



HURSLEY
EMC
SERVICES

EMC TEST REPORT

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UKAS Accredited
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EMC Test Report for the SRT Marine Technology Ltd CS100 Coast Station

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Contents

1.0	OVERVIEW	3
1.1	INTRODUCTION	3
1.2	OBJECTIVE	3
1.3	PRODUCT MODIFICATIONS	3
1.4	CONCLUSION	3
2.0	TEST SUMMARY	4
2.1	SUMMARY	4
2.2	TEST DEVIATIONS	4
2.3	EMC TEST LAB REFERENCE	4
3.0	EQUIPMENT & TEST DETAILS	5
3.1	GENERAL	5
3.2	EUT DESCRIPTION	6
3.3	EUT SUPPORT	6
3.4	EUT TEST EXERCISER	6
3.5	EUT TEST CONFIGURATION	7
3.6	ENVIRONMENTAL TEST CONDITIONS	10
3.7	EMC TEST EQUIPMENT	10
4.0	EMISSION RESULTS	11
4.1	RADIATED DISTURBANCE	11
4.2	CONDUCTED DISTURBANCE	16
4.3	CONDUCTED DISTURBANCE, TELECOMMUNICATION LINE	19
5.0	IMMUNITY RESULTS	21
5.1	PERFORMANCE CRITERIA	21
5.2	ELECTROSTATIC DISCHARGE	22
5.3	RADIATED RF INTERFERENCE	24
5.4	FAST TRANSIENT BURSTS	25
5.5	SURGE, AC PORT	26
5.6	CONDUCTED RF FIELD	27
5.7	POWER LINE DISTURBANCE	28
5.8	PSU SHORT TERM VARIANCE	29
6.0	PHOTO LOG (TYPICAL)	30

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
Radiated disturbance	EN 60945:2002 & ETSI EN 301 489-1:V1.9.2 [†]	CISPR 16-1:1999 & EN 55022:2010
Radiated disturbance, H-Field		
Conducted disturbance, AC port		

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

Description	General Standard	Referenced Standard
Electrostatic discharge	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
Surge		IEC 61000-4-5:2005
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.

2.2 Test Deviations

None.

2.3 EMC Test Lab Reference

Hursley EMC Services file: 14R443.

3.0 EQUIPMENT & TEST DETAILS

3.1 General

EUT:	CS100 Coast Station Make: SRT Marine Technology Ltd Model: CS100 Serial number: 4230001033940007
EUT powered by:	AC/DC Adapter CUI Model EMSA240167 Serial number: 001
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 Richard McMahon
Date EUT received:	9 th October 2014
Test date(s):	9 th to the 20 th October 2014
EMC measurement site:	Hursley EMC Services Limited Trafalgar House, Trafalgar Close, Chandlers Ford, Hampshire

3.2 EUT Description

The EUT is an internet connected AtoN (Aid to Navigation) Transceiver. The Coast Station is suitable for shore locations and may transmit position and other key data to surrounding maritime AIS equipment, as well as to remote locations over the internet.

3.3 EUT Support

- Virgin SuperHub (Wi-Fi), Model: 272-1154-01, s/n 2HA535V212D1B
- SRT CS100 Coast Station, s/n 001
- 30dB attenuators
- HEMCS GPS receiver & repeater
- HP Compaq nx6110 Laptop, s/n CNU616112G
- HP Laptop Power Supply, s/n 57BC30AU4SG0P3
- GPS Antenna (x2)

3.4 EUT Test Exerciser

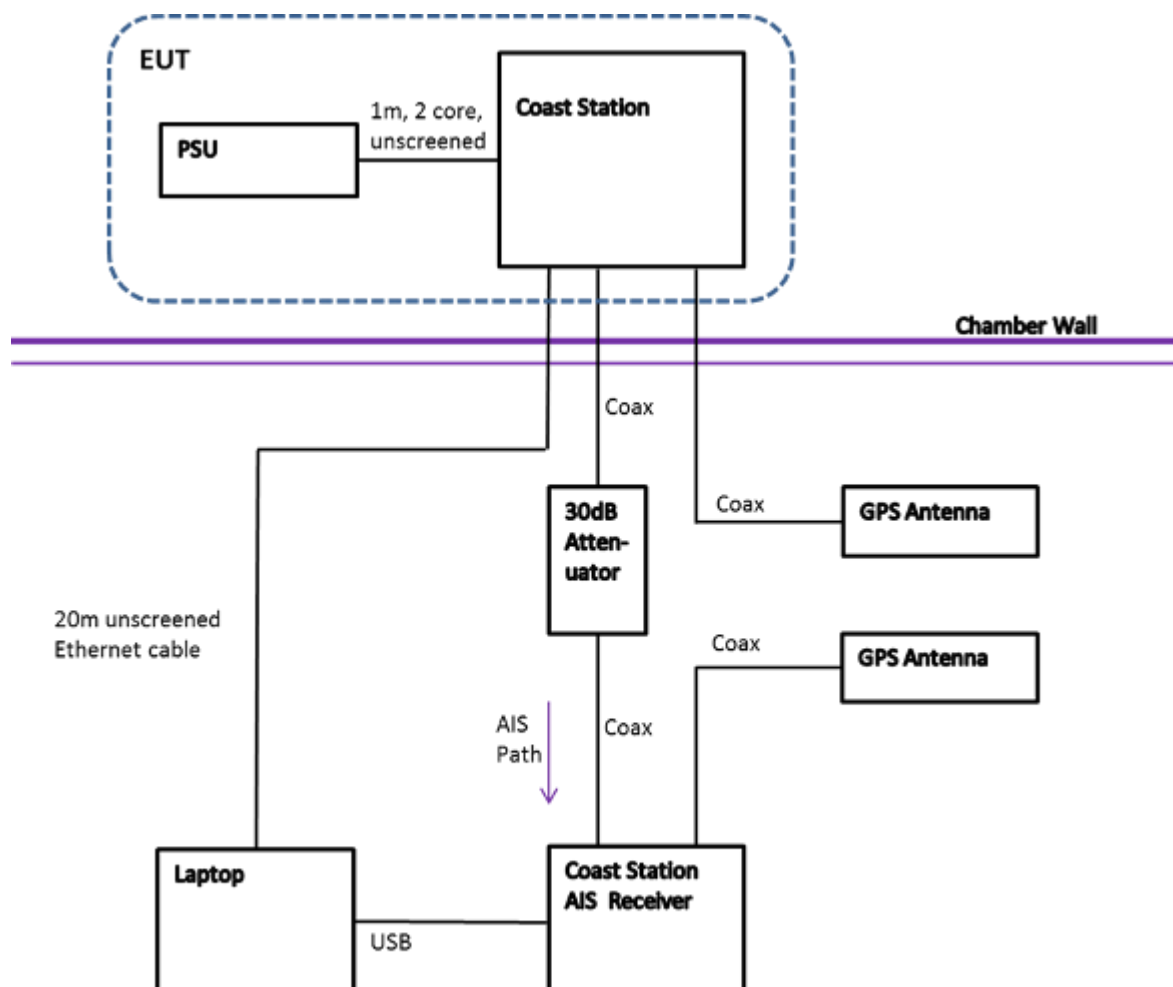
The EUT was set to transmit its position every 10 seconds alternating from channel A and channel B. The AIS receiver will log all transmissions it receives from the EUT to a laptop via Tera Term. The logging is time-stamped in order to check that these transmissions are occurring on time throughout the testing.

