

# EMC Immunity Testing Report

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Research Machines\* PC 330  $\mu$ ATX Mini Tower

Resea4977

## Tested to BS EN55024: 2010

**Electrostatic Discharge (ESD)**

*(as per EN61000-4-2: 2009)*

**Radiated Radio Frequency Electromagnetic Field Immunity**

*(as per EN61000-4-3: 2002)*

**Electrical Fast Transient (EFT) / Burst Immunity**

*(as per EN61000-4-4: 2012)*

**Surge Immunity**

*(as per EN 61000-4-5: 2006)*

**Immunity to Conducted Disturbances induced by RF Fields**

*(as per EN 61000-4-6: 2009)*

**Voltage Dips and Interruptions**

*(as per EN 61000-4-11: 2004)*



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Test	Tested By	Signature
<b>Electrostatic Discharge (ESD)</b> <i>(as per EN61000-4-2)</i>	Giuseppe Deliso <b>25/10/2013</b>	
<b>Radiated Radio Frequency Electromagnetic Field Immunity</b> <i>(as per EN61000-4-3)</i>	Giuseppe Deliso 31/10/2013	
<b>Electrical Fast Transient (EFT) / Burst Immunity</b> <i>(as per EN61000-4-4)</i>	Giuseppe Deliso 31/10/2013	
<b>Surge Immunity</b> <i>(as per EN 61000-4-5)</i>	Giuseppe Deliso 28/10/2013	
<b>Immunity to Conducted Disturbances induced by RF Fields</b> <i>(as per EN 61000-4-6)</i>	Giuseppe Deliso 24/10/2013	
<b>Voltage Dips and Interruptions</b> <i>(as per EN 61000-4-11)</i>	Giuseppe Deliso 28/10/2013	

**Approved By**Anna Mancari  
31 October 2013



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# 1. Introduction

## 1.1. Introduction

This report presents the results of the EMC Immunity tests on the Research Machines\* PC 330  $\mu$ ATX Mini Tower – Lab. Ref. Resea4977 to the generic immunity standard *BS EN55024:2010*. This in turn entailed testing to the following:

- **Electrostatic Discharge (ESD) Immunity** (*as per EN 61000-4-2: 2009*)
- **Radiated Radio-Frequency Electromagnetic Field Immunity** (*as per EN 61000-4-3:2006+A2:2010*)
- **Electrical Fast Transient (EFT)/Burst Immunity** (*as per EN 61000-4-4: 2012*)
- **Surge Immunity** (*as per EN 61000-4-5: 2006*)
- **Immunity to Conducted Disturbances Induced by RF Fields** (*as per EN 61000-4-6: 2009*)
- **Voltage Dips and Interruptions** (*as per EN 61000-4-11: 2004*)

The testing was carried out by INTEL CORPORATION (UK) LTD at their Engineering test facilities located at

Intel Corporation (UK) Ltd  
Pipers Way  
Swindon  
Wiltshire  
England  
SN3 1RJ

This report also details the configuration of the equipment under test, the test methods used and any relevant modifications where appropriate.

## 1.2. Summary of Testing

Test	Result
<b>Electrostatic Discharge (ESD) Immunity</b> ( <i>as per EN 61000-4-2: 2009</i> )	Passes
<b>Radiated Radio Frequency Electromagnetic Field Immunity</b> ( <i>as per EN 61000-4-3:2006+A2: 2010</i> )	Passes
<b>Electrical Fast Transient (EFT)/Burst Immunity</b> ( <i>as per EN 61000-4-4: 2012</i> )	Passes
<b>Surge Immunity</b> ( <i>as per EN 61000-4-5: 2006</i> )	Passes
<b>Immunity to Conducted Disturbances Induced by RF Fields</b> ( <i>as per EN 61000-4-6: 2009</i> )	Passes
<b>Voltage Dips and Interruptions</b> ( <i>as per EN 61000-4-11: 2004</i> )	Passes



