Product Integrity Laboratory

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Certification Test Report

CFR 47 FCC Part 15, Subpart C Section 15.225

Estech Systems Inc.
FCC ID # 1T1MF08B33727

Project Code CG-126

(Report CG-126-0)

Revision: 0

July 25, 2005

Prepared for:	Estech Systems Inc.
Author:	Kuganesan Pararajasingam EMC Engineer
Approved by:	Nick Kobrosly Director of Operations

Report Summary

NTS Canada

Product Integrity Laboratory
5151-47th Street, N.E. Calgary Alberta T3J 3R2

Accreditation Numbers: FCC 101386
IC 46405-3978 File # IC3978-2
Standards Council of Canada Accredited Laboratory No. 440

Performed For: Estech Systems Inc.
3701 E. Plano Parkway
Plano, Texas 75074
USA

Customer Representative: Craig Kibby
Senior Hardware Engineer

EUT Description:

EUT Description	Manufacturer	Model	Revision	Serial Number
125kHz Panther RFID Reader	Estech Systems Inc.	IVX	A	

Test Summary

Appendix	Test/Requirement Description	Deviations* from:			Pass / Fail	Applicable Rule Parts
		Base Standard	Test Basis	NTS Procedure		
A	Radiated E-Field Emissions 30 MHz – 1 GHz	No	No	No	PASS	FCC 15.209
B	Conducted Voltage Emissions 150 kHz – 30 MHz AC Power Leads	No	No	No	PASS	FCC 15.207
C	Radiated H-Field Emissions 9 kHz – 30 MHz	No	No	No	PASS	FCC 15.209

Test Result: The product presented for testing complied with test requirements as shown above.

Prepared By: Digitally signed by Kuganesan Pararajasingam
DN: CN = Kuganesan Pararajasingam, C = CA, O = NTS, OU = EMC
Reason: I am the author of this document
Date: 2005.08.12 16:50:48 -06'00'

Kuganesan Pararajasingam
EMC Engineer

Checked By:

Glen Moore
EMC Manager

Table of Contents

REGISTER OF REVISIONS

Revision	Date	Description of Revisions
0	July 25, 2005	Draft release for review

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this document is to describe the tests applied by NTS Canada to demonstrate compliance of the Panther RFID Reader from Estech Systems Inc. to FCC Part 15 Subpart C section 15.207 and 15.209 for Intentional Radiator and the equivalent sections of Industry Canada's RSS 210 Issue 5

2.0 EUT DESCRIPTION

2.1 CONFIGURATION

Description of EUT

	Name	Model	Revision	Serial Number
EUT	Panther RFID Reader	IVX		
Classification	Low Power Transmitter			
Size (m)	NA			
Weight	NA			
Power	120VAC			
Description	125kHz Panther RFID Reader			

2.2 MODE OF OPERATION

The Panther RFID Reader was tested while in a Reader mode with worst case results reported.

3.0 SUPPORT EQUIPMENT

3.1 CONFIGURATION

All support equipment information was supplied by the client and was not verified by NTS.

The support equipments were placed out of the 10-meter Chamber for the radiated emission test, as the communication cable length is 30 meter.

The EUT and support equipments were placed inside the 10-meter anechoic chamber for the conducted emission test.

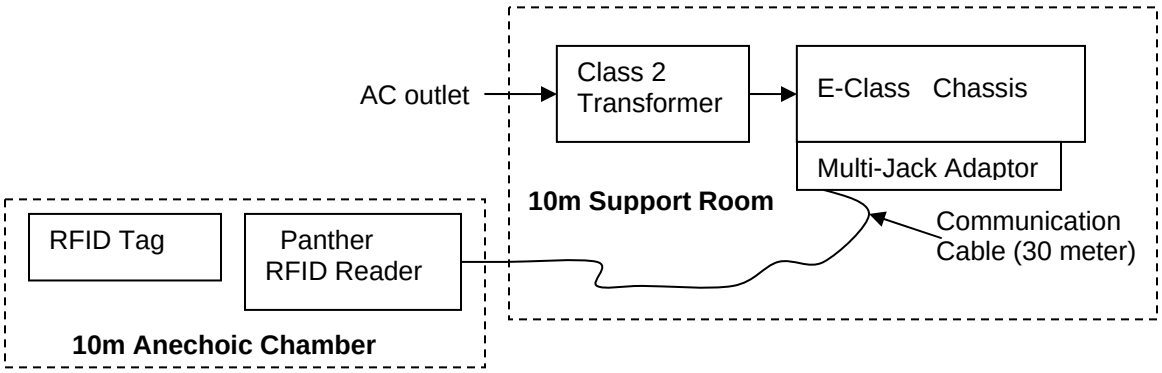

Figure 1 Radiated Emission Test Configuration

E-Class System

Position	Model	Model #	P/N	Serial Number
10m Support Room	ESI		NA	

Class 2 Transformer

Position	Model	Model #	P/N	Serial Number
10m Support Room	ESI	AP3388	4020-1227	NA

Multi-Jack Adaptor

Position	Model	Model #	P/N	Serial Number
10m Support Room	ORTRONICS	OR-812045643		

3.2 CABLES

Support Cable List

Quantity	Model	Routing		Description	Cable Length (m)
		From	To		
1	Power	AC Mains	Class 2 Transformer	Unshielded, Permanent connection to Class 2 Transformer	1.9
1	Power	Class 2 Transformer	E-Class System	Unshielded, Permanent connection to Class 2 Transformer	1.85
1	Communication	E-Class System	Panther RFID Reader	Unshielded, BERK-TEK Hyper-Plus 24 AWG	30

APPENDICES

APPENDIX A: RADIATED EMISSIONS 30 MHZ – 1 GHZ

A.1. Base Standard & Test Basis

Base Standard	CFR Title 47 – Telecommunications, Chapter I - FCC Part 15.209 – Radio Frequency Devices
Test Basis	ANSI C63.4 - 2003 Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
Test Method	NTS Radiated Emissions Test Method E001R7

A.2. Specifications

Frequency	**FCC Part 15 10-m Limit (Quasi-Peak)**
MHz	**dBµV/m**
30 - 88	29.54
88 - 216	33.06
216 - 960	35.56
960 - 1000	43.52

Notes: Limit extrapolated from 3m using 10m Limit = 3m Limit – 20 * $\log_{10}(10/3)$

A.3. Measurement Uncertainty

Radiated Emissions 30 MHz – 1 GHz	**Measurement Uncertainty**	**Expanded Uncertainty (K=2)**
(dB)	+2.32/-2.36	+4.65/-4.72

A.4. Deviations

Deviation Number	**Time & Date**	**Description and Justification of Deviation**	**Deviation Reference**			**Approval**
			Base Standard	**Test Basis**	**NTS Procedure**	
none						

A.5. Test Method

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a motorized turntable. The emission levels were maximized by rotating the turntable through 360 degrees, a measurement antenna was positioned at a distance of 10meters as measured from the closest point of the EUT, and scanned from 1-4 meters.

