

CASS
Industries
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EMC TEST REPORT

For

**DTD PROCESSING MODULE and LED SYMMETRY
CONTROLLER**

To

EC DIRECTIVE 2004/108/EC

EN 61000-6-2:2005

EN 61000-6-4:2007

Generic standards – Emissions and immunity standards for industrial
environments

CASS INDUSTRIES REPORT No. CI05951

TEST DATE: 3rd August 2015

Prepared for:

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Introduction

The DTD Processing Module and LED Symmetry Controller referred to as the EUT (equipment under test) was tested to assess conformity to the EMC Directive 2004/108/EC.

The test standards applied were EN61000-6-2 and EN61000-6-4.

The EUT is a lighting control system for use in poultry farming. The LED lighting in a poultry shed are slowly turned on and off as required to provide optimum conditions for rearing chickens.

Emissions testing was performed with the EUT in operation attached to a representative LED bulb.

Immunity testing was performed with the EUT in operation attached to a representative LED bulb. The LED bulb output and the EUT front panel display were monitored in respect to the criteria bellow.

Performance criteria for the tests were set as being:

Criterion A - Excessive variations in light level or display errors are not permitted.

Criterion B - Complete loss of light output or display is NOT permitted.

Criterion C - Unit must function after completion of test

Tests were carried out in the order listed in the index.

Photo of EUT



CI05951 – EPA Products Ltd. – DTD processor module and LED Symmetry controller

Emissions Test – Conducted

Equipment Used

- Rohde & Schwarz FSV Signal analyser
- EMCO 3810/2 LISN (line impedance stabilisation network)
- Pentagram PTS7200A EMC Pre selector
- TESEQ Compliance 5 software

Method of Measurement

As per CISPR 16.

The mains power for EUT was taken via the LISN and the emissions on the power cable were recorded, readings being taken for both the live and neutral conductors.

The EUT was checked over a frequency range of 0.15-30 MHz with the Analyser set for a resolution bandwidth of 9 kHz.

The limits used being: Class A

Frequency (MHz)	Quasi Peak Limit dB(μV)	Average Peak Limit dB(μV)
0.15 to 0.5	79	66
0.5 to 30	73	60

The frequency range was scanned over three ranges, giving an overall scan time of 60 seconds and the level of the emissions were recorded using Compliance 5 software.

A “Blank” was first run, with the EUT plugged into the LISN but not powered on.

Emissions were recorded with the EUT in operation attached to a representative LED bulb.

Test Results

Graphs are included for:

Graph 1 - The EUT plugged into the LISN, but with no power applied – any emissions recorded being due to pick up on the power cable from external noise sources.

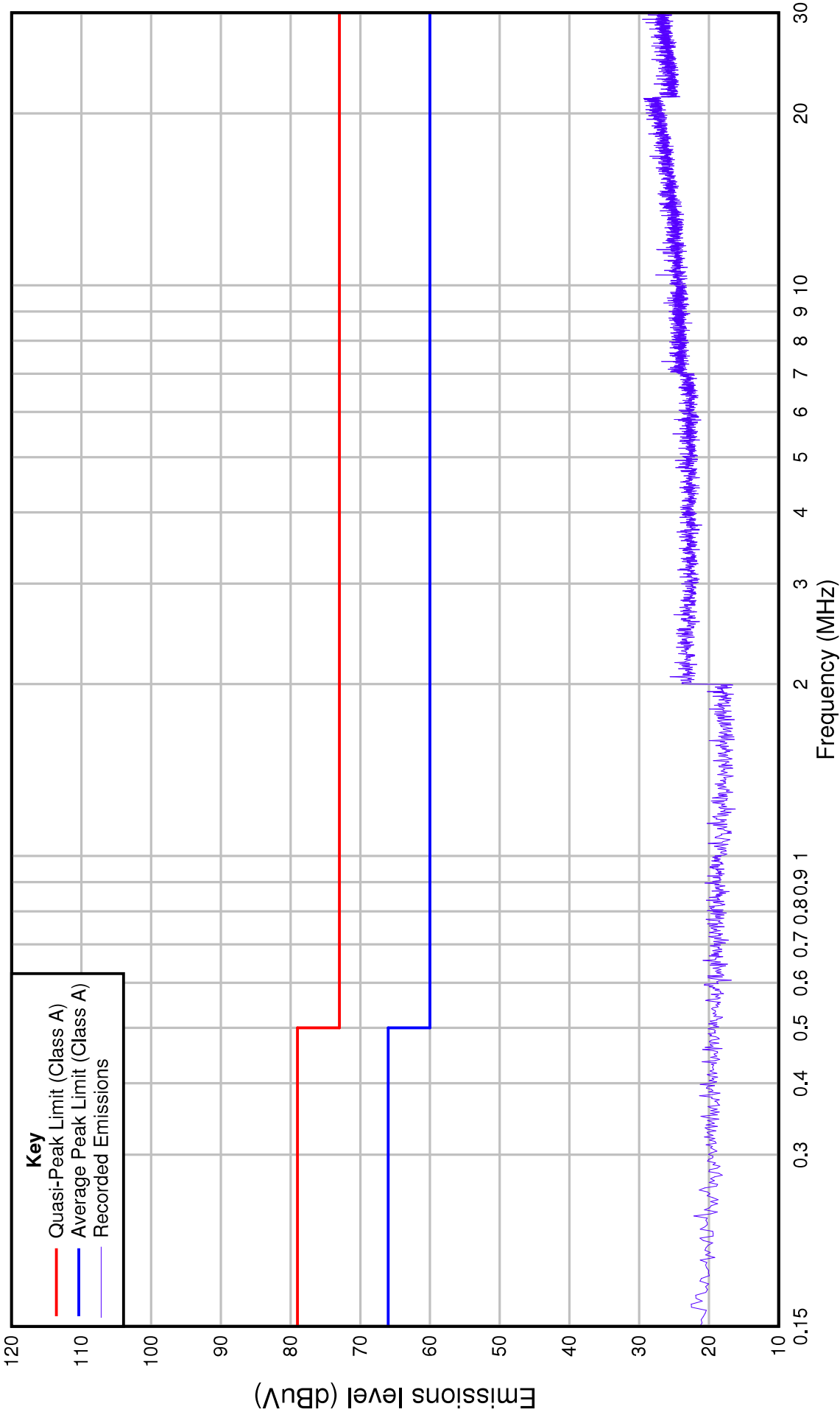
Graph 2 - The EUT plugged into the LISN, powered on and working, controlling a representative LED bulb – a comparison with graph one giving the emissions due to the EUT.

The emissions for the live and neutral cables were very similar.

All emissions recorded were within the limits set by the Standard.