## 2. Test Methodology

Environmental Phenomena	Basic Test Method	Performance Criteria	Test Specification
Electrostatic Discharge	EN 61000-4-2 2009	Performance Criteria B specified by EN 55024	EN 55024 2010
Radio Frequency Electromagnetic Field	EN 61000-4-3 2006+A2:2010	Performance Criteria A specified by EN 55024	EN 55024 2010
Electrical Fast Transients	EN 61000-4-4 2012	Performance Criteria B specified by EN 55024	EN 55024 2010
Surge	EN 61000-4-5 2006	Performance Criteria B specified by EN 55024	EN 55024 2010
Radio Frequency Common Mode	EN 61000-4-6 2009	Performance Criteria A specified by EN 55024	EN 55024 2010
Voltage Dips 30% Reduction	EN 61000-4-11 2004	Performance Criteria C specified by EN 55024	EN 55024 2010
Voltage Dips 100% Reduction	EN 61000-4-11 2004	Performance Criteria B specified by EN 55024	EN 55024 2010
Voltage Interruptions	EN 61000-4-11 2004	Performance Criteria C specified by EN 55024	EN 55024 2010

Table 2-1

### 2.1. Performance Criteria

The following performance criteria specified under *EN 55024:2010* were utilised to evaluate the performance of the EUT during test. The manufacturer may specify an alternative performance criterion, which would be referenced under section of this test report.

**Performance Criteria A:** The equipment shall continue to operate as intended without operator intervention. 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. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specific by the manufacturer, then either of these may be derived from the product description and documentation and by what the user may reasonably expect from the equipment if used as intended.

**Performance Criteria B:** After the test, the equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed, after application of the phenomena below a performance level specified by the manufacturer, when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is allowed. However, no change of operating state or stored data is allowed to persist after the test. If the minimum performance level (or permissible performance loss) is not specified by the manufacturer, then either of these may be derived from the product description and documentation, not by what the user may reasonably expect from the equipment if used as intended.

**Performance Criteria C:** Loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls by the user in accordance with the manufacturer's instructions. Functions, and/or information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

## 3. Equipment Under Test (EUT)

### 3.1. EUT



Figure 3-1 System Name, Description

### 3.2. EUT Configuration

Component	Qty	Manufacturer	Model	Serial Number	Description	Location
System	1	RM*	PC 330 Tower	T093182301	µATX Mini Tower System	N/A
Chassis	1	Chenbro*	PC31176-H02*13246	Not Known	µATX Mini Tower Chassis	N/A
Power Supply	1	AcBel*	PCB029	PCB02913250000102A	iPower 85 400 ATX12V 350W Power Supply Unit.	Top rear of chassis
Motherboard	1	FUJITSU*	D3222-B1	42204493	µATX Desktop Motherboard with Intel® Q87 Chipset	N/A
Processor	1	Intel®	CM8064601464303	N/A	Intel® Core™ i7-4770 Processor (8M Cache, up to 3.90 GHz)	LGA1150 socket
Integrated Graphics	1	Intel®	Intel® HD Graphics 4600	N/A	N/A	N/A
SSD	1	Samsung*	SSD 840	S14GNEACC31555L	2.5" 840, 250 GB Solid State Drive	Side mounted bay
HDD	1	Toshiba*	DT01ACA1	830H4JENS	3.5" 1000 GB, 7200 RPM Hard Disk Drive	Lower 3.5" bay
Optical Drive	2	TSSTcorp*	SH-224DB	R93E6YCD4071MZ R93E6YCD4071MY	Optical Media Drive CD/DVD Super Filemaster	5.25" bays
Memory	4	Elixir*	M2X8G64CB8HC5N-DG	7722123F/D815123E C11C123E/8B11123D	DIMM, DDR3, 8192 MB, 1600 MHz	DIMM A1/A3 DIMM B2/B4

Table 3-1





### 3.3. Support Equipment

#### 3.3.1. Anechoic Chamber 3 meter

Supplier	Description	Model/Part Number
Logitech*	PS/2 Classic Keyboard	Y-SAE71
Logitech*	PS/2 Mouse	M-BT83
Western Digital*	1TB USB/FireWire/eSATA External HDD	WD1000HCS-00
LG*	Flatron 22" Widescreen LCD Monitor	2261VP-PF
Intel Corporation	Serial Emulator	C12573
Intel Corporation	Parallel Emulator	C12574
Logitech	USB Camera	E3500
Sony*	Headphones	MDR-XD200
Logitech	Microphone	Desktop Microphone

