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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

RFID Module AS/0670

dated

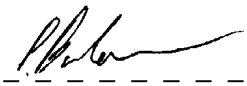
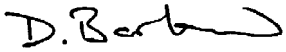
1st July 2005

Document History

Issue	Date	Affected page(s)	Description of modifications	Revised by	Approved by
1	01/07/05		Initial release		
2	15/07/05	2, 9-12	Update stds detail & correct units labels	D.B.	C.A.

Based on report template:
v031111

Equipment Under Test (EUT):	**RFID Module AS/0670**
Test Commissioned by:	**Diomed Ltd Building 2000, Beach Drive Cambridge Research Park Waterbeach Cambridge CB5 9TE**
Representative:	**Andy Howe**
Test Started:	**13th June 2005**
Test Completed:	**21st June 2005**
Test Engineer:	**Peter Barlow**
Date of Report:	**1st July 2005**
Report:	

Written by:	**Peter Barlow**	**Checked by:**	**Derek Barlow**
Signature:		**Signature:**	
Date:	**1st July 2005**	**Date:**	**1st July 2005**

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

Test Standards Applied

CFR 47 : 2004	***Code of Federal Regulations: Pt 15 Subpart C - Radio Frequency Devices - Intentional Radiators***

Emissions Test Results Summary

CFR 47 : 2004 **PASS**

Test	Port	Method	Limit	PASS/FAIL	*Notes*
Conducted Emissions	ac power	ANSI C63.4:2003	CISPR22(B)	PASS	
Radiated Emissions		ANSI C63.4:2003	FCC Pt 15 Subpt C	PASS	

specs_fccv040903

Contents

1 EUT Details

1.1 General

The EUT was a Diomed AS/0670 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/0670 module is an intentional transmitter operating at a nominal frequency of 120kHz to 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 laser unit (the Diomed Reel 2) and also outside of the laser unit as it is intended that this RFID module should be approved for fitting to a range of products and it was required to ascertain that the RFID module still complied when not subject to any shielding from the main instrument enclosure. Conducted emissions were measured on the power leads of the Diomed Reel 2 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
1	Diomed	AS/0670	RF ID module	Pilot 01	RBQAS0670
2	Diomed Ltd	Reel 2	Medical Diode Laser	Pilot 1	N/A

1.2 Details of Interconnecting Cables

The following table lists details of the cables connected to the EUT.

From	To	Cable Type	Length	Notes
EUT	Mains	Standard IEC	1.5m	
EUT (Interlock)	Floating	Braid Screened	3m	
EUT (handswitch)	Handswitch	Braid Screened	3m	

1.3 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.

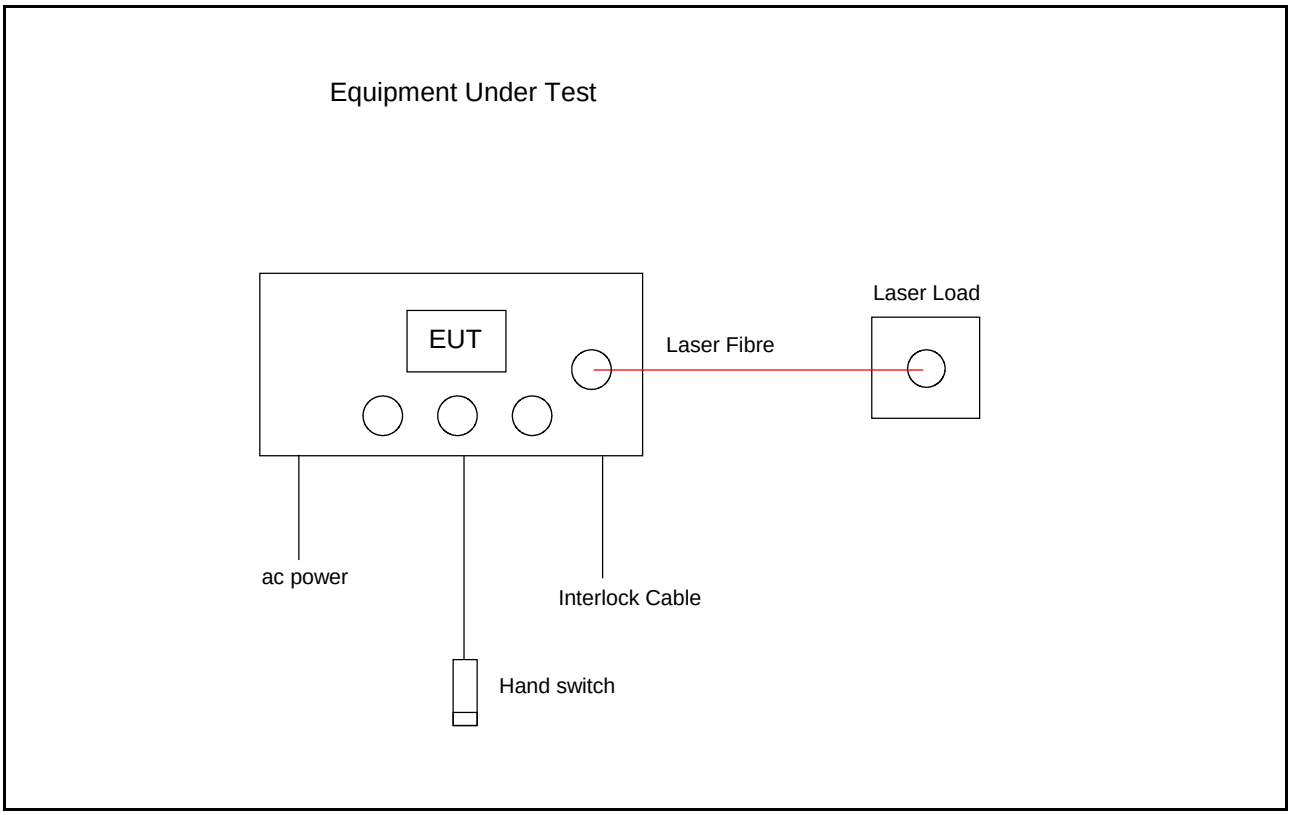
Mod No:	Details	Implemented for
0	As received for testing on 13th June 2005	