A spectrum analyzer with peak detection was used to find the maximum field strength during the scans. The EUT was tested in 3 orthogonal planes, with the worst case results being reported.

Test Results

Compliant. The worst case emission level at 10m was 33.13dBμV/m at 393.24MHz with a margin of 2.43dB.

A.6. Sample Calculation

Emission Level = Measured Level + Correction Factors
Margin = Limit – Emission Level

A.7. Test Data

Product Integrity Laboratory V2.5

Project Number: CG-126 **Tester:** Kuganesan Pararajasingam
Model: IVX Estech Systems Inc. **Test ID:** RE02c-10m-126
Comments: Conf01:E-Class System and Power adaptor were placed in the support room. The RFID Reader was laid flat on the tablewith display-side up.

Standard: FCC15_B | Measurement Distance: 10 meters

Antenna	CL	Frequency	AF	CL+LNA	Total CF	Detector	Measured Value	Corrected Value	Limit	Margin	Mast Height	Turntable Angle
Horizontal		MHz	dB/m	dB	dB/m		dBuV	dBuV/m	dBuV/m	dB	cm	degrees
2261 RX BiCon Hpol	10M Total Link Factor	368.66	15.00	-23.21	-8.21	QP	38.79	30.58	35.56	**4.98**	267.8	193.9
2261 RX BiCon Hpol	10M Total Link Factor	393.24	15.30	-23.29	-7.99	QP	41.12	33.13	35.56	**2.43**	302.1	187.3
Vertical												
2261 RX BiCon Vpol	10M Total Link Factor	67.58	7.00	-25.44	-18.44	QP	30.76	12.32	29.54	**17.23**	159.0	173.6
2261 RX BiCon Vpol	10M Total Link Factor	118.78	12.47	-24.84	-12.36	QP	36.45	24.09	33.06	**8.98**	400.0	138.8
2261 RX BiCon Vpol	10M Total Link Factor	188.42	9.70	-24.03	-14.33	QP	39.60	25.27	33.06	**7.80**	187.3	323.8
2261 RX BiCon Vpol	10M Total Link Factor	213.00	10.06	-23.72	-13.65	QP	43.66	30.01	33.06	**3.06**	95.4	92.1

Positive Margin indicates a Pass

A.8. Tested By

This testing was conducted in accordance with the ISO 17025:1999 scope of accreditation, table 1; Quality Manual.
Name: Kuganesan Pararajasingam
Function: EMC Technician