Table 3-2

#### 3.3.2. Screened Chamber 1

Supplier	Description	Model/Part Number
Logitech*	PS/2 Classic Keyboard	Y-SAE71
Logitech*	PS/2 Mouse	M-BT83
Western Digital	1TB USB/FireWire/eSATA External HDD	WD1000HCS-00
Asus*	24" Widescreen LCD Monitor	VS247
Intel Corporation	Serial Emulator	C12573
Intel Corporation	Parallel Emulator	C12574
Logitech	USB Camera	E3500
Sony*	Headphones	MDR-XD200
Logitech	Microphone	Desktop Microphone

Table 3-3

#### 3.3.3. Screened Chamber 2

Supplier	Description	Model/Part Number
Logitech*	PS/2 Classic Keyboard	Y-SAE71
Logitech*	PS/2 Mouse	M-BT83
Western Digital	1TB USB/FireWire/eSATA External HDD	WD1000HCS-00
Asus*	24" Widescreen LCD Monitor	VS247
Intel Corporation	Serial Emulator	C12573
Intel Corporation	Parallel Emulator	C12574
Logitech	USB Camera	E3500
Sony*	Headphones	MDR-XD200
Logitech	Microphone	Desktop Microphone

Table 3-4



### 3.4. EUT Deviations and Comments

EUT was tested with one Intel® Core™ i7-4770 Processor (8M Cache, up to 3.90 GHz) with EKL\* DC12V Processor Fan [DFR922512CM-010].

Other parts fitted in chassis: Top Motor\* 80mm Chassis Fan [DF128025SL-3]

BIOS Version: FUJITSU // American Megatrends Inc.\* V4.6.5.4 R1.10.0, dated, 09/16/2013.

### 3.5. Software

The program used to exercise the EUT was the EMC Exercizer 2.0.2 software in conjunction with Intel Power Thermal Utility. The system was running Microsoft\* Windows\* 7 Professional 64-bit Version (Service Pack 1).

Video Resolution was 1920 by 1080 pixels.

The software used to exercise the EUT is designed to exercise the various EUT components in a manner similar to typical use. The software was installed on the hard disk drive and starts automatically on EUT power up. Once started the software exercises each of the following EUT components:

<b>Optical drives</b>	Reads data from the optical drive. The directory tree is scanned and data is read until a given number of bytes (1.5M) have been read.
<b>External Hard Disk Drive</b>	Writes, read and verifies 64K bytes of data on each drive.
<b>Keyboard</b>	Performs a keyboard confidence test.
<b>Monitor</b>	Either inverts the colour of every pixel on the screen or continually outputs 'H' characters.
<b>Mouse</b>	Uses the driver to do a mouse confidence test.
<b>Parallel port</b>	Either 256 (with loopback connector) or 54 (without) characters (A-z, a-z) are written (and with loopback connector, also read back).
<b>Serial port</b>	The line is configured, if a loopback connector is present a non-blocking read is issued, (baudrate/20, max 6000) characters (streams of 0-9) are written, and the same number of characters must be read back (only if a loopback connector is present).
<b>USB</b>	Reads device descriptor from each device attached. On subsequent reads it verifies that the data is correct.
<b>Network</b>	Writes a file to a specified directory then reads it back.



## 4. Electrostatic Discharge (ESD) Immunity

(as per EN61000-4-2)

### 4.1. Test Setup

The EUT was placed on top of a fixed wooden table.

### 4.2. Test Equipment

Supplier	Description	Model/Part Number	Serial Number
EM Test*	ESD Simulator, Contact & Air Discharge Guns	ESD 30	0496-47

Table 3-1

### 4.3. EUT

See section 2.1

### 4.4. Support Equipment Deviations

None

### 4.5. Test Method

The EUT was placed on a ground plane as described in section 7.1 of the above specification and static electricity discharges were applied as per the specification. The severity used was level 3 ( $\pm 4$ KV contact and  $\pm 8$ KV air discharge).

