

	Report No: <b>R1739</b> Issue No: <b>1</b>	FCC ID: RBQAS597	
Test No: <b>T0939</b>		<b>Test Report</b>	Page: <b>1 of 20</b>



**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](http://www.dbtechnology.co.uk)  
 email: [mail@dbtechnology.co.uk](mailto: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

RFID Module AS/597

dated

**16 July 2003**

	Report No: <b>R1739</b>	FCC ID: RBQAS597	Page: <b>2 of 20</b>
	Issue No: <b>1</b>	Test No: <b>T0939</b>	

Equipment Under Test (EUT):

RFID Module AS/597

Test Commissioned by:

Diomed Ltd  
Cambridge Research Park  
Beach Drive  
Cambridge  
CB5 9TE

Representative:

Chris Daily

Test Started:

9 June 2003

Test Completed:

8 July 2003

Test Engineer:

Dave Smith

Date of Report:

16 July 2003

Report:

Written by: Dave Smith

Checked by: Derek Barlow

Signature: D. A. Smith

Signature: D. Barlow

Date: 17 July 2003

Date: 17 July 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 : 2003

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

	Report No: <b>R1739</b> Issue No: <b>1</b>	FCC ID: RBQAS597	
Test No: <b>T0939</b>		<b>Test Report</b>	Page: <b>3 of 20</b>

## Emissions Test Results Summary

CFR 47 : 2003

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

	Report No: <b>R1739</b> Issue No: <b>1</b>	FCC ID: RBQAS597	
Test No: <b>T0939</b>		<b>Test Report</b>	Page: <b>4 of 20</b>

## Contents

<b>1 EUT Details</b>	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 on Test Jig</i>	8
<i>Photograph 4 Radiated Emissions in Laser</i>	8
<b>2 Test Equipment</b>	9
<b>3 Test Methods</b>	10
3.1 Conducted Emissions - ac power	10
3.2 Radiated Emissions <30MHz	10
<b>4 Test Results</b>	10
4.1 Conducted Emission Results	11
4.2 Radiated Emissions Results <30MHz	12
<i>PLOT 1 Conducted Emissions - Live Line</i>	13
<i>PLOT 2 Conducted Emissions - Neutral Line</i>	14
<i>PLOT 3 Radiated Emissions - 9kHz to 150kHz - Fitted in D30 plus</i>	15
<i>PLOT 4 Radiated Emissions - 150kHz to 1.5MHz - Fitted in D30 plus</i>	16
<i>PLOT 5 Radiated Emissions - 1.5MHz to 30MHz - Fitted in D30 plus</i>	17
<i>PLOT 6 Radiated Emissions - 9kHz to 150kHz - Fitted to Test Jig</i>	18
<i>PLOT 7 Radiated Emissions - 150kHz to 1.5MHz - Fitted to Test Jig</i>	19
<i>PLOT 8 Radiated Emissions - 1.5MHz to 30MHz - Fitted to Test Jig</i>	20

	Report No: R1739 Issue No: 1 Test No: T0939	FCC ID: RBQAS597 <b>Test Report</b>	Page: 5 of 20
-----------------------------------------------------------------------------------	---------------------------------------------------	----------------------------------------	---------------

## 1 EUT Details

### 1.1 General

The EUT was a Diomed AS/597 RFID module. The module is intended to be fitted to Diomed laser products. Its purpose is to identify the type of optical peripheral device connected to the laser by reading information from a tag.

The AS/597 module is an intentional transmitter operating at a nominal frequency of 125kHz.

This report only covers the RFID module - not the laser device as a whole. Radiated emissions from the intentional transmitter were measured with the module fitted inside a typical laser unit (the Diomed D30 plus) and also outside of a laser unit (fitted to a test jig). Conducted emissions were measured on the power leads of the Diomed D30 plus with the RFID module fitted.

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
	Diomed	AS/597	RF ID module	PILOT/04	RBQAS597
	Diomed	D30 plus	Laser	D30P2300	N/A

### 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

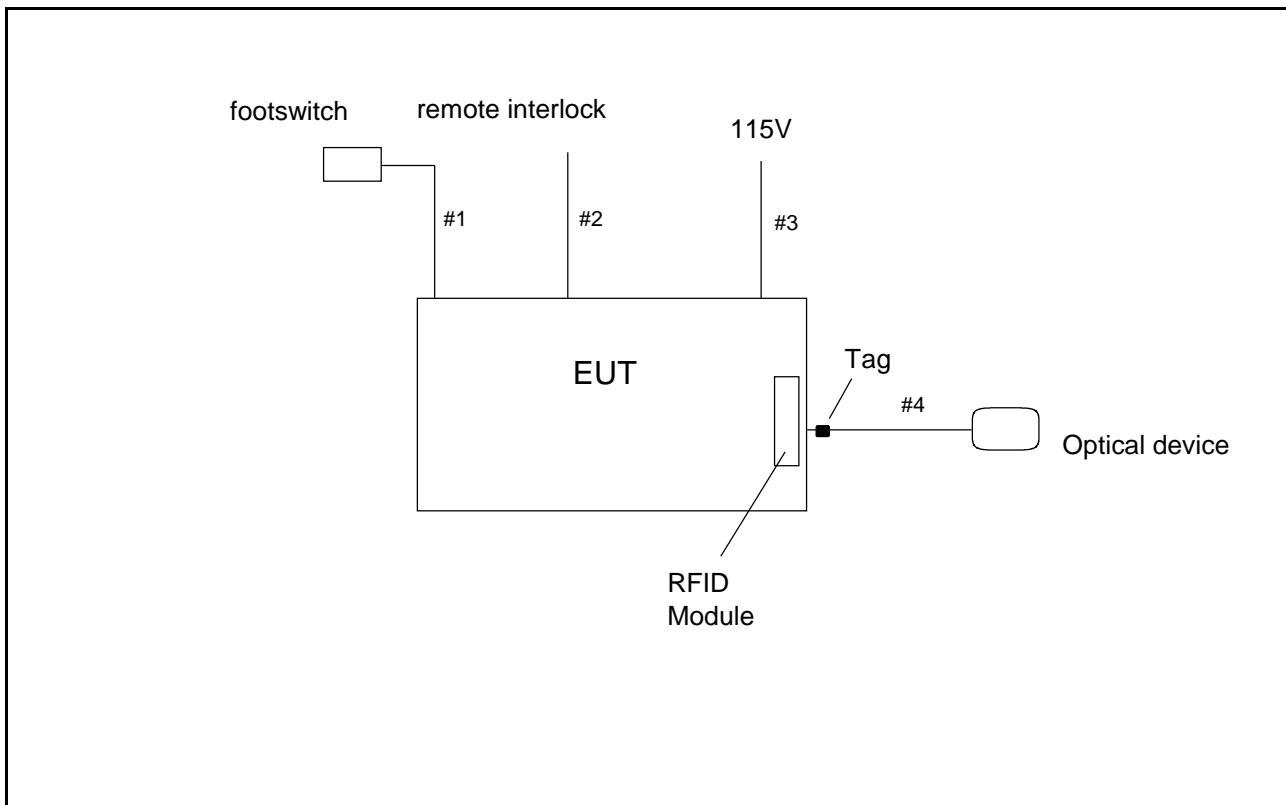
	Report No: R1739 Issue No: 1 Test No: T0939	FCC ID: RBQAS597 Test Report	Page: 6 of 20
-----------------------------------------------------------------------------------	---------------------------------------------------	---------------------------------	---------------

