

**EMC Test Report** : TTR-002356GUS2

**Applicant** : Pace plc.

**Apparatus** : RNG210n

**Authorised by** :



: M Leach, Principal EMC Engineer.

**Issue Date** : 16<sup>th</sup> November 2010

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**Section 1:**

**Introduction**

**1.1 General**

This report contains an assessment of an apparatus against Electromagnetic Compatibility Standards based upon tests carried out on samples submitted to the Laboratory.

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Tests performed by :  
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Report author : As above

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## **1.2 Tests Requested By**

This testing in this report was requested by :

Pace PLC  
Victoria Road  
Saltaire  
Shipley  
West Yorkshire  
BD18 3LF

## **1.3 Manufacturer**

As above.

## **1.4 Apparatus Assessed**

The following apparatus was assessed on 15/11/10:

RNG210n

The above equipment was a HD DVR MoCA / IP Hybrid US Cable box.

## 1.5 Test Result Summary

Full details of test results are contained within Appendix A. The following table summarises the results of the assessment.

The statements relating to compliance with the standards below apply ONLY as qualified in the notes and deviations stated in sections 1.6 to 1.7 of this test report.

Tests marked "Not UKAS accredited" are not included in the Accreditation schedule for our laboratory.

### UKAS Accredited Tests

Test Type	Regulation	Measurement standard	Class / Level	Mod	Result
REFE	Title 47 of the CFR:2008, Part 15 Subpart (b)	ANSI C63.4:2003	Class B	0	Pass*
PLCE	Title 47 of the CFR:2008, Part 15 Subpart (b)	ANSI C63.4:2003	Class B	0	Pass

\*Marginal results were recorded. See Appendix A for details and Section 2.2 (iii).

Abbreviations used in the above table:

CFR	: Code of Federal Regulations	ANSI	: American National Standards Institution
REFE	: Radiated Electric Field Emissions	Mod	: Modification
PLCE	: Power Line Conducted Emissions		

## 1.6 Notes Relating To The Assessment

With regard to this assessment, the following points should be noted:

The results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

The apparatus was set up and exercised using the configurations, modes of operation and arrangements defined in this report only.

Particular operating modes, apparatus monitoring methods and performance criteria required by the standards tested to have been performed except where identified in Section 1.7 of this test report (Deviations from Test Standards).

For emissions testing, throughout this test report, "Pass" indicates that the results for the sample as tested were below the specified limit (refer also to Section 2, Measurement Uncertainty).

All testing with the exception of testing at the Open Area Test Site was performed under the following environmental conditions:

Temperature	: 17 to 23 °C
Humidity	: 45 to 75 %
Barometric Pressure	: 86 to 106 kPa

All dates used in this report are in the format dd/mm/yy.

This assessment has been performed in accordance with the requirements of ISO/IEC 17025.

TRaC Telecoms & Radio Hull is a listed electromagnetic compatibility Conformance Assessment Body (CAB) for EC access to the US market. (Decision No 3/2000 of the Joint Committee established under the Agreement on Mutual Recognition between the European Community and the United States of America. This decision was effective from 16<sup>th</sup> January 2001).

## 1.7 Variations In Test Methods

There were no deviations from the standards tested to.

**Section 2:****Measurement Uncertainty****2.1 Introduction**

The standard ISO/IEC 17025 used for laboratory accreditation requires laboratories to estimate measurement uncertainty using accepted methods of analysis.

Where required, the reported expanded uncertainty is based on a standard uncertainty providing a confidence level of approximately 95%.

Measurement uncertainty is calculated using the methods defined in the UKAS document LAB34 Edition 1 August 2002.

**2.2 Application of Measurement Uncertainty**

The following procedure is used when determining the result of a measurement :

- (i) If specification limits are not exceeded by the measured result, extended by the positive component of the expanded uncertainty interval at a confidence level of 95%, then a pass result is recorded.
- (ii) Where a specification limit is exceeded by the result even when the result is decreased by the negative component of the expanded uncertainty interval, a fail result is recorded.
- (iii) Where measured result is below a limit, but by a margin less than the positive measurement uncertainty component, it is not possible to record a pass based on a 95% confidence level. However, the result indicates that a pass result is more probable than a fail result.
- (iv) Where a measured result is above a limit, but by a margin less than the negative measurement uncertainty component, it is not possible to record a fail based on a 95% confidence level. However the result indicates that a fail is more probable than a pass.

**2.3 Measurement Uncertainty Values**

For the test data recorded in accordance with note (iii) of Section 2.2 the following measurement uncertainty was calculated :

**Radiated Electric Field Emissions**

Quantity Range	Quantity	Expanded Uncertainty
30MHz to 200MHz Horizontal	Amplitude dB( $\mu$ V/m)	$\pm$ 5.0dB
30MHz to 200MHz Vertical	Amplitude dB( $\mu$ V/m)	$\pm$ 4.8dB
200MHz to 1GHz Horizontal	Amplitude dB( $\mu$ V/m)	$\pm$ 4.0dB
200MHz to 1GHz Vertical	Amplitude dB( $\mu$ V/m)	$\pm$ 3.9dB
1GHz to 18GHz Horizontal	Amplitude dB( $\mu$ V/m)	$\pm$ 4.4dB
1GHz to 18GHz Vertical	Amplitude dB( $\mu$ V/m)	$\pm$ 4.4dB

**Section 3:**

**Modifications**

**3.1 Modifications Performed During Assessment**

No modifications were performed during the assessment



## Appendix A:

## Formal Emission Test Results

Abbreviations used in the tables in this appendix:

Spec	: Specification	ALSR	: Absorber Lined Screened Room
Mod	: Modification state	OATS	: Open Area Test Site
CDN	: Coupling & decoupling network	ATS	: Alternative Test Site
EUT	: Equipment Under Test	Verd	: Verdict
SE	: Support Equipment	Deg	: Degree
Sum	: Summary	Det	: Detector
MD	: Measurement Distance	Ref	: Reference
SD	: Specification Distance	Freq	: Frequency
No	: Number	Res	: Result
L	: Live Power Line	Ang	: Angle
N	: Neutral Power Line	Pol	: Polarisation
E	: Earth Power Line	H	: Horizontal Polarisation
Pk	: Peak Detector	V	: Vertical Polarisation
QP	: Quasi-Peak Detector	Hgt	: Height
Av	: Average Detector		

**A1 Radiated Electric Field Emissions**

Preliminary radiated electric field emissions testing was performed using a peak detector in an absorber lined screened room.

The following test site was used for final measurements as specified by the standard tested to :

10m open area test site :

3m alternative test site :

The effect of the EUT set-up on the measurements is summarised in note (c) below.

