EMC File

Excelsys 3Gen 6 Slot Series

CONTENTS

SECTION 1. SCOPE

Excelsys 3gen 6Slot series of modular power supplies

SECTION 2. PURPOSE

The purpose of this file is to document the performance of the 3Gen series in respect of applicable EMC standards. It should be noted that EMC compliance is a system issue. Excelsys cannot guarantee system compliance....no power supply manufacturer can! However, Excelsys engineers have prepared this file to demonstrate the results recorded during type testing of the 3gen product. This document may be used by systems designers to assist in systems compliance.

SECTION 3. APPLICABLE STANDARDS

3.1 Emissions

EN 55022: 1998
Limitation and methods of measurement of radio disturbance characteristics of information technology equipment (CISPR 22:1993)

IEC / EN 61000-3-2: 1995
Limitation of harmonic current emissions in low voltage supply systems for equipment with rated current ≤ 16Amps per phase

IEC / EN 61000-3-3: 2002
Limitation of voltage fluctuations and flicker in low voltage supply systems for equipment with rated current ≤ 16Amps per phase and not subject to conditional connection

3.2 Immunity

IEC / EN 61000-4-2:
Electromagnetic compatibility
Part 4. Testing and measurement techniques
Section 2. Electrostatic Discharge

IEC / EN 61000-4-3: 1996
Electromagnetic compatibility
Part 4. Testing and measurement techniques
Section 3. Radiated radio frequency electromagnetic field immunity test

IEC / EN 61000-4-4: 1995
Electromagnetic compatibility
Part 4. Testing and measurement techniques
Section 4. Electrical fast transient/burst immunity test

IEC / EN 61000-4-5: 1995
Electromagnetic compatibility
Part 4. Testing and measurement techniques
Section 5. Surge immunity test

IEC / EN 61000-4-6: 1996
Electromagnetic compatibility
Part 4. Testing and measurement techniques
Section 6. Immunity to conducted disturbances, induced by radio-frequency fields

IEC / EN 61000-4-11: 1994
Electromagnetic compatibility
Part 4. Testing and measurement techniques
Section 11. Voltage dips, short interruptions and voltage variations immunity tests

SECTION 4. EQUIPMENT UNDER TEST (EUT)

The 3gen 6slot series is a configurable modular series consisting of a common input module combined with up to 6 output modules. It is intended for use in general light industrial or commercial applications. Serial number details of type tested products are included under details of each test in section 8 of this report.

SECTION 5. OPERATION OF THE EUT DURING TESTING

The EUT was loaded with appropriate resistors to simulate system loading. Details are included under each test report in section 8. For immunity testing, the output voltages of the EUT were observed using an oscilloscope to detect any deviations resulting from the disturbances. See Section 7 for a discussion on the permissible deviations.

SECTION 6. METHODS and APPARATUS

The measuring apparatus used during tests was designed and built to the requirements of CISPR 16-1: 1993. Title: Specification for radio disturbance and immunity measuring apparatus and methods. Part 1: Radio disturbance and immunity measuring apparatus

SECTION 7. PERFORMANCE CRITERIA

Electromagnetic Immunity is the ability of equipment or systems to perform without degradation in the presence of electromagnetic disturbances. The aim of Immunity standards is to specify test procedures and testing levels which allow consistent verification of electromagnetic immunity. Both conducted and radiated disturbances are considered. The results of tests are classified in terms of the loss of function or degradation of performance of the EUT according to the following performance criteria:

A
Normal performance within limits specified by the manufacturer.
Excelsys specifies normal performance as the output voltages not deviating by more than 3% from the value prior to the test.

B
Temporary loss of function or degradation of performance which ceases after the disturbance ceases.
Excelsys specifies degradation of performance as a voltage deviation of more than 3% from the value prior to the test.

C
Temporary loss of function or degradation of performance, requiring operator intervention or system reset to achieve correction.
For Excelsys products, this may mean that removal and reapplication of the input supply is necessary.

