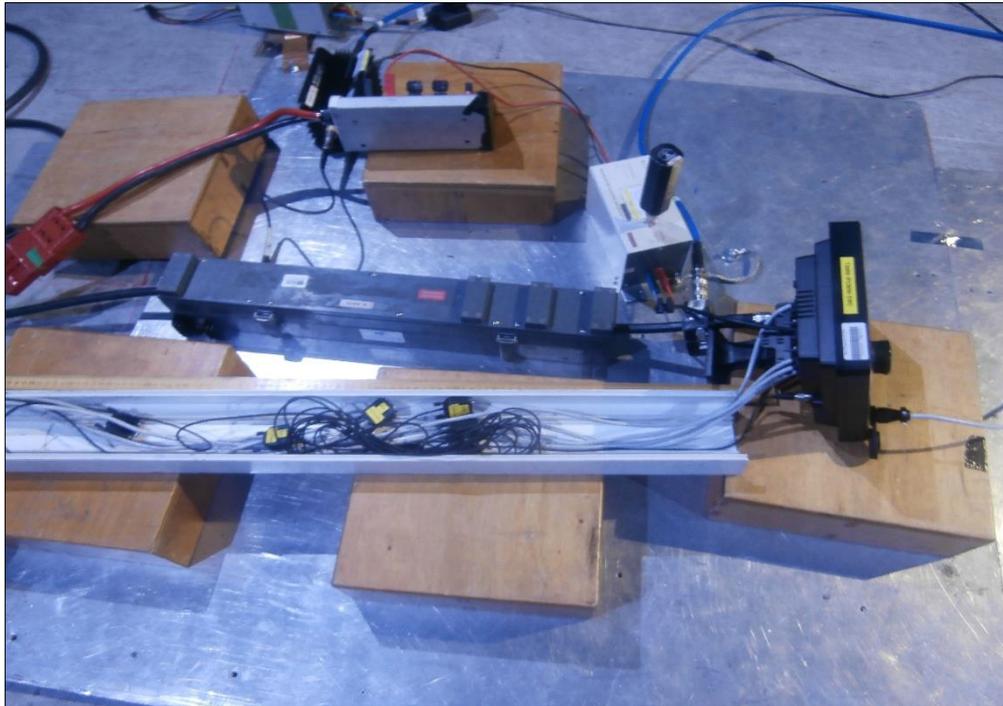


Figure 12 – Test Setup - Immunity to Conducted Radio Frequency Disturbance

2.3.8 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI RF Generator	Schaffner	NSG2070-400	2215	12	13-Nov-2019
Win2070 Software	Schaffner	Version 5.00	5251	-	Software
Termination	MEB Messelektronik	TRA150	211	-	TU
CDN Jig	MEB Messelektronik	M2-801	213	12	21-Nov-2013
Coupling and Decoupling Network	Schaffner	M216	224	12	10-Oct-2019
Coupling Clamp	MEB Messelektronik	KEMZ-801	228	-	TU
Coupling Clamp Jig	MEB Messelektronik	KEMZ-801	229	-	TU
Attenuator (10dB)	Weinschel	45-10-43	509	12	20-Dec-2019
Attenuator 6dB	Advance	10023-6/MF	1539	12	19-Dec-2019
Current Probe	Tegam	91550-1	2135	12	19-Jun-2019
Attenuator (20dB, 150W)	Narda	769-20	3367	12	17-Jul-2019
Attenuator (10dB, 150W)	Narda	769-10	3368	12	17-Jul-2019
Attenuator 40dB 100W	Weinschel	48-40-43-LIM	5134	12	07-Nov-2019

Table 20

TU - Traceability Unscheduled



2.4 Immunity to radiated radio frequencies

2.4.1 Specification Reference

IEC 60945, Clause 10.4

2.4.2 Equipment Under Test and Modification State

ATA100, S/N: TA008 - Modification State 0

2.4.3 Date of Test

29-March-2019 to 01-April-2019

2.4.4 Test Method

The equipment under test including associated cabling was configured, on a 0.8 m non-conductive table for table-top equipment; within a pre-calibrated semi anechoic chamber.