Test Details	
Regulation	Title 47 of the CFR:2008, Part 15 Subpart (b)
Measurement standard	ANSI C63.4:2003
Class	B – refer to specification limit table below.
Frequency range	30 MHz to 12.415 GHz
Highest operating frequency info	2.483 GHz found in Wi-Fi carrier
EUT sample number	S07 and S08
Modification state	0
SE in test environment	None
SE isolated from EUT	8C1497S01
EUT set up	Refer to Appendix C
Photographs	Photographs 1 and 2

The worst case radiated emission measurements are listed below:

Ref No	Freq (MHz)	Det	Ang Deg	Hgt (cm)	Pol	MD (m)	Res at MD (dBuV/m)	SD (m)	Res at SD (dBuV/m)	Spec Limit (dBuV/m)	Margin (dB)	Res Sum
1	114.300	QP	340	100	V	3.0	19.3	10.0	19.4	43.5	-24.1	Pass
2	118.540	QP	0	100	V	3.0	24.3	10.0	24.4	43.5	-19.1	Pass
3	374.960	QP	250	100	H	3.0	39.0	10.0	39.1	46.0	-6.9	Pass
4	484.450	QP	100	100	V	3.0	32.9	10.0	33.0	46.0	-13.0	Pass
5	539.970	QP	190	100	H	3.0	43.6	10.0	43.7	46.0	-2.3	Pass*
6	566.980	QP	190	100	H	3.0	45.7	10.0	45.7	46.0	-0.3	Pass*
7	620.960	QP	105	100	H	3.0	27.2	10.0	27.3	46.0	-18.7	Pass
8	674.960	QP	80	100	V	3.0	38.3	10.0	38.4	46.0	-7.6	Pass
9	702.010	QP	300	100	V	3.0	35.4	10.0	35.4	46.0	-10.6	Pass
10	740.990	QP	185	100	V	3.0	27.5	10.0	27.6	46.0	-18.4	Pass
11	755.980	QP	180	100	V	3.0	43.6	10.0	43.6	46.0	-2.4	Pass*
12	799.980	QP	175	100	V	3.0	37.8	10.0	37.9	46.0	-8.1	Pass
13	874.970	QP	180	100	V	3.0	39.2	10.0	39.3	46.0	-6.7	Pass
14	925.000	QP	300	100	V	3.0	31.3	10.0	31.3	46.0	-14.7	Pass
15	971.970	QP	45	100	V	3.0	48.2	10.0	48.3	54.0	-5.7	Pass

\*See section 2.2 Note (iii).

**Specification limits :**

The upper frequency of the measurement range was decided according to 47 CFR 15:2008 Clause 15.33.

Radiated emission limits (47 CFR 15:2008 Clause 15.109):

Except for a Class A digital device, the field strength of radiated emissions from unintentional radiators at a distance of 3m shall not exceed the following values:

Frequency of emission (MHz)	Field strength $\mu\text{V/m}$	Field strength $\text{dB}\mu\text{V/m}$
30-88	100	40.0 (quasi-peak)
88-216	150	43.5 (quasi-peak)
216-960	200	46.0 (quasi-peak)
960-1000	500	54.0 (quasi-peak)
Above 1000	500	54.0 (average)
Above 1000	-	74.0 (peak)

**Notes:**

- (a) Where results have been measured at one distance, and a signal level displayed at another, the results have been extrapolated using the following formula:

$$\text{Extrapolation (dB)} = 20 \log_{10} \left( \frac{\text{measurement distance}}{\text{specification distance}} \right)$$

The results displayed take into account applicable antenna factors and cable losses.

- (b) The levels may have been rounded for display purposes.
- (c) The following table summarises the effect of the EUT operating mode, internal configuration and arrangement of cables / samples on the measured emission levels :

	See 1)	See 2)	See 3)	See 4)
Effect of EUT operating mode on emission levels		✓		
Effect of EUT internal configuration on emission levels		✓		
Effect of Position of EUT cables & samples on emission levels		✓		
1) Parameter defined by standard and / or single possible. 2) Parameter defined by client and / or single possible. 3) Parameter had a negligible effect on emission levels. 4) Worst case determined by initial measurement.				

**A2 ac Power Line Conducted Emissions**

Preview ac power line port conducted emission measurements were performed with a peak detector in a screened room.

The effect of the EUT set-up on the measurements is summarised in note (b) below.

Where applicable formal measurements of the emissions were performed with a peak, average and/or quasi peak detector. The formal measurements are detailed below:

Test Details	
Regulation	Title 47 of the CFR:2008, Part 15 Subpart (b)
Measurement standard	ANSI C63.4:2003
Class	B – refer to specification limit table below.
Frequency range	150kHz to 30MHz
EUT sample number	S07 and S08
Modification state	0
SE in test environment	None
SE isolated from EUT	8C1497S01
EUT set up	Refer to Appendix C
Photographs	Photograph 3

The worst case ac power line port conducted emission measurements are listed below:

**Results measured using the average detector compared to the average limit**

Ref No.	Freq (MHz)	Conductor	Result (dBuV)	Spec Limit (dBuV)	Margin (dB)	Result Summary
1	0.152	Live	12.9	55.9	-43.0	Pass
2	0.156	Live	12.7	55.7	-43.0	Pass
3	0.257	Live	30.0	51.5	-21.5	Pass
4	0.475	Live	24.3	46.4	-22.1	Pass
5	3.824	Live	27.9	46.0	-18.1	Pass
6	4.227	Live	31.9	46.0	-14.1	Pass
7	4.815	Live	26.5	46.0	-19.5	Pass
8	6.325	Live	27.3	50.0	-22.7	Pass
9	10.110	Live	27.0	50.0	-23.0	Pass
10	0.152	Neutral	12.9	55.9	-43.0	Pass
11	0.156	Neutral	12.2	55.7	-43.5	Pass
12	0.257	Neutral	30.0	51.5	-21.5	Pass
13	0.475	Neutral	24.3	46.4	-22.1	Pass
14	3.824	Neutral	27.6	46.0	-18.4	Pass
15	4.227	Neutral	30.4	46.0	-15.6	Pass
16	4.815	Neutral	26.4	46.0	-19.6	Pass
17	6.325	Neutral	27.7	50.0	-22.3	Pass
18	10.110	Neutral	26.8	50.0	-23.2	Pass

