dB Technology
|---------- (Cambridge Ltd.) ----------|
EMC Testing | EMC Consultancy | EMC Training

23, Headington Drive,
Cambridge.
CB1 9HE
Tel : 01954 251974 (test site)
or : 01223 241140 (accounts)
Fax : 01954 251907
web : www.dbtechnology.co.uk
email: mail@dbtechnology.co.uk

REPORT ON ELECTROMAGNETIC COMPATIBILITY TESTS

Performed at:
TWENTY PENCE TEST SITE

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

on

Diomed Ltd

D30 plus

dated

26 August 2003

Document History

Issue	Date	Affected page(s)	Description of modifications	Revised by	Approved by
1	26/8/2003		Initial release		

Equipment Under Test (EUT):	**D30 plus**
Test Commissioned by:	**Diomed Ltd** **Cambridge Research Park** **Beach Drive** **Cambridge** **CB5 9TE**
Representative:	**Chris Daily**
Test Started:	**9 June 2003**
Test Completed:	**1 August 2003**
Test Engineer:	**Dave Smith**
Date of Report:	**26 August 2003**
Report:	

Written by:	**Dave Smith**	**Checked by:**	**Derek Barlow**
Signature:	D. A. Smith	**Signature:**	D. Barlow
Date:	**4th September 2003**	**Date:**	**4th September 2003**

dB Technology can only report on the specific unit(s) tested at its site. The responsibility of extrapolating this data to a product line lies solely with the manufacturer.

Test Standards Applied

CFR 47 : 2002 **Class A**	***Code of Federal Regulations: Pt 15 Subpart B- Radio Frequency Devices - Unintentional Radiators***

Emissions Test Results Summary

CFR 47 : 2002 **PASS**

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

Contents

1 EUT Details

1.1 General

The EUT was a Diomed D30 plus which included the A5/597 RFID module. The D30 plus is a medical laser device. The A5/597 RFID module is used to identify the type of attachment connected to the laser by reading from a tag. Testing of the RFID module intentional radiator is covered by a separate report (dB Technology report R1739.

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
	Diomed	AS/597	RF ID module		
	Diomed	D30 plus	Laser		

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.

