Spurious Emissions Compliance Report for the 800 MHz Metro Cell Beta MFRM-3

FCC Part 22 and Industry Canada RSS-129

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Prepared for: **Nortel Networks**
3500 Carling Avenue
Ottawa, Ontario
Canada, K2H 8E9

Author: **Denis Lalonde**
Radio Compliance Discipline Leader

Solectron EMS Canada Inc.
Design & Engineering Kanata (SDE)
21 Richardson Side Road
Kanata, Ontario, K2K 2C1
http://www.solectron.com/services/prod.htm

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Approvals

Function	Name	Job title	Signature	Date
Document Release Approval	Steve Tippet	Manager, Product Engineering and Verification		13th Dec 2006
Author	Denis Lalonde	Radio Compliance Discipline Leader		Dec. 13, 2006
Technical Reviewer	Jacques Rollin	EMC Advisor		Dec 13, 2006

Accreditations

Solectron EMS Canada Inc.'s (SDE) test facilities are accredited by the Standards Council of Canada (SCC) to ISO/IEC 17025 in accordance with the scope of accreditation outlined at the following web site http://palcan.scc.ca/specs/pdf/95_e.pdf [2]. The SCC is a signatory of the APLAC [15] and ILAC [16] Mutual Recognition Arrangements.

RSS-129 is not currently on SDE's SCC scope of accreditation. SDE laboratory discipline specialists have ensured our laboratory has the required documentation, test equipment, and technical expertise to test to this standard.

Solectron EMS Canada Inc.'s (SDE) quality management system is registered to ISO 9001: 2000 [17] and its processes are documented in the SDE Quality Manual [4] and Lab Operations Manual [5].

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1. Executive Summary

At the request of Nortel Networks, Solectron EMS Canada Inc. has evaluated the system radiated spurious emissions. This report describes the test results of the FCC Part 22 and Industry Canada RSS-129 radiated emissions tests performed on the 800 MHz Metro Cell Beta MFRM-3 system.

On the basis of measurements performed in October and November 2006, the 800 MHz Metro Cell Beta MFRM-3 is verified to be compliant with the radiated emissions requirements of FCC Part 22 and Industry Canada RSS-129. The test data included in this report apply to the product titled above manufactured by Nortel Networks.

2. Scope and Purpose

At the request of Nortel Networks, Solectron EMS Canada Inc. has evaluated the system radiated spurious emissions. This report describes the test results of the FCC Part 22 and Industry Canada RSS-129 radiated emissions tests performed on the 800 MHz Metro Cell Beta MFRM-3 system.

3. Compliance Summary

This section summarizes all the measurements performed on 800 MHz Metro Cell Beta MFRM-3 and its compliance to FCC Part 22 and Industry Canada RSS-129.

Table 3-1: Compliance Results Summary

Product Summary			
Product Name:	800 MHz Metro Cell Beta MFRM-3	Project Leader:	William Kwong
Product Code:		EMC Engineer:	Denis Lalonde
Product Release:		Tester:	Kasi Sivaratnam, Denis Lalonde
Product Status:		Date:	October 30 and November 24, 2006

Test Cases [1]					
Completed	**Description**	**Specification**	**Test Results**		**Notes**
			Pass	Fail	
■	Radiated Spurious Emissions (E-field)	FCC Part 22	■	☐	
■	Radiated Spurious Emissions (E-field)	Industry Canada RSS-129	■	☐	

1. All the emissions measurements were performed at Solectron EMS Canada Inc. Kanata, Ontario.

4. Equipment Under Test (EUT)

4.1 Product Functional Description

The MFRM-3 is an evolution of the FRM (SFRM/MFRM/MFRM-2) CDMA MetroCell product, bringing a 3-sector 3-carrier system into a single radio module. It is an environmentally sealed module to allow installation into both outdoor and indoor systems. The MFRM-3 electronic assemblies are enclosed within EMI shield, thus providing maximum protection for RE/RI EMC. Fiber connectivity is used for data transfer with the digital equipment and allows the optional remote installation of the radio module. The MFRM-3 has a new Tri-Sector Duplexer Module (TDM), which will essentially provide the functionality of three separate MFRM/MFRM-2 duplexers. Images of an MFRM-3 are shown in the following three figures.