### 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.

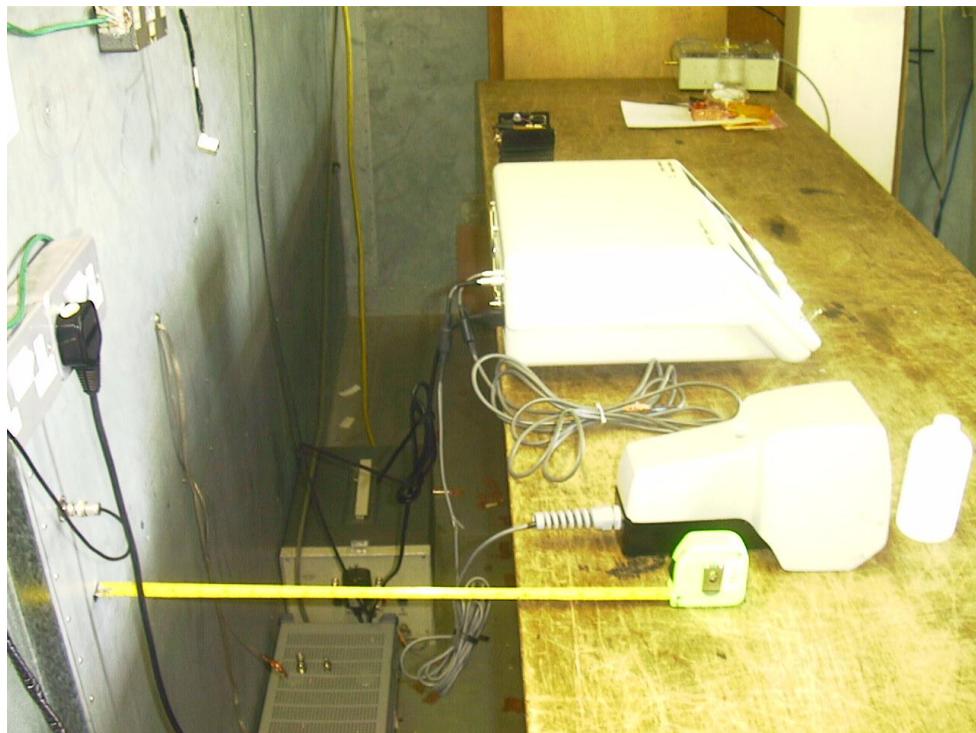
Operating Mode	Details
1	RF ID module fitted inside main laser unit. RF ID module repetitively reading tag.
2	RF ID module in test jig (outside main laser system). RF signal continuously on.

**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: <b>R1739</b> Issue No: <b>1</b>	FCC ID: RBQAS597	
Test No: <b>T0939</b>		<b>Test Report</b>	Page: <b>7 of 20</b>



**Photograph 1 Conducted Emissions - Back**



**Photograph 2 Conducted Emissions - Front**

	Report No: <b>R1739</b> Issue No: <b>1</b>	FCC ID: RBQAS597	
Test No: <b>T0939</b>		<b>Test Report</b>	Page: <b>8 of 20</b>



**Photograph 3 Radiated Emissions on Test Jig**



**Photograph 4 Radiated Emissions in Laser**

	Report No: <b>R1739</b>	FCC ID: RBQAS597	
	Issue No: <b>1</b>		
Test No: <b>T0939</b>		<b>Test Report</b>	Page: <b>9 of 20</b>

## 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.	Manufacturer	Model	Description	Serial Number	Cal Date
R1	Chase	LHR7000	RF Receiver (10kHz-30MHz)	1056	14 Mar 03
R3	Rohde and Schwarz	ESHS10	RF Receiver (9kHz-30MHz)	843743/010	6 Jun 03
R4	Rohde and Schwarz	ESVS10	RF Receiver (20MHz-1GHz)	843744/002	20 Mar 03
R5	Hewlett Packard	HP 8595E	Spectrum Analyser	3412A00701	27 Oct 02
L1	EMCO	3825/2	LISN	1358	6 Oct 02
A4	Chase	CBL6112	Bilog Antenna (30MHz-2GHz)	2027	23 Jul 02
A5	Chase	CBL111A	Bilog Antenna (30MHz-1GHz)	1760	23 Jul 02
A9	EMCO	6502	Act Loop Antenna (9kHz-30MHz)	2139	2 Jul 03

	Report No: <b>R1739</b>	FCC ID: RBQAS597	Page: 10 of 20
	Issue No: <b>1</b>		
Test No: <b>T0939</b>		<b>Test Report</b>	

### 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. Cables are moved to establish highest emission levels. The table of results is shown in the conducted emissions results section.

#### 3.2 Radiated Emissions <30MHz

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 using an appropriate loop antenna. 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. The open area test site does not have a ground plane. Maximised readings are obtained by rotating the EUT through 360°. The receiving antenna remains at a fixed height of 1m. Measurements are made with the receiving antenna both coaxial and perpendicular to the EUT.

