

# Product Integrity Laboratory

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# Emissions Test Report Project Code CG-040023

(Report CG-040023-2)

# Nortel MFRM2 800MHz CR - FCC Part 22 Report

Revision: 1

October 28, 2004

Prepared for: Nortel Networks

**Author:** Eric Warkentin

**EMC Specialist** 

**Approved by:** Nick Kobrosly

Lab Manager

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# Report Summary NTS Canada

Product Integrity Laboratory 5151-47<sup>th</sup> 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: Nortel Networks Inc.

5050-40<sup>th</sup> Street, N.E. Calgary Alberta T3J 4P8 Phone (403) 769-2425

Customer Representative: Thomas Wong

CDMA / TDMA Regulatory Prime

**EUT Description:** 

	Name	Model	Revision	Serial Number
EUT	MFRM2 CR	NRGY30AA	P5	NNTM536G2RE2
				NNTM536G2R3P
				NNTM536G2RG4
				NNTM536G2RF3
				NNTM536G2R9W
				NNTM536G2R2N
				NNTM536G2RC0
				NNTM536G2RD1

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**Test Summary** 

Appendix	Standards		Decembration 9 Bonne	Deviations* from:			Pass /	Outtoute
	Base	Test Basis	Description & Range	Base Standard	Test Basis	NTS Procedure	Fail	Criteria
Α	FCC CFR 47 Part 22	ANSI C63.4-2001	Radiated Emissions 30 MHz – 10 GHz	No	No	No	PASS	Subpart H

<sup>\*</sup>Deviation details are outlined in the applicable appendix of this report

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**Test Log and Signatures** 

Appen	ndix	Test Case	Start	End	Tester / Date
А		Radiated Emissions - 30 MHz – 10 GHz FCC Part 22	October 5, 2004	October 9, 2004	Eric Warkentin, EMC Specialist

The test outlined may not be inclusive of all testing required by the Base Standards or fulfill the applicable regulatory requirements in their entirety.

Test Result:	The product presented to	or testing complied with test requirements as shown above.
Prepared By:	E2: West con-	
	Eric Warkentin EMC Specialist	
Checked By:		
	Glen Moore EMC Manager	

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# **REGISTER OF REVISIONS**

Revision	Date	Description of Revisions
0	October 28, 2004	Draft release for review
1	October 28, 2004	Customer release following internal review

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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 Nortel Network's MFRM2 800MHz CR to the applicable Electromagnetic Compatibility (EMC) standards as outlined in section 1.3.

The test outlined may not be inclusive of all testing required by the Base Standards or fulfill the applicable regulatory requirements in their entirety.

# 1.2 ABBREVIATIONS AND DEFINITIONS

The following are the abbreviations and definitions that may be relevant to this document.

Abbreviation	<u>Explanation</u>
ĀF	Antenna Factor
ANSI	American National Standards Institute
AWG	American Wire Gauge
cm	centimetre
CF	Correction Factor
CFR	Code of Federal Regulations
CISPR	International Special Committee on Radio Interference
dB	Decibel
dΒμV	Decibel relative to 1 microvolt
DC	Direct Current
EMC	Electromagnetic Compatibility
EN	European Norms
EUT	Equipment Under Test
FCC	Federal Communications Commission
GHz	Gigahertz
Hpol	Horizontal Polarization
Hz	Hertz
kg	kilogram
kHz	kilohertz
LNA	Low Noise Amplifier
m	Metre
MHz	Megahertz
μV	Microvolts
NA	Not Available
PI	Product Integrity
RE	Radiated Emissions
RF	Radio Frequency
Rx	Receive
SMA	SubMiniature version A
Tx	Transmit
VDC	Volts Direct Current
Vpol	Vertical Polarization

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#### **Definitions:**

Equipment Under Test (EUT): A representative ITE or functionally interactive group of ITE (that is a system), which includes one or more host units and is used for evaluation purposes.

*Electromagnetic compatibility (EMC)*: The ability of an equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment.