**Results measured using the quasi-peak detector compared to the quasi-peak limit**

Ref No.	Freq (MHz)	Conductor	Result (dBuV)	Spec Limit (dBuV)	Margin (dB)	Result Summary
1	0.152	Live	40.4	65.9	-25.5	Pass
2	0.156	Live	39.7	65.7	-26.0	Pass
3	0.257	Live	43.0	61.5	-18.5	Pass
4	0.475	Live	39.6	56.4	-16.8	Pass
5	3.824	Live	40.2	56.0	-15.8	Pass
6	4.227	Live	43.8	56.0	-12.2	Pass
7	4.815	Live	39.3	56.0	-16.7	Pass
8	6.325	Live	38.8	60.0	-21.2	Pass
9	10.110	Live	37.5	60.0	-22.5	Pass
10	0.152	Neutral	40.2	65.9	-25.7	Pass
11	0.156	Neutral	39.3	65.7	-26.4	Pass
12	0.257	Neutral	42.7	61.5	-18.8	Pass
13	0.475	Neutral	39.5	56.4	-16.9	Pass
14	3.824	Neutral	39.9	56.0	-16.1	Pass
15	4.227	Neutral	42.7	56.0	-13.3	Pass
16	4.815	Neutral	39.1	56.0	-16.9	Pass
17	6.325	Neutral	39.0	60.0	-21.0	Pass
18	10.110	Neutral	37.6	60.0	-22.4	Pass

**Specification limits :**

ac power port conducted emission limits (47 CFR 15:2008 Clause 15.107):

Conducted disturbance at the ac power line ports of Class B information technology equipment.

Frequency range MHz	Limits dB $\mu$ V	
	Quasi-peak	Average
0.15 to 0.5	66 to 56	56 to 46
0.5 to 5	56	46
5 to 30	60	50

Notes:

1. The lower limit shall apply at the transition frequency.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

Notes:

- (a) The levels may have been rounded for display purposes.
- (b) The following table summarises the effect of the EUT operating mode and internal configuration on the measured emission levels :

	See 1)	See 2)	See 3)	See 4)
Effect of EUT operating mode on emission levels		✓		
Effect of EUT internal configuration on emission levels		✓		
Effect of Position of EUT cables & samples on emission levels		✓		

- 1) Parameter defined by standard and / or single possible.
- 2) Parameter defined by client and / or single possible.
- 3) Parameter had a negligible effect on emission levels.
- 4) Worst case determined by initial measurement.

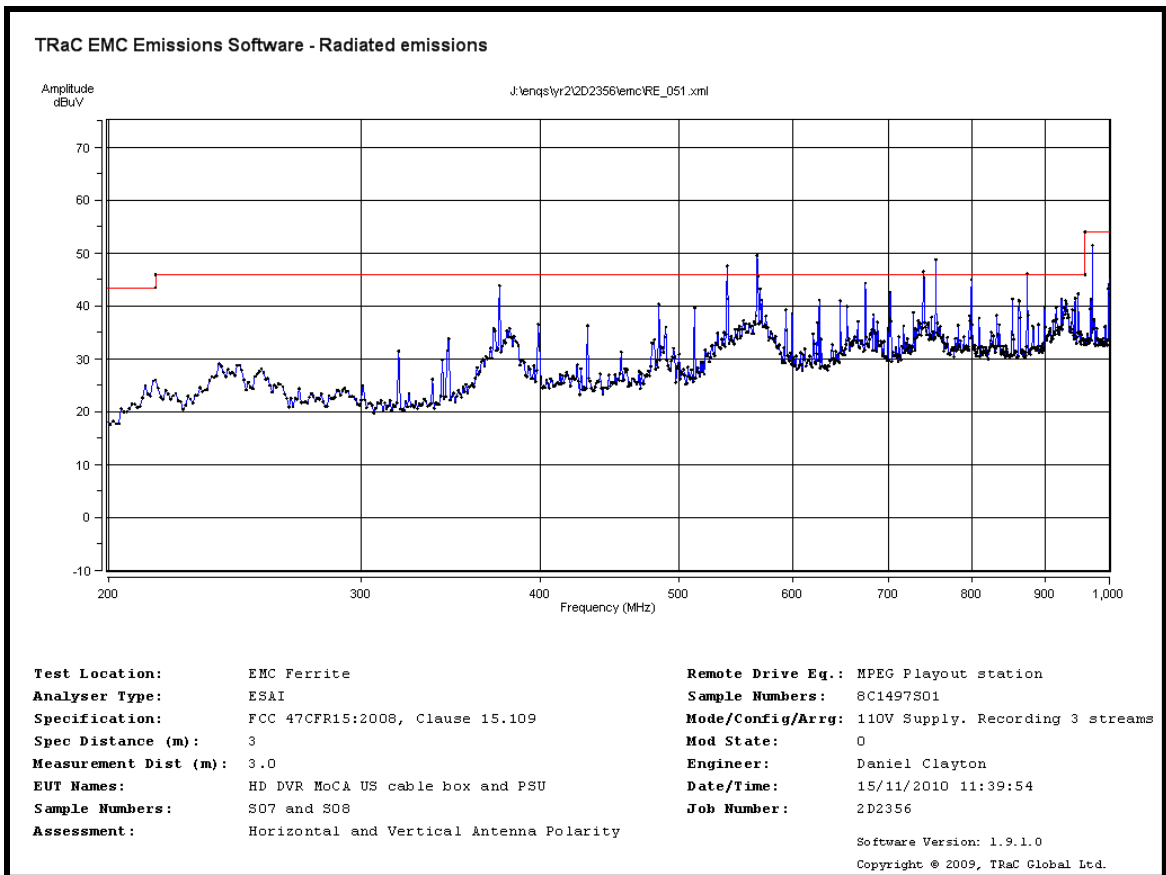
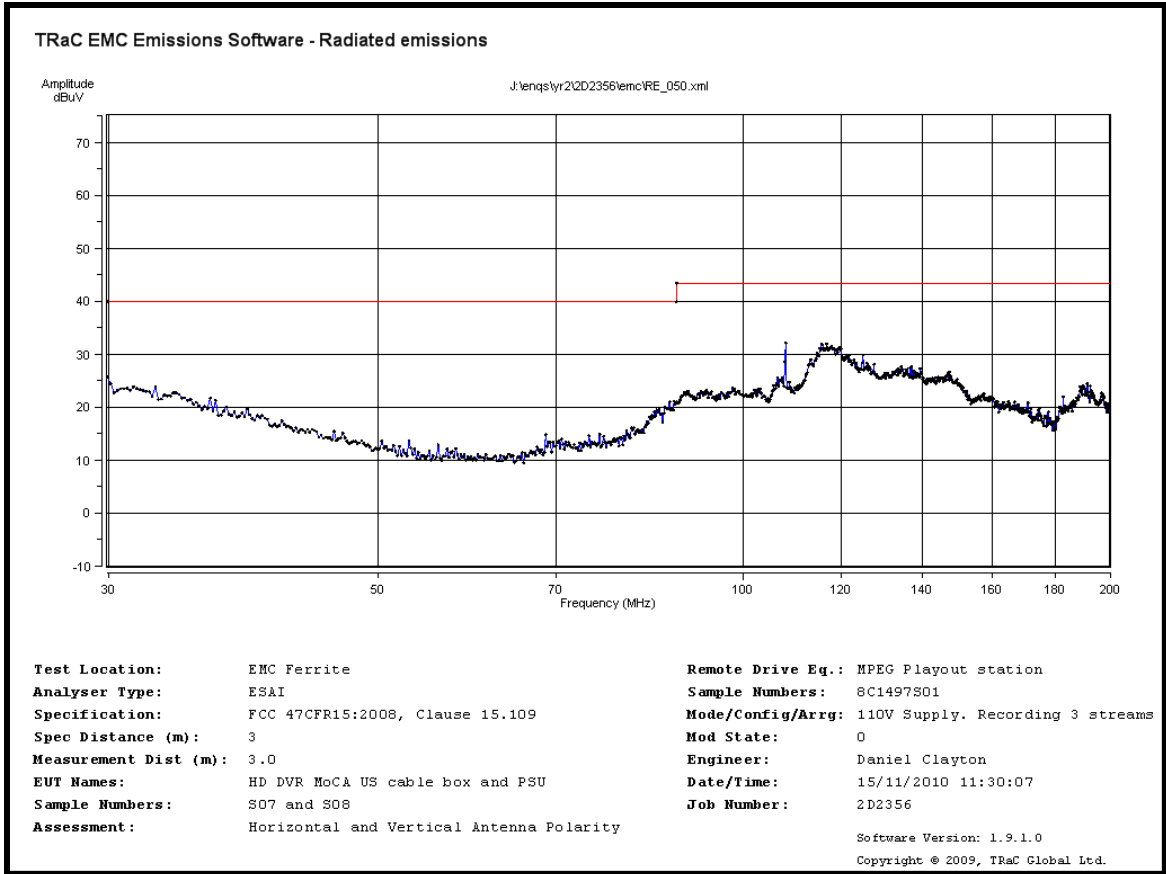
**Appendix B:****Supporting Graphical Data**