The EUT was also connected to the laptop via Ethernet or Wi-Fi. The laptop had a second Tera Term window open connected via TCP/IP directly logging the EUT serial data. Again this logging was time-stamped in order to check for connection drop-outs.

The power supply providing the DC power to the EUT was powered at 230V/50Hz.

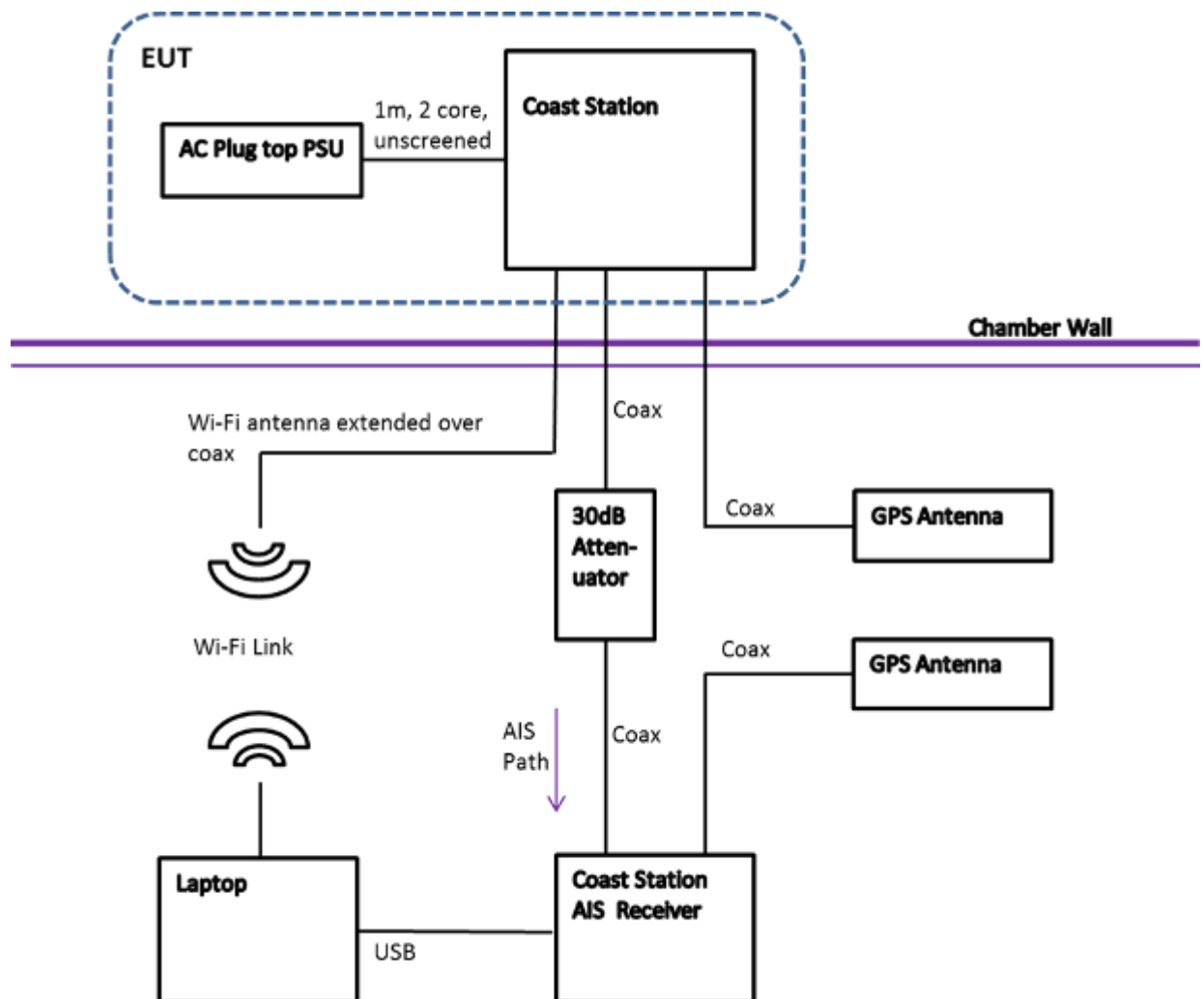
3.5 EUT Test Configuration

Radiated immunity – Ethernet mode



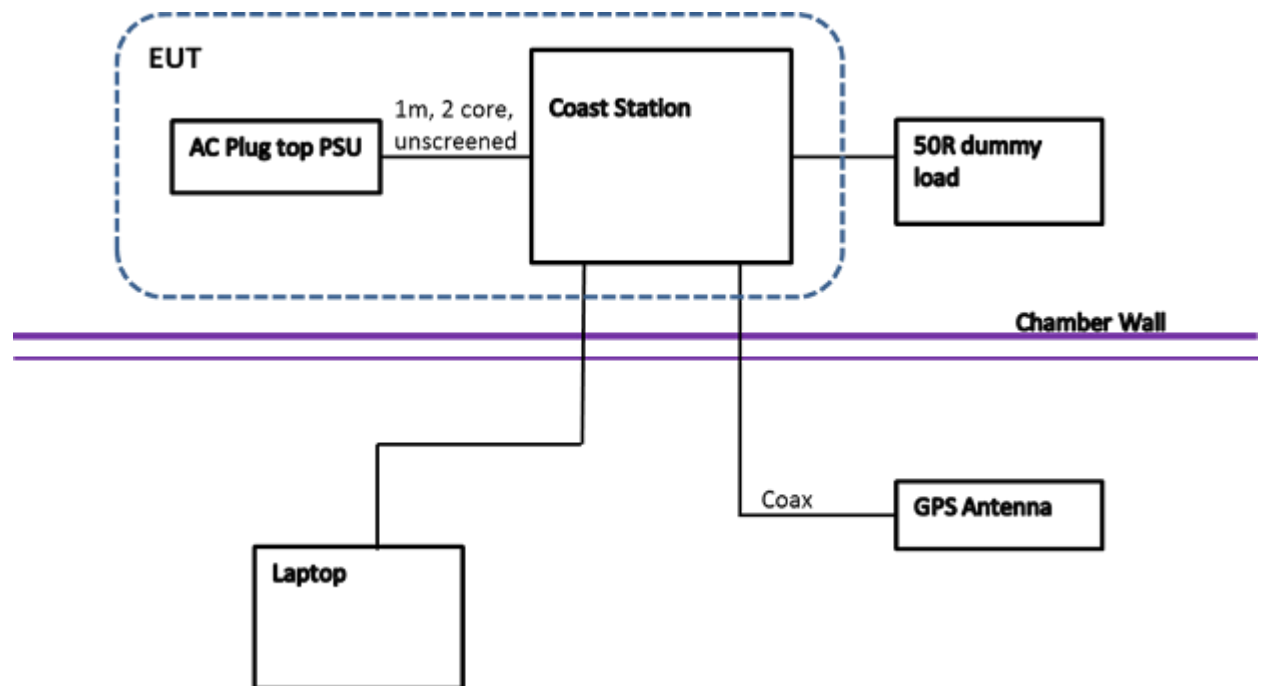
EUT Test Configuration (continued)

Radiated immunity – WiFi mode



EUT Test Configuration (continued)

Emissions



3.6 Environmental Test Conditions

Temperature	21 to 22° Celsius
Relative Humidity	45 to 52%
Atmospheric Pressure	992 to 1015 millibars

3.7 EMC Test Equipment

#ID	CP	Manufacturer	Type	Serial Nø	Description	Calibration due date
003	1	Rohde & Schwarz	ESH-3	872994/027	Test receiver (9kHz-30MHz)	19/09/2015
007	1	HP	8568B	1921A00797	Spectrum analyser	Internal
030a	1	KeyTek	TPC-2	1407181	OmniTip probe for #30 Zap	11/08/2015
040	1	HP	8593EM	3536A00137	Spectrum analyser (9kHz-26.5GHz)	10/10/2015
047	3	Rohde & Schwarz	HFH2-Z2	879021/22	Loop antenna (9kHz-30MHz)	05/08/2017
050	1	HP	8447D	1937A02341	Pre-amplifier (30-1000MHz)	Internal
068	1	EM	CWS500C	1001-07	Conducted immunity simulator	13/02/2015
070	1	HP	8449B	3008A00481	Pre-amplifier (1.0-26.5GHz) + 0.5m cable	05/12/2014
116	1	Rohde & Schwarz	ESH-3 Z2	M458	Pulse limiter BNC type	04/02/2015
117	1	KeyTek	EMC Pro	9711274	Immunity tester	08/07/2015
126	0	Schaffner	NSG1007	55090	Power source (5kW)	Internal
147	1	Rohde & Schwarz	ESH3 Z5	846695/011	Single phase (LISN / AMN)	06/06/2015
