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Test No: T0645			



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## REPORT ON ELECTROMAGNETIC COMPATIBILITY TESTS

**Performed at:  
 TWENTY PENCE TEST SITE**

**Twenty Pence Road,  
 Cottenham,  
 Cambridge  
 U.K.  
 CB4 8PS**

on

**Bewator Group Ltd**

**PR500**

**dated**

**24th June 2002**

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Equipment Under Test (EUT):

PR500

Test Commissioned by:

Bewator Group Ltd  
Mercers Row  
Cambridge  
CB5 8EX

Representative:

Kevin O'Farrell

Test Started:

29th April 2002

Test Completed:

11th June 2002

Test Engineer:

Greg Halsall

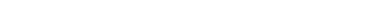
Date of Report:

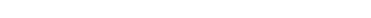
24th June 2002

Report:

Written by: Claire Arber

Checked by: Greg Halsall

Signature: 

Signature: 

Date: 

Date: 

## Test Standards Applied

CFR 47 : 2001

*Code of Federal Regulations: Pt 15 Subpart C - Radio Frequency Devices - PASS  
Intentional Radiators*

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## Emissions Test Results Summary

CFR 47 : 2001

Test	Port	Method	Limit	PASS/FAIL	Notes
Conducted Emissions	ac power	ANSI C63.4:1992	CISPR22(B)	PASS	
Radiated Emissions		ANSI C63.4:1992	CISPR22(B)	PASS	

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## 1 EUT Details

### 1.1 General

The EUT was a magnetic tag (loop) detector. This comprised a reader and a tag. The reader and tag were permanently transmitting.

Details of the EUT and associated peripherals used during the tests are listed below. Figure 1 shows the interconnections between the EUT and peripherals.

Item	Manufacturer	Model	Description	Serial No:	Notes
1	Bewator	N/A	Tag	N/A	
2	Bewator	PR500	Reader	N/A	
	<u>Peripheral equipment</u> (not part of EUT)				
3			AC/DC external power brick	N/A	
4	Bewator	4101	Control box	N/A	

### 1.2 Details of Interconnecting Cables

The following table lists details of the cables connected to the EUT.

From	To	Cable Type	Length	Notes
Reader	4101	D02/743 (foil screened with screen disconnected at the reader)	3m / 15m	
Reader	AC / DC Power Brick	Unscreened	2m	

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### 1.3 Modifications to EUT and Peripherals

Details of any modifications that were required to achieve compliance are listed below. The modification numbers are referred to in the results sections as appropriate.

Mod No:	Details
1	74LVC flip flop replaced by 74HC flip flop and contention state removed.

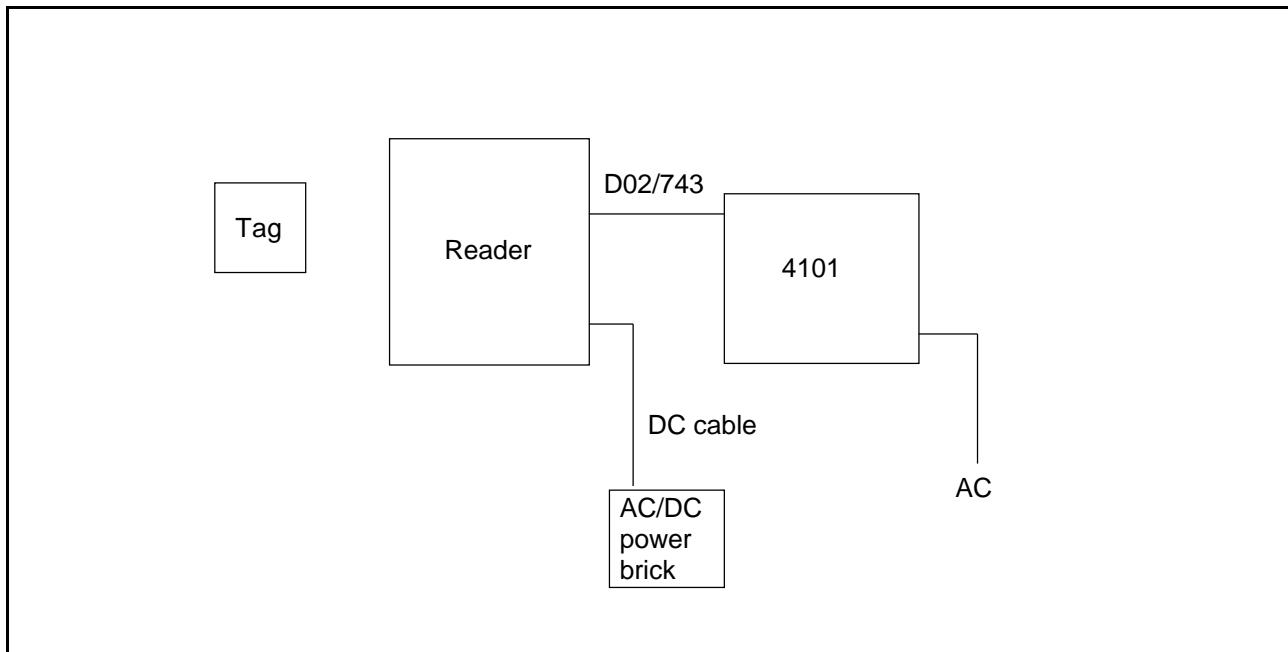
### 1.4 EUT Operating Modes

The EUT was tested in the following operating mode or modes. Generally, operating modes are chosen that will exercise the functions of the EUT as fully as possible and in a manner likely to produce maximum emission levels or susceptibility. Individual test result sheets reference the operating mode of the EUT.