This appendix contains data obtained during testing.

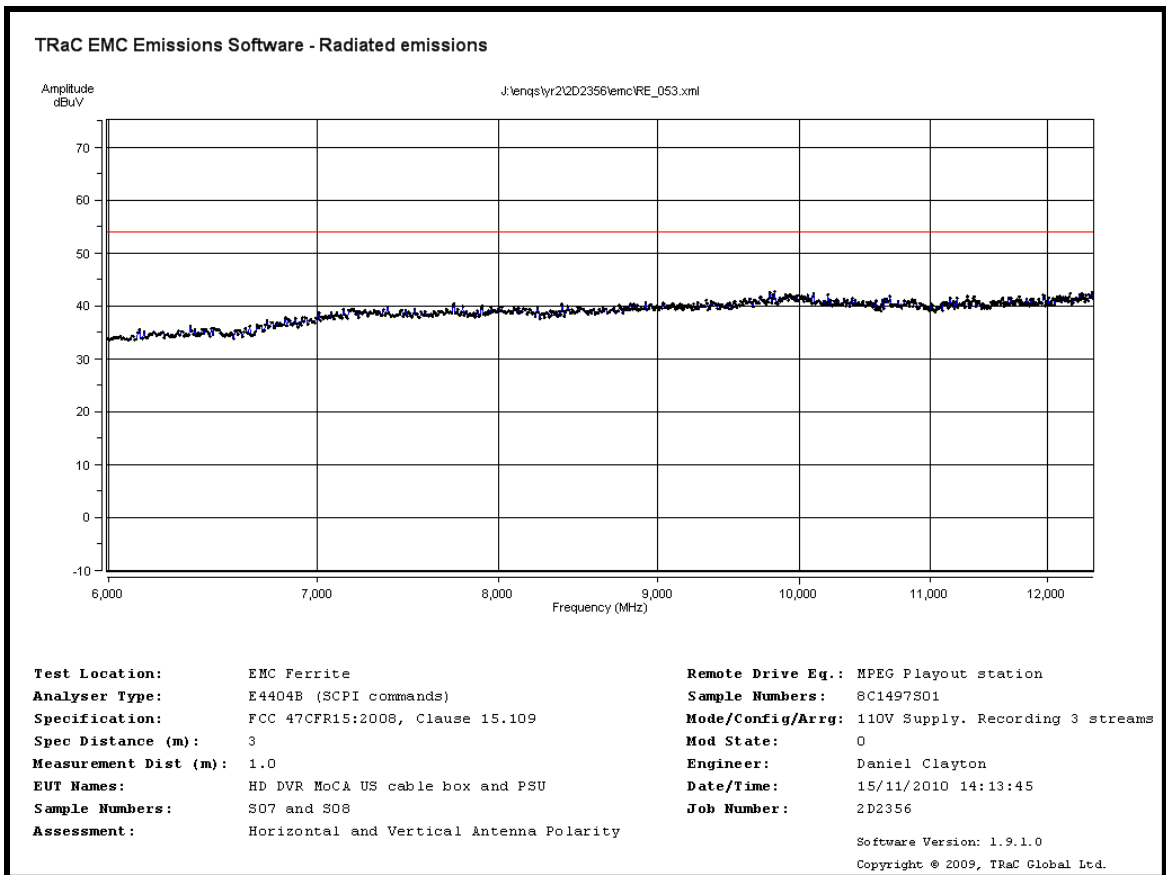
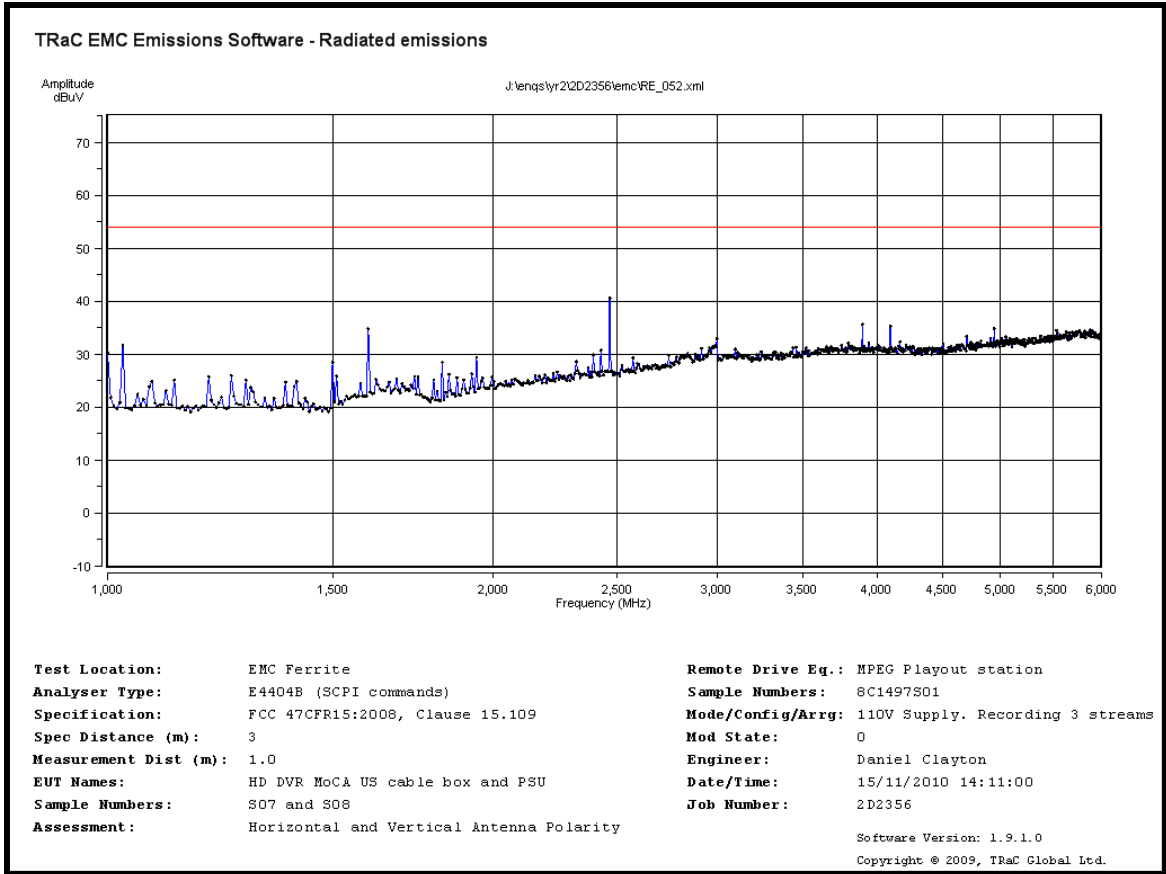
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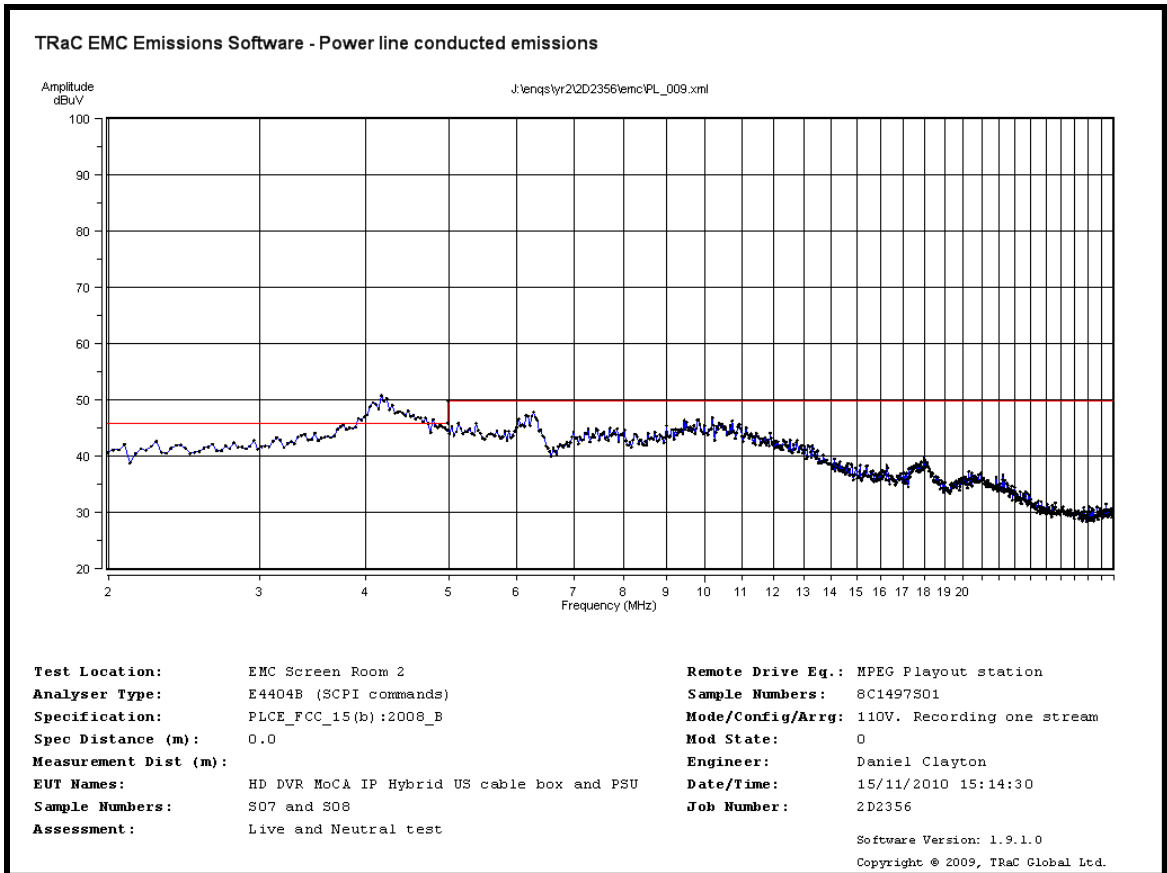
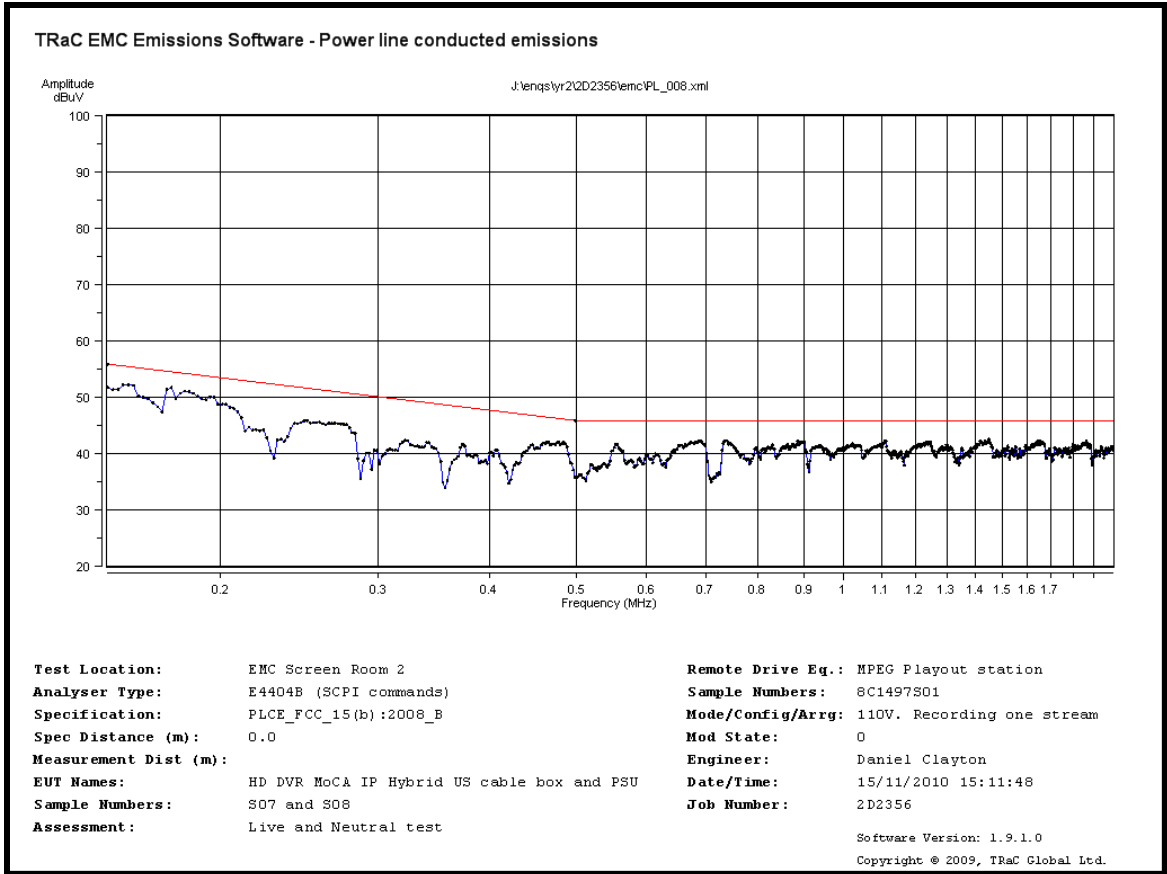
- (a) The radiated electric field emissions and conducted emissions graphical data in this appendix is preview data showing peak hold scan results. For details of formal results, refer to Appendix A.
- (b) The time and date on the plots do not necessarily equate to the time of the test.
- (c) Where relevant, on power line conducted emission plots, the limit displayed is the average limit which is stricter than the quasi peak limit.
- (d) Appendix C details the numbering system used to identify the sample and its modification state.
- (e) The plots presented in this appendix may not be a complete record of the measurements performed, but are a representative sample, relative to the final assessment.
- (f) The following table highlights typographical errors contained within this appendix.

