



Product Integrity Laboratory

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Certification Test Report

CFR 47 FCC Part 15, Subpart C Section 15.225
Industry Canada RSS 210, Issue 6

VUI RFID Reader
FCC ID # SYXVUI00
IC ID # 6205A-VUI00

Project Code CG-159
(Report CG-159-0)

Revision: 1
December 13, 2005

Prepared for: Microlynx Systems Inc./BMI Technologies Inc

Author: Kuganesan Pararajasingam
EMC Engineer

Approved by: Nick Kobrosly
Director of Operations

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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: Microlynx Systems Inc.
#240, 6715 - 8th Street N.E.
Calgary, AB, T2E 7H7
Canada

Customer Representative: Luc De Vocht
Email: luc@microlynxsystems.com
Tel: (403) 275-7346 Fax: (403) 275-9501

EUT Description:

EUT Description	Manufacturer	Model	Revision	Serial Number
Vehicle monitoring RFID	BMI TECHNOLOGIES INC.	G Force Plus VUI RFID Reader	NA	01

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Test Summary

Appendix	Test/Requirement Description	Deviations* from:			Pass / Fail	Applicable Rule Parts
		Base Standard	Test Basis	NTS Procedure		
A	Radiated H-Field Emissions 9 kHz – 30 MHz	No	No	No	PASS	FCC 15.209 , 15.225, RSS 210
B	Radiated E-Field Emissions 30 MHz – 10 GHz	No	No	No	PASS	FCC 15.209, RSS 210

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

Prepared By: _____
Kuganesan Pararajasingam
EMC Engineer

Checked By: _____
Glen Moore
EMC Manager

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REGISTER OF REVISIONS

Revision	Date	Description of Revisions
0	November 8, 2005	Draft release for review
1	December 13, 2005	Final draft

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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 VUI RFID Reader from BMI Technologies. to FCC Part 15 Subpart C section 15.225 for Intentional Radiator and the equivalent sections of Industry Canada's RSS 210 Issue 6

2.0 EUT DESCRIPTION

2.1 CONFIGURATION

Description of EUT

	Name	Model	Revision	Serial Number
EUT	VUI RFID Reader	G Force Plus VUI RFID Reader	NA	01
Classification	Low Power Transmitter			
Size (m)	NA			
Weight	NA			
Power	12 VDC Nominal			
Description	13.56 MHz RFID Reader			

2.2 MODE OF OPERATION

The VUI RFID Reader was tested while in a Reader/Writer mode with worst case results reported. For Radiated emissions the EUT was checked in three orthogonal planes with worst case results reported. The EUT was also check at all available data rates for worst case.

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APPENDICES

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

A.1. Base Standard & Test Basis

Base Standard	CFR Title 47 – Telecommunications, Chapter I - FCC Part 15.209 and Part 15.225 – Radio Frequency Devices, RSS 210 Issue 6
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

A.2. Specifications

Frequency (F)	Limit		Limit at 10m
	Field Strength	Distance	
MHz	$\mu\text{V/m}$	m	$\text{dB}\mu\text{V/m}$
0.009 – 0.49	2400/ F(kHz)	300	107.6 to 72.9 ¹
0.49 – 1.705	24000/ F(kHz)	30	52.9 to 42.1
1.705 – 13.11	30	30	48.6
13.11 – 13.41	106	30	59.6
13.41 – 13.553	334	30	69.6
13.553 – 13.567	15848	30	103.1
13.567 – 13.71	334	30	69.6
13.71 – 14.01	106	30	59.6
14.01 – 30	30	30	48.6

Notes:

- ¹ decrease with the logarithm of the frequency.
- Limit is extrapolated from 300m and 30 to 10m by adding 59.1dB and 19.1dB respectively.

A.3. Measurement Uncertainty

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

A.4. Deviations

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

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A.5. Test Method

The EUT was placed on a non-conductive table 0.8 meters above the floor. 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 at a distance of 3 meters as measured from the closest point of the EUT and 1 meter above the ground plane. A spectrum analyzer with peak detection was used to find the maximum field strength during the scans. The EUT was tested in 3 orthogonal, with the worst case results being reported.

A.6. Test Results

Compliant. The worst case fundamental field strength is 44.62dB μ V/m at 27.123MHz with 4.0dB margin.

A.7. Sample Calculation

Margin = Limit – Emission Level

A.8. Test Data



Product Integrity
Laboratory V2.5

Project Number: CG-159
Model: G force +VM - VUI
Comments: Conf04: G-Force+VM-VUI, Vertical Upright position, 12VDC, Inductor added in the RFID reader

Tester: Deniz
Test ID: RE01-10m-159

Standard :	FCC Part 15	Measurement Distance :	10 meters	Measurement Type :	H-Field
------------	-------------	------------------------	-----------	--------------------	---------

Antenna	Frequency	AF	CL	Total CF	Detector	Measured Value	Corrected Value	Limit	Margin
Horizontal	MHz	dB/m	dB	dB/m		dBuV	dBuV/m	dBuV/m	dB
R&S HFH2-Z2 Loop	1.5860	19.44	0.22	19.66	Peak	11.08	30.74	42.68	11.94
R&S HFH2-Z2 Loop	1.6435	19.44	0.21	19.65	Peak	10.68	30.33	42.37	12.04
R&S HFH2-Z2 Loop	1.6866	19.43	0.21	19.64	Peak	10.71	30.35	42.14	11.79
Perpendicular									
R&S HFH2-Z2 Loop	1.6148	19.44	0.21	19.65	Peak	11.52	31.17	42.52	11.35
R&S HFH2-Z2 Loop	13.5528	20.34	0.60	20.94	Peak	17.61	38.55	69.55	31.00
R&S HFH2-Z2 Loop	13.5600	20.34	0.60	20.94	Peak	24.32	45.26	103.08	57.82
R&S HFH2-Z2 Loop	13.5672	20.34	0.59	20.93	Peak	20.97	41.90	69.55	27.65
R&S HFH2-Z2 Loop	27.1230	21.53	0.81	22.34	QP	22.28	44.62	48.62	4.00