1.4 EUT Operating Modes

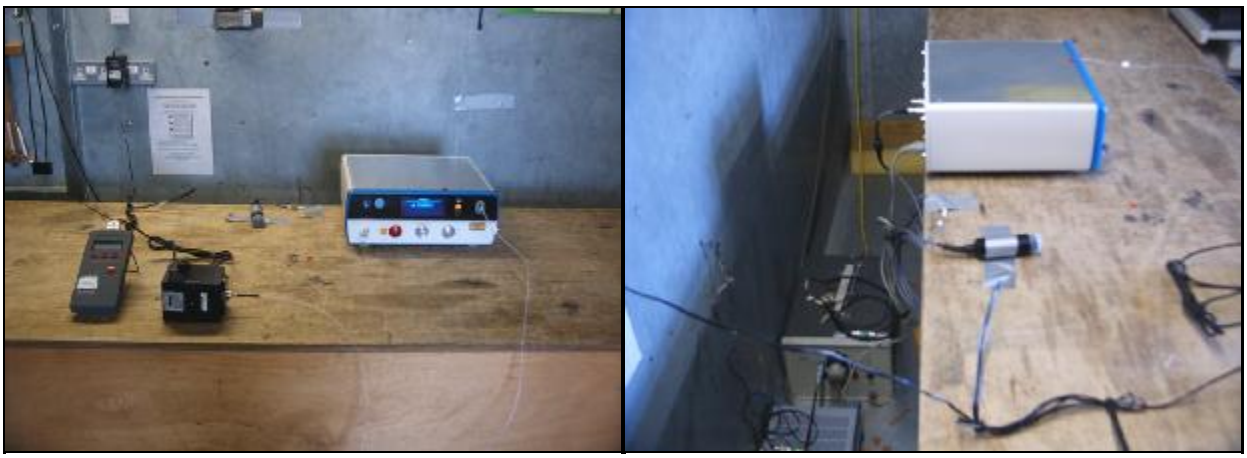
The EUT was tested in the following operating mode. The operating mode was chosen in order to exercise the functions of the EUT as fully as possible and to produce maximum emission levels. Individual test result sheets reference the operating mode of the EUT.

Operating Mode	Details
1	**Laser unit powered but idle. All ports intended for final use populated. RFID module external to laser unit and operational.**
2	**Laser unit powered but idle. All ports intended for final use populated. RFID module fitted to laser unit and operational.**

Figure 1 General Arrangement of EUT and Peripherals



Photograph 1 Arrangement of EUT and Peripherals for Conducted Emissions



Photograph 2 Arrangement of EUT and Peripherals for RFID Emissions

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:	Details	Calibration Date	Serial Number
A5	Chase Bilog CBL6111A	1st June 2005	1760
A9	EMCO 6502 Loop	2nd July 2004	2139
L1	EMCO 3825/2 LISN	18th Nov 2004	1358
R1	CHASE LHR 7000	24th March 2005	1056
R3	R&S ESHS10	24th Jan 2005	843743/010
R4	R&S ESVS10	29th March 2005	843744/002
R5	HP 8595E Spec. Analyser	9th Jan 2005	3412A00701
R5B	dB Technology Pre-amp	9th Jan 2005	dB001

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.