Operating Mode	Details
1	Scanning (no tag present).
2	Reading one tag.

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**Figure 1 General Arrangement of EUT and Peripherals**



**Photograph 1 General Arrangement of EUT and Peripherals**



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## 2 Test Equipment

The test equipment used during the tests was one or more of the items listed below. Individual test result sheets indicate which items were used.

Ref No:	Manufacturer	Model	Description	Serial Number
R1	Chase	LHR7000	RF Receiver (10kHz-30MHz)	1056
R2	Chase	UHR4000	RF Receiver (25MHz-1GHz)	6111
R3	Rohde and Schwarz	ESHS10	RF Receiver (9kHz-30MHz)	843743/010
R4	Rohde and Schwarz	ESVS10	RF Receiver (20MHz-1GHz)	843744/00
R5	Hewlett Packard	HP 8595E	Spectrum Analyser	3412A00701
R5A	Hewlett Packard	HP11947A	Transient Limiter	3107A01209
R5B	Hewlett Packard	HP87405A	Pre-amp	3207A00322
L1	EMCO	3825/2	LISN	1358
L2	Rohde and Schwarz	ESH3-Z5	LISN	843862/009
ISN1	dB Technology	ISN_1	Impedance Stabilisation Network	001
A1	EMCO	3104	Bicon Antenna (20MHz-200MHz)	3449
A2	EMCO	3146	Log Per Antenna (200MHz-1GHz)	2011
A3	EMCO	3147	HF Log P Antenna (200MHz-5GHz)	9207-1096
A4	Chase	CBL6112	Bilog Antenna (30MHz-2GHz)	2027
A5	Chase	CBL111A	Bilog Antenna (30MHz-1GHz)	1760
A6	EMCO	3104M	Bicon Antenna (30MHz-200MHz)	DB0001
SG1	Marconi	2022D	Signal Generator	119216/050
AMP1	Kalmus	737LC	Power Amplifier	072694-4
FP1A	Holaday	4422	Field Strength Meter	89360
FP1B	Holaday	4416	Repeater for FSM	84553
WG1	HILO-TEST	EFTG 4510	EFT Generator	951833
WG2	EMTEST	ESD30	ESD Generator	1189-23
WG3	HILO-TEST	CE-Tester	EFT, Dips, surge	972327
WG4	EM TEST	UCS 500-M	EFT, ESD, DIPS, Surge	1299-36
CLAMP1	CHASE	CIC-8100	EM clamp	138
CDN1	dB Technology	dB-CDN-M3	3w mains CDN	001
CDN2	CHASE	CDN-1000-M2-16	2w mains CDN	56
Clamp 2	MDS	MDS21	Clamp	901921
HA1	Thurlby Thandar	HA16000	Harmonics Analyser	125509
HA1a	Thurlby Thandar	AC1000	Low Distortion Supply	116745
HA1b	Thurlby Thandar	AC1000	Low Distortion Supply	

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### 3 Test Methods

#### 3.1 Conducted Emissions - ac power

This section describes the general method of performing this test. The specific method used and any deviations from this general method are listed in the appropriate results section.

Bench top EUTs and peripheral equipment are normally placed on a 0.8m high non-conducting bench, positioned 0.4m from one of the metallic walls of a screened room. Floor standing EUTs are normally placed 0.1m above the metallic floor of the screened room. Mains leads are bundled so as not to exceed 1m.

The EUT is powered using a 50ohm/50uH Line Impedance Stabilisation Network (LISN). Peripherals are powered using a second a 50ohm/50uH LISN. These LISNs are bonded to the screened room floor.

With the correct supply voltage applied to the EUT scans are performed on both the live and neutral line outputs of the LISN using quasi-peak detection over the specified frequency range. The results of these scans are shown in the plots section at the end of the report.

Significant emissions identified by the scans are measured and the results tabulated. The table of results is shown in the conducted emissions results section.

#### 3.2 Radiated Emissions

This section describes the general method of performing this test. The specific method used and any deviations from this general method are listed in the appropriate results section.

Initial scans are performed in a semi-anechoic screened room at a distance of 3m. Scans are performed over the frequency range specified in the test standard with the antenna both horizontally and vertically polarised. During these scans the EUT and peripherals are rotated through 360°. Bench top EUTs are placed on a non-conducting bench at a height of 0.8m above the ground plane. Floor standing EUTs are placed 0.1m above the ground plane. The results of the scans are shown in the plots included at the end of the report.

Significant emissions identified by the scans are measured on an open area test site at the appropriate test distance using a CISPR16 quasi-peak receiver. Maximised readings are obtained by rotating the EUT through 360° and adjusting the height of the antenna from 1m to 4m. Measurements are made with the antenna both horizontally and vertically polarised and the results tabulated.