Figure 4-1: MFRM-3 Radio Module

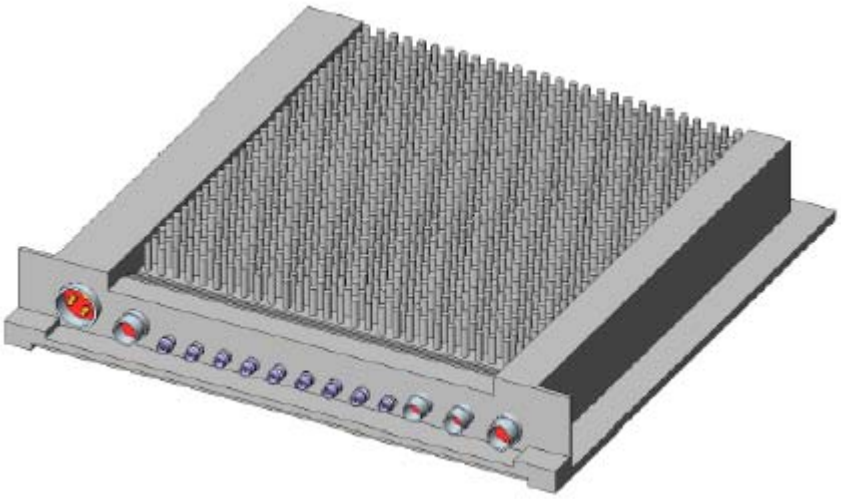


Figure 4-2: Fully Assembled MFRM-3

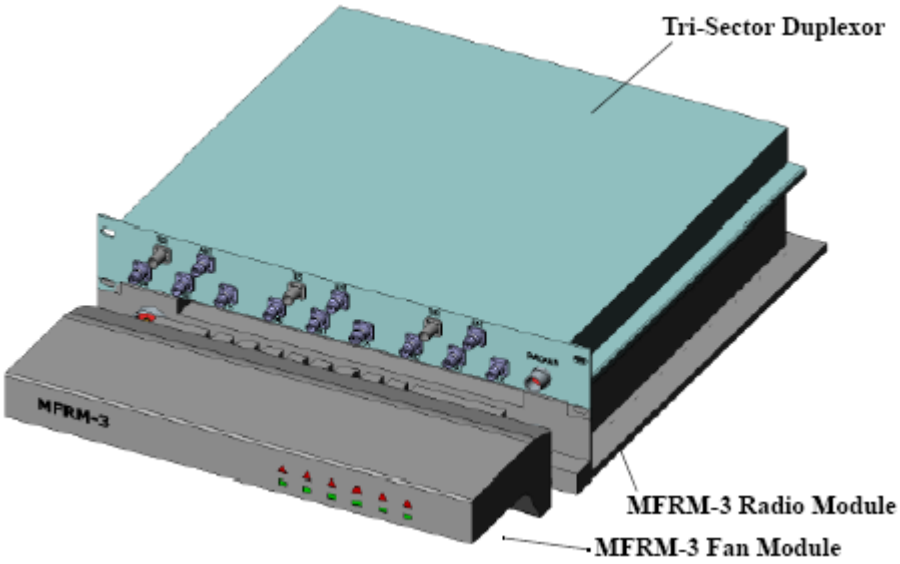
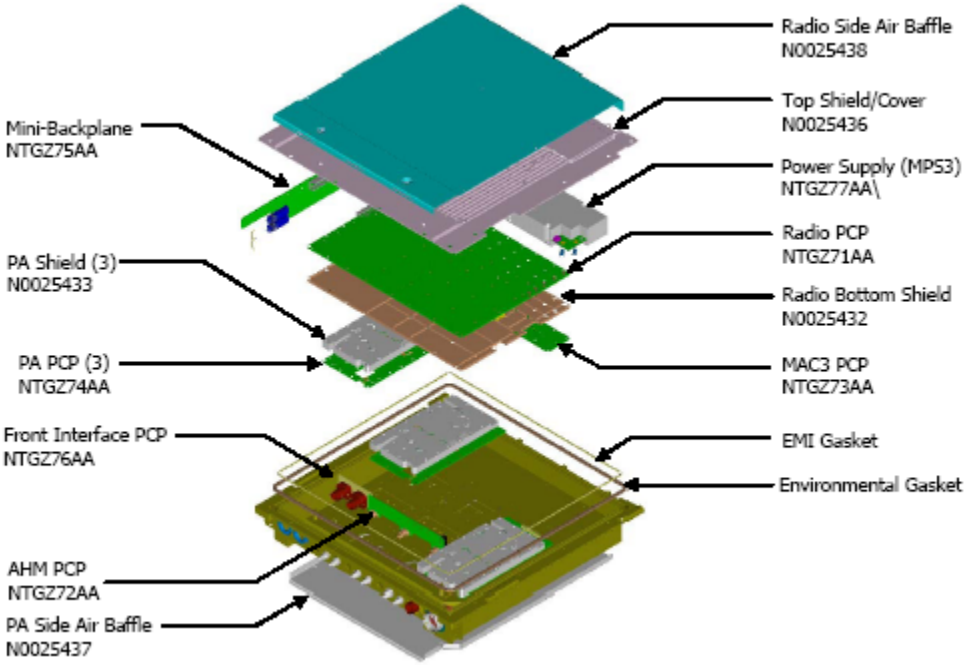