D
Loss of function or degradation of performance which is not recoverable.

NOTE: As EMC standards apply to the final system rather than to components parts of the system (such as the power supply), the performance criteria also apply to the system. The performance criteria specified by Excelsys for the component power supply may therefore be exceeded in some systems.

SECTION 8. TESTING

8.1 Standard: EN 55022: 1998

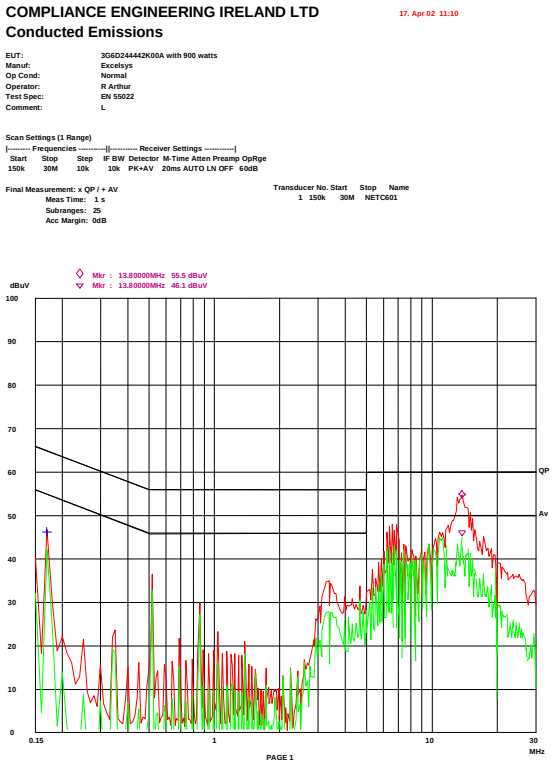
Limitation and methods of measurement of radio disturbance characteristics of information technology equipment (CISPR 22:1993)

Test Conditions

Model no. of EUT:	3G6D001445-03
Serial no. of EUT:	925910
Date of Testing:	21April, 2002
Testing carried out by:	Alan Cunningham, CEI Ltd.
Temperature:	23 ^{o} C
Relative Humidity:	63%
Input Voltage:	230V, 50 Hz
Output Voltages:	5V, 24V, 24V, 15V, 15V (combination loading to 800W)
Equipment used:	See appendix 1
Measurement Uncertainty:	+/-2.8dB (95% confidence level)
Test configuration:	See Figure A1

Test Description

Measurement of conducted emissions were carried out using the receiver analysis feature, which uses three detectors; peak, quasi peak and average. Using this mode the voltage emission spectrum was scanned in peak detection mode. The live and neutral conductors were examined individually to determine the maximum. The receiver bandwidth was set to 10kHz.



Commentary *(not part of test report)*

This test was performed using a 3Gen 6Slot power supply with passive resistive loading. Measurements taken in actual systems (which may contain switching circuits) may differ from those above, particularly at high frequencies (i.e >1MHz), where system grounding may play an important role. Use of ferrite absorbing tube cores (Excelsys part no. 390D042) on the incoming line cord may assist in reducing HF line conducted emissions.

The measurement system should ensure attenuation of sub 150kHz frequencies in order to avoid erroneous measurement of harmonics (of sub 150kHz components), generated by signal limiters, and erroneously measured in the measurement band.