#### 1.3 REFERENCES

#### US Code of Federal Regulations

47 CFR Part 22 Federal Communications Commission, Part 22, 10-01-97 edition

# American National Standards Institute

•	ANSI C63.4-2001	American National Standards for Methods of Measurements of Radio	ı_
•	ANSI 603.4-200 I	ATHETICALI NALIUTIAI SLATIUATUS IUI IVIELITUUS UI IVIEASULETTIETIIS UI IVAUTU	,-

Noise Emissions from Low Voltage Electrical and Electronic

Equipments in the range of 9 kHz to 40 GHz, June 6, 2001

ANSI C63.4-1992 American National Standards for Methods of Measurements of Radio-

Noise Emissions from Low Voltage Electrical and Electronic Equipments in the range of 9 kHz to 40 GHz, July 17, 1992

#### NTS Documentation

- NTS Radiated Emissions 30MHz 1GHz Automated Test Method E001R7
- NTS Radiated Emissions 1GHz 18 GHz Manual Test Method E006R4
- NTS Radiated Emissions Substitution 30 MHz 20 GHz Test Method 11.0

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# 2.0 EUT

# 2.1 CONFIGURATION

# **Description of EUT**

•	Name	Model	Revision	Serial Number			
EUT	MFRM2 CR	NRGY30AA	P5	NNTM536G2RE2			
				NNTM536G2R3P			
				NNTM536G2RG4			
				NNTM536G2RF3			
				NNTM536G2R9W			
				NNTM536G2R2N			
				NNTM536G2RC0			
				NNTM536G2RD1			
Classification	Floor Standing (Module configured as part of a system in a Nortel Networks Metrocell Radio Rack)						
Size (m)	NA	NA					
Weight	NA						
Power	-48 VDC						
Functional Description	The MFRM2 CR is a 1 sector, 3 carrier product similar to the MFRM1 except that the MPAM and MTRM that existed in the MFRM1 are integrated into a single module for MFRM2.						

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The cost -reduced 800MHz MFRM-2 is a 1-sector, 3 carrier CDMA product. The resulting new module, with the same name 800MHz MFRM-2 Radio Module, consists of the following: a new wide voltage range Multi-carrier Power Supply Assembly (MPSA) that replaces the WR HPCA and includes the wide range protector entry module (WR MPEM) and the 5V analog Radio Power Supply Unit (PSU) (that were supplied with previous product); a new artwork for the radio board; a new power amplifier (PA); a new MAC card; interface cables; and mechanical assemblies. The radio board is AW01 (from AW06). The PA board is NTGY33EB AW01. The MAC board is NTGY35AB AW02. The MPSA is from AcBel. A picture of the MFRM2 CR is shown in Figure 1 below.

# Physical Description



Figure 1 MFRM2 CR Radio Module

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# 2.1.1 <u>SET UP CONFIGURATION</u>

Description	P/N RLS	Serial Number
Radio Rack	NTGS65AA 09	NNTM786016N9
MFRM2 Position 1	NRGY30AA P5	NNTM536G2RE2
MFRM2 Position 2	NRGY30AA P5	NNTM536G2R3P
MFRM2 Position 3	NRGY30AA P5	NNTM536G2RG4
MFRM2 Position 4	NRGY30AA P5	NNTM536G2RF3
MFRM2 Position 5	NRGY30AA P5	NNTM536G2R9W
MFRM2 Position 6	NRGY30AA P5	NNTM536G2R2N
MFRM2 Position 7	NRGY30AA P5	NNTM536G2RC0
MFRM2 Position 8	NRGY30AA P5	NNTM536G2RD1
MFRM2 Position 9	not populated	
DPM 1	NTGS89DB 12	CLWVPP2059HB
DPM 2	NTGS89DB 06	CLWVMM1009AF
DPM 3	NTGS89DB 12	CLWVPP2059G9
DPM 4	NTGS89DB 06	CLWVPP2023WP
DPM 5	NTGS89DB 06	CLWVMM1009AN
DPM 6	NTGS89DC 06	CLWVCC100LCQ
DPM 7	NTGS89DB 06	CLWVPP201TKF
DPM 8	NTGS89DC 10	CLWVPP202T8U
DPM 9	NTGS89DB 06	CLWVMM1009BD
Fan Tray 1	NTGS5652 01	NNTM533UCW5F
Fan Tray 2	NTGY60AD 01	NNTM532XLH9H
Fan Tray 3	NTGY60AE 01	NNTM532VW84A
Fan Tray 4	NTGY60AD 01	NNTM538G2RLA
Fan Tray 5	NTGY60AE 01	NNTM538G2N6R
Fan Tray 6	NTGY60AD 01	NNTM538G2W71
Fan Tray 7	NTGS5652 01	NNTM533UC6N9
Fan Tray 8	NTGS5651 01	NNTM535VWG6P
Fan Tray 9	NTGS5651 01	NNTM53586PR6

The setup of the EUT on the turn table is shown in Figure 2 and Figure 3. Setup of the EUT was conducted by the customer.