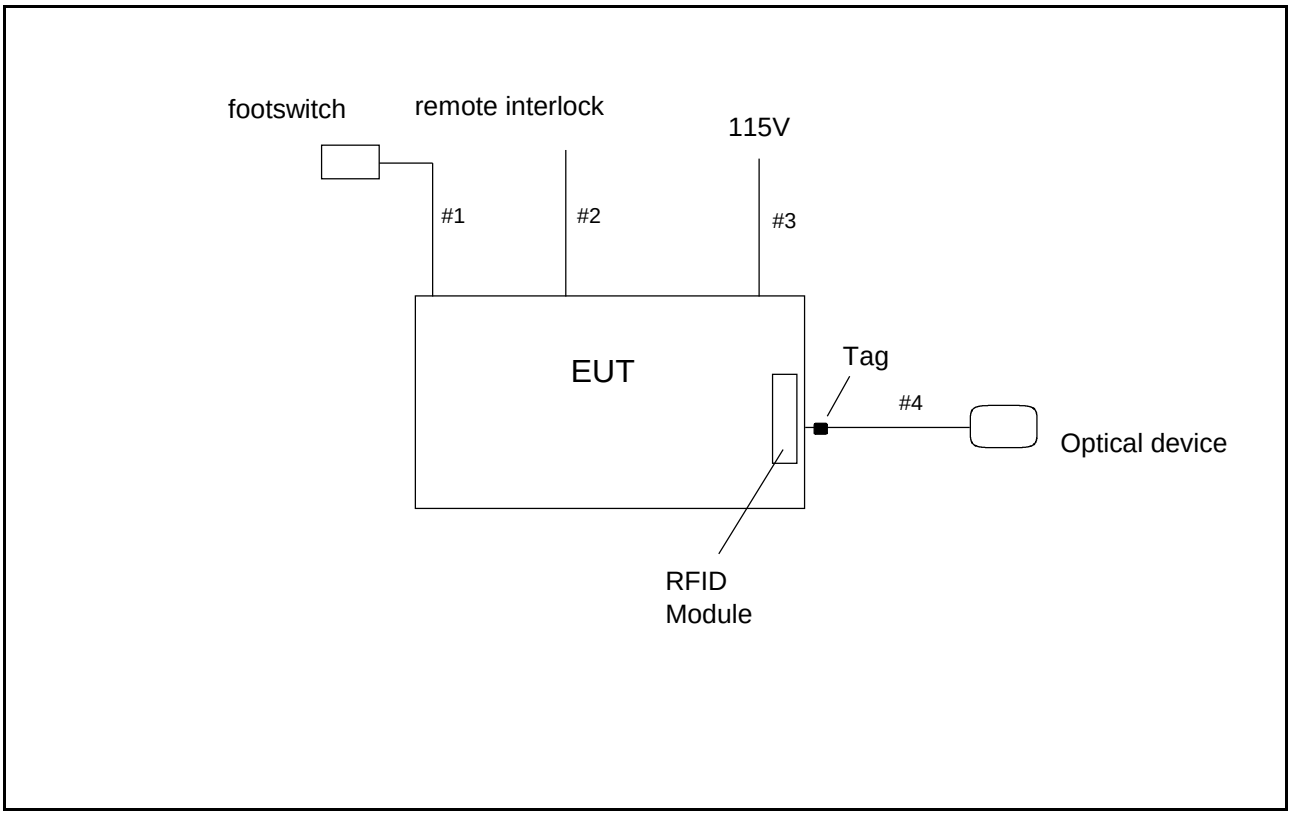
Mod No:	Details	Implemented for
0	Original unit.	
1	470nF X cap fitted. Ferrite on primary of transformer.	Conducted emissions
2	Ferrite (with turn) on remote interlock cable.	Radiated emissions
3	Mains transformer rotated to shorten secondary wires and tidy primary wires. Transformer earth shield extended to follow primary cable form. Rear panel earth connected directly to IEC inlet mounting screws. Fan shield grounded. Ferrite on transformer primary leads. Ferrite on IEC to chassis earth lead. Copper tape on each lid mounting boss.	Conducted emissions

1.3 EUT Operating Modes

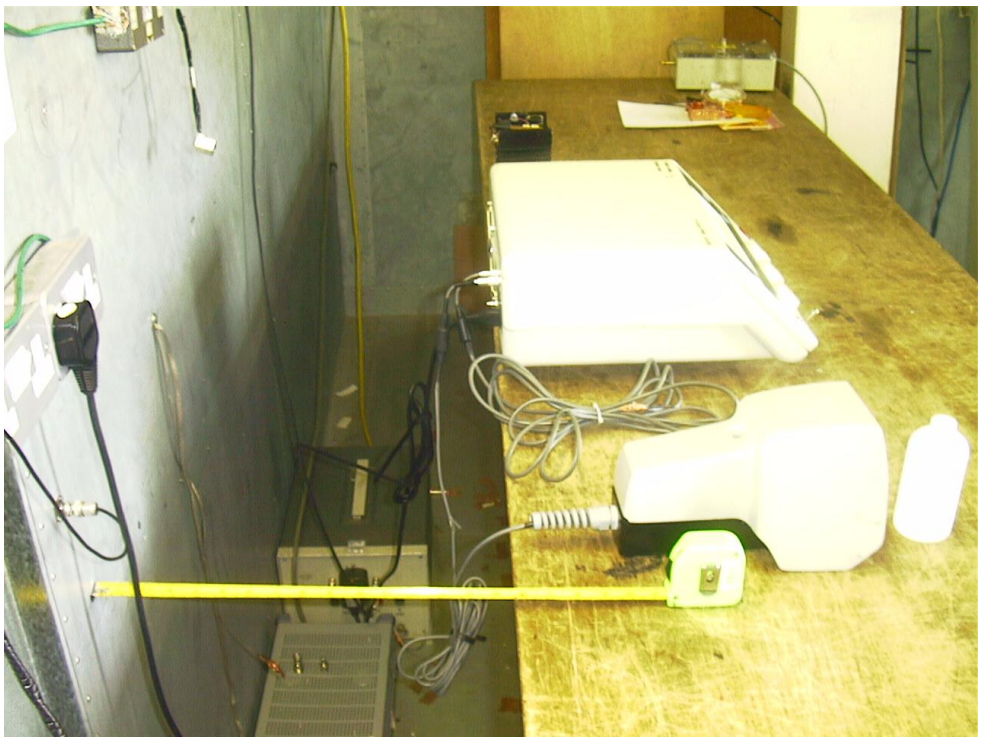
The EUT was tested in the following operating mode or modes. Generally, operating modes are chosen that will exercise the functions of the EUT as fully as possible and in a manner likely to produce maximum emission levels or susceptibility. Individual test result sheets reference the operating mode of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