8.2 Standard: IEC / EN 61000-3-2: 1995

Limitation of harmonic current emissions in low voltage supply systems for equipment with rated current ≤ 16Amps per phase)

Test Conditions

Model no. of EUT:	3G6D123465-00
Serial no. of EUT:	918050
Date of Testing:	Alan Cunningham, 6th September, 2000
Testing carried out by:	CEI
Temperature:	20 ° C
Relative Humidity:	65%
Input Voltage:	230V, 50 Hz
Output Voltages:	5V, 12V, 18V, 24V, 5V, 24V, 24V, 24V (combination loading to 800W)
Equipment used:	See appendix 1
Test Configuration:	See Figure A2

Test Description

The steady state harmonics test measures the current at each of the harmonic frequencies from the second harmonic up to the 40th harmonic. A 50 Hz , 230v AC source was used to power the EUT in compliance with IEC / EN 61000-3-2: 1995. The current harmonic levels were measured and compared with the limit levels for Class A waveforms. See table below for results

Harmonic	*Reading*	*Limit Amps*	*Result*	*Harmonic*	*Reading*	*Limit Amps*	*Result*
2	24mA	1.08	Pass	3	705mA	2.3	Pass
4	6mA	0.43	Pass	5	221mA	1.14	Pass
6	<1mA	0.3	Pass	7	135mA	0.77	Pass
8	<1mA	0.23	Pass	9	85mA	0.4	Pass
10	<1mA	0.184	Pass	11	170mA	0.33	Pass
12	<1mA	0.153	Pass	13	162mA	0.21	Pass
14	<1mA	0.1314	Pass	15	84mA	0.15	Pass
16	<1mA	0.115	Pass	17	62mA	0.1324	Pass
18	2mA	0.1022	Pass	19	51mA	0.1184	Pass
20	<1mA	0.092	Pass	21	47mA	0.1071	Pass
22	2mA	0.0836	Pass	23	28mA	0.0978	Pass
24	<1mA	0.0766	Pass	25	29mA	0.09	Pass
26	2mA	0.0708	Pass	27	26mA	0.0833	Pass
28	<1mA	0.0657	Pass	29	21mA	0.0776	Pass
30	2mA	0.0613	Pass	31	18mA	0.0726	Pass
32	<1mA	0.0575	Pass	33	31mA	0.0682	Pass
34	2mA	0.0541	Pass	35	28mA	0.0643	Pass
36	<1mA	0.0511	Pass	39	27mA	0.0608	Pass
38	<1mA	0.0484	Pass	39	22mA	0.0577	Pass
40	3mA	0.046	Pass				

Commentary *(not part of test report)*

The low levels of harmonics above corresponds to a high (near unity) power factor, defined as INPUT WATTS divided by INPUT VOLTS x AMPS. Power factor improves as line voltage decreases and as load increases. Typical measured PF values are:

$PF_{230V, 800W} = 0.95$

$PF_{115V, 800W} = 0.99$

8.3 Standard: IEC / EN 61000-3-3: 2002

Limitation of voltage fluctuations and flicker in low voltage supply systems for equipment with rated current ≤ 16Amps per phase and not suitable to conditional connection.

Test Conditions

Model no. of EUT:	3G6D123465 (x3)
Serial no. of EUT:	922880, 922881, 923082
Date of Testing:	5 May, 2002
Testing carried out by:	Alan Cunningham, Schaffner.
Temperature:	24 ^{o} C
Relative Humidity:	65%
Input Voltage:	230V, 50 Hz
Output Voltages:	5V, 12V, 18V, 24V, 5V, 24V, 24V, 24V (combination loading in system 800W)
Equipment used:	See appendix 1

Test Description

Assessment of long term flicker value P_{lt} and short term flicker value P_{st} are primarily dependent on the pulsing nature of system loads, and therefore cannot be verified with passive loads by Excelsys. However, voltage fluctuations caused by line switching are dependent on the power supply.

Annex B of the standard suggests test procedures for measuring dmax voltage changes caused by manual switching, whereby 24 measurements are taken and the highest and lowest values deleted and the arithmetic average taken of the remaining 22 values.

In order to replicate the effects of flicker on a large system, this test was performed on a large system incorporating 3 Excelsys power supplies. The results for manual switching are given here.