Figure 4-3: Exploded View of an MFRM-3 Radio Module



4.2 System Modifications

No modifications to the EUT were made during testing.

4.3 Customer Information

Company Name	Nortel Networks
Mailing Address	3500 Carling Avenue, Ottawa, Ontario, Canada, K2H 8E9
Product Name	800 MHz Metro Cell Beta MFRM-3
Model Number	800 MHz Tri-Sector Duplexer Module (TDM) A-Band (PEC code: NTGZ80AA) 800 MHz Tri-Sector Duplexer Module (TDM) B-Band (PEC code: NTGZ80BA) 800 MHz MFRM-3 Radio Module Beta (PEC code: NTGZ70AA) Fan Assembly Module (FAM) (PEC code: NTGZ85AA)
Primary Technical Contact	Andrew Kemp
Title	Technical Project Manager
Phone	(403) 769-4943
E-mail	akemp@nortel.com

4.4 Power Requirements

The following tables describe the power requirements for the 800 MHz Metro Cell Beta MFRM-3.

Table 4-1: -48V DC Power Requirement

Feed	Voltage	Current
A	-48 V DC	30 A max

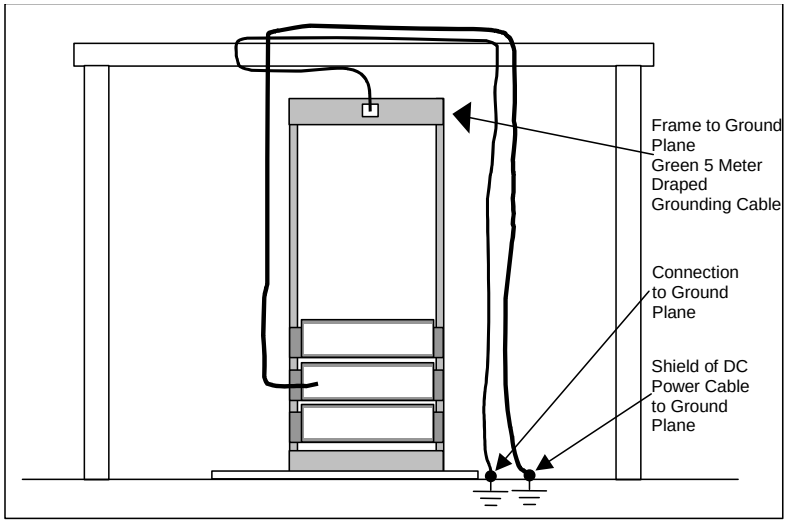
Table 4-2: +24V DC Power Requirement

Feed	Voltage	Current
A	+24V DC	50 A max

4.5 Grounding Requirements

For the purposes of the EMC testing, the system was grounded in the same manner as its typical installation as shown in Figure 4-4.

