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REPORT ON ELECTROMAGNETIC COMPATIBILITY TESTS

Performed at:

TWENTY PENCE TEST SITE

Twenty Pence Road,
Cottenham,
Cambridge
U.K.
CB4 4PS

on

BEWATOR COTAG Ltd.

5298 Pin and Proximity Reader

dated

16 October 1999

Equipment Under Test (EUT)	5298 Pin & Proximity Reader
Test Commissioned by:	BEWATOR COTAG A Division of Bewator Group Ltd., Mercers Row Cambridge CB5 8EX
Representative:	Martin Young
Test Started:	8 October 1999
Test Completed:	8 October 1999
Test Engineer:	Dave Smith
Date of Report:	16 October 1999
Report:	

Written by:	Dave Smith	Checked by:	D. BARLOW
Signature:	D. A. Smith	Signature:	D. Barlow
Date:	26/10/99	Date:	26/10/99

Test Standards Applied

CFR 47 : 1998	*Code of Federal Regulations: Part 15 Subpart C - Radio Frequency Devices - Intentional Radiators*	**PASS**

Test Results Summary

CFR 47 : 1998 PASS

Test	Port	Method	Limit	PASS/FAIL	*Notes*
Conducted Emissions	ac power	ANSI C63.4:1992	FCC pt 15 sub C	PASS	
Radiated Emissions		ANSI C63.4:1992	FCC pt 15 sub C	PASS	

Contents

1 EUT Details

1.1 General

The EUT consisted of a Model 5298 Pin and Proximity Reader. The device is a variant of the Model 5290.

The EUT is an intentional radiator at a frequency of 132kHz and therefore the rules of CFR47 part 15 subsection C were applied.

The EUT contained no clocks or circuitry operating at or above 108MHz.

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:	FCC ID
1	Bewator Cotag	5298	EUT		
2	Bewator Cotag	P900	Control Unit		EZO5PQP900
3	Belser	A9526	110V - 24V ac adaptor	BE11645000AA 0001	

1.2 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.

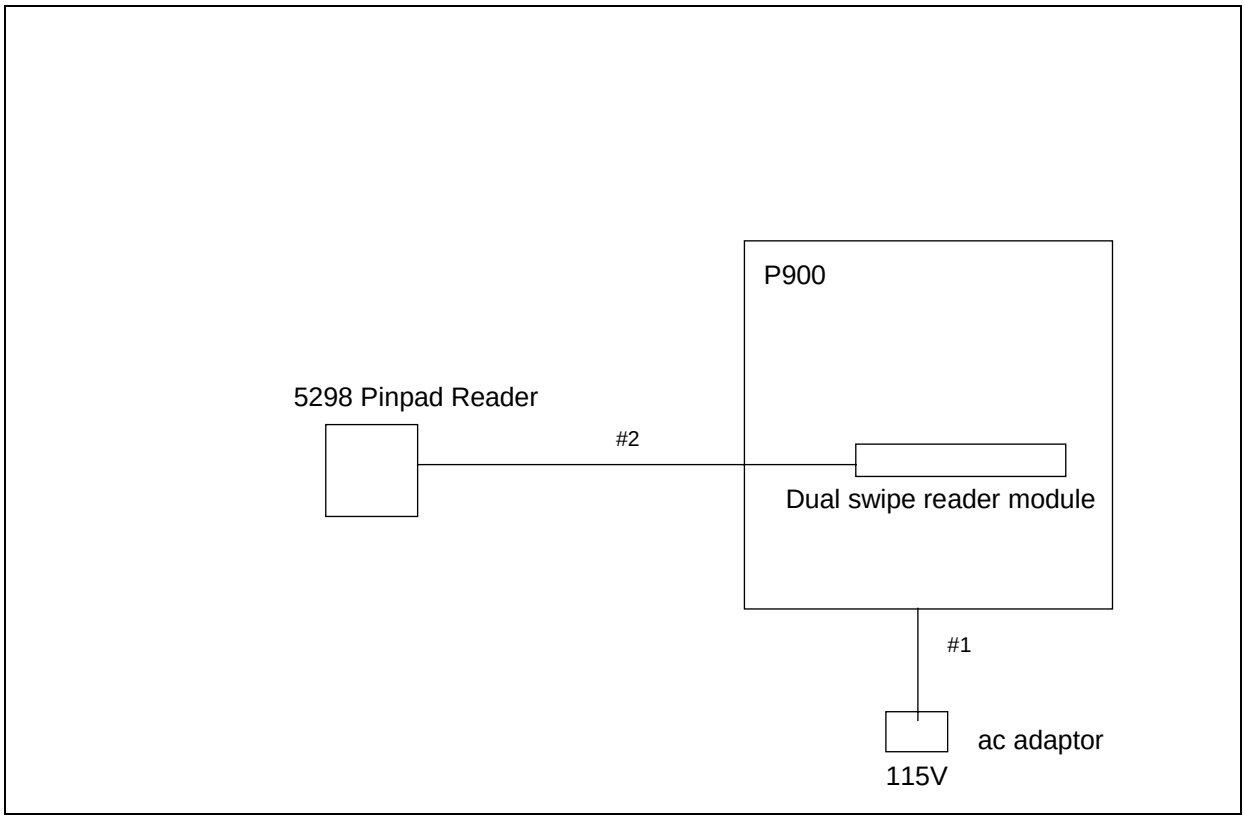
Mod No:	Details
0	As received on 8 October 1999.

1.3 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.