Result	dc	dt > dc	dmax	included
1	0.309	10	3.718	Yes
2	0.232	10	4.774	Yes
3	0.217	10	4.245	Yes
4	0.306	10	3.715	Yes
5	0.205	10	4.482	Yes
6	0.197	10	3.614	Yes
7	0.271	10	4.795	No
8	0.211	10	3.416	Yes
9	0.237	10	4.077	Yes
10	0.213	10	4.530	Yes
11	0.262	10	3.819	Yes
12	0.290	10	3.346	No
13	0.370	10	4.192	Yes
14	0.305	10	4.133	Yes
15	0.220	10	4.471	Yes
16	0.268	10	4.195	Yes
17	0.359	10	4.414	Yes
18	0.318	10	3.463	Yes
19	0.386	10	4.394	Yes
20	0.179	10	4.414	Yes
21	0.218	10	4.348	Yes
22	0.194	10	3.815	Yes
23	0.178	10	3.756	Yes
24	0.261	10	3.897	Yes

Average dmax = 4.086 %
LIMIT dmax = 6 % for manual switching

Commentary *(not part of test report)*
These results suggest that up to four 3gen 6Slot units may be used together in large systems without the need for special soft-switching starting circuits.

8.4 Standard: IEC / EN 61000-4-2:

Electromagnetic compatibility
Part 4. Testing and measurement techniques
Section 2. Electrostatic discharge

Test Conditions

Model no. of EUT:	3G6D123465-00
Serial no. of EUT:	918050
Date of Testing:	5 September, 2000
Testing carried out by:	Alan Cunningham, Schaffner Ltd.
Temperature:	20 ^{o} C
Relative Humidity:	58%
Input Voltage:	230V, 50 Hz
Output Voltages:	5V, 12V, 18V, 24V, 5V, 24V, 24V, 24V (combination loading to 800W)
Equipment used:	See appendix 1
Port:	Enclosure

Test Description

The EUT was placed 0.8m above the ground plane, sitting on an insulating table.

Electrostatic discharges were applied to in direct contact with the enclosure and also over a short air distance

The output voltages were monitored during tests for any deviation from normal operating mode. The EUT maintained normal operation during the testing and was subsequently found to be operating satisfactorily.

Test	*Disturbance Level*	*Result*	*Performance Criterion*
Contact Discharge	8kV	Complied	A
Air Discharge	15kV	Complied	A

Commentary *(not part of test report)*

The limits above correspond to Level 4

8.5 Standard: IEC / EN 61000-4-3: 1996

Electromagnetic compatibility
Part 4. Testing and measurement techniques
Section 3. Radiated radio frequency electromagnetic field immunity test

Test Conditions

Model no. of EUT:	3G6D123465-00
Serial no. of EUT:	918050
Date of Testing:	6 September, 2000
Testing carried out by:	Alan Cunningham, CEI Ltd
Temperature:	23 ^{o} C
Relative Humidity:	64%
Input Voltage:	230V, 50 Hz
Output Voltages:	5V, 12V, 18V, 24V, 5V, 24V, 24V, 24V (combination loading to 800W)
Equipment used:	See appendix 1
Test Configuration:	See Figure A3
Port:	Enclosure

Test Description

The EUT was placed 0.8m above the ground plane, sitting on an insulating table, situated in an anechoic chamber. All peripheral equipment was placed outside the anechoic chamber.

These tests were carried out over the frequency range of 80-1000 MHz. The step sizes used were 1%.

The dwell time at each frequency was 2 seconds. The test level was maintained at over 10 V/m at all frequencies.

A field sensor was placed in close proximity to the EUT. The distance of the antenna from the EUT was 3.0m. The tests were carried out with the antenna oriented in horizontal and vertical polarisations.

All four sides of the EUT were illuminated. The output voltages were monitored during tests for any deviation from normal operating mode. The EUT maintained normal operation during the testing and was subsequently found to be operating satisfactorily.