Operating Mode	Details
1	**Laser firing at 30W.**
2	**Ready to fire mode.**

Figure 1 General Arrangement of EUT and Peripherals

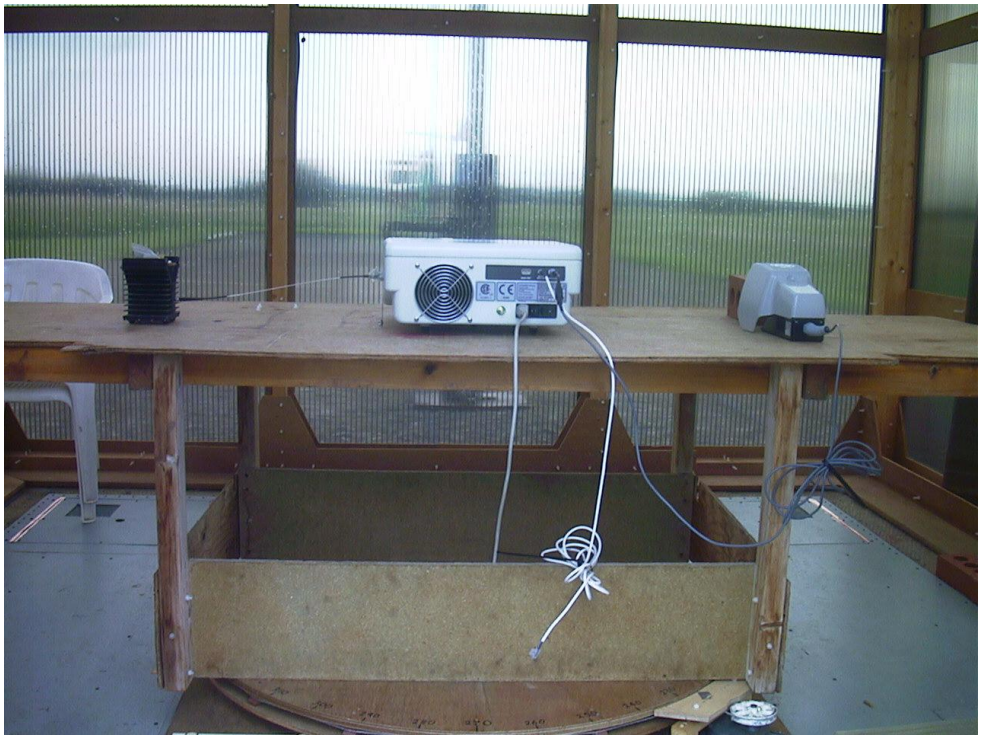


#1 Footswitch cable - screened - 4m long.
#2 Remote interlock cable - screened - 3m long.
#3 Unscreened ac power lead - 2m long.
#4 Fibre optic cable.