### 4.6. EUT pass/fail Criteria

See section 2.1

### 4.7. Monitoring of EUT

As per performance criteria B.



## 4.8. Test Results

### Environmental Status

24°C, 43% Humidity, 987mB Barometric Pressure

#### 4.8.1. Contact Discharge

Test Point		Performance Criteria			
		+2KV	-2KV	+4KV	-4KV
1	Horizontal coupling plane	Pass	Pass	Pass	Pass
2	Vertical coupling plane	Pass	Pass	Pass	Pass
3	Chassis securing screws	Pass	Pass	Pass	Pass
4	PSU top left screw	Pass	Pass	Pass	Pass
5	PSU bottom left screw	Pass	Pass	Pass	Pass
6	PSU bottom right screw	Pass	Pass	Pass	Pass
7	Video card connector	Pass	Pass	Pass	Pass

Table 4-2

#### 4.8.2. Air Discharge

Test Point		Performance Criteria					
		+2KV	-2KV	+4KV	-4KV	+8KV	-8KV
1	Top of chassis	Pass	Pass	Pass	Pass	Pass	Pass
2	Side panel	Pass	Pass	Pass	Pass	Pass	Pass
3	CD ROM	Pass	Pass	Pass	Pass	Pass	Pass
4	Power LED	Pass	Pass	Pass	Pass	Pass	Pass

Table 4-3

System complies with performance criteria.

# 5. Radiated Radio-Frequency Electromagnetic Field Immunity

(as per EN61000-4-3)

## 5.1. Test Setup

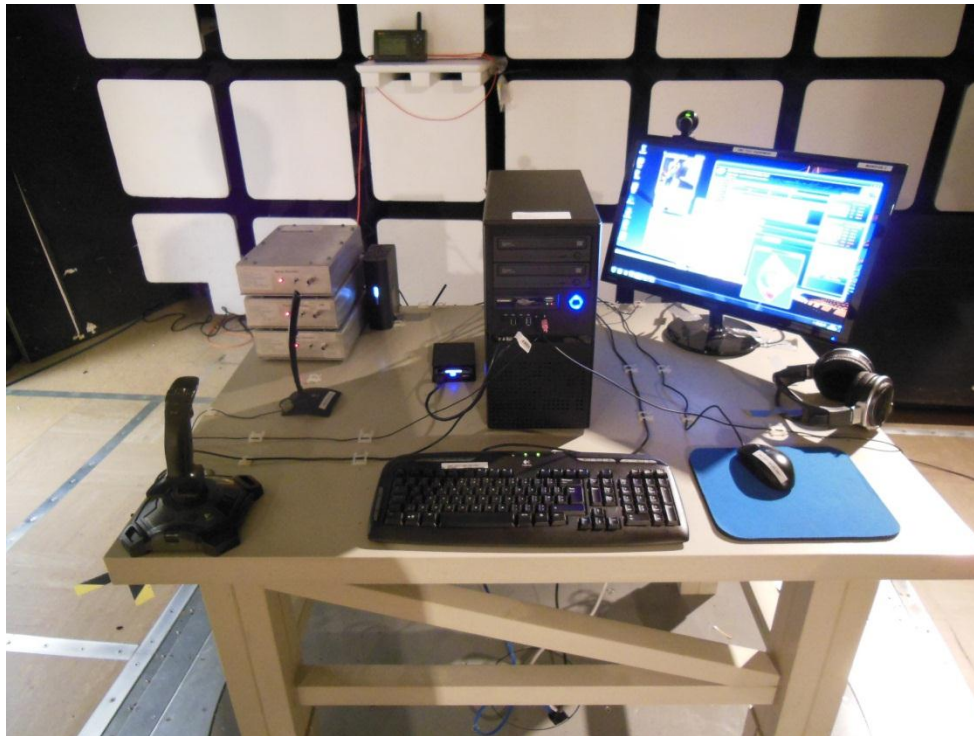


Figure 5-1 Research Machines\* PC 330  $\mu$ ATX Mini Tower

1. Equipment Under Test
2. Monitor
3. Peripheral Emulators (Parallel/USB)
4. 1TB USB/FireWire/eSATA External Hard Drive
5. Headphones
6. Microphone
7. USB Camera
8. PS/2 UK Keyboard
9. PS/2 Mouse
10. Joystick



