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EMC TEST REPORT

No. 16R389 CR

Issue#1: 22nd August 2016

UKAS Accredited
EU Notified Body
FCC & VCCI Registered
BSMI Lab ID: SL2-IN-E-3008
KC Lab ID: EU0184

EMC Test Report

for the

SRT Marine Technology Ltd

Neon II+ Class B Transceiver

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1.0 OVERVIEW

1.1 Introduction

The Equipment Under Test (EUT), as described within this document, was submitted for EMC testing as agreed with the customer.

1.2 Objective

The purpose of the test was to measure and report the EUT against limits and methods of the emissions and immunity standards, as requested for and listed in section **2.0 Test Summary**.

1.3 Product Modifications

None to sample submitted:

1.4 Conclusion

The EUT met the emission limits and immunity requirements of the tests defined in section **2.0 Test Summary**.

This report relates to the sample tested and may not represent the entire population. It is valid only for the product identified, either in part or in full, to the relevant electromagnetic requirements necessary for compliance with the EMC Directive 2004/108/EC.

2.0 TEST SUMMARY

2.1 Summary

The EUT was tested to the EN 60945 (Parts 9 and 10) test standard for maritime navigation and radio communication equipment.

The EUT met the **emission** test requirements of the following standards:

Description	General Standard	Referenced Standard
Conducted disturbance, AC port	EN 301 843-1:V1.3.1† & EN 60945:2002	CISPR 16-1:1999

The EUT met the **immunity** test requirements of the following standards:

Description	General Standard	Referenced Standard
Electrostatic discharge	EN 301 843-1:V1.3.1† EN 60945:2002, ETSI EN 301 489-1:V1.9.2† & ETSI EN 301 489-17:V2.2.1†	IEC 61000-4-2:1995
Radiated RF interference		IEC 61000-4-3:1995
Fast transient bursts		IEC 61000-4-4:1995
Conducted RF Interference		IEC 61000-4-6:1996
Power interrupts		IEC 61000-4-11:1994

The uncertainty of measurement for each test has been included to support a level of confidence of approximately 95%.

† These test standards are not currently included in the UKAS Accreditation Schedule for Hursley EMC Services.

Note: The radiated emissions are covered by the requirements of the radio transmitter specifications.

2.2 Test Deviations

None.

2.3 EMC Test Lab Reference

Hursley EMC Services file: 16R389.

3.0 EQUIPMENT & TEST DETAILS

3.1 General

EUT:	Neon II+ Class B Transceiver Make: SRT Marine Technology Ltd Model: Neon II+ Serial number: 41300802060043
EUT powered by:	12V DC via a bench power supply
EUT manufacturer:	SRT Marine Technology Ltd
EUT build level:	Production sample
Customer:	SRT Marine Technology Ltd Wireless House Westfield Industrial Estate Midsomer Norton Bath BA3 4BS United Kingdom Tel: +44 (0) 1761 409 500
Test commissioned by:	Mr Philip Pittaway
Date EUT received:	8 th August 2016
Test date(s):	8 th to the 10 th August 2016
EMC measurement site:	Hursley EMC Services Limited Hursley Park, Winchester, Hampshire

3.2 EUT Description

The Neon II+ is an updated version of a mature existing product, the Neon II. It is an AIS Class B CSTDMA AIS Transponder with an additional WIFI port. The product can be installed on a variety of marine vessels ranging from fishing boats to large cargo ships and will transmit messages such as position and safety reports.

3.3 EUT Support

- SRT Apollo, s/n 42500021
- 30dB attenuators
- HEMCS 3115 Horn Antenna, s/n 85 & 430
- HP Probook H530S Laptop, ID 000209
- GPS Antenna, s/n 02
- Weir Power Supply 413D, s/n 8796

3.4 EUT Test Exerciser

The EUT was set to transmit its position over the VHF channel every 5 seconds. An AIS Class A unit [Apollo] was used as a receiver, although by default will also transmit every 20 seconds. Their VHF ports are connected together via 3x30dB attenuators and cabling. On the Apollo display, there is a screen that lists all other AIS targets that are in range.