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Figure 2 **EUT Setup – Front View** 

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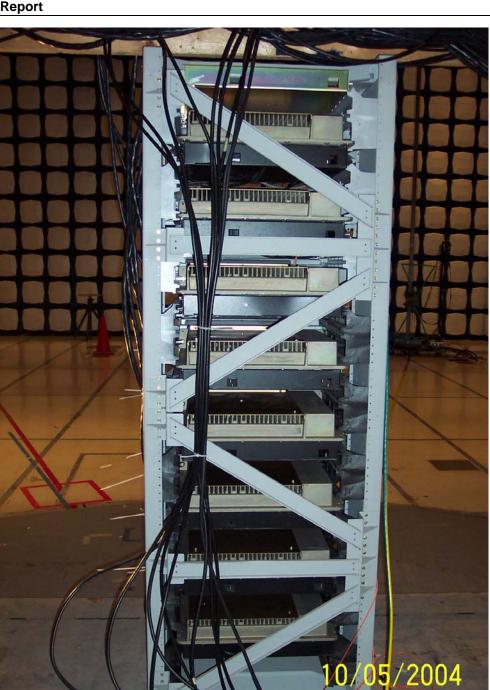


Figure 3 EUT Setup – Rear View

# 2.1.2 <u>TEST PLAN CONFIGURATION DEVIATIONS</u>

8 MFRM2 CR were used in the setup instead of the planned 9.

# 2.1.3 EUT POWER

Voltage	-48 VDC
Number of Feeds	2
Gauge of cable	1/0 AWG
Current Draw	110 AMPS (total combined current – both hubbles)
Special Requirements	The power (1 hot and 1 return per feed) was supplied through a two wire power cord into the EUT.

# 2.1.4 TEST PLAN POWER DEVIATIONS

None

#### 2.2 CABLES

# **EUT Cable List**

tity		Ro	uting		Cable	
Quantity	Model From		То	Description	Length (m)	
6	NTGS8082	Hubble A	Radios	Radio Power Cable	11	
3	NTGS8030	Hubble B	Radios	Radio Power Cable	6	
9	LMR400	DPM	Chamber Bulkhead	N Male – N Male Cable	9.2	
9	NTGS3525	MFRM2	CORE in digital rack in support room	Fiber	11	
1	NA	Hubble A	Radio Break Panel (Powering 6 radios)	1/0 AWG DC Power Cable	5.8	
1	NA	Hubble B	Radio Power Cables (Powering 3 radios)	1/0 AWG DC Power Cable	0.3	

# 2.2.1 TEST PLAN CABLE LIST DEVIATIONS

None

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#### 2.3 FREQUENCIES

# **EUT Frequency List**

Module	Frequency(MHz)
MFRM 2 800 MHz CR	39.326
MFRM 2 800 MHz CR	63.6976
MFRM 2 800 MHz CR	78.6432
MFRM 2 800 MHz CR X	638.976

#### 2.3.1 TEST PLAN FREQUENCY LIST DEVIATIONS

None.

#### 2.4 EUT SOFTWARE

Software Name	Software Release Number	Software Description		
	Not provided by custon	ner		

#### 2.5 MODE OF OPERATION

As defined by Nortel Networks, the EUT was operated in a typical manner. During testing, the customer monitored the system operation. See Section 2.4 for software mode of operation information.

# 2.5.1 TEST PLAN MODE OF OPERATION DEVIATION

None indicated by customer.

#### 2.6 PASS / FAIL CRITERIA

The pass/fail criteria are defined by the emission limits outlined in each reference base standard. The specific limits are described in each test appendices of this report.