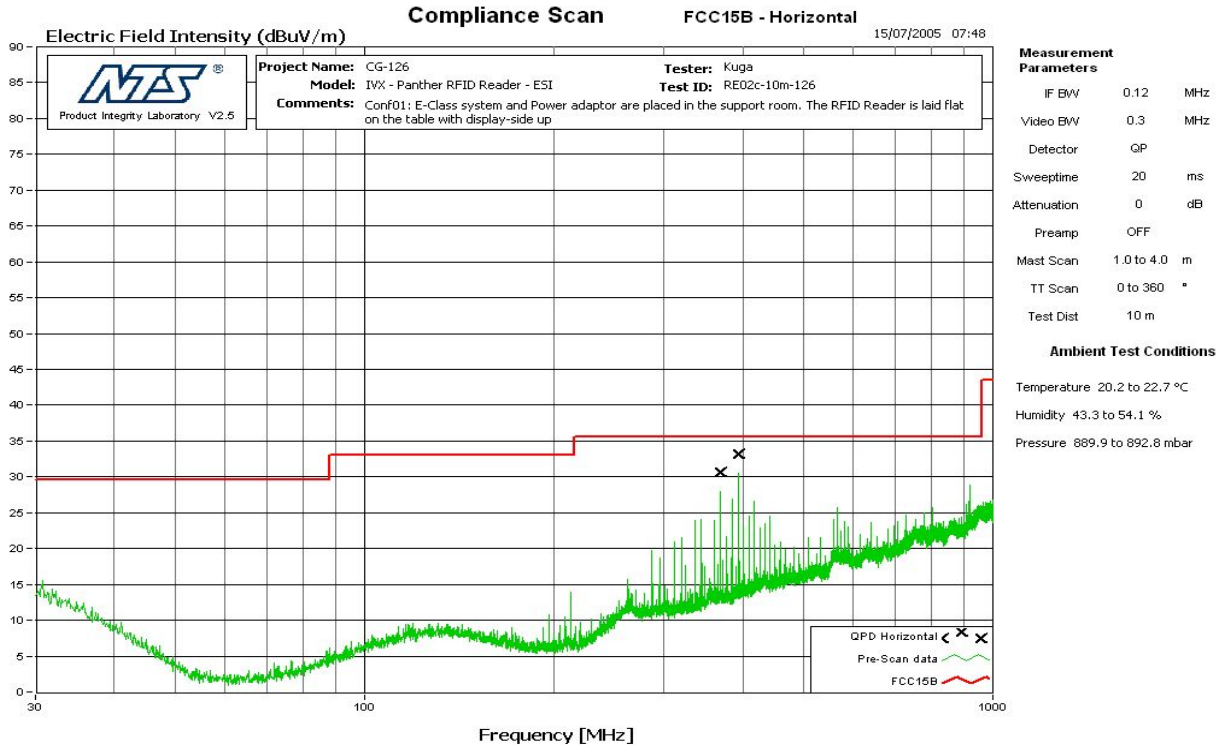

Figure 2 RE - Horizontal – 30 MHz – 1 GHz

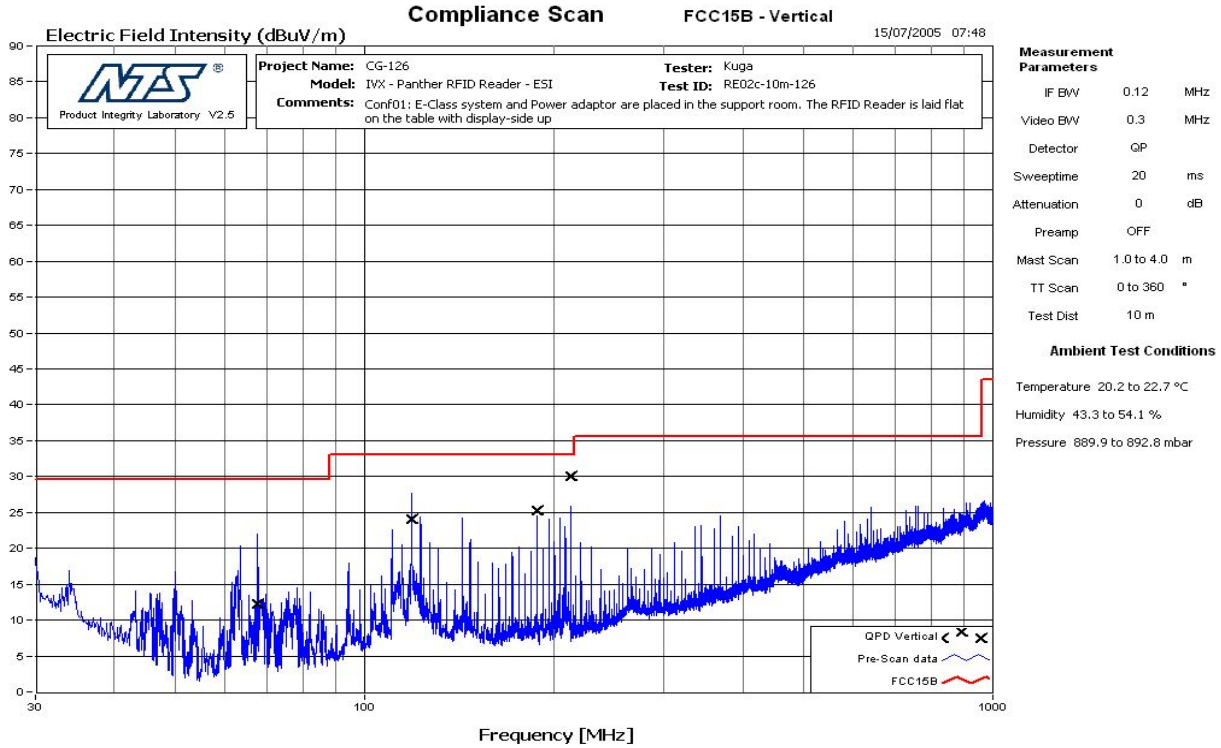

Figure 3 RE - Vertical – 30 MHz – 1 GHz

APPENDIX B: CONDUCTED EMISSIONS 150 KHZ – 30 MHZ

B.1. Base Standard & Test Basis

Base Standard	CFR Title 47 – Telecommunications, Chapter I - FCC Part 15.207 – Radio Frequency Devices
Test Basis	ANSI C63.4 - 2003 Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
Test Method	NTS Conducted Emissions Test Method E011R1

B.2. Specifications

Frequency	**Limit**	
	Quasi-Peak	**Average**
MHz	**dBµV**	**dBµV**
0.150 – 0.500	66 to 56[1]	56 to 46[1]
0.500 – 5.00	56	46
5.00 – 30.00	60	50

Note 1: decrease with the logarithm of the frequency

B.3. Measurement Uncertainty

Conducted Current Emissions 150 kHz – 30 MHz	**Measurement Uncertainty**	**Expanded Uncertainty (K=2)**
(dB)	+1.21/-1.33	+2.41/-2.66

B.4. Deviations

Deviation Number	**Time & Date**	**Description and Justification of Deviation**	**Deviation Reference**			**Approval**
			Base Standard	**Test Basis**	**NTS Procedure**	
none						

B.5. Test Results

Compliant. The worst case emission level was 32.84dBμV at 7.77MHz with a margin of 17.16dB.

B.6. Sample Calculation

Correction Factor = LISN Correction Factor + Cable Loss
Corrected Value = Measurement + Correction Factor
Margin = Limit – Corrected Emission Level

B.7. Test Data

Product Integrity Laboratory V2.5

Project Number: CG-126 **Tester:** Kuganesan Pararajasingam
Model: IVX Estech Systems Inc. **Test ID:** CE02tc-10m-126
Comments: Conf01:E-Class System and Power adaptor were placed in the support room. The RFID Reader was laid flat on the tablewith display-side up.

Standard: FCC15_B

Voltage/Line	LISN/Lead	Frequency	Measurement Detector	Measured Value	CF	Corrected Value	Limit Detector Type	Limit	Margin
		MHz		dBuV	dB	dBuV		dBuV	dB
Phase1	TT LISN A1	0.15	QP	31.25	12.44	43.69	QP	65.97	**22.28**
Phase1	TT LISN A1	7.77	QP	28.82	11.48	40.30	QP	60.00	**19.70**
Phase1	TT LISN A1	18.64	QP	24.42	12.13	36.55	QP	60.00	**23.45**
Phase1	TT LISN A1	25.12	QP	26.56	12.40	38.96	QP	60.00	**21.04**
Neutral	TT LISN A4	0.15	QP	30.75	12.24	42.99	QP	65.92	**22.94**
Neutral	TT LISN A4	0.21	QP	21.33	11.40	32.73	QP	63.04	**30.31**
Neutral	TT LISN A4	0.47	QP	16.3	10.65	26.95	QP	56.45	**29.50**
Neutral	TT LISN A4	7.51	QP	29.7	11.12	40.82	QP	60.00	**19.18**
Phase1	TT LISN A1	0.40	Avg	11.45	10.96	22.41	Avg	47.87	**25.46**
Phase1	TT LISN A1	0.27	Avg	17.92	11.24	29.16	Avg	51.01	**21.85**
Phase1	TT LISN A1	7.77	Avg	21.35	11.49	32.84	Avg	50.00	**17.16**
Phase1	TT LISN A1	18.64	Avg	19.07	12.13	31.20	Avg	50.00	**18.80**
Neutral	TT LISN A4	0.15	Avg	14.98	12.26	27.24	Avg	55.98	**28.75**
Neutral	TT LISN A4	0.40	Avg	11.09	10.73	21.82	Avg	47.75	**25.94**
Neutral	TT LISN A4	0.49	Avg	11.02	10.65	21.67	Avg	46.22	**24.55**
Neutral	TT LISN A4	7.51	Avg	17.72	11.12	28.84	Avg	50.00	**21.16**

Positive Margin indicates a Pass

B.8. Tested By

This testing was conducted in accordance with the ISO 17025:1999 scope of accreditation, table 1; Quality Manual.