4.1 Conducted Emissions (Power) - Results

Factor Set 1:	L1_04B	CSET001_04A	-	-
Factor Set 2:	-	-	-	-
Factor Set 3:	-	-	-	-
Test Equipment:	R1 L1 CSET001			

Conducted Emissions (Power)

Company:	Diomed Ltd	*Product:*	RFID Module AS/0670
Date:	13/06/2005	*Test Eng:*	Peter Barlow
Ports:	ac power		
Test:	ANSI C63.4:2003 using limits of		CISPR22(B)
Ports:			
Test:	using limits of		

Plot	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	Notes
1	2	0	N	1	0.186	qp	34.6	10.3	44.9	64.2	19.4	115V
1	2	0	N	1	0.235	qp	34.2	10.2	44.4	62.3	17.8	115V
1	2	0	N	1	0.375	qp	35.4	10.2	45.6	58.4	12.8	115V
1	2	0	N	1	0.375	av	35.2	10.2	45.4	48.4	3.0	115V
1	2	0	N	1	0.622	qp	30.0	10.3	40.3	56.0	15.7	115V
2	2	0	L	1	0.186	qp	42.2	10.3	52.5	64.2	11.8	115V
2	2	0	L	1	0.232	qp	41.9	10.2	52.1	62.4	10.2	115V
2	2	0	L	1	0.232	av	35.3	10.2	45.5	52.4	6.8	115V
2	2	0	L	1	0.299	qp	37.4	10.2	47.6	60.3	12.6	115V
2	2	0	L	1	0.362	qp	36.0	10.2	46.2	58.7	12.4	115V
2	2	0	L	1	0.407	qp	34.5	10.2	44.7	57.7	13.0	115V
2	2	0	L	1	0.524	qp	33.4	10.3	43.7	56.0	12.3	115V

Results	Minimum Margin	3.0 dB	
	PASS/FAIL	PASS	

Notes	Comments and Observations
	Results of scans shown in plots 1 and 2

4.2 Magnetic Field Emissions Results - Module outside of enclosure

Factor Set 1:	A9_HI_V_04A	-	-	RG214_04A	50 m cable
Factor Set 2:	-	-	-	-	
Factor Set 3:	-	-	-	-	
Test Equipment:	R3 A9 CSET005				

Radiated_Emissions

Company:	Diomed Ltd	*Product:*	RFID Module AS/0670
Date:	21/06/2005	*Test Eng:*	Danny Williamson
Ports:			
Test:	ANSI C63.4:2003 using limits of	FCC Pt 15 Subpt C =CISPR22(B)	
Ports:			
Test:	using limits of		

Plot	Op Mode	Mod State	Dist m	Fact Set	Freq. MHz	Ant Pol	Rec. Level dBuV	Corr'n Factor dB/m	Corr'n Factor dB	Total Level dBuV/m	Limit FCC subpt C dBuV/m	Margin FCC subpt C dB	Notes
3	1	0	3	1	0.120	S	76.0	10.8		86.8	106.0	19.2	Limits
3	1	0	3	1	0.120	F	78.7	10.8		89.5	106.0	16.5	adjusted
3	1	0	3	1	0.126	S	60.0	10.8		70.8	105.6	34.8	for 3m
3	1	0	3	1	0.126	F	66.9	10.8		77.7	105.6	27.9	distance
3	1	0	10	1	0.120	S	49.0	10.8		59.8	85.1	25.3	Limits
3	1	0	10	1	0.120	F	50.2	10.8		61.0	85.1	24.1	adjusted
3	1	0	10	1	0.126	S	39.4	10.8		50.2	84.7	34.5	for 10m
3	1	0	10	1	0.126	F	40.0	10.8		50.8	84.7	33.9	distance
5	2	1	3	1	0.121	S	64.0	10.8		74.8	105.9	31.1	Limits
5	2	1	3	1	0.121	F	66.7	10.8		77.5	105.9	28.4	adjusted
5	2	1	3	1	0.126	S	58.0	10.8		68.8	105.6	36.8	for 3m
5	2	1	3	1	0.126	F	64.9	10.8		75.7	105.6	29.9	distance
5	2	1	10	1	0.121	S	38.5	10.8		49.3	85.0	35.7	Limits
5	2	1	10	1	0.121	F	39.7	10.8		50.5	85.0	34.5	adjusted
5	2	1	10	1	0.126	S	38.1	10.8		48.9	84.7	35.8	for 10m
5	2	1	10	1	0.126	F	38.7	10.8		49.5	84.7	35.2	distance

