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Report On

FCC Testing of the
RF Solutions Ltd
Tensator Display

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FCC ID: P9OQ1864-PDU

Document 75907908 Report 02 Issue 1

February 2010



Product Service

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COMMERCIAL-IN-CONFIDENCE

REPORT ON

FCC Testing of the
RF Solutions Ltd
Tensator Display

Document 75907908 Report 02 Issue 1

February 2010

PREPARED FOR

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DATED


04 February 2010

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC CFR 47 Part 15. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineers;


G Lawler


A Guy


R A Blagg





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SECTION 1

REPORT SUMMARY

FCC Testing of the
RF Solutions Ltd
Tensator Display



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the RF Solutions Ltd, Tensator Display to the requirements of FCC CFR 47 Part 15.

Objective	To perform FCC Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	RF Solutions Ltd
Model Number	Q1864-PDU
Serial Number(s)	Not Serialised
Software Version	Version 1
Hardware Version	Version 2
Number of Samples Tested	1
Test Specification/Issue/Date	FCC CFR 47 Part 15: 2009
Incoming Release Date	Declaration of Build Status 05 January 2010
Disposal Reference Number Date	Held Pending Disposal Not Applicable Not Applicable
Order Number Date	13465 20 October 2009
Start of Test	26 October 2009
Finish of Test	27 January 2010
Name of Engineer(s)	A Guy G Lawler R A Blagg
Related Document(s)	ANSI C63.4: 2003



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1.2 BRIEF SUMMARY OF RESULTS

A brief summary of results in accordance with FCC CFR 47 Part 15, is shown below.

Configuration 1 - Stand Alone						
Section	Spec Clause	Test Description	Mode	Mod State	Result	Base Standard
2.1	15.109 15.231 15.205	Radiated Emissions (Enclosure Port)	Transmit with modulation	0	Pass	-
			Idle	0	Pass	
2.2	15.107 and 15.207	Conducted Emissions (AC Power Port)	Transmit with modulation	0	Pass	-
			Idle	0	Pass	
2.3	15.231	Bandwidth of the Emission	Transmit with modulation	0	Pass	-
			Idle		N/A	

N/A – Not Applicable



1.3 DECLARATION OF BUILD STATUS

MAIN EUT		
MANUFACTURING DESCRIPTION	Tensator Display	
MANUFACTURER	RF Solutions Ltd	
TYPE	PDU	
PART NUMBER	Q1864-PDU	
SERIAL NUMBER	N/A	
HARDWARE VERSION	Version 2	
SOFTWARE VERSION	Version 1	
TRANSMITTER OPERATING RANGE	-	
RECEIVER OPERATING RANGE	-	
COUNTRY OF ORIGIN	UK	
INTERMEDIATE FREQUENCIES	-	
ITU DESIGNATION OF EMISSION	433MF2D	
HIGHEST INTERNALLY GENERATED FREQUENCY	-	
OUTPUT POWER (W or dBm)	30μW	
FCC ID	P90Q1864-PDU	
INDUSTRY CANADA ID	N/A	
TECHNICAL DESCRIPTION (a brief description of the intended use and operation)	Display Unit (Dot Matrix) For tensator que forwarding system	
BATTERY/POWER SUPPLY		
MANUFACTURING DESCRIPTION	INT PSV 5A 15W	INT PSV 5A 15W
MANUFACTURER	Stontronics	Sandan
TYPE	T3246ST	SPA0503000I
PART NUMBER	PSU-Q1864	PSV-Q1864
VOLTAGE	5V	5V
SERIAL NUMBER	UK	HK

Signature

 Date
 D of B S Serial No

 05 January 2010
 75907908

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 RF Solutions Ltd, Tensator Display as shown in the photograph below. A full technical description can be found in the manufacturer's documentation.



Equipment Under Test



1.4.2 Test Configuration

Configuration 1: Stand Alone

The EUT was configured in accordance with FCC CFR 47 Part 15.

1.4.3 EUT Cable / Port Identification

Port	Max Cable Length specified	Usage	Type	Screened
AC/DC Power	2.0m	Power	2 core	No

1.4.4 Modes of Operation

Modes of operation of EUT during testing were as follows:

Mode 1 – Transmit with modulation

Mode 2 – Idle

Information on the specific test modes utilised are detailed in the test procedure for each individual test.



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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 120V 60Hz AC/DC Adaptor supply.

FCC Accreditation
90987 Octagon House, Fareham Test Laboratory

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.



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SECTION 2

TEST DETAILS

FCC Testing of the
RF Solutions Ltd
Tensator Display



Product Service

2.1 RADIATED EMISSIONS (ENCLOSURE PORT)

2.1.1 Specification Reference

FCC CFR 47 Part 15, Clauses 15.109, 15.231(b) and 15.205

2.1.2 Equipment Under Test

Tensator Display, S/N: Not Serialised

2.1.3 Date of Test and Modification State

26 October 2009, 23 November 2009, 19 and 21 January 2010 - 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 ANSI C63.4.

