

	Report No: R1758 Issue No: 1		
	Test No: T0939	Test Report	Page: 1 of 16



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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

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		

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	Report No: R1758	
	Issue No: 1	
Test No: T0939	Test Report	Page: 2 of 16

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***

	Report No: R1758		
	Issue No: 1		
	Test No: T0939	Test Report	Page: 3 of 16

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	

	Report No: R1758 Issue No: 1	
	Test No: T0939	Test Report Page: 4 of 16

Contents

1 EUT Details	5
1.1 General	5
1.2 Modifications to EUT and Peripherals	5
1.3 EUT Operating Modes	6
<i>Figure 1 General Arrangement of EUT and Peripherals</i>	6
<i>Photograph 1 Conducted Emissions - Back</i>	7
<i>Photograph 2 Conducted Emissions - Front</i>	7
<i>Photograph 3 Radiated Emissions - Back</i>	8
<i>Photograph 4 Radiated Emissions - Front</i>	8
2 Test Equipment	9
3 Test Methods	10
3.1 Conducted Emissions - ac power	10
3.2 Radiated Emissions	10
4 Test Results	10
4.1 Conducted Emission Results	11
4.2 Radiated Emissions Results	12
<i>PLOT 1 Conducted Emissions - Neutral</i>	13
<i>PLOT 2 Conducted Emissions - Live</i>	14
<i>PLOT 3 Radiated Emissions - 25MHz to 275MHz</i>	15
<i>PLOT 4 Radiated Emissions - 250MHz to 1GHz</i>	16

	Report No: R1758 Issue No: 1	
	Test No: T0939	Test Report Page: 5 of 16

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.

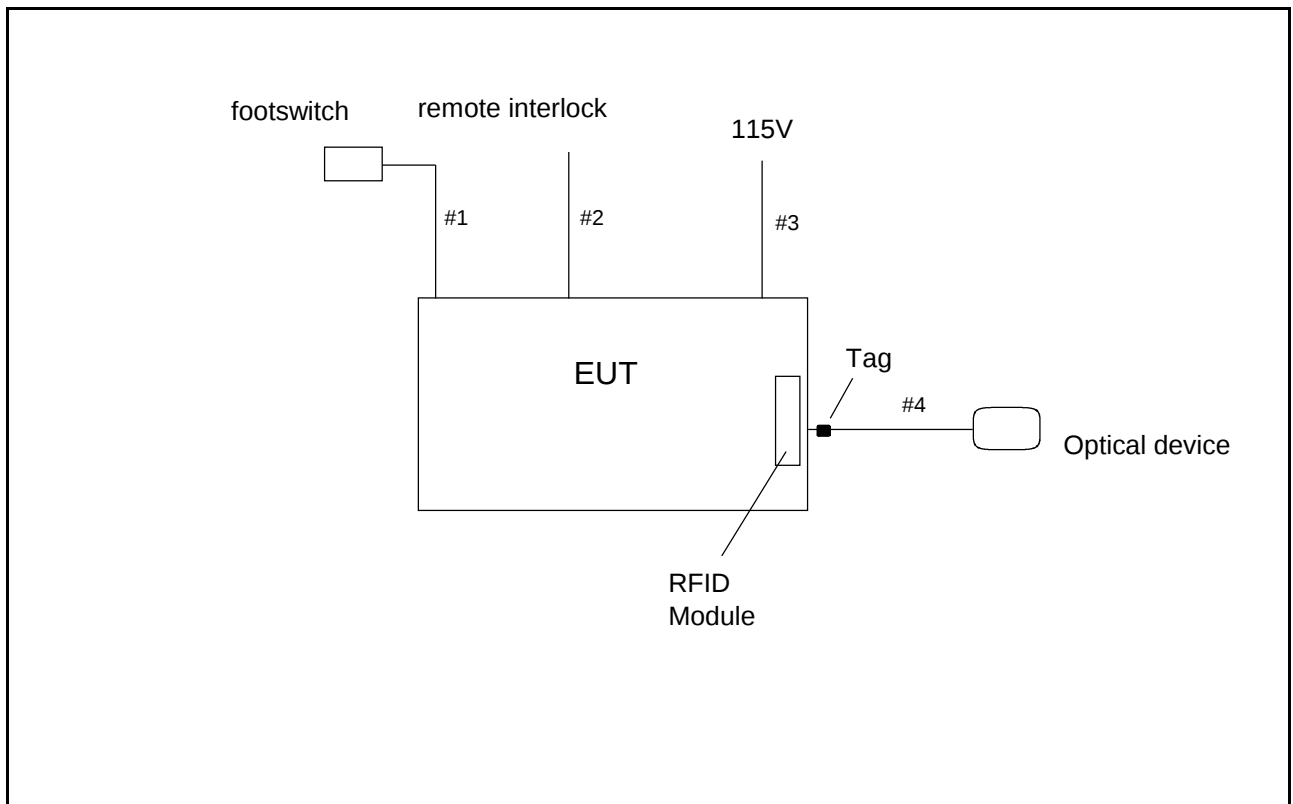
Mod No:	Details	Implemented for
0	Original unit.	
1	470nF X cap fitted. Ferrite on primary of transformer.	Conducted emissions
2	Ferrite (with turn) on remote interlock cable.	Radiated emissions
3	Mains transformer rotated to shorten secondary wires and tidy primary wires. Transformer earth shield extended 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.