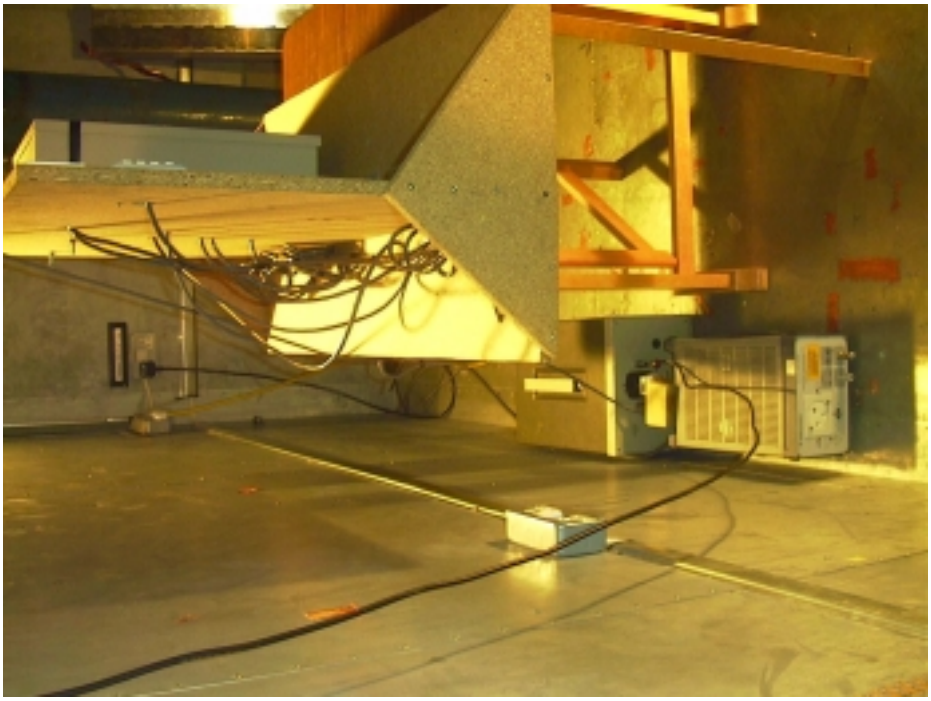
Operating Mode	Details
1	Normal operating mode with intentional transmitter always active.

Figure 1 General Arrangement of EUT and Peripherals

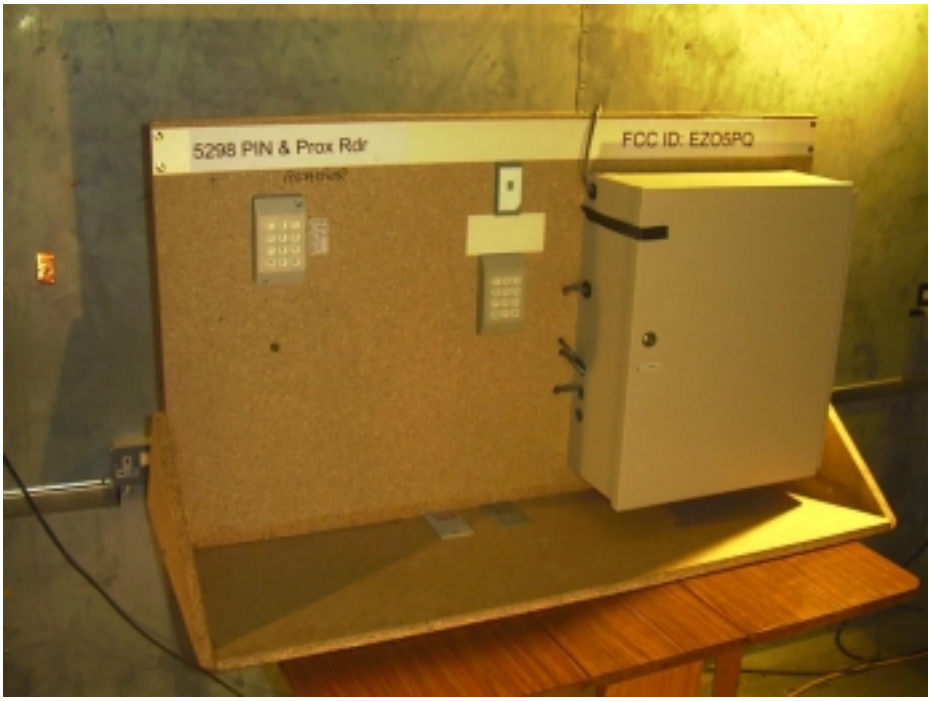


#1 1.5m spiral wrap screen
#2 2m braid screen data cable

Photograph 1 Conducted Emissions - Back



Photograph 2 Conducted Emissions - Front



Photograph 3 Radiated Emissions - Back

Photograph 4 Radiated Emissions - Front

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	Cal Date
R1	Chase	LHR7000	RF Receiver 10kHz - 30MHz	1056	30 June 99
R4	Rohde and Schwarz	ESVHS10	RF Receiver 20MHz - 1GHz	843744/00	23 June 99
R5 R5B	Hewlett Packard Hewlett Packard	HP 8595E HP87405A	Spectrum Analyser Pre-amp	3412A00701 3207A00322	1 Oct 98
L1	EMCO	1912.5	LISN	1358	18 Mar 99
L2	Rohde and Schwarz	ESH3-Z5	LISN	843862/009	18 Mar 99
A2	EMCO	3146	Log Periodic Antenna 200MHz - 1GHz	2011	15 Jul 99
A4	Chase	CBL6112	Bilog Antenna 30MHz - 2GHz	2027	15 Jul 99
A5	Chase	CBL111A	Bilog Antenna 30MHz - 1GHz	1760	15 Jul 99
A7	EMCO	6502	Active Loop 9kHz - 30MHz	2139	1 Oct 99

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 30MHz to 1GHz 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.