### 4 Test Results

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

	Report No: <b>R1739</b>	FCC ID: RBQAS597	
	Issue No: <b>1</b>		
Test No: <b>T0939</b>	<b>Test Report</b>		Page: <b>11 of 20</b>

## 4.1 Conducted Emission Results

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

### Conducted Emissions

Company:	Diomed Ltd			Product:	RFID Module AS/597												
Date:	8 July 2003			Test Eng:	Peter Barlow												
Ports:	ac power																
Test:	ANSI C63.4:1992 using limits of			CISPR22(B)													
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(B) dBuV	Margin CISPR22(B) dB	Limit	Margin	Notes			
1	1	N	1	0.220	qp	49.6	10.2	59.8	62.8	3.1							
1	1	N	1	0.220	av	17.8	10.2	28.0	52.8	24.9							
1	1	N	1	16.000	qp	31.3	10.6	41.9	60.0	18.1							
1	1	N	1	16.000	av	27.5	10.6	38.1	50.0	11.9							
1	1	N	1	18.044	qp	35.1	10.7	45.8	60.0	14.2							
1	1	N	1	18.044	av	27.9	10.7	38.6	50.0	11.4							
1	1	L	1	0.223	qp	49.6	10.2	59.8	62.7	3.0							
1	1	L	1	0.223	av	17.5	10.2	27.7	52.7	25.1							
1	1	L	1	14.167	qp	29.3	10.6	39.9	60.0	20.1							
1	1	L	1	14.167	av	18.8	10.6	29.4	50.0	20.6							
1	1	L	1	18.046	qp	34.4	10.7	45.1	60.0	14.9							
1	1	L	1	18.046	av	27.8	10.7	38.5	50.0	11.5							
Results				Minimum Margin PASS/FAIL			3.0	dB									
Notes		Comments and Observations															
		Results of scans shown in plot 1 and plot 2.															

	Report No: R1739	FCC ID: RBQAS597	
	Issue No: 1	Test No: T0939	Test Report

## 4.2 Radiated Emissions Results <30MHz

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

### Radiated Emissions

Company:	Diomed Ltd							Product:	RFID Module AS/597																		
Date:	9 June 2003							Test Eng:	Dave Smith																		
Ports:																											
Test:	ANSI C63.4:1992 using limits of							FCC(C)																			
Ports:																											
Test:																											
Test	Op	Mod	Dist	Fact	Freq.	Ant	Rec.	Corr'n	Total	Limit	Margin	Limit	Margin	Notes													
	Mode	State	m	Set	MHz	Pol	Level	Factor	Level	FCC(C)	FCC(C)																
Fitted in laser unit.																											
1	0	10	2		0.124	#1	49.2	10.7	59.9	84.8	24.9																
1	0	10	2		0.249	#1	32.4	10.7	43.1	78.8	35.7																
1	0	10	2		0.373	#1	32.5	10.7	43.2	75.3	32.0																
1	0	10	2		0.498	#1	29.5	10.7	40.2	52.8	12.5																
Fitted on test jig.																											
2	0	10	2		0.125	#1	47.1	10.7	57.8	84.8	26.9																
2	0	10	2		0.250	#1	36.2	10.7	46.9	78.7	31.8																
2	0	10	2		0.375	#1	31.2	10.7	41.9	75.2	33.3																
2	0	10	2		0.499	#1	28.2	10.7	38.9	52.7	13.8																
Results					Minimum Margin PASS/FAIL				12.5 dB																		
Notes		Comments and Observations																									
#1	Results of screened room scans shown in plot 3 to plot 8.																										
	Note - rules allow emissions in the 100kHz to 490kHz band to be measured with an average detector. The above measurements were made with a quasi-peak detector which will give a reading at least as high as an average detector. The unit operates by generating an unmodulated 125kHz signal. The presence of a tag produces a small modulating effect but it is expected that peak, quasi-peak and average detectors would all give similar readings.																										
	All measurements were made at 10m. Limits were adjusted using an extrapolation of 40dB/decade as described in section 15.31 f (2) of FCC part 15.																										
#1		Rotated for maximum response.																									

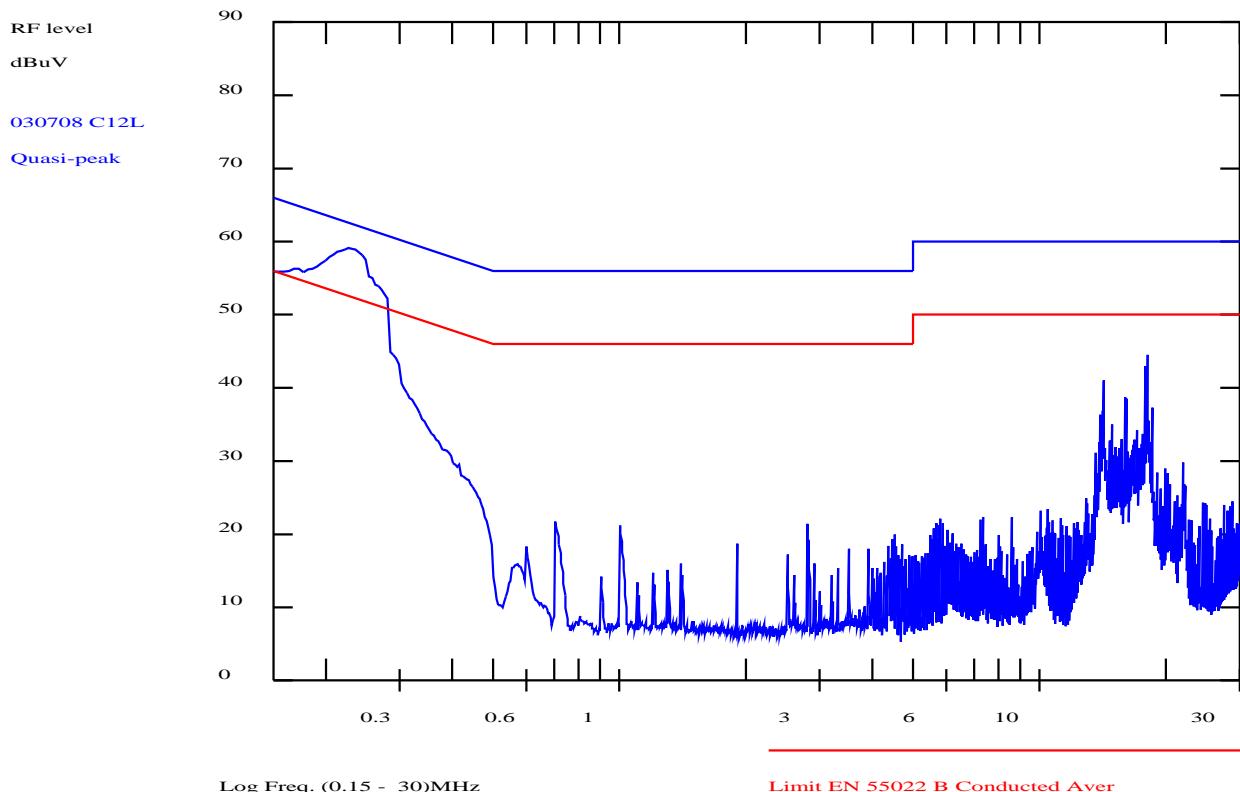
	Report No: <b>R1739</b> Issue No: <b>1</b>	FCC ID: RBQAS597	
Test No: <b>T0939</b>		<b>Test Report</b>	Page: <b>13 of 20</b>