	Report No: R1758		
	Issue No: 1		
Test No: T0939	Test Report		Page: 7 of 16



Photograph 1 Conducted Emissions - Back



Photograph 2 Conducted Emissions - Front

	Report No: R1758		
	Issue No: 1		
Test No: T0939	Test Report		Page: 8 of 16



Photograph 3 Radiated Emissions - Back



Photograph 4 Radiated Emissions - Front

	Report No: R1758 Issue No: 1	
	Test No: T0939	Test Report Page: 10 of 16

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.

	Report No: R1758	Test Report	Page: 11 of 16
	Issue No: 1		
	Test No: T0939		

4.1 Conducted Emission Results

Test Equipment:	Factor Set 1:	EMLISN	10DB_PAD	RG214	10 m cable
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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		15.1 dB			
										PASS/FAIL		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.														

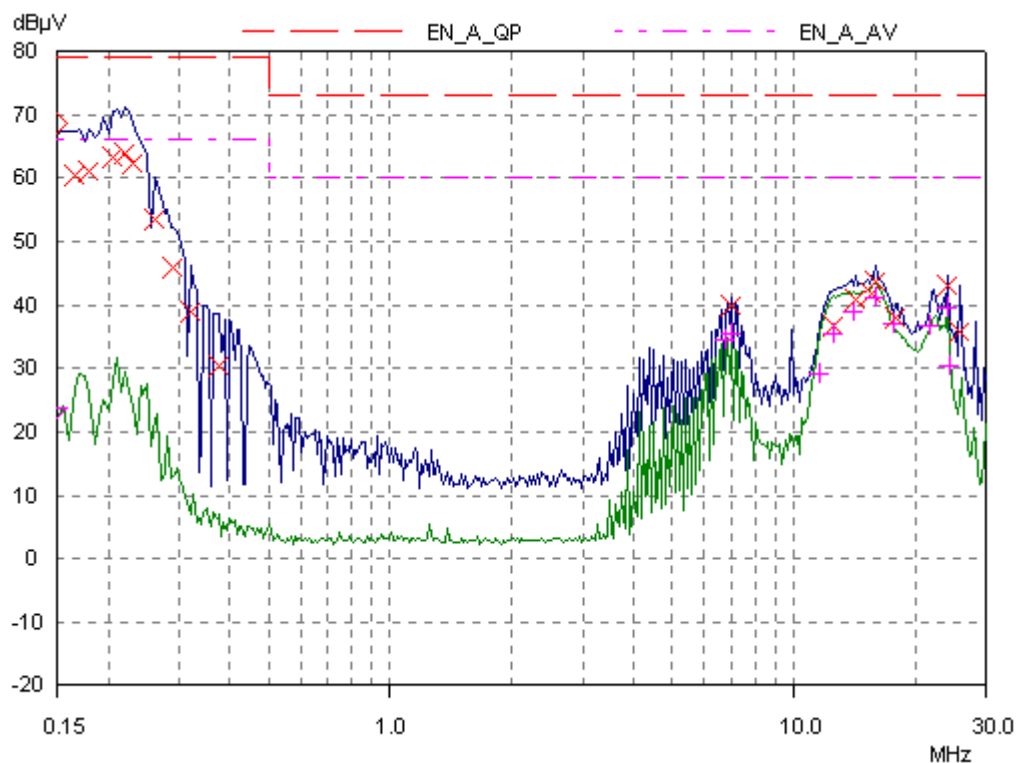
	Report No: R1758 Issue No: 1	Test Report	Page: 12 of 16
	Test No: T0939		