152	1	Fischer	801-M2-16	9867	CDN mains 2xwire	06/11/2014
170	1	Fischer	FCC150-50	336	Adapter (100Ω)	Internal
171	1	Fischer	FCC150-50	337	Adapter (100Ω)	Internal
187	1	Fischer	F-2031-23	379	EM injection clamp (10k-1GHz)	26/03/2015
207	1	Fischer	801-M2-16	08003	CDN 2xwire	20/11/2014
213	1	Fischer	801-M3-16	1051	CDN 3W 16A	20/11/2014
249	1	EMC Partner	H1000	157	Harmonics & flicker analyser	30/06/2015
254	1	KeyTek	Pro CCL	A000103416	Capacitive clamp	Internal
390	0	Schwarzbeck	STLP9128D	9128D-060	RES antenna Saturn	Internal
452	3	CHASE	CBL 6141	4013	Pink 30M-2G Antenna	02/10/2015
455	1	Schwarzbeck	8158	cat5-8158-0055	ISN	27/11/2014
466	2	Schwarzbeck	BBHA 9120 571	571	1-10GHz Horn	29/01/2015
552	1	Rohde & Schwarz	ESC17	1166595007	7GHz Receiver	17/04/2015
554	1	Rohde & Schwarz	ESH3	872079/120	Conducted Receiver	17/09/2015
555	1	Milmega	500W Amp	0	80-1000 MHz	Internal

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 Radiated Disturbance

A profile scan was taken at a distance of three metres on eight azimuths of the EUT in both the vertical and horizontal polarities of the antenna in a semi-anechoic chamber. Tests were carried out with the transmitter ready to transmit but not transmitting.

Using the data obtained from the chamber profile-scan as an engineering guide, the EUT was then transferred onto the turntable in the Open Area Test Site. The antenna was positioned at a distance of three metres from the periphery of the EUT. Radiated emissions were then systematically maximised by revolving the EUT and adjusting the antenna in polarity and height. The highest emissions are presented here.