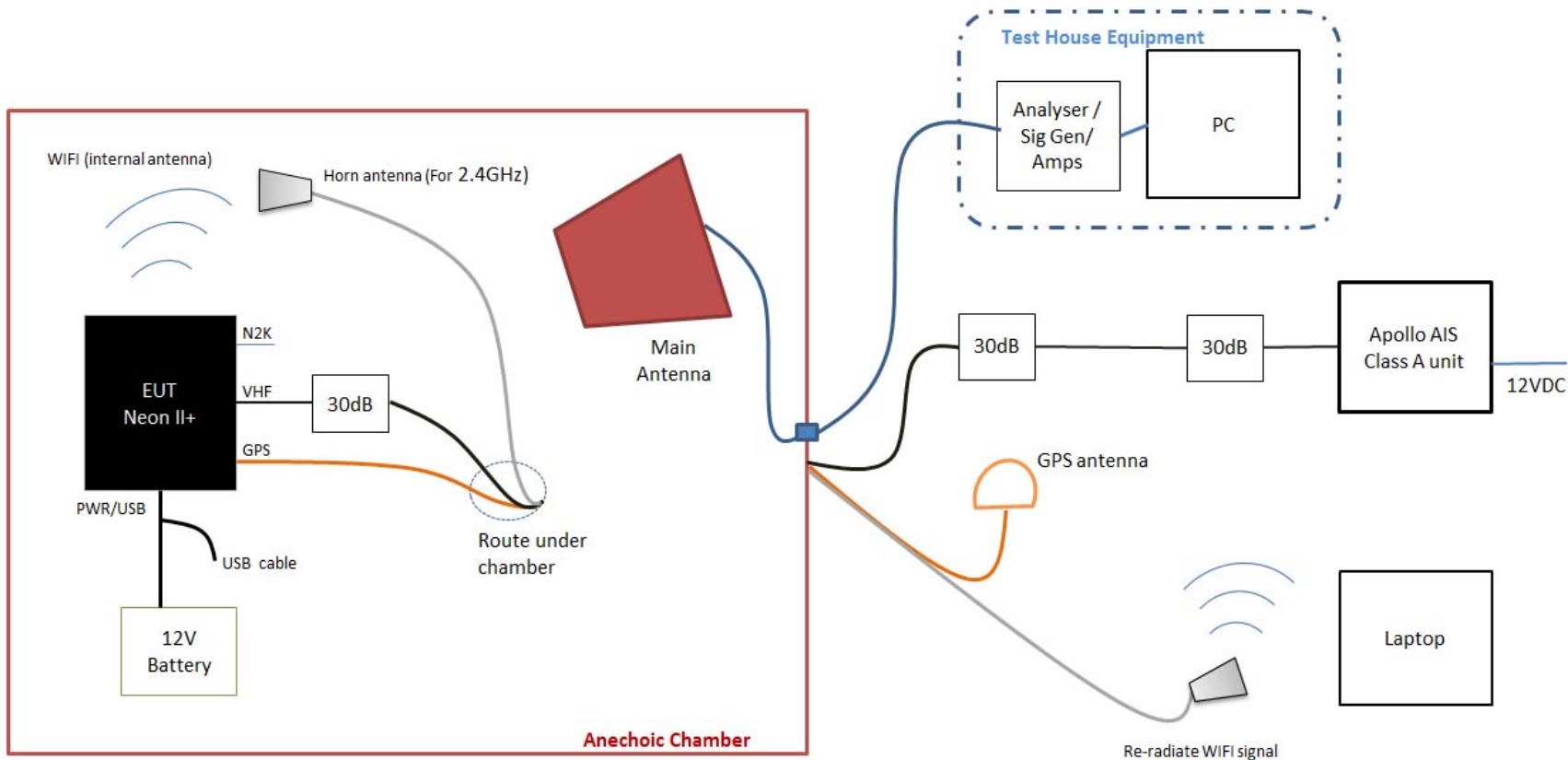
1. The age of a received transmission will not be older than 5 seconds. This can be monitored on the Apollo display.

The second port of interest is the new WIFI port. The Neon II+ utilises a WIFI module with an internal antenna so the WIFI signal is captured and re-radiated out of the chamber using a pair of horn antennas. Outside the chamber, a laptop can connect to the WIFI port using TeraTerm. This terminal should receive 1-2 sentences a second and so the terminal can be easily monitored for activity, or lack of.

2. The activity from the WIFI port can be monitored via a TCP connection using a terminal application called TeraTerm, where dropouts can be easily spotted. All other immunity tests may take place outside the chamber. This means the WIFI link will not need re-radiating. Checking operation of the EUT remains the same.

3.5 EUT Test Configuration

Radiated immunity



3.6 Environmental Test Conditions

Temperature	20 to 21° Celsius
Relative Humidity	48 to 50%
Atmospheric Pressure	1011 to 1014millibars

3.7 EMC Test Equipment

#ID	CP	Manufacturer	Type	Serial Nø	Description	Calibration due date
013	1	Schaffner	CBL6140A	1235	Antenna X-wing (chamber)	Internal
030a	1	KeyTek	MZ-15/EC	0406216	ESD Minizap /pink	12/02/2017
068	1	EM	CWS500C	1001-07	Conducted immunity simulator	23/03/2017
068a	1	EM	6dB pad	001	CWS 6dB matcher	11/03/2017
080	1	Select	-	11.5m	BNC conducted emissions	Internal
117	1	KeyTek	EMC Pro	9711274	Immunity tester	03/09/2016
118	1	KeyTek	Pro CCL	9711291	Capacitive clamp	Internal
189	1	Rohde & Schwarz	ESH3-Z2		Pulse limiter N type	08/09/2016
166	1	Oregon Sci	BA-888	f block	Electronic barometer	Internal
170	1	Fischer	FCC150-50	336	Adapter (100Ω)	Internal
190	0	Milmega	AS0104-55/55	1010023	RF amplifier (1-4GHz)	Internal
200	1	Fischer	F-203I-32MM	09849	EM Injection clamp (10k-1GHz)	11/03/2017
201	1	Boonton	4231A	12402	Power meter	05/11/2016
207	1	Fischer	801-M2-16	08003	CDN 2xwire	21/01/2017
297	3	Q-par Angus	QSH20S20S	9526	18 to 26 GHz Barbie	13/08/2017
550	1	AR	200W1000N7A	0	80 to 1000MHz RF Amplifier	Internal
254	1	KeyTek	Pro CCL	A000103416	Capacitive clamp	27/05/2017
668	1	EMC Partner	IMU 4000	0	IMU 4000+E698+A698:G698	Internal
674	1	R&S	ESH3-Z5	838576-018	1 phase LISN	30/08/2016
698	1	Gauss	TDEMI30M	1510002	Time Domain Conducted Receiver	19/10/2016
718	1	Rohde Schwarz	SMT06	831654/005	6GHz sig gen with pulse	08/06/2017