4.2 Radiated Emissions Results

Test Equipment:	Factor Set 1:	HFBIOLOG	RG214	25 m cable
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Radiated Emissions

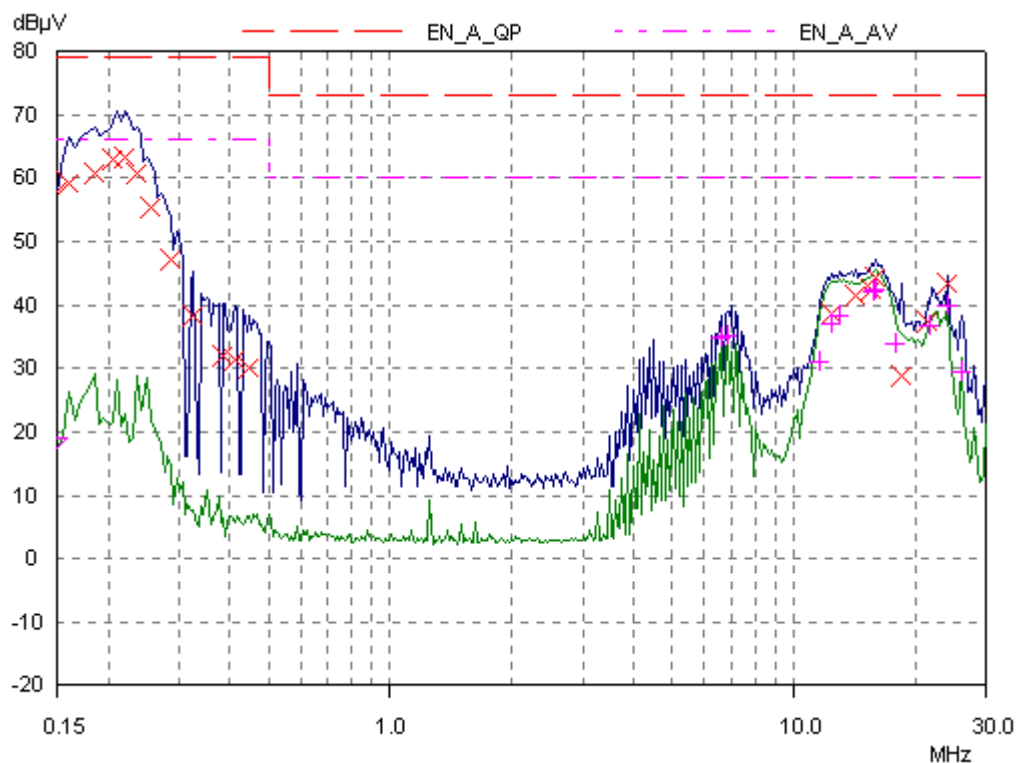
Company: Diomed Ltd										Product: D30 plus				
Date: 9 June 2003										Test Eng: Dave Smith				
Ports:														
Test: ANSI C63.4:1992 using limits of CISPR22(A)														
Ports:														
Test:														
Test	Op Mode	Mod State	Dist m	Fact Set	Freq. MHz	Ant Pol	Rec. Level dBuV	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 PASS/FAIL					12.7 dB 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
Detector:	QuasiPeak	Operating Mode:	1
LISN:	EMCO	Mod. State:	3
Filename:		C38137B0.plt	