4.1 Conducted Emission Results

Test Equipment:	Factor Set 1: EMLISN	RG214	10 m cable

Conducted Emissions

Company:	BEWATOR COTAG Ltd.	*Product:*	5298
Date:	8 October 1999	*Test Eng:*	Dave Smith
Ports:	ac power		
Test:	ANSI C63.4:1992 using limits of		FCC pt 15 sub C
Ports:			
Test:			

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 FCCB dBuV/m	Margin FCCB dBuV/m	Limit	Margin	Notes
C1	1	0	L	1	5.542	qp	43.1	0.2	43.3	48.0	4.7			
C1	1	0	L	1	7.391	qp	37.3	0.2	37.5	48.0	10.5			
C1	1	0	L	1	9.240	qp	38.9	0.2	39.1	48.0	8.9			
C1	1	0	L	1	14.783	qp	37.4	0.2	37.6	48.0	10.4			
C1	1	0	L	1	16.630	qp	29.6	0.3	29.9	48.0	18.1			
C1	1	0	L	1	29.494	qp	36.5	0.3	36.8	48.0	11.2			
C2	*1*	*0*	*N*	*1*	*5.544*	*qp*	*50.3*	*0.2*	*50.5*	*48.0*	*-2.5*			*#1*
C2	1	0	N	1	5.544	av	39.2	0.2	39.4	48.0	8.6			
C2	1	0	N	1	5.544	qp	37.3	0.2	37.5	48.0	10.5			#2
C2	1	0	N	1	7.391	qp	36.5	0.2	36.7	48.0	11.3			
C2	1	0	N	1	9.241	qp	40.1	0.2	40.3	48.0	7.7			
C2	1	0	N	1	14.783	qp	32.3	0.2	32.5	48.0	15.5			
C2	1	0	N	1	25.871	qp	25.3	0.3	25.6	48.0	22.4			
C2	1	0	N	1	29.494	qp	35.6	0.3	35.9	48.0	12.1			

Results	**Minimum Margin**	**4.7 dB**		
	PASS/FAIL	**PASS**		

Notes	Comments and Observations
	Results of scans shown in Plot 1 and Plot 2
#1	Exceeded limit of 48dBuV but average reading was more than 6dB below quasi-peak reading therefore 13dB reduction of quasi-peak reading permitted by 15.207.
#2	Reading when 13dB reduction applied.

4.2 Radiated Emissions Results

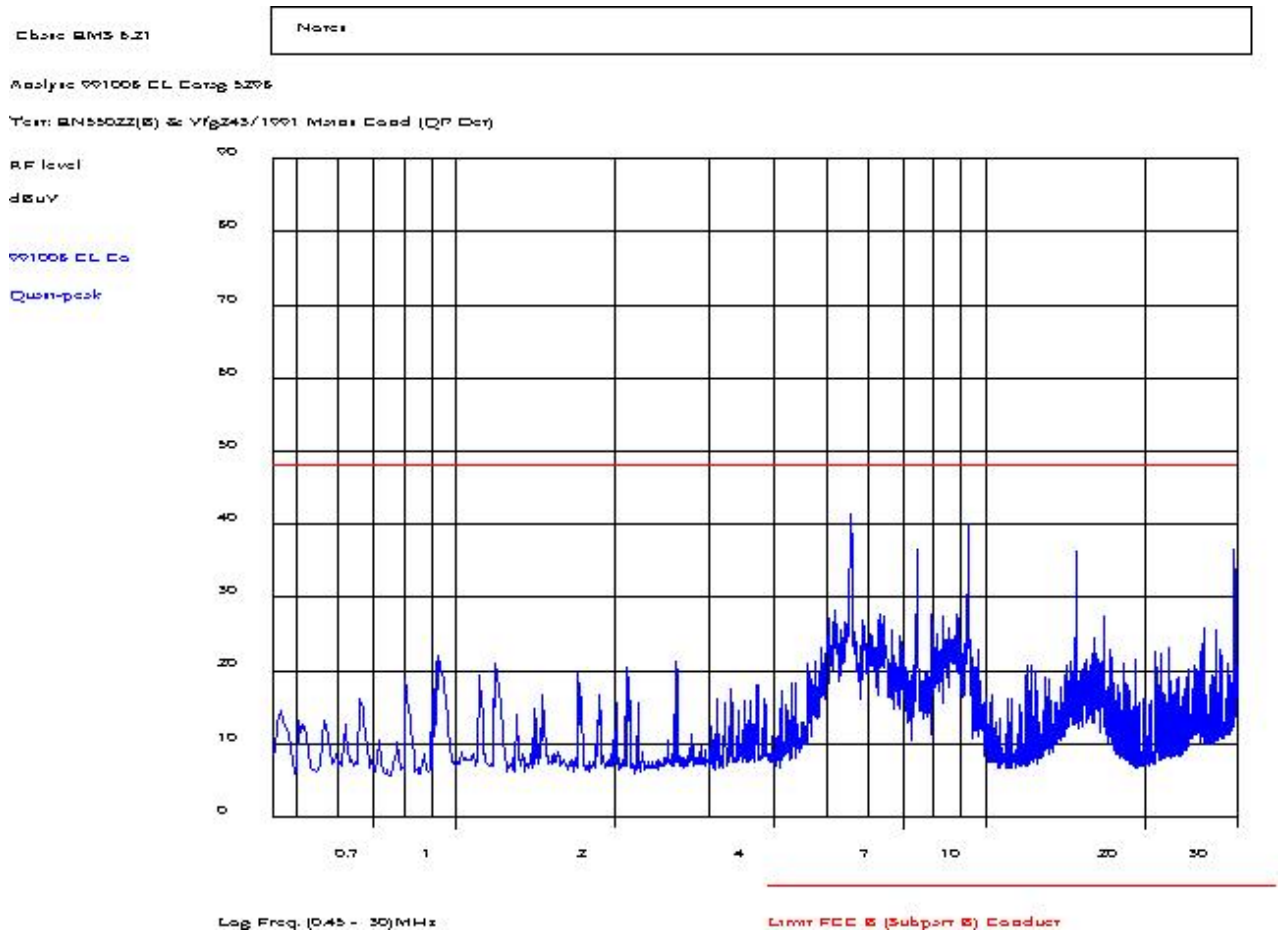
Test Equipment:	Factor Set 1:	HFBilog	RG214	25 m cable
	Factor Set 2:	Loop	RG214	25 m cable