CP = Interval period [year] prescribed for external calibrations

Note: ‘Calibration due date’ means that the instrument is certified with a UKAS or traceable calibration certificate.
‘Internal’ means internally calibrated using HEMCS procedures

4.0 EMISSION RESULTS

4.1 Conducted Disturbance

A filtered 12V DC mains supply was fed to the EUT via a 50Ω/50μH Artificial Mains Network (AMN). The AMN was bonded to a conductive ground plane. Line and neutral phases were measured separately.

A spectrum analyser was set to scan between 10 kHz and 30 MHz to record the peak emission profiles. The worst-case peaks were then measured using a quasi-peak receiver and compared to the EN 60945 limit. Measurements made according the EN 60945 test standard and Hursley EMC Services test procedure CON-02. The worst-case results are shown here.

4.1.1 Data

0V

Frequency	Quasi-peak value (dBμV)			
	Measured	Measured quasi-peak value including uncertainty budget	Limit	Status
17.981 kHz	49.10	52.32	86.03	Pass
31.193 kHz	39.24	42.46	76.68	Pass
49.671 kHz	26.62	29.84	68.77	Pass
65.863 kHz	23.33	26.55	63.98	Pass
65.962 kHz	22.97	26.19	63.96	Pass
93.579 kHz	14.03	17.25	58.01	Pass
99.341 kHz	18.62	21.84	57.00	Pass
121.395 kHz	12.29	15.51	53.59	Pass
133.912 kHz	14.31	17.53	51.93	Pass
140.071 kHz	22.37	25.59	51.16	Pass
1.259 MHz	39.44	42.66	50.00	Pass
3.142 MHz	26.31	29.53	50.00	Pass
6.919 MHz	28.05	31.27	50.00	Pass
10.691 MHz	24.56	27.78	50.00	Pass
12.579 MHz	24.78	28.00	50.00	Pass
17.300 MHz	21.26	24.48	50.00	Pass
19.202 MHz	29.03	32.25	50.00	Pass
24.004 MHz	21.04	24.26	50.00	Pass
25.001 MHz	21.77	24.99	50.00	Pass
29.993 MHz	22.48	25.70	50.00	Pass

Uncertainty of measurement: ± 3.22 dBμV for a 95% confidence level has been added to the measured result.

Conducted disturbance (continued)