Figure 4-4: System Grounding



4.6 Clocks / Oscillators / Switching Power Supply Frequencies

Table 4-3 lists all the clock sources (e.g., discrete crystals, VCXOs, DC/DC converter switching frequencies) used in the configuration(s) under test.

Table 4-3: EUT Fundamental Frequencies

Circuit Pack	Nortel PEC Code	Fundamental Frequencies (MHz)
800 MHz Radio Module	NTGZ70AA	7.3728, 19.6608, 31.9488, 39.3216, 78.6432, 638.976

4.7 EUT Interfaces and Cables

The system contained the following interfaces defined in the following table(s).

Table 4-4: System Cables

Cable #	Cable Designation	Permanently Connected (Y/N)	Interface Description	Connection Point	Length (m)	Qty	Termination During Testing
1	-48V DC power cable	YES	Shielded DC power cable	MFRM-3 Main DC Power Connector	10	1 per MFRM-3	–48V DC power supply
2	+24V DC power cable	YES	Shielded DC power cable	MFRM-3 Main DC Power Connector	10	1 per MFRM-3	+24V DC power supply
3	Ground cable	YES	AWG 2 electrical cable	Frame ground	3	1	Earth ground
4	Antenna RF cables	YES	RF output via a coaxial cable	TDM Alpha /Beta/ Gamma antenna port connector	6-10	3 per MFRM-3	RF attenuators and Loads
5	Multimode Tx/Rx optical fiber	YES	SC-SC optical connection	MFRM-3 Fiber Optics Connector	10	1 per MFRM-3	CORE-2 module in digital shelf of a BTS
6	Alarm cable	YES		Loopback	0.25	1 per MFRM-3	Loopback
7	Craft Ethernet cable	NO	RJ-45 connector on FAM	Ethernet port on FAM	3	1	Support computer

4.8 Support Equipment

The support equipment is defined in Table 4-5 and Table 4-6.

Table 4-5: List of Test Support Equipment Provided by Nortel

Description	Make	Model Number	Serial Number	Cal. Due
Personal computer	Dell	OPTILEX GX520	5MK7391	Not required
Personal computer	Dell	OPTILEX GX1	2XNKE	Not required
Personal computer	Dell	OPTILEX GX1	R3737	Not required
Cell phone/power supply/cable	Qualcomm	QSP860	11600080151	Not required
Cell phone/power supply/cable	Qualcomm	QSP860	615221A01	Not required
Nortel test box	Nortel	N/A	N/A	Not required
+30V DC power supply	XANTREX	LXQ 20-3	645906	Not required
+30V DC power supply	XANTREX	LXQ 20-3	645912	Not required
+30V DC power supply	XANTREX	LXQ 20-3	R0000113	Not required
Capacitor bank (DC power filter)	Nortel	N/A	N/A	Not Required