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

	26 October 2009	23 November 2009	19 January 2010
Ambient Temperature	23.0°C	23.3°C	23.9°C
Relative Humidity	38%	28%	38%
Atmospheric Pressure	1005mbar	1000mbar	1002mbar
	21 January 2010		
Ambient Temperature	23°C		
Relative Humidity	23%		
Atmospheric Pressure	1017mbar		



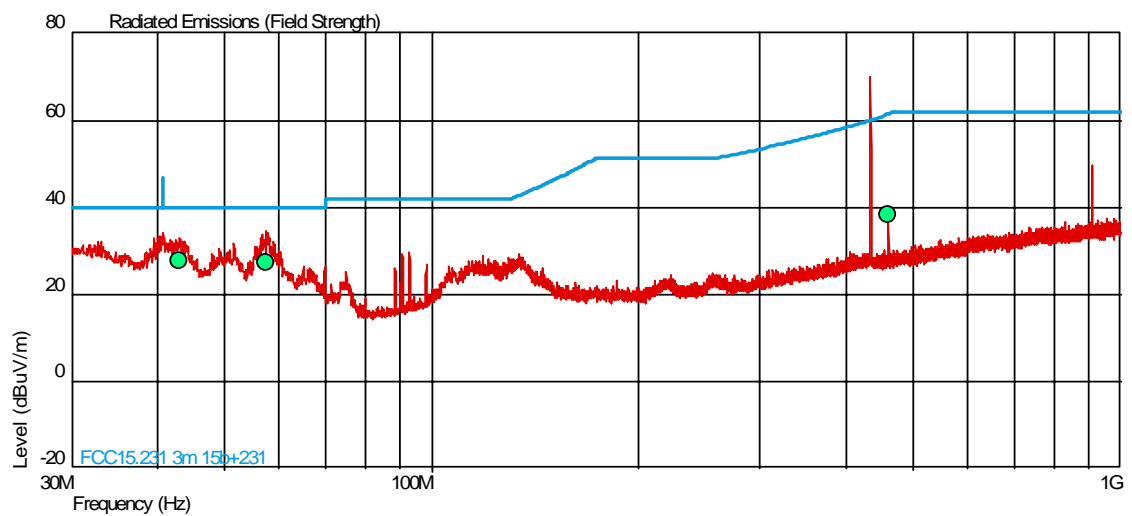
2.1.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 15.231 (b) and FCC CFR 47 Part 15.205, for Radiated Emissions (Enclosure Port).

The test results are shown below.

Configuration 1 - Mode 1

30MHz to 1GHz



Frequency (MHz)	QP Level (dBμV/m)	QP Level (μV/m)	QP Limit (dBμV/m)	QP limit (μV/m)	QP Margin (dBμV/m)	QP Margin (μV/m)	Angle (deg)	Height (m)	Polarity
42.935	27.7	24.3	40.0	100	-12.3	75.7	360	1.00	Vertical
57.405	27.3	23.2	40.0	100	-12.7	76.8	304	1.00	Vertical
460.632	38.3	82.2	61.4	1174.9	-23.1	1092.7	231	1.00	Vertical

Emission at 433 MHz is the carrier

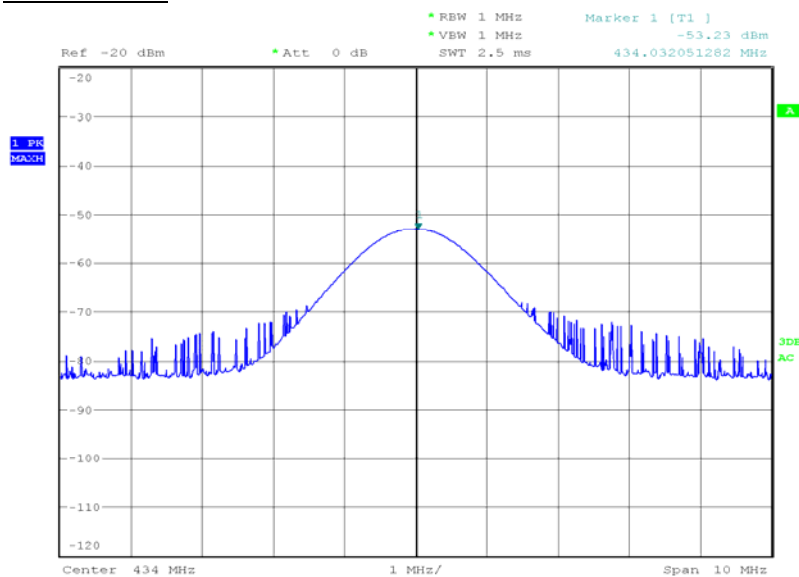
Emission at 908MHz is an intermittent ambient



Carrier power measurement

Freq. MHz	Ant Pol V/H	Ant Hgt cm	EUT Arc Deg	Final Peak dB μ V/m	Final Peak μ V/m	Limit Final Field Strength dB μ V/m	Limit μ V/m	Result
433.912	H	100	000	74.0	5011.8	80.1	10155.8	Pass

