

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



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

RFID Module AS/597

dated

16 July 2003

	Report No: R1739	FCC ID: RBQAS597	
	Issue No: 1		
Test No: T0939	Test Report		Page: 2 of 20

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: R1739 Issue No: 1	FCC ID: RBQAS597	
	Test No: T0939	Test Report	Page: 3 of 20

Emissions Test Results Summary

CFR 47 : 2003

PASS

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: R1739 Issue No: 1	FCC ID: RBQAS597	
	Test No: T0939	Test Report	Page: 4 of 20

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 on Test Jig</i>	8
<i>Photograph 4 Radiated Emissions in Laser</i>	8
2 Test Equipment	9
3 Test Methods	10
3.1 Conducted Emissions - ac power	10
3.2 Radiated Emissions <30MHz	10
4 Test Results	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	FCC ID: RBQAS597	
	Test No: T0939	Test Report	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. It's 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.

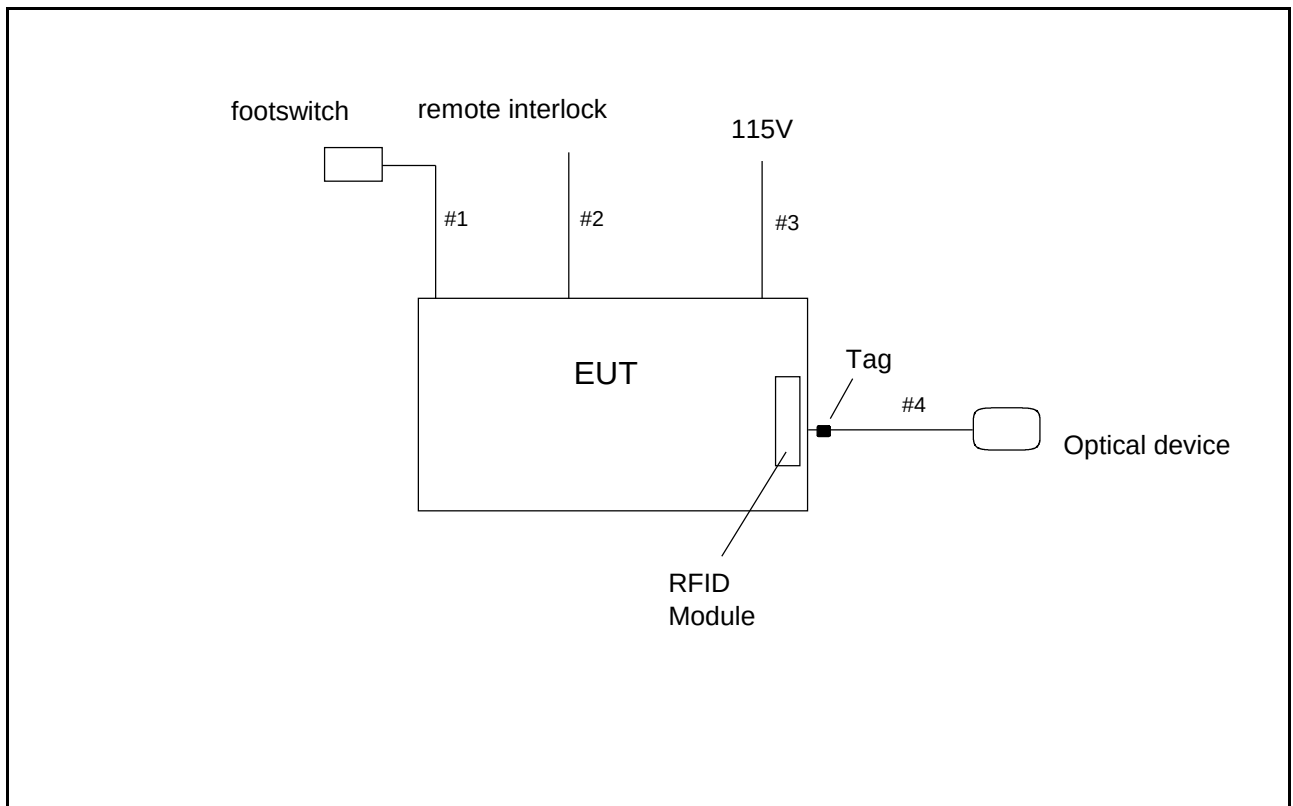
Mod No:	Details	Implemented for
0	Original unit.	Conducted emissions
1	470nF X cap fitted. Ferrite on primary of transformer.	