All four sides of the equipment under test were subjected to the required RF field strength, modulated as described, swept over the frequency range of test with the antenna positioned in both horizontal and vertical polarizations.

During this test, any anomalies in the equipment under tests performance were recorded.

2.4.5 Environmental Conditions

Ambient Temperature 21.0 °C
 Relative Humidity 40.0 %

2.4.6 Specification Limits

Required Test Levels					Performance Criteria
Frequency Range (MHz)	Level (V/m)	Modulation	Step Size (%)	Dwell (s)	
80 to 1000	10*	AM (80 %,400 Hz, sine wave)	1	3 ¹	A
1000 to 2000	10*	AM (80 %,400 Hz, sine wave)	1	9 ¹	A

Supplementary information:
 Note 1. dwell times <1GHz can be reduced to 2 s and >1GHz to 6 s for samples with fast cycle times.
 Note 2. EUT powered at one of the Nominal input voltages and frequencies
 *As detailed in specification clause 5.3 Test results, the EUT shall pass the test only if the measured performance margin is favourable and greater than the test measurement uncertainty.

Table 21

2.4.7 Test Results

Results for Configuration and Mode: DC Powered - Operating

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

Tabulated Results for RF Electromagnetic Field				
Step Size		1%		
Dwell Time < 1GHz		3 s		
Dwell Time > 1GHz		6 s		
Modulation		400Hz Sine 80% AM		
Frequency Range (MHz)	Test Face	Antenna Polarisation	Test Level (V/m)	Result
80 MHz to 1 GHz	Front, Right, Left and Rear	Horizontal and Vertical	12.6 (10 + MU)	Pass
1 GHz to 2 GHz	Front, Right, Left and Rear	Horizontal and Vertical	12.6 (10 + MU)	Pass

Table 22



Figure 13 - Test Setup - Immunity to radiated radio frequencies



2.4.8 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMCWare	Amp Research	V3.8.2	4899	-	Software
Signal Generator, 9kHz to 6GHz	Rohde & Schwarz	SMB 100A	3500	12	16-Apr-2019
Amplifier (250W, 80MHz - 1GHz)	Amp Research	250W1000A	3029	-	TU
CW TWT (1-2.5GHz)	Thorn	PTC6341	2069	-	TU
Directional Coupler	Amp Research	DC6180	283	-	TU
Power Meter	Rohde & Schwarz	NRVD	1391	12	TU
Power Sensor (10MHz to 18GHz)	Rohde & Schwarz	NRV-Z1	2899	-	TU
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	234	-	TU
Antenna	Schaffner	CBL6143	322	-	TU
Load (50ohm, 30W)	JFW	50T-054	351	12	26-Jun-2019
Attenuator (20dB, 150W)	Narda	769-20	3367	12	17-Jul-2019
Attenuator (10dB, 150W)	Narda	769-10	3368	12	17-Jul-2019
Attenuator 40dB 100W	Weinschel	48-40-43-LIM	5134	12	07-Nov-2019

Table 23

TU - Traceability Unscheduled



2.5 Immunity to power supply short term variation

2.5.1 Specification Reference

IEC 60945, Clause 10.7

Test not applicable to d.c. powered equipment.



2.6 Immunity to power supply failure

2.6.1 Specification Reference

IEC 60945, Clause 10.8

2.6.2 Equipment Under Test and Modification State

ATA100, S/N: TA008 - Modification State 0

2.6.3 Date of Test

04-April-2019

2.6.4 Test Method

The equipment under test including associated cabling was configured on but insulated from, using a 0.1 m isolator, a ground reference plane all within a test laboratory.

Using a programmable power supply the equipment under test was subjected to the detailed supply voltage interruptions. The required supply phase synchronisation and test repetition rate, detailed, was controlled by the programmable power supply.

During this test, any anomalies in the equipment under tests performance were recorded.