Plot of Carrier

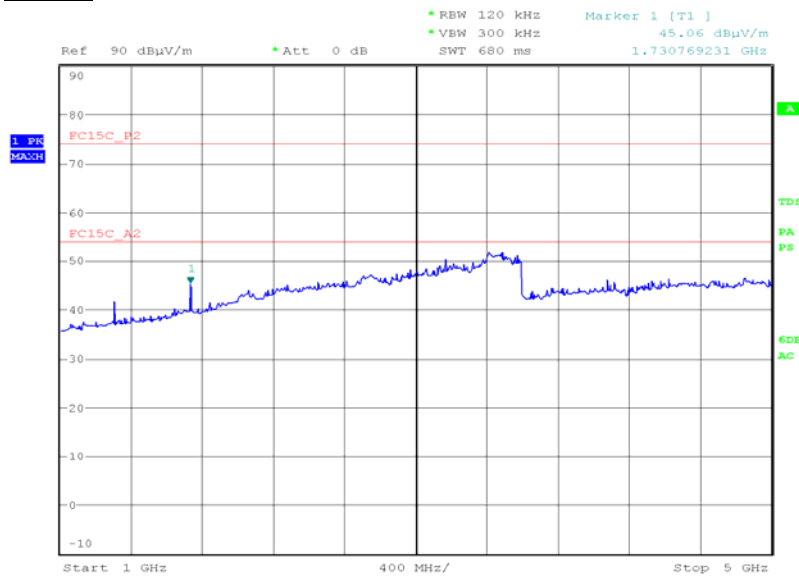


Date: 19.JAN.2010 18:14:43

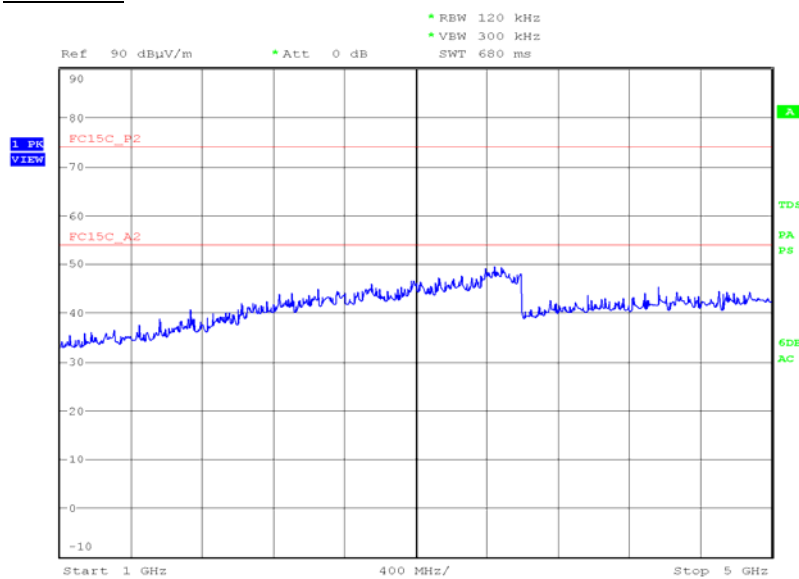
The above plot shows a measurement bandwidth of 1MHz and 1MHz in a peak function. This should normally be on final measurement a bandwidth of 120kHz RBW and 300kHz VBW. Although these bandwidths and detectors were used, it was deemed acceptable as the emission still passed the limit with the worst case bandwidths and detectors used.

1GHz to 5GHz

Freq. GHz	Ant Pol V/H	Ant Hgt cm	EUT Arc Deg	Final Peak dBμV/m	Final Average dBμV/m	Final Peak μV/m	Final Average μV/m	Peak Limit dBμV/m	Peak Limit μV/m
1.735	V	100	10	45.3	Peak Final is under Average limit. No measurement required.	184.1	N/A	62.0	1250
1.736	V	100	10	45.2		182.0	N/A	62.0	1250