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 Number
R3	Rohde and Schwarz	ESHS10	RF Receiver (9kHz-30MHz)	843743/010
R4	Rohde and Schwarz	ESVS10	RF Receiver (20MHz-1GHz)	843744/002
R5 R5B	Hewlett Packard Hewlett Packard	HP 8595E HP87405A	Spectrum Analyser Pre-amp	3412A00701 3207A00322
L1	EMCO	3825/2	LISN	1358
L2	Rohde and Schwarz	ESH3-Z5	LISN	843862/009
A4	Chase	CBL6112	Bilog Antenna (30MHz-2GHz)	2027
A5	Chase	CBL6111A	Bilog Antenna (30MHz-1GHz)	1760

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.

4.1 Conducted Emission Results

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

Conducted Emissions

Company:	Diomed Ltd	*Product:*	D30 plus
Date:	16 July 2003	*Test Eng:*	Dave Smith
Ports:	ac power		
Test:	ANSI C63.4:1992 using limits of		CISPR22(A)
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 CISPR22(A) dBuV	Margin CISPR22(A) dB	Limit	Margin	Notes
	1	3	L	1	0.220	qp	53.3	10.2	63.4	79.0	15.6			
	1	3	N	1	0.220	qp	53.7	10.2	63.9	79.0	15.1			
Results							Minimum Margin PASS/FAIL			15.1 dB PASS				

Notes	Comments and Observations
	Results of scans shown in plot 1 and plot 2. The plots show peak measurements at least 6dB below the quasi-peak limit and average measurements at least 10dB below the average limit.