Name: Kuganesan Pararajasingam
Function: EMC Technician

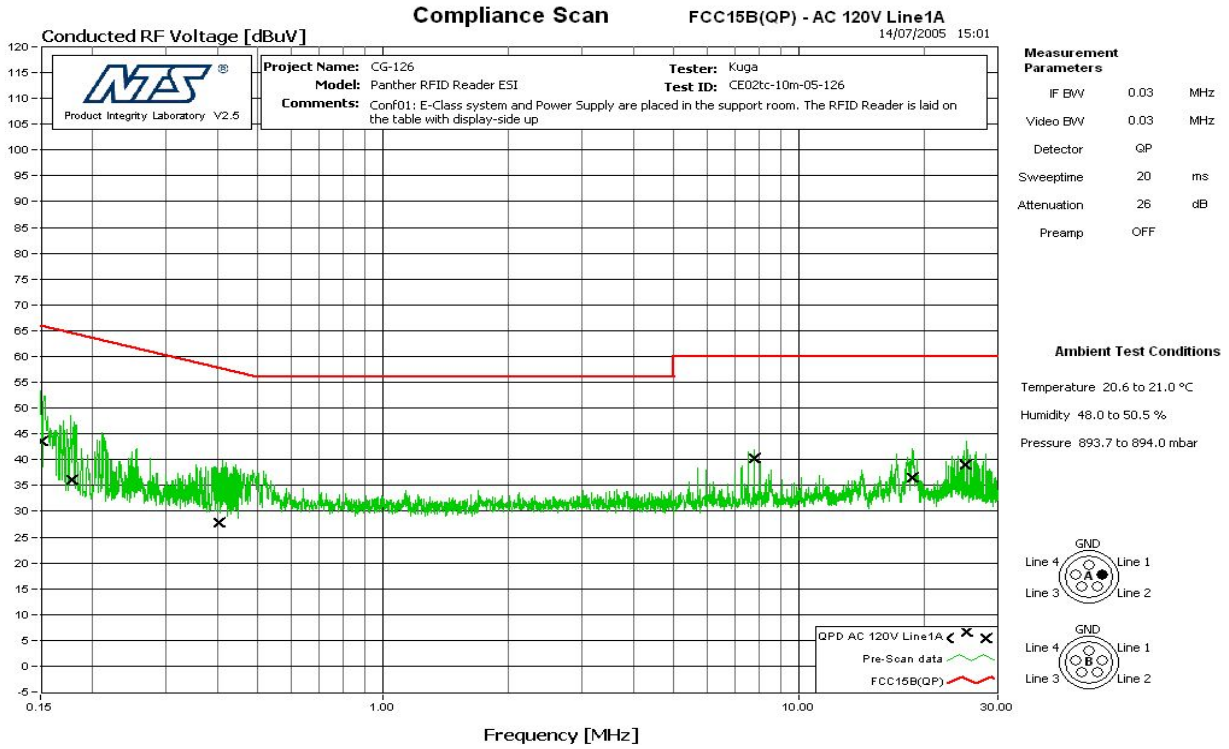

Figure 4 CE –Line A1 – 150 kHz – 30 MHz (QP Detector)

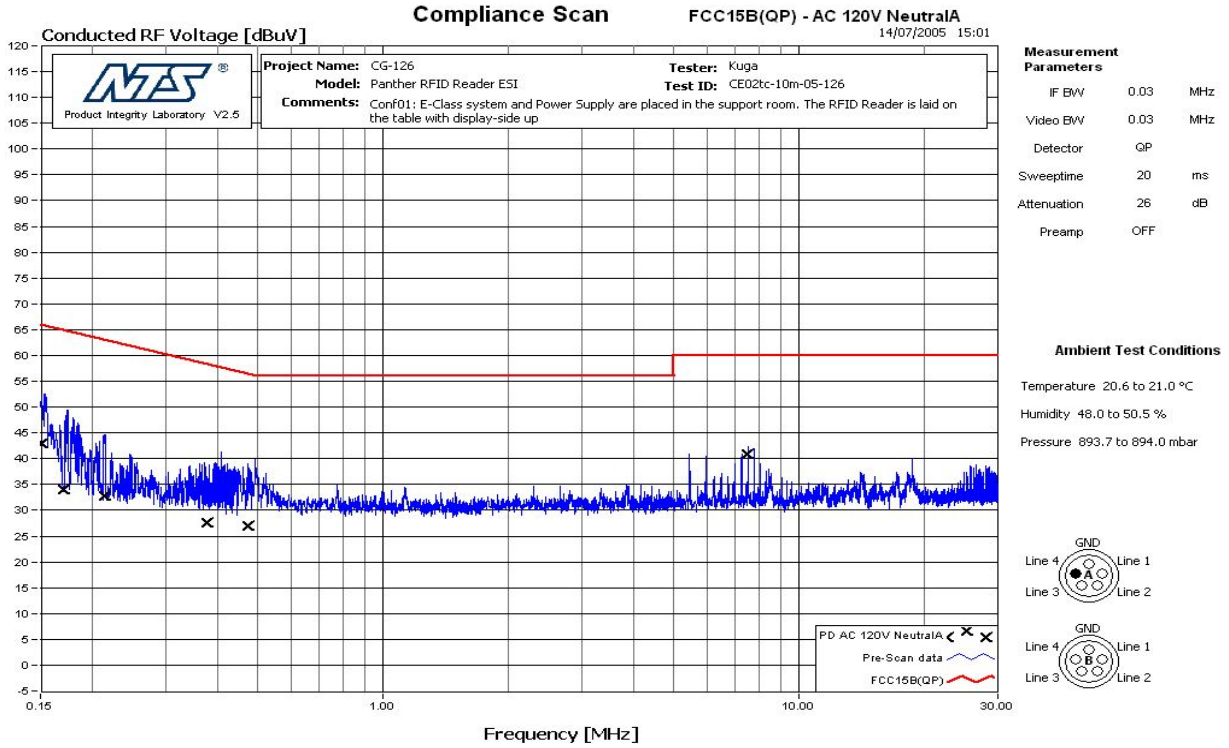

Figure 5 CE –Return A2 – 150 kHz – 30 MHz (QP Detector)