EPA Products Ltd - DTD Processor Module and LED Symmetry Controller

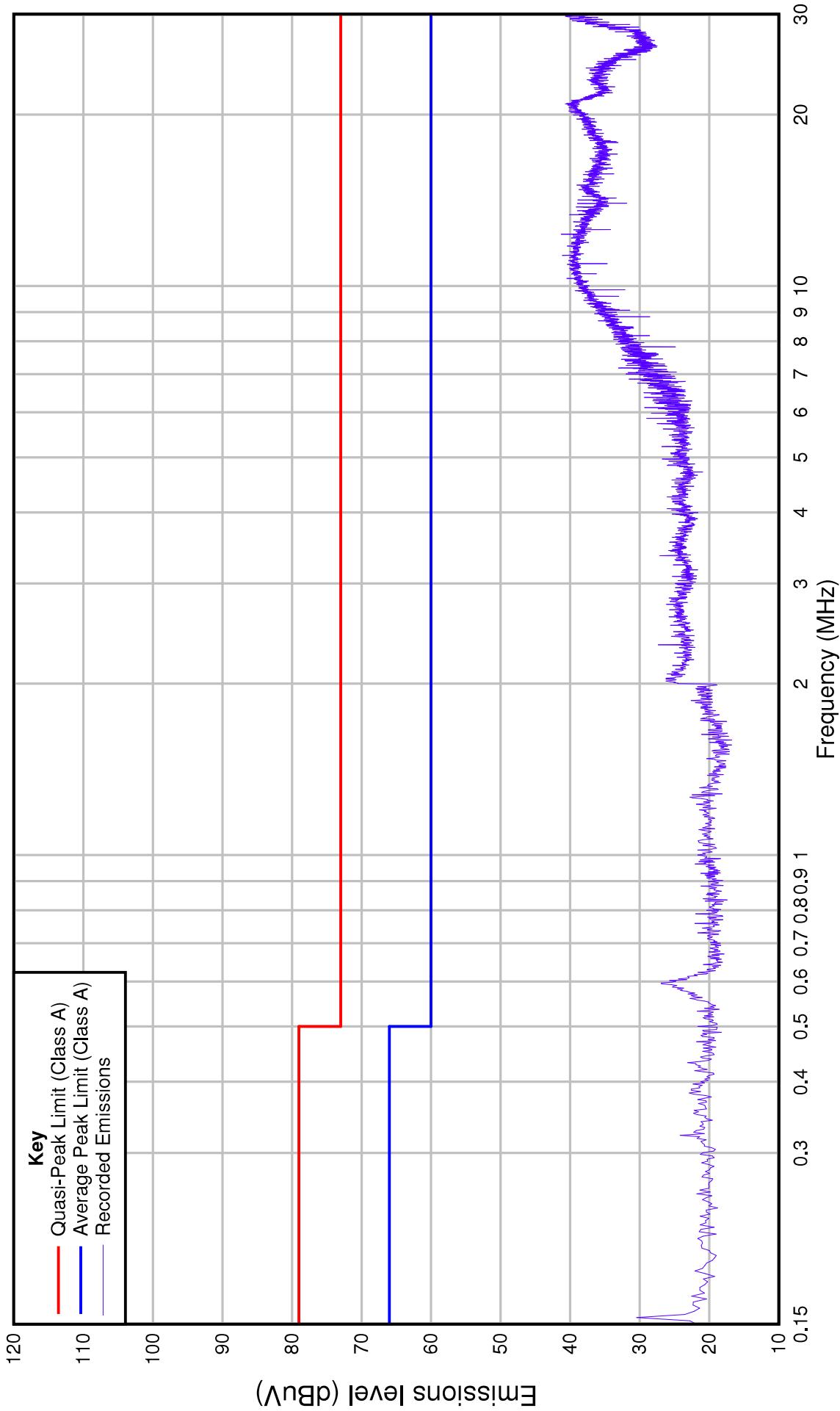
Graph 1: Background Scan

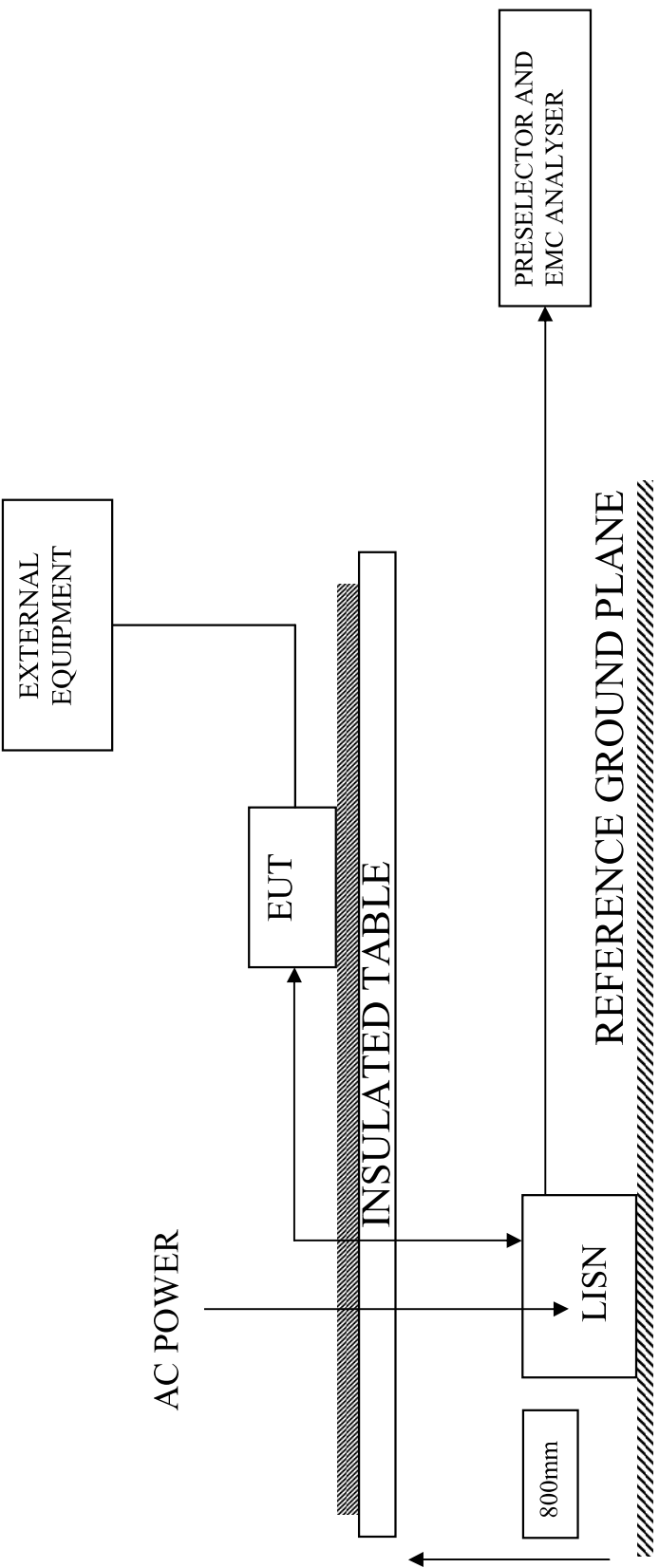


Conducted Emissions

EPA Products Ltd - DTD Processor Module and LED Symmetry Controller

Graph 2: Unit in Operation - Live side





CONDUCTED EMISSIONS SET-UP

Emissions Test – Radiated

Equipment Used

- G-Cell
- Rohde & Schwarz FSV signal analyser
- Pentagram PTS7200A EMC pre selector
- TESEQ Compliance 5 software

Method of Measurement

As per CISPR16.

The EUT was checked for radiated emissions over a frequency range of 30-1000 MHz with the Analyser set for a resolution bandwidth of 120 kHz using the G-Cell as calibrated for a 10 metre OATS (open area test site) equivalent.

The limits used being: Class A

Frequency (MHz)	Quasi Peak Limit dB(μ V/m)
30 - 230	40
230 – 1000	47

The frequency range was scanned over 4 ranges, giving an overall scan time of 90 seconds and the level of the emissions recorded using Compliance 5 software.

An initial background reference scan was performed with the EUT in the cell, but with no power applied.

Emissions were recorded with the EUT in operation attached to a representative LED bulb.

Emissions were recorded for both the vertical and horizontal orientations of the EUT with respect to the axis of the cell.

The cable position was adjusted to obtain the worst-case configuration for the emissions.

Test Results

Graphs are included for:

Graph 3 - The EUT placed in the G-Cell, but with no power applied – any emissions recorded being due to pick up external noise sources.

Graph 4 - The EUT placed in the G-Cell, powered on and working, controlling a representative LED bulb - a comparison with graph three giving the emissions due to the EUT.