4.2 Radiated Emissions Results

Test Equipment:	Factor Set 1:	HFBILOG	RG214	25 m cable

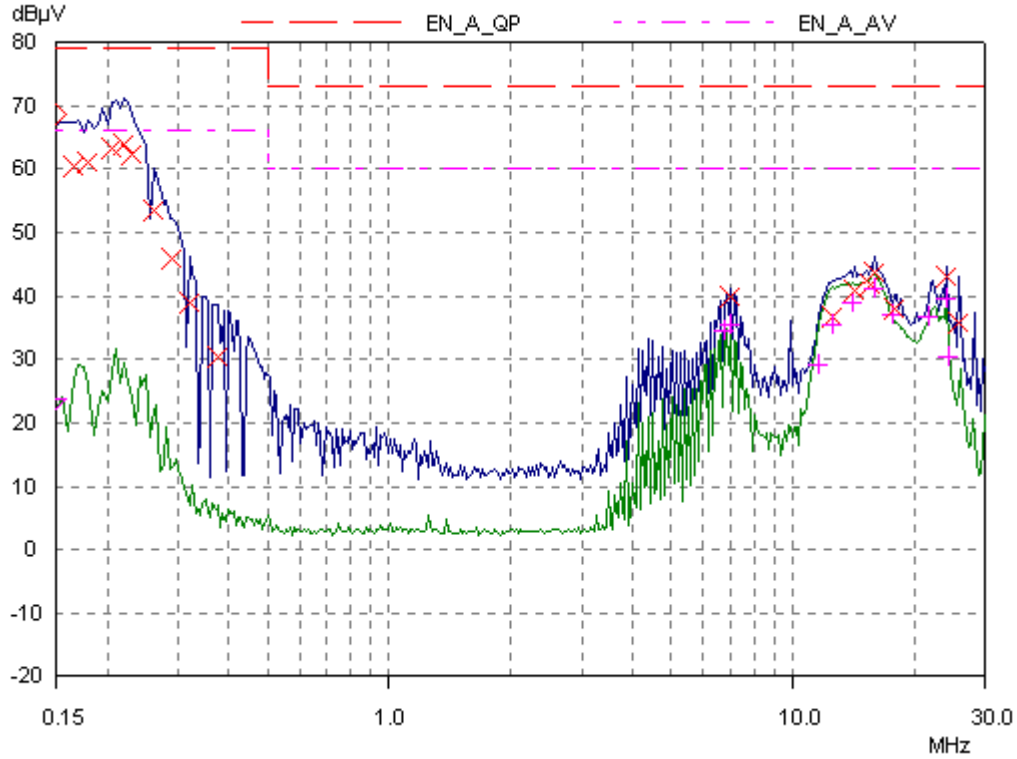
Radiated Emissions

Company:	Diomed Ltd	*Product:*	D30 plus
Date:	9 June 2003	*Test Eng:*	Dave Smith
Ports:			
Test:	ANSI C63.4:1992 using limits of		CISPR22(A)
Ports:			
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 CISPR22(A) dBuV/m	Margin CISPR22(A) dB	Limit	Margin	Notes
	2	1	10	1	48.000	V	17.2	10.1	27.3	40.0	12.7			
	2	1	10	1	30.000	V	3.8	19.7	23.5	40.0	16.6			
	2	1	10	1	32.000	V	3.8	18.5	22.3	40.0	17.7			
	2	1	10	1	64.000	V	16.2	7.6	23.8	40.0	16.2			
	2	1	10	1	68.000	V	10.2	7.6	17.8	40.0	22.2			
	2	1	10	1	88.000	V	3.2	10.2	13.4	40.0	26.6			
	2	2	10	1	124.000	V	-2.8	14.1	11.3	40.0	28.7			#1
	2	1	10	1	200.000	V	4.8	12.2	17.0	40.0	23.0			
	2	2	10	1	208.000	V	14.2	12.1	26.3	40.0	13.7			#1
	1	2	10	1	48.000	V	16.4	10.1	26.5	40.0	13.5			#1
	1	2	10	1	30.000	V	-2.8	19.7	16.9	40.0	23.2			#1
	1	2	10	1	32.000	V	4.3	18.5	22.8	40.0	17.2			#1
	1	2	10	1	64.000	V	5.0	7.6	12.6	40.0	27.4			#1
	1	2	10	1	68.000	V	6.7	7.6	14.3	40.0	25.7			#1
	1	2	10	1	88.000	V	7.8	10.2	18.0	40.0	22.0			#1
	1	2	10	1	124.000	V	-2.1	14.1	12.0	40.0	28.0			#1
	1	2	10	1	200.000	V	3.4	12.2	15.6	40.0	24.4			#1
	1	2	10	1	208.000	V	14.3	12.1	26.4	40.0	13.6			#1
	1	2	10	1	30.000	H	-5.0	19.7	14.7	40.0	25.4			#1
	1	2	10	1	32.000	H	-3.6	18.5	14.9	40.0	25.1			#1
	1	2	10	1	48.000	H	11.8	10.1	21.9	40.0	18.1			#1
	1	2	10	1	64.000	H	6.4	7.6	14.0	40.0	26.0			#1
	1	2	10	1	68.000	H	3.8	7.6	11.4	40.0	28.6			#1
	1	2	10	1	88.000	H	3.3	10.2	13.5	40.0	26.5			#1
	1	2	10	1	124.000	H	-2.0	14.1	12.1	40.0	27.9			#1
	1	2	10	1	200.000	H	2.0	12.2	14.2	40.0	25.8			#1
	1	2	10	1	208.000	H	14.3	12.1	26.4	40.0	13.6			#1

Results	Minimum Margin	12.7 dB		
	PASS/FAIL	PASS		

Notes	Comments and Observations
#1	Results of screened room scans shown in plot 3 and 4. Ferrite with turn on remote interlock cable.