2.6.5 Environmental Conditions

Ambient Temperature 21.0 °C
 Relative Humidity 36.0 %

2.6.6 Specification Limits

Required Test Levels			Performance Criteria
Test	Test Level % of nominal Voltage	Duration (s)	
Short Interruption	0	60 repeated 3 times	C
Supplementary information:			
Note 1. EUT powered at one of the Nominal input voltages and frequencies			

Table 24

2.6.7 Test Results

Results for Configuration and Mode: DC Powered - Operating

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

Tabulated Results for Power Supply Failure					
Line under test	Operating Frequency	Nominal Voltage (V)	Test Level Voltage (V)	Duration (s)	Result
12 V DC Power Supply Line	DC	12	0	60	Pass

Table 25



Figure 14 - Test Setup - Immunity to Power Supply Failure



2.6.8 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI Generator	Teseq	NSG 3040-05	4861	12	08-May-2019
Stepped Transformer	Teseq	INA 6502-05	4862	12	08-May-2019

Table 26



2.7 Immunity to electrostatic discharge

2.7.1 Specification Reference

IEC 60945, Clause 10.9

2.7.2 Equipment Under Test and Modification State

ATA100, S/N: TA008 - Modification State 0

2.7.3 Date of Test

04-April-2019

2.7.4 Test Method

The equipment under test including associated cabling was configured on but insulated from, using a 0.5mm isolator, a horizontal coupling plane fitted to the top of a 0.8m nonconductive table for table-top equipment; and on a 0.1m insulated support for floor standing equipment; above a ground reference plane all within a test laboratory.

Using the air discharge method for non-metallic parts, contact discharge method for metallic parts with both vertical and horizontal couple plane discharge methods for the sides of the equipment under test, the required electrostatic discharge voltage levels in both voltage polarities were applied at the detailed pulse repartition rate.

During this test, any anomalies in the equipment under tests performance were recorded.

2.7.5 Environmental Conditions

Ambient Temperature 21.0 °C
 Relative Humidity 33.0 %

2.7.6 Specification Limits

Required Test Levels				Performance Criteria
Discharge type	Discharge Level (kV)		Number of discharges per location (each polarity)	
	Positive	Negative		
Air – Direct	2, 4 and 8	2, 4 and 8	10	B
Contact – Direct	2, 4 and 6	2, 4 and 6	10	B
Contact – Indirect	2, 4 and 6	2, 4 and 6	10	B
Supplementary information:				
None				

Table 27



2.7.7 Test Results

Results for Configuration and Mode: DC Powered - Operating

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

 Contact Air

ID	Test Point	Discharge	Results									
			2kV		4kV		6kV		8kV		15kV	
			+	-	+	-	+	-	+	-	+	-
	Horizontal Coupling Plane	Contact	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A
	Vertical Coupling Plane	Contact	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A
	Contact Discharge Points	Contact	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A
	Air Discharge Points	Air	✓*	✓*	✓*	✓*	N/A	N/A	✓*	✓*	N/A	N/A

Table 28

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 point when the ESD pulse was applied.
N/A	Not Applicable.