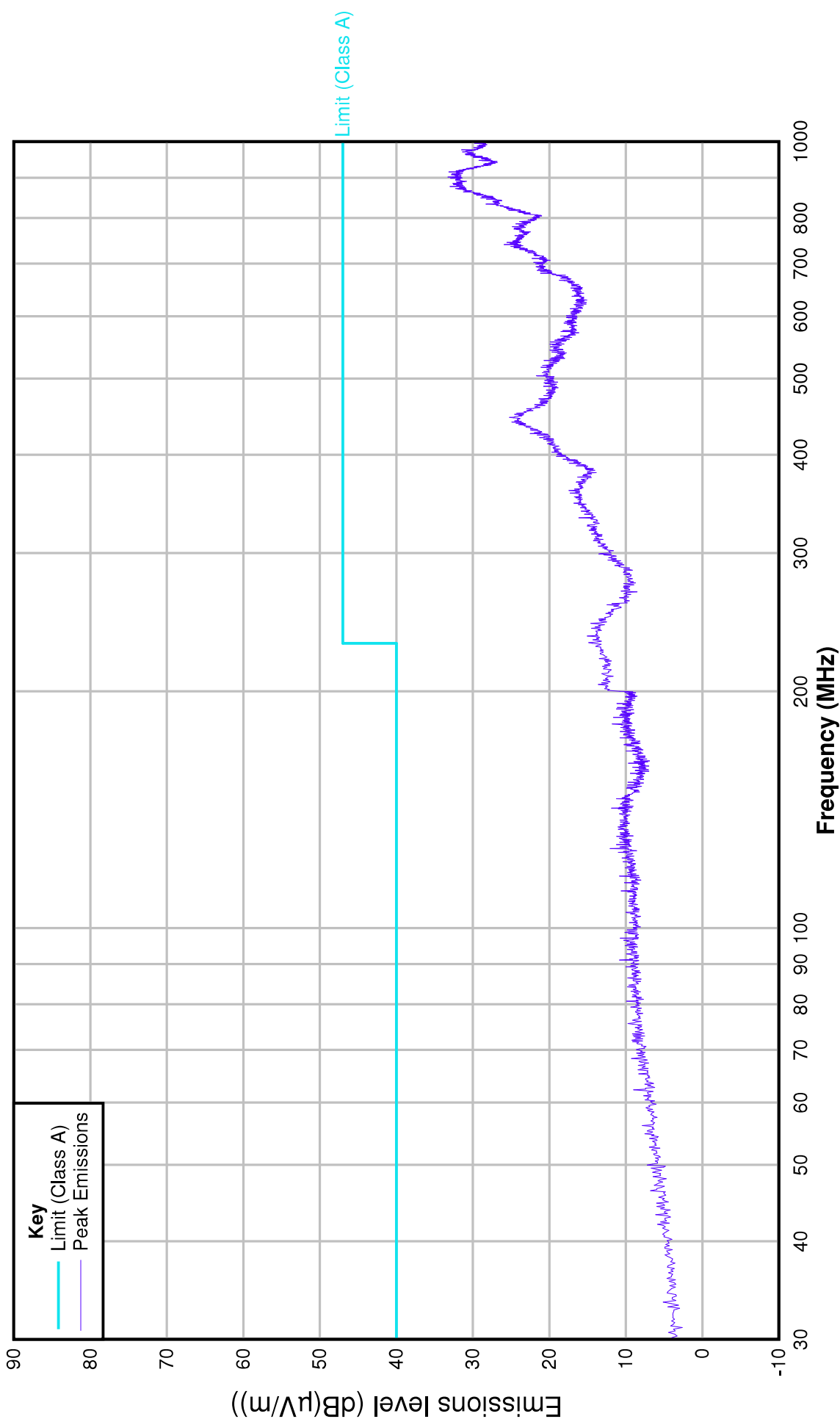
The emissions for both orientations were very similar.

All emissions recorded were within the limits set by the Standard.