Table 4-6: List of Test Support Equipment (Indoor BTS) Provided by Nortel

Reference	Component	Nortel PEC Code	Release Number	Serial Number
SE_1	Digital Rack (AC)	NTGS35AA	76	SNMN5300M6DH
SE_1.4	BIP	NTGS36AA	10	SNMN5300M6NG
		NTGS26AA	17	SNMN5300M6LJ
SE_1.2-3	Digital Shelf	NTGS20AA	12	SNMN5300M57H
SE_1.3.1	CEM 64	NTBW70BA	15	NNTM5387FTNH
SE_1.3.2	CEM 64	NTBW70BA	15	NNTM5387X0YF
SE_1.3.3	CEM 64	NTBW70BA	15	NNTM5387G1RV
SE_1.3.4	CEM 192	NTRZ80BA	3	NNTM74X0WPJK
SE_1.3.5	CEM 64	NTRZ80AA	2	NNTM74XOTVEW
SE_1.3.6	Blank	N/A	N/A	N/A
SE_1.3.7	Blank	N/A	N/A	N/A
SE_1.3.8	Blank	N/A	N/A	N/A
SE_1.3.9	Blank	N/A	N/A	N/A
SE_1.3.10	CEM 64	NTRZ80AA	2	NNTM74XOTYRL
SE_1.3.11	CEM 192	NTRZ80BA	50	NNTM74X194G4
SE_1.3.12	CEM 192	NTRZ80BA	3	NNTM74X0WPK4
SE_1.2.1	Blank	N/A	N/A	N/A
SE_1.2.2	GPSTM	NTBW50AA	9	NNTM74TC1341
SE_1.2.3	Blank	N/A	N/A	N/A
SE_1.2.4	CM-2	NTBW40BA	4	NNTM74X0VME1
SE_1.2.5	CM-2	NTBW40BA	4	NNTM84C02C22
SE_1.2.6	CORE-2	NTBW30BA	12	NNTM74X1DV0G
SE_1.2.7	CORE-2	NTBW30BA	12	NNTM74X1DTY0
SE_1.2.8	Blank	N/A	N/A	N/A
SE_1.1	COOLING UNIT	NTGS18AB	3	EBMI00005263

4.9 System Set-up and Test Configurations

Three carriers per Radio were used for the MFRM-3 800MHz Beta PI testing. Refer to Table 4-7.

Table 4-7 4xMFRM-3 Configuration, Transmission Carriers Frequencies

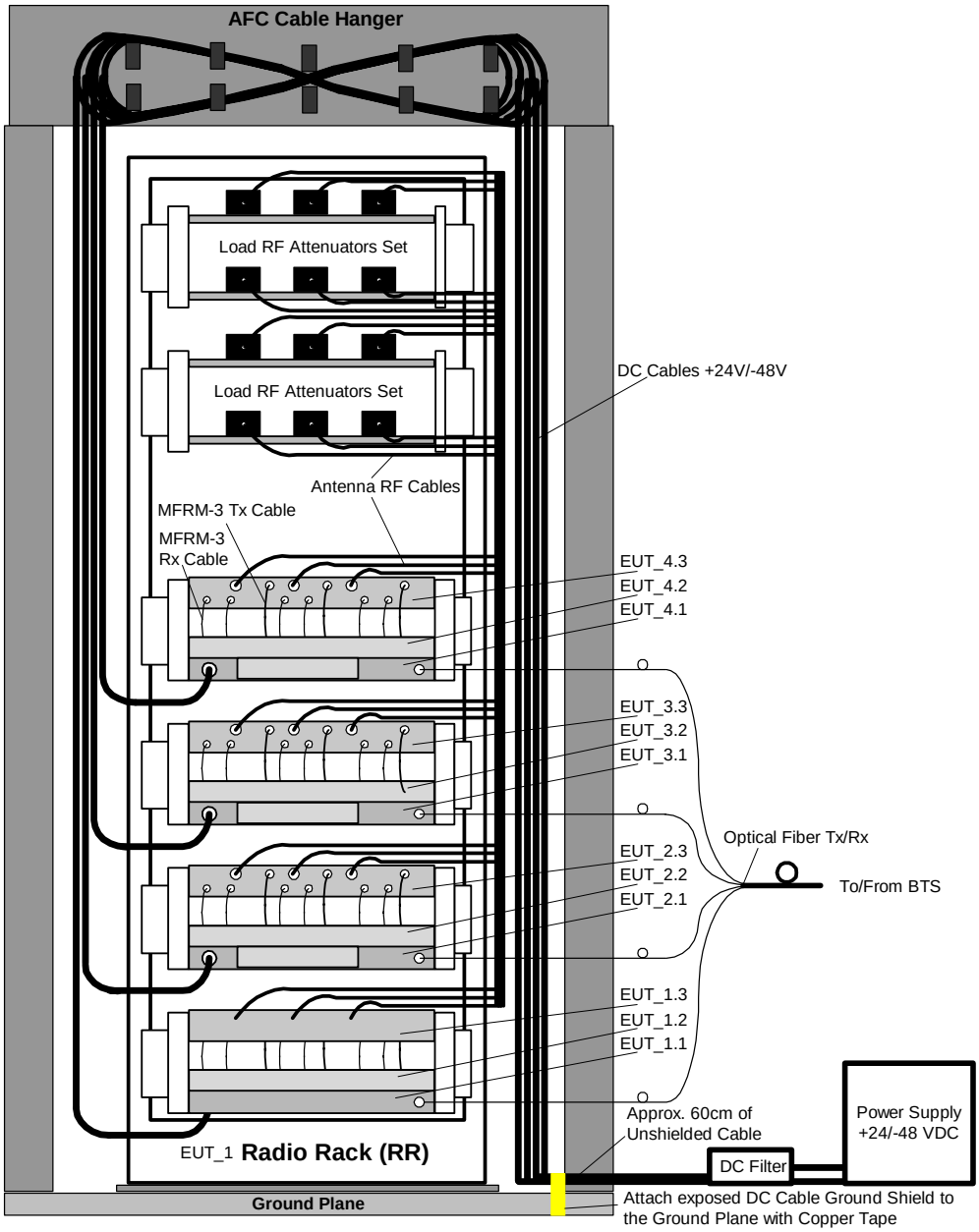
Radio	Band	Channel	Frequency (MHz)
Radio 1	A – Band	37	871.110
		78	872.340
		119	873.570
Radio 2	A – Band	201	876.030
		242	877.260
		283	878.490
Radio 3	B – Band	384	881.520
		425	882.750
		466	883.980
Radio 4	B – Band	548	876.440
		589	887.670
		630	888.900