Table 29

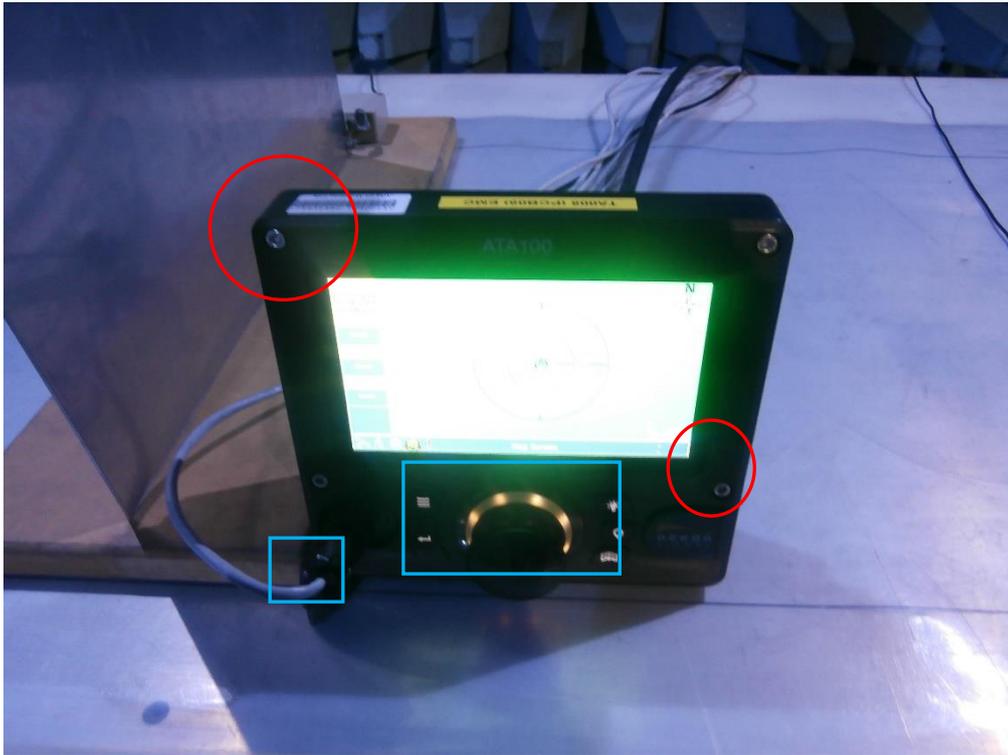


Figure 15 - Test Positions

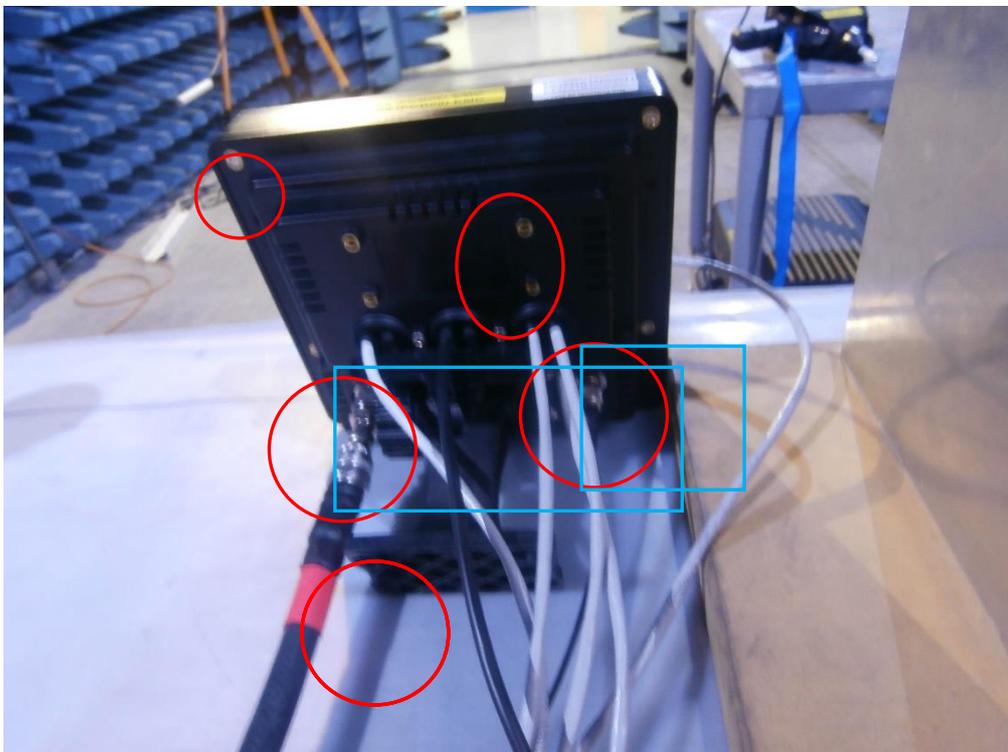


Figure 16 - Test Positions

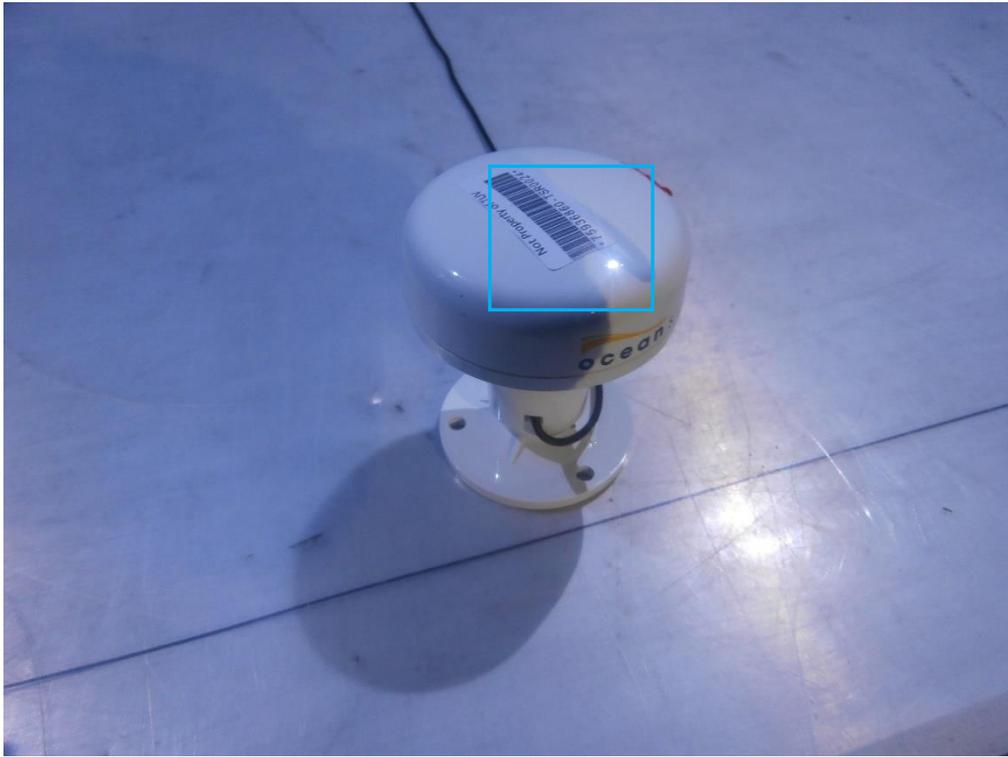


Figure 17 - Test Positions

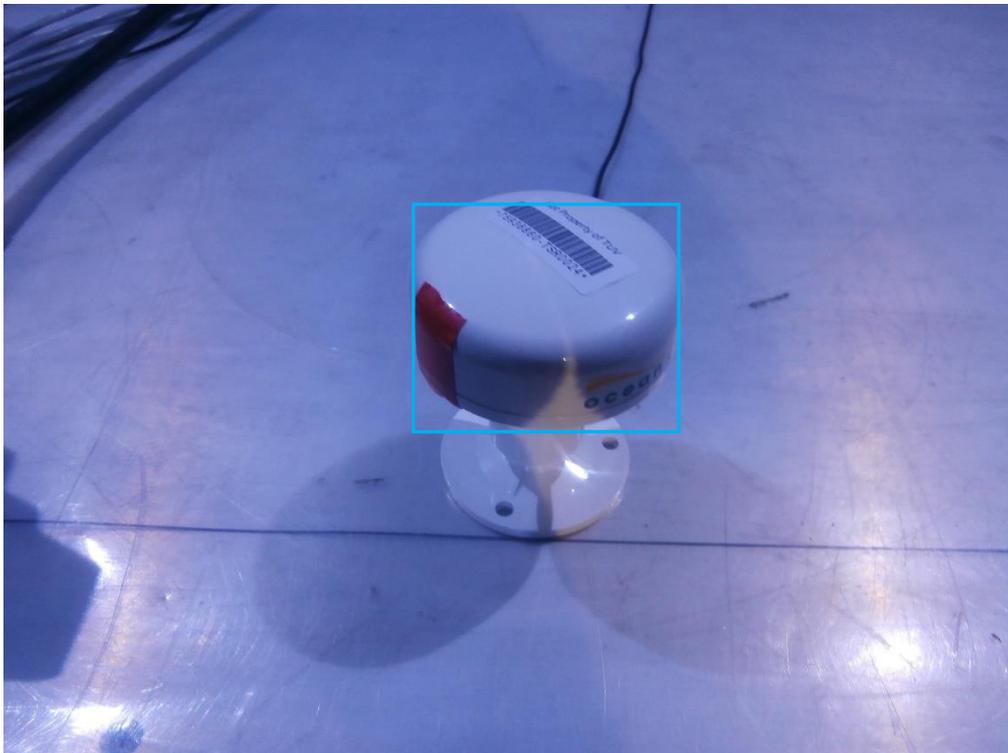


Figure 18 - Test Positions



Figure 19 - Test Setup - Immunity to Electrostatic Discharge

2.7.8 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Multimeter	Iso-tech	IDM 101	2170	12	06-Jun-2019
ESD Generator	Schloder	SESD 30000	4724	12	14-May-2019

Table 30



2.8 Compass safe distance

2.8.1 Specification Reference

IEC 60945, Clause 11.2

2.8.2 Equipment Under Test and Modification State

ATA100, S/N: TA008 - Modification State 0

2.8.3 Date of Test

05-April-2019

2.8.4 Test Method

The EUT was setup on an East to West oriented level non-magnetic surface.

A magnetometer was used to take a horizontal magnetic flux density measurement and from this measurement, a standard and an emergency compass deflection was calculated.

A ships magnetic compass was located at the west end of the non-magnetic surface.