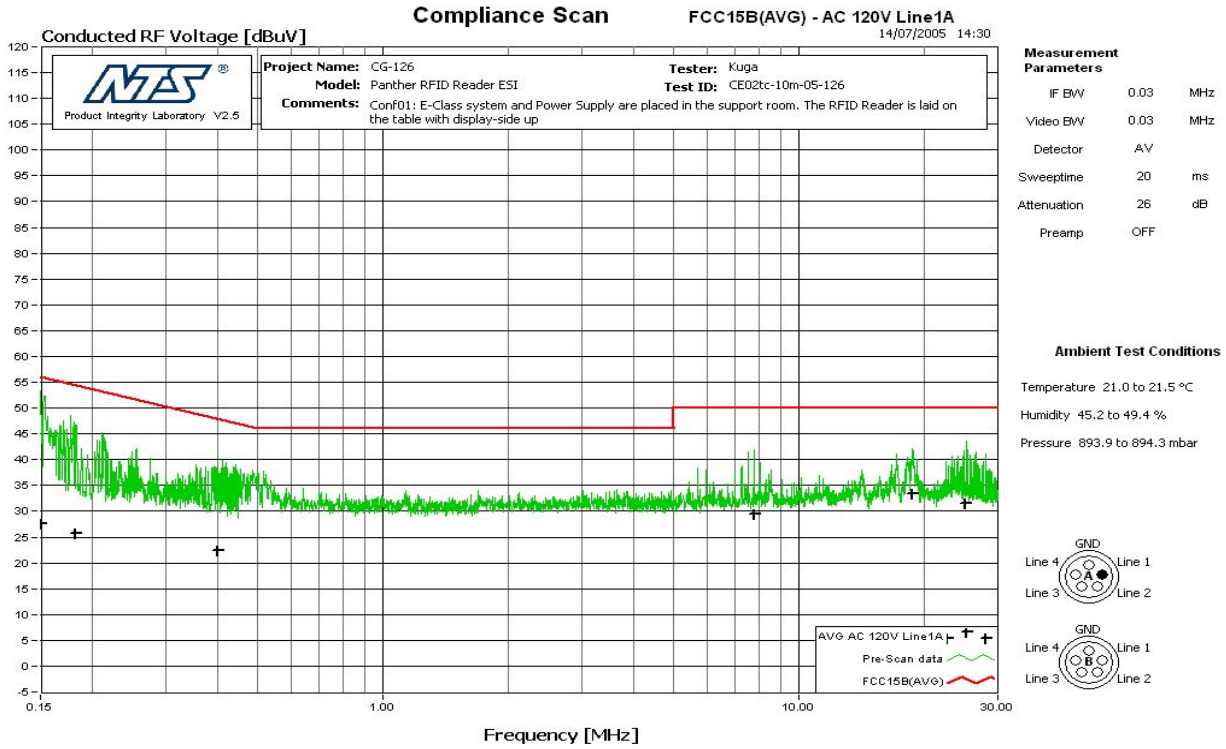

Figure 6 CE –Line A1 – 150 kHz – 30 MHz (Average Detector)

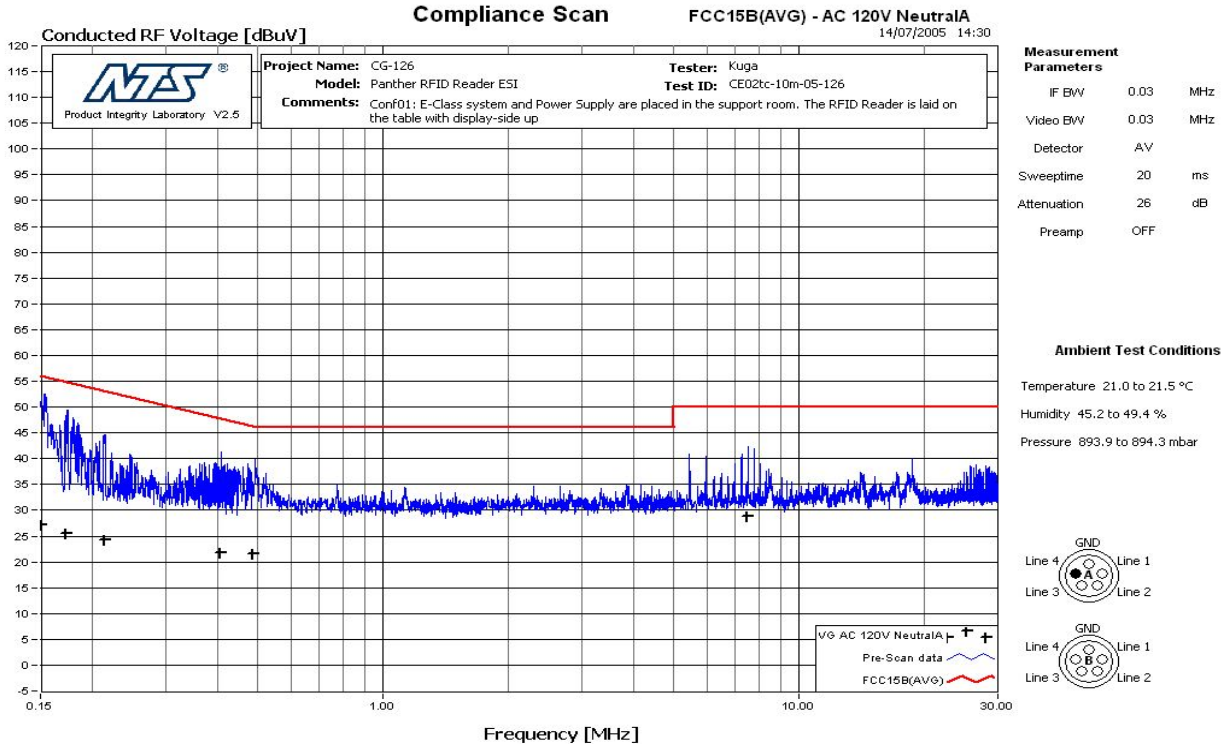

Figure 7 CE –Return A2 – 150 kHz – 30 MHz (Average Detector)

APPENDIX C: RADIATED H-FIELD EMISSIONS 9 KHZ - 30 MHZ

C.1. Base Standard & Test Basis

Base Standard	CFR Title 47 – Telecommunications, Chapter I - FCC Part 15.209 and Part 15.225 – Radio Frequency Devices
Test Basis	ANSI C63.4 - 2003 Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
Test Method	NTS Radiated H-Field Emissions Test Method 28.2, Rev 1.0

C.2. Specifications

Frequency (F)	Limit		Limit at 3m
	Field Strength	Distance	
MHz	µV/m	m	dBµV/m
0.009 – 0.49	2400/ F(kHz)	300	128.5 to 93.8[1]
0.49 – 1.705	24000/ F(kHz)	30	73.8 to 63.0[1]
1.705 – 30	30	30	69.5

Notes:

1. [1] decrease with the logarithm of the frequency.
2. Limit is extrapolated from 300m and 30 to 3m by adding 80dB and 40dB respectively.

C.3. Measurement Uncertainty

Radiated H-Field Emissions 9kHz – 30MHz	Measurement Uncertainty	Expanded Uncertainty (K=2)
(DB)	+2.15/-2.19	+4.30/-4.38

C.4. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
none						

C.5. Test Method

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a motorized turntable. The fundamental field strength was maximized by rotating the turntable through 360 degrees. The receive Loop antenna was positioned with its plane vertical at a distance of 3 meters as measured from the closest point of the EUT and 1 meter above the ground plane and rotated about its vertical axis for maximum response. A spectrum analyzer with peak detection was used to find the maximum field strength during the scans. The EUT was tested in 3 orthogonal planes, with the worst case results being reported.