### 4 Test Results

The following sections contain tabulated test results. Plots of various scans are included at the back of this section.

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## 4.1 Conducted Emission Results

Test Equipment:	Factor Set 1:	EMLISN	RG214	10 m cable
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### Conducted Emissions

Company:	Bewator Group Ltd			Product:	PR500												
Date:	15th June 2002			Test Eng:	Greg Halsall												
Ports:	ac power																
Test:	ANSI C63.4:1992 using limits of			CISPR22(B)	=FCC_B												
Ports:	ac power																
Test:	EN55022 using limits of			EN50081-1	=CISPR22(B)												
Test	Op Mode	Mod State	Line (L/N)	Fact Set	Freq. MHz	Det qp/av	Rec. Level dBuV	Corr'n Factor dB	Total Level dBuV	Limit FCC_B dBuV	Margin FCC_B dB	Limit CISPR22(B) dBuV	Margin CISPR22(B) dB	Notes			
2	1	N	1	1	0.771	qp	32.5	0.1	32.6	48.0	15.4						
2	1	N	1	1	0.771	av	7.0	0.1	7.1	48.0	40.9						
2	1	L	1	1	18.479	qp	34.0	0.3	34.3	48.0	13.7						
2	1	L	1	1	18.479	av	30.8	0.3	31.1	48.0	16.9						
Results				Minimum Margin PASS/FAIL			13.7 dB										
Notes		Comments and Observations															
		Results of scans shown in plots 1 and 2.															

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## 4.2 Radiated Emissions Results

Test Equipment:	Factor Set 1:	LOOP	RG214	25 m cable
	Factor Set 2:	HFBLOG	RG214	25 m cable

### Radiated Emissions

Company:	Bewator Group Ltd										Product:	PR500						
Date:	15th June 2002										Test Eng:	Greg Halsall						
<i>Ports:</i>																		
Test:	ANSI C63.4:1992 using limits of										FCC(C)	=FCC_C						
<i>Ports:</i>																		
Test:	EN300-330 using limits of										EN300-330							
Test	Op Mode	Mod State	Dist m	Fact Set	Freq. MHz	Ant Pol	Rec. Level dBuV	Corr'n Factor dB/m	Total Level dBuV/m	Limit FCC_C dBuV/m	Margin FCC_C dB	Limit	Margin	Notes				
15.209	1	1	3	1	0.132	360	70.4	10.7	81.1	85.0	3.9			1				
	1	1	10	1	0.132	F	39.8	10.7	50.5	55.0	4.5			2				
	1	1	10	1	0.132	E	35.0	10.7	45.7	55.0	9.3							
	1	1	10	1	5.540	E	11.0	11.5	22.5	39.5	17.0							
	1	1	10	1	20.326	E	9.2	11.0	20.2	39.5	19.3							
	1	1	10	1	21.570	F	8.5	11.0	19.5	39.5	20.0							
	1	1	10	1	22.174	F	9.0	11.0	20.0	39.5	19.5							
	1	1	10	1	22.174	F	11.3	11.0	22.3	39.5	17.2							
	1	1	10	1	22.174	E	9.6	11.0	20.6	39.5	18.9							
	1	1	10	1	22.769	F	6.0	11.0	17.0	39.5	22.5							
	1	1	10	1	22.769	F	4.0	11.0	15.0	39.5	24.5							
Results										Minimum Margin	3.9	dB						
PASS/FAIL										PASS								
Notes	Comments and Observations																	
#1	Results of screened room scans shown in plots 3 to 6																	
	F= Face on, E= Edge On																	
#2	Carrier = 0.132MHz																	
	3m limit greater than 10m limit by 30dB (near field correction of 60dB/decade of distance). See plot 3.																	
	A worst case correction of 20dB/decade of distance has been applied in converting from the 300m limit to the 10m limit.																	

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### 4.3 Radiated Emissions Results cont.

Test Equipment:	Factor Set 1:	LOOP	RG214	25 m cable
	Factor Set 2:	HFBLOG	RG214	25 m cable

#### Radiated Emissions

Company:	Bewator Group Ltd										Product:	PR500					
Date:	15th June 2002										Test Eng:	Greg Halsall					
Ports:																	
Test:	ANSI C63.4:1992 using limits of										FCC(C)	=FCC_C					
Ports:																	
Test:	EN300-330 using limits of										EN300-330						
Test	Op Mode	Mod State	Dist m	Fact Set	Freq. MHz	Ant Pol	Rec. Level dBuV	Corr'n Factor dB	Total Level dBuV/m	Limit FCC_C dBuV/m	Margin FCC_C dB	Limit dBuV/m	Margin dB	Notes			
15.209	1	1	3	2	33.270	V	17.5	17.7	35.2	40.0	4.8			1			
	1	1	3	2	77.430	V	27.4	8.3	35.7	40.0	4.3			1			
	1	1	3	2	84.810	V	20.6	9.4	30.0	40.0	10.0			1			
Results										Minimum Margin	4.3 dB						
PASS/FAIL										PASS		dB					
Notes	Comments and Observations																
#1	Results of screened room scans shown in plots 3 to 6 Using 15m cable set, laid vertically to peripheral equipment.																