4.1.1 Data, 30 to 6000 MHz

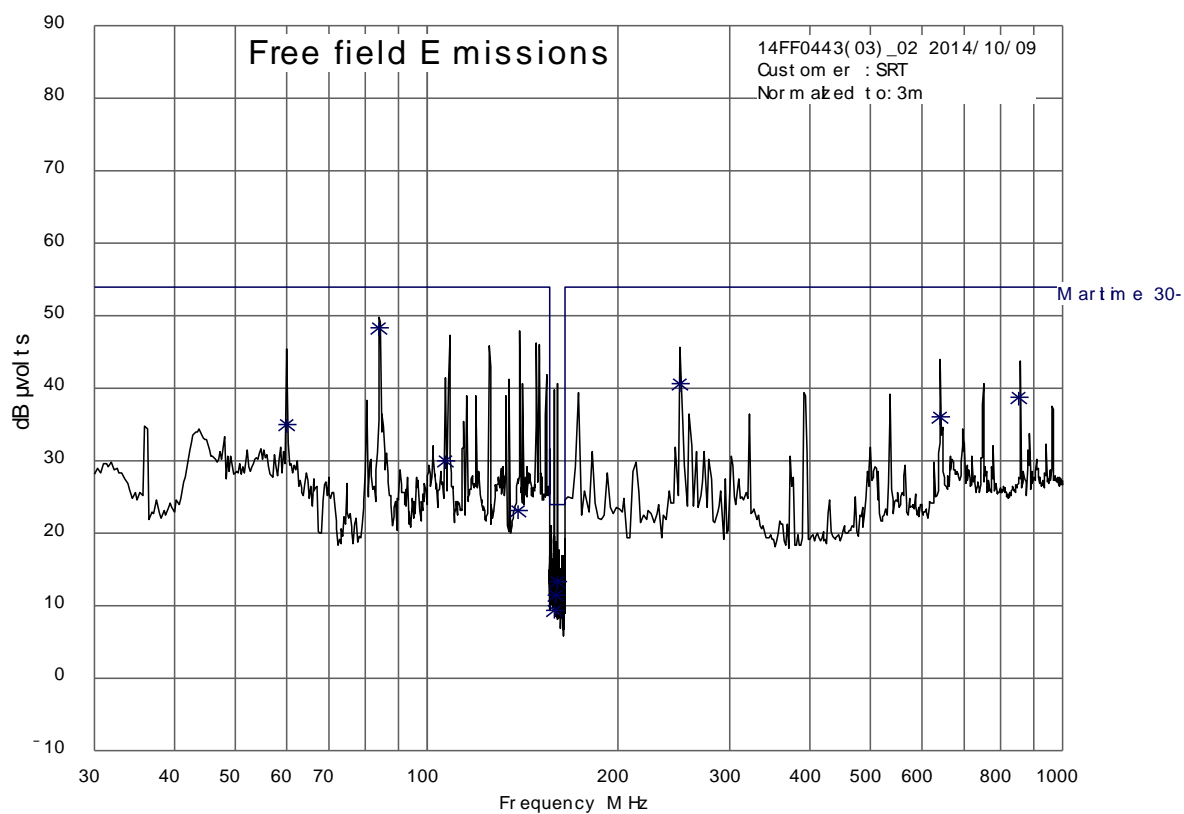
Emission frequency (MHz)	Measured quasi-peak value (dB μ V/m)	Measured quasi-peak value including uncertainty budget	Specified quasi-peak limit (dB μ V/m)	Status
59.999	34.95	39.15	54.0	Pass
84.004	48.33	52.53	54.0	Pass
106.677	30.06	34.26	54.0	Pass
139.212	23.22	27.42	54.0	Pass
158.491	9.46	13.66	24.0	Pass
159.637	11.42	15.62	24.0	Pass
160.050	13.38	17.58	24.0	Pass
249.998	40.57	44.77	54.0	Pass
640.000	36.14	40.34	54.0	Pass
853.370	38.75	42.95	54.0	Pass

The uncertainty of measurement: $\pm 4.2\text{dB}\mu\text{V}$ for a 95% confidence level has been added to the measured result.

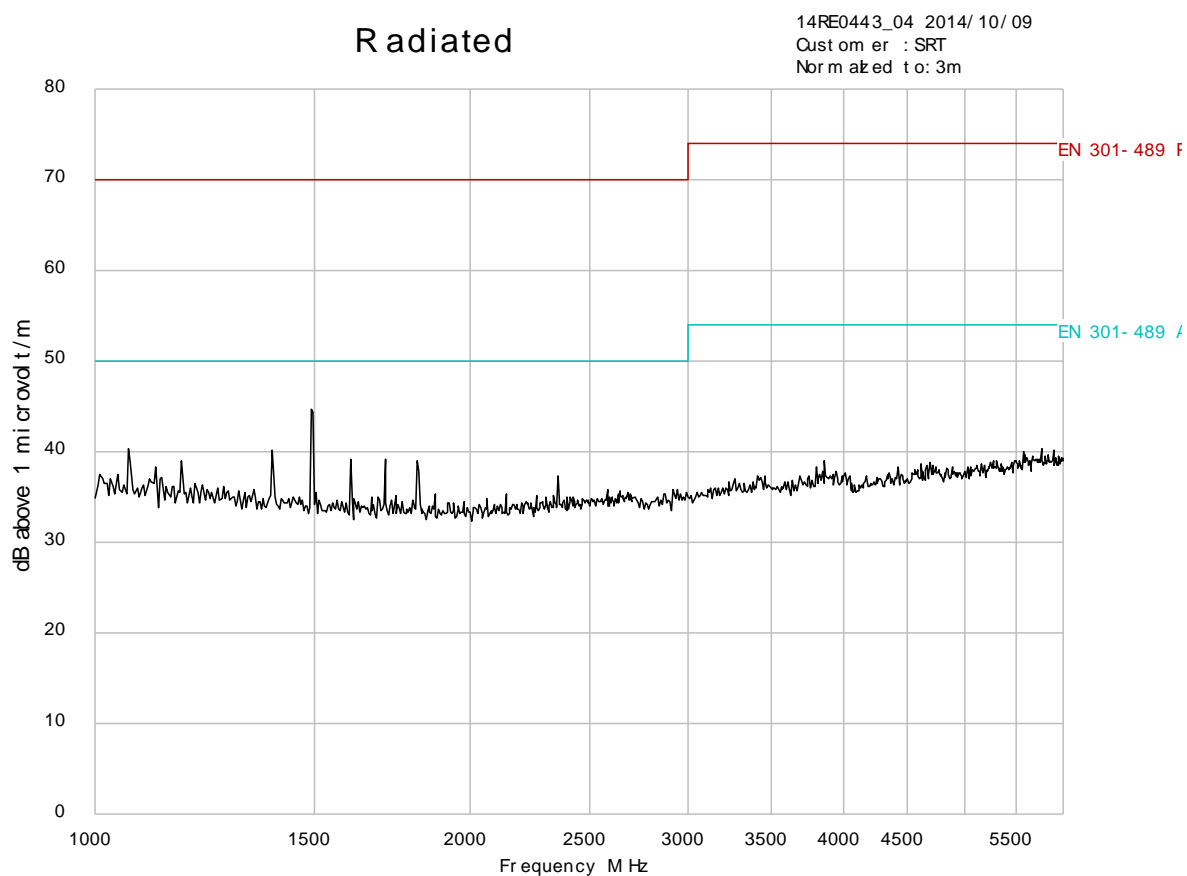
The measurements reported are the highest emissions relative to the EN 60945 limit and take into account the antenna, cable loss factors and uncertainty budget. Measurements made according to the EN 60945 test standard and Hursley EMC Services test procedure RAD-01.

TEST ENGINEERS: Rob St John James & Richard Pennell

4.1.2 Radiated Emission Plot, 30 to 1000 MHz



4.1.3 Radiated Emission Plot, 1.0 to 6.0 GHz



4.1.4 Radiated H-Field, 150 kHz to 30 MHz

A profile scan was taken at a distance of three metres with a 360° azimuth scan of the EUT in a semi-anechoic chamber. The tests were repeated for three orientations of the loop antenna.