C.6. Test Results

Compliant. The worst case fundamental field strength is 73.07dBμV/m

C.7. Sample Calculation

Margin = Limit – Emission Level

C.8. Test Data

Product Integrity Laboratory **V2.5**

Project Number:	CG-126	**Tester:**	Kuga
Model:	IVX - Panther RFID Reader	**Test ID:**	RE01-10m-126
Comments:	Conf02:E-Class system and Power supply are placed in the support room, The RFID reader stands still on the table at the up-right position		

Standard :	FCC Part 15	Measurement Distance :	3 meters	Measurement Type :	H-Field

Antenna	Frequency	AF	CL	Total CF	Detector	Measured Value	Corrected Value	Limit at 3 meter	Margin
Horizontal	MHz	dB/m	dB	dB/m		dBuV	dBuV/m	dBuV/m	dB
R&S HFH2-Z2 Loop	0.0510	19.50	0.08	19.58	Peak	41.57	61.15	113.45	**52.30**
R&S HFH2-Z2 Loop	0.1020	19.40	0.08	19.48	Peak	32.47	51.95	107.43	**55.48**
R&S HFH2-Z2 Loop	0.1250	19.38	0.09	19.47	Peak	53.60	73.07	105.67	**32.60**
Vertical									
R&S HFH2-Z2 Loop	0.0510	19.50	0.08	19.58	Peak	36.94	56.52	113.45	**56.93**
R&S HFH2-Z2 Loop	0.1020	19.40	0.08	19.48	Peak	28.71	48.19	107.43	**59.24**
R&S HFH2-Z2 Loop	0.1250	19.38	0.09	19.47	Peak	50.26	69.73	105.67	**35.94**

Positive Margin indicates a Pass

C.9. Tested By

This testing was conducted in accordance with the ISO 17025:1999 scope of accreditation, table 1; Quality Manual.
Name: Kuganesan Pararajasingam
Function: EMC Technician

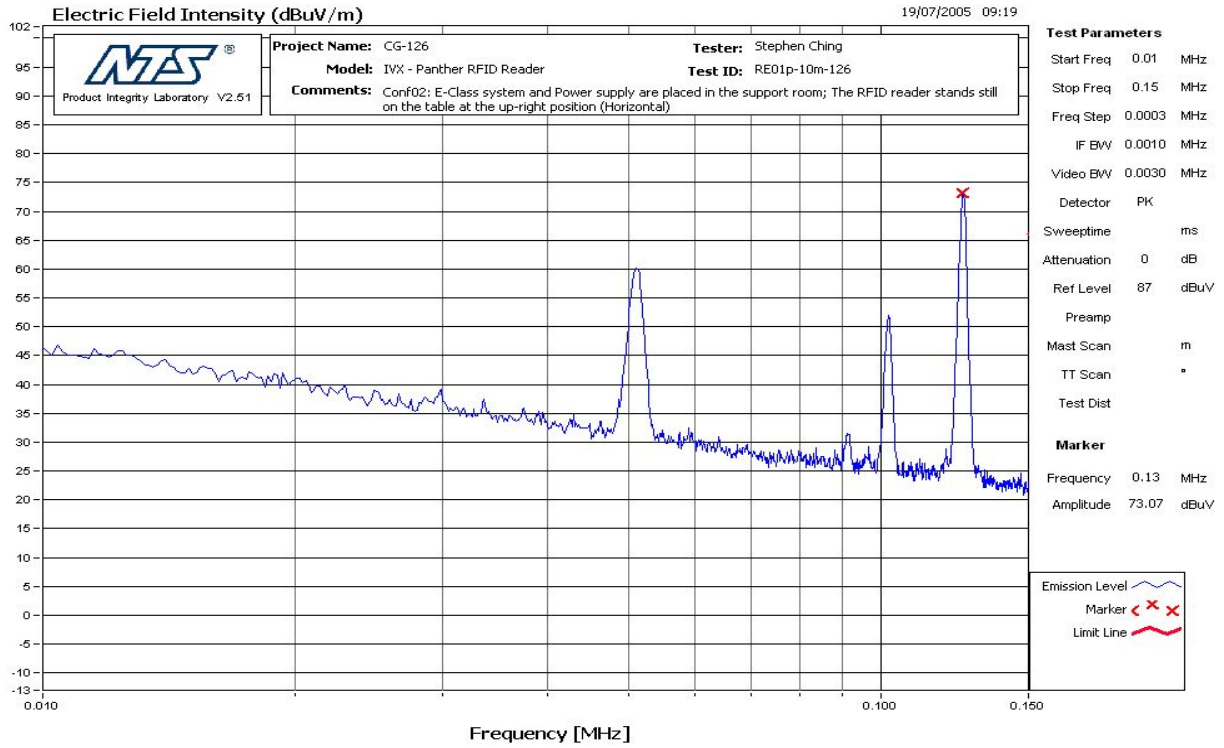

Figure 8 RE - Horizontal – 9kHz – 150kHz (EUT on Up-right Position)

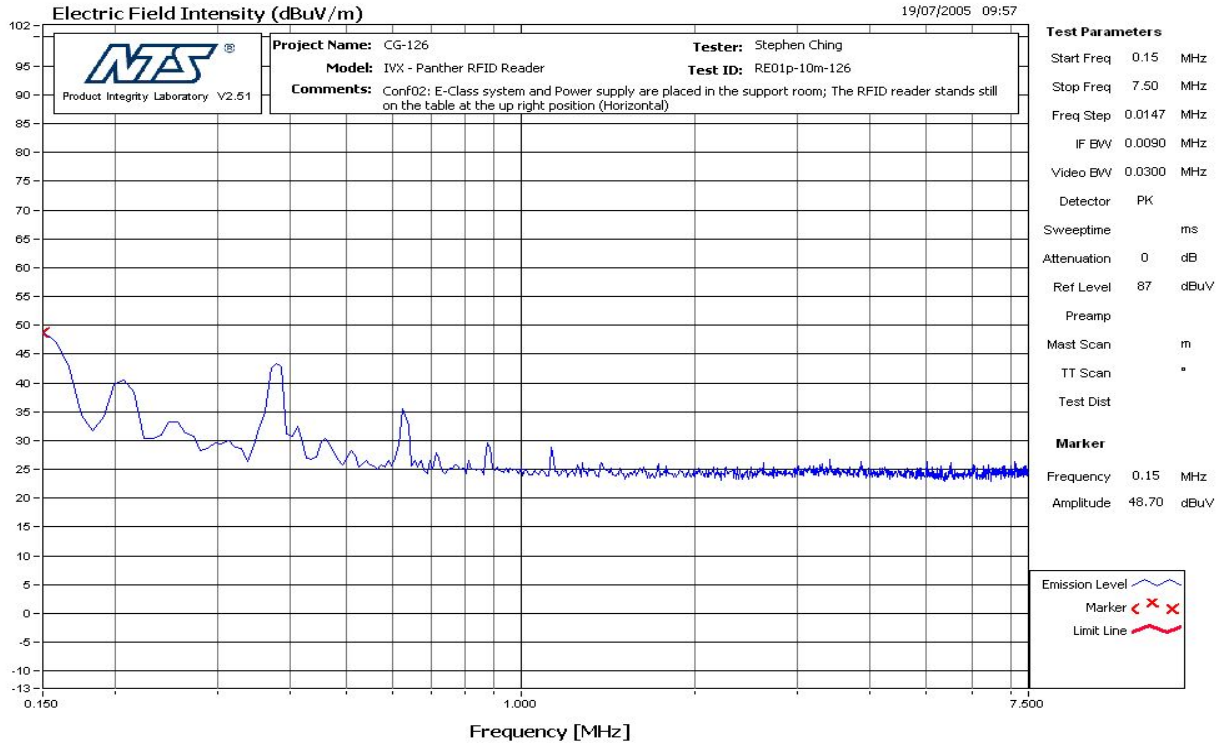

Figure 9 RE - Horizontal – 150kHz – 7.5MHz (EUT on Up-right Position)