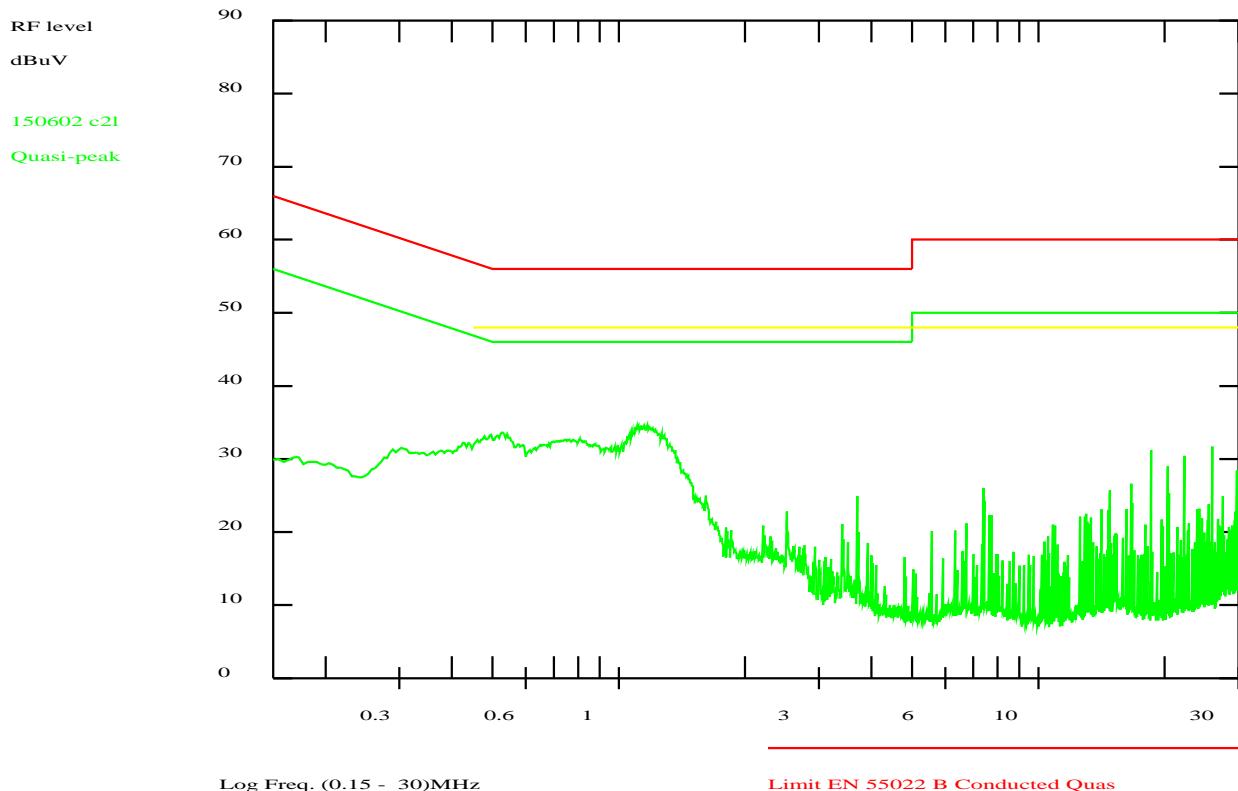
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Chase EMS 6.21

Notes

Analyse 150602 c21

Test: EN55022(B),EN55011(B),EN55014&amp;13 Main Cond(QP Det)



### PLOT 1 Conducted Emissions - 115V AC (live line)

Company:	Bewator	Product:	PR500
Date:	15 Jun 02	Test Engineer:	gjh
Test:	EN55022/FCC	Limit:	EN (B) /FCC B
Notes:			
3m cable to periph 4101 (turned off)			
Line:	Live	Attenuator:	10dB PAD
Detector:	QuasiPeak	Operating Mode:	2=+1tag
LISN:	EMCO	Mod. State:	1
Filename:	C2615666.plt		