The compass was zeroed and the EUT was gradually moved from the east to the west end of the non-magnetic surface towards the compass centre in all 6 of its orthogonal planes and in 3 different states until the calculated compass deflection was achieved, or the EUT had reached the boundary of the ships magnetic compass.

Once all raw readings had been obtained, the worst case reading for each state was rounded up to the nearest 50mm or 100mm.

2.8.5 Environmental Conditions

Ambient Temperature	16.0 °C
Relative Humidity	35.0 %

2.8.6 Specification Limits

The greatest distance obtained under all these conditions is the safe distance.

Distances are to be rounded up to the nearest 50 mm or 100 mm.

The findings shall be noted in the test report.

The safe distance shall be marked on the EUT or recorded as described in IEC 60945, Section 4.5.3.



2.8.7 Test Results

Results for Configuration and Mode: DC Powered - Operating

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

Magnetometer Reading and Calculations

Horizontal Maximum Flux Density, Magnetic North (H)	Standard Compass Deviation Limit (5.4/H in Degrees)	Emergency Compass Deviation Limit (18/H in Degrees)
20.2	0.3	0.9

Table 31

EUT In Unpowered State

EUT Orientation in Relation to Magnetic Compass	Distance from Magnetic Compass when Standard Deviation is seen (mm)	Distance from Magnetic Compass when Emergency Deviation is seen (mm)
Front	470	280
Top	320	220
Left Hand Side	470	220
Right Hand Side	340	230
Underside	220	165
Rear	420	250

Table 32

EUT In Normalised State

EUT Orientation in Relation to Magnetic Compass	Distance from Magnetic Compass when Standard Deviation is seen (mm)	Distance from Magnetic Compass when Emergency Deviation is seen (mm)
Front	450	290
Top	300	165
Left Hand Side	650	360
Right Hand Side	330	190
Underside	350	300
Rear	490	450

Table 33



EUT In Powered State

EUT Orientation in Relation to Magnetic Compass	Distance from Magnetic Compass when Standard Deviation is seen (mm)	Distance from Magnetic Compass when Emergency Deviation is seen (mm)
Front	420	290
Top	165	165
Left Hand Side	550	320
Right Hand Side	380	165
Underside	350	310
Rear	750	460

Table 34

GPS Antenna In Unpowered State

EUT Orientation in Relation to Magnetic Compass	Distance from Magnetic Compass when Standard Deviation is seen (mm)	Distance from Magnetic Compass when Emergency Deviation is seen (mm)
Front	165	165
Top	165	165
Left Hand Side	165	165
Right Hand Side	165	165
Underside	165	165
Rear	165	165