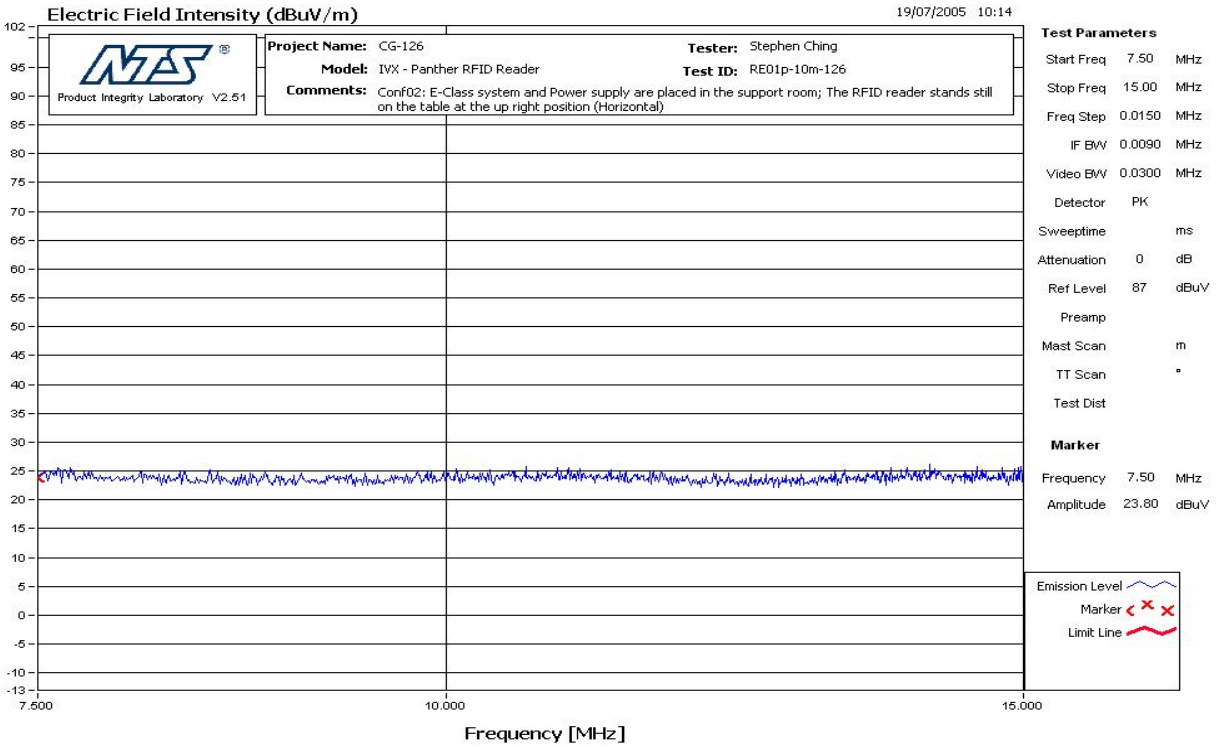

Figure 10 RE - Horizontal – 7.5Hz – 15MHz (EUT on Up-right Position)

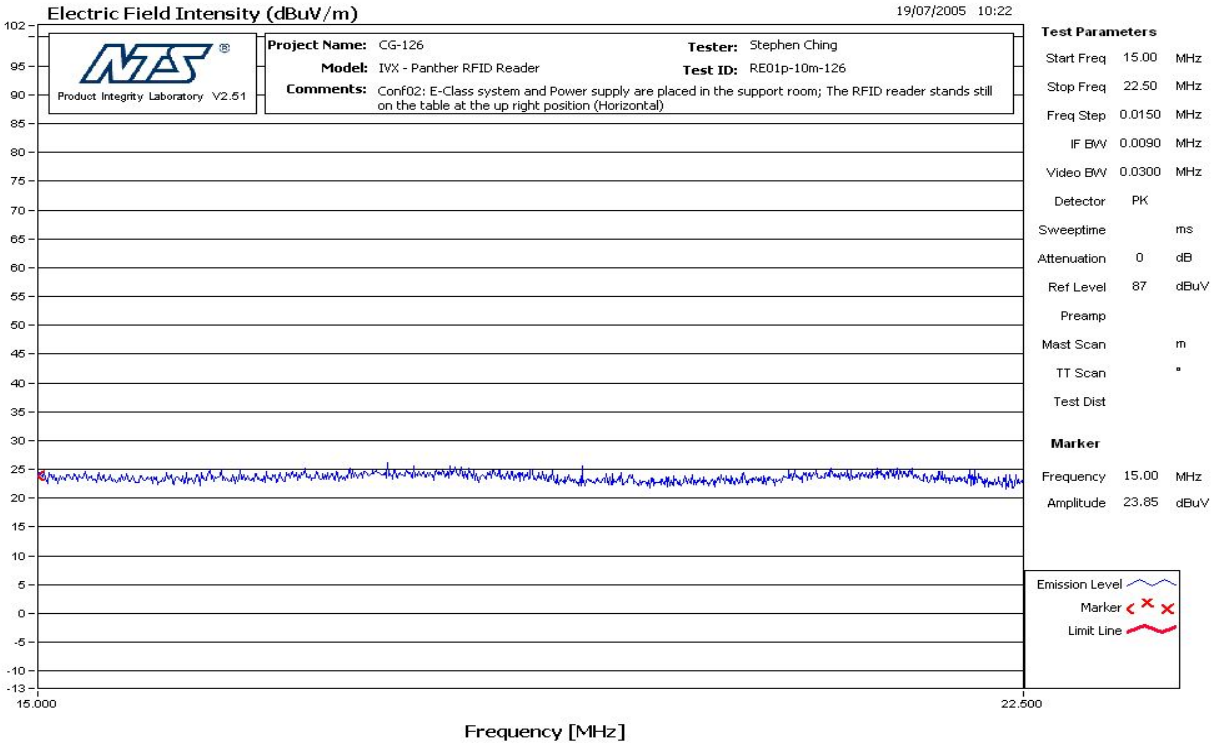

Figure 11 RE - Horizontal – 15Hz – 22.5MHz (EUT on Up-right Position)

