

EMC Emissions Testing Report

Research Machines* PC 330 µATX Mini Tower

Resea4977

Power Line Conduction Mains Port

(as per BS EN55022: 2006)

Conducted Common Mode Telecommunications Ports/Network Port

(as per BS EN55022: 2006)

Radiated Emissions (E-Field)

(as per BS EN55022: 1998)



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Test	Tested By	Signature
Power Line Conduction Mains Port (as per BS EN55022: 2006)	Giuseppe Deliso 14/10/2013	
Conducted Common Mode Telecommunications Ports/Network Port (as per BS EN55022: 2006)	Giuseppe Deliso 14/10/2013	
Radiated Emissions (E Field) (as per BS EN55022: 1998)	Giuseppe Deliso 29/10/2013	

Approved	Signature
Anna Mancari 31 October 2013	



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1. Introduction

1.1 Introduction

This report presents the results of the EMC Emissions tests on the Research Machines* PC 330 µATX Mini Tower – Lab. Ref. Resea4977 to the following Standards

- **Power Line Conduction Mains Port** (*as per BS EN55022: 2006*)
- **Conducted Common Mode Telecommunications Ports/Network** (*as per BS EN55022:2006*)
- **Radiated Emissions (E Field)** (*as per BS EN55022: 1998*)

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

Intel Corporation (UK) Ltd		Intel Corporation (UK) Ltd
Pipers Way		Sheppards Farm
Swindon		Chiseldon
Wiltshire	and	Swindon
England		Wiltshire
SN3 1RJ		England

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 Issues

A summary of Action Items for hardware related issues are given below.

An Action Item (AI) means that the particular test is not meeting the relevant specification and could prevent correct operation of the named EUT.

Other items in this report may be marked as FYI. These are recommendations or observations that may be of interest to the system designer.

1.2.1. Action Items

- From the results it can be seen that the EUT *passed* Class B Radiated and Conducted Emissions testing.

1.2.2. FYI Items

- None
- For EMI considerations, please refer to the microATX EMC Design Suggestions document at: <http://www.formfactors.org/developer/specs/matxemc.pdf>

2. Equipment Under Test (EUT)

2.1 EUT



Figure 2-1 Research Machines* PC 330 μ ATX Mini Tower

2.2 EUT Configuration

Component	Qty	Manufacturer	Model	AA/Serial Number	Description	Location
System	1	RM*	PC 330 Tower	T093182301	μ ATX Mini Tower System	N/A
Chassis	1	Chenbro*	PC31176-H02*13246	Not Known	μ ATX 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	μ ATX Desktop Motherboard with Intel® Q87 Chipset	N/A
Processor	1	Intel®	CM80646014 64303	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*	M2X8G64CB8 HCSN-DG	7722123F/D815123E C11C123E/8B11123D	DIMM, DDR3, 8192 MB, 1600 MHz	DIMM A1/A3 DIMM B2/B4

Table 2-1

2.3 Support Equipment

(NB: Not all equipment maybe used this is dependent on EUT configuration)

2.3.1 Anechoic Chamber 3 meter

Supplier	Description	Model/Part Number
Logitech*	PS/2 Classic Keyboard	868017-0120
Logitech*	PS/2 Mouse	810-000361
Western Digital*	1TB USB/FireWire/eSATA External HDD	WD1000HCS-00
LG*	22" Flatron Widescreen LCD Monitor	W2261VP
Intel Corporation	Serial Emulator	C12573
Intel Corporation	Parallel Emulator	C12574
Logitech	USB Camera	E3500
Sony*	Headphones	MDR-XD200
Logitech	Microphone	Desktop Microphone
Kingston*	2GB SD Card	SD/2GB

Table 2-2

2.3.2 Open Area Test Site (OATS 2) 10 meter

Supplier	Description	Model/Part Number
Logitech*	PS/2 Classic Keyboard	868017-0120
Logitech*	PS/2 Mouse	810-000361
Western Digital	1TB USB/FireWire/eSATA External HDD	WD1000HCS-00
LG*	22" Flatron Widescreen LCD Monitor	W2261VP
Intel Corporation	Serial Emulator	C12573
Intel Corporation	Parallel Emulator	C12574
Logitech	USB Camera	E3500
Sony*	Headphones	MDR-XD200
Logitech	Microphone	Desktop Microphone
Kingston	2GB SD Card	SD/2GB

Table 2-3

2.3.3 Screened Chamber

Supplier	Description	Model/Part Number
Logitech*	PS/2 Classic Keyboard	868017-0120
Logitech*	PS/2 Mouse	810-000361
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
Kingston	2GB SD Card	SD/2GB

Table 2-4

2.4 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.

2.5 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 (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:

Optical drives	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.
External Hard Disk Drive	Writes, read and verifies 64K bytes of data on each drive.
Keyboard	Performs a keyboard confidence test.
Monitor	Either inverts the colour of every pixel on the screen or continually outputs 'H' characters.
Mouse	Uses the driver to do a mouse confidence test.
Parallel port	Either 256 (with loopback connector) or 54 (without) characters (A-z, a-z) are written (and with loopback connector, also read back).
Serial port	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).
USB	Reads device descriptor from each device attached. On subsequent reads it verifies that the data is correct.
Network	Writes a file to a specified directory then reads it back.

Table 2-5

3. Power Line Conduction Mains Port

(as per BS EN55022:2006)

3.1 Test Setup

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

3.2 Test Equipment

3.2.1 Powerline Conduction

Supplier	Description	Model/Part Number	Serial Number
Rohde & Schwarz*	LISN	ESH3-Z5	839135/022
Rohde & Schwarz	9 kHz - 3GHz ESCI EMI Test Receiver	ESCI	100989

Table 3-1

3.3 EUT

See section 2.1

3.4 Support Equipment Deviations

None

3.5 Test Method

The EUT was powered up via the LISN and the EUT exercising software was invoked to exercise all sub systems of the EUT. The RF conducted emissions from the EUT were measured using the Rohde & Schwarz ESCI via the LISN under computer control. Using Rohde & Schwarz EMC32 measurement software, the *Average* and *Peak* levels were measured at the same time for all frequencies in the range 150 kHz to 30 MHz. Any frequency over the Av or QP limit respectively constituted a failure.