Table 35

GPS Antenna In Normalised State

GPS Orientation in Relation to Magnetic Compass	Distance from Magnetic Compass when Standard Deviation is seen (mm)	Distance from Magnetic Compass when Emergency Deviation is seen (mm)
Front	165	165
Top	165	165
Left Hand Side	165	165
Right Hand Side	165	165
Underside	165	165
Rear	165	165

Table 36

GPS Antenna In Powered State

EUT Orientation in Relation to Magnetic Compass	Distance from Magnetic Compass when Standard Deviation is seen (mm)	Distance from Magnetic Compass when Emergency Deviation is seen (mm)
Front	165	165
Top	165	165
Left Hand Side	165	165
Right Hand Side	165	165
Underside	165	165
Rear	165	165

Table 37

Final Results

Standard Compass Safe Distance (mm)	Emergency Compass Safe Distance (mm)
750	500

Table 38



Figure 20 Compass Safe Distance



2.8.8 Test Location and Test Equipment Used

This test was carried out in Offsite Testing.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Sussex Helmholtz Coil	Various	88771	327	-	TU
Compass Verification Unit	TUV SUD	CVU	3579	-	TU
Marine Binnacle Compass with Repeater Display	Cassens & Plath	Compass: Type 11	3834	-	TU

Table 39

TU - Traceability Unscheduled



2.9 Immunity to fast transients on DC power, signal and control lines

2.9.1 Specification Reference

IEC 60945, Clause 10.5

2.9.2 Equipment Under Test and Modification State

ATA100, S/N: TA008 - Modification State 0

2.9.3 Date of Test

03-April-2019

2.9.4 Test Method

The equipment under test including associated cabling was configured on but insulated from, using a 0.1 m isolator, a horizontal coupling plane; above a ground reference plane all within a test laboratory.

Using a CDN for power ports, capacitive coupling clamp for signal and control ports and a 33nF coupling capacitor for earth ports, the required fast transient burst voltage levels in both voltage polarities were applied at the detailed pulse repartition rate and duration of test.

During this test, any anomalies in the equipment under tests performance were recorded.

2.9.5 Environmental Conditions

Ambient Temperature 21.0 °C
 Relative Humidity 35.0 %

2.9.6 Specification Limits

Required Test Levels					Performance Criteria
Line Under Test	Level (±kV)	Repetition Rate (kHz)	Test Duration	Coupling Method	
Signal / Control Port (1)	1.0	5	3 min per polarity	Capacitive Clamp	B
Supplementary information: Note 1. Only required in the case of lines > 3m					

Table 40

2.9.7 Test Results

Results for Configuration and Mode: DC Powered - Operating

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

Tabulated Results for Fast Transient Burst Immunity					
Line under test	Test Level (kV)	Repetition Rate (kHz)	Test Duration (min)	Coupling Method	Result
RF Cable	±0.25, ±0.5 & ±1.0	5	300	Capacitive Clamp	Pass
Sensor 1 2 and 3 cable	±0.25, ±0.5 & ±1.0	5	300	Capacitive Clamp	Pass
LR Cable	±0.25, ±0.5 & ±1.0	5	300	Capacitive Clamp	Pass
GPS Antenna Cable	±0.25, ±0.5 & ±1.0	5	300	Capacitive Clamp	Pass
DGPS	±0.25, ±0.5 & ±1.0	5	300	Capacitive Clamp	Pass
Pilot Port	±0.25, ±0.5 & ±1.0	5	300	Capacitive Clamp	Pass
ECDIS	±0.25, ±0.5 & ±1.0	5	300	Capacitive Clamp	Pass