Vertical

Date: 26.NOV.2009 23:03:03

Horizontal

Date: 26.NOV.2009 22:53:56

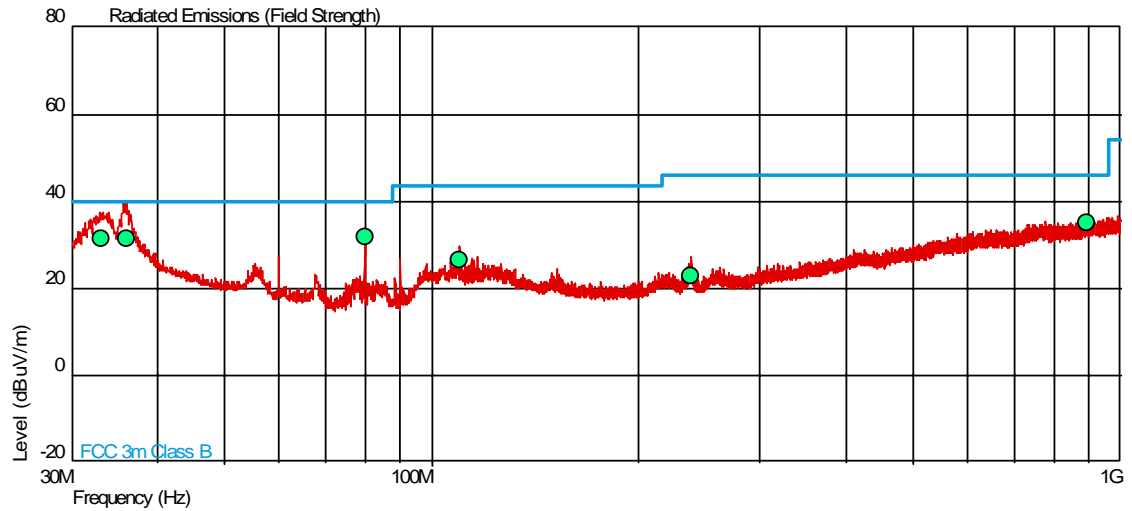


Product Service

For the period of test the EUT met the requirements of FCC CFR 47 Part 15.109 for Radiated Emissions (Enclosure Port).

The test results are shown below.

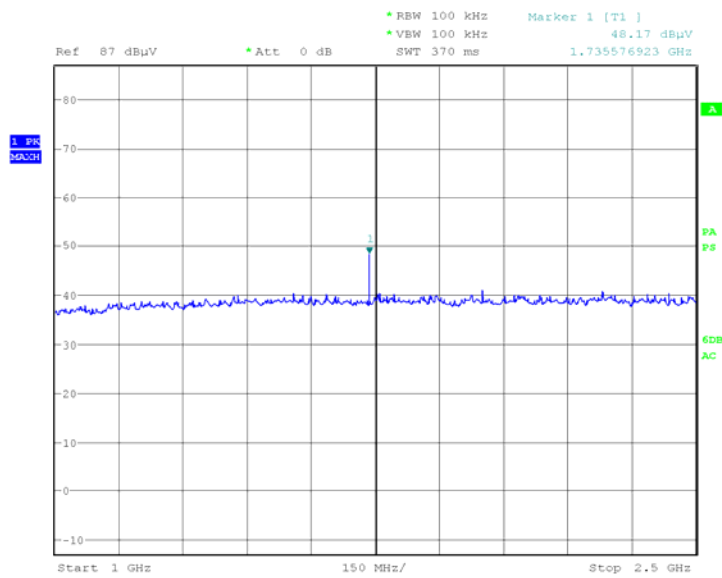
Configuration 1 - Mode 2



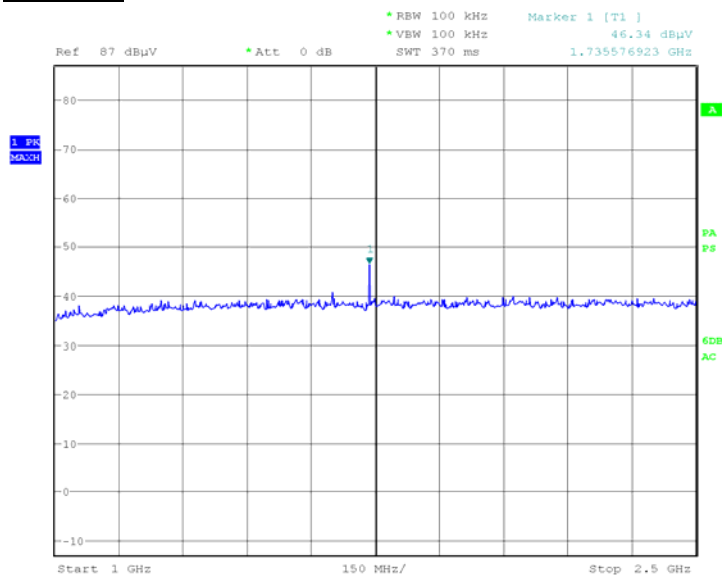
Frequency (MHz)	QP Level (dBμV/m)	QP Level (μV/m)	QP Limit (dBμV/m)	QP limit (μV/m)	QP Margin (dBμV/m)	QP Margin (μV/m)	Angle (deg)	Height (m)	Polarity
33.247	31.5	37.6	40.0	100	-8.5	-62.4	47	1.00	Vertical
36.063	31.4	37.2	40.0	100	-8.6	-62.8	292	1.00	Vertical
80.001	31.7	38.5	40.0	100	-8.3	-61.5	260	1.00	Vertical
109.985	26.7	21.6	43.5	150	-16.8	-128.4	68	1.00	Vertical
238.135	22.7	13.6	46.0	200	-23.3	-186.4	4	1.33	Horizontal
894.013	34.9	55.6	46.0	200	-11.1	-144.4	0	1.18	Horizontal

1GHz to 2.5GHz

Freq. GHz	Ant Pol V/H	Ant Hgt cm	EUT Arc Deg	Final Peak dBμV/m	Final Average dBμV/m	Final Peak μV/m	Final Average μV/m	Peak Limit dBμV/m	Average Limit dBμV/m	Peak Limit μV/m	Average Limit μV/m
1.735	V	100	042	43.6	38.8	151.4	87.1	74.0	54.0	5000	500

Vertical

Date: 25.OCT.2009 09:50:48

Horizontal

Date: 25.OCT.2009 09:53:11

No other EUT emissions were detected within 10dB of limit.