Positive Margin indicates a Pass

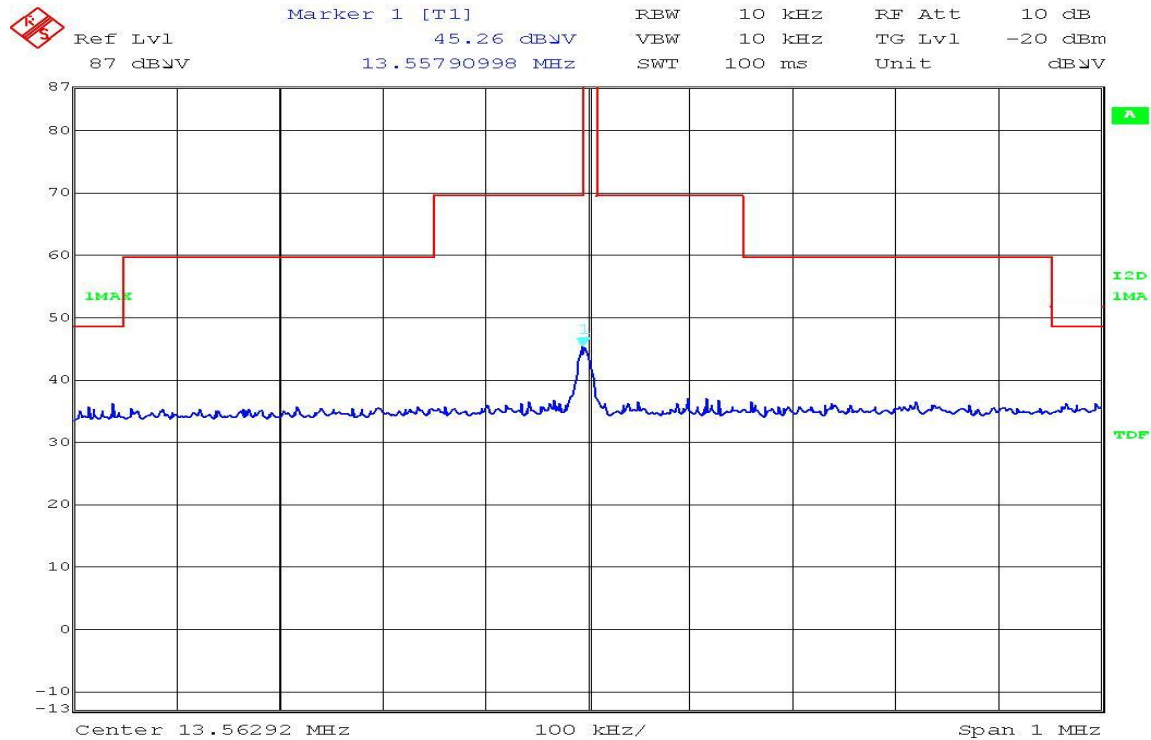
A.9. Tested By

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

Name: Deniz Demirci
Function: EMC Engineer

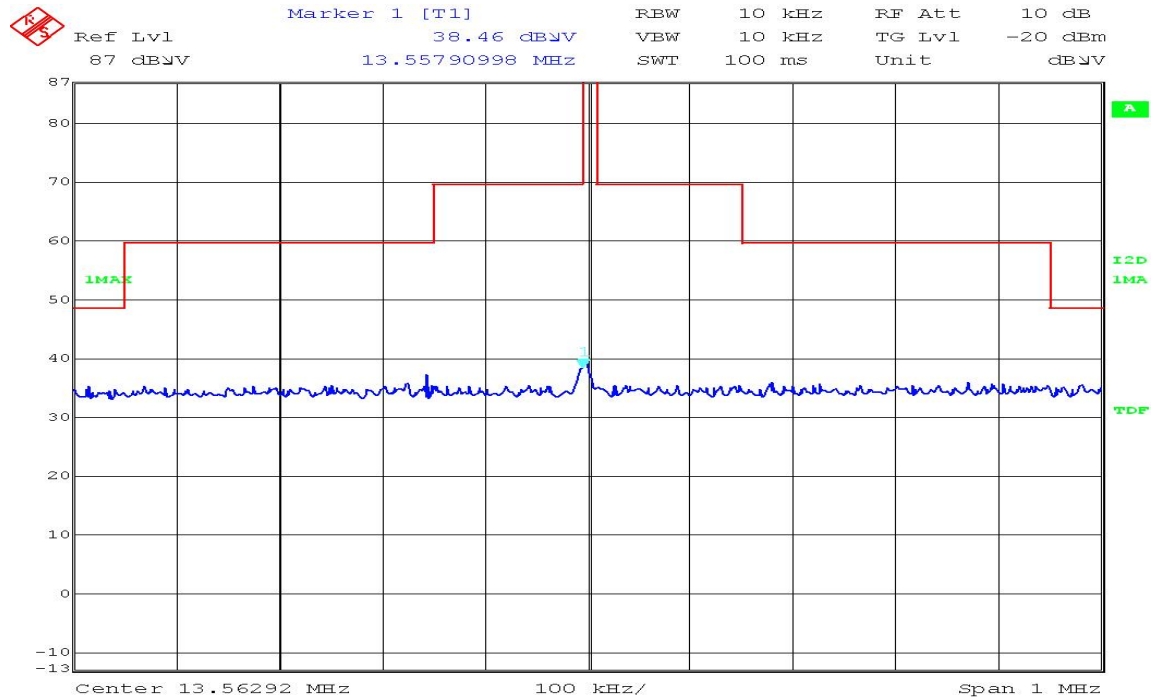
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Title: CG-159
Comment A: Conf04 Perpendicular
Date: 1.NOV.2005 09:53:16