Radiated Emissions

Company:	BEWATOR COTAG Ltd.	*Product:*	5298
Date:	8 October 1999	*Test Eng:*	Dave Smith
Test:	ANSI C63.4:1992 using limits of		FCC pt 15 sub C
Test:			

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) dBuV/m	Limit	Margin	Notes
R1	1	0	10	2	0.132	C	41.1	10.6	51.7	85.2	33.5			#1
R2	1	0	3	2	0.132	C	69.1	10.6	79.7	105.2	25.5			#1
R3	1	0	3	1	31.400	H	0.6	18.8	19.4	40.0	20.6			
R3	1	0	3	1	44.248	H	11.8	11.8	23.6	40.0	16.4			
R3	1	0	3	1	62.845	V	14.1	7.7	21.8	40.0	18.2			
R3	1	0	3	1	74.872	V	19.3	8.0	27.3	40.0	12.7			
R3	1	0	3	1	81.111	H	25.2	8.8	34.0	40.0	6.0			
R3	1	0	3	1	86.637	H	27.2	9.9	37.1	40.0	2.9			
R3	1	0	3	1	88.500	V	23.0	10.3	33.3	43.5	10.2			
R3	1	0	3	1	110.869	H	12.4	13.9	26.3	43.5	17.2			
R3	1	0	3	1	112.733	V	15.6	14.0	29.6	43.5	13.9			
R3	1	0	3	1	120.103	H	13.3	14.2	27.5	43.5	16.0			
Results							Minimum Margin			2.9	dB			
							PASS/FAIL			PASS				

Notes	Comments and Observations
	Results of screened room scans shown in Plot 3 to Plot 7
#1	Limit extrapolated using 40dB per decade as per section 15.31(f)(2)
	V= vertical, H= horizontal, C= co-axial