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 repetatively reading tag.
2	RF ID module in test jig (ouside 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: R1739 Issue No: 1	FCC ID: RBQAS597	
	Test No: T0939	Test Report	Page: 7 of 20



Photograph 1 Conducted Emissions - Back



Photograph 2 Conducted Emissions - Front

	Report No: R1739 Issue No: 1	FCC ID: RBQAS597	
	Test No: T0939	Test Report	Page: 8 of 20



Photograph 3 Radiated Emissions on Test Jig



Photograph 4 Radiated Emissions in Laser

	Report No: R1739 Issue No: 1	FCC ID: RBQAS597	
	Test No: T0939	Test Report	Page: 10 of 20

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: R1739 Issue No: 1	FCC ID: RBQAS597	
	Test No: T0939		
Test Report			Page: 11 of 20

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 PASS			
Notes		Comments and Observations													
		Results of scans shown in plot 1 and plot 2.													

	Report No: R1739 Issue No: 1	FCC ID: RBQAS597	
	Test No: T0939	Test Report	Page: 12 of 20

4.2 Radiated Emissions Results <30MHz

Test Equipment:	Factor Set 1:	HFBIOLOG	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 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	Note
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 PASS				
Notes	Comments and Observations													
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.														

Chase EMS 6.21

Notes

Analyse 030708 C12L D30 Mains 115V

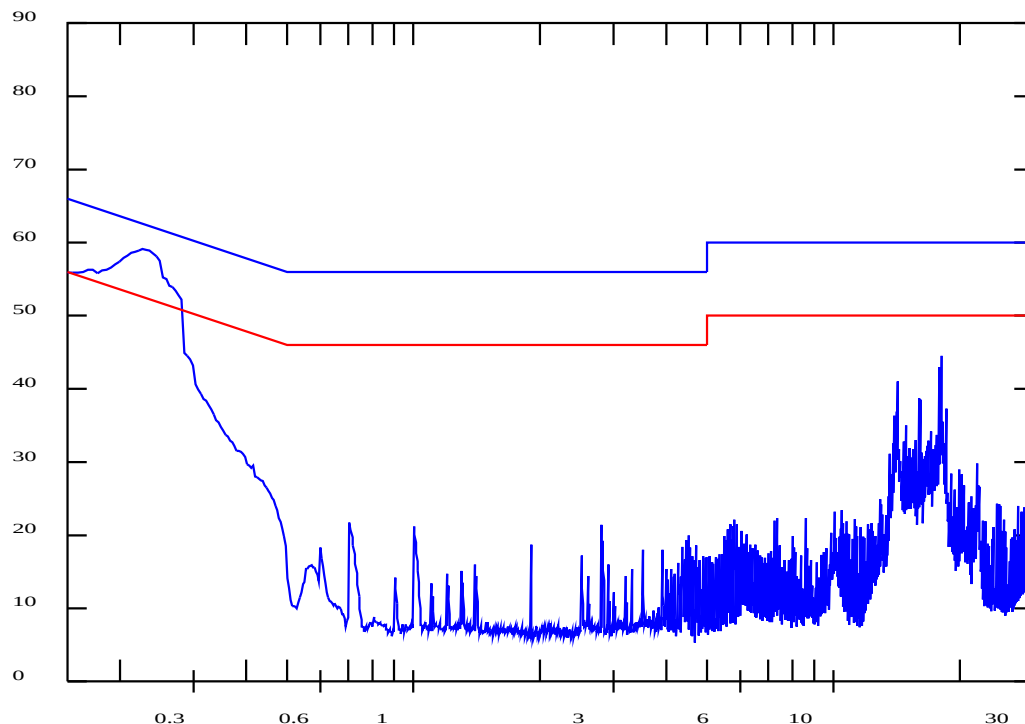
Test: EN55022(B),EN55011(B),EN55014&13 Main Cond(QP Det)

RF level

dBuV

030708 C12L

Quasi-peak



Log Freq. (0.15 - 30)MHz

Limit EN 55022 B Conducted Aver

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
Detector:	QuasiPeak	Operating Mode:	1
LISN:	EMCO	Mod. State:	1
		Filename:	C3708655.plt