Figure 1 RE - Perpendicular – 13.06MHz – 14.06MHz



Title: CG-159
Comment A: Conf04 Parallel
Date: 1.NOV.2005 10:15:38

Figure 2 RE - Parallel – 13.06MHz – 14.06MHz

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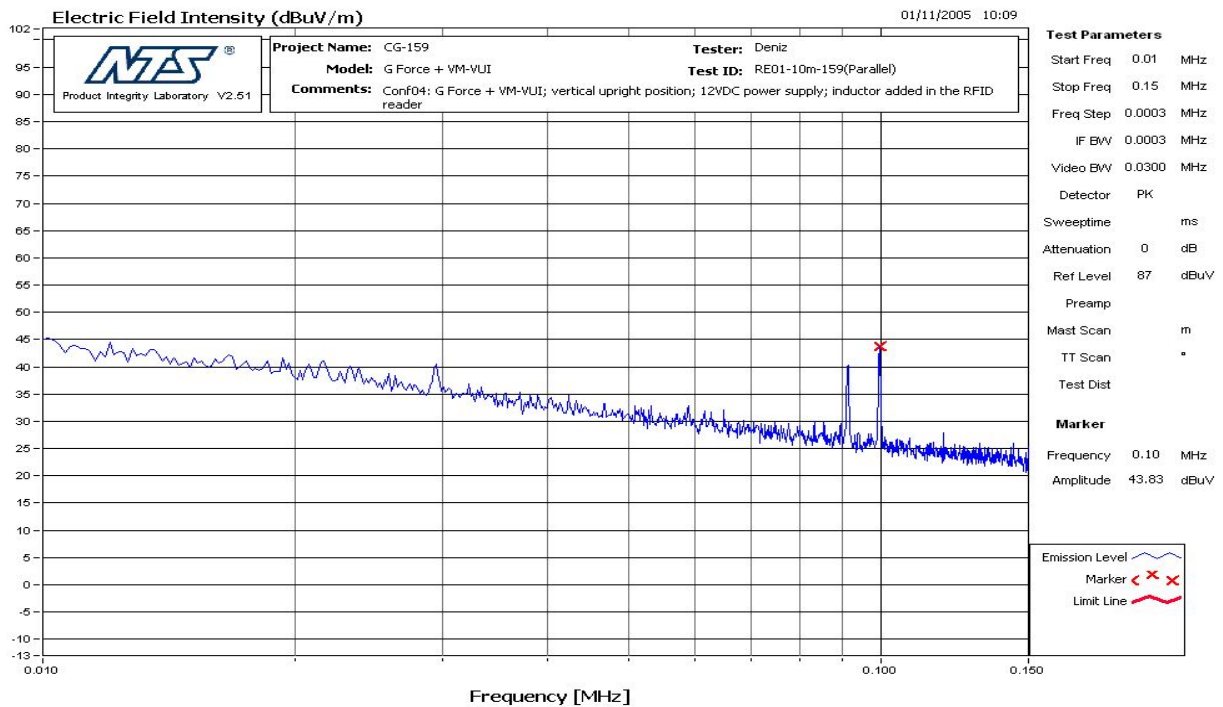