### Frequency List (MHz)

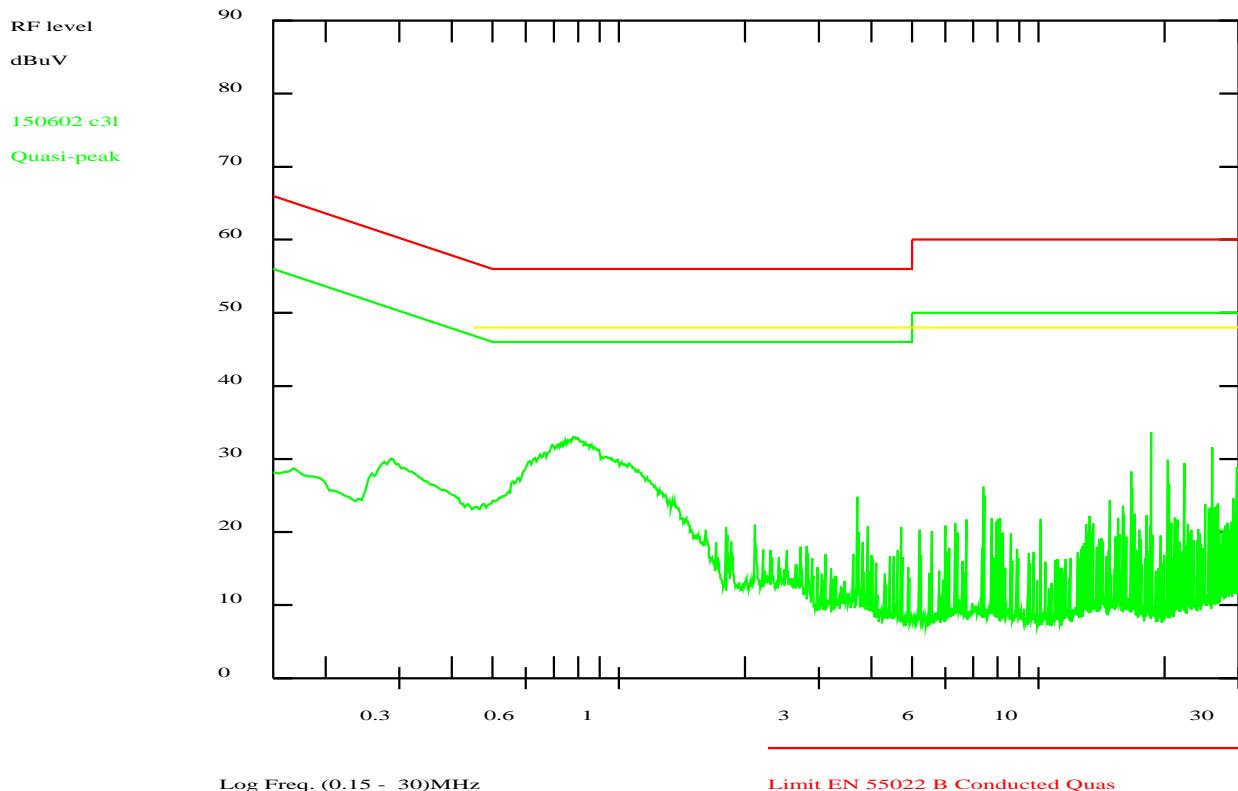

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Chase EMS 6.21

Notes

Analyse 150602 c31

Test: EN55022(B), EN55011(B), EN55014&amp;13 Main Cond(QP Det)



## PLOT 2 Conducted Emissions - 115V AC (neutral line)

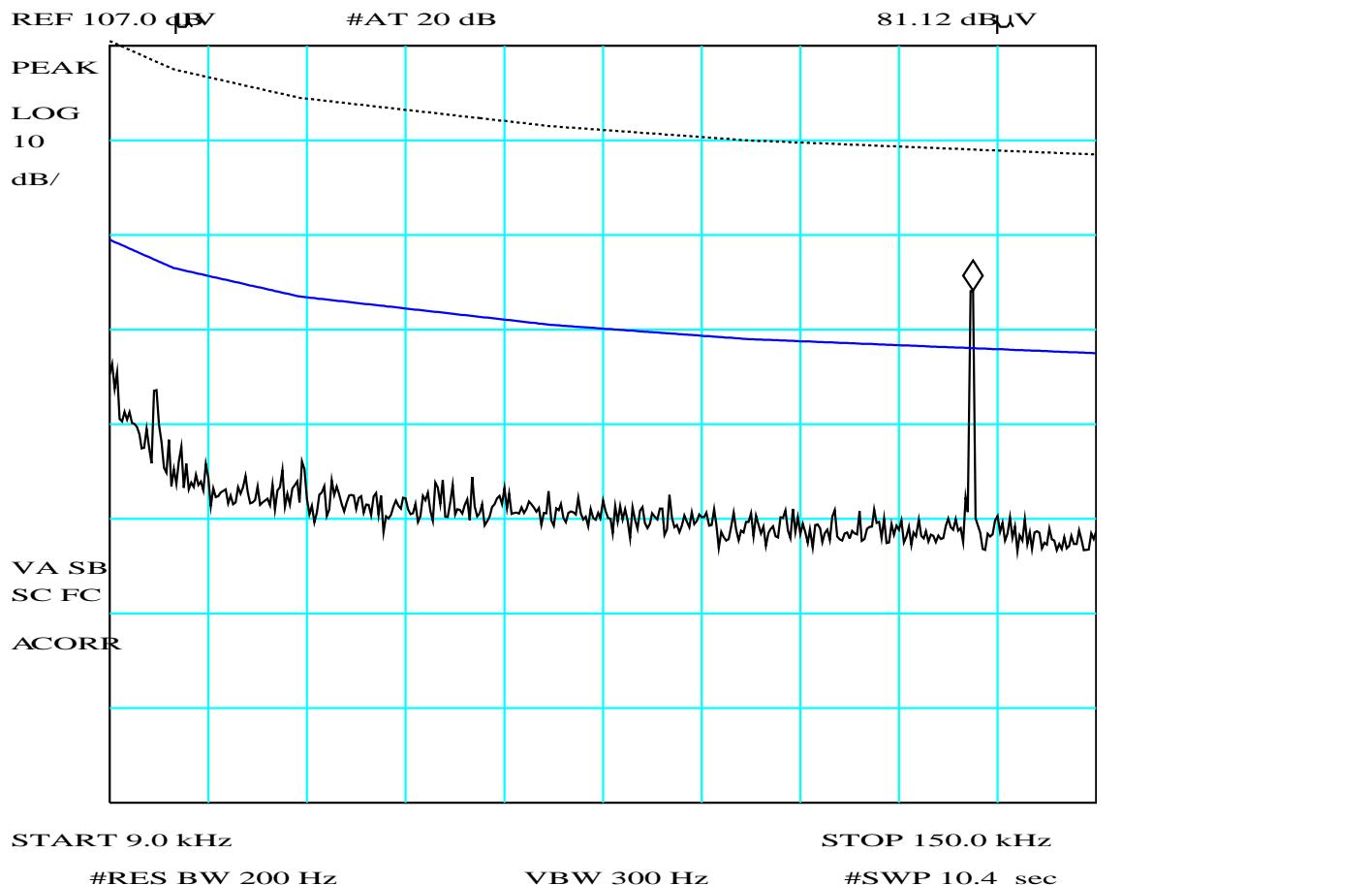
Company:	Bewator	Product:	PR500
Date:	15 Jun 02	Test Engineer:	gjh
Test:	EN55022/FCC	Limit:	EN (B) /FCC B
Notes:			
3m cable to periph 4101 (turned off)			
Line:	Neutral	Attenuator:	10dB PAD
Detector:	QuasiPeak	Operating Mode:	2=+1tag
LISN:	EMCO	Mod. State:	1
Filename:	C2615673.plt		