EPA Products Ltd - DTD Processor Module and LED Symmetry Controller

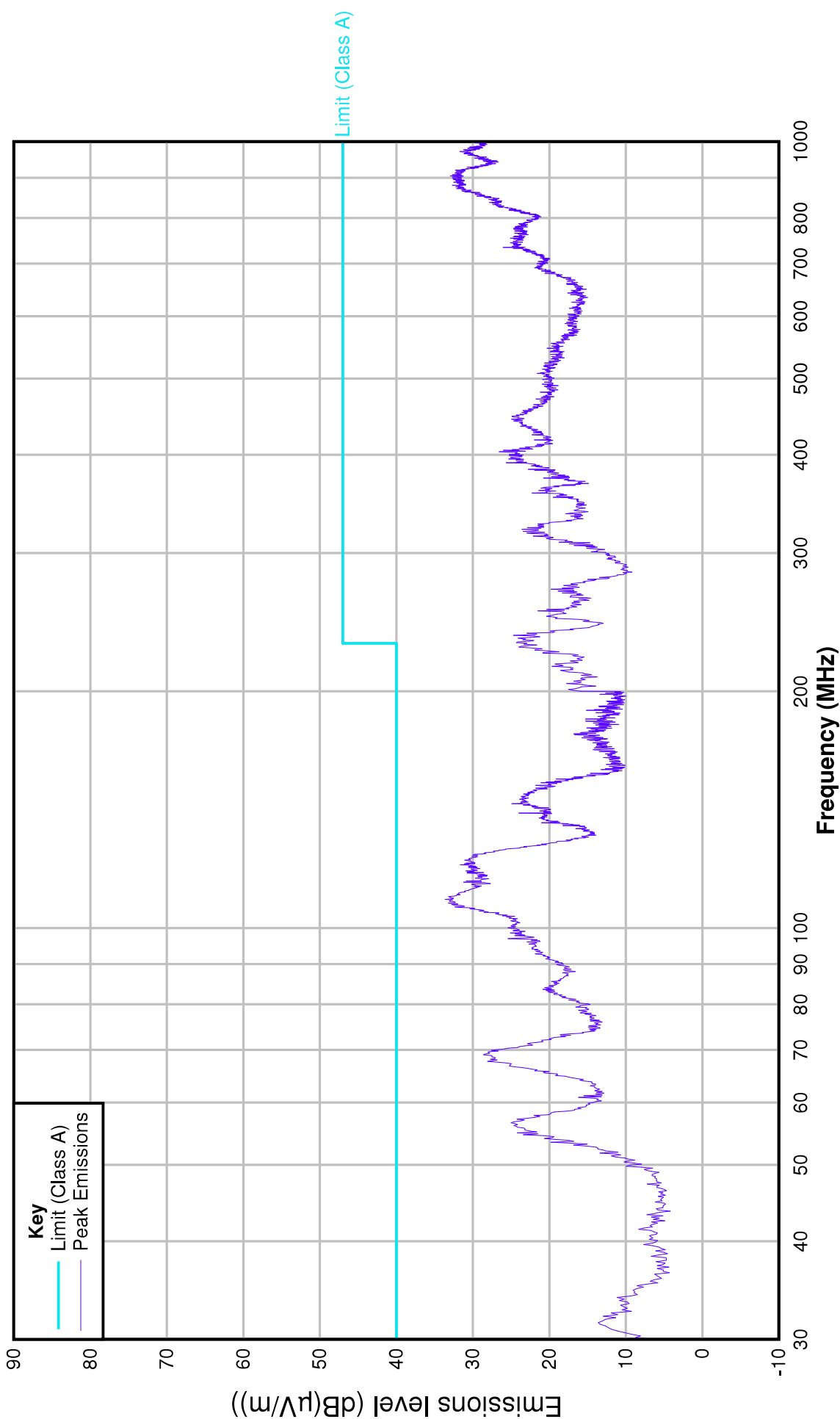
Radiated Emissions

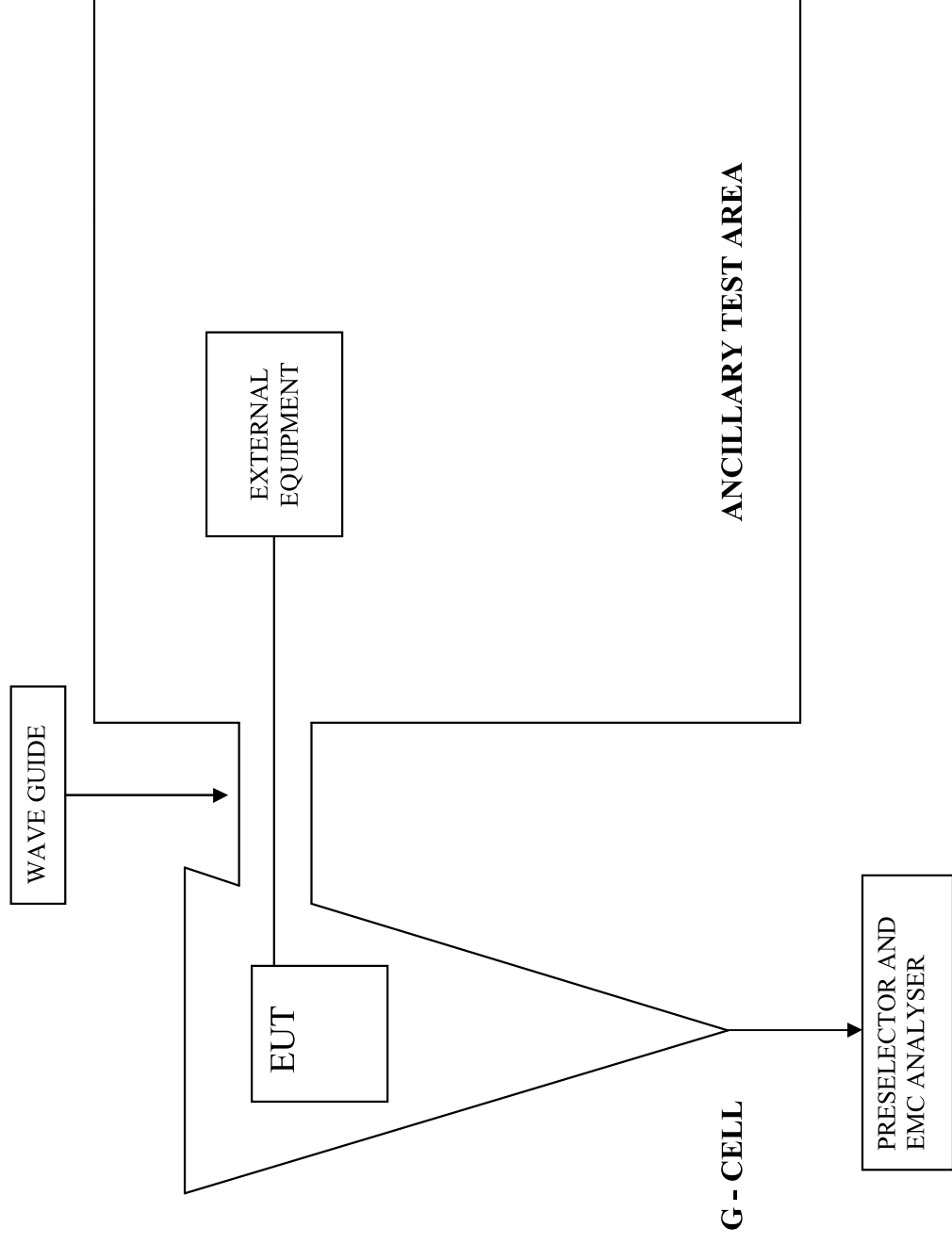
Graph 3 - Background Scan



EPA Products Ltd - DTD Processor Module and LED Symmetry Controller
Graph 4 - Unit in Operation - 1st Orientation

Radiated Emissions





RADIATED EMISSIONS TEST SET-UP

Immunity Test – Enclosure (Radiated)

Equipment Used

- G-Cell
- Rohde & Schwarz SMC100A signal generator (9 kHz ... 3 GHz)
- Amplifier Research 10W1000A RF Amplifier
- MILMEGA AS0104-30/17 microwave amplifier
- Wandel&GoltermannEMR-20 field probe
- Rohde & Schwarz FSV signal analyser
- Pierce EMCycle 3.0 software

Test Method

As per EN 61000-4-3.

The EUT was subjected to an applied radiated field strength of at least 10 V/m for a frequency range of 80 – 2700 MHz, the frequency change being logarithmic where $\Delta f = 0.5\%$. The dwell time was set to 3 seconds and the amplitude modulation was set to 80 % (1 kHz). The test specifications were as per Table 1 EN61000-6-2.

The EUT was tested in the cell, operating, attached to a representative LED bulb. The LED bulb output and the EUT front panel were monitored to ensure that no excessive variations in light level or display errors occurred due to the applied RF fields.

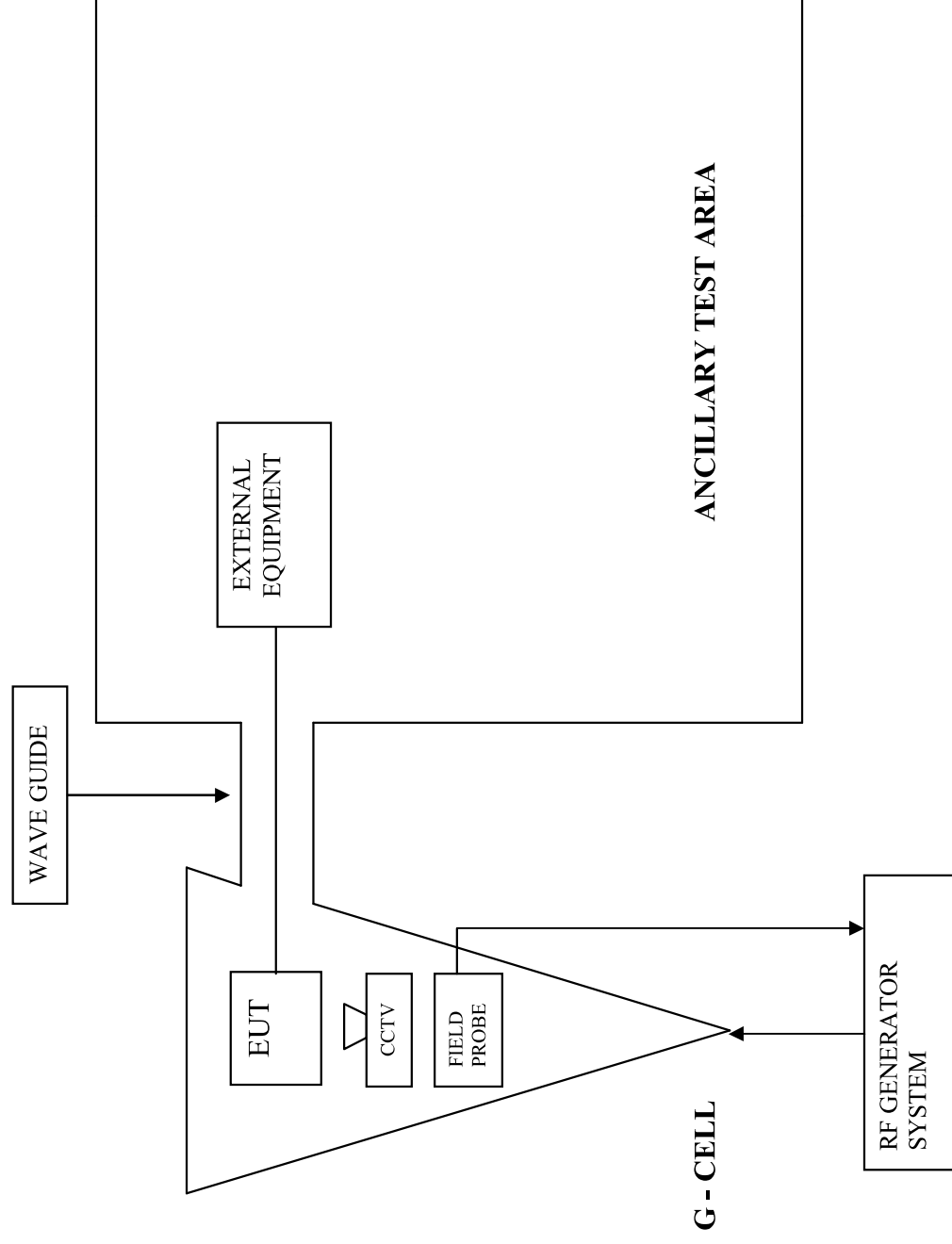
Testing was carried out with the EUT mounted in multiple orientations relative to the applied field.