Plot Reference	Incorrect Text (In-Error)	Correct Text
RE_050	Recording 3 streams	Recording 1 stream
RE_051	Recording 3 streams	Recording 1 stream
RE_052	Recording 3 streams	Recording 1 stream
RE_053	Recording 3 streams	Recording 1 stream









**Appendix C:****Additional Test and Sample Details**

This appendix contains details of:

1. The Samples submitted for testing.
2. Details of EUT operating mode(s)
3. Details of EUT configuration(s) (see below).
4. EUT arrangement (see below).

Throughout testing, the following numbering system is used to identify the sample and it's modification state:

**Sample No:** Sxx Mod w

where:

xx	= sample number	eg. S01
w	= modification number	eg. Mod 2

The following terminology is used throughout the test report:

**Support Equipment (SE)** is any additional equipment required to exercise the EUT in the applicable operating mode. Where relevant SE is divided into two categories:

SE in test environment: The SE is positioned in the test environment and is not isolated from the EUT (e.g. on the table top during REFE testing).

SE isolated from the EUT: The SE is isolated via filtering from the EUT. (e.g. equipment placed externally to the ALSR during REFE testing).

**EUT configuration** refers to the internal set-up of the EUT. It may include for example:

- Positioning of cards in a chassis.
- Setting of any internal switches.
- Circuit board jumper settings.
- Alternative internal power supplies.

Where no change in EUT configuration is **possible**, the configuration is described as "single possible configuration".

**EUT arrangement** refers to the termination of EUT ports / connection of support equipment, and where relevant, the relative positioning of samples (EUT and SE) in the test environment.

For further details of the test procedures and general test set ups used during testing please refer to the related document "EMC Test Methods - An Overview", which can be supplied by TRaC Telecoms & Radio upon request.

**C1 Test Samples**

The following samples of the apparatus were submitted by the client for testing :

Sample No.	Description	Identification
S07	RNG210n	S/N: PAEX00001576
S08	Delta Electronics Inc – EADP-65GB A ac adaptor	S/N: DDBD09R0272

The following samples of apparatus were submitted by the client as host, support or drive equipment (auxiliary equipment):

Sample No.	Description	Identification
8C1497S01	MPEG Playout Station	S/N: PACE0000015767

The following samples of apparatus were supplied by TRaC Telecoms & Radio as support or drive equipment (auxiliary equipment):

TRaC Identification	Description
RFG109	110Vac / 60Hz supply

**C2 EUT Operating Mode During Testing.**

During testing, the EUT was exercised as described in the following table :

Test	Description of Operating Mode
All tests detailed in this report	<p>The EUT was receiving a streamed MPEG video from a play out station unit, all ports were terminated with representative loads as in appendix E.</p> <p>The streamed MPEG had the following characteristics:</p> <ul style="list-style-type: none"><li>• Frequency: 830MHz</li><li>• Bit Rate: 26,970,000b/s</li><li>• Modulation: 256-QAM (QAM-B)</li><li>• Symbol rate: 5,360,537bd</li></ul> <p>The EUT was also made to record one stream for the duration of the test.</p>

**C3 EUT Configuration Information**

Sample	Internal Configuration Details
S07	Single possible internal configuration
S08	Single possible internal configuration

**C4 List of EUT Ports**

The table below describes the termination of EUT ports:

Sample : S07  
Tests : All

Port	Description of Cable Attached	Cable length	Equipment Connected
dc power input	2 core unscreened	1.5m	S08
Cable in	75 Ohm co-axial	1.0m	8C1497S01
Ethernet	CAT5e STP	1.0m	Ethernet load box
Component Video Y	Phono cable	1.0m	Component load box
Component Video Pr	Phono cable	1.0m	Component load box
Component Video Pb	Phono cable	1.0m	Component load box
Left audio out	Phono cable	1.0m	AV load box
Right audio out	Phono cable	1.0m	AV load box
HDMI in	HDMI cable	1.0m	None
HDMI out	HDMI cable	1.0m	HDMI load box
USB (Rear)	USB 2.0 cable	1.0m	USB load box
USB (Front)	USB 2.0 cable	1.0m	USB load box
1394 Port	1394 Cable	1.0m	1394 Load box
SATA	SATA cable	1.0m	SATA load box
Digital audio port	None	N/A	None