Chase EMS 6.21

Notes

Analyse 030708 C12L D30 Mains 115V

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



## PLOT 1 Conducted Emissions - Live Line

Company:	Diomed	Product:	As/597
Date:	08 Jul 03	Test Engineer:	Peter Barlow
Test:	EN55022	Limit:	CISPR (B) QP + AV
Notes: 115V Fitted in D30 plus laser. Footswitch and remote connected. Ferrite on transformer Primary (excluding earth lead). Earth lead to filter tag ferrited. Machine in standby, continuous RFID read.			
Line: Live Attenuator: 10dB PAD Operating Mode: 1 Detector: QuasiPeak Mod. State: 1 LISN: EMCO Filename: C3708655.plt			

### Frequency List (MHz)

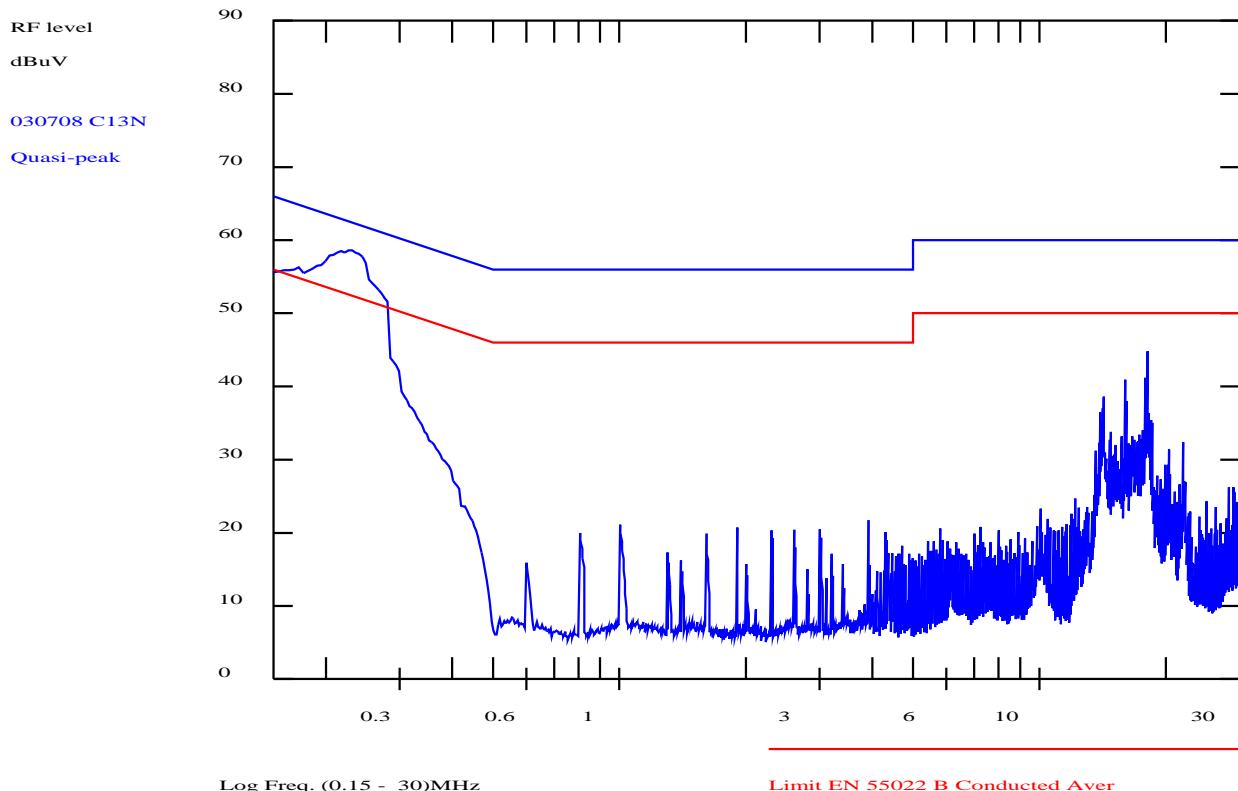

	Report No: <b>R1739</b> Issue No: <b>1</b>	FCC ID: RBQAS597	
Test No: <b>T0939</b>		<b>Test Report</b>	Page: <b>14 of 20</b>