Frequency List (MHz)

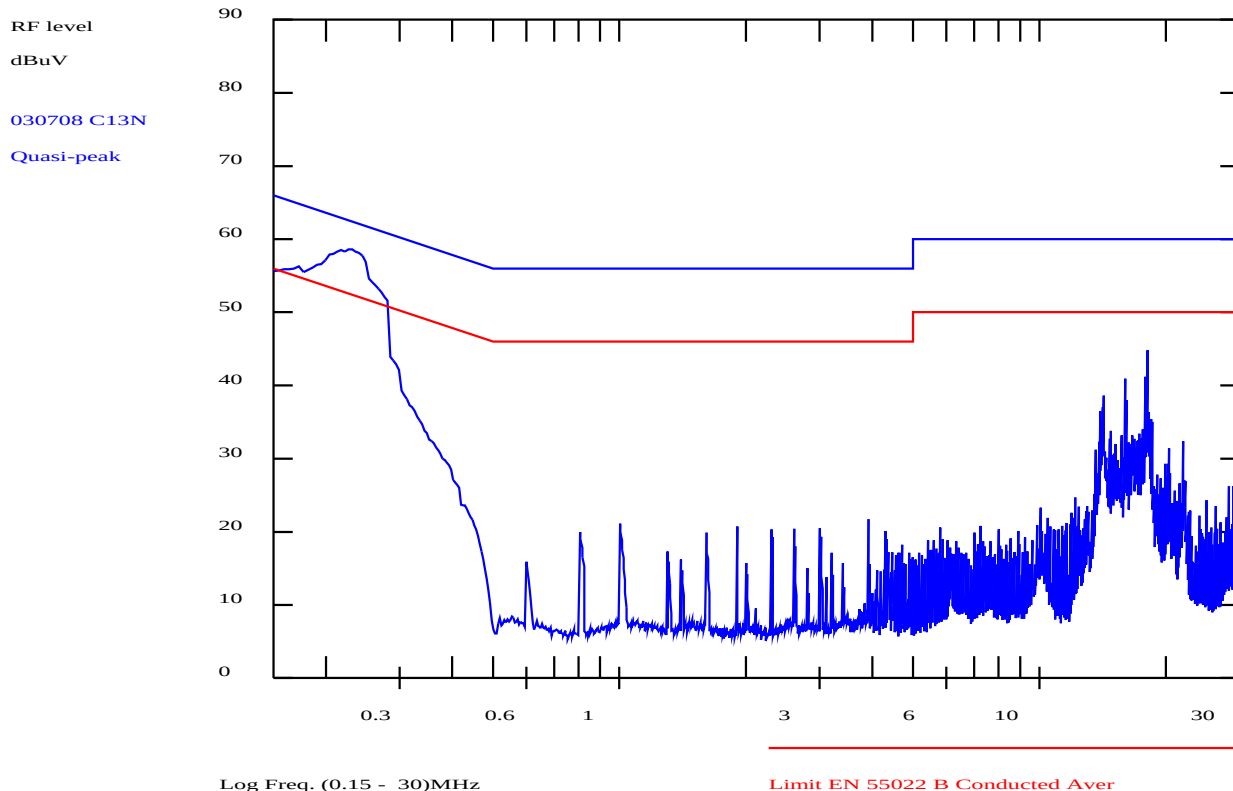
	Report No: R1739	FCC ID: RBQAS597	
	Issue No: 1		
	Test No: T0939	Test Report	Page: 14 of 20