3.6 Mains Test Results

Environmental Status

23.5°C, 34% Humidity, 992mB Barometric Pressure

Conducted Emissions_Mains_ClassB

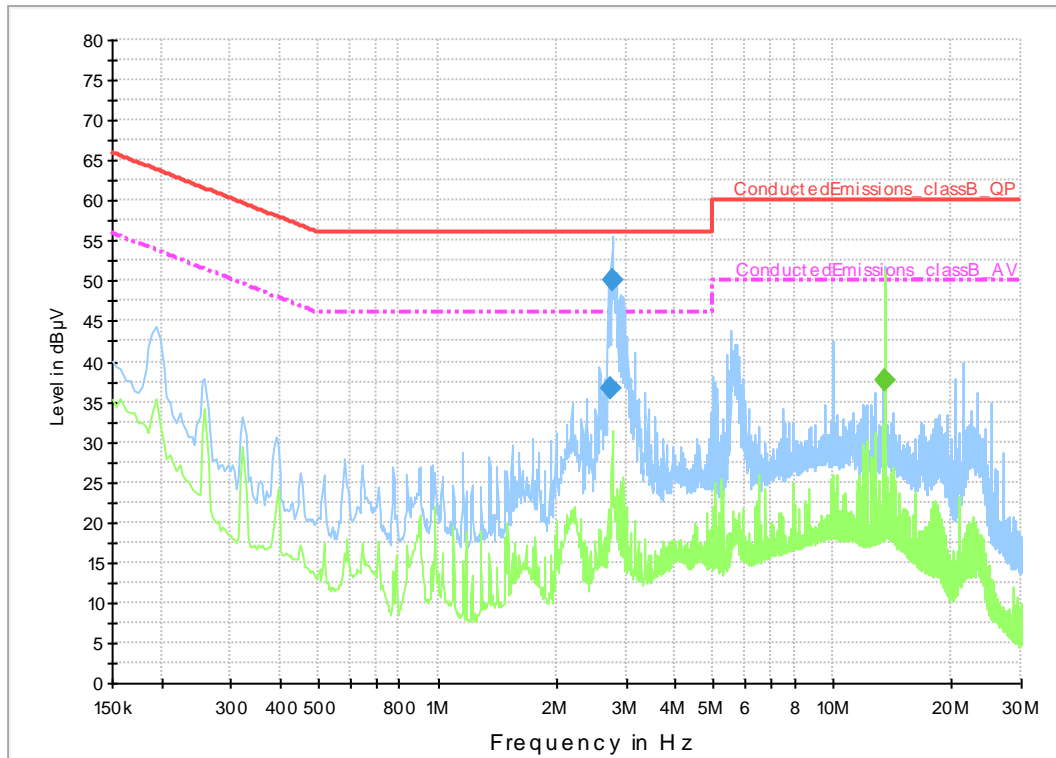


Figure 3-1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	LINE	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
2.743000	36.7	1000.0	9.000	GND	L1	10.4	19.3	56.0	Pass
2.765000	50.0	1000.0	9.000	GND	L1	10.4	6.0	56.0	Pass

Table 3-2

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	LINE	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
13.561000	37.6	1000.0	9.000	GND	N	10.4	12.4	50.0	Pass

Table 3-3

No frequencies were determined to be over the AV or QP limits.

4. Telecommunications Ports/Network

(as per BS EN55022:2006)

4.1 Test Setup

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

4.2 Test Equipment

4.2.1 Telecommunications Ports/Network

Supplier	Description	Model/Part Number	Serial Number
Rohde & Schwarz	9 kHz - 3GHz ESCI EMI Test Receiver	ESCI	100989
Fischer Custom Communications* inc.	Telecom ISN 150kHz 30MHz + LCL CAT5 Ethernet Adapter	FCC-TLISN-T8-02	20543
Fischer Custom Communications inc.	Telecom ISN 150kHz 30MHz + LCL CAT3 Modem Adapter	FCC-TLISN-T2-02	20544
TTi*	Function Generator	TG550	245101

Table 4 -1

4.3 EUT

See section 2.1

4.4 Support Equipment Deviations

None

4.5 Test Method

The EUT was powered up via the ISN and the EUT exercising software was invoked to exercise all sub systems of the EUT. In order to make reliable emission measurements representative of high LAN utilization, LAN utilization in excess of 10% was created and was sustained for a minimum of 250ms. Measurements were obtained for idle and active transmission modes as required. The RF conducted emissions from the EUT were measured using the Rohde & Schwarz ESHS 10 EMI test receiver via the FCC Telecom Ethernet/Modem ISN under computer control. Using Rohde & Schwarz EMC32 measurement software, the *Average* and *Peak* levels were measured concurrently for all frequencies in the range 150 kHz to 30 MHz. Any frequency over the Av or QP limit respectively constituted a failure.