The MFRM-3 operated at full RF power during all PI tests.
47.3 dBm (53.7 W) was present at every TDM Antenna sector output connector.

The total power for all 3 sectors was 161.1 W (52.1 dBm).

Configuration 1 was a set-up of four MFRM-3 in a Radio Rack. This configuration represents the maximum number of MFRM-3 co-operating in a single frame (Radio Rack). A DC filter (capacitor bank) was added on the battery side. The capacitor bank was in parallel with the DC power cables to the MFRM-3 during Radiated Emissions testing. Each MFRM-3 was linked by fiber optics to a CORE-2 module in the digital shelf (BTS). The digital rack with the digital shelf was used as support equipment, and was placed in the ambient free chamber (AFC) support room. Configuration 1 is presented in Figure 4-5.

Figure 4-5: Setup for Configurations 1 and 2 (Radiated Emissions Testing)



Configuration 2 had an identical set-up and optical fiber connections as Configuration 1, however, the four MFRM-3 were operating at +30VDC input voltage, instead of –50VDC input voltage. Configuration 2 is presented in Figure 4-5.

4.10 EUT Operations and Software

The system booted (with intervention) from an off state to a fully enabled state only requiring input to start test routines. DMI access was not required for the tests. The software requirement for the PC and the MFRM-3 Beta System is shown in Table 4-8.

Table 4-8: BTS Software Requirements for MFRM-3 Beta System

Software	Description	Functionality	Release	Interface
MFRM-3	MFRM-3 Application Software	Operates and debug MFRM-3 system	mfrmthree140ac8	All MFRM-3 interfaces
Vortex	BTS Manager	Commission, operate and monitor the BTS	14.0	10 Base-T connection to CM-2

4.11 System Components and Inventory

The components and inventories of the system(s) tested are provided in the following table(s).