## 5.2. Test Equipment

Supplier	Description	Model/Part Number	Serial Number
Rohde & Schwarz*	Signal Generator 9kHz-3.2GHz	SMC100A	101748
Rohde & Schwarz	AVG Smart Sensor 9kHz-6GHz	NRP-Z92	142034
Amplifier Research*	Amplifier	100W 1000M1	17521
Amplifier Research	Power Coupler	DC1680	17389
Amplifier Research	Isotropic Field Probe	FP4000	17232
Rohde & Schwarz*	Signal Generator 9kHz-3.2GHz	SMC100A	101748

Table 5-1

## 5.3. EUT

See section 3.1

## 5.4. Support Equipment Deviations

None

## 5.5. Test Method

The EUT was tested with each of its four sides coincident with the calibration plane, as per the specification. The test field strength used was 5.5V/m (2.5V/m above the requirements of level 2). Dwell time at each frequency in the selected range was 3 seconds.

## 5.6. EUT pass/fail Criteria

See section 2.1.

## 5.7. Monitoring of EUT

As per performance criteria A.

## 5.8. Test Results

### Environmental Status

22.5°C, 38% Humidity, 1000mB Barometric Pressure

4.5V/m 80% AM 1KHZ Frequency Level		Performance Criteria
0°	Vertical	Pass
0°	Horizontal	Pass
90°	Vertical	Pass
90°	Horizontal	Pass
180°	Vertical	Pass
180°	Horizontal	Pass
270°	Vertical	Pass
270°	Horizontal	Pass

Table 5-2

Complies with performance criteria.

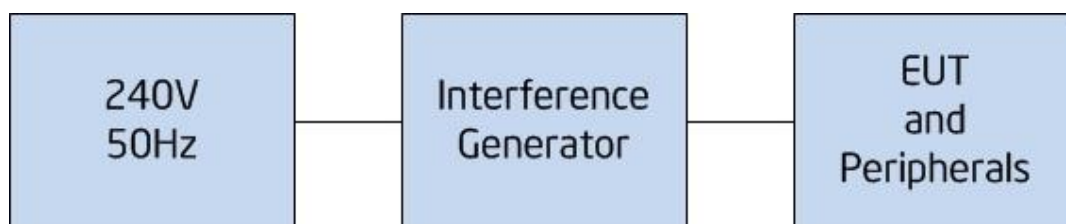
## 6. Electrical Fast Transient (EFT)/ Burst Immunity

(as per EN61000-4-4)

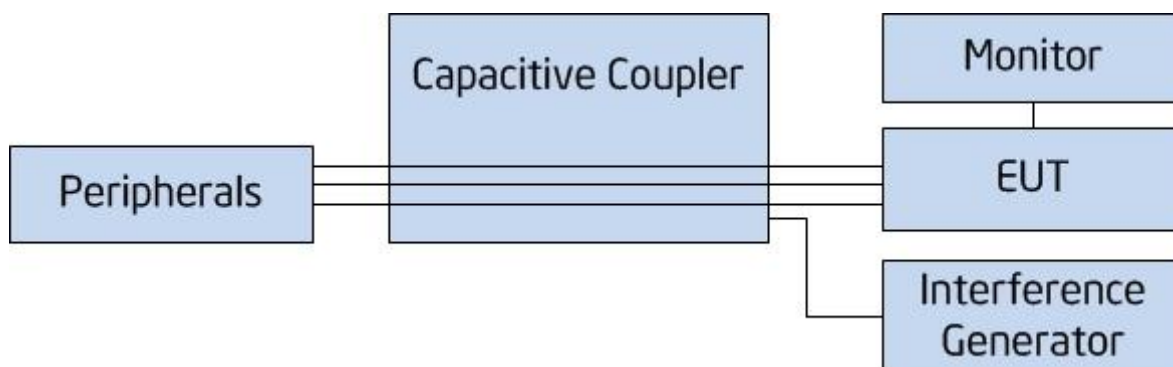
### 6.1. Test Setup

The EUT was placed on top of a fixed wooden table as shown in the following two diagrams.