Chase EMS 6.21

Notes

Analyse 030708 C13N D30 Mains 115V

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

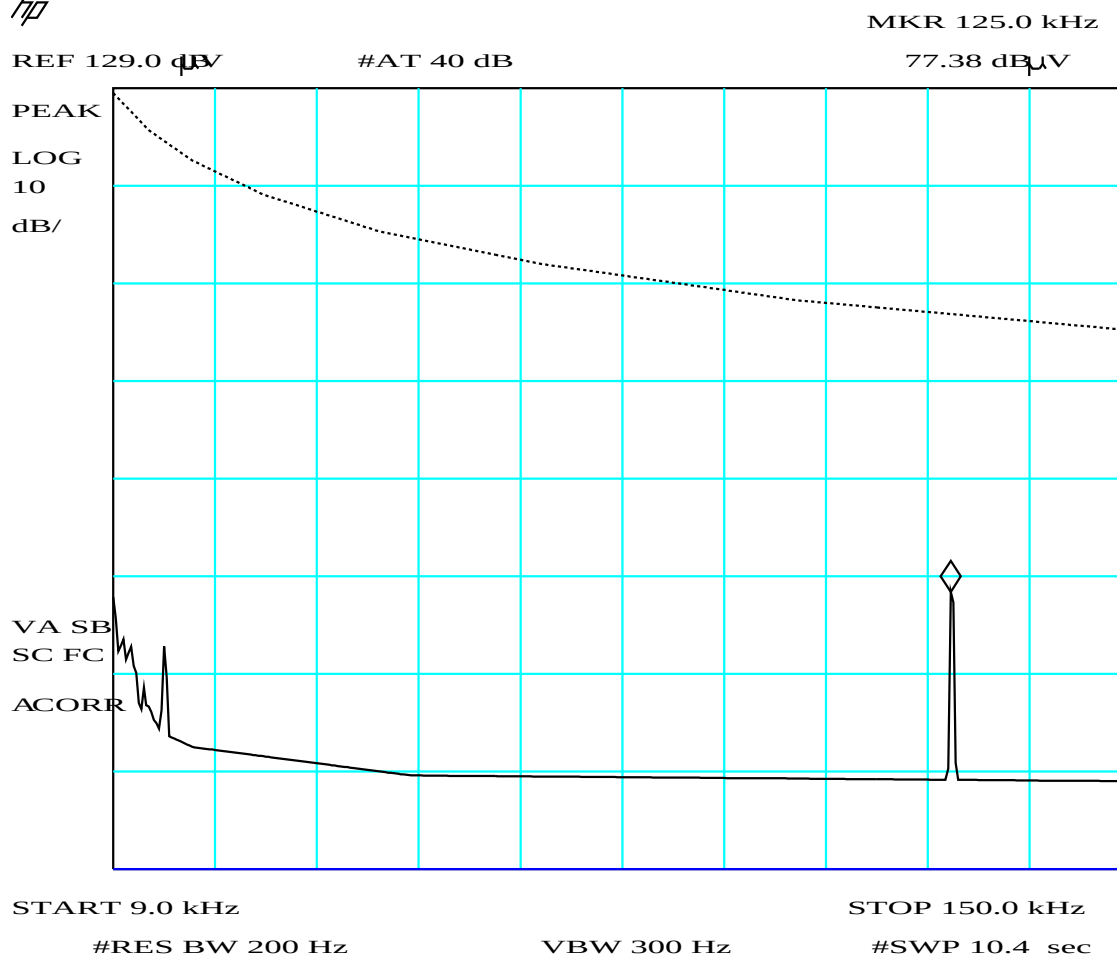


PLOT 2 Conducted Emissions - Neutral Line

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)