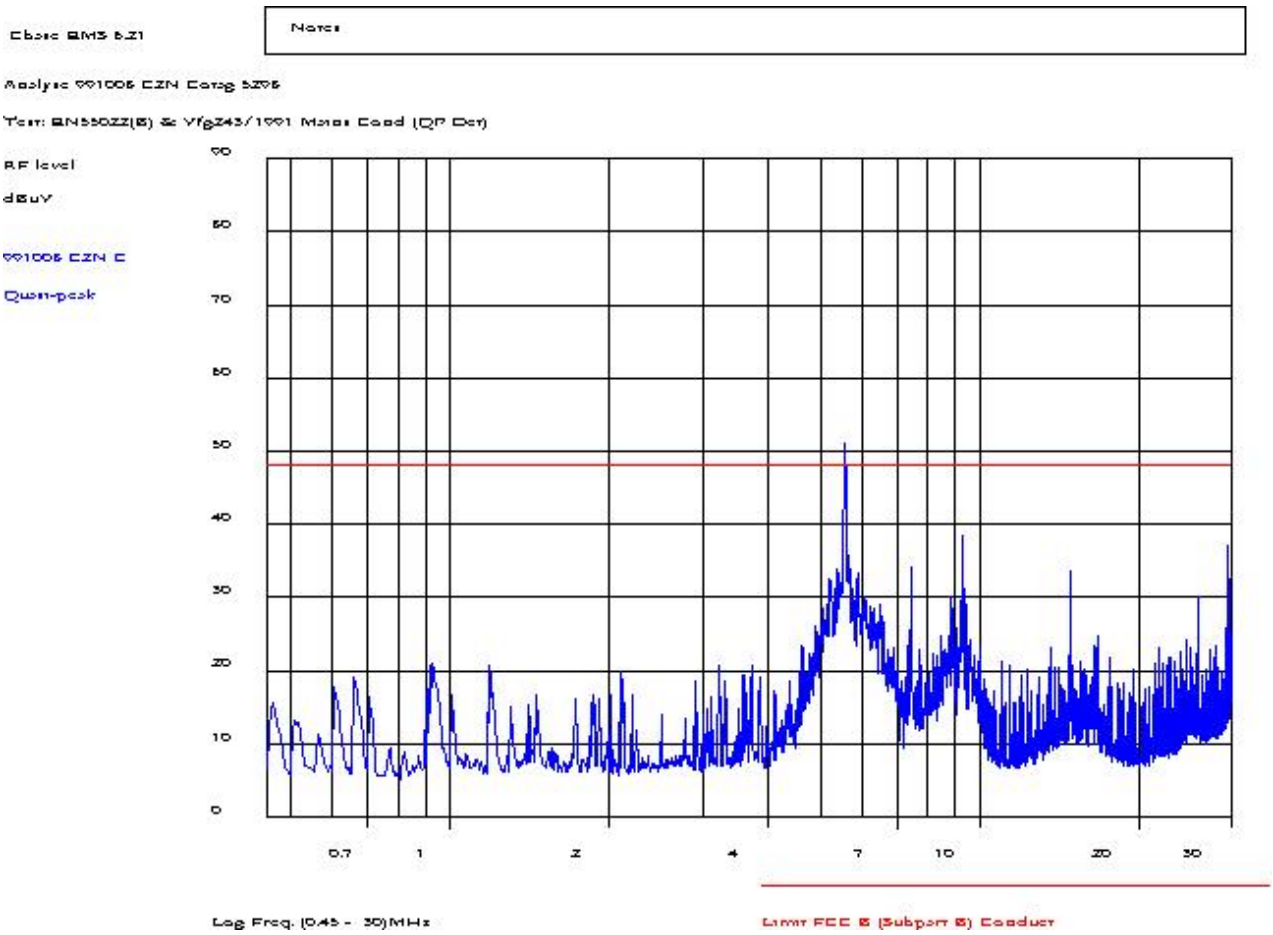


Frequency List (MHz)

5.542	29.494		
7.391	29.564		
9.240			
14.783			
16.630			

PLOT 1 Conducted Emission Scan - Live

Test	Line	Mod	Op. Mode	Test Engineer	Date
C1	L	0	1	DS	8 Oct 99

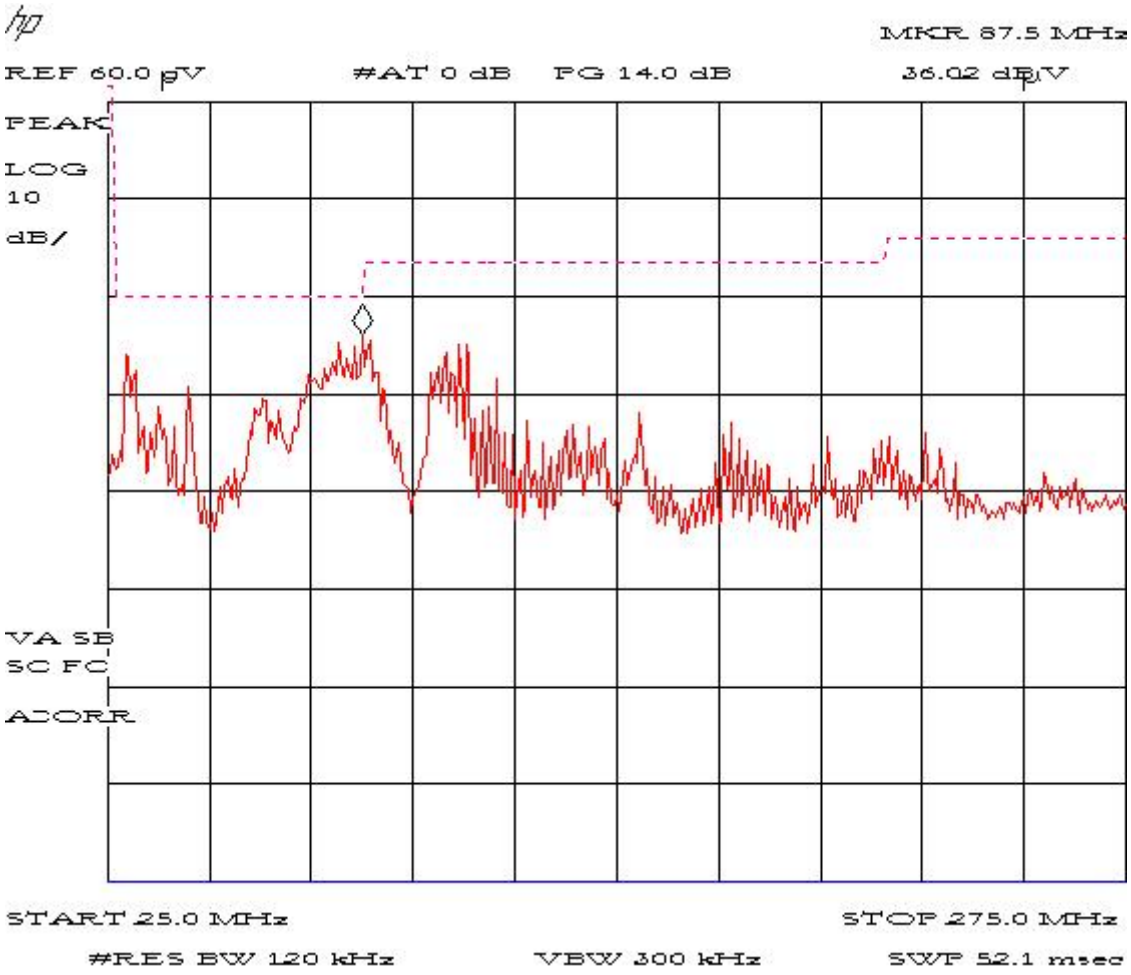


Frequency List (MHz)