Chase EMS 6.21

Notes

Analyse 030708 C13N D30 Mains 115V

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

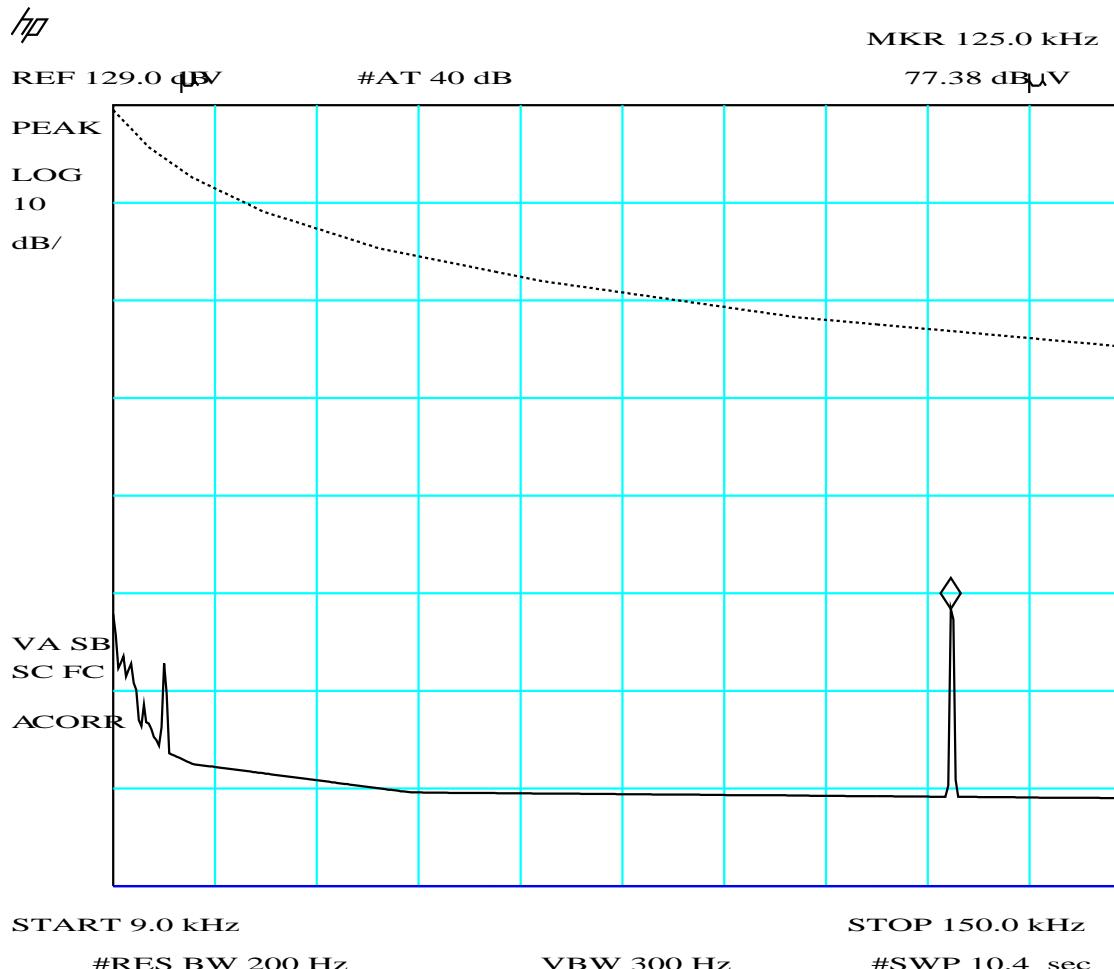


## PLOT 2 Conducted Emissions - Neutral Line

Company:	Diomed	Product:	As/597
Date:	08 Jul 03	Test Engineer:	Peter Barlow
Test:	EN55022	Limit:	CISPR (B) QP + AV
Notes: 115V Fitted in D30 plus laser.			
Footswitch and remote connected. Ferrite on transformer Primary (excluding earth lead).			
Earth lead to filter tag ferrited. Machine in standby, continuous RFID read.			
Line:	Neutral	Attenuator:	10dB PAD
Detector:	QuasiPeak	Operating Mode:	1
LISN:	EMCO	Mod. State:	1
Filename: C3708667.plt			

### Frequency List (MHz)


	Report No: R1739 Issue No: 1 Test No: T0939	FCC ID: RBQAS597 Test Report	Page: 15 of 20
-----------------------------------------------------------------------------------	---------------------------------------------------	---------------------------------	----------------