Frequency List (MHz)



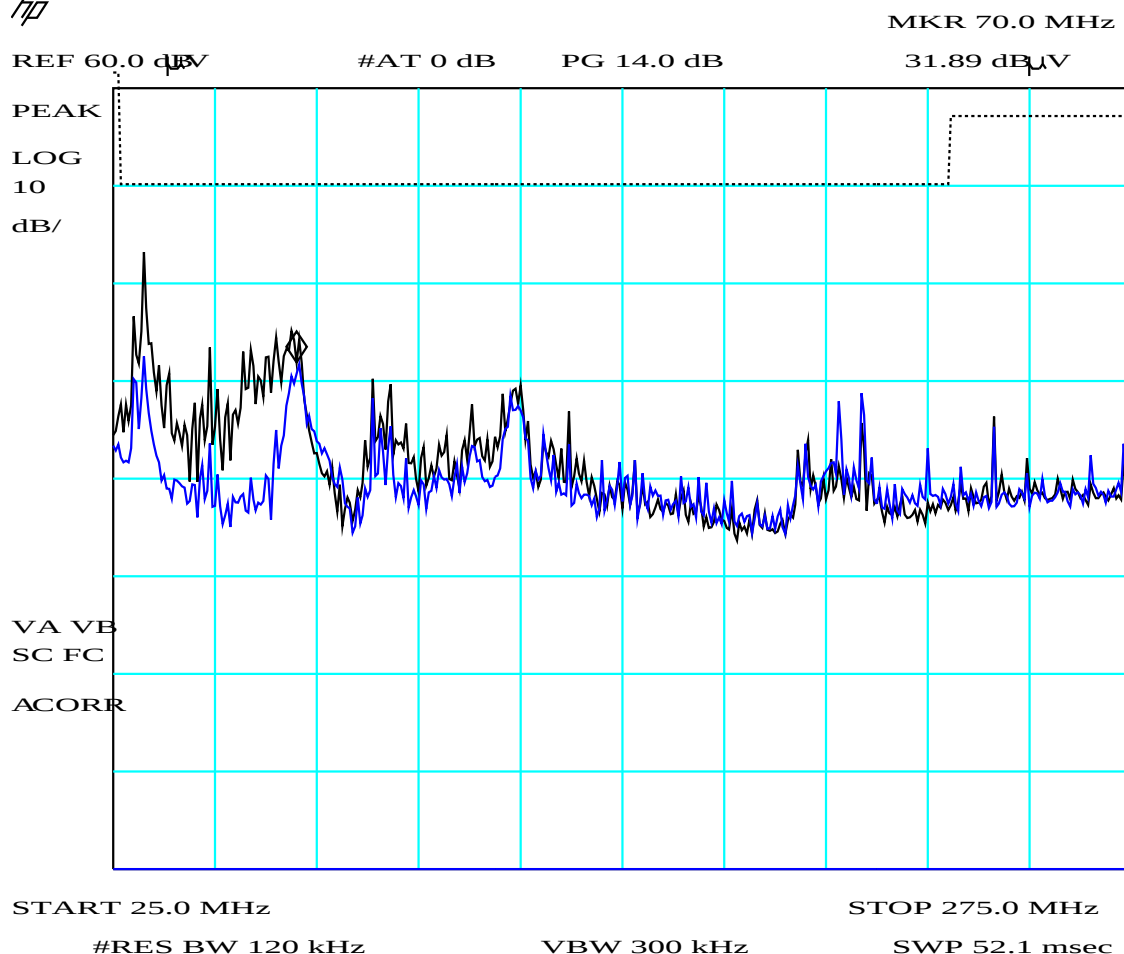
PLOT 2 Conducted Emissions - Live

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
Detector:	QuasiPeak	Operating Mode:	1
LISN:	EMCO	Mod. State:	3
Filename:		C38137CA.plt	

Frequency List (MHz)