5.544	9.240		
5.894	29.566		
7.391			
9.241			
14.783			

Plot 2 Conducted Emission Scan - Neutral

Test	Line	Mod	Op. Mode	Test Engineer	Date
C2	N	0	1	DS	8 Oct 99

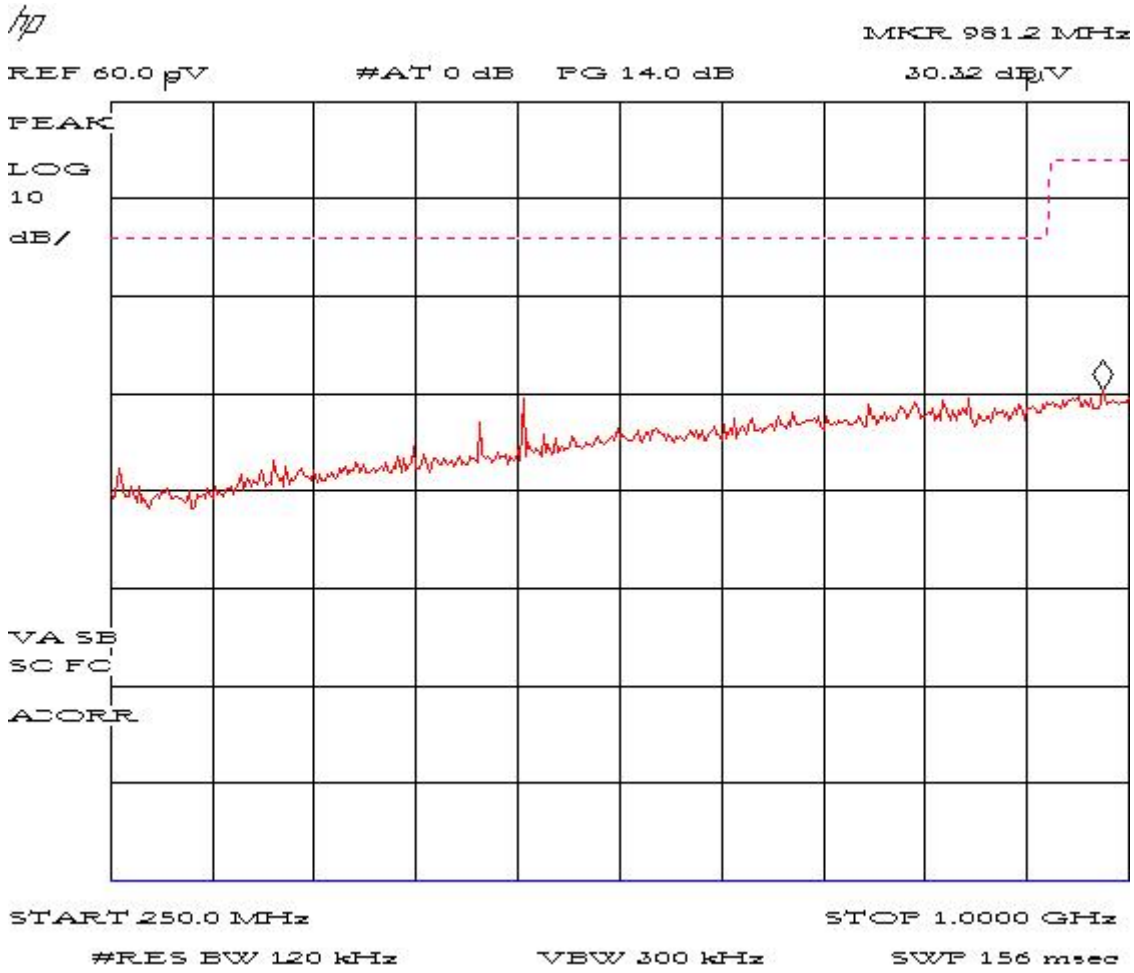


Frequency List (MHz)

31.400	86.637	216.210	
44.248	88.500	218.058	
62.845	110.869		
74.872	112.733		
81.111	120.103		