4.6 10mbps Active Test Results

Environmental Status

23.5°C, 34% Humidity, 992mB Barometric Pressure

ConductedEmissions_Telco_ClassB

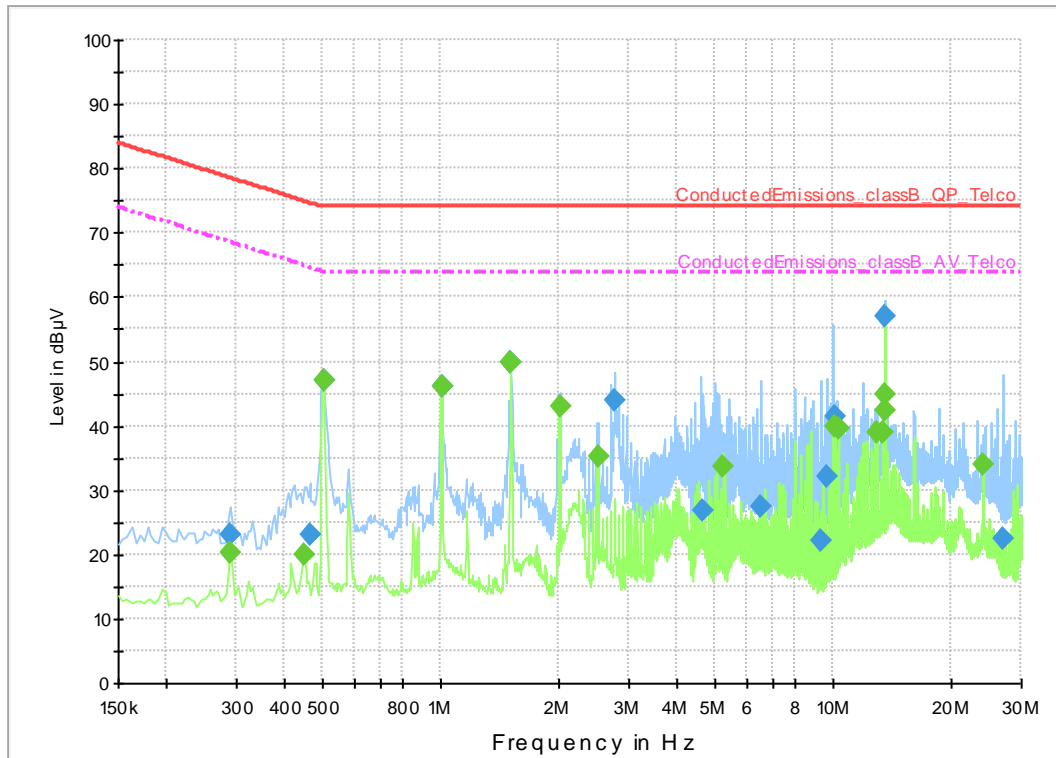


Figure 4-1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.289000	23.0	1000.0	9.000	19.7	55.5	78.6	Pass
0.461000	23.1	1000.0	9.000	19.7	51.6	74.7	Pass
0.501000	46.9	1000.0	9.000	19.7	27.1	74.0	Pass
1.001000	46.2	1000.0	9.000	19.7	27.8	74.0	Pass
1.501000	50.0	1000.0	9.000	19.7	24.0	74.0	Pass
2.765000	43.8	1000.0	9.000	19.7	30.2	74.0	Pass
4.613000	26.8	1000.0	9.000	19.7	47.2	74.0	Pass
6.501000	27.5	1000.0	9.000	19.7	46.5	74.0	Pass
9.245000	22.2	1000.0	9.000	19.7	51.8	74.0	Pass
9.593000	32.2	1000.0	9.000	19.7	41.8	74.0	Pass
10.005000	41.4	1000.0	9.000	19.7	32.6	74.0	Pass
13.561000	57.0	1000.0	9.000	19.7	17.0	74.0	Pass
26.965000	22.4	1000.0	9.000	19.8	51.6	74.0	Pass

Table 4-2

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.289000	20.3	1000.0	9.000	19.7	48.2	68.6	Pass
0.445000	19.9	1000.0	9.000	19.7	45.1	65.0	Pass
0.501000	47.0	1000.0	9.000	19.7	17.0	64.0	Pass
1.001000	46.2	1000.0	9.000	19.7	17.8	64.0	Pass
1.501000	49.7	1000.0	9.000	19.7	14.3	64.0	Pass
2.001000	43.1	1000.0	9.000	19.7	20.9	64.0	Pass
2.501000	35.3	1000.0	9.000	19.7	28.7	64.0	Pass
5.237000	33.7	1000.0	9.000	19.7	30.3	64.0	Pass
10.061000	39.9	1000.0	9.000	19.7	24.1	64.0	Pass
10.245000	39.5	1000.0	9.000	19.7	24.5	64.0	Pass
12.809000	38.9	1000.0	9.000	19.7	25.1	64.0	Pass
13.357000	39.0	1000.0	9.000	19.7	25.0	64.0	Pass
13.557000	42.4	1000.0	9.000	19.7	21.6	64.0	Pass
13.561000	44.7	1000.0	9.000	19.7	19.3	64.0	Pass
24.085000	33.9	1000.0	9.000	19.7	30.1	64.0	Pass

Table 4-3

No frequencies were determined to be over the AV or QP limits.