Test Results

At no time while testing was carried out was any excessive variations in light level or display errors observed.

The EUT was tested to be operating correctly after completion of the tests.

This met the Criterion A response as specified for the test.



RADIATED RF IMMUNITY TEST SET-UP

Immunity Test – Conducted RF (AC power port)

Equipment Used

- Rohde & Schwarz SMC100A signal generator (9 kHz ... 3 GHz)
- Amplifier Research 75A250 RF Amplifier
- CASS ICON RF probe
- Pierce EMCycle 3.0 software

Test Method

As per BS EN 61000-4-6.

A Criterion A response was set for the test.

The EUT was placed on a test table 100 mm above a reference ground plane, and the AC power port for the EUT was directly coupled to the output of the RF Amplifier.

The test specifications were as per Table 4 EN61000-6-2.

The EUT was subjected to common mode radio frequency disturbances of 10 volts RMS, 80 % amplitude modulated (1 kHz), over a frequency range of 0.15 – 80 MHz.

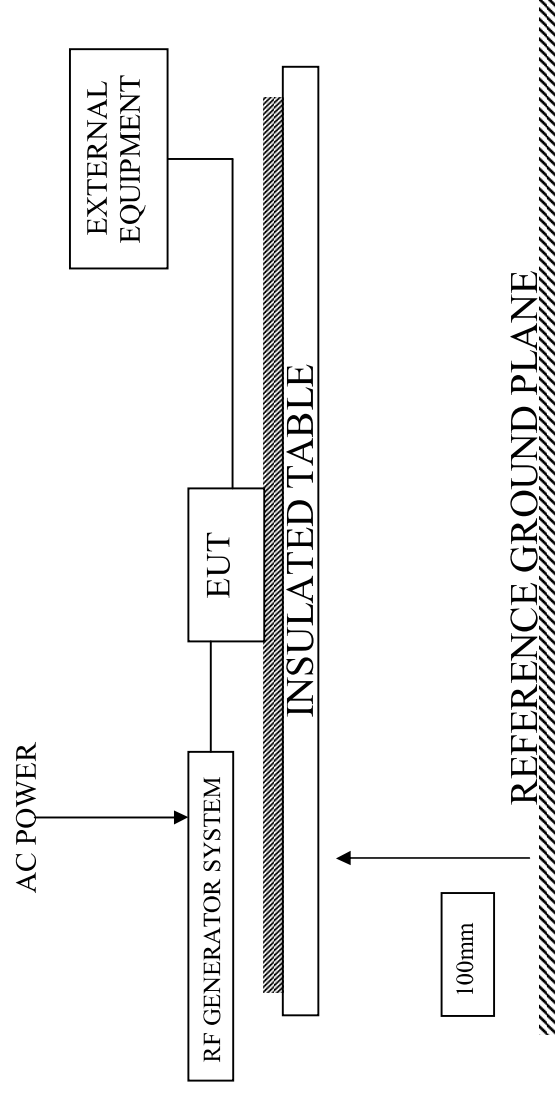
The EUT was tested operating, attached to a representative LED bulb. The LED bulb output and the EUT front panel were monitored to ensure that no excessive variations in light level or display errors occurred due to the applied disturbances.

Test Results

At no time while testing was carried out was any excessive variations in light level or display errors observed.

The EUT was tested to be operating correctly after completion of the tests.

This met the Criterion A response as specified for the test.



CONDUCTED RF (AC MAINS) SET-UP

Immunity Test – Conducted RF (Signal Ports)

Equipment Used

- Rohde & Schwarz SMC100A signal generator (9 kHz ... 3 GHz)
- Amplifier Research 75A250 RF Amplifier
- CASS ICON RF probe
- Pierce EMCycle 3.0 software

Test Method

As per BS EN 61000-4-6.

A Criterion A response was set for the test.

The EUT was placed on a test table, 100 mm above a reference ground plane, and the signal cables for the EUT were placed in an Electromagnetic Radio Frequency clamp.

The input of the Electromagnetic clamp was directly coupled to the output of the RF Amplifier.

The test specifications were as per Table 2 EN61000-6-2.

The EUT was subjected to common mode radio frequency disturbances of 10 volts RMS, 80 % amplitude modulated (1 kHz) over a frequency range of 0.15 – 80 MHz.

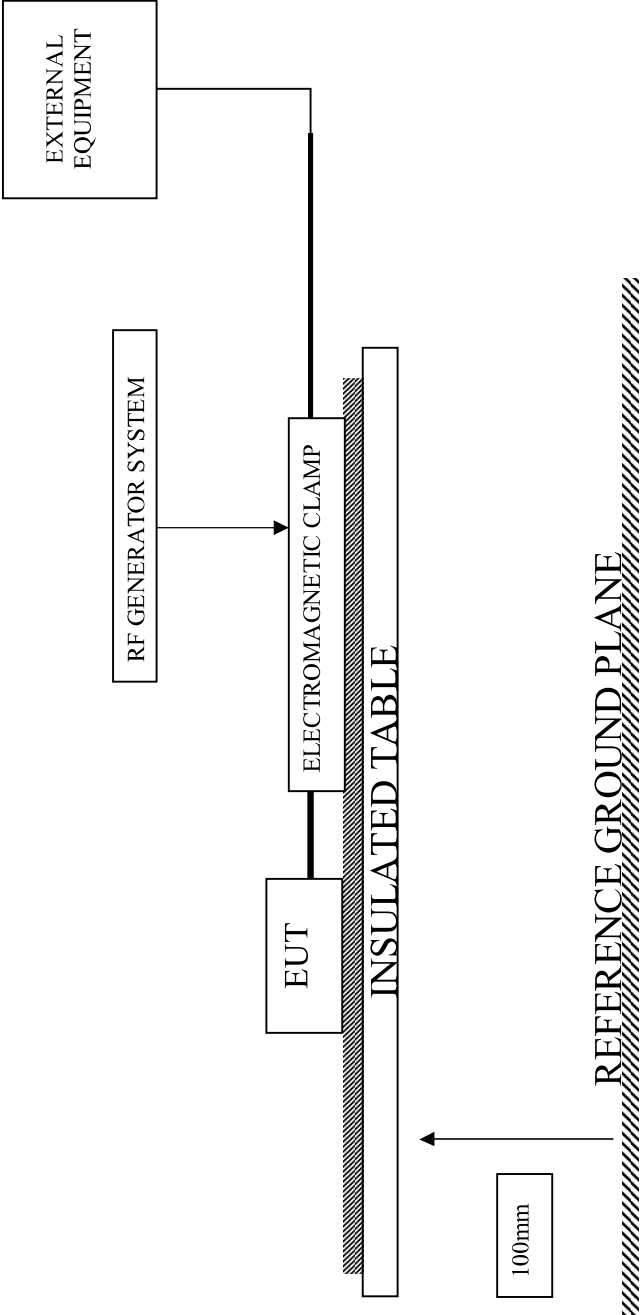
The EUT was tested operating, attached to a representative LED bulb. The LED bulb output and the EUT front panel were monitored to ensure that no excessive variations in light level or display errors occurred due to the applied disturbances.

Test Results

At no time while testing was carried out was any excessive variations in light level or display errors observed.

The EUT was tested to be operating correctly after completion of the tests.

This met the Criterion A response as specified for the test.



CONDUCTED RF (SIGNAL) SET-UP

Immunity Test – Fast Transient Burst (AC Power Port)

Equipment Used

- Schaffner PNW 2225 Burst Generator

Test Method

As per BS EN 61000-4-4.

A Criterion B response was set for the test.

The EUT was placed on an insulated table, 100 mm above a reference ground plane and the power for the EUT was taken via the Burst Generator.

The test specifications were as per Table 4 EN61000-6-2.

The EUT was subjected to AC mains disturbance of repetitive (5 kHz) 2 kV spikes having a rise time of 5ns and a decay time of 50 ns, for at least 1 minute.