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# 3.0 SUPPORT EQUIPMENT

# 3.1 CONFIGURATION

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

**Co-Located Support Equipment/Assemblies** 

Position	QTY	Description	P/N	Serial Number	Revision Number			
	No co-located support equipment							

Offsite Support Equipment/Assemblies

Position	QTY	Description	P/N	Serial Number
10m Support Room	1	Digital Rack	NTGS35AB 03	NNTM538NFHNP
10m Support Room	1	BIP	NTBW47BA 01	NNTM74XL0YLN
10m Support Room	1	XCEM1	NTBW70BA 14	NNTM538D9YGG
10m Support Room	1	XCEM2	NTBW70BA 15	NNTM538HGNCE
10m Support Room	1	XCEM3	NTBW70BA 19	NNTM538HKWW9
10m Support Room	1	XCEM4	NTBW70BA 51	NNTM538L8P53
10m Support Room	1	XCEM5	NTBW70BA 51	NNTM538L8P97
10m Support Room	1	XCEM6	NTBW70BA 51	NNTM538L8DPB
10m Support Room	1	XCEM7	NTBW70BA 14	NNTM538D9TNH
10m Support Room	1	XCEM8	NTBW70BA 15	NNTM538HGTT0
10m Support Room	1	XCEM9	NTBW70BA 14	NNTM538D9TWQ
10m Support Room	1	XCEM10	NTBW70BA 11	NNTM53821MJM
10m Support Room	1	XCEM11	NTBW70BA 51	NNTM538L67XA
10m Support Room	1	XCEM12	NTBW70BA 51	NNTM538L8L4Y
10m Support Room	1	TIIM	NTGS3188 04	NNTM74XL1PJ3
10m Support Room	1	GPSTM1	NTBW50AA 07	NNTM74TC0C2F
10m Support Room	1	GPSTM2	NTBW50AA 09	NNTM74TC11O7
10m Support Room	1	CM1	NTBW40BA T4P04	NNTM84C01MDL
10m Support Room	1	CM2	NTBW40AA 23	NNTM538L8RTT
10m Support Room	1	CORE1	NTBW30BA S4	NNTM533GRGJH
10m Support Room	1	CORE2	NTBW30AA 23	NNTM538L8K0T
10m Support Room	1	Digital Shelf	NTBW20BA 04	SNMN5300UC1F
10m Support Room	1	Fan Tray	NTBW18AA 02	NNTM74XA0EX2

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# 3.2 CABLES

**Support Cable List** 

tity		Ro	uting		Cable	
Quantity	Model	From	То	Description	Length (m)	
9	NA	Chamber Bulkhead	Support Room Bulkhead	N Male – N Male Cable	2.14	
9	NTMY00CL-SF	Support Room Bulkhead	RF Loads	N Male – N Male Cable	See cable spec	

#### 3.3 FREQUENCIES

# **Support Frequency List**

Assembly	Signal	Frequency (MHz)
	Not provided by customer.	

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# **APPENDICES**

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# APPENDIX A: RADIATED E-FIELD EMISSIONS 30 GHZ – 10 GHZ (ERP MEASUREMENT)

#### A.1. Base Standard & Test Basis

Base Standard	CFR Title 47 – Telecommunications, Chapter I - FCC Part 22 – Public Mobile Services – Subpart H – Cellular Radiotelephone Sevice
	CFR Title 47 – Telecommunications, Chapter I - FCC Part 24 – Personal Communication Services – Subpart E – Broadband PCS
Test Basis	ANSI C63.4-2001  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 E006R4 NTS Radiated Emissions Signal Substitution Method 30MHz - 20GHz. EMC Test Method 11.0, Revision 01

# A.2. Specifications

Frequency	47 CFR FCC Part 22			
	47 CFR FCC Part 24			
	Theoretical Peak @ 3m <sup>1</sup> ERP <sup>2</sup>			
MHz	dBμV/m dBm			
1000 - 18000	84.3	-13		

Note 1: Calculated using: Pd-(43 + 10 log(Pw)

where Pd is the EUT power in dBm and Pw is the EUT power in watts

Note 2: Calculated using: 120+20log(SQRT(49.2\*Pw)/3)

where Pw is the EUT power in watts

# A.3. Measurement Uncertainty

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

# A.4. Deviations

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

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# A.5. Radiated Emissions Measurement Equipment