4.7 100mbps Active Test Results

Environmental Status

23.5°C, 34% Humidity, 992mB Barometric Pressure

ConductedEmissions_Telco_ClassB

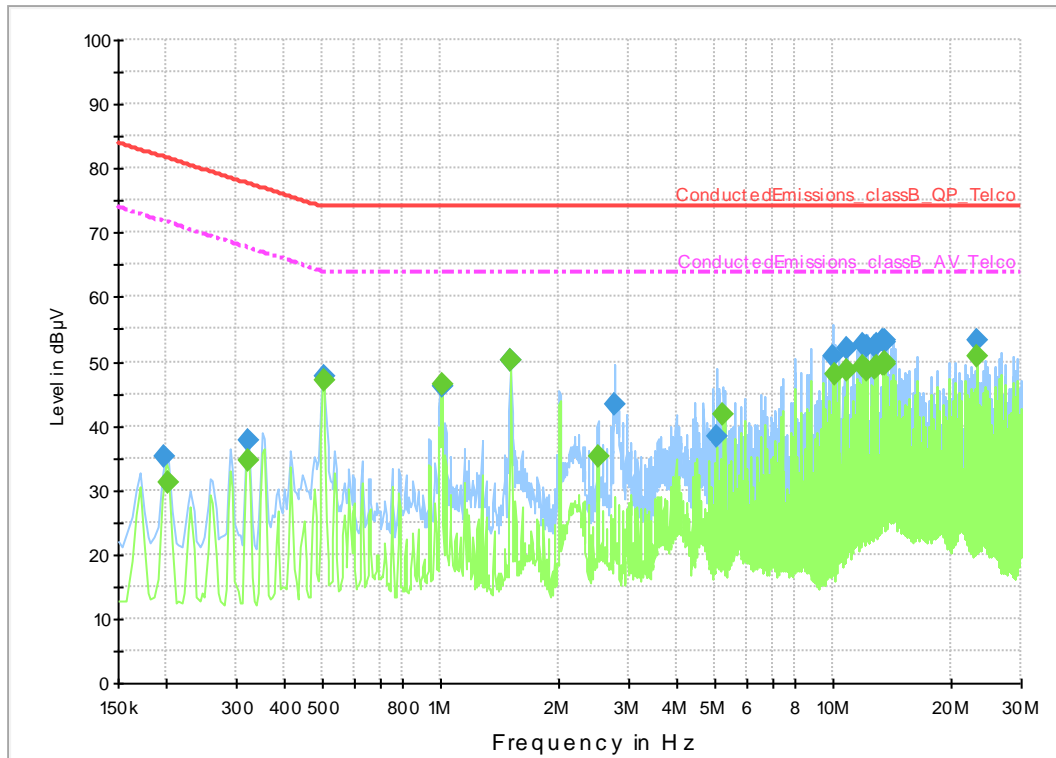


Figure 4-2

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.197000	35.2	1000.0	9.000	19.8	46.5	81.7	Pass
0.321000	37.5	1000.0	9.000	19.7	40.1	77.7	Pass
0.501000	47.6	1000.0	9.000	19.7	26.4	74.0	Pass
1.001000	46.2	1000.0	9.000	19.7	27.8	74.0	Pass
1.501000	50.2	1000.0	9.000	19.7	23.8	74.0	Pass
2.765000	43.3	1000.0	9.000	19.7	30.7	74.0	Pass
5.025000	38.3	1000.0	9.000	19.7	35.7	74.0	Pass
9.937000	50.7	1000.0	9.000	19.7	23.3	74.0	Pass
10.793000	52.0	1000.0	9.000	19.7	22.0	74.0	Pass
11.893000	52.8	1000.0	9.000	19.7	21.2	74.0	Pass
12.197000	52.3	1000.0	9.000	19.7	21.7	74.0	Pass
12.749000	52.5	1000.0	9.000	19.7	21.5	74.0	Pass
12.809000	52.8	1000.0	9.000	19.7	21.2	74.0	Pass
13.357000	53.2	1000.0	9.000	19.7	20.8	74.0	Pass
13.421000	53.4	1000.0	9.000	19.7	20.6	74.0	Pass
13.481000	53.0	1000.0	9.000	19.7	21.0	74.0	Pass
23.129000	53.4	1000.0	9.000	19.7	20.6	74.0	Pass

Table 4-4

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.201000	31.2	1000.0	9.000	19.8	40.4	71.6	Pass
0.321000	34.5	1000.0	9.000	19.7	33.1	67.7	Pass
0.501000	47.1	1000.0	9.000	19.7	16.9	64.0	Pass
1.001000	46.4	1000.0	9.000	19.7	17.6	64.0	Pass
1.501000	50.2	1000.0	9.000	19.7	13.8	64.0	Pass
2.501000	35.3	1000.0	9.000	19.7	28.7	64.0	Pass
5.237000	41.8	1000.0	9.000	19.7	22.2	64.0	Pass
10.061000	47.9	1000.0	9.000	19.7	16.1	64.0	Pass
10.793000	48.7	1000.0	9.000	19.7	15.3	64.0	Pass
11.893000	49.3	1000.0	9.000	19.7	14.7	64.0	Pass
12.197000	48.6	1000.0	9.000	19.7	15.4	64.0	Pass
12.749000	49.0	1000.0	9.000	19.7	15.0	64.0	Pass
12.809000	49.1	1000.0	9.000	19.7	14.9	64.0	Pass
13.357000	49.4	1000.0	9.000	19.7	14.6	64.0	Pass
13.421000	50.0	1000.0	9.000	19.7	14.0	64.0	Pass
13.481000	49.5	1000.0	9.000	19.7	14.5	64.0	Pass
23.129000	50.8	1000.0	9.000	19.7	13.2	64.0	Pass

Table 4-5

No frequencies were determined to be over the AV or QP limits.