The sample was then re-measured in an anechoic chamber; the pre-scan results were used as a guide at three metre. There were no frequencies found within the laboratory's ≤ 12 dB criterion and so no further measurements were necessary.

4.1.5 Data

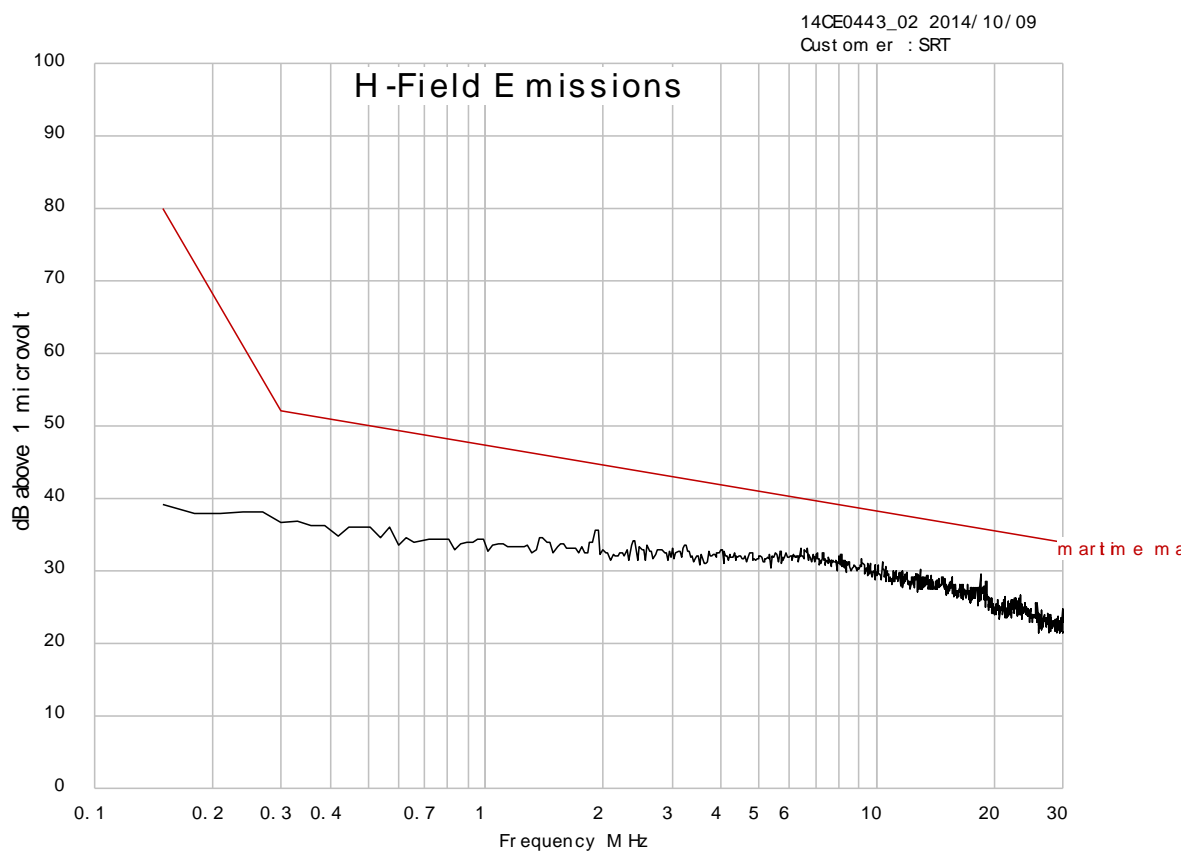
Emission frequency (MHz)	Measured quasi-peak value (dB μ V/m)	Measured quasi-peak value including uncertainty budget	Specified quasi-peak limit (dB μ V/m)	Status
No significant peaks found within the specified limit.				Pass

The uncertainty of measurement: ± 4.2 dB μ V for a 95% confidence level has been added to the measured result.

The measurements reported are the highest emissions relative to the EN 60945 limit and take into account the antenna, cable loss factors and uncertainty budget. Measurements made according to the EN 60945 test standard and Hursley EMC Services test procedure MAR-01.

TEST ENGINEERS: Rob St John James & Richard Pennell

4.1.6 Profile



4.2 Conducted Disturbance

A filtered 230V mains supply was fed to the EUT via a 50 Ω /50 μ H 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 to the EN 60945 test standard and Hursley EMC Services test procedure CON-02. The worst-case results are shown here.

4.2.1 Data

Neutral

Frequency (MHz)	Quasi-peak value (dB μ V)			
	Measured	Measured quasi-peak value including uncertainty budget	Limit	Status
0.052	47.70	50.92	67.87	Pass
0.074	48.60	51.82	61.97	Pass
0.102	38.20	41.42	56.64	Pass
0.123	30.40	33.62	53.39	Pass
0.128	30.90	34.12	52.69	Pass
0.397	27.30	30.52	50.00	Pass
23.438	24.64	27.86	50.00	Pass