Results	Minimum Margin	16.5 dB	
	PASS/FAIL	PASS	

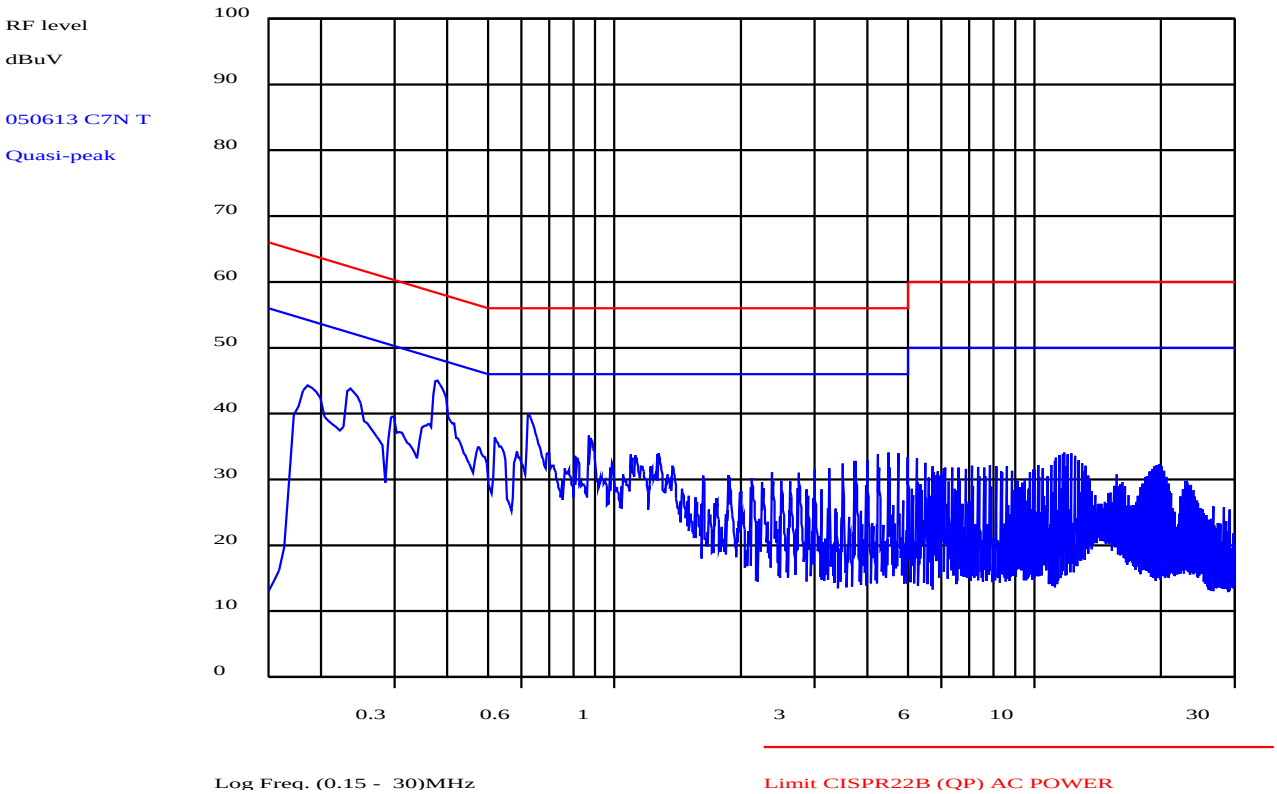
Notes	Comments and Observations
	Note - rules allow emissions in the 100kHz to 490kHz band to be measured with an average detector. The above measurements were made with a quasi-peak detector which will give a reading at least as high as an average detector. The unit operates by generating an unmodulated 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. Measurements were made at 3m and 10m. Limits were adjusted using an extrapolation of 40dB/decade as described in section 15.31 f (2) of FCC part 15. Rotated for maximum response.

Chase EMS 6.21

Notes

Analyse 050613 C7N T1584 Reel2 115V ac power

Test: 150kHz-30MHz (L1+CSET001) dBuV



PLOT 1 Conducted Emissions - Neutral Line - 115V

Company:	Diomed Ltd	Product:	AS/0670
Date:	13 Jun 05	Test Engineer:	PB
Test:	FCC Part 15 / EN55022	Limit:	Class B (QP + AV)

Notes:
Op.Mode: EUT powered, hand switch connected, laser unit idle.

Equip:R1,L1,AB002,CBL005,Patch5,CBL007.

Line:	Neutral	Attenuator:	10dB PAD	Operating Mode:	2
Detector:	QuasiPeak			Mod. State:	0
LISN:	EMCO	Filename:	C56134F0.plt		