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	260301	09JULY05	09JULY04			
Dilog Arterina		CBL6112B	260398	09302103	09302104			
RF Cable	Suhner Succoflex	Ferrite bead loaded cable	260388	07JAN06	07JAN04			
	CONT	ROL ROOM						
Test Receiver	Rohde & Schwarz	ESMI	260424 / 260423	27MAR05	27MAR04			
rest Neceiver	Rohde & Schwarz	ESMI	260424 / 260423	27MARUS	27101/11/04			
Mast Controller	EMCO	2090	260166	N/A	N/A			
Multi Device Controller TT1 (Turntable)	EMCO	2090	260165	N/A	N/A			
RF 10m East site Link								
- Cable 1	Suhner Succoflex	NA	263191					
- Cable 2	Suhner Succoflex	NA	263135					
- Cable 3	Suhner Succoflex	NA	263161	07JAN06	07JAN04			
- Cable 4	Suhner Succoflex	NA	263162					
- Switch Matrix Controller	TDL	SMC-002	260162					
- Amplifier	Hewlett Packard	8447F	260164					

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Radiated Emissions 1 GHz – 10 GHz Measurement Equipment

Description	Manufacturer	Type/Model	Asset #	Cal Due	Cal Date			
10m ANECHOIC CHAMBER								
Horn Antenna (Rx) 1 G – 18 G	⊠ EMCO	3115	260092	16JUN05	16JUN04			
Standard Gain Horn (Rx) 5.95 G – 8.2G	☐ EMCO	3160-06	260090	27NOV04	27NOV01			
Standard Gain Horn (Rx) 8.2G – 12.5 G	☐ EMCO	3160-07	260089	27NOV04	27NOV01			
Standard Gain Horn (Rx) 12.5G – 18 G	☐ EMCO	3160-08	260074	27NOV04	27NOV01			
High pass filter	K&L	11SH10- 3860	263124	08JAN06	08JAN04			
High frequency Link								
Step Attenuator/Switch (0dB & 10 dB)	HP	11713A	260048 260097	07JAN06	07JAN04			
LNA	Miteq	JSD000121	260477	070711100				
Cable from LNA to SA	Succoflex	101PEA	263187					
Spectrum Analyzer 9k- 40GHz	Rohde & Schwarz	FSEK	260104	27MAR05	27MAR04			
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	05APR05	05APR04			
	CONT	ROL ROOM						
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			
		ION EQUIPMEN	NT					
Horn Antenna (Tx)		3115	260088	N/A	N/A			
Signal Generator	Rohde & Schwarz	SMP-04	260425	N/A	N/A			
5.g. (a) 55.15.4(6)	Rohde & Schwarz	SMIQ		N/A	N/A			
Cable RX antenna to 3M center bulk head	Succoflex	104	263136	N/A	N/A			
Cable 3M center bulk head to Control room	Succoflex	104	263188	N/A	N/A			
Cable Control room bulk head to Signal Generator	Succoflex	104	263134	N/A	N/A			

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# A.6. Special Considerations

None.

#### A.7. Test Results

Compliance Scan Summary

<i>∐</i> 47≥5			Project Name: Model: Comments:		CG-040023 MFRM2 CR -48VDC, 8MFRM2_800MHzCR					Tester: Test ID:		Eric Warkentin RE03c-10m-2004-CG-040023						
Standard FCC_22 3 meters																		
	Rx Antenna	Tx Antenna	Frequency	E-Field Peak Emission Level	Substituted Measured Rx Level	Rx AF	Rx Link	Rx FL	Total Rx CF	Det	Substituted Rx E-Field Emission	Signal Generator	Tx Num Gain	Tx Cable	Total Tx CF	Effective Radiated Power (E.R.P.)	ERP Limit	ERP Margin
Hpol	260092	260091	MHz 1754.51	dBuV/m 68.83	dBuV 71.69	dB/m 26.42	dB -29,20	dB 0.00	dB -2.78	PK	dBuV/m 68.91	dBm -34.80	dB 7.23	dB 6.71	dB 0.52	dBm -34.28	dBm -13.00	dB 21.28
			1759.80	68.29	71.12			0.00		PK	68.32	-34.90	7.18	6.77	0.41	-34.49	-13.00	
AF: Antenna Factors Link: Link Loss FL: Filter Loss Rx E-Field Emission = Measured from the system Substituted Rx E-Field Emission: Corrected level measured from the substitution transmit antenna														21.49				

The EUT is in compliance with the limits as specified above.