Product Service

2.2 CONDUCTED EMISSIONS (AC POWER PORT)

2.2.1 Specification Reference

FCC CFR 47 Part 15, Clauses 15.107 and 15.207.

2.2.2 Equipment Under Test

Tensator Display, S/N: Not Serialised

2.2.3 Date of Test and Modification State

06 December 2009 - 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 ANSI C63.4.

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

06 December 2009

Ambient Temperature 23.3°C

Relative Humidity 28%

Atmospheric Pressure 1000mbar



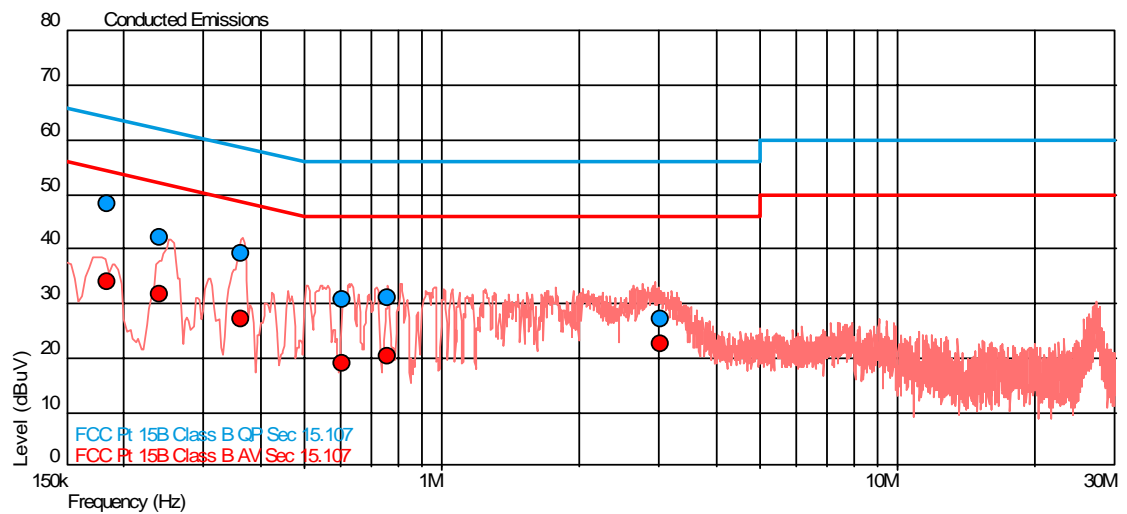
2.2.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 15.107 and 15.207 for Conducted Emissions (Power Port).

The test results are shown below.