Line

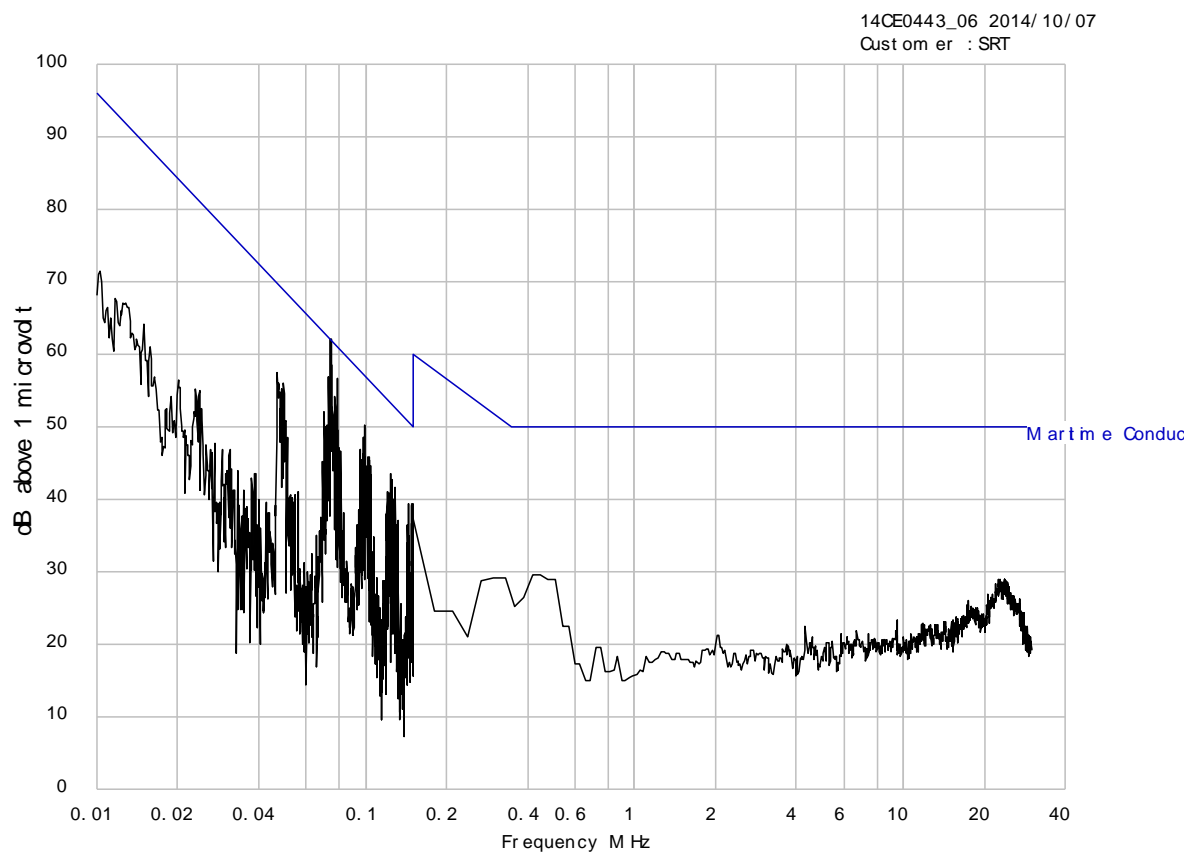
Frequency (MHz)	Quasi-peak value (dB μ V)			
	Measured	Measured quasi-peak value including uncertainty budget	Limit	Status
0.022	47.30	50.52	82.54	Pass
0.053	47.50	50.72	67.81	Pass
0.073	47.30	50.52	62.20	Pass
0.100	36.70	39.92	56.88	Pass
0.106	30.00	33.22	55.96	Pass
0.158	48.10	51.32	59.42	Pass
0.436	26.30	29.52	50.00	Pass
23.957	25.46	28.68	50.00	Pass

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

TEST ENGINEERS: Rob St John James & Richard Pennell

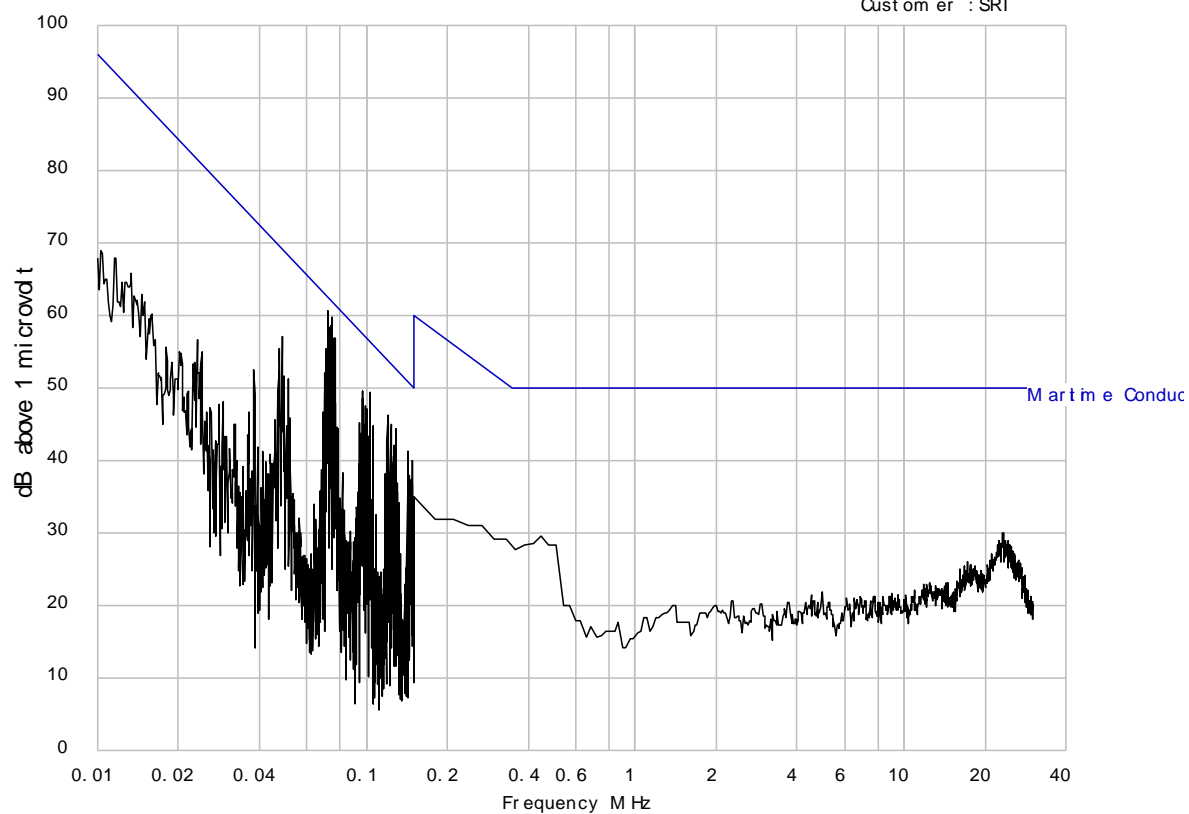
4.2.2 Profile; Neutral

Conducted Emissions



4.2.3 Profile; Line

Conducted Emissions

14CE0443_05 2014/ 10/ 07
Customer : SRT

4.3 Conducted Disturbance, Telecommunication Line

The conducted emissions were measured in a partially screened room in order to eliminate ambient noise. The signal port cable was unscreened and as a result the voltage measurement was made by using an Impedance Stabilisation Network (ISN). The ISN was bonded to the ground plane and the signal fed into the receiver.

A spectrum analyser was set to scan between 0.15MHz and 30.0MHz to record the peak emission profile. The worst-case peaks were then measured using an average and/or quasi-peak receiver and compared to the EN 55022 / CISPR 22 Class B telecoms limits. Measurements made according to the EN 55022 / CISPR 22 test standard and Hursley EMC Services test procedure CON-02.

The worst-case quasi-peak results, with the EUT powered at 230V/50Hz, are recorded below.