#### 6.1.1. Fast Transient Test



#### 6.1.2. Capacitive Coupling Test



### 6.2. Test Equipment

Supplier	Description	Model/Part Number	Serial Number
EM Test*	Ultra Compact Simulator	UCS 500N	V1134110523
HFK*	Capacitive Coupler	None	0196-24

Table 6-1

### 6.3. EUT

See section 3.1.



## 6.4. Support Equipment Deviations

None

## 6.5. Test Method

As per the specification.

## 6.6 EUT pass/fail Criteria

See section 3.1.

## 6.7. Monitoring of EUT

As performance criteria B.

## 6.8. Test Results

### Environmental Status

25.5°C, 40% Humidity, 990mB Barometric Pressure

#### 6.8.1. AC Powerline

Test Point	Level (kV)	Performance Criteria
Live	$\pm 1$	Pass
Neutral	$\pm 1$	Pass
Earth	$\pm 1$	Pass
Live + Neutral	$\pm 1$	Pass

#### 6.8.2. I/O Cables (as per list)

Test Point	Level (V)	Performance Criteria
Capacitive Coupler	$\pm 500$	Pass

Keyboard, Mouse, COM1, COM2, Parallel

Compliant with performance criteria.





## 7. Surge Immunity

(as per EN61000-4-4)

### 7.1. Test Setup

The EUT was tested while connected to a coupling decoupling network (CDN). Surges were applied at AC input of the EUT. Line-to-line tests were conducted using a generator source impedance setting of 2 ohms. Line-to-ground tests were conducted using a generator source impedance setting of 12 ohms. Line-to-line tests were conducted using a 0.5kV and 1kV surge. Line to ground tests were conducted using a 1kV and 2kV surge. Five positive and five negative surges were applied at a phase angles of 0, 90, 180 and 270 degrees, with respect to the AC line.

### 7.2. Test Equipment

Supplier	Description	Model/Part Number	Serial Number
EM Test	Ultra Compact Simulator	UCS 500N	V1134110523
RS*	Variable Transformer	208-563	9495/7

Table 6-1

### 7.3. EUT

See section 3.1.

### 7.4. Support Equipment Deviations

None

### 7.5. Test Method

As per the specification.

### 7.6 EUT pass/fail Criteria

See section 2.1.

### 7.7. Monitoring of EUT

As performance criteria B.



## 7.8. Test Results

### Environmental Status

23°C, 39% Humidity, 992mB Barometric Pressure

	+1.0	-1.0	+2.0	-2.0
<b>0 Phase</b>	Pass	Pass	Pass	Pass
<b>90 Phase</b>	Pass	Pass	Pass	Pass
<b>180 Phase</b>	Pass	Pass	Pass	Pass
<b>270 Phase</b>	Pass	Pass	Pass	Pass

Table 7-1 Common mode High line to ground

	+1.0	-1.0	+2.0	-2.0
<b>0 Phase</b>	Pass	Pass	Pass	Pass
<b>90 Phase</b>	Pass	Pass	Pass	Pass
<b>180 Phase</b>	Pass	Pass	Pass	Pass
<b>270 Phase</b>	Pass	Pass	Pass	Pass

Table 7-2 Common mode Low line to ground

	+1.0	-1.0	+2.0	-2.0
<b>0 Phase</b>	Pass	Pass	Pass	Pass
<b>90 Phase</b>	Pass	Pass	Pass	Pass
<b>180 Phase</b>	Pass	Pass	Pass	Pass
<b>270 Phase</b>	Pass	Pass	Pass	Pass

Table 7-3 Common mode High line + Low line to ground

	+1.0	-1.0	+2.0	-2.0
<b>0 Phase</b>	Pass	Pass	Pass	Pass
<b>90 Phase</b>	Pass	Pass	Pass	Pass
<b>180 Phase</b>	Pass	Pass	Pass	Pass
<b>270 Phase</b>	Pass	Pass	Pass	Pass

Table 7-4 Common mode High line to Low line

## 8. Immunity to Conducted Disturbances Induced by RF Fields

(as per EN61000-4-6)

### 8.1. Test Setup

The test shall be performed with the test generator and amplifier connected to each of the coupling and decoupling devices in turn. The frequency range is swept through the desired frequency, using the signal levels established during the calibration process. The disturbance signal is 80% amplitude modulated with a 1kHz sinewave, pausing to adjust the RF-signal or to switch coupling devices as necessary.