	Report No: R1758	Test Report	Page: 15 of 16
	Issue No: 1		
	Test No: T0939		

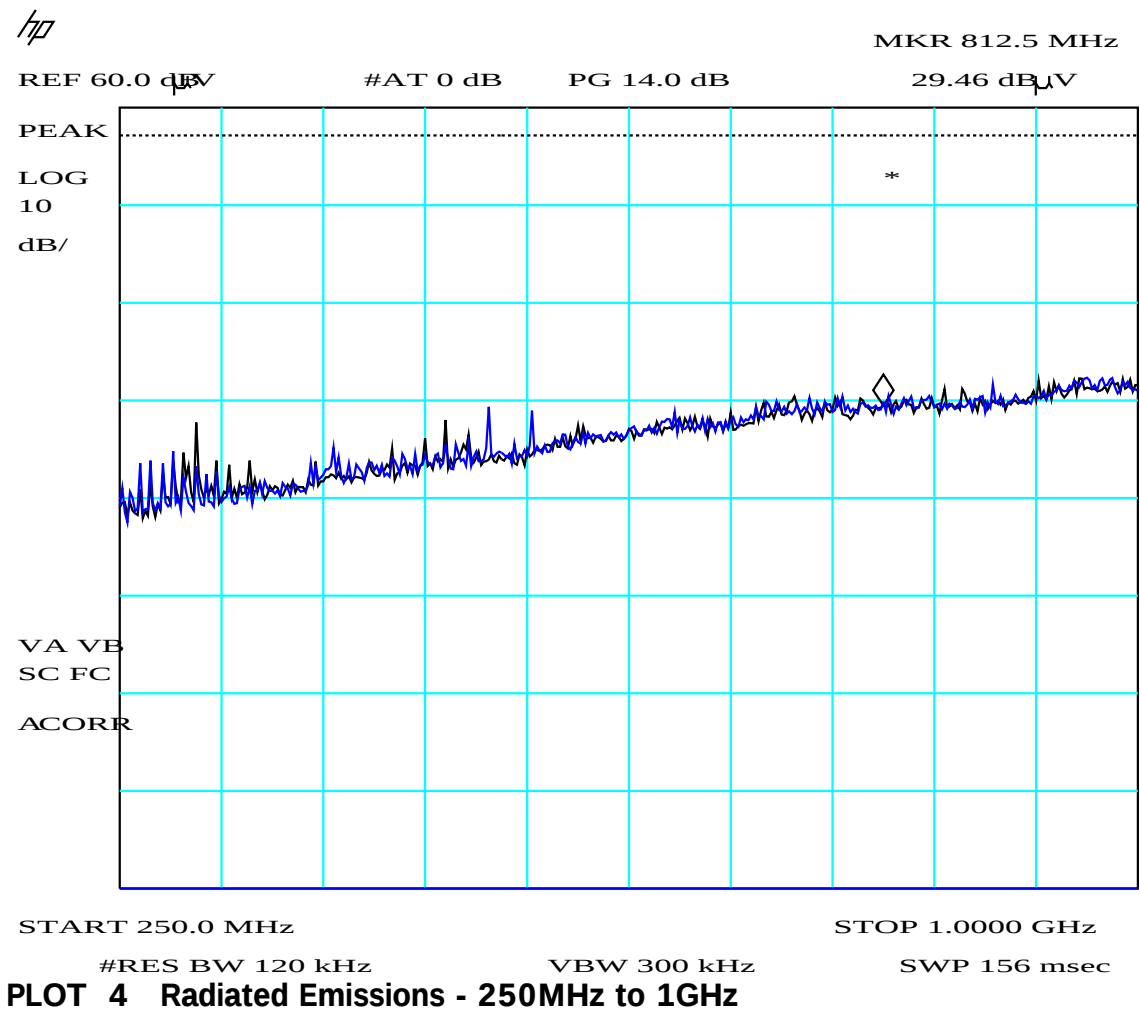
hp



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°
Distance:	3m	Antenna:	Bilog
Height:	1m	Filename:	H3609496.plt
		Operating Mode:	1
		Mod. State:	0

Frequency List (MHz)



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°
Distance:	3m	Antenna:	Bilog
Height:	1m	Filename:	H36094B6.plt
Operating Mode:		1	
Mod. State:		0	

Frequency List (MHz)