Figure 3 RE - Parallel- 9kHz - 150kHz

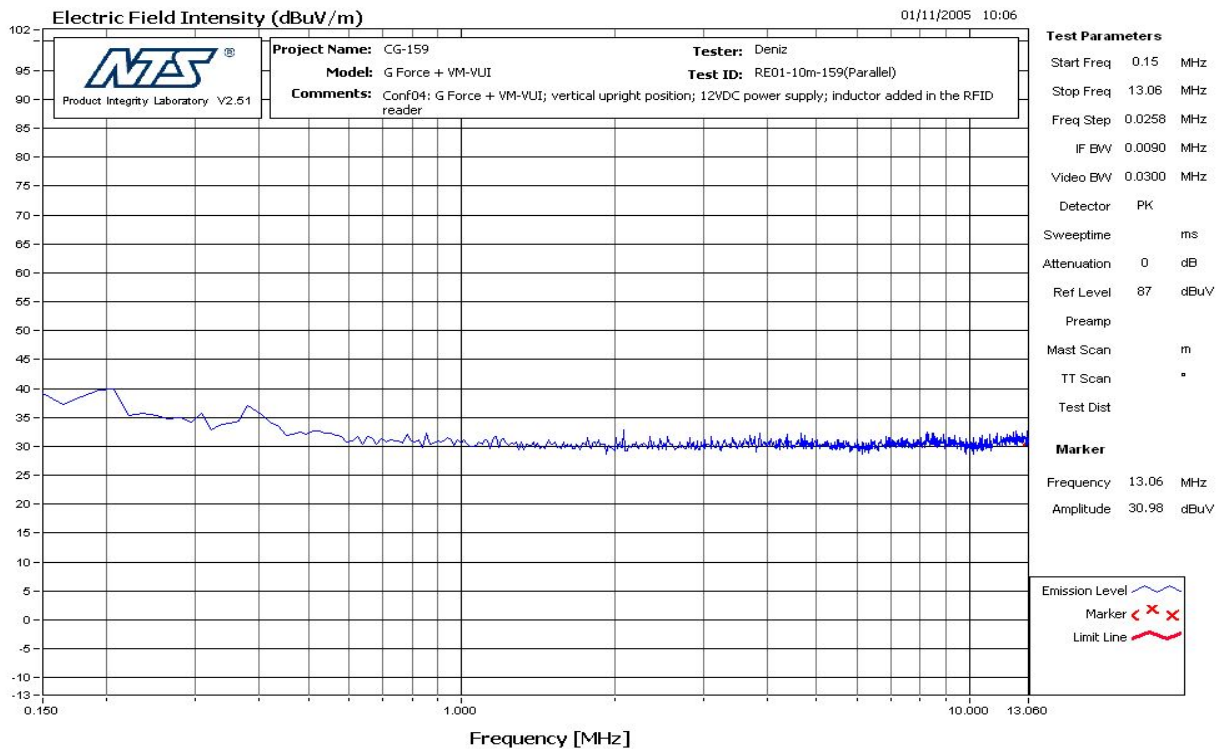


Figure 4 RE - Parallel - 150kHz - 13.06MHz

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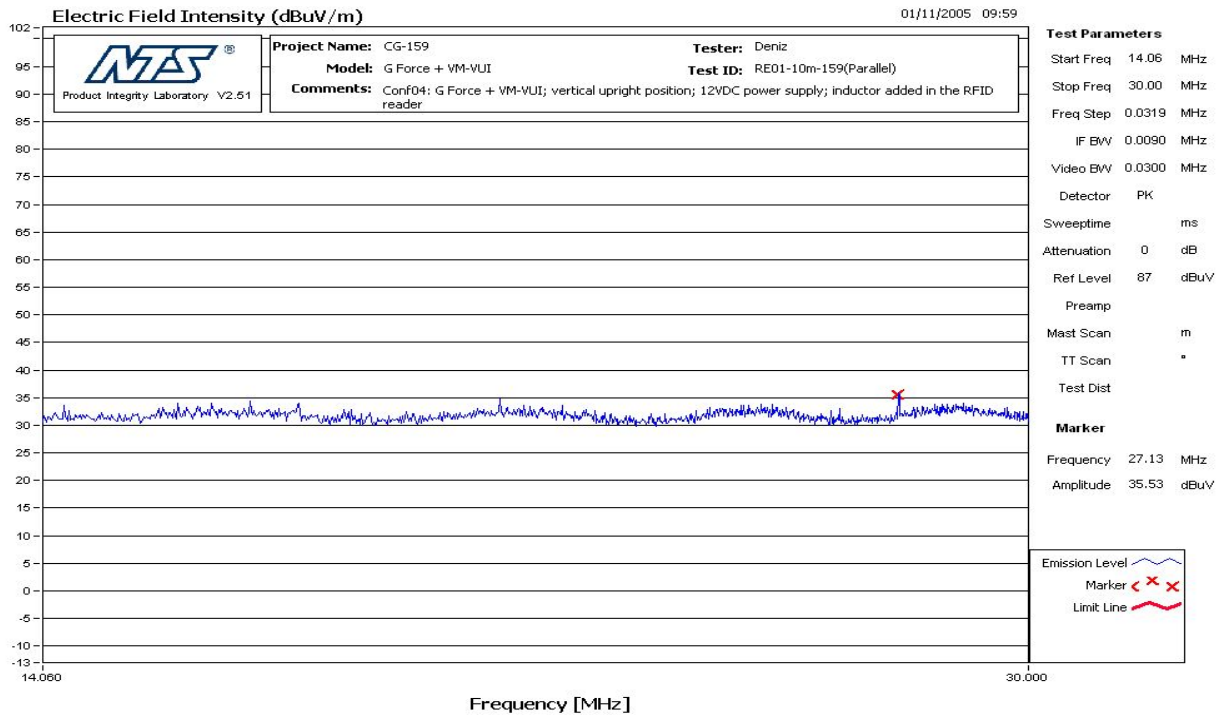