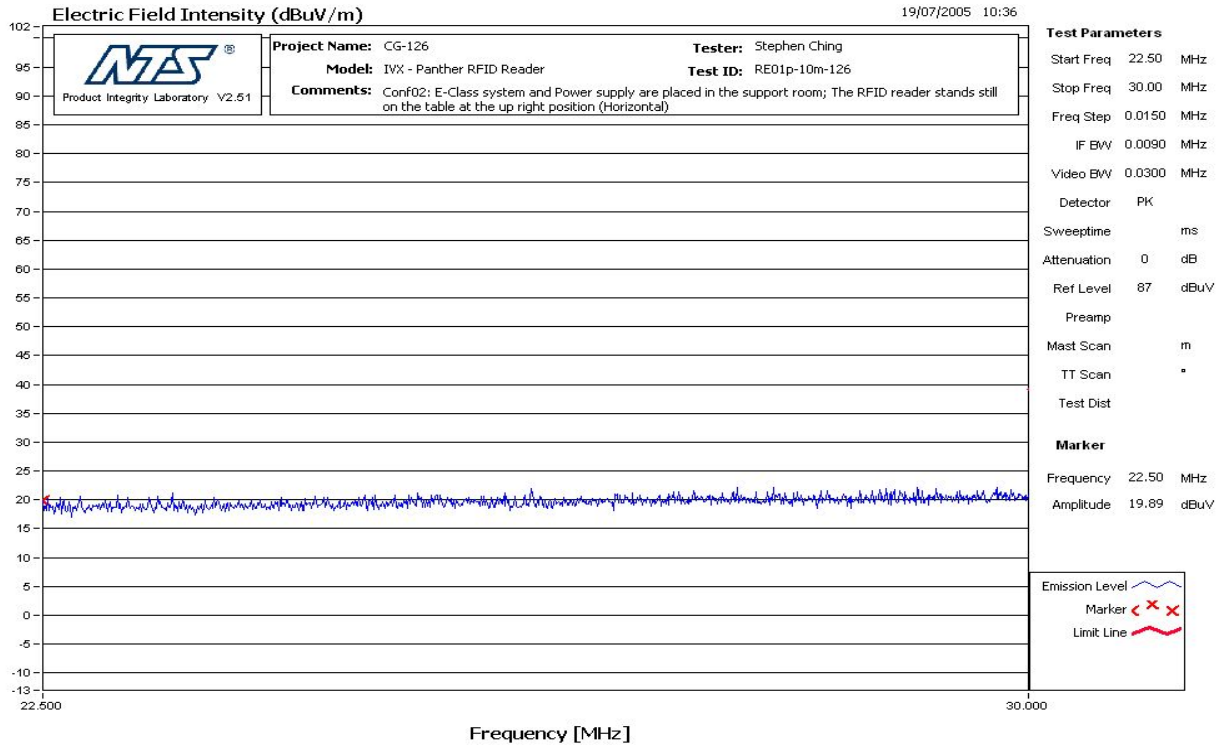

Figure 12 RE - Horizontal – 22.5Hz – 30MHz (EUT on Up-right Position)

APPENDIX D: TEST EQUIPMENT

D.1. Radiated Emissions 30 MHz – 1 GHz Measurement Equipment

Description	Manufacturer	Type/Model	Asset #	Cal Due	Cal Date
10m ANECHOIC CHAMBER					
Bilog Antenna	☐ Chase	CBL 6111B	260398	09JULY06	09JULY04
	☒ Chase	CBL 6112B	260301		
RF Cable	Suhner Succoflex	Ferrite bead loaded cable	260388	07JAN06	07JAN04
CONTROL ROOM					
Test Receiver	☒ Rohde & Schwarz	ESAI	260110 / 260111	2FEB06	2FEB05
Mast Controller	EMCO	2090	260165	N/A	N/A
Multi Device Controller TT1 (Turntable)	07JAN06	07JAN04		N/A	N/A
RF 10m East site Link				08JAN06	08JAN04
- Cable 1	Suhner Succoflex	NA	263135		
- Cable 2	Suhner Succoflex	NA	263161		
- Cable 3	Suhner Succoflex	NA	263162		
- Cable 4	TDL	SMC-002	260162		
- Amplifier	Hewlett Packard	8447F	260164		

D.2. Conducted Emissions 10 kHz – 30 MHz Measurement Equipment

Description		Manufacturer	Type/Model	Serial #	Cal Due	Cal Date
10m ANECHOIC CHAMBER						
A LISN Link					07JAN06	07JAN04
-LISN A Switch	☒ A	NA	NA	263177		
-Cable Switch to Limiter	☒ A	NA	NA	263164		
- Cable LISN to Switch	☒ A1	Succoflex	NA	263168	07JAN06	07JAN04
	☐ A2	Succoflex	NA	263169	07JAN06	07JAN04
	☐ A3	Succoflex	NA	263170	07JAN06	07JAN04
	☒ A4	Succoflex	NA	263171	07JAN06	07JAN04
- Table Top LISN	☒ TT	EMCO	3825	260354	08JAN06	08JAN04
CONTROL ROOM						
Test Receiver		Rohde & Schwarz	ESAI	260110 / 260111	2FEB06	2FEB05
Mast Controller		EMCO	2090	260166	N/A	N/A
Switch Matrix		TDL	SMC-002	260162	07JAN06	07JAN04
Cable Switch Matrix to Receiver		NA	NA	263166	07JAN06	07JAN04
A LISN Link					07JAN06	07JAN04
-LISN A Limiter	☒ A	NA	NA	263178		
-Cable Switch to Limiter	☒ A	NA	NA	263164		

D.3. Radiated H-Field Emissions 10kHz – 30MHz Measurement Equipment

Description		Manufacturer	Type/Model	Serial #	Cal Due	Cal Date
10m ANECHOIC CHAMBER						
Loop Antenna		R&S	HFH2-Z2	DE12245	09NOV05	09NOV04
Loop Antenna Power Supply		NA	NA	263257	N/A	N/A
Cable	☒ 3m center site bulkhead to antenna	Succoflex	NA	263136	08JAN06	08JAN04
	☐ H-Field site bulkhead to antenna	Succoflex	NA	263387	08JAN06	08JAN04
CONTROL ROOM						
Mast Controller		EMCO	2090	260166	N/A	N/A
Multi Device Controller TT1 (Turntable)		EMCO	2090	260165	N/A	N/A
Test Receiver		Rohde & Schwarz	ESAI	260110 / 260111	02FEB06	02FEB05
☒ RF 3m Center site Link					08JAN06	08JAN04
- Cable 1		Succoflex	NA	263188		
- Cable 2		Succoflex	NA	263134		
☐ RF 10m H-Field site Link					08JAN06	08JAN04
- Cable 1		Succoflex	NA	263184		
- Cable 2		Succoflex	NA	263189		
- Cable 3		Succoflex	NA	263167		
- Switch Matrix Controller		TDL	SMC-002	260162		

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