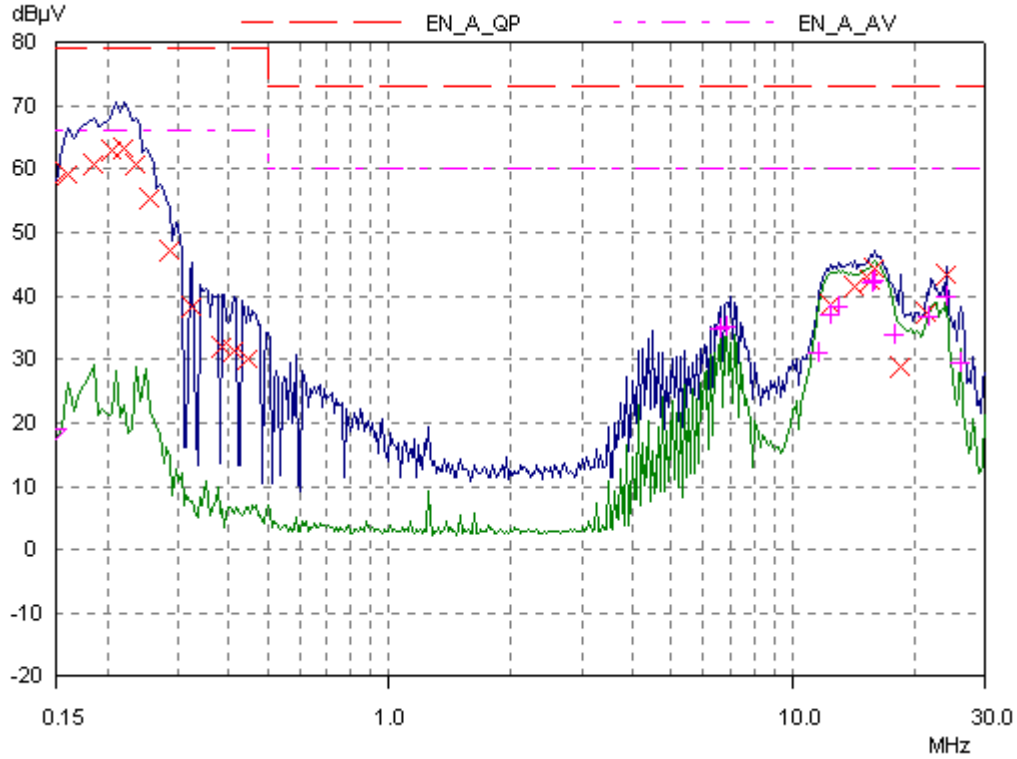
PLOT 1 Conducted Emissions - Neutral

Company:	Diomed	Product:	D30 plus
Date:	16 July 2003	Test Engineer:	DS
Test:	FCC part 15	Limit:	FCC A

Notes:
Firing.

Line:	Neutral	Attenuator:	10dB PAD	Operating Mode:	1
Detector:	QuasiPeak			Mod. State:	3
LISN:	EMCO	Filename:	C38137B0.plt		

Frequency List (MHz)