Configuration 1 - Mode 1

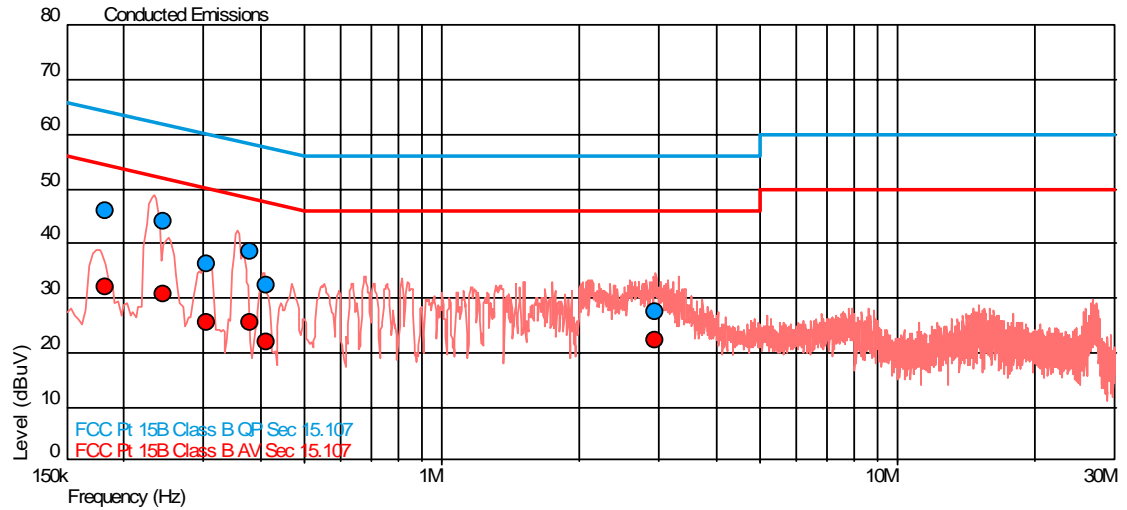
Live Line



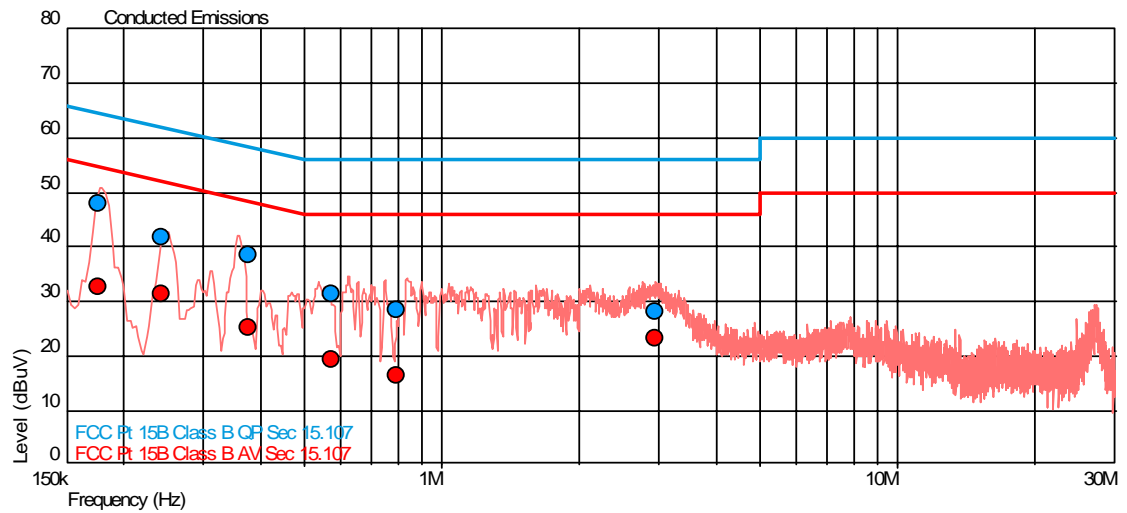
Frequency (MHz)	QP Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Level (dBuV)	AV Limit (dBuV)	AV Margin (dBuV)
0.184	48.2	64.3	-16.2	34.1	54.3	-20.2
0.241	42.0	62.1	-20.1	31.6	52.1	-20.5
0.363	39.3	58.7	-19.4	27.1	48.7	-21.5
0.604	30.6	56.0	-25.4	19.1	46.0	-26.9
0.761	31.0	56.0	-25.0	20.2	46.0	-25.8
3.011	27.1	56.0	-28.9	22.7	46.0	-23.3



Neutral Line



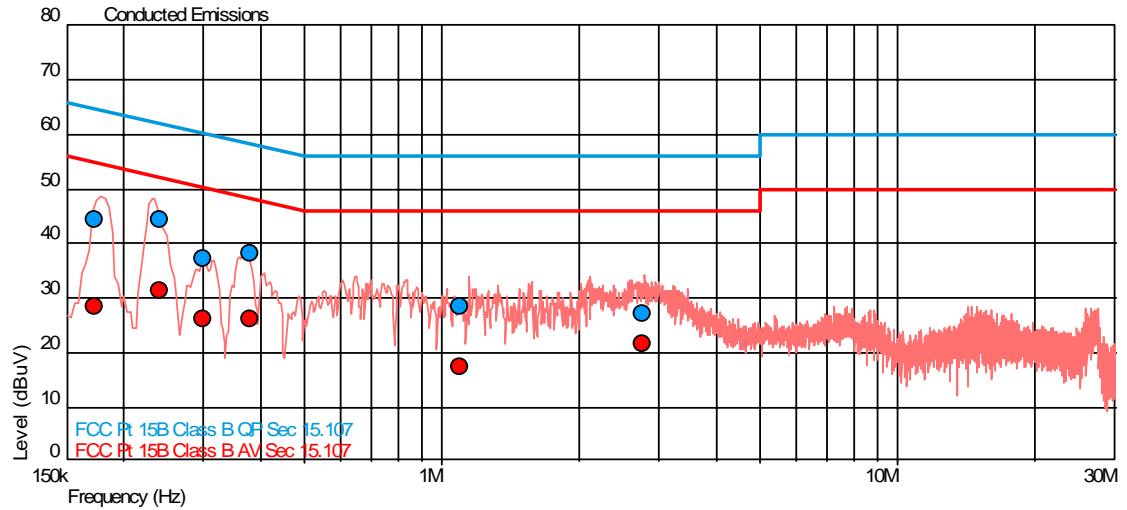
Frequency (MHz)	QP Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Level (dBuV)	AV Limit (dBuV)	AV Margin (dBuV)
0.183	45.9	64.3	-18.5	31.9	54.3	-22.4
0.245	43.9	61.9	-18.0	30.6	51.9	-21.3
0.304	36.2	60.1	-23.9	25.7	50.1	-24.5
0.381	38.4	58.3	-19.8	25.5	48.3	-22.7
0.413	32.2	57.6	-25.3	22.1	47.6	-25.5
2.938	27.6	56.0	-28.4	22.3	46.0	-23.7