### Frequency List (MHz)


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MKR 132.4 kHz

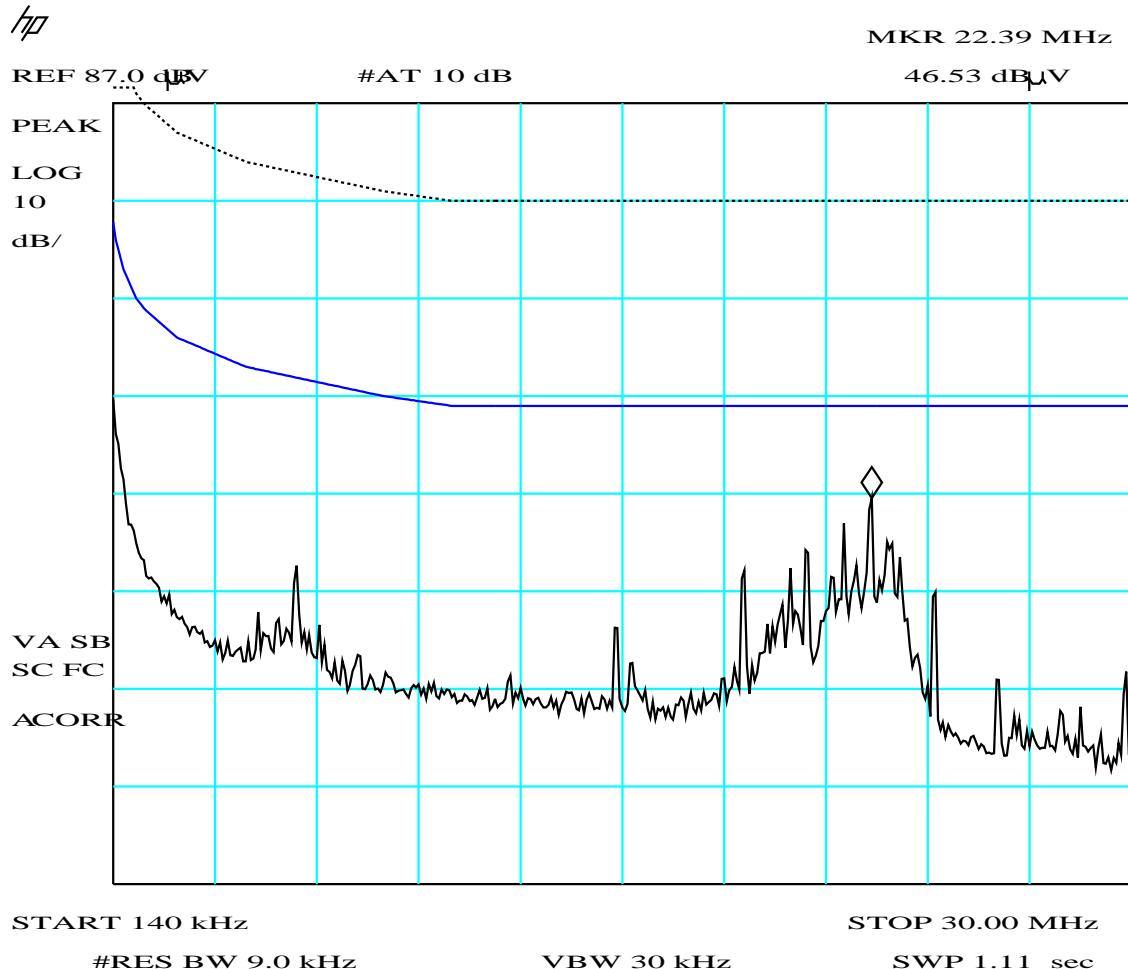


### PLOT 3 Radiated Emissions - 9kHz to 150kHz

Company:	Bewator	Product:	PR500
Date:	02 May 02	Test Engineer:	gjh
Test:	EN300330	Limit:	Table 7
Notes:			
Limits shown are EN300-330 transmit spurious (higher) and standby spurious (lower). The limits shown for 3m measurements are 29dB higher than the specified 10m limit (using 60dB/decade).			
With power modules outside screened room on 15m foil scn cable			
Polarisation:	Face+Perp	Orientation:	F+B+L+R
Distance:	3m	Antenna:	Loop Curve3
Height:	1.5m	Filename:	H250278B.plt