4.3.1 Data; Ethernet Cable

Frequency (MHz)	Quasi-peak value (dBμV)			Status
	Measured	Measured quasi-peak value including uncertainty budget	Limit	
0.200	24.80	28.02	81.60	Pass
0.350	26.10	29.32	76.97	Pass
1.021	27.40	30.62	74.00	Pass
1.703	23.10	26.32	74.00	Pass
5.214	14.11	17.33	74.00	Pass
10.018	19.00	22.22	74.00	Pass
18.165	14.30	17.52	74.00	Pass
23.029	13.53	16.75	74.00	Pass
29.166	16.88	20.1	74.00	Pass

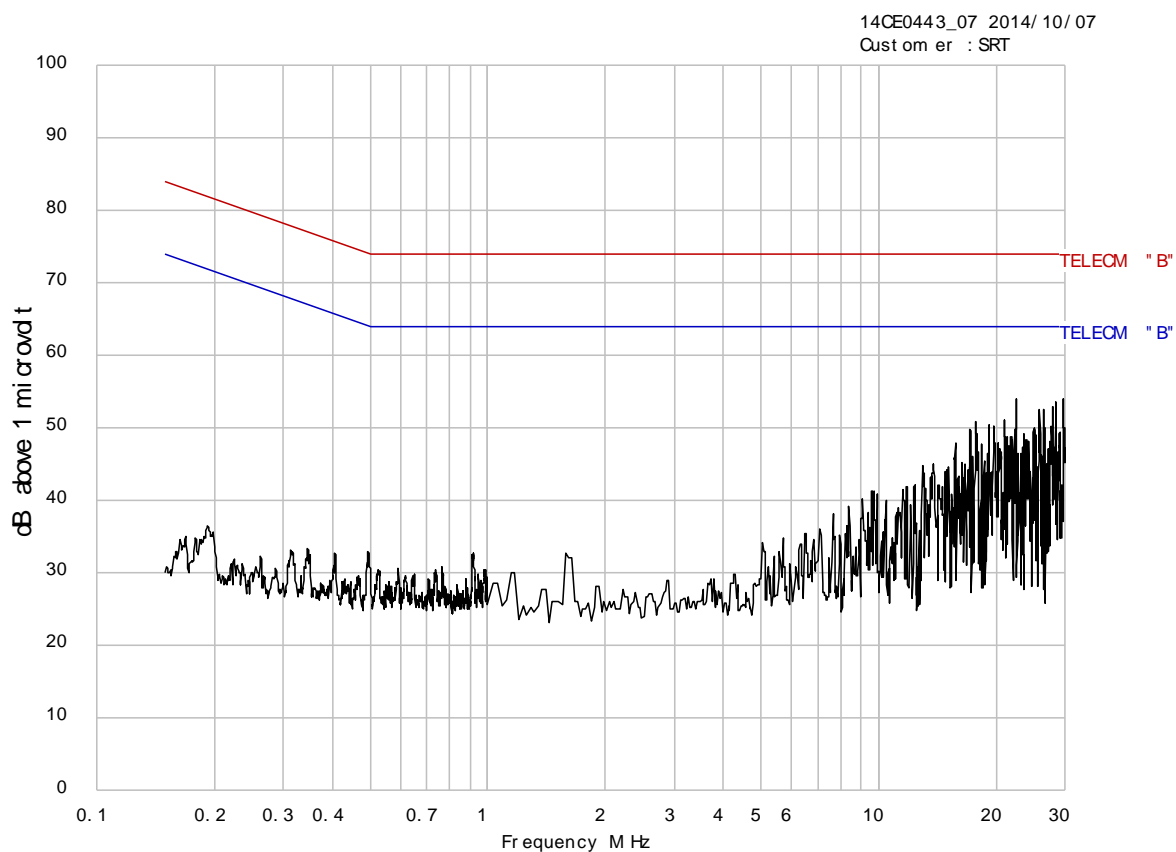
Uncertainty of measurement: ± 3.22 dBμV for a 95% confidence level has been added to the measured result.

The emissions reported are the highest relative to the Class B limit; the measured results meet the conducted limits with a significant pass margin. When quasi-peak results are at least 10dB below the quasi-peak limit average results are not required; the results meet the quasi-peak and average limits. The emissions profile from the cable is shown on the next page.

TEST ENGINEERS: Rob St John James & Richard Pennell

4.3.2 Profile; Ethernet Cable

Conducted Emissions



Note: The limits shown are the quasi-peak limit (higher Line) and average limit (lower line)

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.

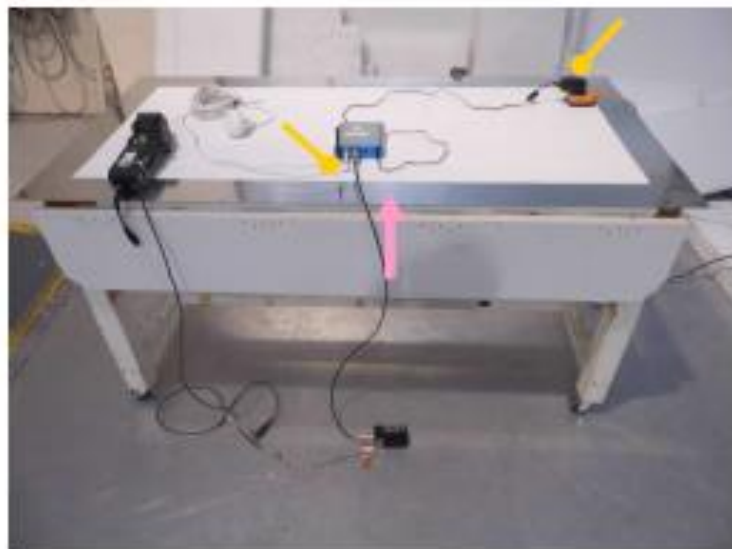
COMMENT: The EUT met the specified test criterion.