Configuration 1 - Mode 2Live Line

Frequency (MHz)	QP Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Level (dBuV)	AV Limit (dBuV)	AV Margin (dBuV)
0.176	47.9	64.7	-16.8	32.6	54.7	-22.1
0.242	41.9	62.0	-20.1	31.3	52.0	-20.7
0.375	38.4	58.4	-20.0	25.3	48.4	-23.1
0.572	31.5	56.0	-24.5	19.4	46.0	-26.6
0.796	28.5	56.0	-27.5	16.5	46.0	-29.5
2.936	28.1	56.0	-27.9	23.2	46.0	-22.8



Neutral Line



Frequency (MHz)	QP Level (dBUV)	QP Limit (dBUV)	QP Margin (dBUV)	AV Level (dBUV)	AV Limit (dBUV)	AV Margin (dBUV)
0.173	44.4	64.8	-20.4	28.4	54.8	-26.4
0.241	44.3	62.1	-17.7	31.4	52.1	-20.7
0.300	37.1	60.2	-23.1	26.1	50.2	-24.1
0.378	38.3	58.3	-20.1	26.2	48.3	-22.1
1.094	28.6	56.0	-27.4	17.5	46.0	-28.5
2.756	27.1	56.0	-28.9	21.7	46.0	-24.3



Product Service

2.3 BANDWIDTH OF THE EMISSIONS

2.3.1 Specification Reference

FCC CFR 47 Part 15, Clause 15.231

2.3.2 Equipment Under Test

Tensator Display, S/N: Not Serialised

2.3.3 Date of Test and Modification State

27 January 2010 - 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 FCC CFR 47 Part 15.

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

Configuration 1 - Mode 1

2.3.6 Environmental Conditions

27 January 2010

Ambient Temperature 22.8°C

Relative Humidity 22.7%



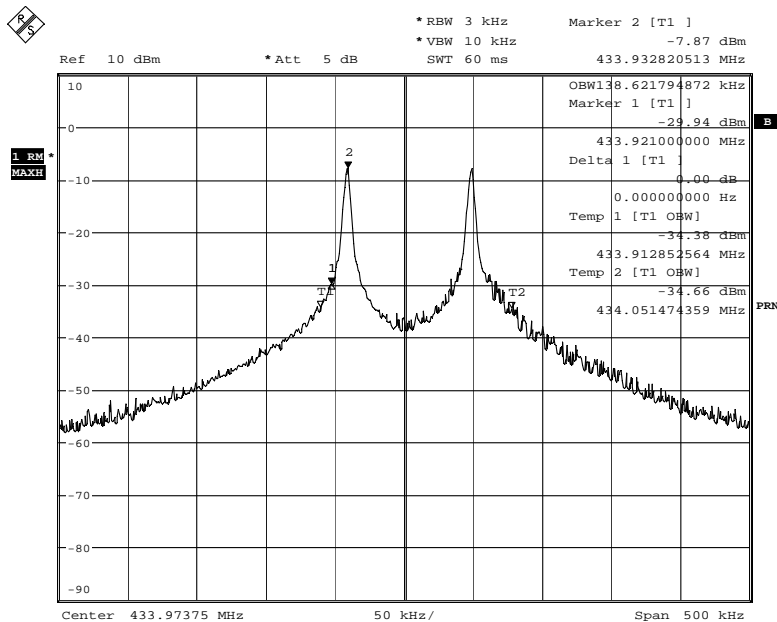
2.3.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 15, for Bandwidth of the Emission.

The test results are shown below.

Configuration 1 - Mode 1

Channel Number/Frequency	Result (MHz)	Limit (MHz)
433.920	0.13861	1.0848



Date: 27.JAN.2010 16:26:21

Limit Clause

The 99% bandwidth shall be no wider than 0.25% of the centre frequency for devices operating between 70 MHz to 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the centre frequency.



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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 - Radiated Emissions					
Antenna (1GHz-18GHz)	EMCO	3115	235	12	12-Oct-2010
Pre-Amplifier	Phase One	PS04-0085	1532	12	16-Sep-2010
Screened Room (5)	Rainford	Rainford	1545	36	11-Feb-2011
Mast Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Turntable/Mast Controller	EMCO	2090	1610	-	TU
Antenna (Bilog)	Chase	CBL6143	287	24	21-Jan-2010
Antenna (Bilog)	Chase	CBL6143	2904	24	28-Nov-2009
Signal Generator	Rohde & Schwarz	SMR40	3171	12	4-Aug-2010
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	1-Sep-2010
Section 2.2 EMC - Conducted Emissions					
3 Phase Artificial Mains Network (LISN)	Rohde & Schwarz	ESH2-Z5	16	12	11-Mar-2010
Transient Limiter	Hewlett Packard	11947A	2378	12	22-Jun-2010
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	1-Sep-2010
Section 2.3 Radio (Tx) - Occupied Bandwidth					
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	4-Mar-2010
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	2-Nov-2010
Hygrometer	Rotronic	I-1000	2891	12	17-Apr-2010

TU – Traceability Unscheduled



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	5.1dB*
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	26MHz to 2.5GHz Test Amplitude	1.4dB†
Conducted Susceptibility	100kHz to 250MHz Amplitude	1.8dB†
DC Input Ripple Immunity	Current Voltage	0.45% 0.91%
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 10⁶.