Figure 5 RE - Parallel – 14.06MHz – 30.0MHz

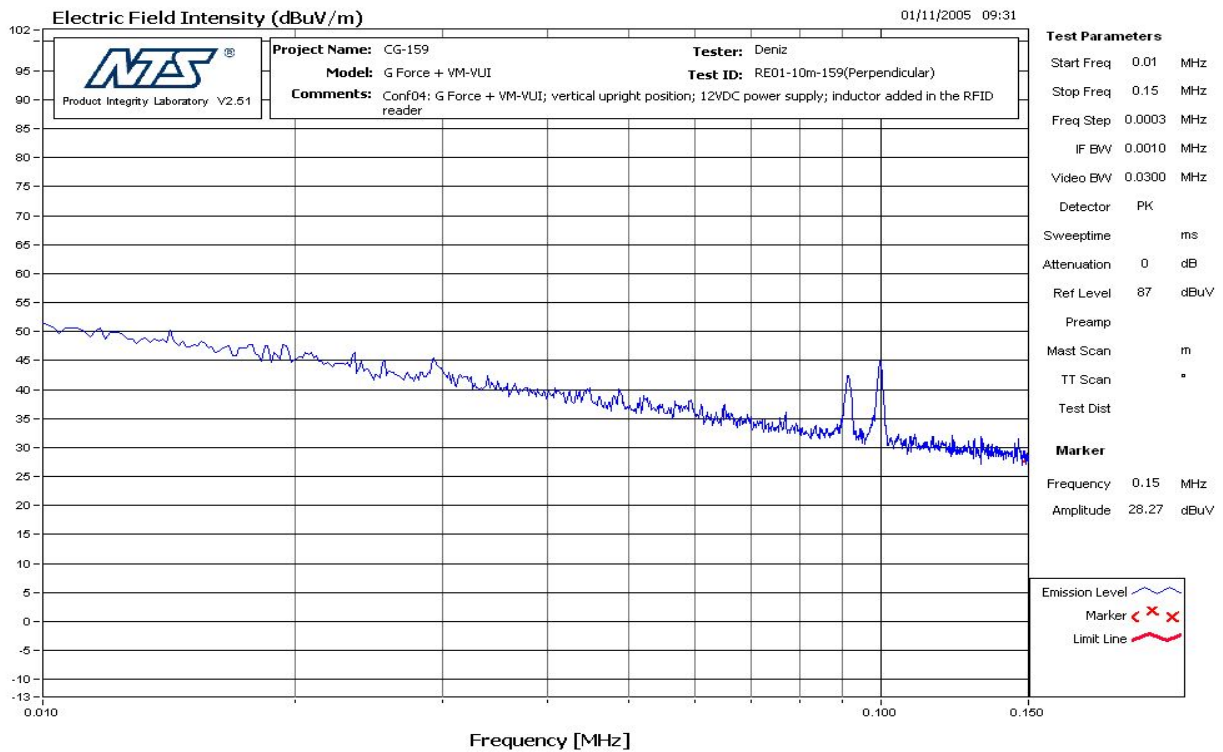


Figure 6 RE - Perpendicular – 9kHz – 150kHz

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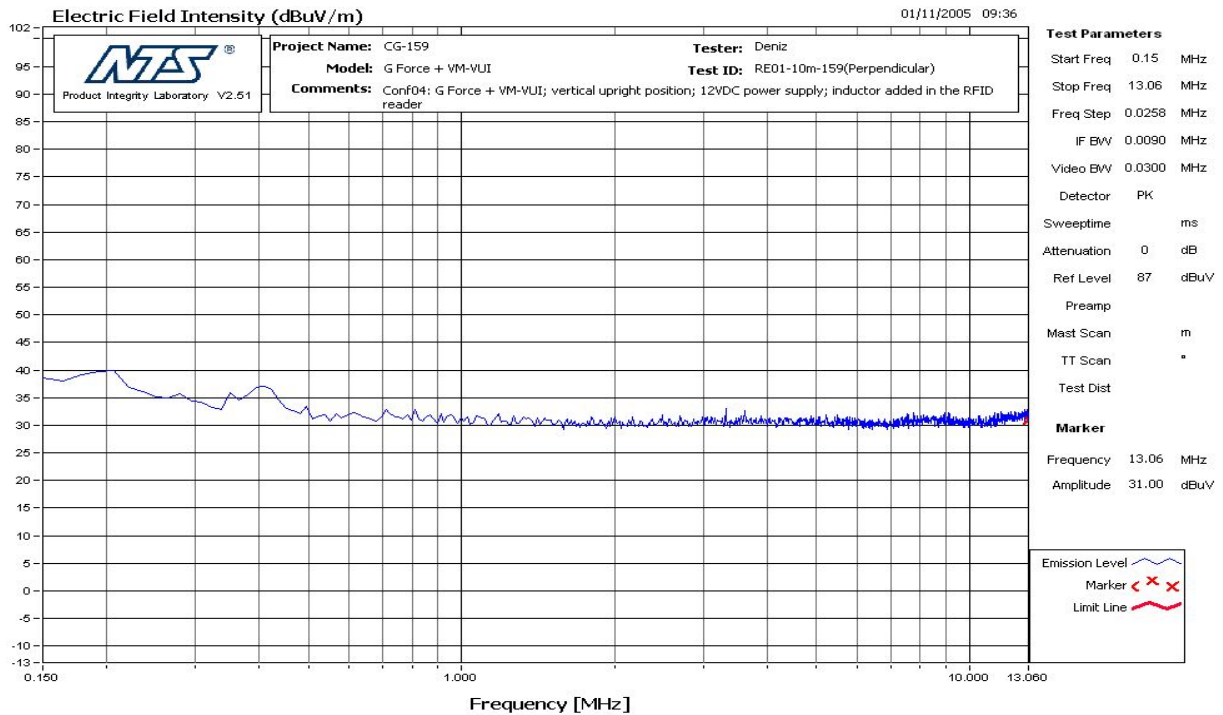


Figure 7 RE - Perpendicular – 150kHz – 13.06MHz

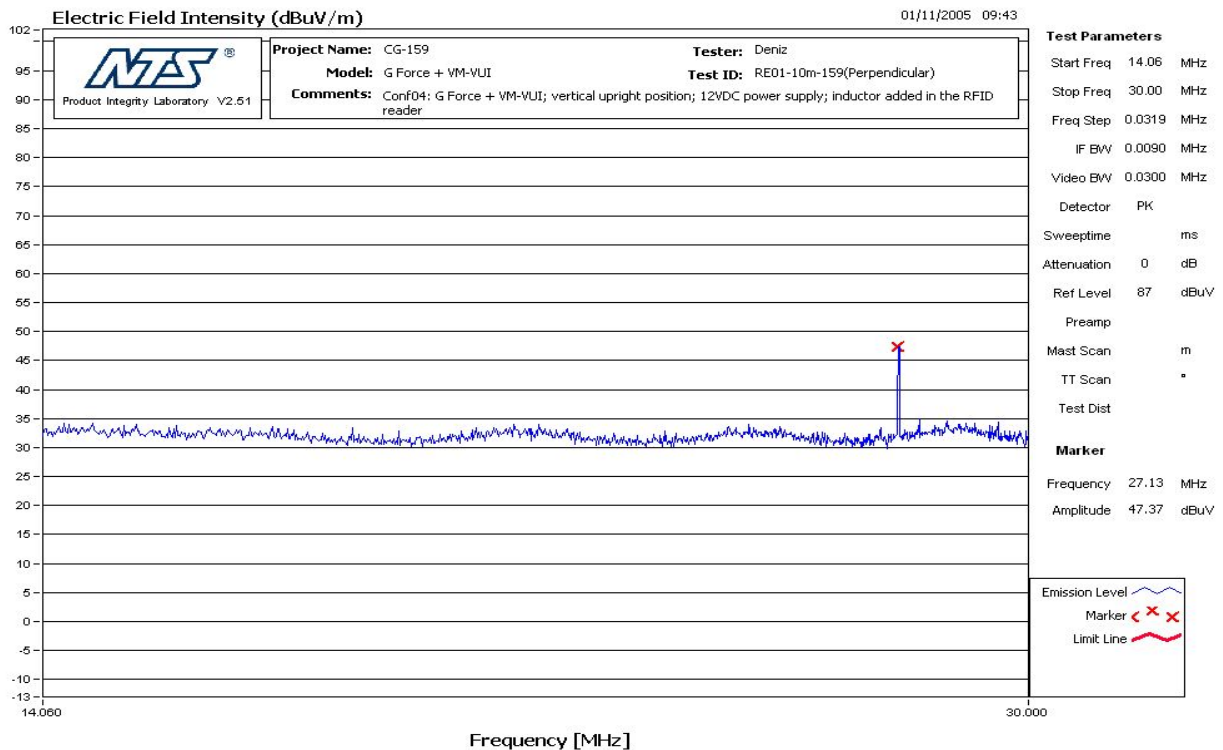


Figure 8 RE - Perpendicular – 14.06MHz – 30.0MHz

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APPENDIX B: RADIATED EMISSIONS 30 MHZ – 10 GHZ