### Frequency List (MHz)


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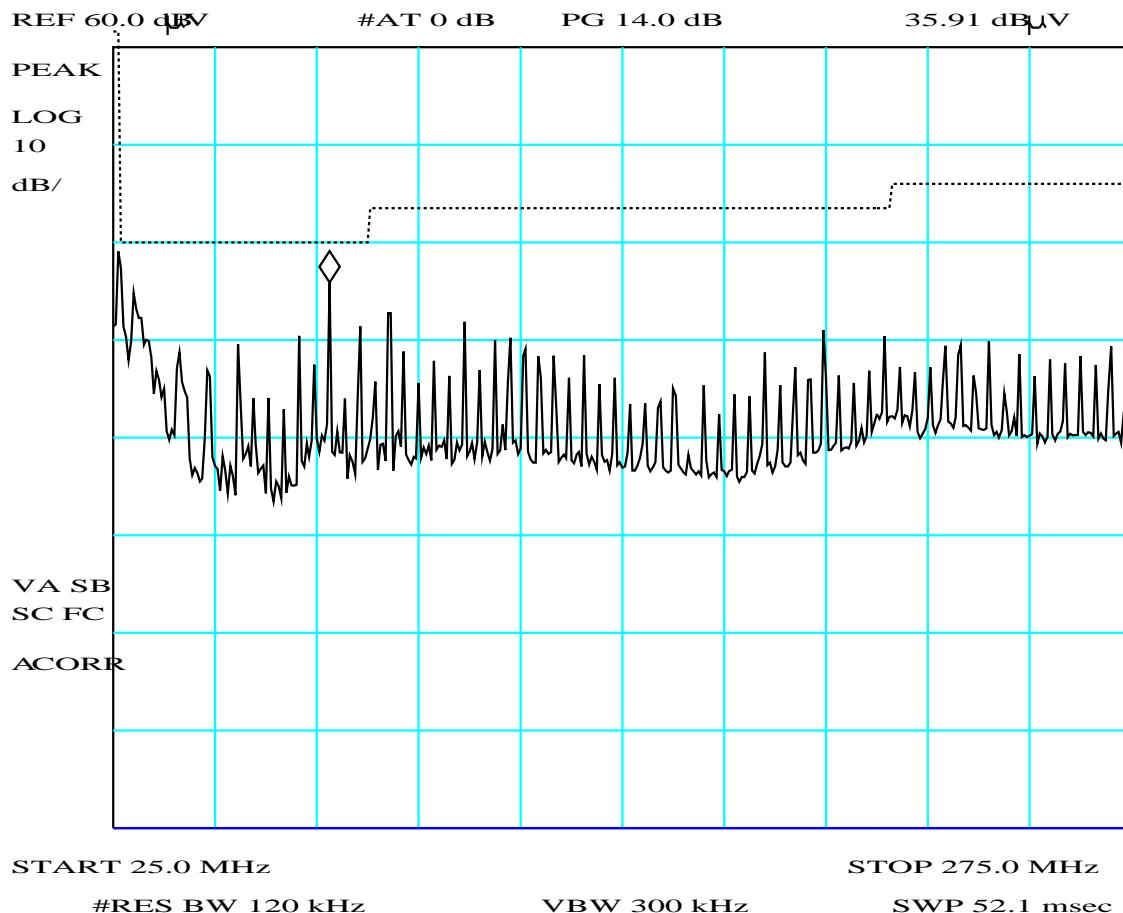
Company:	Bewator	Product:	PR500
Date:	02 May 02	Test Engineer:	gjh
Test:	EN300330	Limit:	Table 7
Notes:			
Limits shown are EN300-330 transmit spurious (higher) and standby spurious (lower).			
The FCC limits are 84.7dB <sub>u</sub> V/m at 140kHz (far field 300m to 10m at 20dB/decade, nearfield 10m to 3m at 60dB/decade of distance)			
and 49.5dB <sub>u</sub> V/m from 1.705MHz to 30MHz (far field 30m to 3m at 20dB/decade - worst case)			
With power modules outside screened room on 15m foil scn cable			
Polarisation:	Face+Perp	Orientation:	F+B+L+R
Distance:	3m	Antenna:	Loop Curve3
Height:	1.5m	Filename:	H25027C5.plt