Table 41

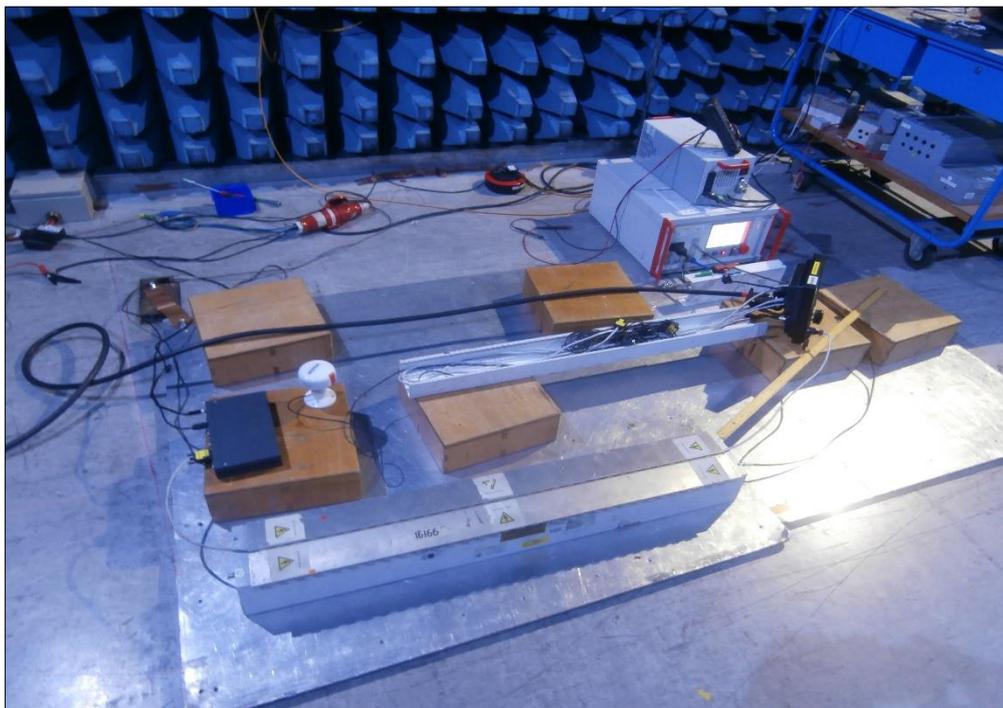


Figure 21 - Immunity to Fast Transients



2.9.8 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Capacitive Coupling Clamp	Omiran	EFTC 105	298	12	03-Jul-2019
EMI Generator	Teseq	NSG 3040-05	4861	12	08-May-2019

Table 42



3 Test Equipment Information

3.1 General Test Equipment Used

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
DC Power Supply	Hewlett Packard	6269B	326	-	TU
Multimeter	Iso-tech	IDM 101	2118	12	08-Feb-2020
GPS/SBAS Simulator	Spirent	STR4500	3056	-	06-Oct-2019
GPS Antenna	ACC	PA175-S	4228	-	TU
Oscilloscope	Tektronix	TDS3052B	3156	12	24-May-2019
35V - 5A Bench Power Supply	Thurlby Thandar Instruments	EX355R	5223	-	TU
Attenuator (20dB, 150W)	Narda	769-20	3367	12	17-Jul-2019
Attenuator (10dB, 150W)	Narda	769-10	3368	12	17-Jul-2019
Attenuator 40dB 100W	Weinschel	48-40-43-LIM	5134	12	07-Nov-2019

Table 43

TU – Traceability Unscheduled



4 Measurement Uncertainty

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

Test Name	Measurement Uncertainty
Immunity to fast transients on DC power, signal and control lines	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-4
Compass safe distance	0.1 Degrees
Immunity to electrostatic discharge	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-2
Immunity to power supply failure	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-11
Immunity to power supply short-term variation	Frequency and Time Voltage Amplitude - 12 parts in 106 / 0.16%
Immunity to radiated radiofrequencies	80 MHz to 2 GHz Test Amplitude ± 2.0 dB
Immunity to conducted radio frequency disturbance	150 kHz to 80 MHz EM Clamp Method of Test, Amplitude ± 3.1 dB CDN Method of Test, Amplitude ± 1.2 dB BCI Clamp Method of Test, Amplitude ± 1.1 dB Direct Injection Method of Test, Amplitude ± 1.2 dB
Radiated emissions	9 kHz to 30 MHz, Active Loop Antenna, ± 3.4 dB 30 MHz to 2 GHz, Bilog Antenna, ± 5.2 dB
Conducted emissions	10 kHz to 30 MHz, LISN, ± 3.7 dB

Table 44

Worst case error for both Time and Frequency measurement 12 parts in 106.
 All measurement uncertainties have been calculated using CISPR guidelines.