Sample : S08  
Tests : All

Port	Description of Cable Attached	Cable length	Equipment Connected
dc power output	2 core unscreened	1.5m	S07
ac power input	2 core unscreened	1.0m	ac supply

**C5 Details of Equipment Used**

For Radiated Electric Field Emissions 30MHz to 1GHz:

RFG No	Type	Description	Manufacturer	Date Calibrated.
274	ATS	Ferrite Lined Chamber	Panashield	14/06/10
231	CBL6111	Blue Bilog Antenna (0.03 - 1GHz)	Chase	12/08/08
095	96002	Bicon Antenna (30 - 200MHz)	Eaton	12/05/10
191	CBL6111	Log Periodic Antenna (0.2 - 1GHz)	Emco	12/05/10
214	ESAI	Spec Analyser/Test Rxer	R & S	22/03/10
246	N-type	RF coaxial cable (Lab 10)	TRaC	17/09/10
270	N-type	RF coaxial cable (Lab 10)	TRaC	17/09/10

For Radiated Electric Field Emissions 1GHz to 18GHz:

RFG No	Type	Description	Manufacturer	Date Calibrated
274	ATS	Ferrite Lined Chamber	Panashield	14/06/10
129	3115	Horn Antennas	EMCO	11/08/08
307	HP8449B	Microwave Pre-Amp (1-26.5GHz)	HP	01/03/10
643	ST18	Sucotest Microwave Cable 2m	Huber & Suhner	17/09/10
650	106	Sucoflex Microwave Cable 3m	Huber & Suhner	17/09/10
651	106	Sucoflex Microwave Cable 7m	Huber & Suhner	17/09/10
404	E4407B	Spectrum Analyser	Agilent	10/07/10

For power line conducted emissions:

RFG No	Type	Description	Manufacturer	Date Calibrated
n/a	Lab 11	Small Screened Chamber	TRaC	-
189	ESH3-Z5	Single-phase LISN	R & S	20/05/010
232	ESH3-Z2	Pulse Limiter	R & S	16/02/10
125	ESHS 10	Test Receiver (LF)	R & S	25/11/09
657	E4404B	Spectrum Analyser	Agilent	28/05/10
296	BNC	RF coaxial cable (Lab 5)	TRaC	17/09/10
298	BNC	RF coaxial cable (Lab 5)	TRaC	17/09/10



**Appendix D:**

**Additional Information**

The following additional information was supplied by the client to support this assessment:

Termination	Resistor Value ( $\Omega$ )
Audio output	1k

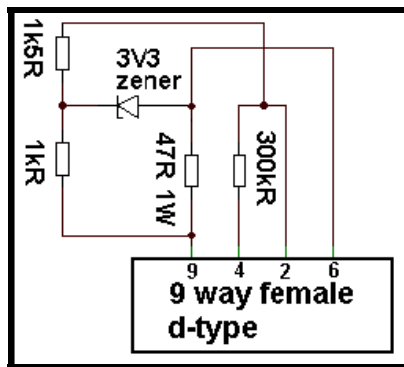
**AV Load Box**

Termination	Resistor Value ( $\Omega$ )
Y output	75
Pb output	75
Pr output	75

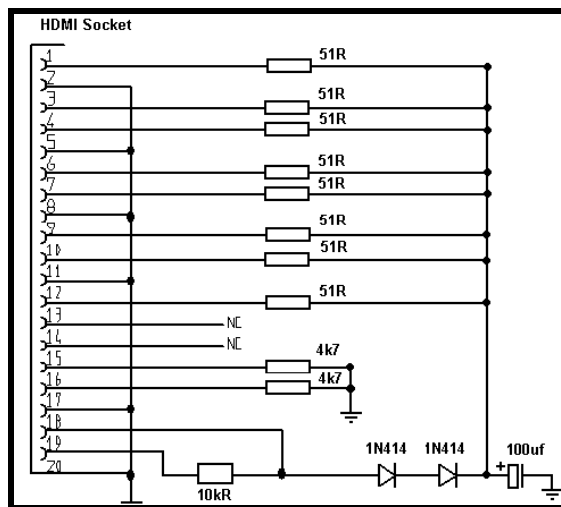
**Component Video Load Box**

Resistor Value ( $\Omega$ )	Connect between pins
100	1 and 4
100	6 and 9

**Ethernet Load Box**



**USB Load Box**



**HDMI Load Box**

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Component	Connect Between Pins
100 $\Omega$	4 and 5
100 $\Omega$	2 and 3

**SATA Load Box**

Component Value	9 Way Female D-Type Pin Number
56 $\Omega$	6 and 1
56 $\Omega$	5 and 1
56 $\Omega$	3 and 220pF 4K7 $\Omega$ Junction
56 $\Omega$	4 and 220pF 4K7 $\Omega$ Junction
220pF	2 to 56 from pin 3
4.7k $\Omega$	2 to 56 from pin 4