Frequency MHz	*Polarisation (V/H)*	*Disturbance Level (V/m)*	*Result*	*Performance Criterion*
80-1000 MHz	V and H	10	Complied	A

Commentary *(not part of test report)*

8.6 Standard: IEC / EN 61000-4-4: 1995

Electromagnetic compatibility
Part 4. Testing and measurement techniques
Section 3. Electrical fast transient/burst immunity test

Test Conditions

Model no. of EUT:	3G6D123465-00
Serial no. of EUT:	922880
Date of Testing:	27 May, 2002
Testing carried out by:	Alan Cunningham, Schaffner.
Temperature:	22 ^{o} C
Relative Humidity:	61%
Input Voltage:	230V, 50 Hz
Output Voltages:	5V, 12V, 18V, 24V, 5V, 24V, 24V, 24V (combination loading in system 800W)
Equipment used:	See appendix 1
Port:	Input

Test Description

Positive and negative fast transient discharges of amplitude 1kV were applied to the mains input in accordance with the requirements of EN 61000-4-4: 1995.

Transients were applied to the live and neutral and earth lines.

The application time for each test was 1 minute.

The output voltages of the EUT were monitored during tests for any deviation from normal operation. The EUT and system maintained normal operation during the testing and both were subsequently found to be operating satisfactorily.

Test Port	*Disturbance Level*	*Result*	*Performance Criterion*
Live	2kV	Complied	A
Neutral	2kV	Complied	A
L&N	2kV	Complied	A
Live & Earth	2kV	Complied	A
Neutral & Earth	2kV	Complied	A
Earth	2kV	Complied	A
N & L & Earth	2kV	Complied	A
Live	-2kV	Complied	A
Neutral	-2kV	Complied	A
L&N	-2kV	Complied	A
Live & Earth	-2kV	Complied	A
Neutral & Earth	-2kV	Complied	A
Earth	-2kV	Complied	A
N & L & Earth	-2kV	Complied	A

Commentary *(not part of test report)*

This test was performed in a customer system. The performance level achieved is consistent with Level 3.

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8.7 Standard: IEC / EN 61000-4-5: 1995

Electromagnetic compatibility
Part 4. Testing and measurement techniques
Section 3 Surge immunity test

Test Conditions

Model no. of EUT:	3G6D123465-00
Serial no. of EUT:	919125
Date of Testing:	25 March, 2001
Testing carried out by:	Alan Cunningham, Excelsys Technologies.
Temperature:	23 ^{o} C
Relative Humidity:	64%
Input Voltage:	230V, 50 Hz
Output Voltages:	5V, 12V, 18V 24V, 5V, 24V, 24V, 24V (combination loading to 800W)
Equipment used:	See appendix 1
Test Configuration:	See Figure A4
Port:	Input

Test Description

Positive and negative surges were applied to the mains inputs in accordance with the requirements of EN 61000-4-5: 1995.

Surges were applied to the mains conductors coupled line to line and line to earth.

The test configuration is shown in Figure 5, Appendix 2.

The tests were carried out with positive and negative surges. The test was repeated every 60 seconds for a total of 5 times in each polarity and in all coupling modes.

The output voltages of the EUT were monitored during tests for any deviation from normal operation. The E.U.T. maintained normal operation during the testing and was subsequently found to be operating satisfactorily.