#### Notes:

- No radio emissions seen below 1.7 GHz or above 4.5 GHz
- Frequencies chosen from compliance are radio harmonics, all other emissions are digital harmonics and fall under Part 15 tests.

#### A.8. Observations

None

# A.9. Deviations from Normal Operating Mode During Test

None

# A.10. Sample Calculation

3m Limit = 10m Limit - 20 \* log (3/10)
Emission Level = Measured Level + Correction Factors
Margin = Limit - Emission Level
ERP Limit (dBm) = Pd-(43 + 10 log(Pw)

where Pd is the EUT power in dBm and Pw is the EUT power in watts Theoretical ERP Limit (dBuV/m) 120+20log(SQRT(49.2\*Pw)/3)

where Pw is the EUT power in watts

#### A.11. Test Data & Photographs

The test data and photographs collected during this test appear following this page.

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# A.12. Tested By

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

Name: Eric Warkentin Function: EMC Specialist

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Figure 4 RE 30 MHz - 1 GHz EUT Configuration

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Figure 5 RE 1 GHz – 18 GHz EUT Configuration

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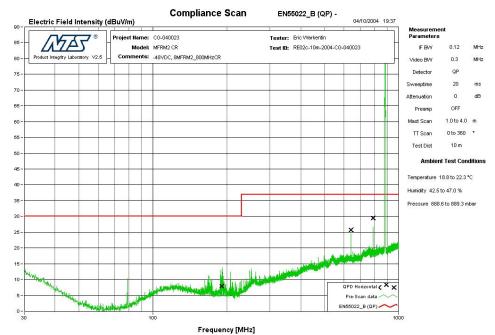


Figure 6 RE - Horizontal – 30 MHz – 1 GHz Pre-scan Note: Limit line shown is for EN 55022 Class B, not FCC Part 22

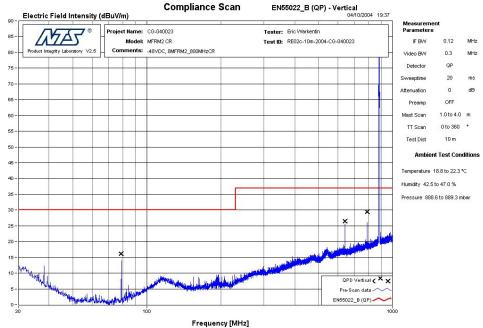


Figure 7 RE - Vertical - 30 MHz - 1 GHz Pre-Scan Note: Limit line shown is for EN 55022 Class B, not FCC Part 22

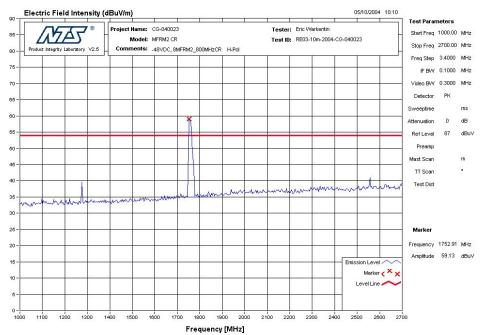


Figure 8 RE - Horizontal – 1 GHz – 2.7 GHz Pre-scan Note: Limit line shown is for Part 15 Class B, not Part 22

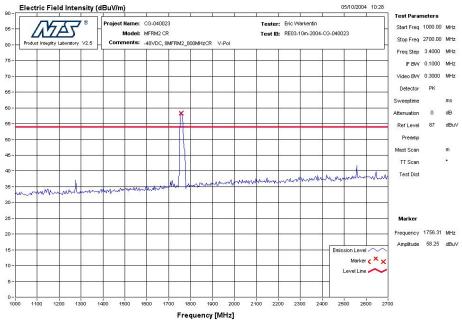


Figure 9 RE - Vertical – 1 GHz – 2.7 GHz Pre-Scan Note: Limit line shown is for Part 15 Class B, not Part 22