Tests were made in both the positive and negative modes.

The disturbances being applied to each conductor in turn.

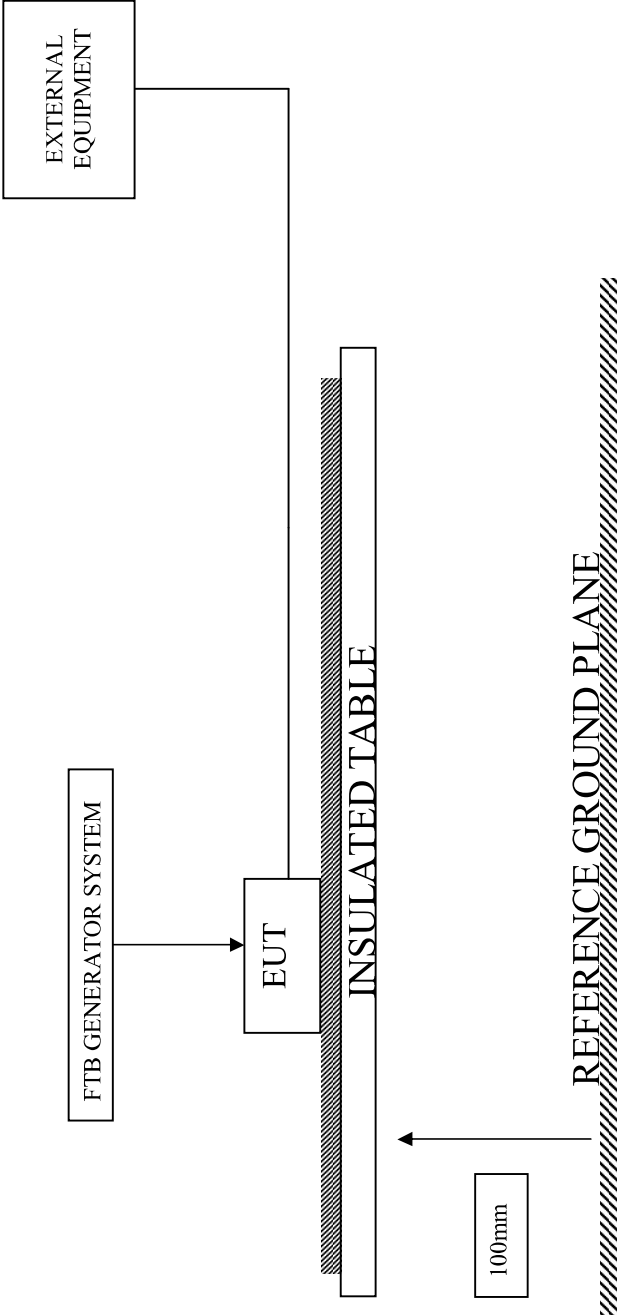
The EUT was tested operating, attached to a representative LED bulb. The LED bulb output and the EUT front panel were monitored to ensure that no loss of light level or display occurred due to the applied disturbances.

Test Results

At no time while testing was carried out was any loss of light or display observed.

The EUT was tested to be operating correctly after completion of the tests.

This met the Criterion B response as specified for the test.



FAST TRANSIENT BURSTS (AC) SET-UP

Immunity Test – Fast Transient Burst (Signal Ports)

Equipment Used

- TESEQ PNW 2225 fast transient burst generator

Test Method

As per BS EN 61000-4-4.

A Criterion B response was set for the test.

The EUT was placed on a test table 100 mm above a reference ground plane, and the signal lines were placed in a capacitive clamp.

The test specifications were as per Table 2 EN61000-6-2.

The EUT was subjected to power disturbances of repetitive (5 kHz) 1 kV spikes having a rise time of 5 ns and a decay time of 50 ns for at least 1 minute.

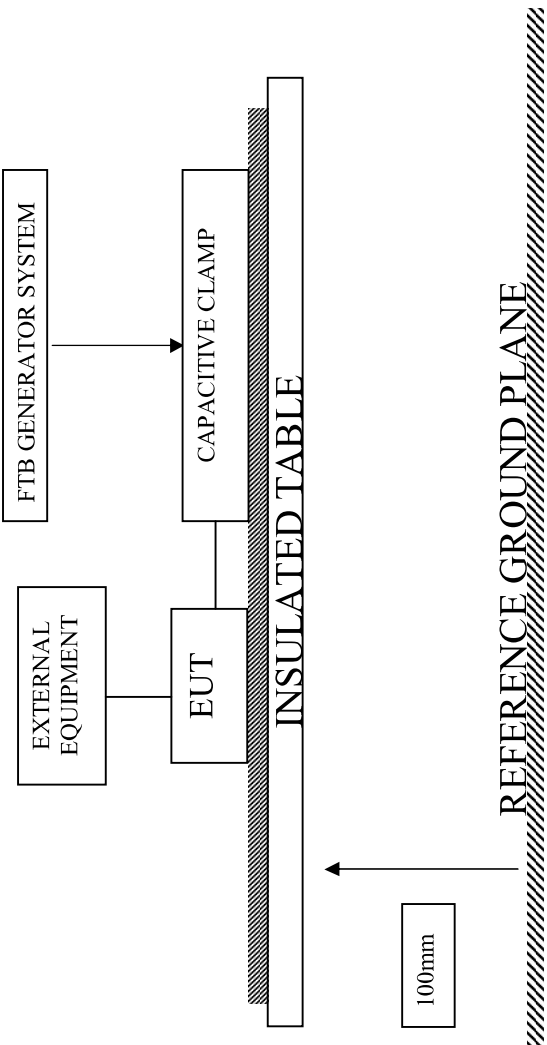
Tests were made in both the positive and negative modes.

The EUT was tested operating, attached to a representative LED bulb. The LED bulb output and the EUT front panel were monitored to ensure that no loss of light level or display occurred due to the applied disturbances.

Test Results

At no time while testing was carried out was any loss of light or display observed.

This met the Criterion B response as specified for the test.



FAST TRANSIENT BURSTS (SIGNAL) SET-UP

Immunity Test – Voltage Dips and Interruptions

Equipment Used

- Schaffner PNW 2003 PQT Voltage dip generator

Test Method

As per BS EN 61000-4-11.

A Criterion B response was set for the 100 % reductions.

A Criterion C response was set for the 30 %, and 60 % reductions and 100% interruptions.

The EUT was placed on a test table 100 mm above a reference ground plane, and the mains power for the EUT was directly coupled to the Interference Simulator.

The test specifications were as per Table 4 EN61000-6-2.

3 mains interruptions, at 10-second intervals, of 30 %, 60 % and 100 % reductions were carried out for:

20 ms (1 cycles)

200 ms (10 cycles)

500 ms (25 cycles)

5000 ms (250 cycles)

The EUT was tested operating, attached to a representative LED bulb. The LED bulb output and the EUT front panel were monitored to ensure that no loss of light level or display occurred due to the applied disturbances.