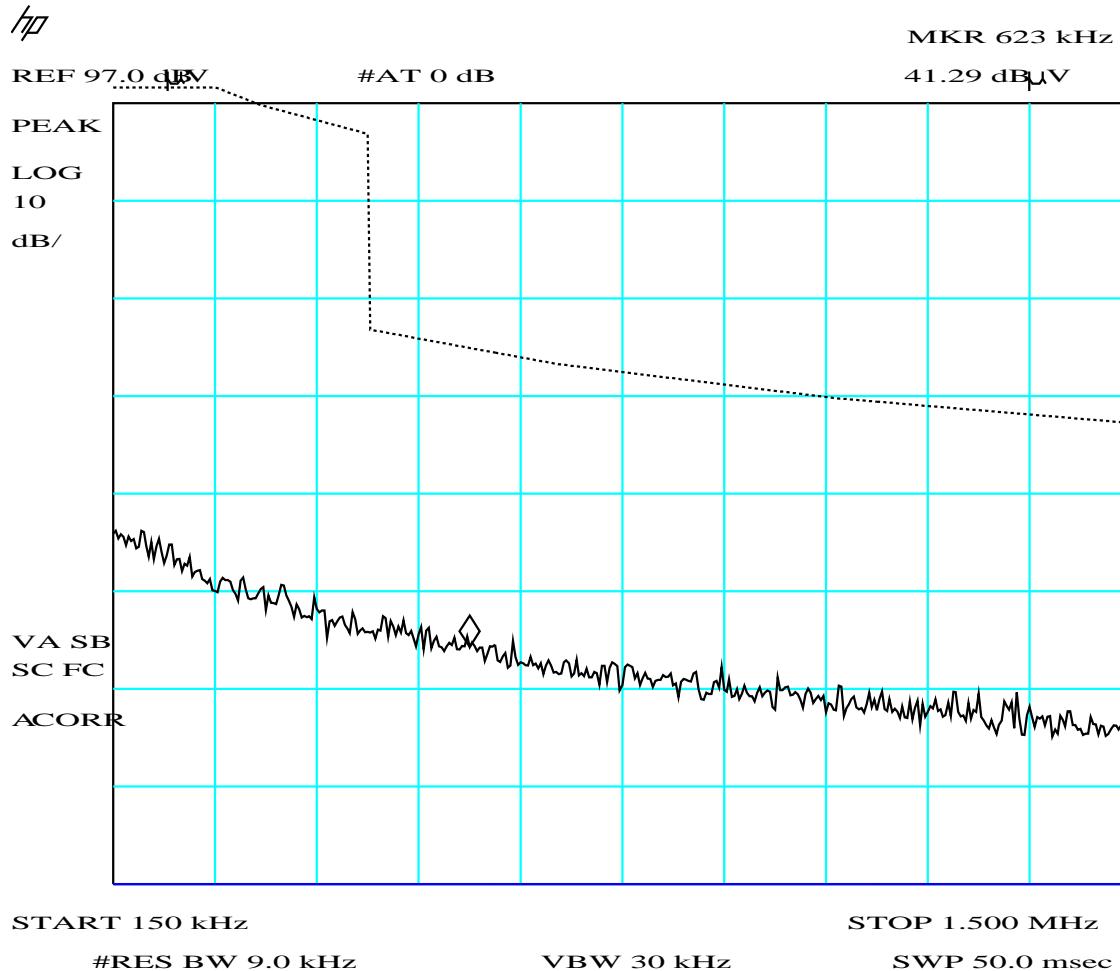


### PLOT 3 Radiated Emissions - 9kHz to 150kHz - Fitted in D30 plus

Company: Diomed	Product: As/597
Date: 09 Jun 03	Test Engineer: Dave Smith
Test: FCC pt 15	Limit: FCC pt 15 C
Notes:	
115V.	
RF ID in laser unit.	
Limit adjusted to 3m using extrapolation of 40dB/decade below 1.705MHz, 20dB/decade above 1.705MHz.	
Polarisation: both	Orientation: 0 - 360°
Distance: 3m	Antenna: Loop
Height: 1m	Filename: H3609516.plt

#### Frequency List (MHz)


	Report No: R1739 Issue No: 1 Test No: T0939	FCC ID: RBQAS597 Test Report	Page: 16 of 20
-----------------------------------------------------------------------------------	---------------------------------------------------	---------------------------------	----------------



#### PLOT 4 Radiated Emissions - 150kHz to 1.5MHz - Fitted in D30 plus

Company: Diomed	Product: As/597
Date: 09 Jun 03	Test Engineer: Dave Smith
Test: FCC pt 15	Limit: FCC pt 15 C
Notes:	
115V. RF ID in laser unit. Limit adjusted to 3m using extrapolation of 40dB/decade below 1.705MHz, 20dB/decade above 1.705MHz.	
Polarisation: both	Orientation: 0 - 360°
Distance: 3m	Antenna: Loop
Height: 1m	Filename: H3609536.plt

#### Frequency List (MHz)


	Report No: <b>R1739</b> Issue No: <b>1</b>	FCC ID: RBQAS597	
Test No: <b>T0939</b>		<b>Test Report</b>	Page: <b>17 of 20</b>