B.1. Base Standard & Test Basis

Base Standard	CFR Title 47 – Telecommunications, Chapter I - FCC Part 15 Subpart B – Unintentional Radiators
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 30MHz – 1 GHz Test Method E001R7 NTS Radiated Emissions 1GHz – 18 GHz Manual Test Method E006R4

B.2. Specifications

Frequency	FCC Part 15 A 10-m Limit (Quasi-Peak)
MHz	dBμV/m
30 - 88	39.08
88 - 216	43.52
216 - 960	46.44
960 - 1000	49.54*

Frequency	FCC Part 15 A 3-m Limit (Average)
GHz	dBμV/m
1 -10	60

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

B.3. Measurement Uncertainty

Radiated Emissions (dB)	Measurement Uncertainty	Expanded Uncertainty (K=2)
30 MHz – 1 GHz	+2.32/-2.36	+4.65/-4.72
1 GHz – 10 GHz	+3.48/-3.51	+6.96/-7.02

B.4. Deviations

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

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B.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 32.72dB μ V/m at 324.4 with a margin of 2.84dB.

B.6. Sample Calculation

Emission Level = Measured Level + Correction Factors

Margin = Limit – Emission Level

B.7. Test Data

Test Data for Radiated Emissions 30 MHz – 1 GHz



Product Integrity
Laboratory V2.5

Project Number: CG-159
Model: VUI RFID Reader
Comments: Conf05: G Force + VM-VUI; horizontal layflat position; 12VDC power supply; inductor added in the RFID reader, Radio Off.

Tester: Deniz
Test ID: RE02c-10m-159

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					
2701 RX BiCon Hpol	10M Total Link Factor	302.95	13.26	-23.05	-9.79	QP	22.64	12.85	35.56	22.72	355.1	359.8					
2701 RX BiCon Hpol	10M Total Link Factor	324.41	13.69	-23.07	-9.38	QP	41.07	31.69	35.56	3.87	221.0	47.8					
2701 RX BiCon Hpol	10M Total Link Factor	722.53	19.25	-22.71	-3.46	QP	34.72	31.26	35.56	4.31	116.5	340.6					
Vertical																	
2701 RX BiCon Vpol	10M Total Link Factor	324.40	13.93	-23.07	-9.14	QP	41.86	32.72	35.56	2.84	100.9	185.9					
2701 RX BiCon Vpol	10M Total Link Factor	340.00	14.30	-23.11	-8.81	QP	38.76	29.95	35.56	5.62	100.4	179.0					
2701 RX BiCon Vpol	10M Total Link Factor	406.79	16.54	-23.38	-6.84	QP	37.92	31.08	35.56	4.48	400.0	355.1					

Positive Margin indicates a Pass

Positive Margin indicates a Pass

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Test Data for Radiated Emissions 1 GHz – 10 GHz

 Product Integrity Laboratory V2.5	Project Number : CG-159		Tester: Stephan Ching										
	Model : VUI RFID Reader		Test ID: RE03-10m-159										
	Comments : Conf03: G Force + VM-VUI; vertical side position; 12VDC power supply; inductor added in the RFID reader												
Standard FCC15 B		Measurement Distance 3 meters											
Antenna	Band		Frequency	AF	CL+LNA	FL	Atten	Total CF	Det	Measured Value	Corrected Value	Limit	Margin
	Start	Stop											
Horizontal	MHz	MHz	MHz	dB/m	dB	dB	dB	dB		dBuV/m	dBuV/m	dBuV/m	dB
9711-5362R3 HPol	1000	2700	1647	25.95	-29.48	0.00	0.00	-3.53	Avg	36.40	32.87	53.98	21.11
9711-5362R3 HPol	1000	2700	2563	28.71	-28.11	0.00	0.00	0.61	Avg	28.67	29.28	53.98	24.70
9711-5362R3 HPol	2700	5950	3468	31.14	-26.47	0.00	0.00	4.67	Avg	23.91	28.58	53.98	25.40
Vertical													
9711-5362R3 VPol	1000	2700	1648	25.92	-29.47	0.00	0.00	-3.55	Avg	36.05	32.50	53.98	21.48
9711-5362R3 VPol	1000	2700	2590	28.79	-28.08	0.00	0.00	0.71	Avg	29.21	29.92	53.98	24.06
9711-5362R3 VPol	2700	5950	3468	31.13	-26.47	0.00	0.00	4.66	Avg	24.04	28.70	53.98	25.28
Positive Margin indicates a Pass AF: Antenna Factors, Atten: Attenuator Loss, CF: Correction Factor, CL= Cable Loss, Det: Detector Type, FL: Filter Loss, LNA: Low Noise Amplifier Total CF = AF + CL + LNA + FL + Atten Corrected Value = Measured Value + Total CF													