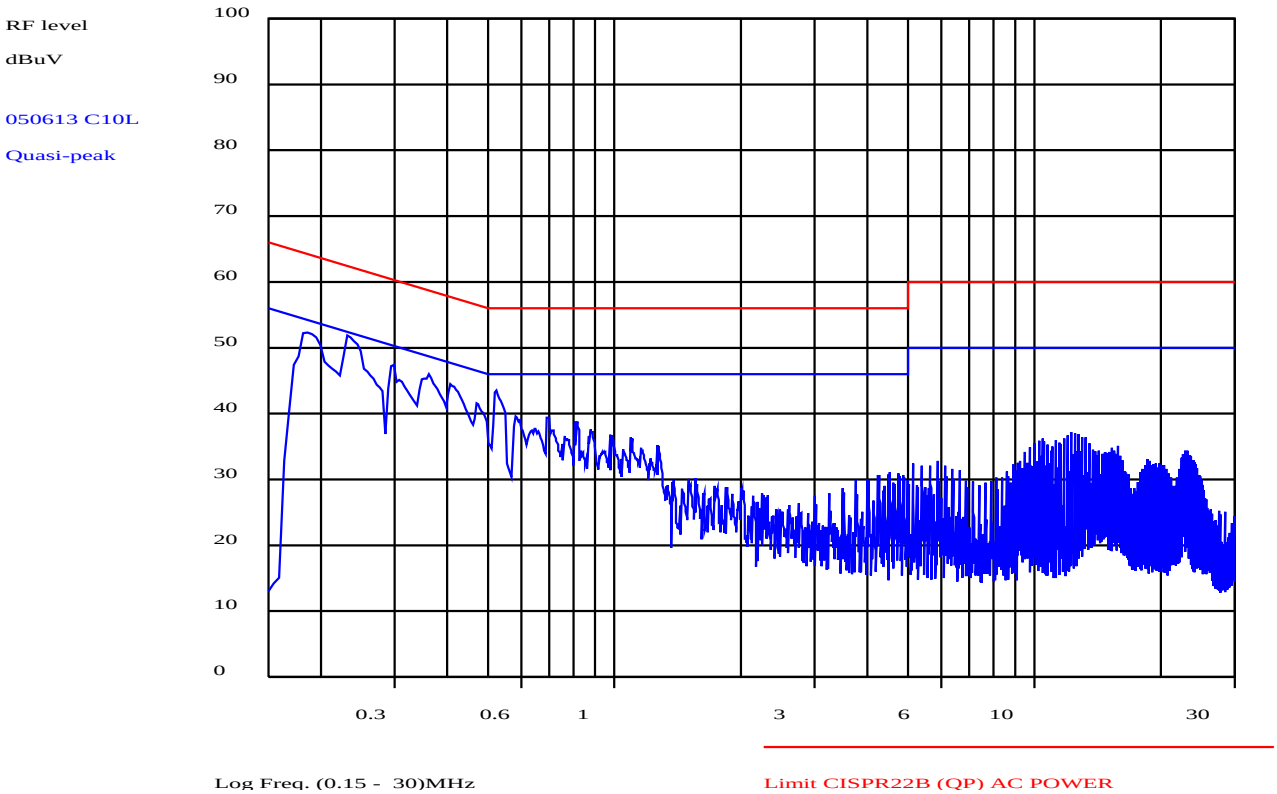
Frequency List (MHz)

Chase EMS 6.21

Notes

Analyse 050613 C10L T1584 Reel2 115V ac power

Test: 150kHz-30MHz (L1+CSET001) dBuV



PLOT 2 Conducted Emissions - Live Line - 115V

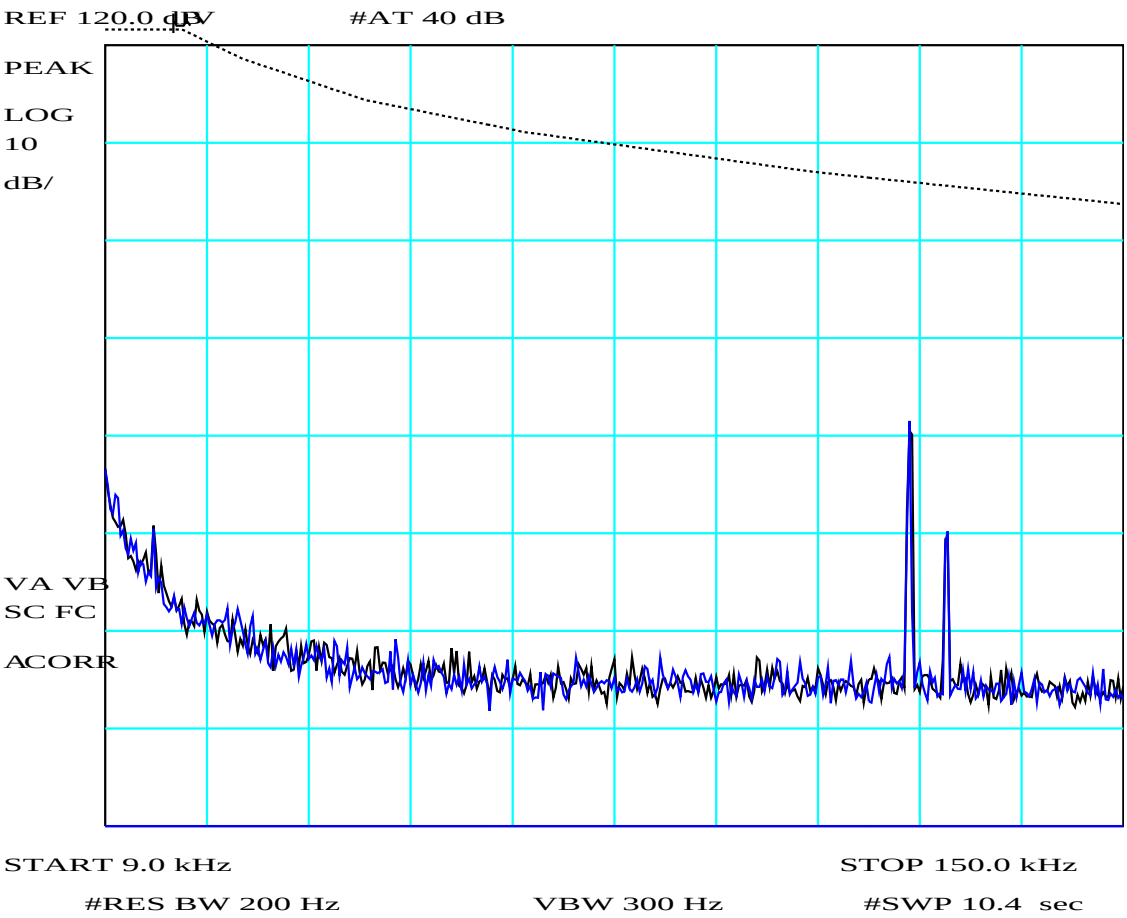
Company:	Diomed Ltd	Product:	AS/0670
Date:	13 Jun 05	Test Engineer:	PB
Test:	FCC Part 15 / EN55022	Limit:	Class B (QP + AV)