Test Results

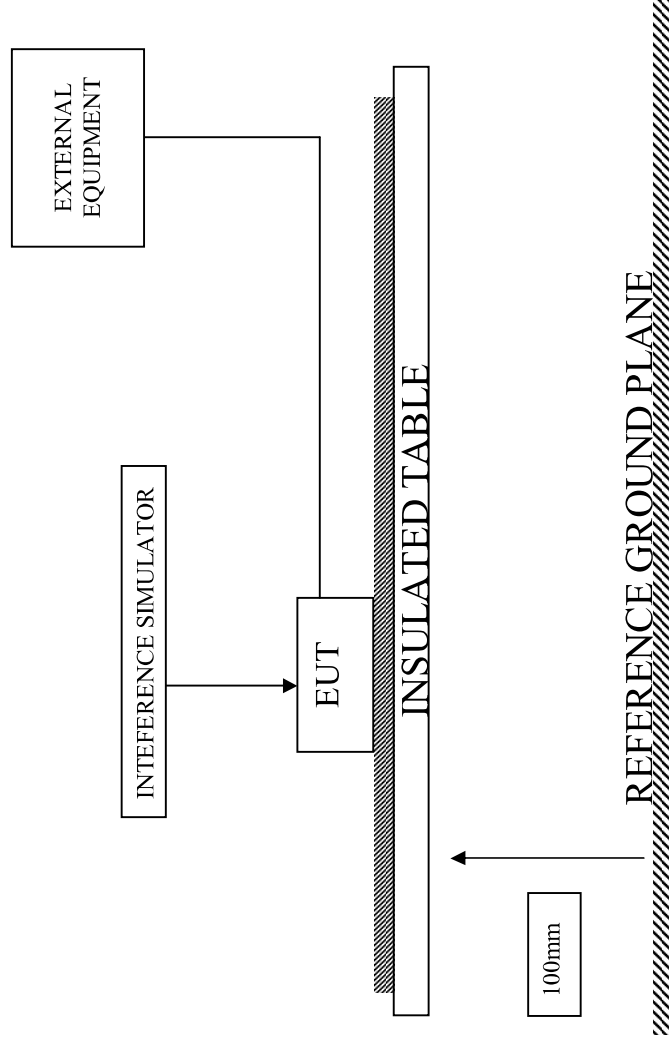
% DIP	Number and Duration	Result
30 %	3 repeats for a duration of 500 ms	Pass
60 %	3 repeats for a duration of 200 ms	Pass
100 %	3 repeats for a duration of 20 ms	Pass
100 %	3 repeats for a duration of 5000 ms	Pass

At no time while testing was carried out was any loss of light or display observed.

For the 5000 ms interruption the EUT restarted during the test and continued normal operation upon completion of the test.

The correct operation of the system was confirmed upon completion of each test.

This met the Criterion B and C responses as specified for the test.



VOLTAGE DIP AND INTERRUPTIONS TEST SET-UP

Immunity Test – Voltage Surges (AC Power Port)

Equipment Used

- Schaffner PNW2050 Surge generator

Test Method

As per BS EN 61000-4-5.

A Criterion B response was set for the test.

The EUT was placed on a test table 100 mm above a reference ground plane, and the mains power lines for the EUT were directly coupled to the Surge Generator individually.

The characteristics of the surges being;

Waveform - 1.2 / 50 μ s (rise time/duration)

Generator circuit - 18 μ F / 2 Ω network (Line to Line)

9 μ F / 12 Ω network (Line to Earth)

Phase shift - 0°, 90°, 180°, 270°.

5 repeat surges at 30 second intervals.

The test specifications were as per Table 4 EN61000-6-2.

Open circuit disturbance surges of 1 kV and 2 kV were applied.

The EUT was tested operating, attached to a representative LED bulb. The LED bulb output and the EUT front panel were monitored to ensure that no change of state occurred due to the applied disturbances.

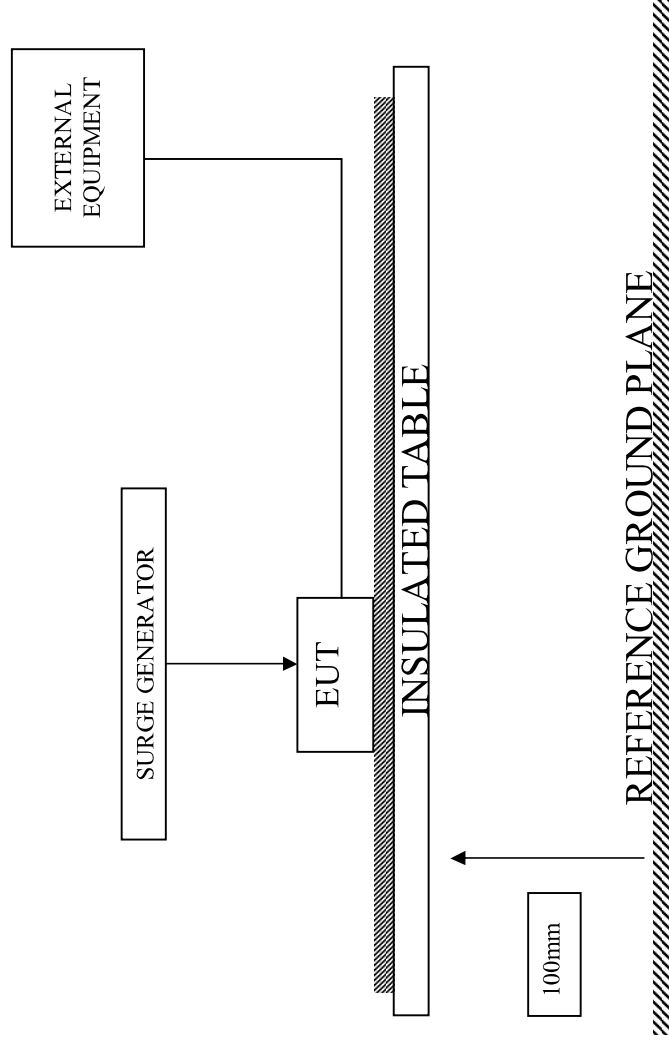
(5 repeat surges)

SURGE	Lines Applied	PASS/FAIL
+1 kV	Live to Neutral	Pass
-1 kV	Live to Neutral	Pass
+2 kV	Live to Ground	Pass
-2 kV	Live to Ground	Pass
+2 kV	Neutral to Ground	Pass
-2 kV	Neutral to Ground	Pass

At no time while testing was carried out was any loss of light or display observed.

The EUT was tested to be operating correctly after completion of the tests.

This met the Criterion B response as specified for the test.



SURGE IMMUNITY (AC) SET-UP

Immunity Test – Electrostatic Discharge

Equipment Used

- Schaffner NSG437 Discharge simulator

Test Method

As per BS EN 61000-4-1.

A Criterion B response was set for the test.

The EUT was placed on an insulated sheet on a stainless steel HCP (horizontal coupling plane), 800 mm above a reference ground plane and 100 mm away from a VCP (vertical coupling plane) and subjected to discharges of ± 4 kV.

These contact discharges being between the high voltage probe and the coupling planes.

± 8 kV air discharges were carried out to insulating surfaces on the EUT and connection cables.

The test specifications were as per Table 1 EN61000-6-2.

The EUT was tested operating, attached to a representative LED bulb. The LED bulb output and the EUT front panel were monitored to ensure that no loss of light level or display occurred due to the applied disturbances.