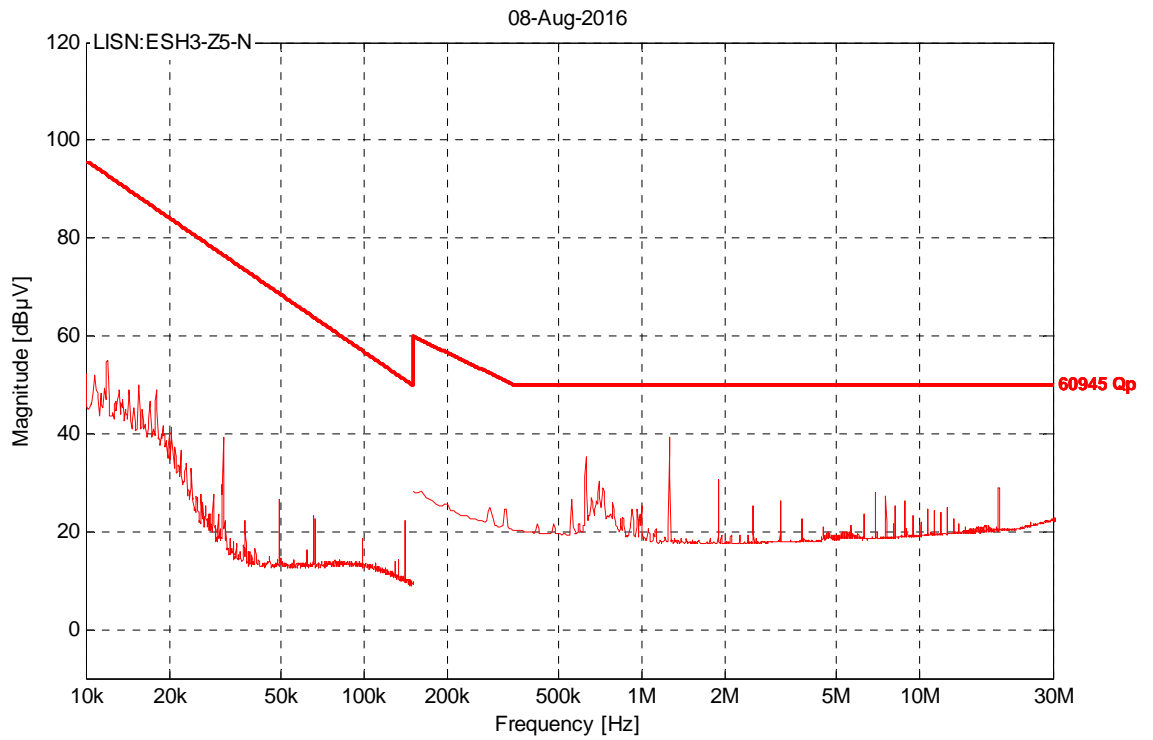
12V

Frequency	Quasi-peak value (dB μ V)			
	Measured	Measured quasi-peak value including uncertainty budget	Limit	Status
17.981 kHz	48.85	52.07	86.03	Pass
31.193 kHz	41.66	44.88	76.68	Pass
49.671 kHz	26.69	29.91	68.77	Pass
65.863 kHz	23.59	26.81	63.98	Pass
65.962 kHz	23.09	26.31	63.96	Pass
93.679 kHz	13.91	17.13	58.00	Pass
99.341 kHz	18.67	21.89	57.00	Pass
120.997 kHz	12.17	15.39	53.65	Pass
133.812 kHz	14.07	17.29	51.94	Pass
140.071 kHz	22.49	25.71	51.16	Pass
629.425 kHz	41.82	45.04	50.00	Pass
4.511 MHz	21.01	24.23	50.00	Pass
6.919 MHz	24.95	28.17	50.00	Pass
10.686 MHz	24.59	27.81	50.00	Pass
12.574 MHz	25.92	29.14	50.00	Pass
17.238 MHz	22.10	25.32	50.00	Pass
19.202 MHz	29.52	32.74	50.00	Pass
23.899 MHz	21.06	24.28	50.00	Pass
26.808 MHz	21.84	25.06	50.00	Pass
29.712 MHz	22.52	25.74	50.00	Pass

Uncertainty of measurement: ± 3.22 dB μ V for a 95% confidence level has been added to the measured result.

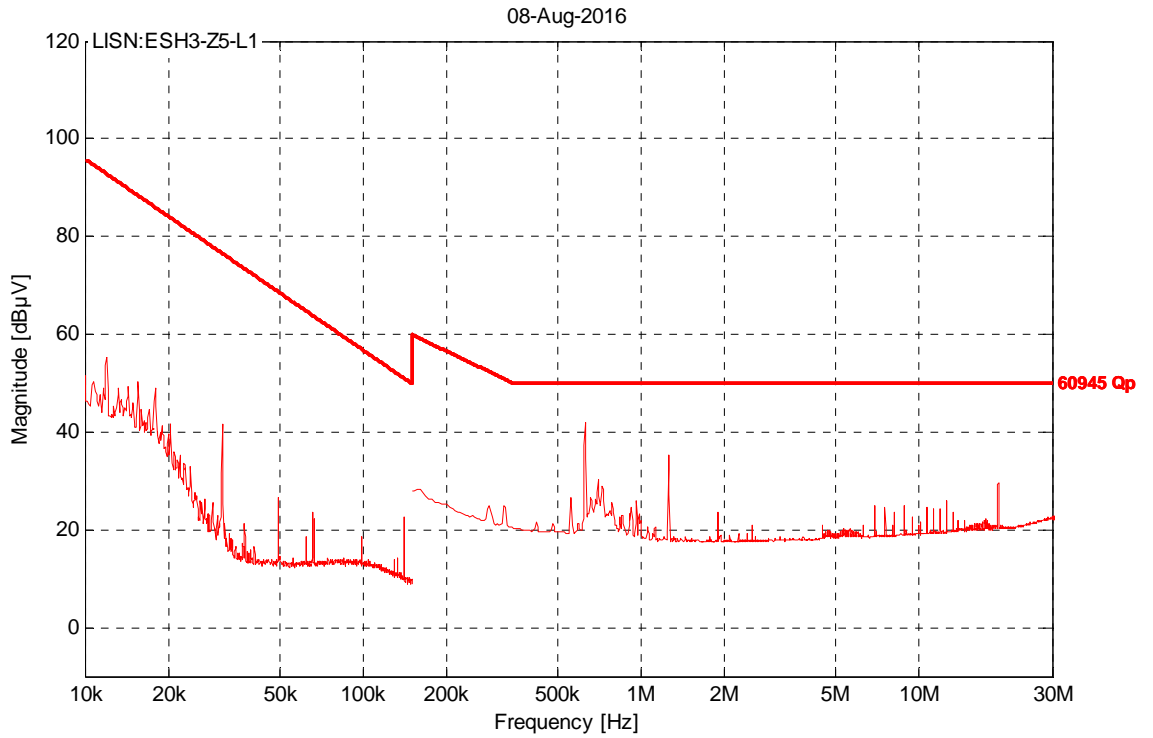
TEST ENGINEER: Allan Wheelen

4.1.2 Profile; 0V



Receiver Model: TDEMI G0,SN1510002
Protocol Number: 16R389_CE_2
Serial Number: 41300802060043
Operation State: TRANSCIEVE