B.8. Tested By

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

Name: Stephen Ching
Function: EMC Technician

Name: Deniz Demirci
Function: EMC Engineer

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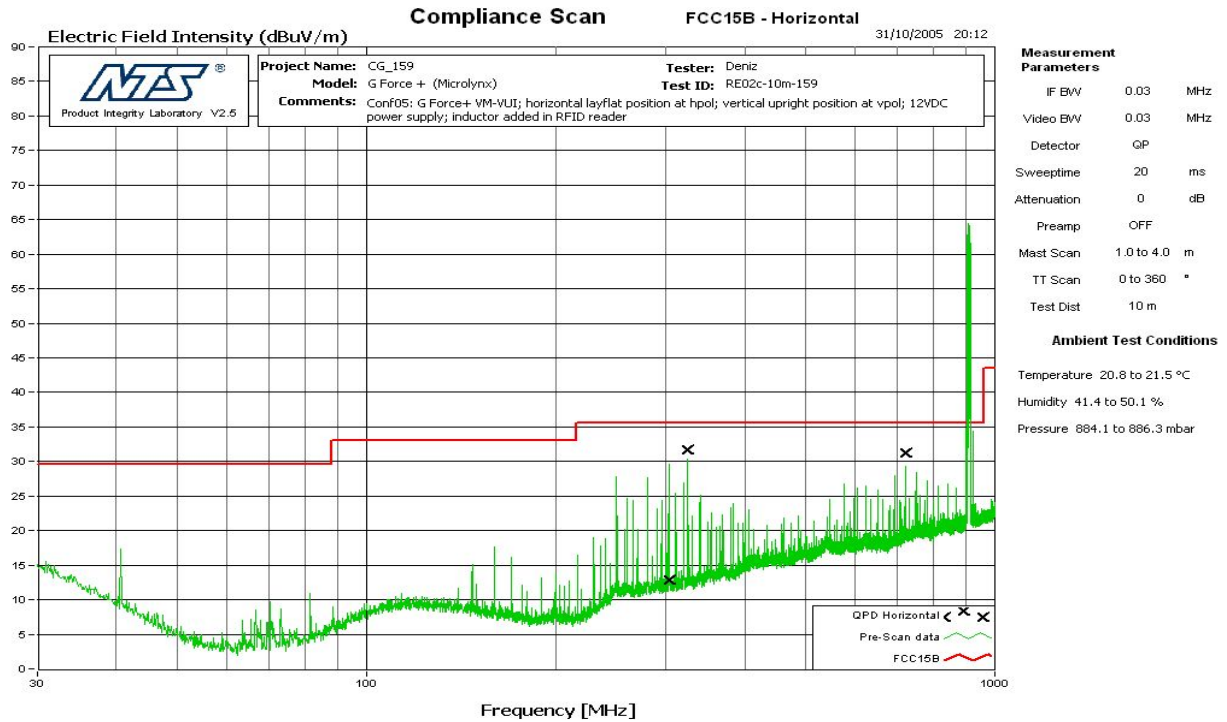


Figure 9 RE - Horizontal – 30 MHz – 1 GHz

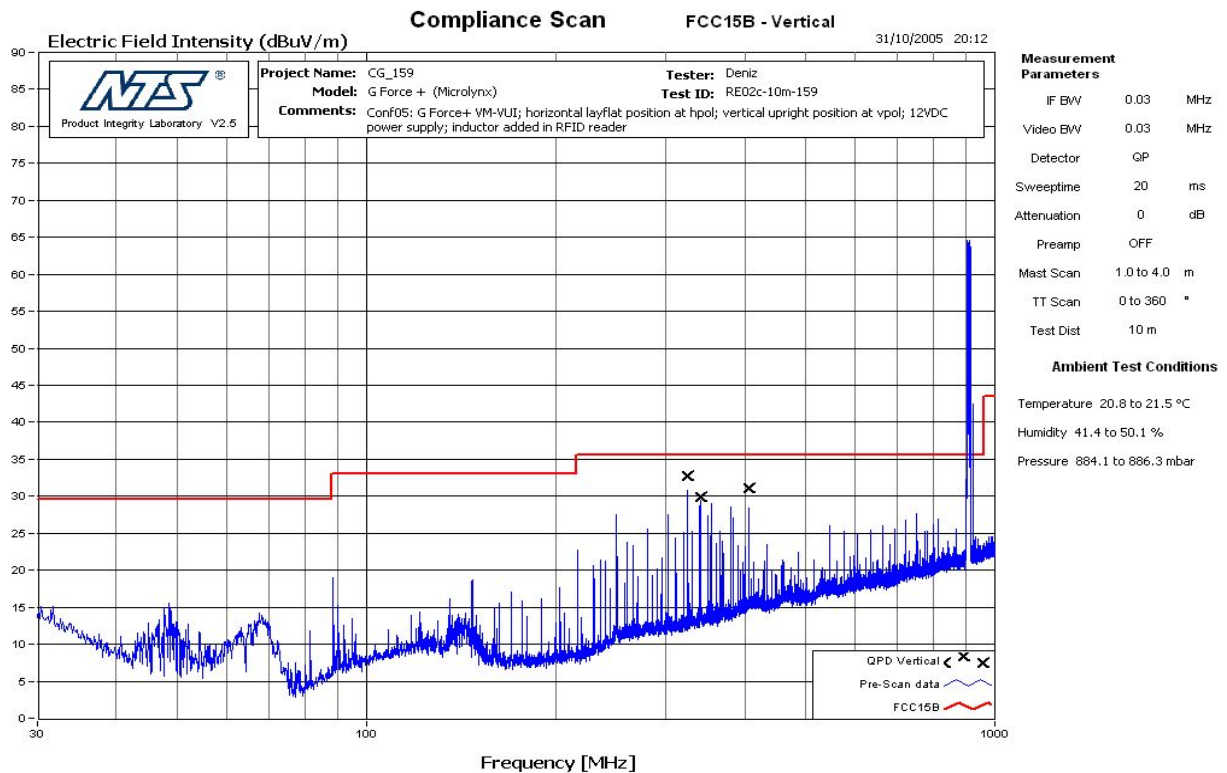


Figure 10 RE - Vertical – 30 MHz – 1 GHz

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APPENDIX C: IC 99% OCCUPIED BW