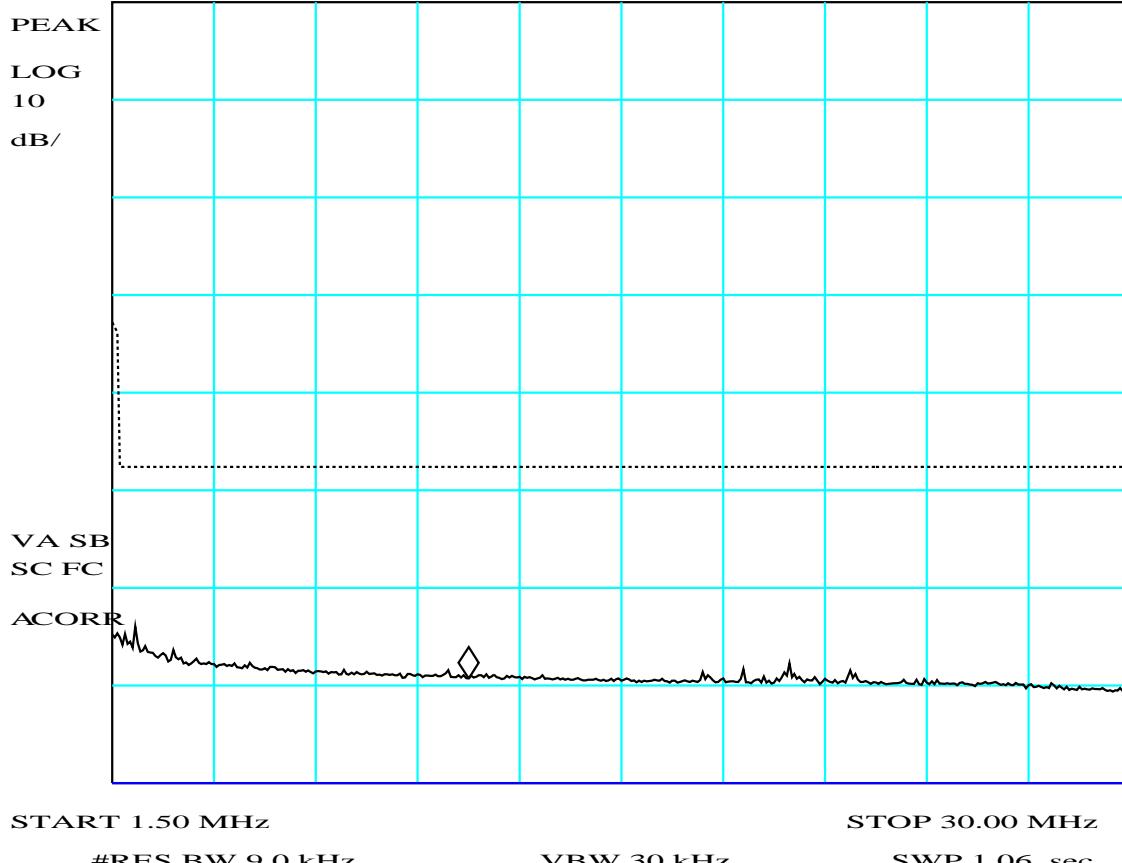
/p

**MKR 11.48 MHz**

**REF 97.0 dB<sub>V</sub>**

**#AT 0 dB**

**27.71 dB<sub>UV</sub>**

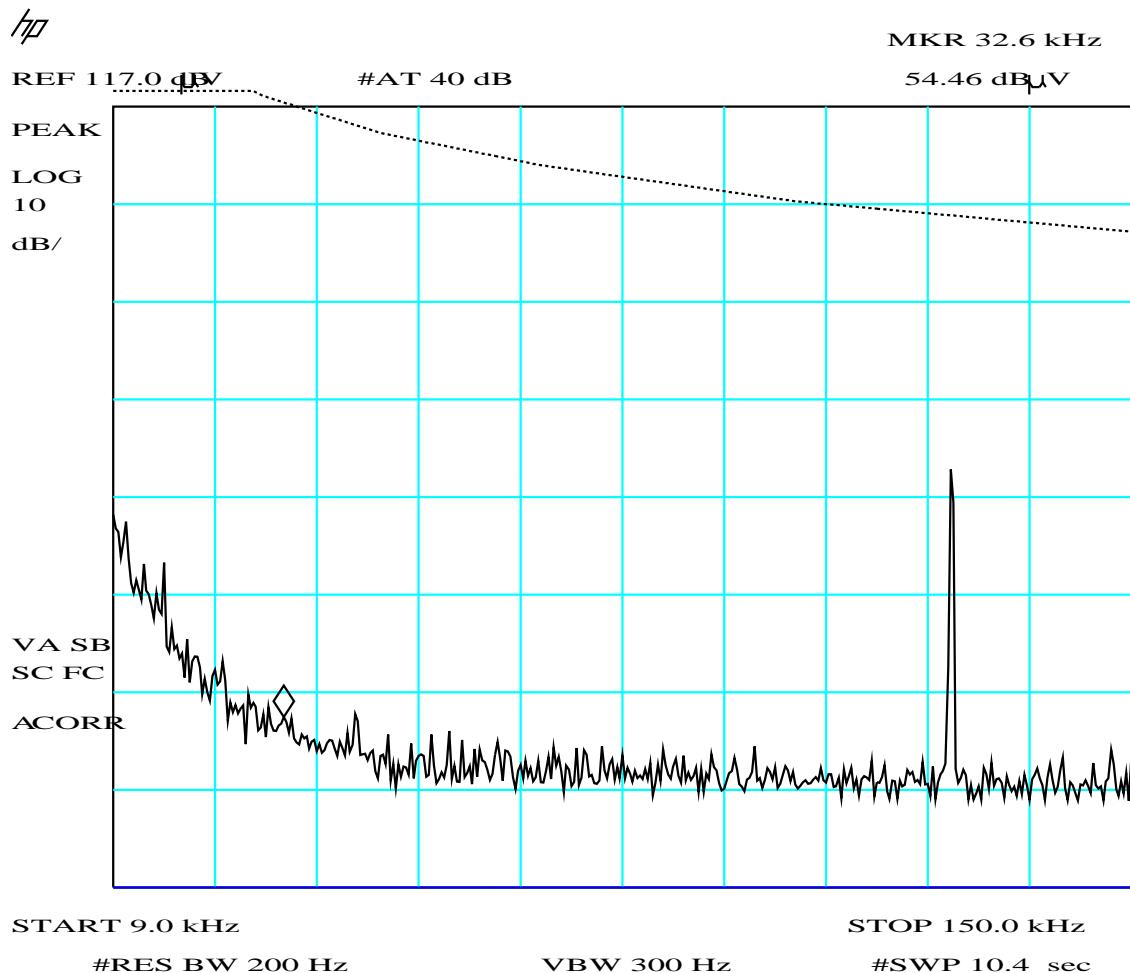


### PLOT 5 Radiated Emissions - 1.5MHz to 30MHz - Fitted in D30 plus

Company:	Diomed	Product:	As/597
Date:	09 Jun 03	Test Engineer:	Dave Smith
Test:	FCC pt 15	Limit:	FCC pt 15 C
Notes:			
115V. RF ID in laser unit. Limit adjusted to 3m using extrapolation of 40dB/decade below 1.705MHz, 20dB/decade above 1.705MHz.			
Polarisation:	both	Orientation:	0 - 360°
Distance:	3m	Antenna:	Loop
Height:	1m	Filename:	H3609539.plt

#### Frequency List (MHz)


	Report No: R1739 Issue No: 1 Test No: T0939	FCC ID: RBQAS597 Test Report	Page: 18 of 20
-----------------------------------------------------------------------------------	---------------------------------------------------	---------------------------------	----------------