4.8 100mbps Idle Test Results

Environmental Status

23.5°C, 34% Humidity, 992mB Barometric Pressure

ConductedEmissions_Telco_ClassB

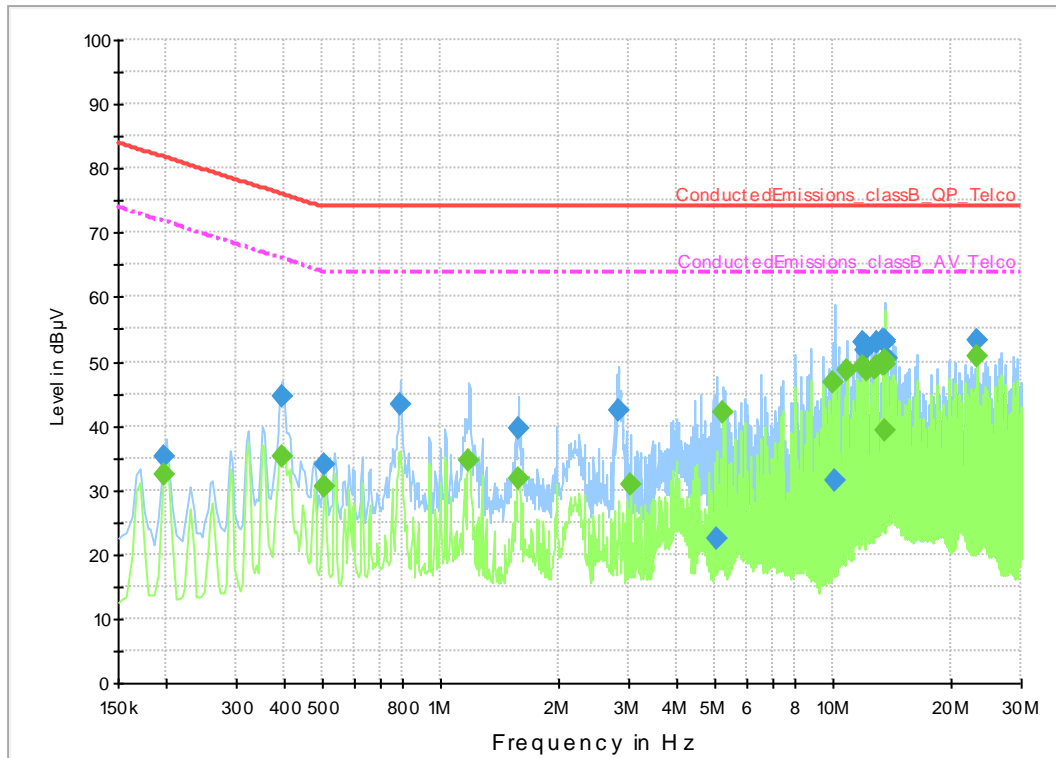


Figure 4-3

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.197000	35.3	1000.0	9.000	19.8	46.5	81.7	Pass
0.393000	44.6	1000.0	9.000	19.7	31.4	76.0	Pass
0.505000	33.8	1000.0	9.000	19.7	40.2	74.0	Pass
0.785000	43.4	1000.0	9.000	19.7	30.6	74.0	Pass
1.569000	39.6	1000.0	9.000	19.7	34.4	74.0	Pass
2.841000	42.2	1000.0	9.000	19.7	31.8	74.0	Pass
5.001000	22.5	1000.0	9.000	19.7	51.5	74.0	Pass
10.009000	31.6	1000.0	9.000	19.7	42.4	74.0	Pass
11.893000	52.8	1000.0	9.000	19.7	21.2	74.0	Pass
11.953000	51.6	1000.0	9.000	19.7	22.4	74.0	Pass
12.197000	52.3	1000.0	9.000	19.7	21.7	74.0	Pass
12.809000	52.8	1000.0	9.000	19.7	21.2	74.0	Pass
13.357000	53.2	1000.0	9.000	19.7	20.8	74.0	Pass
13.421000	53.4	1000.0	9.000	19.7	20.6	74.0	Pass
13.481000	53.0	1000.0	9.000	19.7	21.0	74.0	Pass
13.601000	50.5	1000.0	9.000	19.7	23.5	74.0	Pass
23.129000	53.4	1000.0	9.000	19.7	20.6	74.0	Pass

Table 4-6

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.197000	32.4	1000.0	9.000	19.8	39.3	71.7	Pass
0.393000	35.1	1000.0	9.000	19.7	30.9	66.0	Pass
0.505000	30.5	1000.0	9.000	19.7	33.5	64.0	Pass
1.173000	34.5	1000.0	9.000	19.7	29.5	64.0	Pass
1.569000	31.8	1000.0	9.000	19.7	32.2	64.0	Pass
3.037000	30.8	1000.0	9.000	19.7	33.2	64.0	Pass
5.237000	41.9	1000.0	9.000	19.7	22.1	64.0	Pass
9.937000	46.9	1000.0	9.000	19.7	17.1	64.0	Pass
10.793000	48.8	1000.0	9.000	19.7	15.2	64.0	Pass
11.893000	49.3	1000.0	9.000	19.7	14.7	64.0	Pass
12.197000	48.6	1000.0	9.000	19.7	15.4	64.0	Pass
12.749000	49.1	1000.0	9.000	19.7	14.9	64.0	Pass
12.809000	49.2	1000.0	9.000	19.7	14.8	64.0	Pass
13.357000	49.4	1000.0	9.000	19.7	14.6	64.0	Pass
13.421000	50.0	1000.0	9.000	19.7	14.0	64.0	Pass
13.481000	49.6	1000.0	9.000	19.7	14.4	64.0	Pass
13.565000	39.3	1000.0	9.000	19.7	24.7	64.0	Pass
23.129000	50.8	1000.0	9.000	19.7	13.2	64.0	Pass

Table 4-7

No frequencies were determined to be over the AV or QP limits.