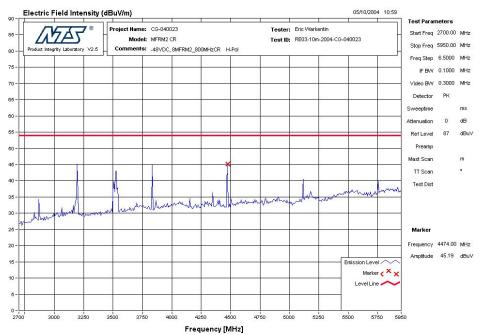


Figure 10 RE - Horizontal – 2.7 GHz – 5.95 GHz Pre-scan Note: Limit line shown is for Part 15 Class B, not Part 22

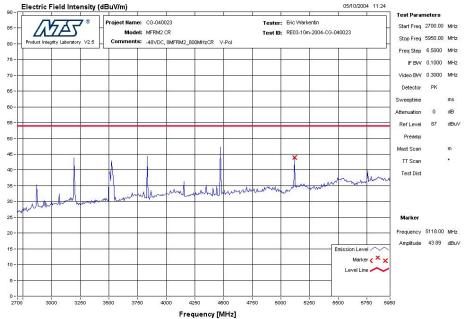


Figure 11 RE - Vertical – 2.7 GHz – 5.95 GHz Pre-Scan Note: Limit line shown is for Part 15 Class B, not Part 22

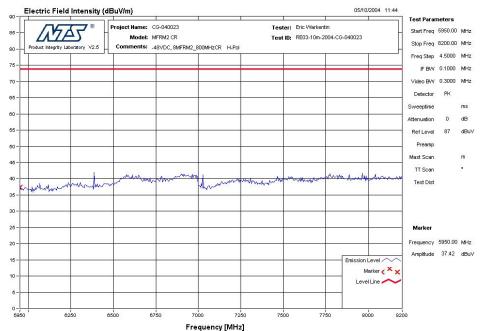


Figure 12 RE - Horizontal - 5.95 GHz - 8.2 GHz Pre-scan

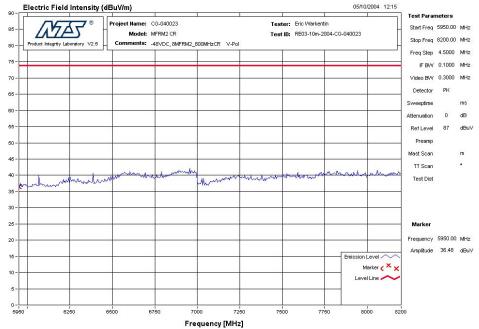


Figure 13 RE - Vertical - 5.95 GHz - 8.2 GHz Pre-Scan

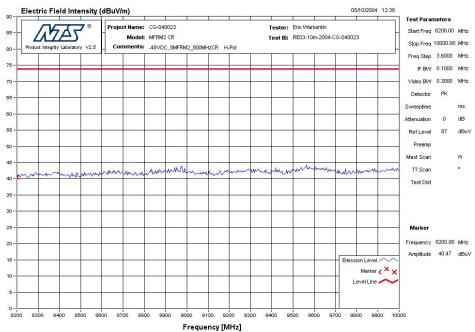


Figure 14 RE - Horizontal - 8.2 GHz - 10 GHz Pre-scan

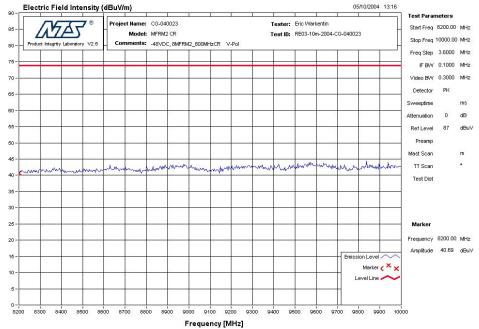


Figure 15 RE - Vertical - 8.2 GHz - 10 GHz Pre-Scan



Figure 16 RE 1 GHz – 10 GHz EUT Configuration

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**APPENDIX B: TEST PLAN** 

Not Attached

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# **APPENDIX C: SUPPLEMENTARY INFORMATION**

None attached

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# **END OF DOCUMENT**

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