4.1.3 Profile; 12V



Receiver Model: TDEMI G0,SN1510002
Protocol Number: 16R389_CE_2
Serial Number: 41300802060043
Operation State: TRANSCEIVE

5.0 IMMUNITY RESULTS

5.1 Performance Criteria

General performance criteria for immunity testing are defined below:-

Criterion A:	<p>The apparatus shall continue to operate as intended. 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. In some cases the performance level may be replaced by a permissible loss of performance. If the performance level or the permissible level is not specified by the manufacturer then either of these may be derived from the EUT description and documentation and what the user may reasonably expect from the apparatus if used as intended.</p> <p>Wi-Fi: No unintended transmissions, no loss of communication.</p>
Criterion B:	<p>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. In some cases 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 level is not specified by the manufacturer then either of these may be derived from the EUT description and documentation and what the user may reasonably expect from the apparatus if used as intended.</p> <p>Wi-Fi: No unintended transmissions, any loss of communication shall automatically recover.</p>
Criterion C:	<p>Temporary loss of function is allowed provided the loss of function is self-recoverable or can be restored by the operation of the controls, or by any operation specified in the instructions for use.</p>

Note: All immunity tests were applied above the specification level to include the uncertainty attributed to each test.

5.2 Electrostatic Discharge

TEST METHOD	IEC 61000-4-2 REFERENCING PROCEDURE: ESD-03
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TEST DETAILS

Test severity, <u>contact discharge</u>	± 6.0 kV, 50 strikes per point. Total of 200 strikes (minimum).
Test severity, <u>air discharge</u>	± 8.0 kV, 10 strikes for each selected point
Exerciser program during test	Referencing section 3.4
Specified test criterion	Criterion 'B'
EUT performance criterion	Criterion 'A'

RESULTS

Contact, Indirect

SPECIFIED VOLTS	REFERENCE PLANE @ 10cm	STATUS
± 4.0 kV	Horizontal and vertical; front, rear and sides	PASS
± 6.0 kV	Horizontal and vertical; front, rear and sides	PASS

Contact, Direct To EUT

SPECIFIED VOLTS	TEST POINTS	STATUS
± 2.0 kV	Case and connector shells; see illustration on next page	PASS
± 4.0 kV		PASS
± 6.0 kV		PASS

Air Discharge (Insulating, Slots & Apertures)

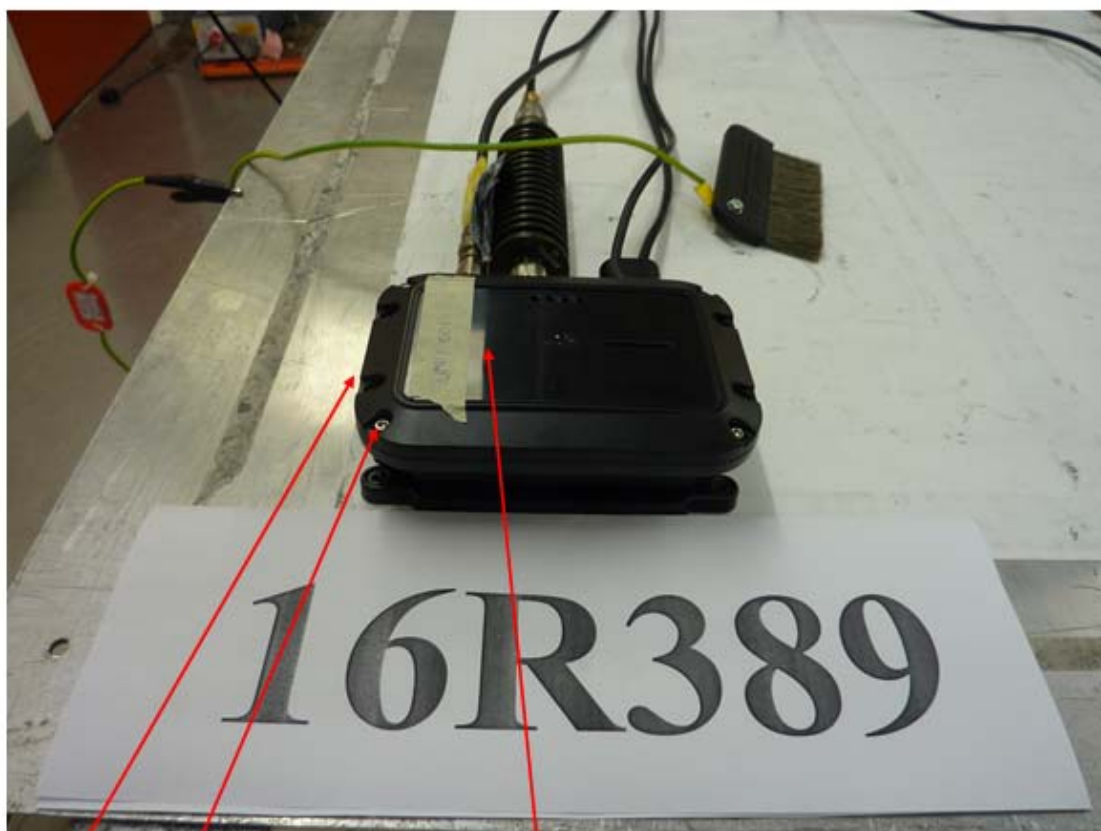
SPECIFIED VOLTS	TEST POINTS	STATUS
± 2.0 kV	See illustration on next page	PASS
± 4.0 kV		PASS
± 8.0 kV		PASS

UNCERTAINTY: Specified as less than 5%. The level applied was 5% higher than the upper levels stated above to take into account the uncertainty for this test.