4.9 1000mbps Active Test Results

Environmental Status

23.5°C, 34% Humidity, 992mB Barometric Pressure

ConductedEmissions_Telco_ClassB

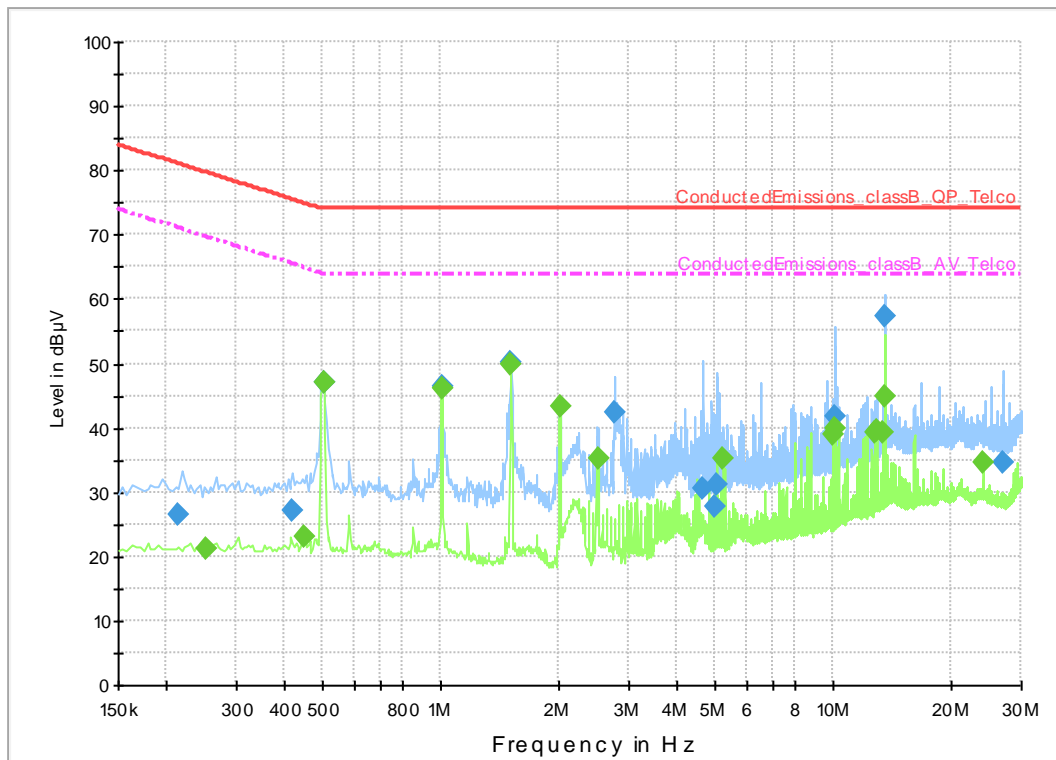


Figure 4-4

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.213000	26.5	1000.0	9.000	19.8	54.6	81.1	Pass
0.417000	27.0	1000.0	9.000	19.7	48.5	75.5	Pass
0.501000	47.1	1000.0	9.000	19.7	26.9	74.0	Pass
1.001000	46.4	1000.0	9.000	19.7	27.6	74.0	Pass
1.501000	50.3	1000.0	9.000	19.7	23.7	74.0	Pass
2.765000	42.3	1000.0	9.000	19.7	31.7	74.0	Pass
4.637000	30.5	1000.0	9.000	19.7	43.5	74.0	Pass
4.981000	27.7	1000.0	9.000	19.7	46.3	74.0	Pass
5.009000	31.2	1000.0	9.000	19.7	42.8	74.0	Pass
10.061000	41.9	1000.0	9.000	19.7	32.1	74.0	Pass
13.561000	57.4	1000.0	9.000	19.7	16.6	74.0	Pass
26.933000	34.5	1000.0	9.000	19.8	39.5	74.0	Pass

Table 4-8

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.253000	21.3	1000.0	9.000	19.8	48.4	69.7	Pass
0.445000	23.1	1000.0	9.000	19.7	41.9	65.0	Pass
0.501000	47.0	1000.0	9.000	19.7	17.0	64.0	Pass
1.001000	46.1	1000.0	9.000	19.7	17.9	64.0	Pass
1.501000	49.8	1000.0	9.000	19.7	14.2	64.0	Pass
2.001000	43.2	1000.0	9.000	19.7	20.8	64.0	Pass
2.501000	35.1	1000.0	9.000	19.7	28.9	64.0	Pass
5.237000	35.1	1000.0	9.000	19.7	28.9	64.0	Pass
9.937000	38.9	1000.0	9.000	19.7	25.1	64.0	Pass
10.061000	40.0	1000.0	9.000	19.7	24.0	64.0	Pass
12.749000	39.2	1000.0	9.000	19.7	24.8	64.0	Pass
12.809000	39.5	1000.0	9.000	19.7	24.5	64.0	Pass
13.357000	39.2	1000.0	9.000	19.7	24.8	64.0	Pass
13.561000	44.8	1000.0	9.000	19.7	19.2	64.0	Pass
24.089000	34.5	1000.0	9.000	19.7	29.5	64.0	Pass

Table 4-9

No frequencies were determined to be over the AV or QP limits.