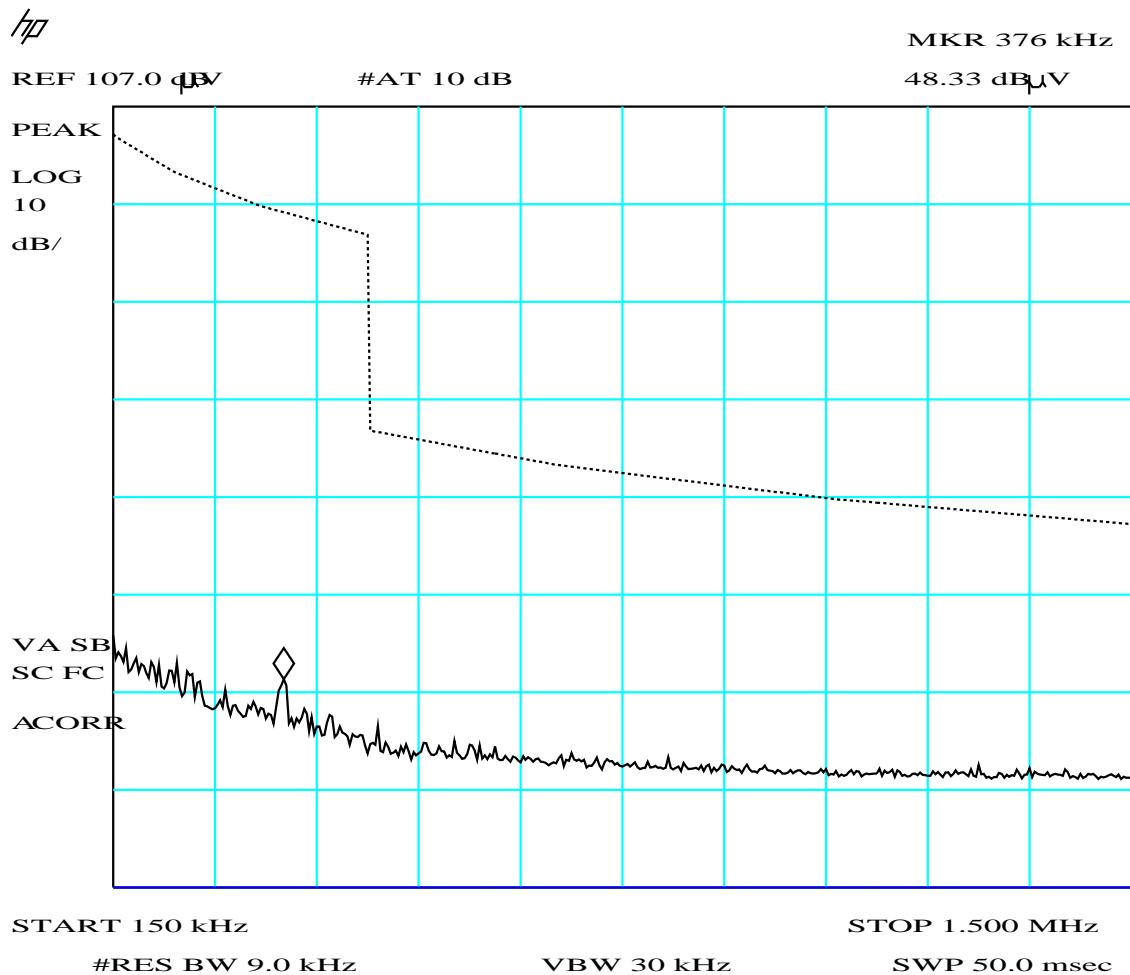


### PLOT 6 Radiated Emissions - 9kHz to 150kHz - Fitted to Test Jig

Company:	Diomed	Product:	As/597
Date:	09 Jun 03	Test Engineer:	Dave Smith
Test:	FCC pt 15	Limit:	FCC (C)
Notes:			
RF ID board only - with test jig. Limit adjusted to 3m using extrapolation of 40dB/decade below 1.705MHz, 20dB/decade above 1.705MHz.			
Polarisation:	both	Orientation:	0 - 360°
Distance:	3m	Antenna:	Loop
Height:	1m	Filename:	H36095C5.plt

### Frequency List (MHz)


	Report No: R1739 Issue No: 1 Test No: T0939	FCC ID: RBQAS597 Test Report	Page: 19 of 20
-----------------------------------------------------------------------------------	---------------------------------------------------	---------------------------------	----------------



### PLOT 7 Radiated Emissions - 150kHz to 1.5MHz - Fitted to Test Jig

Company:	Diomed	Product:	As/597
Date:	09 Jun 03	Test Engineer:	Dave Smith
Test:	FCC pt 15	Limit:	FCC (C)
Notes:			
RF ID board only - with test jig. Limit adjusted to 3m using extrapolation of 40dB/decade below 1.705MHz, 20dB/decade above 1.705MHz.			
Polarisation:	both	Orientation:	0 - 360°
Distance:	3m	Antenna:	Loop
Height:	1m	Filename:	H36095D5.plt

#### Frequency List (MHz)


	Report No: <b>R1739</b> Issue No: <b>1</b>	FCC ID: RBQAS597	
Test No: <b>T0939</b>		<b>Test Report</b>	Page: <b>20 of 20</b>

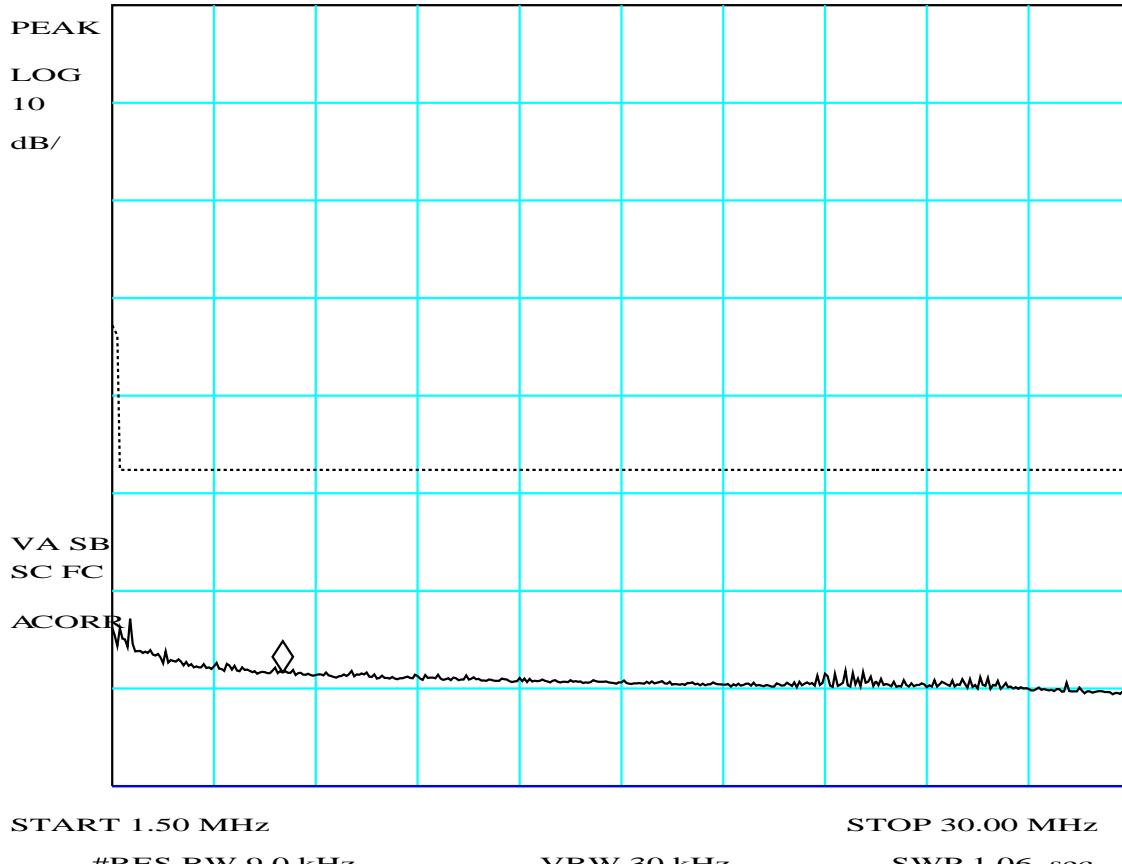
/p

**MKR 6.27 MHz**

**REF 97.0 dB $\mu$ V**

**#AT 0 dB**

**28.63 dB $\mu$ V**



### PLOT 8 Radiated Emissions - 1.5MHz to 30MHz - Fitted to Test Jig

Company: Diomed	Product: As/597
Date: 09 Jun 03	Test Engineer: Dave Smith
Test: FCC pt 15	Limit: FCC (C)
Notes:	
RF ID board only - with test jig.	
Limit adjusted to 3m using extrapolation of 40dB/decade below 1.705MHz, 20dB/decade above 1.705MHz.	
Polarisation: both	Orientation: 0 - 360°
Distance: 3m	Antenna: Loop
Height: 1m	Filename: H36095D9.plt

#### Frequency List (MHz)