### 8.2. Test Equipment

Supplier	Description	Model/Part Number	Serial Number
Amplifier Research	RF Amplifier	25A250A	18921
Rohde & Schwarz*	Signal Generator 9kHz-3.2GHz	SMC100A	101748
Rohde & Schwarz	AVG Smart Sensor 9kHz-6GHz	NRP-Z92	142034
MEB*	Current Probe	RK100 Coupler	12709
MEB	CDN	M3	None
MEB	CDN	USB	None
MEB	CDN	S9	None
MEB	CDN	S25	None
MEB	CDN	S9	None
MEB	RF Switch for CDN's	HF-Schaitfieldi	13122
FCC*	CDN Ethernet	FCC-801-T8-RJ45	08010

Table 8-1

### 8.3. EUT

See section 3.1.

### 8.4. Support Equipment Deviations

None

### 8.5. Test Method

As per the specification.

### 8.6. EUT pass/fail Criteria

See section 2.1.

### 8.7. Monitoring of EUT

As performance criteria B.

### 8.8. Test Results

#### Environmental Status

25°C, 43% Humidity, 985mB Barometric Pressure

Compliant to performance criteria.



## 9. Voltage Dips and Interruptions

(as per EN61000-4-11)

### 9.1. Test Setup

The test shall be performed with the EUT connected to the test generator with the shortest power supply cable as specified by the EUT manufacturer. If no cable length is specified, it shall be the shortest possible length suitable to the application of the EUT.

The test set-ups for the two types of phenomena described in this standard are:

- Voltage dips and short interruptions
- Voltage variations with gradual transition between the rated voltage and the changed voltage (option).

### 9.2. Test Equipment

Supplier	Description	Model/Part Number	Serial Number
EM Test	Ultra Compact Simulator	UCS 500N	V1134110523

Table 9-1

### 9.3. EUT

See section 3.1.

### 9.4. Support Equipment Deviations

None

### 9.5. Test Method

As per the specification.

### 9.6 EUT pass/fail Criteria

See section 2.1.

### 9.7. Monitoring of EUT

As performance criteria B.

### 9.8. Test Results

#### Environmental Status

23°C, 39% Humidity, 992mB Barometric Pressure

Voltage Range: Upper: 240V, 50Hz      Nominal: N/A      Lower: 200V, 50Hz

Environmental Phenomena	Number of Events	Percent Reduction	Duration	Performance Criteria	Status
Dip	3	100%	10mS	B	Pass
Dip	3	30%	500mS	C	Pass
Interruptions	1	100%	5000mS	C	Pass



## 10. Conclusions

The compliance levels achieved by the Research Machines\* PC 330 µATX Mini Tower were:

Environmental Phenomena	Basic Test Method	Performance Criteria	Status
Electrostatic Discharge	EN 61000-4-2 2009	Performance Criteria B specified by EN 55024	Meets
Radio Frequency Electromagnetic Field	EN 61000-4-3 2006+A2:2010	Performance Criteria A specified by EN 55024	Meets
Electrical Fast Transients	EN 61000-4-4 2012	Performance Criteria B specified by EN 55024	Meets
Surge	EN 61000-4-5 2006	Performance Criteria B specified by EN 55024	Meets
Radio Frequency Common Mode	EN 61000-4-6 2009	Performance Criteria A specified by EN 55024	Meets
Voltage Dips 30% Reduction	EN 61000-4-11 2004	Performance Criteria C specified by EN 55024	Meets
Voltage Dips 100% Reduction	EN 61000-4-11 2004	Performance Criteria B specified by EN 55024	Meets
Voltage Interruptions	EN 61000-4-11 2004	Performance Criteria C specified by EN 55024	Meets

Table 10-1