4.10 1000mbps Idle Test Results

Environmental Status

23.5°C, 34% Humidity, 992mB Barometric Pressure

ConductedEmissions_Telco_ClassB

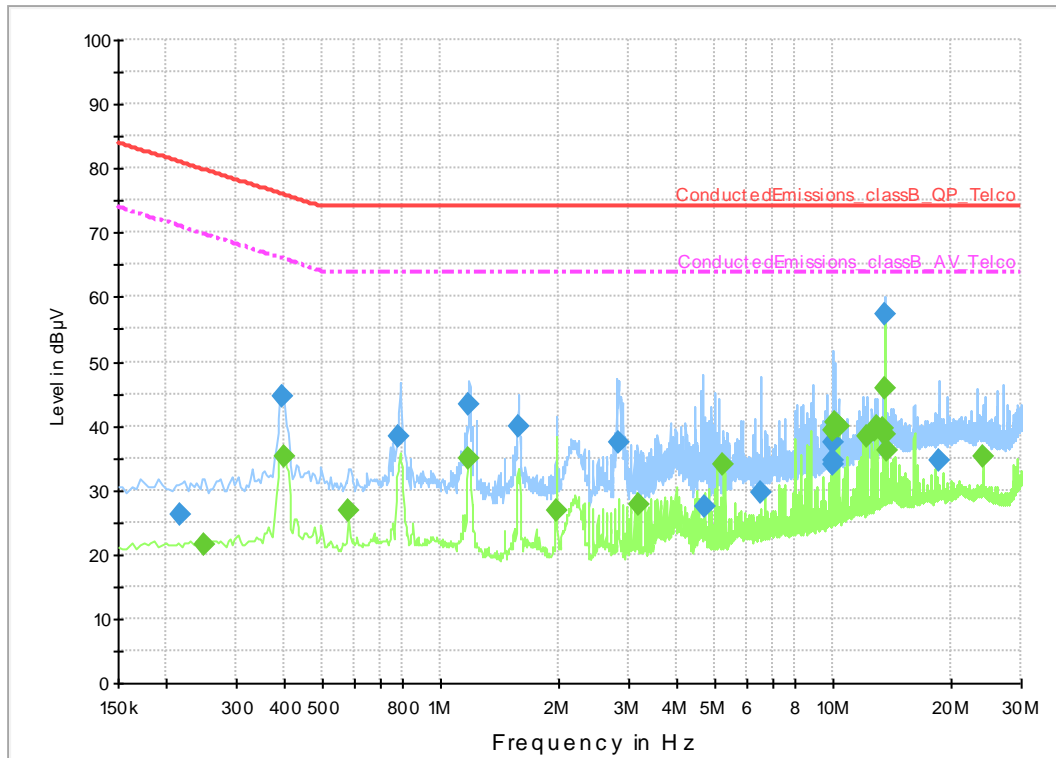


Figure 4-5

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.217000	26.3	1000.0	9.000	19.8	54.7	80.9	Pass
0.393000	44.5	1000.0	9.000	19.7	31.5	76.0	Pass
0.779000	38.3	1000.0	9.000	19.7	35.7	74.0	Pass
1.177000	43.4	1000.0	9.000	19.7	30.6	74.0	Pass
1.569000	39.9	1000.0	9.000	19.7	34.1	74.0	Pass
2.817000	37.5	1000.0	9.000	19.7	36.5	74.0	Pass
4.665000	27.5	1000.0	9.000	19.7	46.5	74.0	Pass
6.533000	29.5	1000.0	9.000	19.7	44.5	74.0	Pass
9.969000	33.9	1000.0	9.000	19.7	40.1	74.0	Pass
9.989000	34.5	1000.0	9.000	19.7	39.5	74.0	Pass
10.001000	37.5	1000.0	9.000	19.7	36.5	74.0	Pass
13.561000	57.4	1000.0	9.000	19.7	16.6	74.0	Pass
18.605000	34.4	1000.0	9.000	19.7	39.6	74.0	Pass

Table 4-10

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.249000	21.3	1000.0	9.000	19.8	48.4	69.8	Pass
0.397000	35.2	1000.0	9.000	19.7	30.7	65.9	Pass
0.581000	26.7	1000.0	9.000	19.7	37.3	64.0	Pass
1.177000	34.9	1000.0	9.000	19.7	29.1	64.0	Pass
1.961000	26.7	1000.0	9.000	19.7	37.3	64.0	Pass
3.165000	27.7	1000.0	9.000	19.7	36.3	64.0	Pass
5.237000	34.0	1000.0	9.000	19.7	30.0	64.0	Pass
9.937000	39.4	1000.0	9.000	19.7	24.6	64.0	Pass
10.061000	40.4	1000.0	9.000	19.7	23.6	64.0	Pass
10.245000	39.9	1000.0	9.000	19.7	24.1	64.0	Pass
12.197000	38.3	1000.0	9.000	19.7	25.7	64.0	Pass
12.749000	39.1	1000.0	9.000	19.7	24.9	64.0	Pass
12.809000	39.7	1000.0	9.000	19.7	24.3	64.0	Pass
13.357000	39.5	1000.0	9.000	19.7	24.5	64.0	Pass
13.421000	38.8	1000.0	9.000	19.7	25.2	64.0	Pass
13.561000	45.8	1000.0	9.000	19.7	18.2	64.0	Pass
13.601000	36.1	1000.0	9.000	19.7	27.9	64.0	Pass
24.085000	35.2	1000.0	9.000	19.7	28.8	64.0	Pass

Table 4-11

No frequencies were determined to be over the AV or QP limits.

5. Radiated Emissions (E-Field)

(as per BS EN55022:1998)

5.1 Test Setup



Figure 5-1 Research Machines* PC 330 μ 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

5.2.1 Radiated Emissions (E-Field)

Supplier	Description	Model/Part Number	Serial Number
ETS Lindgren *	BiConiLog * Antenna (3 Meter Chamber)	3142C	00049374
ETS Lindgren	BiConiLog Antenna (Open Area Test Site)	3142C	00049376
Rohde & Schwarz *	9 kHz ~ 7GHz GHz ESCI EMI Test Receiver	ESCI 7	100762
Rohde & Schwarz	20Hz~8GHz EMI Test Receiver (3 Meter Chamber)	ESU 8	100248
Lindgren *	Ray Proof Shielded Semi-Anechoic Enclosure	S81	CP52240
N/A	10 Meter OATS (Open Area Test Site)	SF2	N/A

Table 5-1

5.3 EUT

See section 2.1

5.4 Support Equipment Deviations

None

5.5 Test Method

EUT is first tested in 3 meter Anechoic Chamber as outlined below and if any frequencies are determined to be over or within 10dB of limit then the EUT is further tested at the Open Area Test Site (OATS) also outlined below.

5.5.1 Test Method in 3 meter Anechoic Chamber

The EUT was placed on or beside a table, 0.8 meters above the ground plane and 3 meters from the antenna. The antenna was positioned 1.5 meters up above the ground plane. From 30MHz to 1000MHz a BiConiLog antenna was used. The receiver was equipment reference 4 and the antenna used was equipment reference 1. The test was run automatically under computer control using Rohde & Schwarz EMC32 Measurement Software. The algorithm used was as follows:

The EUT was scanned in four modes: preview measurement, data reduction, frequency zoom and final measurement. Preview measurements were done on the EUT using a peak detector whilst the turntable rotated continuously and the antenna raised and lowered from 1 meter to 2.3 meters and the polarity of the antenna changed from the vertical position to the horizontal position – all graphs were superimposed.

Please note Rohde & Schwarz initially determines a number of peaks within each divided sub range which are further analyzed. When the exact peak frequency is determined, R&S EMC32 then performs the Peak, Quasi peak and Average measurement. The peak table will only show the final (most accurate) measured values. Up to Fifteen frequencies on the resultant graph with amplitude within 10dB of the quasi peak limit detected between 30MHz to 1GHz were selected. With the receiver set to each of the selected frequencies the EUT was rotated, the antenna raised and lowered from 2.3 meters to 1 meter and the antenna polarization was changed from the vertical to the horizontal and the maximum Quasi-Peak (QP) signal strength noted.

5.5.2 Test Method in 10 meter Open Area Test Site (OATS)

The EUT was tested on OATS equipment reference 5 where it was placed on or beside a table 0.8 meters above the ground plane and 10 meters from the antenna. The EUT was powered on and ran the referenced EUT exercising software (see section 2). The antenna was mounted on a mast permitting movement from 1.0 meter to 4.0 meters above the ground plane in horizontal or vertical polarization. From 30MHz to 1000MHz a BiConiLog antenna equipment reference 2 was used. The receiver was a Rohde and Schwarz ESVS equipment reference 3. All frequencies found to be over or within 10dB of the quasi peak limit when tested in the 3 meter Anechoic Chamber were measured. The EUT was rotated and the antenna raised and lowered from 1 meter to 4 meters and the antenna was also changed from the vertical polarization to the horizontal polarization and the maximum Quasi Peak (QP) signal strength noted.