Port	*Mode of conduction*	*Disturbance Level*	*Result*	*Performance Criterion*
Mains	L-N	+ 1 kV, 0 degrees	Complied	B
Mains	L-N	+ 1 kV, 90 degrees	Complied	B
Mains	L-N	+ 1 kV, 180 degrees	Complied	B
Mains	L-N	+ 1 kV, 270 degrees	Complied	B
Mains	L-N	- 1 kV, 0 degrees	Complied	B
Mains	L-N	- 1 kV, 90 degrees	Complied	B
Mains	L-N	- 1 kV, 180 degrees	Complied	B
Mains	L-N	- 1 kV, 270 degrees	Complied	B
Mains	N-E	+ 2 kV, 0 degrees	Complied	B
Mains	N-E	+ 2 kV, 90 degrees	Complied	B
Mains	N-E	+ 2 kV, 180 degrees	Complied	B
Mains	N-E	+ 2 kV, 270 degrees	Complied	B
Mains	N-E	- 2 kV, 0 degrees	Complied	B
Mains	N-E	- 2 kV, 90 degrees	Complied	B
Mains	N-E	- 2 kV, 180 degrees	Complied	B
Mains	N-E	- 2 kV, 270 degrees	Complied	B
Mains	L-E	+ 2 kV, 0 degrees	Complied	B
Mains	L-E	+ 2 kV, 90 degrees	Complied	B
Mains	L-E	+ 2 kV, 180 degrees	Complied	B
Mains	L-E	+ 2 kV, 270 degrees	Complied	B
Mains	L-E	- 2 kV, 0 degrees	Complied	B
Mains	L-E	- 2 kV, 90 degrees	Complied	B
Mains	L-E	- 2 kV, 180 degrees	Complied	B
Mains	L-E	- 2 kV, 270 degrees	Complied	B

Commentary *(not part of test report)*

Although performance criterion B is achieved on testing the power supply as a stand alone unit (due to a measured deviation of approx 4%, lasting 5uS), performance criterion A would be achievable in most systems incorporating a 3gen 4Slot power supply.

8.8 Standard: IEC / EN 61000-4-6: 1996

Electromagnetic compatibility
Part 4. Testing and measurement techniques
Section 3 Immunity to conducted disturbances, induced by radio-frequency fields.

Test Conditions

Model no. of EUT:	3G6D123465-00
Serial no. of EUT:	918050
Date of Testing:	6 September, 2000
Testing carried out by:	Alan Cunningham, CEI
Temperature:	22 ^{o} C
Relative Humidity:	61%
Input Voltage:	230V, 50 Hz
Output Voltages:	5V, 12V, 18V, 24V, 5V, 24V, 24V, 24V (combination loading to 800W)
Equipment used:	See appendix 1
Test Configuration:	See Figure A5
Port:	Input

Test Description

The EUT was place 0.3m above the ground plane and the mains cable was 0.01m above the ground plane. All peripheral equipment was also placed 0.3m above the ground plane.

The current was injected on the mains cable in common mode. The current probe was located at 0.1m from the EUT AC power port. Each surface of the EUT was more than 0.5m from other metal surfaces.

The test configuration used was the current probe injection method. The system was calibrated to provide a current input level equivalent to an injected voltage level of 10V rms into a 150 ohm system. The injected current was also monitored on a spectrum analyser.

The output voltages of the EUT were monitored during tests for any deviation from normal operation. The EUT functioned as normal during the testing and was subsequently found to be operating satisfactorily.

Port	*Disturbance Level*	*Result*	*Performance Criterion*
Mains	10V emf, 150 kHz – 80 MHz 80% AM Modulation	Complied	A

Commentary (not part of test report)

8.8 Standard: IEC / EN 61000-4-11: 1994

Electromagnetic compatibility
Part 4. Testing and measurement techniques
Section 3 Voltage dips, short interruptions and voltage variations immunity tests.

Test Conditions

Model no. of EUT:	3G6D123465
Serial no. of EUT:	922880
Date of Testing:	27 May, 2002
Testing carried out by:	Alan Cunningham, Schaffner
Temperature:	22 ^{o} C
Relative Humidity:	61%
Input Voltage:	230V, 50 Hz
Output Voltages:	5V, 12V, 18V, 24V, 5V, 24V, 24V, 24V (combination loading in system 800W)
Equipment used:	See appendix 1
Port:	Input

Test Description

As the basic standard IEC / EN 61000-4-11: 1994 does not stipulate specific conditions, testing was carried out according to a product standard (IEC / EN 55024: 1998). This standard references the basic standard IEC / EN 61000-4-11: 1994 for testing guidelines.