Table 4-9: System Components

Component	Code	Quantity
Radio Rack	NTRZ51AA	1
MFRM-3 800MHz Beta	NTGZ70AA	4
FAM	NTGZ85AA	4
TDM 800MHz A-Band	NTGZ80AA	2
TDM 800MHz B-Band	NTGZ80BA	2
Digital Rack (DC)	NTGS45DA	1
BIP	NTGS47AD	1
Digital Shelf	NTGS20BA	1
CEM 64	NTBW70BA	5
CEM 192	NTRZ80BA	3
TIIM	NTGS3188	3
CM-2	NTBW40BA	2
CORE-2	NTBW30BA	2
COOLING UNIT	NTGS18AC	1

Table 4-10: MFRM-3 Inventory List

Reference	Component	Nortel PEC Code	Release Number	Serial Number
EUT_1	Radio Rack	NTRZ51AA	03	NNTMGY000N2D
EUT_1.1	MFRM-3 800MHz Beta	NTGZ70AA	N6	NNTMEEH0006
EUT_1.2	FAM	NTGZ85AA	N1	NNTM84G027RF
EUT_1.3	TDM 800MHz B-Band	NTGZ80BA	N1	ANDWMA000472
EUT_2.1	MFRM-3 800MHz Beta	NTGZ70AA	N5	NNTMEEH0001F
EUT_2.2	FAM	NTGZ85AA	N2	NNTM84G027T2
EUT_2.3	TDM 800MHz A-Band	NTGZ80AA	P3	ANDWMA000457
EUT_3.1	MFRM-3 800MHz Beta	NTGZ70AA	N5	NNTMEEH0100C
EUT_3.2	FAM	NTGZ85AA	N1	NNTM84G027RH
EUT_3.3	TDM 800MHz B-Band	NTGZ80BA	N1	ANDWMA000468
EUT_4.1	MFRM-3 800MHz Beta	NTGZ70AA	N6	NNTMEEH00007
EUT_4.2	FAM	NTGZ85AA	N1	NNTM84G027RG
EUT_4.3	TDM 800MHz A-Band	NTGZ80AA	P3	ANDWMA000459

5. General Test Conditions

5.1 Test Facility

Radiated emissions testing was performed in a 10-meter Ambient Free Chamber (AFC). The AFC consists of a shielded room lined with ferrite tiles and anechoic material. It is located in the Solectron EMS Canada Inc facilities on 21 Richardson Side Road, Kanata, Ontario, Canada.

Facility accreditation information is located in the Accreditation Section on page 2 of this test report.

5.2 Measurement Instrumentation

The measurement instrumentation conforms to ANSI C63.2 [7] and CISPR 16 [8]. Calibration of the measurement instrumentation is maintained in accordance with the supplier's recommendations, or as necessary to ensure its accuracy.

6. E-field Radiated Emissions

E-field Radiated Emissions tests are performed to assure that that the product does not produce excess amounts of radiated emissions that could interfere with licensed radiators.

6.1 Test Specification

The system was tested to the following requirements, listed in Table 6-1:

Table 6-1: E-field Radiated Emissions Requirements

Requirement	Country of Application
RSS-129	Canada
FCC Part 2.1053, 2.1057 FCC Part 22.917	USA

6.1.1 Limits

6.1.1.1 FCC Part 2.1053

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emissions. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of FCC 2.1049 [19], as appropriate.
Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from half wave dipole antennas.

6.1.1.2 FCC Part 2.1057

The spectrum should be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower. Particular attention should be paid to harmonics and sub harmonics of the carrier frequency as well as to those frequencies removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked. The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

6.1.1.3 FCC Part 22.917

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

6.1.1.4 RSS-129 Section 8.1.2

Unwanted Emissions from Base Stations

In any 30 kHz outside the cellular band, the attenuation shall be at least 43+10 Log_{10} (mean output power in watts) or 70, dB, whichever is the less stringent.

6.1.2 Test Facility Information

Location: SDE 10-meter AFC

Date tested: Recorded in the pre-scan plots included in Section 8.3.

Tested by: Recorded in the pre-scan plots included in Section 8.3.

6.1.3 Test Configurations

For radiated emissions test cases, the EUT hardware configuration/software load used are described in Section 4.9 and Section 4.10 on page 17 respectively.