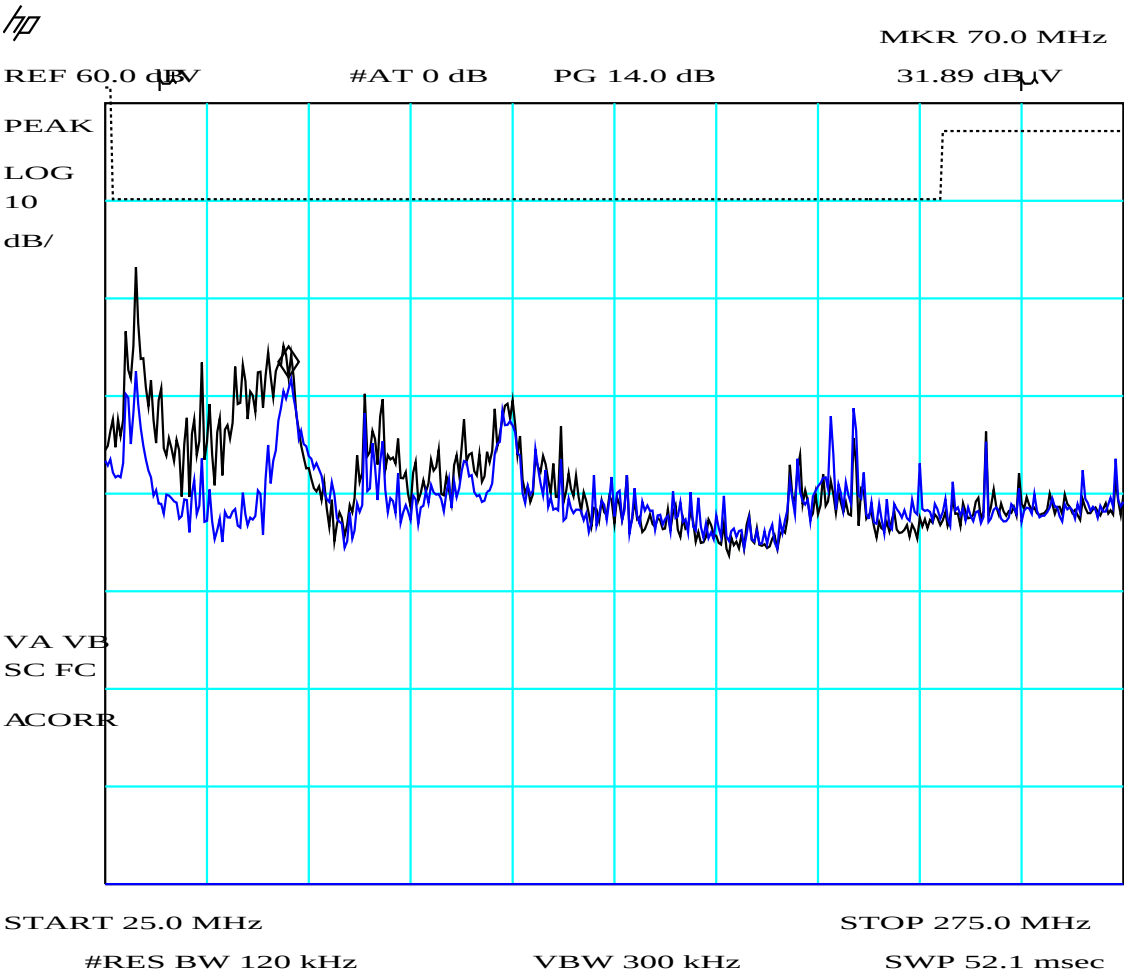
PLOT 2 Conducted Emissions - Live

Company:	Diomed	Product:	D30 plus
Date:	16 July 2003	Test Engineer:	DS
Test:	FCC part 15	Limit:	FCC A

Notes:
Firing

Line:	Live	Attenuator:	10dB PAD	Operating Mode:	1
Detector:	QuasiPeak			Mod. State:	3
LISN:	EMCO	Filename:	C38137CA.plt		

Frequency List (MHz)