h/p

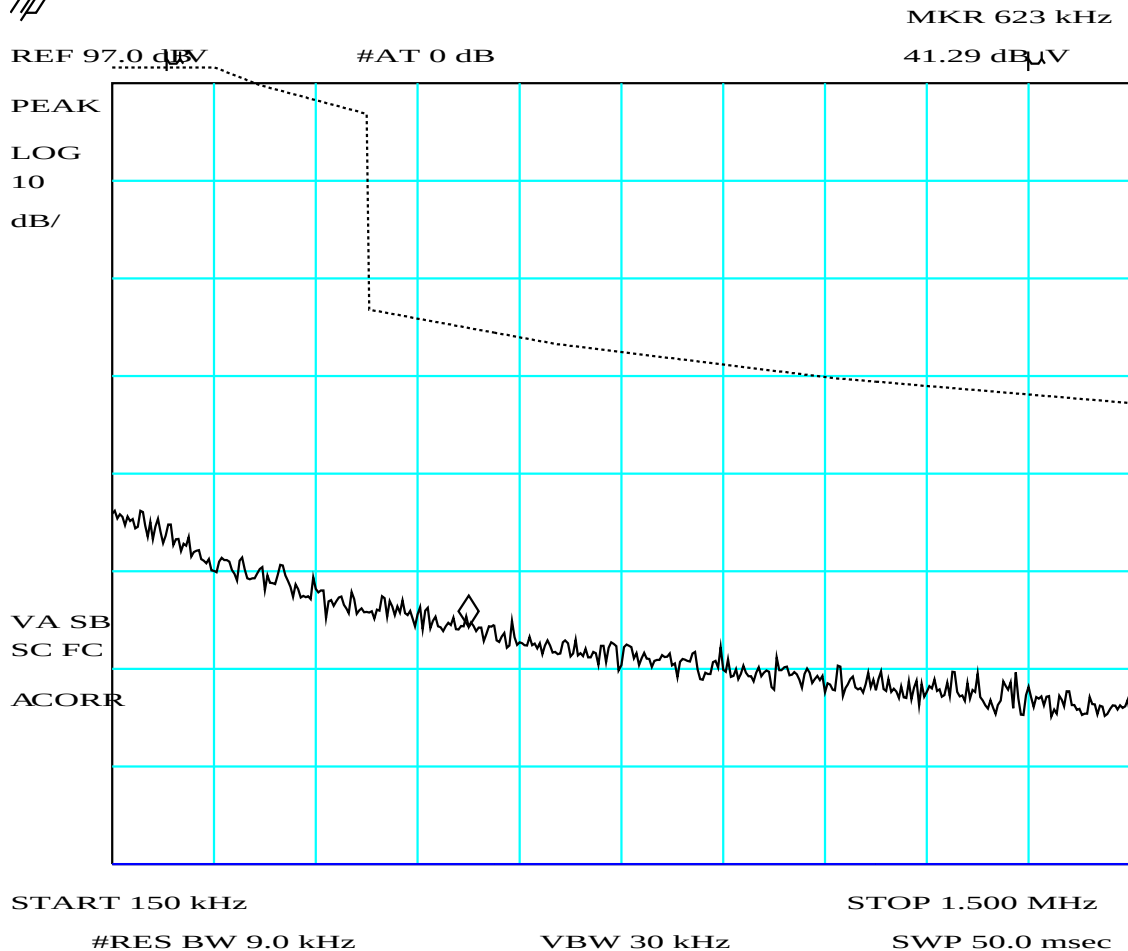


PLOT 3 Radiated Emissions - 9kHz to 150kHz - Fitted in D30 plus

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
		Operating Mode:	1
		Mod. State:	0

Frequency List (MHz)

h/p



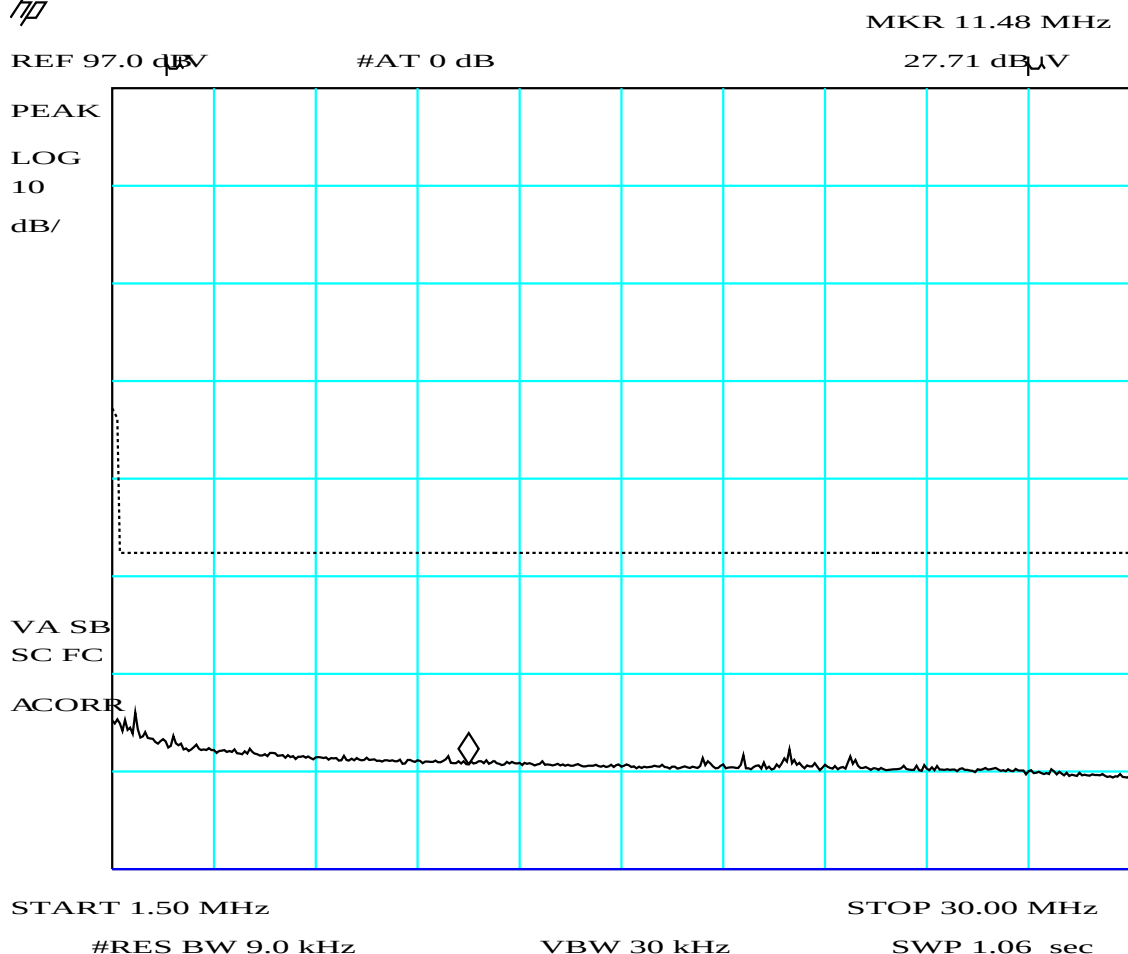
PLOT 4 Radiated Emissions - 150kHz to 1.5MHz - Fitted in D30 plus