Notes:
Op.Mode: EUT powered, hand switch connected, laser unit idle.

Equip:R1,L1,AB002,CBL005,Patch5,CBL007.

Line:	Live	Attenuator:	10dB PAD	Operating Mode:	2
Detector:	QuasiPeak			Mod. State:	0
LISN:	EMCO	Filename:	C561351D.plt		

Frequency List (MHz)



PLOT 3 Magnetic Emissions - 9kHz to 150kHz - RFID module outside enclosure

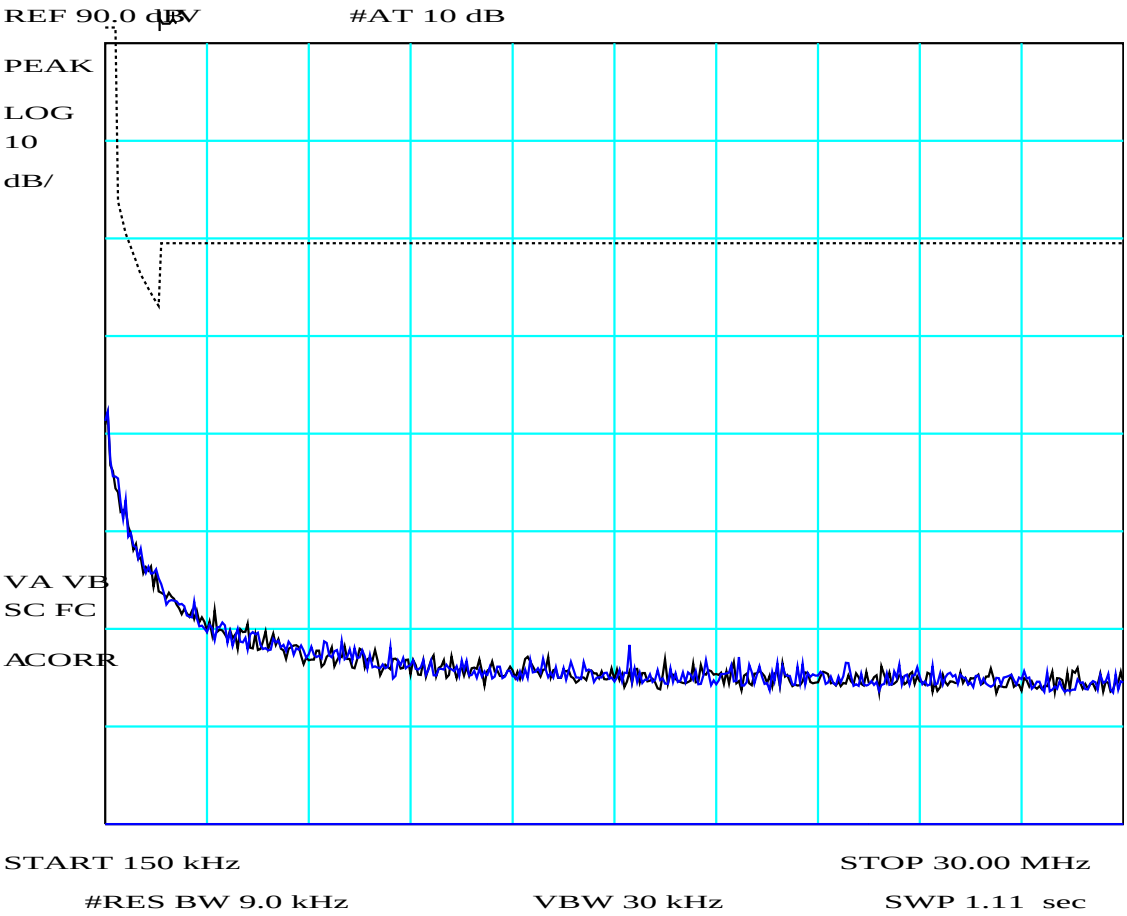
Company:	Diomed Ltd	Product:	AS/0670
Date:	21 Jun 05	Test Engineer:	Danny Williamson
Test:	FCC pt 15 subpart C	Limit:	General

Notes:
Op.Mode: RFID permanently on. Rest of EUT in standby.
RFID module outside of enclosure.