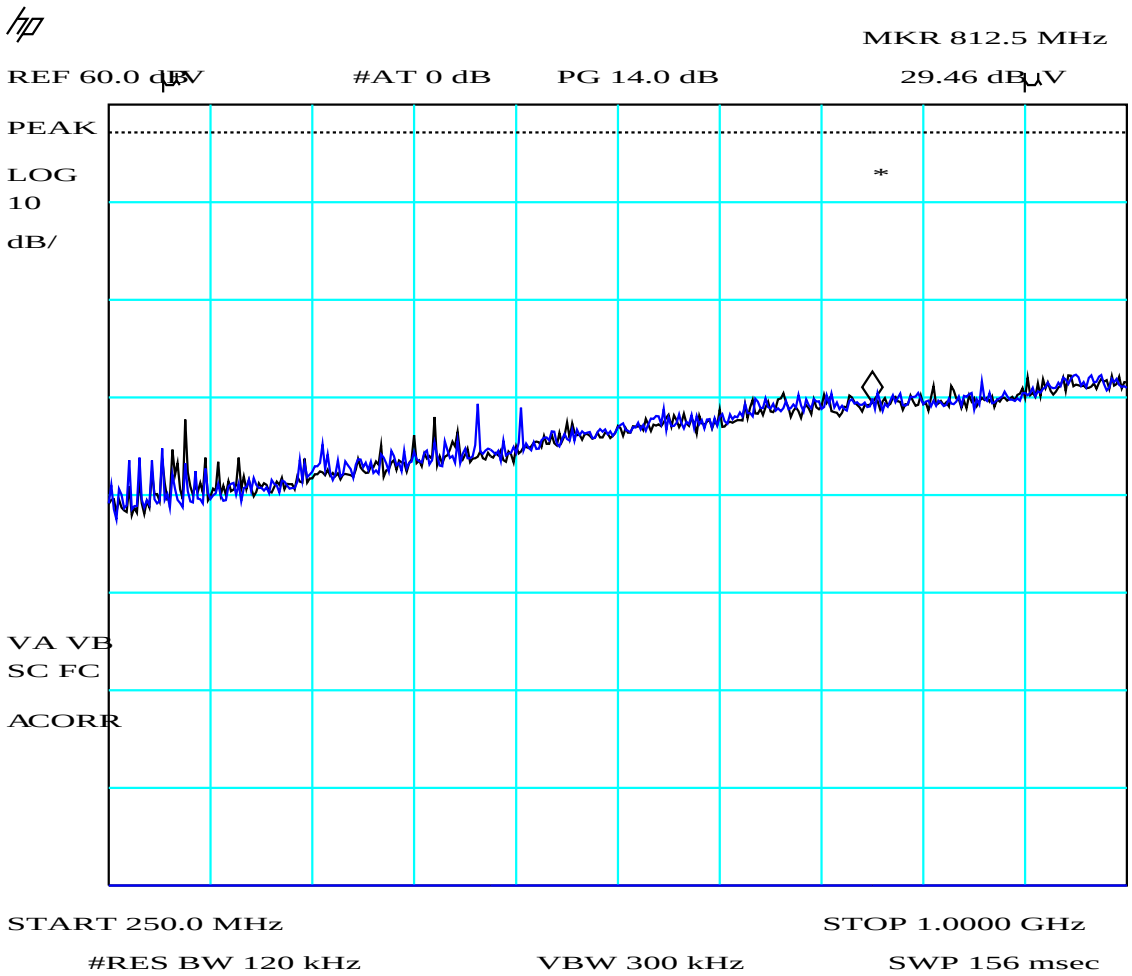
PLOT 3 Radiated Emissions - 25MHz to 275MHz

Company:	Diomed	Product:	Diomed 30 plus
Date:	09 Jun 03	Test Engineer:	Dave Smith
Test:	FCC part 15	Limit:	CISPR22 A

Notes:

Polarisation:	V + H	Orientation:	0 - 360°	Operating Mode:	1
Distance:	3m	Antenna:	Bilog	Mod. State:	0
Height:	1m	Filename:	H3609496.plt		

Frequency List (MHz)



PLOT 4 Radiated Emissions - 250MHz to 1GHz

Company:	Diomed	Product:	Diomed 30 plus
Date:	09 Jun 03	Test Engineer:	Dave Smith
Test:	FCC part 15	Limit:	CISPR22 A

Notes:

Polarisation:	V + H	Orientation:	0 - 360°	Operating Mode:	1
Distance:	3m	Antenna:	Bilog	Mod. State:	0
Height:	1m	Filename:	H36094B6.plt		

Frequency List (MHz)