COMMENT: The EUT met the specified test criterion.

TEST ENGINEER: Allan Wheelen

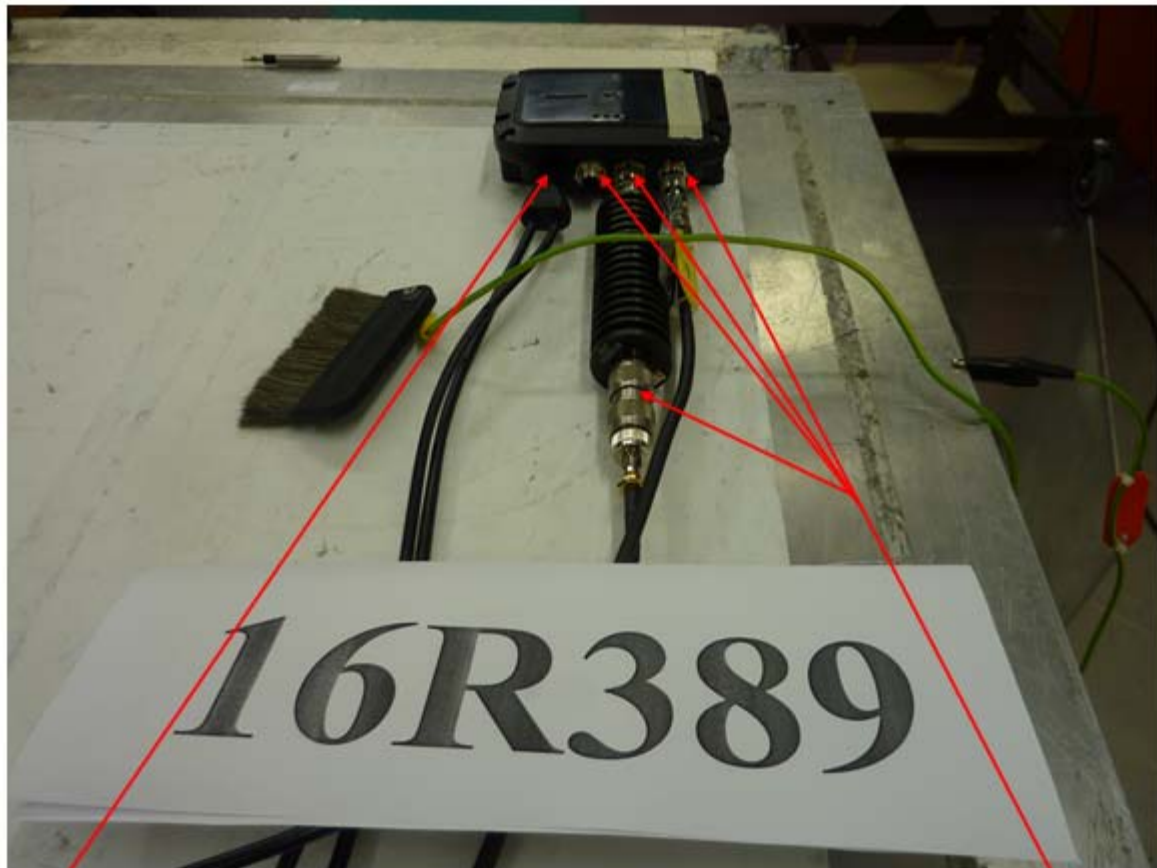
5.2.1 Electrostatic Discharge Test Points



1. 2. 3.

- 1. Side seams (Air) (No discharge)
- 2. Fixing screw x 4 (Contact) (No discharge)
- 3. Top (Air) (No discharge)

Electrostatic discharge set-up (continued)



4.

5.

- 4. DC input (Air) (No discharge)
- 5. Connector shell x 4 (Contact)

HCP: (Indirect)
VCP: (Indirect)

5.3 Radiated RF Interference

TEST METHOD	IEC 61000-4-3 REFERENCING PROCEDURE: RES-02
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TEST DETAILS

Test severity levels,	<ul style="list-style-type: none"> • 10.0 V/m; 80 to 2700 MHz swept frequency • 80% amplitude modulation 400 Hz • 1% increment, 3 seconds dwell time and 9 seconds dwell time from 1.0 GHz
Exerciser program during test	Referencing section 3.4
Specified test criterion	Criterion 'A'
EUT performance criterion	Criterion 'A'

RESULTS

TEST POINTS	ANTENNA POLARITIES	FIELD LEVEL SPOT FREQUENCY	STATUS
Front	Horizontal & vertical	10.0 V/m	PASS
Side, left	Horizontal & vertical	10.0 V/m	PASS
Side, right	Horizontal & vertical	10.0 V/m	PASS
Rear	Horizontal & vertical	10.0 V/m	PASS

UNCERTAINTY: Estimated uncertainty is 20%. The field level has been applied at level higher of 12 V/m to take into account uncertainties.