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
		Operating Mode:	1
		Mod. State:	0

Frequency List (MHz)

	Report No: R1739	FCC ID: RBQAS597	
	Issue No: 1		
	Test No: T0939	Test Report	Page: 17 of 20

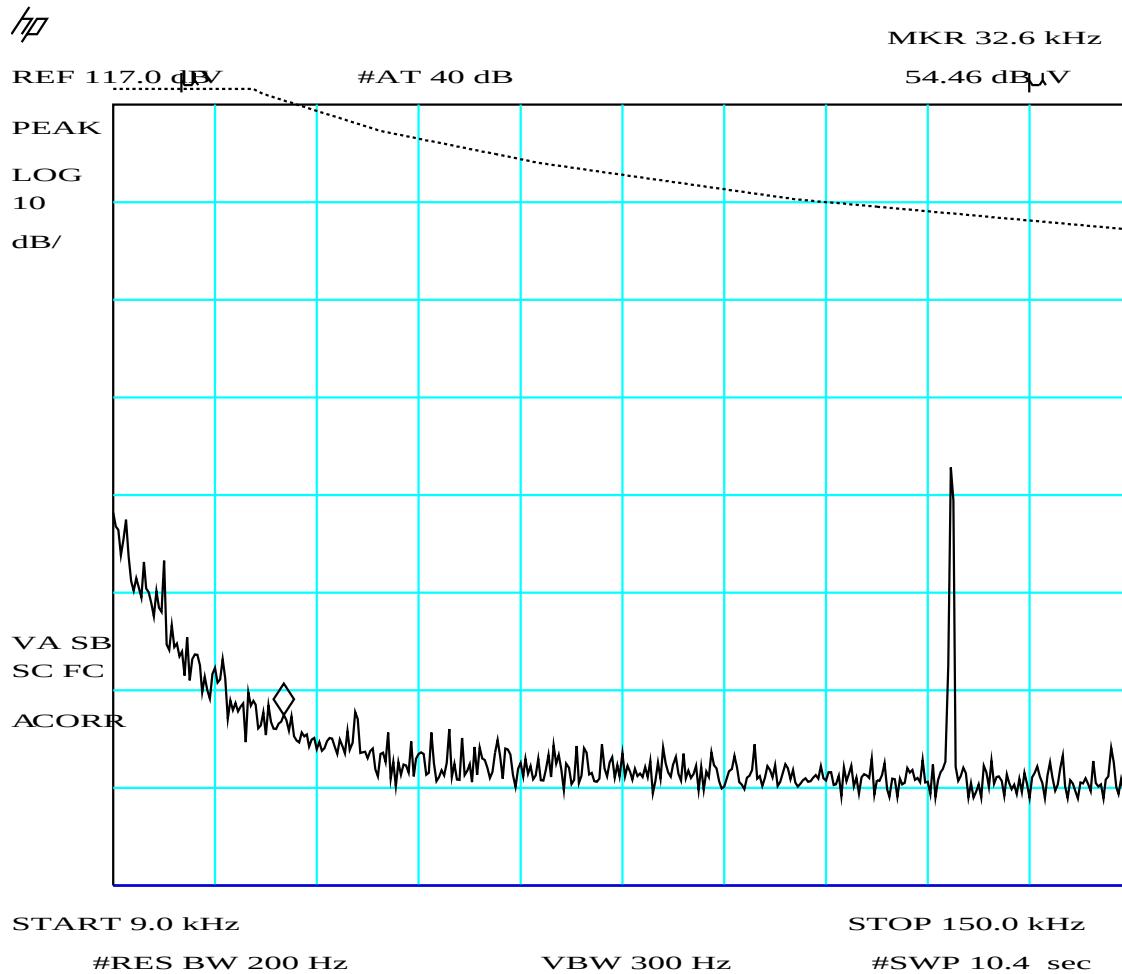
h/p



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
		Operating Mode:	1
		Mod. State:	0

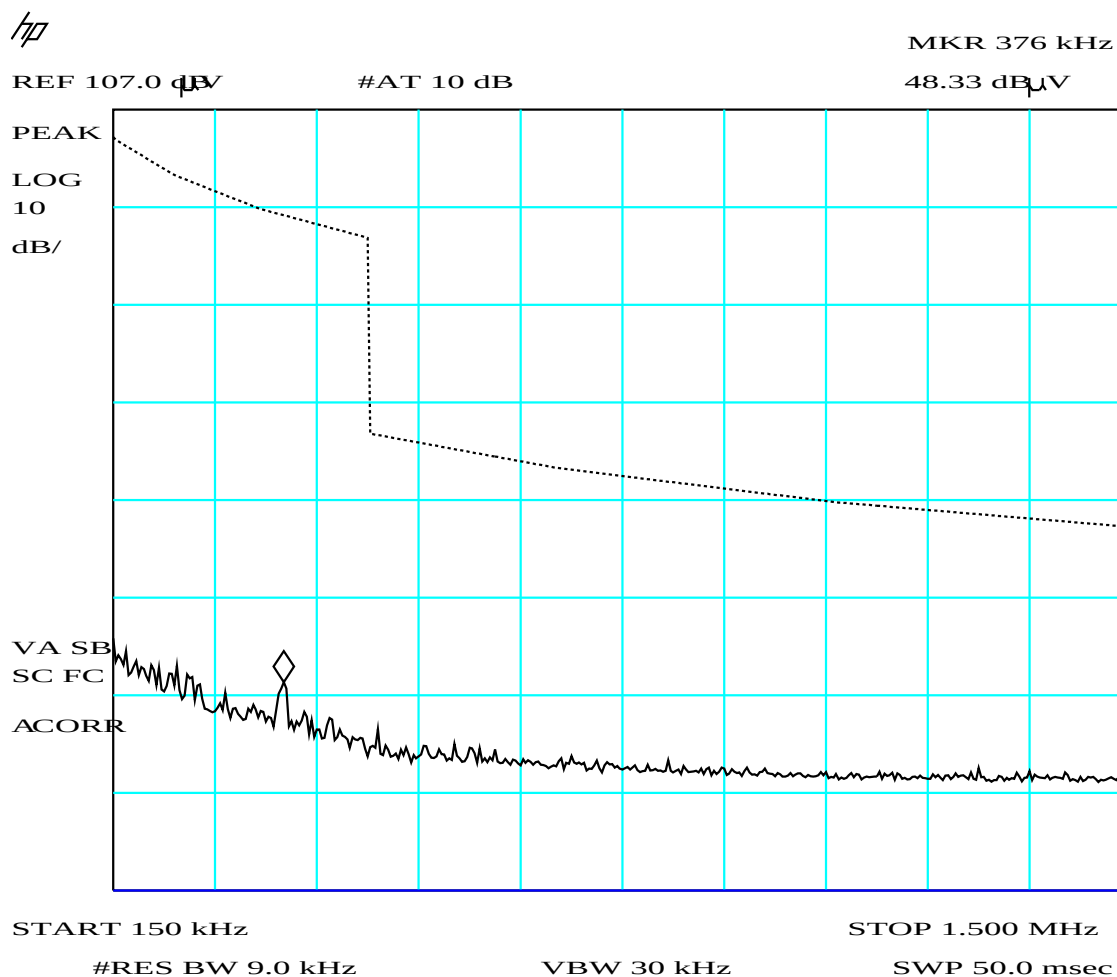
Frequency List (MHz)