Equip: R5,CBL002,Patch1,CBL003,A9. Face on - Black Trace, Edge on - Blue Trace

Polarisation:	Face/Edge	Orientation:	0 - 360°	Operating Mode:	1
Distance:	3m	Antenna:	A9	Mod. State:	0
Height:	1m	Filename:	H56216F6.plt		

Frequency List (MHz)



PLOT 4 Magnetic Emissions - 150kHz to 30MHz - RFID Module outside enclosure

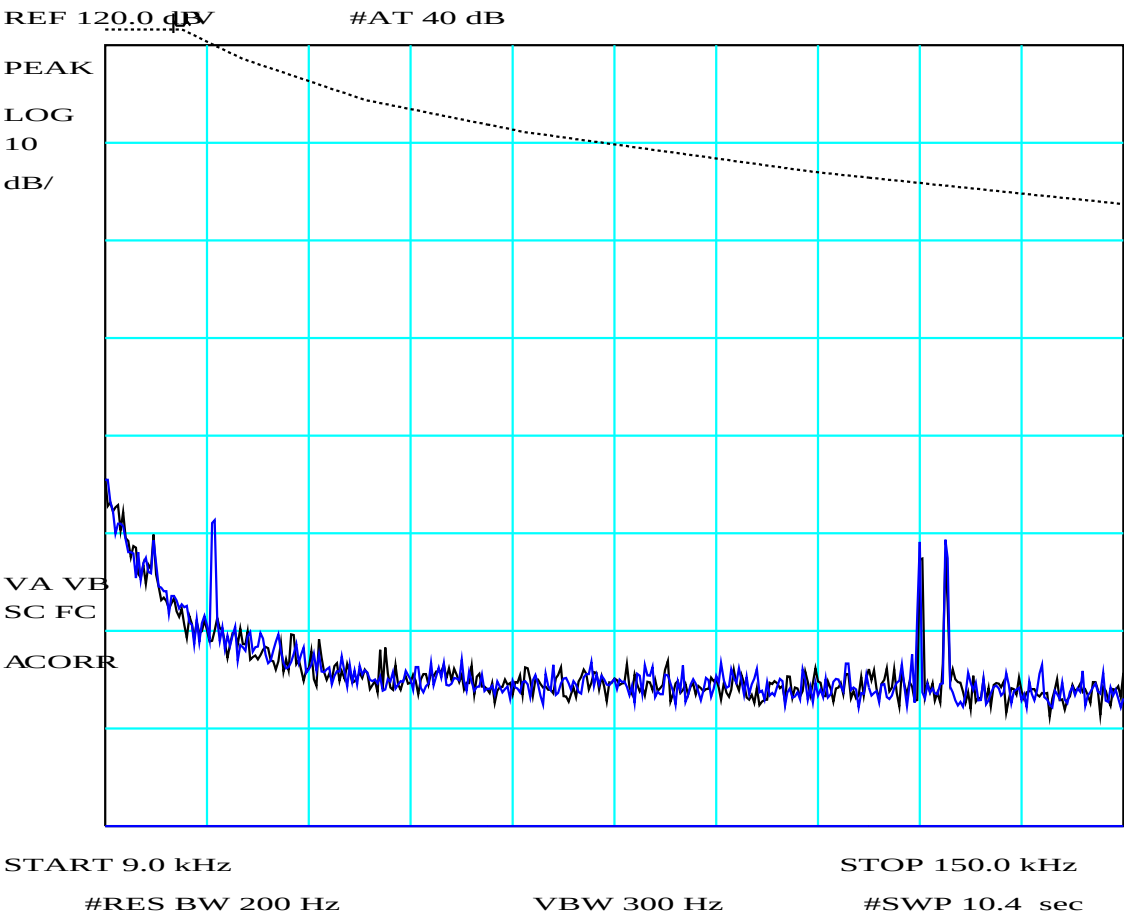
Company:	Diomed Ltd	Product:	AS/0670
Date:	21 Jun 05	Test Engineer:	Danny Williamson
Test:	FCC pt 15 subpart C	Limit:	General

Notes:
Op.Mode: RFID permanently on. Rest of EUT in standby.
RFID module outside of enclosure.