* In accordance with CISPR 16-4

† In accordance with UKAS Lab 34

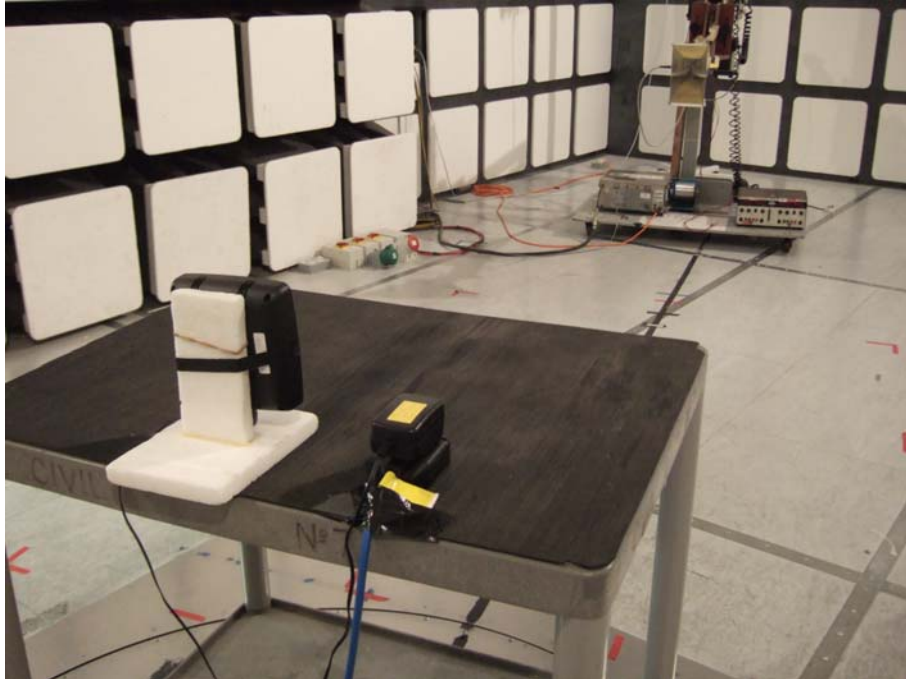


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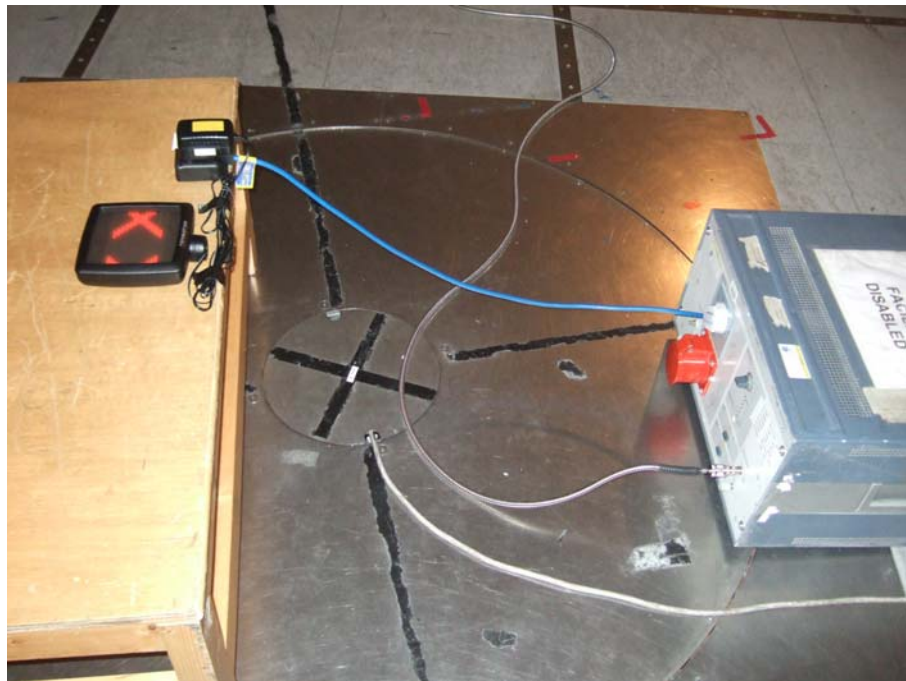
SECTION 4

PHOTOGRAPHS

4.1 TEST SET UP PHOTOGRAPHS



Radiated Emissions (Enclosure Port)



Conducted Emissions (AC Power Port)



Product Service

SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



Product Service

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT



This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA
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