TEST ENGINEERS: Rob St John James & Richard Pennell

5.2.1 Electrostatic Discharge Test Points



Arrow indicates Contact Discharge → / → Air discharge



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 2000 MHz swept frequency• 3.0 V/m; 2.0 to 2.7 GHz• 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 & 3.0 V/m	PASS
Side, left	Horizontal & vertical	10.0 & 3.0 V/m	PASS
Side, right	Horizontal & vertical	10.0 & 3.0 V/m	PASS
Rear	Horizontal & vertical	10.0 & 3.0 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) $\pm 10\text{MHz}$ 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 ENGINEERS: Rob St John James & Richard Pennell

5.4 Fast Transient Bursts

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

Test severity	• ± 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 ENGINEERS: Rob St John James & Richard Pennell

5.5 Surge, AC Port

TEST METHOD	IEC 61000-4-5 REFERENCING PROCEDURE: SUR-02
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TEST DETAILS

Test severity level	<ul style="list-style-type: none">± 1.0 kV Line to Line± 2.0 kV Line to Earth Phase Angles: 0, 90, 270 degrees 1.2/50us Tr/Td 60s event intervals
Exerciser program during test	Referencing section 3.4
Specified test criterion	Criterion 'B'
EUT performance criterion	Criterion 'A'

RESULTS

TEST VOLTAGES	COUPLING MODES	STATUS
± 1.0 V	Line to Line	PASS
± 2.0 kV	Line to Earth	PASS

UNCERTAINTY: Specified as less than 10% but estimated 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: No deviations observed or measured.

TEST ENGINEERS: Rob St John James & Richard Pennell

5.6 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	AC 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 ENGINEERS: Rob St John James & Richard Pennell

5.7 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
	Dips: 100% reduction for ½ cycle	B
	Dips: 100% reduction for 1 cycle	B
	Dips: 30% reduction for 500ms	C
	Interrupt: 100% reduction for 5s	C
	Interrupt: 100% reduction for 5s	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 ½ cycle	AC Input	240V / 50Hz & 100V/60Hz	A	PASS
-100% x 1 cycle			A	PASS
-30% x 500ms			A	PASS
-100% x 5s			C	PASS
-100% x 60s			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 ENGINEERS: Rob St John James & Richard Pennell

5.8 PSU Short Term Variance

TEST METHOD	IEC 1000-4-11 REFERENCING PROCEDURE: PLD-01
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TEST DETAILS

Test Severity Level	<ul style="list-style-type: none">• $\pm 20\%$ Voltage with• $\pm 10\%$ Frequency shift Voltage shift @ zero phase crossing
Exerciser program during test	Referencing section 3.4
Specified test criterion	Criterion 'B'
EUT performance criterion	Criterion 'A'
Nominal AC mains rating	240V/50Hz

RESULTS

TEST VOLTAGE	TEST POINTS AC Mains 100V/60Hz and 240V/50Hz	STATUS	CRITERIA
+20% voltage for 1.5s with a frequency shift of +10% for 5s	AC Mains Input	PASS	A
-20% voltage for 1.5s with a frequency shift of -10% for 5s	AC Mains Input	PASS	A

UNCERTAINTY: Specification level is 5% but estimated as less than 1%. The under voltage was applied 1% under the nominal levels and the over voltage was applied 1% over the nominal levels to take into account the uncertainty for this test.

COMMENT: No performance degradation was observed or measured.
The EUT met the performance criteria.

TEST ENGINEERS: Rob St John James & Richard Pennell

6.0 PHOTO LOG (TYPICAL)

Emissions:

Radiated disturbance



Photo Log (continued)

Immunity:

Conducted disturbance

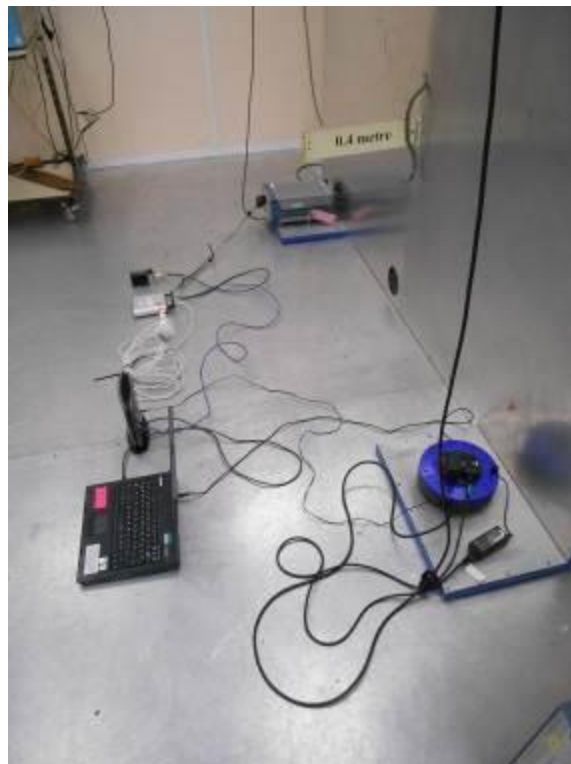
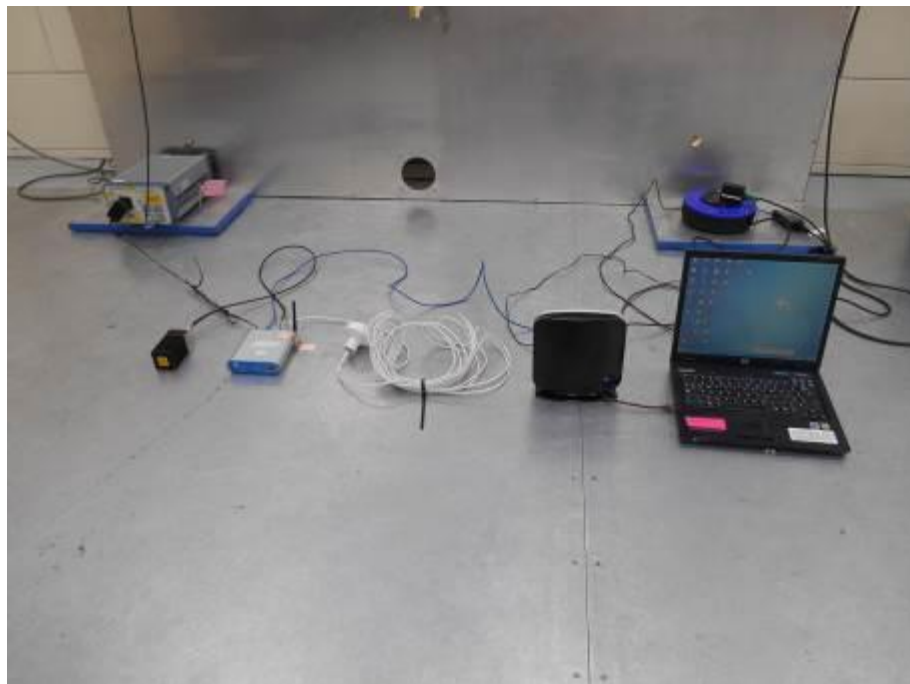


Photo Log (continued)

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**

Photo Log (continued)

Immunity:

Surge