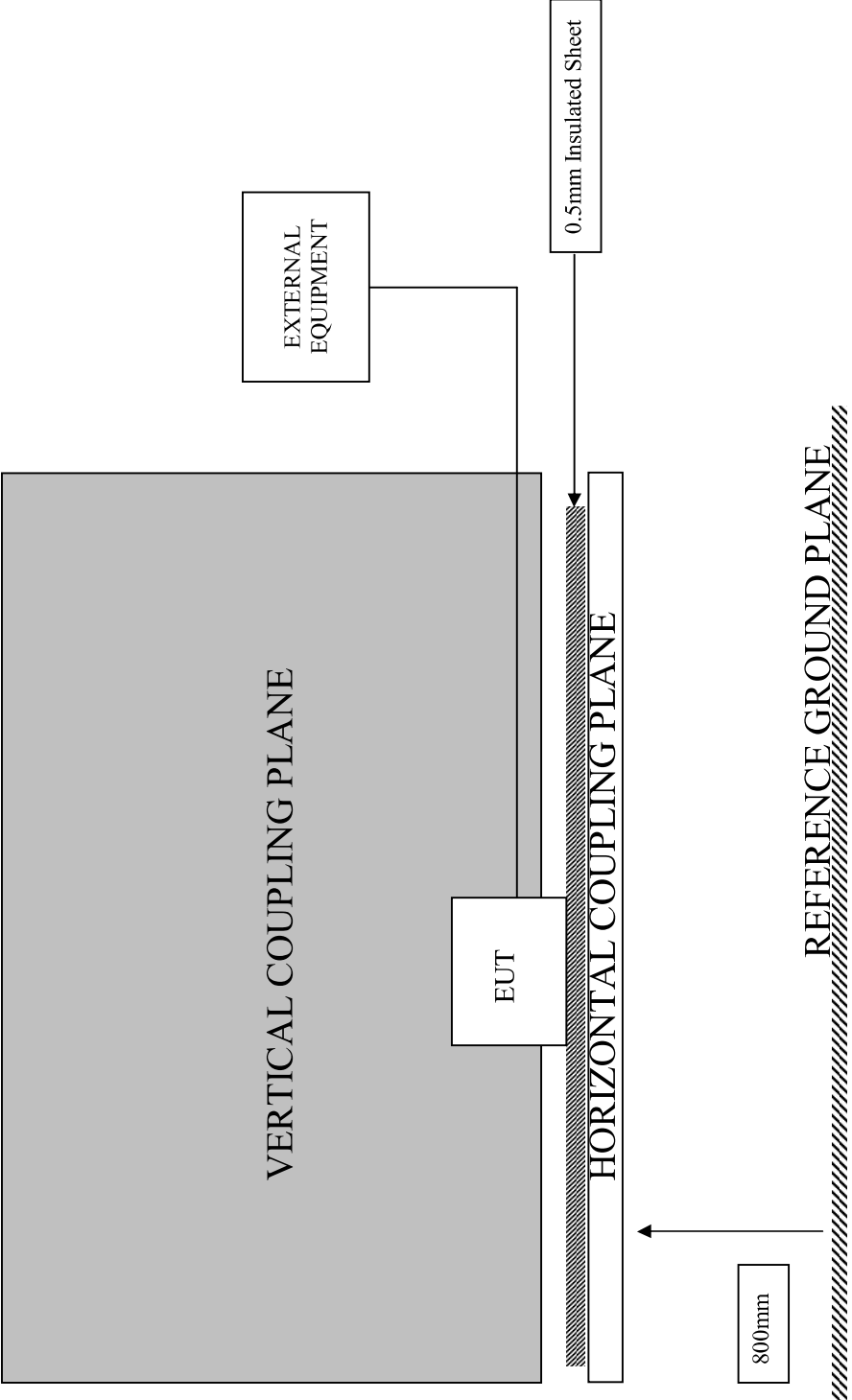
Test Results

Voltage	Position	Result
+4 kV Contact	HCP, close to and symmetrically about the EUT	Pass
-4 kV Contact	HCP, close to and symmetrically about the EUT	Pass
+4 kV Contact	VCP, centre of one vertical edge	Pass
-4 kV Contact	VCP, centre of one vertical edge	Pass
+4 kV Contact	Conducting parts of the EUT enclosure	Pass
-4 kV Contact	Conducting parts of the EUT enclosure	Pass
+8 kV Air	Insulating parts of the EUT enclosure	Pass
-8 kV Air	Insulating parts of the EUT enclosure	Pass
+8 kV Air	Insulating parts of the connection cables	Pass
-8 kV Air	Insulating parts of the connection cables	Pass

At no time while testing was carried out was any loss of light or display observed.

The correct operation of the system was confirmed upon completion of each test.

This met the Criterion B response as specified for the test.



ELECTROSTATIC DISCHARGE SET-UP

Result of Testing

The “DTD processor module and LED Symmetry controller” has met the performance criteria set by:

- EN 61000-6-4
 - Conducted Emissions
 - Radiated Emissions
- EN 61000-6-2
 - Immunity Test – Enclosure (Radiated)
 - Immunity Test – Conducted RF (AC power port)
 - Immunity Test – Conducted RF (Signal Ports)
 - Immunity Test – Fast Transient Burst (AC Power Port)
 - Immunity Test – Fast Transient Burst (Signal Ports)
 - Immunity Test – Voltage Dips and Interruptions
 - Immunity Test – Voltage Surges (AC Power Port)
 - Immunity Test – Electrostatic Discharge

REPORT APPROVED BY:



J Davidson

03/09/2015

For

CASS Industries Ltd.

Comments:

- Before testing commenced the EUT was modified with the application of an FN2070-10-06 Schaffner filter at the mains input.
- The cable position was adjusted to obtain the worst-case configuration for the emissions.
- Testing measurements are limited up to 1 GHz due to the highest frequency of the EUT's internal sources being less than 108 MHz.

EQUIPMENT CALIBRATION

MANUFACTURER	EQUIPMENT	SERIAL #	CALIBRATED	DUE	BY
AGILENT (HEWLETT PACKARD)	11947A Transient Limiter	3107A01467	23/10/14	23/10/15	In House (Traceable)
CASS INDUSTRIES	G - CELL - Amplitude Calibration	NSN	07/11/14	07/11/15	In House (Traceable)
CASS INDUSTRIES	ICON RF current probe	010	20/05/15	20/05/16	In House (Traceable)
EMCO	Line Impedance Stabilisation Network	3810/2	03/08/15	04/09/16	In House (Traceable)
EDMUND OPTICS	LASERCHECK Optical Sensor	OTC568	26/06/14	26/06/16	OTC (UKAS)
KIKUSUI	TOS8650 Voltage Withstand Tester	1040061	25/03/15	25/03/16	ServiceCal (UKAS)
LAPLACE INSTRUMENTS	AC2000 Harmonics & Flicker Analyser	1349739	22/01/14	22/01/16	Laplace Insts. (Traceable)
MECMESIN	Compact gauge 200N	99SER0166-02	02/12/14	02/12/15	Quasartronics (UKAS)
MEGGER	PAT 2/2 Portable Appliance Tester	1007 0495	25/03/15	25/03/16	ServiceCal (UKAS)
PENTAGRAM	PTS 7200A-Preselector	MA 4527	20/01/15	20/01/16	In House (Traceable)
ROHDE & SCHWARZ	SMC100A Signal Generator	1400-42353	09/10/12	09/10/15	Rohde &Schwartz (UKAS)
ROHDE & SCHWARZ	FSV Spectrum Analyser	1400-42156	05/09/13	04/09/15	Rohde &Schwartz (UKAS)
TESEQ	NSG 437 ESD Simulator	660	05/03/15	05/03/17	Teseq (UKAS)
SCHAFFNER	PNW2050 Surge plug-in	200430-543LU	20/01/13	20/11/15	Teseq (UKAS)
SCHAFFNER	PNW2003 PQT Voltage DIP Generator	200209-019SC	20/11/13	20/11/15	Teseq (UKAS)
SCHAFFNER	PNW2225 FTB plug-ig	200448-528LU	20/11/13	20/11/15	Teseq (UKAS)
TEKTRONIX	TDS 360 Oscilloscope	B010180	25/03/15	25/03/16	ServiceCal (UKAS)
THURLBY THANDAR	TG1010 Function Generator	055245	25/03/15	25/03/16	ServiceCal (Traceable)
WANDEL & GOLTERMAN	EMR-20 Field Probe	L-0093	06/04/15	06/04/18	Teseq (UKAS)

EQUIPMENT CALIBRATION

MANUFACTURER	EQUIPMENT	SERIAL #	CALIBRATED	DUE	BY
WEST	2300 Digital Thermometer	NSN	25/03/15	25/03/16	ServiceCal (UKAS)
ROBUCK	EXTERNAL MICROMETER	R-181	24/03/15	24/03/16	Quasartronics (UKAS)
AGILENT	U1241B RMS Multimeter	MY52220059	15/03/15	15/03/16	Agilent
CASS INDUSTRIES	DRUM TEST SET TYPE	60205	25/11/14	25/11/15	In House (Traceable)
TEKTRONIX	TDS 2004 DIGITAL STORAGE	C010044	15/04/15	15/04/16	ServiceCal (UKAS)
DIGITRONIX	DIGITAL CALIPER	NSN	05/02/15	05/02/16	In House (Traceable)
KEYSIGHT TECHNOLOGIES (AGILENT)	U1241B RMS MULTIETER	MY55060006	28/07/15	28/07/16	Keysight Technologies