C.1. Base Standard & Test Basis

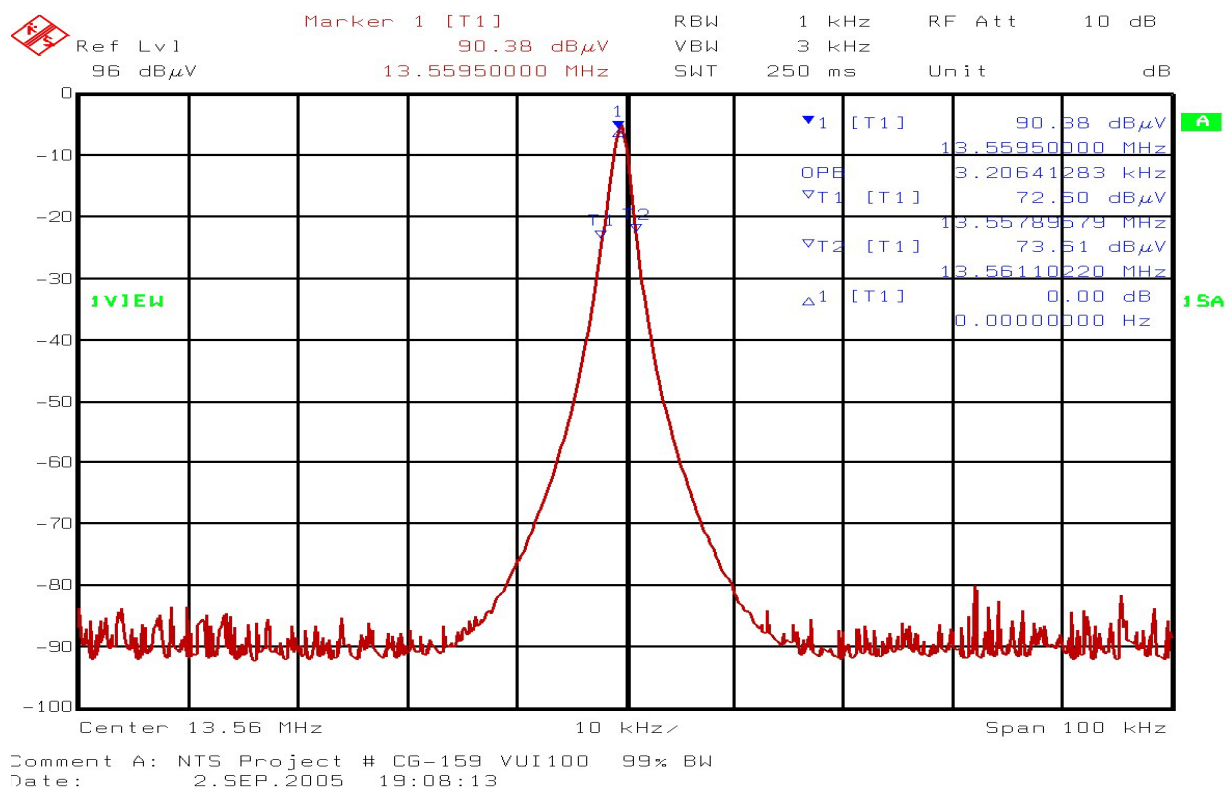
Base Standard	RSS Gen Issue 1, September 2005
Test Basis	ANSI C63.4 - 2003 Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
Test Method	RSS Gen Issue 1, September 2005

C.2. Test Method

The eut was coupled to the spectrum analyzer via a loop antenna. The 99% BW feature on the analyzer was used to make the measurement

Test Results

Compliant. The 99% BW is 3.21 KHz



C.3. Tested By

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

Name: Glen Moore
Function: EMC Manager

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APPENDIX D: TEST EQUIPMENTS

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	23APR06	23APR04
	☒ 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				Suhner Succoflex	NA
- 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. Radiated Emissions 1 GHz – 10 GHz Measurement Equipment

Description	Manufacturer	Type/Model	Asset #	Cal Due	Cal Date
10m ANECHOIC CHAMBER					
Horn Antenna (Rx) 1 GHz – 18 GHz	EMCO	3115	260092	16JUN06	16JUN04
High pass filter	K&L	11SH10-3860	263124	08JAN06	08JAN04
High frequency Link				07JAN06	07JAN04
Step Attenuator/Switch (0dB & 10 dB)	HP	11713A	260048 260097		
LNA	Miteq	JSD000121	260477		
Cable from LNA to SA	Succoflex	101PEA	263187		
Spectrum Analyzer 9k - 40GHz	Rohde & Schwarz	FSEK	260104	05APR06	05APR05
LNA DC Power Supply	Xantrex	LXO 30-2	260483	NA	NA
HPIB Extender	HP	37204	260096	N/A	N/A
10dB Attenuator	Wiltron	41KC-10	260449	05APR06	05APR04
CONTROL ROOM					

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PC with FSEK Manual ctrl S/W	N/A	N/A	N/A	N/A	N/A
HPIB Extender	HP	37204	260168	N/A	N/A
Mast Controller	EMCO	2090	260166	N/A	N/A
Multi Device Controller TT1	EMCO	2090	260165	N/A	N/A

D.3. 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
B LISN Link					07JAN06	07JAN04
-LISN B Switch	☐ B	NA	NA	263176		
-Cable Switch to Limiter	☐ B	NA	NA	263165		
- Cable LISN to Switch	☐ B1	Succoflex	NA	263172	07JAN06	07JAN04
	☐ B2	Succoflex	NA	263173	07JAN06	07JAN04
	☐ B3	Succoflex	NA	263174	07JAN06	07JAN04
	☐ B4	Succoflex	NA	263175	07JAN06	07JAN04
CONTROL ROOM						
		Rohde & Schwarz	ESAI	260110 / 260111		
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		
B LISN Link					07JAN06	07JAN04
-LISN B Limiter	☐ B	NA	NA	263179		
-Cable Switch to Limiter	☐ B	NA	NA	263194		

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D.4. 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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