Equip: R5,CBL002,Patch1,CBL003,A9. Face on - Black Trace, Edge on - Blue Trace

Polarisation:	Face/Edge	Orientation:	0 - 360°	Operating Mode:	1
Distance:	3m	Antenna:	A9	Mod. State:	0
Height:	1m	Filename:	H562170B.plt		

Frequency List (MHz)



PLOT 5 Magnetic Emissions - 9kHz to 150kHz - RFID Module inside enclosure

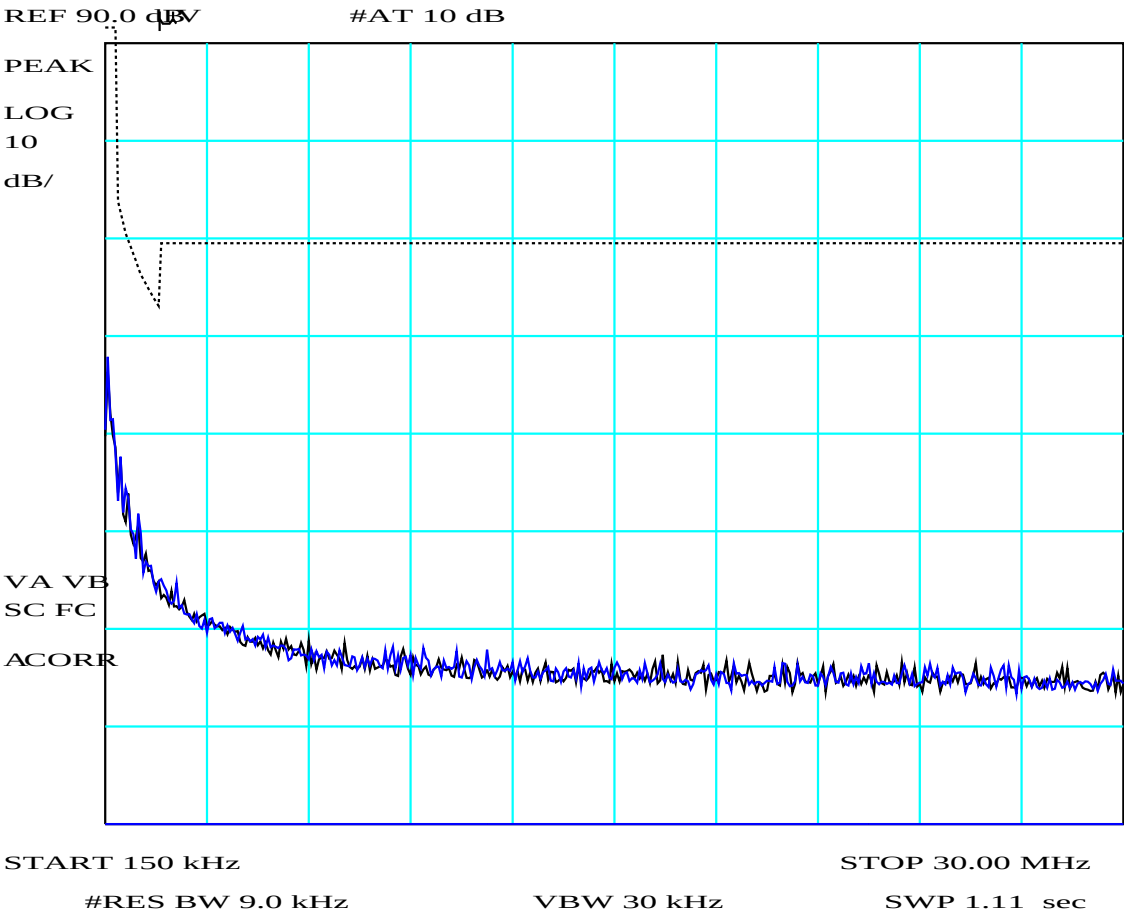
Company:	Diomed Ltd	Product:	AS/0670
Date:	21 Jun 05	Test Engineer:	Danny Williamson
Test:	FCC pt 15 subpart C	Limit:	General

Notes:
Op.Mode: RFID permanently on. Rest of EUT in standby.
RFID module inside enclosure.

Equip: R5,CBL002,Patch1,CBL003,A9. Face on - Black Trace, Edge on - Blue Trace

Polarisation:	Face/Edge	Orientation:	0 - 360°	Operating Mode:	2
Distance:	3m	Antenna:	A9	Mod. State:	0
Height:	1m	Filename:	H562171A.plt		

Frequency List (MHz)



PLOT 6 Magnetic Emissions - 150kHz to 30MHz - RFID Module inside enclosure

Company:	Diomed Ltd	Product:	AS/0670
Date:	21 Jun 05	Test Engineer:	Danny Williamson
Test:	FCC pt 15 subpart C	Limit:	General

Notes:
Op.Mode: RFID permanently on. Rest of EUT in standby.
RFID module inside enclosure.

Equip: R5,CBL002,Patch1,CBL003,A9. Face on - Black Trace, Edge on - Blue Trace

Polarisation:	Face/Edge	Orientation:	0 - 360°	Operating Mode:	2
Distance:	3m	Antenna:	A9	Mod. State:	0
Height:	1m	Filename:	H562171F.plt		

Frequency List (MHz)