COMMENT: The exclusion band was $\pm 5\%$ of the GPS frequency (1570 MHz), Wi-Fi Band (2.45 - 2.485GHz) ± 10 MHz and $\pm 5\%$ of the AIS frequency band (156.025 to 162.025 MHz). In test no exclusion bands were used. The EUT met the specified test criterion.

TEST ENGINEER: Allan Wheelen

5.4 Fast Transient Bursts

TEST METHOD	IEC 61000-4-4 REFERENCING PROCEDURE: FTB-01
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TEST DETAILS

Test severity	<ul style="list-style-type: none"> • ± 1.0 kV All Ports 5/50ns Tr/Td 5kHz Repetition Rate
Exerciser program during test	Referencing section 3.4
Specified test criterion	Criterion 'B'
EUT performance criterion	Criterion 'A'

RESULTS

Injection Via Clamp

PORT	TEST VOLTAGE	STATUS
All ports	± 1.0 kV	PASS

UNCERTAINTY: Specified as less than 10% but estimated as less than 5%. The level applied was 5% higher than the levels stated above to take into account the uncertainty for this test.

COMMENT: The EUT met the specified test criterion.

TEST ENGINEER: Allan Wheelen

5.5 Conducted RF Field

TEST METHOD	IEC 61000-4-6 REFERENCING PROCEDURE: CES-02
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TEST DETAILS

Test severity level	<ul style="list-style-type: none"> • 3.0V rms, 80% amplitude modulation 400 Hz 0.15 to 80 MHz • 10V rms spot frequencies at: 2, 3, 4, 6.2, 8.2, 12.2, 12.6, 16.5, 18.8, 22, 25 MHz, the dwell at each frequency was 60 seconds.
Exerciser program during test	Referencing section 3.4
Specified test criterion	Criterion 'A'
EUT performance criterion	Criterion 'A'

RESULTS

TEST VOLTAGE	TEST POINTS	COUPLING METHOD	STATUS
3.0V & 10.0V	DC Input	CDN	PASS

RESULTS – Signal Port

TEST VOLTAGE	TEST POINTS	COUPLING METHOD	STATUS
3.0V & 10.0V	AIS & GPS	150-50 ohm Adapter	PASS
3.0V & 10.0V	All other signal ports	EM-Clamp	PASS

UNCERTAINTY: Estimated uncertainty is < 5%. The applied voltage has been applied at higher level of 4 or 12V to take into account uncertainties.

COMMENT: The EUT met the performance criterion.

TEST ENGINEER: Allan Wheelen

5.6 Power Line Disturbance

TEST METHOD	IEC 61000-4-11 REFERENCING PROCEDURE: PLD-01
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TEST DETAILS	Specified test types & levels (voltage shift @ zero phase crossing)	Specified criteria
	Interrupt: 100% reduction for 60s	C
Exerciser program during test	Referencing section 3.4	

RESULTS

Applied test types & levels	Test point	Nominal operation frequency / voltage	Performed criteria	Status
-100% x 60s	DC Input	12V DC	C	PASS

UNCERTAINTY: Specification level is 5% but estimated as less than 1%.

COMMENT: The EUT reset and continued after the test. The EUT met the performance criteria.

TEST ENGINEER: Allan Wheelen

6.0 PHOTO LOG (TYPICAL)

Emissions:

Conducted disturbance



Photo Log (continued)

Immunity:

Electrostatic discharge (set-up)



Photo Log (continued)

Immunity:

Conducted RF field



Photo Log (continued)

Immunity:

Radiated RF field

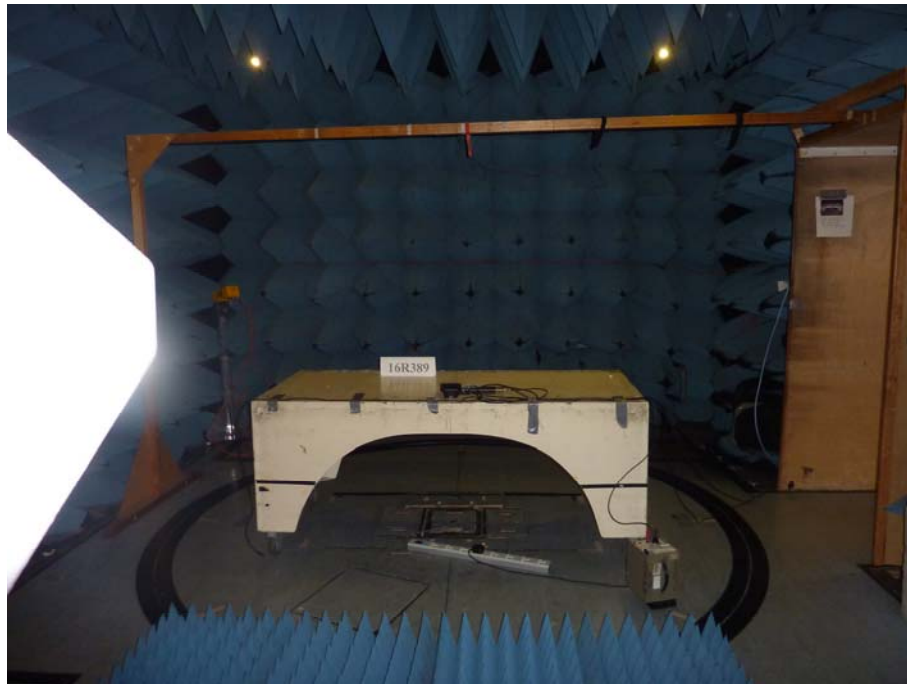
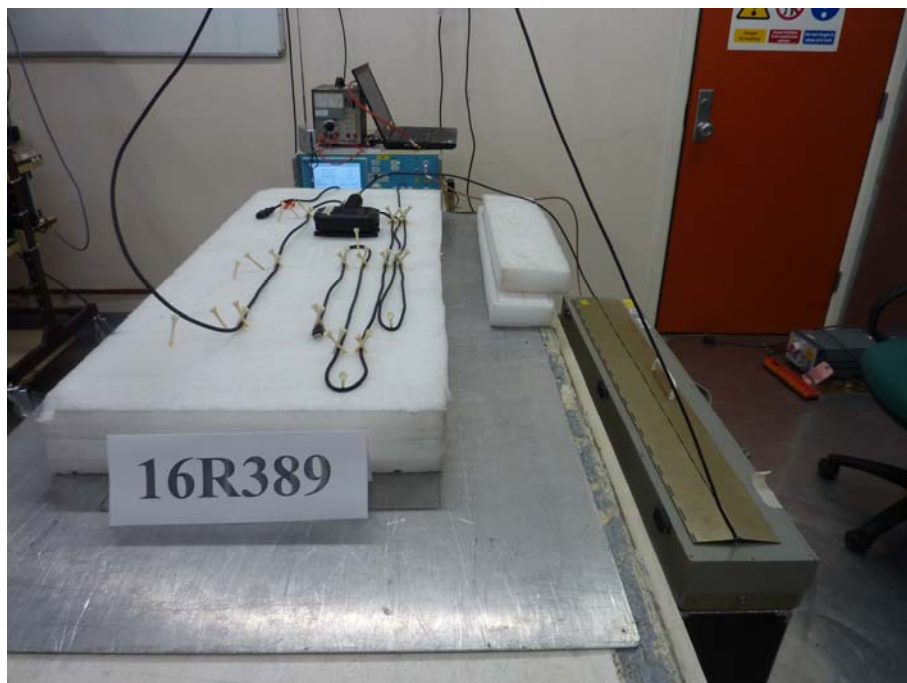
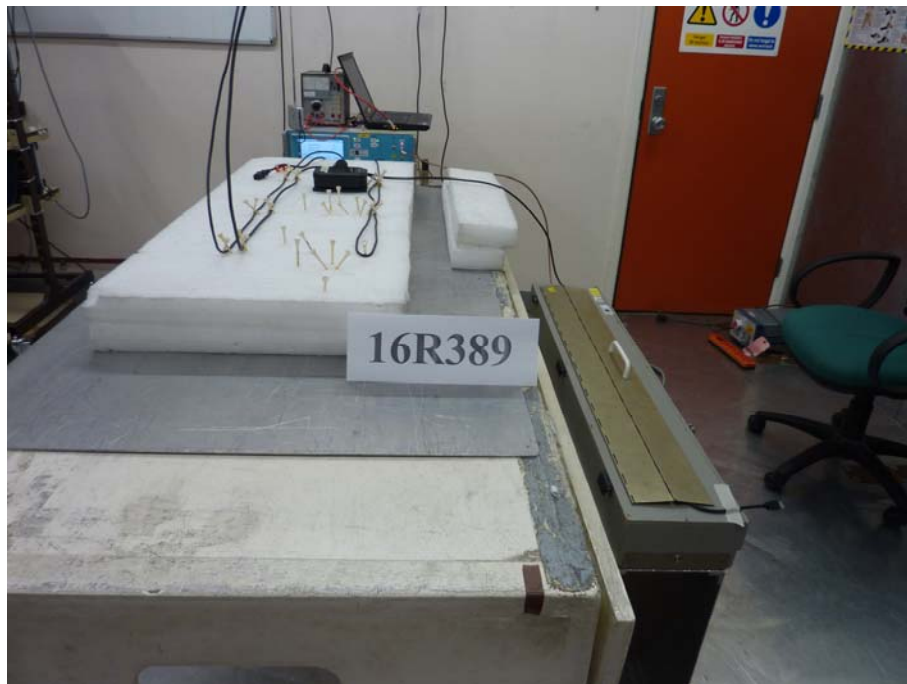


Photo Log (continued)

Immunity:

Fast burst transients



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