#### Frequency List (MHz)


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1/1

MKR 78.1 MHz



### PLOT 5 Radiated Emissions - 25MHz to 275MHz

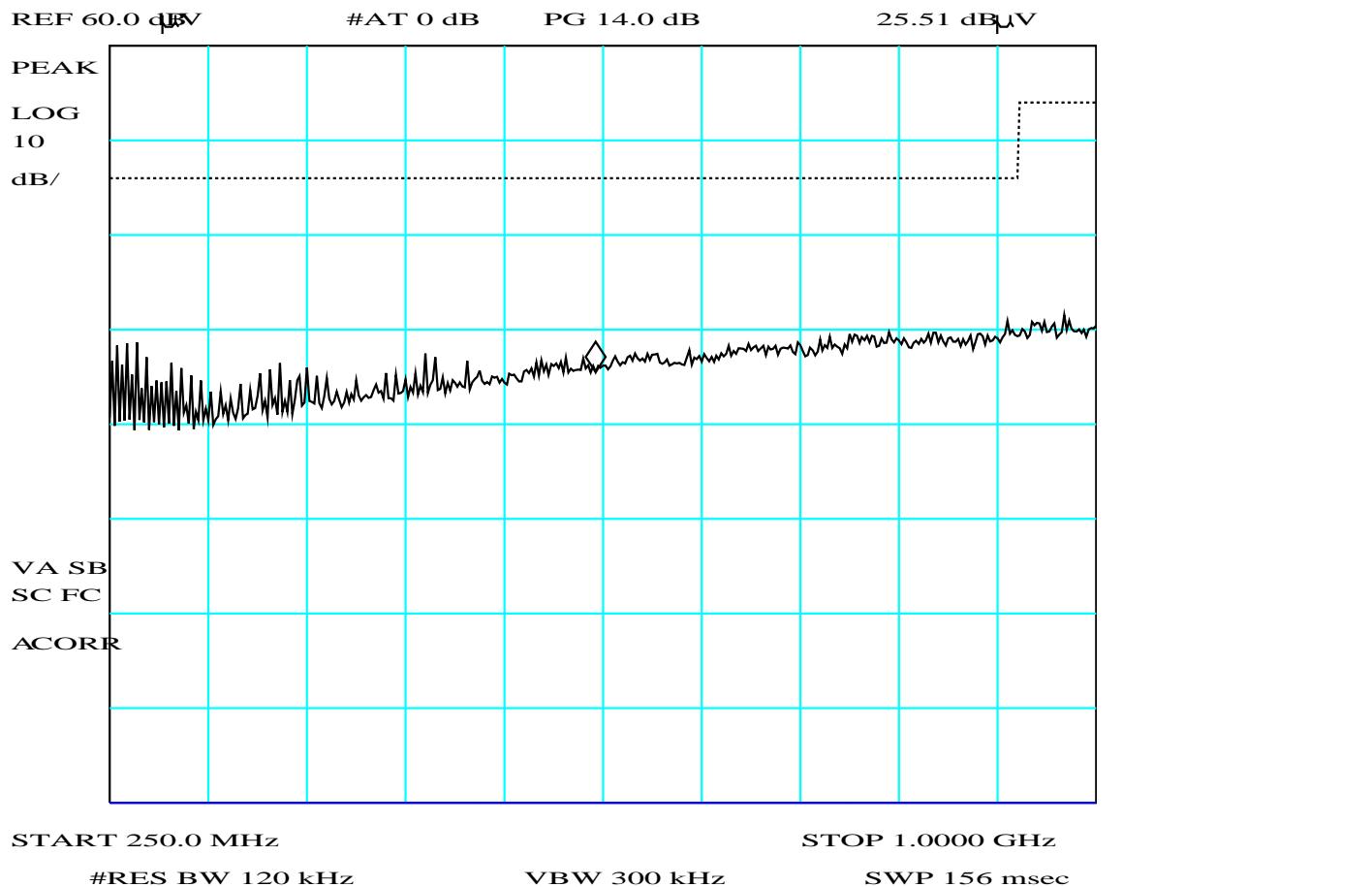
Company:	Bewator	Product:	PR500
Date:	01 May 02	Test Engineer:	gjh
Test:		Limit:	FCC (B)
Notes: FCC limit shown.			
With power modules outside screened room on 15m foil scn cable			
Mod 1=using new HC74 flip flop			
Polarisation:	V + H	Orientation:	0 - 360°
Distance:	3m	Antenna:	Bilog
Height:	1m	Filename:	H250157D.plt

### Frequency List (MHz)


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/p

**MKR 619.4 MHz**



### PLOT 6 Radiated Emissions - 250MHz to 1GHz

Company:	Bewator	Product:	PR500
Date:	01 May 02	Test Engineer:	gjh
Test:	FCC pt 15 C	Limit:	FCC (B)
Notes: FCC limit shown.			
With power modules outside screened room on 15m foil scn cable			
Mod 1=using new HC74 flip flop			
Polarisation:	V + H	Orientation:	0 - 360°
Distance:	3m	Antenna:	Bilog
Height:	1m	Filename:	H2501599.plt

### Frequency List (MHz)