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
		Operating Mode:	2
		Mod. State:	0

Frequency List (MHz)



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

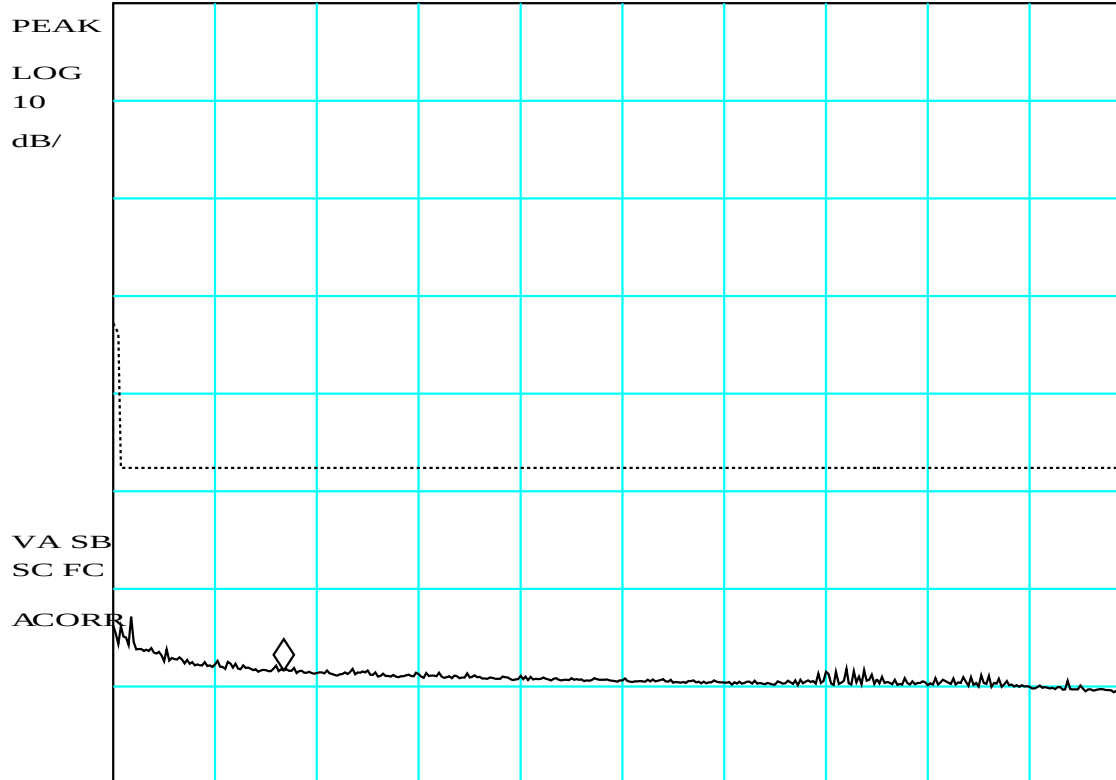
Company:	Diomed	Product:	As/597
Date:	09 Jun 03	Test Engineer:	Dave Smith
Test:	FCC pt 15	Limit:	FCC (C)
Notes:			
RF ID board only - with test jig.			
Limit adjusted to 3m using extrapolation of 40dB/decade below 1.705MHz, 20dB/decade above 1.705MHz.			
Polarisation:	both	Orientation:	0 - 360°
Distance:	3m	Antenna:	Loop
Height:	1m	Filename:	H36095D5.plt
Operating Mode:		2	
Mod. State:		0	

Frequency List (MHz)

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

hp

REF 97.0 μV #AT 0 dB MKR 6.27 MHz 28.63 dB μV



START 1.50 MHz STOP 30.00 MHz
#RES BW 9.0 kHz VBW 30 kHz SWP 1.06 sec

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
		Operating Mode:	2
		Mod. State:	0

Frequency List (MHz)