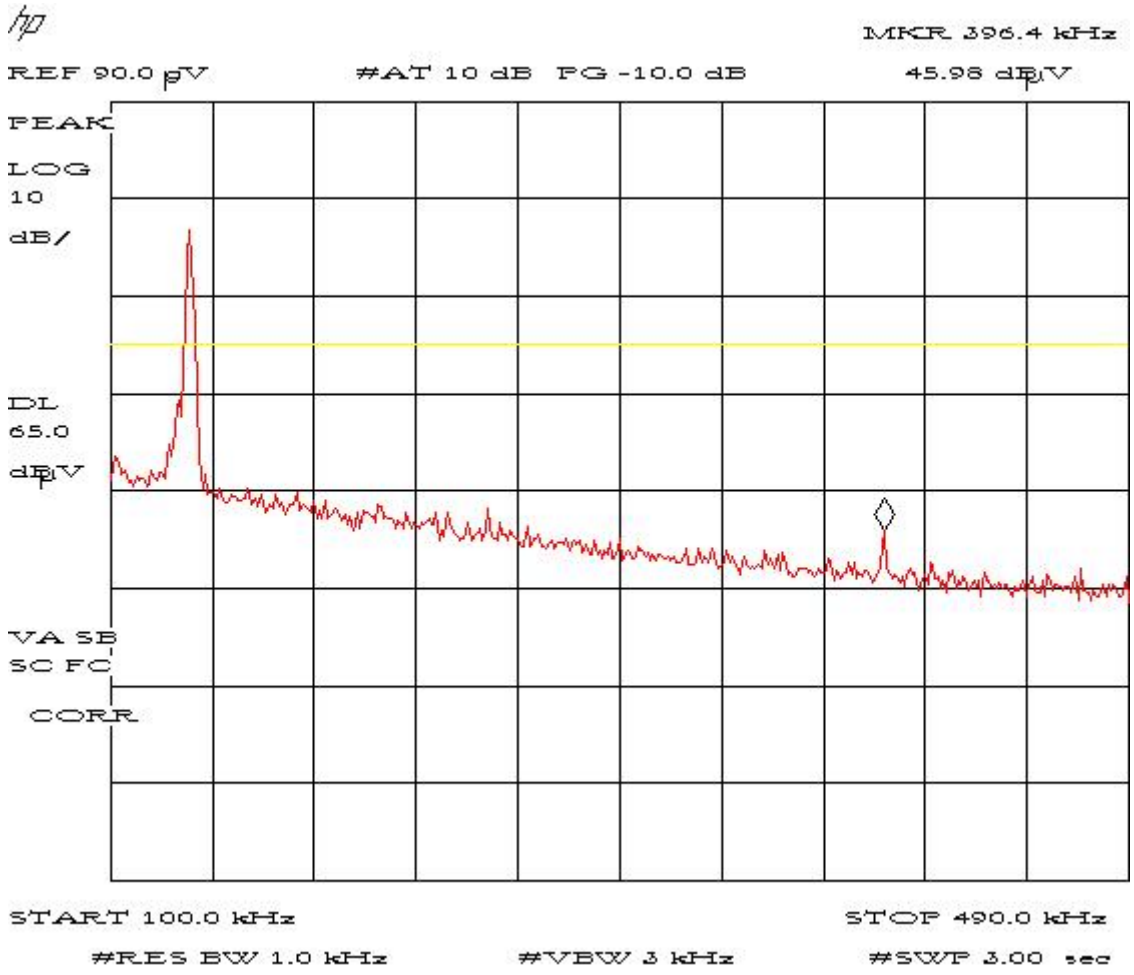
Plot 3 Radiated Emission Scan: 25MHz - 275MHz

Test	Pol	Dist. (m)	Height (m)	Mod	Op. Mode	Test Engineer	Date
R3	V+H	3	1	0	1	DS	8 Oct 99



Plot 4 Radiated Emission Scan: 250MHz - 1GHz

Test	Pol	Dist. (m)	Height (m)	Mod	Op. Mode	Test Engineer	Date
R3	V+H	3	1	0	1	DS	8 Oct 99