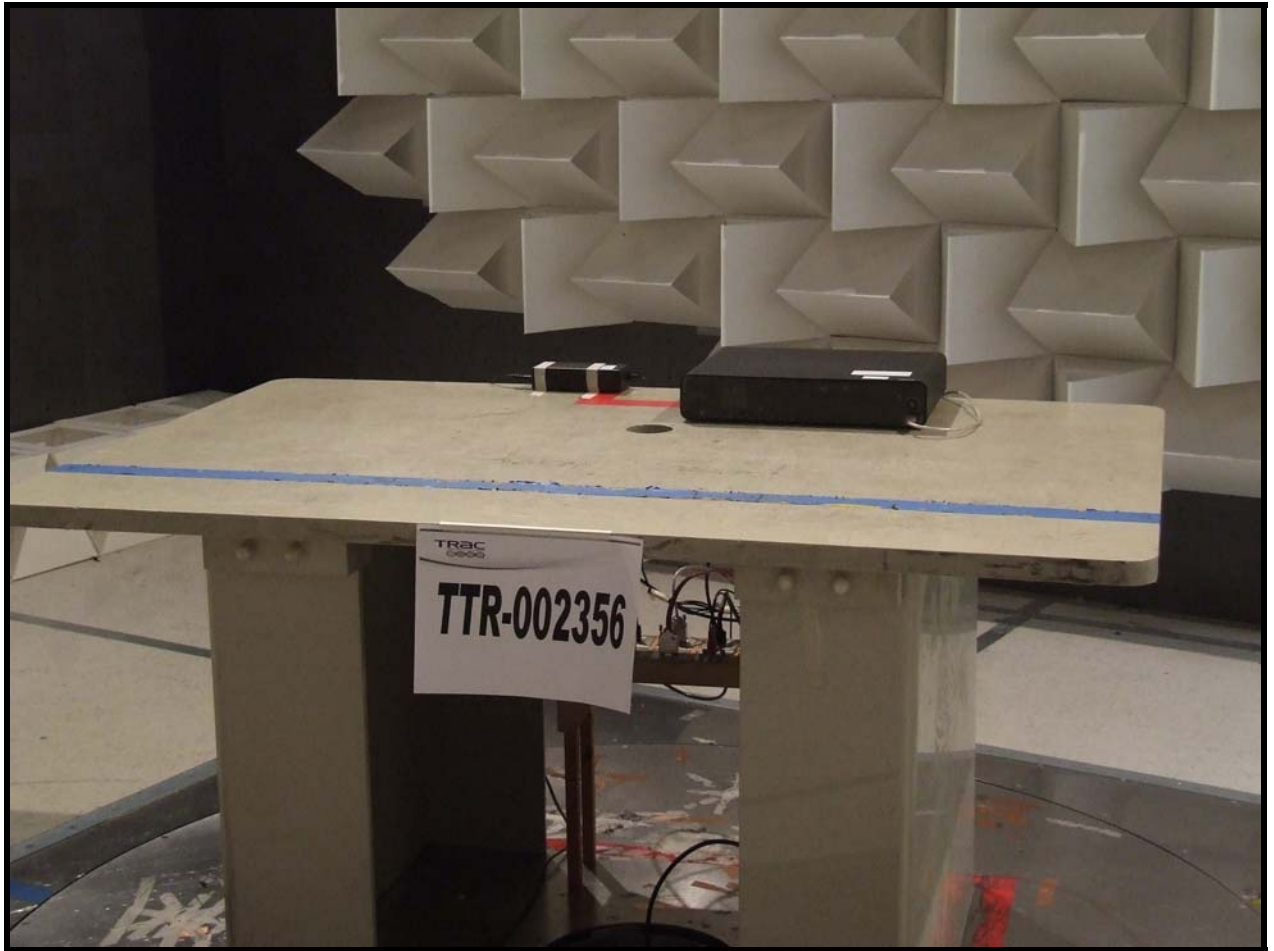
**1394 Load Box**

**Appendix E:**

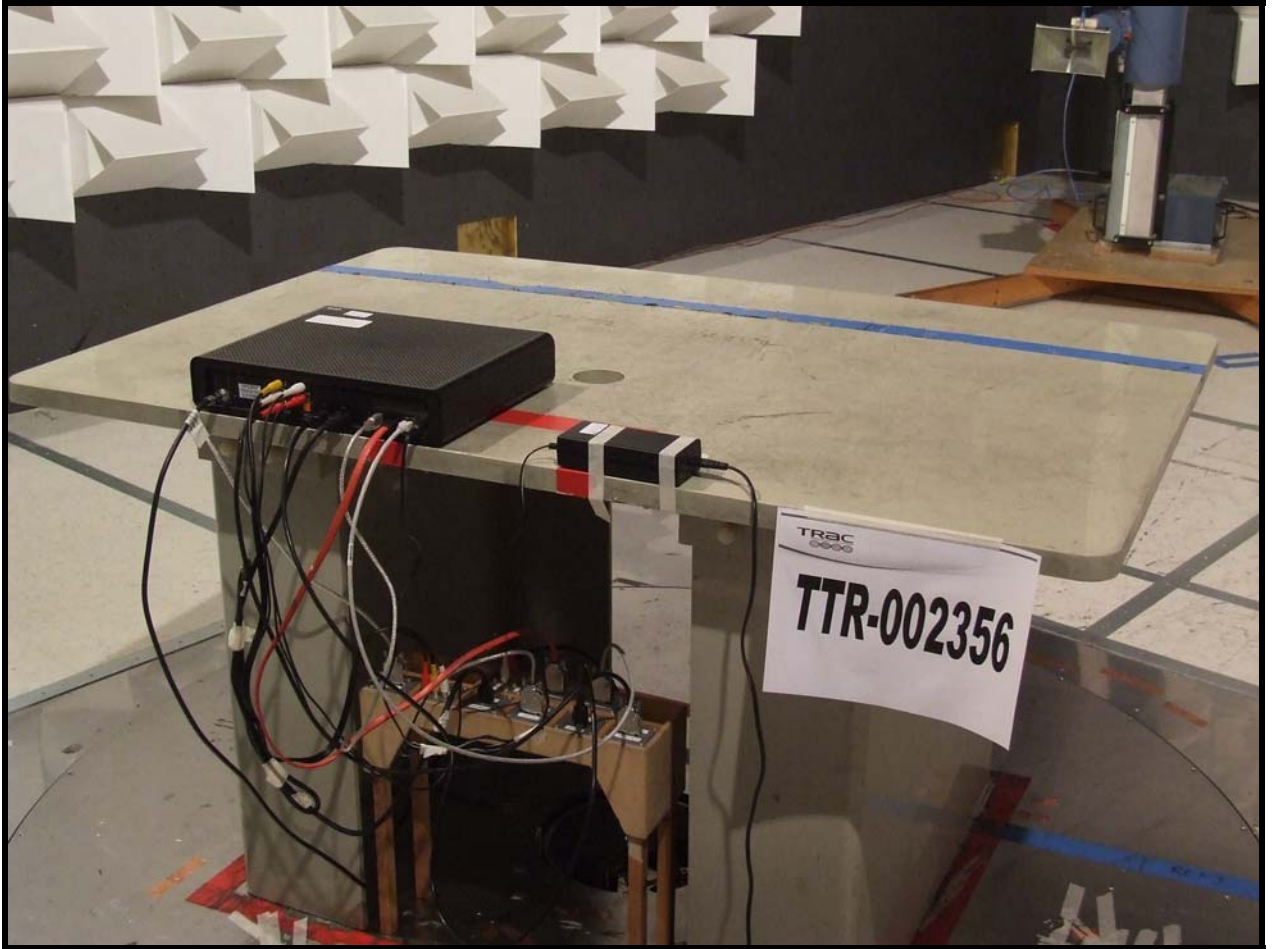
**Photographs and Figures**

The following photographs were taken of the test samples:

1. Radiated electric field emissions arrangement: front view.
2. Radiated electric field emissions arrangement: back view.
3. Power line conducted emissions arrangement.



Photograph 1



Photograph 2



Photograph 3