Line Voltage Dip	Period of DIP	Result	Performance Criterion
>95%	10ms	Complied	A
30%	500ms	Complied	A
>95%	5000ms	Complied	B

Commentary *(not part of test report)*
Testing was performed as part of system testing

APPENDICES

A.1 Test Equipment Used

Instrument	*Mftr.*	*Location*	*Model*	*Serial No.*
Measuring Receiver	Rhode and Schwarz	CEI	ESHS30	826003/014
Biconical Antenna	Schwarzbeck	CEI	BBA9106	610
Log Periodic Antenna	Chase	CEI	UPA6108	1072
Signal Generator	Marconi	CEI	2022D	119164/021
Power meter	Rhode and Schwarz	CEI	NRVS	848888/019
Spectrum analyser	Advantest	CEI	R3361A	21730251
Power Amplifier	Amplifier Research	CEI	150L	12396
Power Amplifier	Milmega	CEI	ASM1000-75R	981440
Field Monitor System	Amplifier Research	CEI	FM2000	13142
Field Probe	Amplifier Research	CEI	FP2000	13130
Anechoic Chamber		CEI		CEIL 626
N Type Cable	-	CEI	615	615
LISN	Rhode & Schwarz	CEI	ESHS-3Z	911064
Directional Coupler	Werlatone	CEI	C2630	5206
Injection Probe	Solar Electronics	CEI	9217-1N	934002
Current Probe	Solar Electronics	CEI	9119-1N	930421
AC Power Source	Elgar	CEI	1751SL	14665
Coupling Clamp	Schaffner	CEI	CDN125	337 9319
Function Generator	Hewlett Packard	CEI	3325A	1748A 11042
Reference Impedance Network	Voltech	CEI	IEC Standard 555	ID20/1249
Power Analyser	Voltech	CEI	PM3000A	AM60/5932
Surge/EFT Simulator	Schaffner	Excelsys	Best	IN3796-008
Oscilloscope	Tektronix	CEI	2430A	900534
Power Analyser	Voltech	Schaffner	PM3000A v.1.71	5941
Windows software	Voltech	Schaffner	IEC1000-3	31.01.03
Electrostatic Gun	Schaffner	Excelsys	Best	IN3796-008

A.1 Test Configurations

Figure A1. Conducted emissions test set-up

Figure A2. Steady state harmonics test set-up

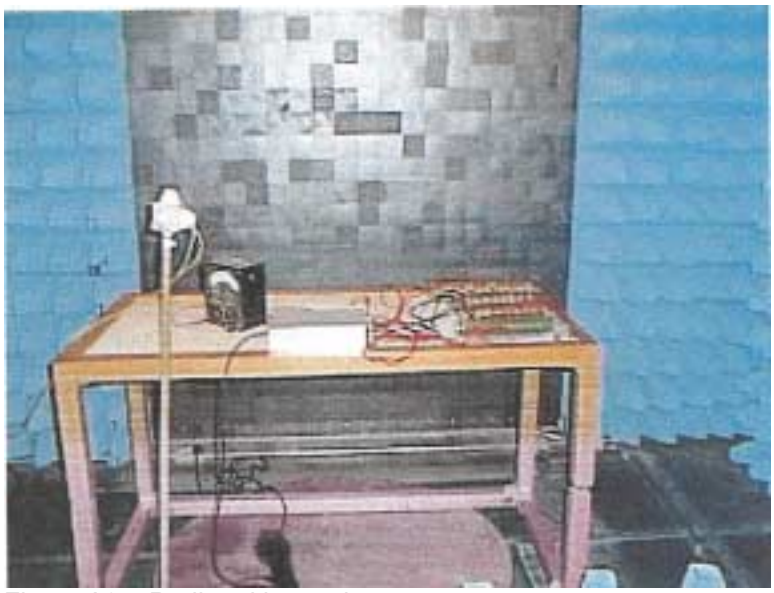

Figure A3. Radiated immunity test set-up

Figure A4. EFT / Surge immunity test set-up

Figure A5. conducted immunity test set-up