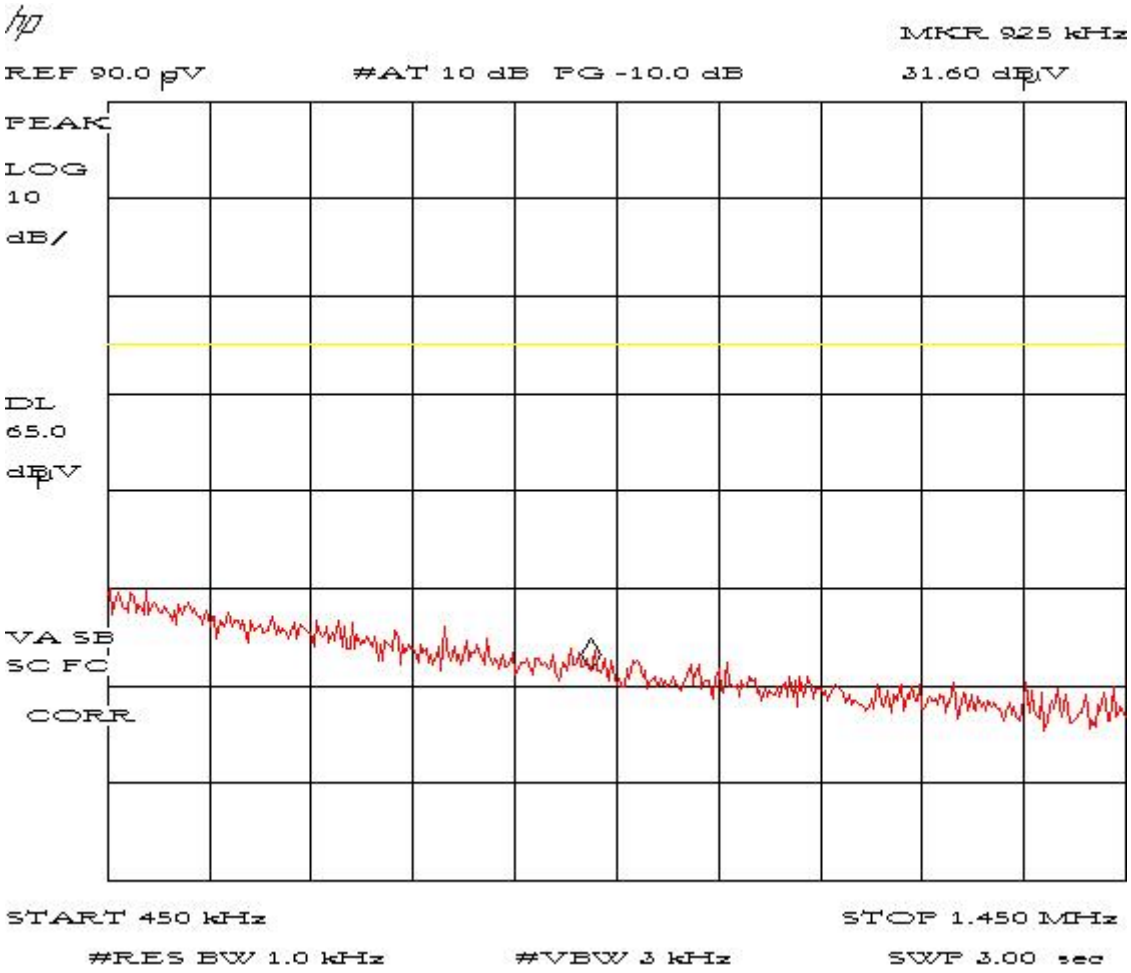


Only siginificant frequency = fundemental at 132kHz

Plot 5 Radiated Emission Scan: 100kHz - 490kHz

Test	Pol	Dist. (m)	Height (m)	Mod	Op. Mode	Test Engineer	Date
R1	C+O	3	1	0	1	DS	8 Oct 99

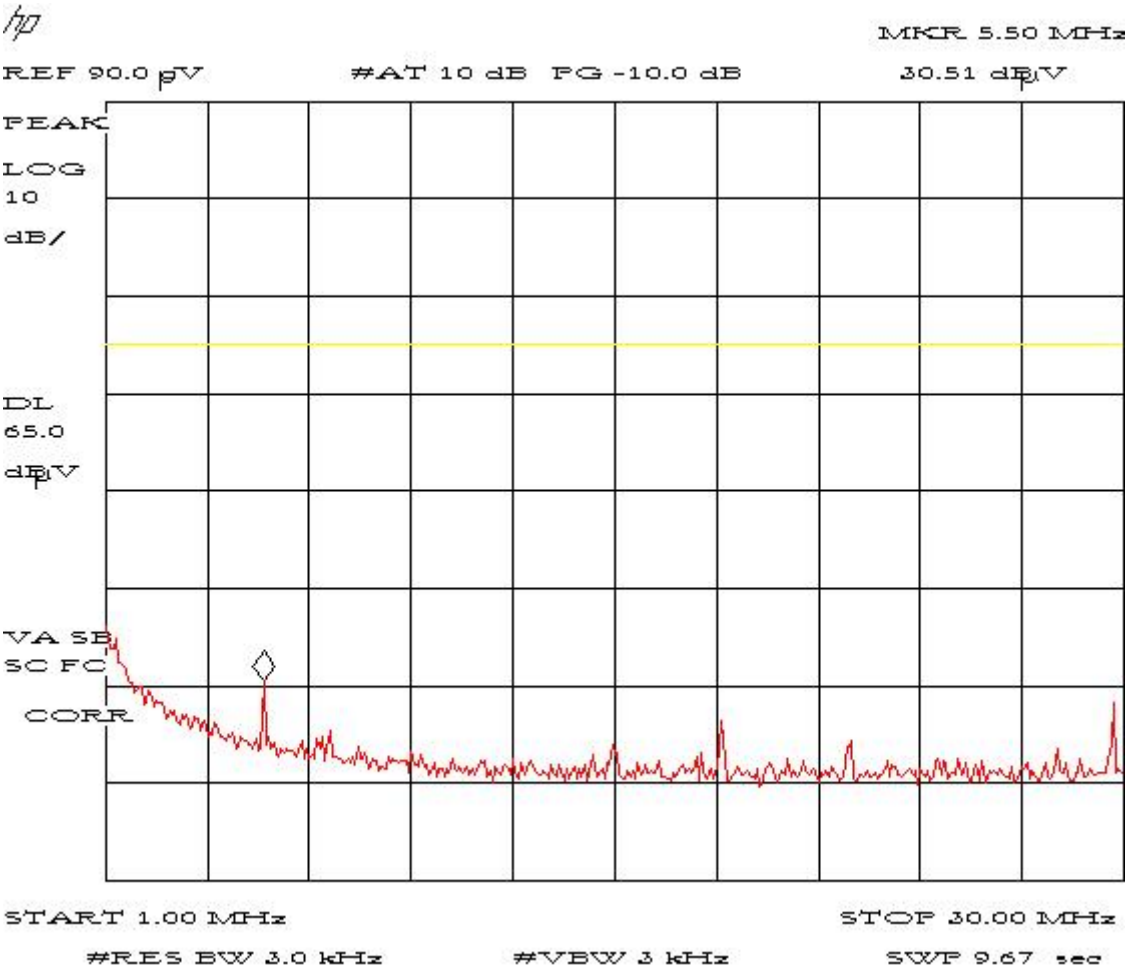
c=co-axial
o=orthaganol
limit varies with frequency - line shown on graph = lowest limit level



PLOT 6 Radiated Emission Scan: 450kHz - 1.45MHz

Test	Pol	Dist. (m)	Height (m)	Mod	Op. Mode	Test Engineer	Date
R1	C+O	3	1	0	1	DS	8 Oct 99

c=co-axial
o=orthaganol
limit varies with frequency - line shown on graph = lowest limit level



Plot 7 **Radiated Emission Scan: 1MHz - 30MHz**

Test	Pol	Dist. (m)	Height (m)	Mod	Op. Mode	Test Engineer	Date
R1	C+O	3	1	0	1	DS	8 Oct 99

c=co-axial
o=orthaganol
limit varies with frequency - line shown on graph = lowest limit level