5.6 Test Results

5.6.1 Preliminary Scan in 3 metre Anechoic Chamber

Environmental Status

23.86C 53.9% Humidity, 975mB Barometric Pressure

55022_RadiatedEmissions_ClasssB_NEW_SCANS

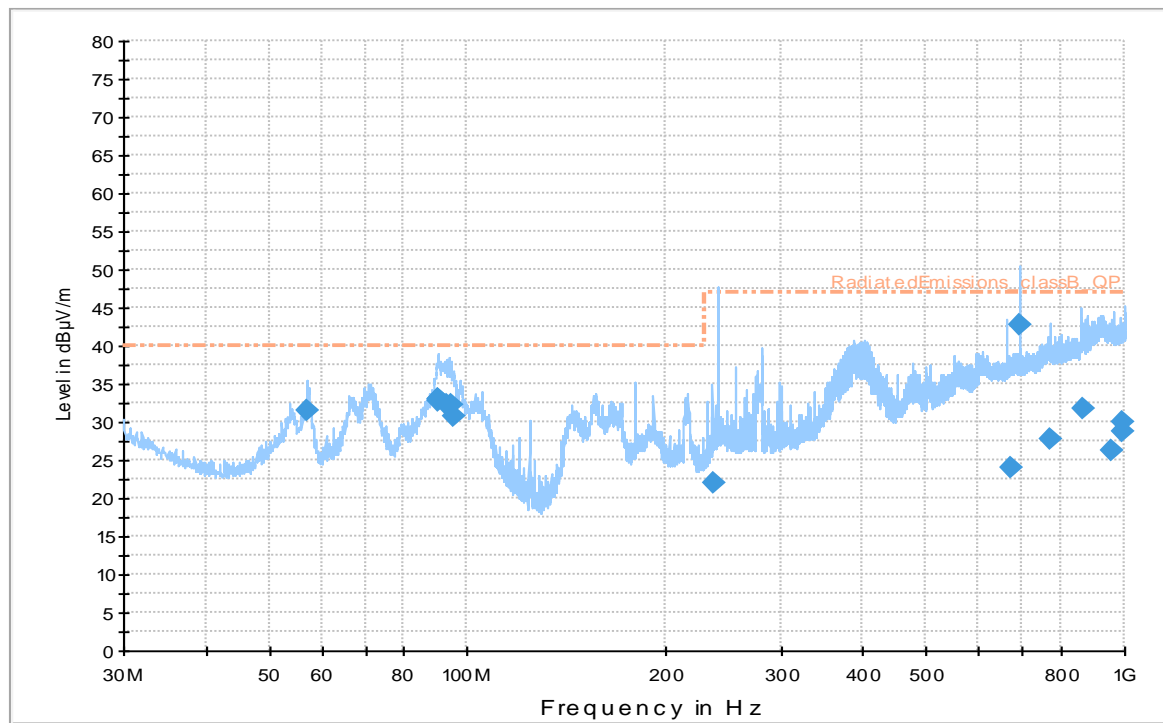


Figure 5-2

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
57.130500	31.4	1000.0	120.000	133.0	V	172.0	7.1	8.6	40.0
90.198000	32.8	1000.0	120.000	110.0	V	114.0	7.4	7.2	40.0
90.322500	32.9	1000.0	120.000	105.0	V	95.0	7.4	7.1	40.0
90.375000	33.0	1000.0	120.000	110.0	V	113.0	7.4	7.0	40.0
93.420000	32.2	1000.0	120.000	168.0	V	203.0	7.7	7.8	40.0
94.945500	32.4	1000.0	120.000	118.0	V	205.0	7.9	7.6	40.0
95.121000	30.7	1000.0	120.000	126.0	V	281.0	7.9	9.3	40.0
236.577000	22.1	1000.0	120.000	100.0	H	216.0	12.1	24.9	47.0
672.720000	23.9	1000.0	120.000	100.0	V	102.0	21.7	23.1	47.0
692.371500	42.8	1000.0	120.000	124.0	V	104.0	21.7	4.2	47.0
768.928500	27.7	1000.0	120.000	208.0	V	14.0	22.6	19.3	47.0
866.947500	31.7	1000.0	120.000	100.0	V	270.0	24.0	15.3	47.0
957.480000	26.2	1000.0	120.000	230.0	V	101.0	24.9	20.8	47.0
989.920500	28.6	1000.0	120.000	180.0	V	142.0	25.2	18.4	47.0
990.643500	29.9	1000.0	120.000	111.0	V	175.0	25.2	17.1	47.0

Table 5-2

Eight Frequencies were determined to be within 10dB of the limit, so further testing at the 10 meter Open Area Test Site (OATS) was required.

5.6.2 Results from testing at the 10M OATS

Environmental Status

21°C, 38% Humidity, 875mB Barometric Pressure

Frequency MHz	Ambient Signal dBuV/M	QP Level dBuV/M	Class B Limit dBuV/M	Delta dB	Rotation °	Height	Orientation
57.130500	28.90	0	30	1.1	0	0	V
90.198000	35.31	Ambient Noise – no signal detected from EUT					
90.322500	26.31	29.31	30	0.69	11	1.5	V
90.375000	23.88	29.03	30	0.97	0	1.5	V
93.420000	44.43	Ambient Noise – no signal detected from EUT					
94.945500	19.51	23.81	30	6.19	340	4	V
95.121000	32.75	Ambient Noise – no signal detected from EUT					
692.371500	29.92	30.30	37	6.70	320	2	V

Table 5-4

Note, although the above highlighted frequencies were found to be over the limit, this does not constitute a failure as the dBuV/M level was within 6dBuV/M of the ambient noise level. Please reference section 10.8 of the BS EN 55022:2006+A1:2007 test standard.