6.1.4 Test Procedure

Verifications of the test equipment and AFC were performed prior to the installation of the EUT in accordance with the quality assurance procedures documented in the Solectron EMC Test Procedures document [10]. The test was performed as per the relevant test procedures in ANSI C63.4 [6] and TIA-603-C [9]:

- The EUT was placed on a turntable inside the AFC (configured as in normal operation). The system and its cables were separated from the ground plane by an insulating support 10 mm in height. The system was grounded in accordance with its installation specifications. No additional grounding connections were connected.
- For tests between **30 MHz and 10 GHz** the receive antenna (bi-log/horn) was placed at a 10 m distance from the EUT. An initial scan was performed to find emissions (frequencies) requiring detail measurement. The pre-scan was performed by rotating the system 360 degrees while recording all emissions (frequency and amplitude). This procedure was repeated for antenna heights of 1 to 4 meters, and for horizontal and vertical polarizations of the receiving antenna. Between 30 MHz and 1 GHz measurements at discrete frequencies, the detector mode was quasi-peak (QP) unless otherwise noted. Above 1 GHz measurements were made with an average detector mode (AVG) unless otherwise noted. Above 1 GHz the corresponding peak level can be no more than 20 dB above this limit.
- For **all the above frequency ranges** optimization was performed based on the pre-scan data. For each identified frequency, the EUT was rotated in azimuth over 360 degrees and the direction of maximum emission was noted. Antenna height was then varied from 1 to 4 meters at this azimuth to obtain maximum emissions. The procedure was repeated for both horizontal and vertical polarizations (were applicable) of the search antenna. The maximum level measured was recorded.
- A 800 MHz notch filter was used while measuring emissions between 30 MHz and 4 GHz. A 3 GHz high pass filter was used while measuring emissions between 4 and 10 GHz. The losses of each filter were previously evaluated with a Network Analyzer.

- The highest emissions were re-evaluated using the substitution method. This is accomplished by replacing the EUT by a calibrated antenna, cable and signal generator. This equipment is used to transmit a signal that will generate a RF meter reading level identical to the one recorded when the EUT was present.

6.1.5 Test Results: E-field Radiated Emissions

This section presents the E-field radiated emissions results. Optimized emissions are presented in the table(s) below, while pre-scan plots of all measurements including marked peaks appear in Appendix C: Radiated Emissions Plots on page 32.

Positive margin values in the "RE Test Results" table(s) below indicate a **PASS** while negative margin values indicate a **FAILURE** to meet the requirement.

6.1.5.1 Configuration 1: Four 800 MHz Beta MFRM-3 (-50VDC Input Voltage)

Pre-scan results between 10 kHz to 1000 MHz show no emissions present that require optimization.

Table 6-2: RE Test Results @ 10m (1-4 GHz and 4-10 GHz)

Parameter	Unit	Emission 1	Emission 2	Emission 3	Emission 4
Frequency	MHz	1765.9	2648.75	3530.64	5296.5
Azimuth	deg	12	327	333	10
Height	cm	283	206	208	317
Polarization		Vertical	Vertical	Vertical	Hor.
Meter Reading	dB(μV)	63.65	61.48	47.31	49.68
Detector	PK, QP, AV	AV	AV	AV	AV
Gain / Loss Factor	dB	-35.7	-34.6	-33.6	-31.0
Transducer Factor	dB	26.8	28.5	31.1	33.6
Level	dB(μV/m)	54.7	55.4	44.8	52.3

Note: Emissions 1, 2, 3, and 4 are the second, third, fourth, and sixth harmonic of the broadcast frequency of four 800 MHz Beta MFRM-3.

6.1.5.2 Configuration 2: Four 800 MHz Beta MFRM-3 (+30VDC Input Voltage)

Pre-scan results between 10 kHz to 1000 MHz show no emissions present that require optimization.

Table 6-3: RE Test Results @ 10m (1-4 GHz and 4-10 GHz)

Parameter	Unit	Emission 1	Emission 2	Emission 3	Emission 4
Frequency	MHz	1765.0	2647.54	3531.52	5297.14
Azimuth	deg	349	328	337	4
Height	cm	187	198	238	103
Polarization		Vertical	Vertical	Hor.	Vertical
Meter Reading	dB(μV)	64.75	57.77	43.2	49.89
Detector	PK, QP, AV	AV	AV	AV	AV
Gain / Loss Factor	dB	-35.7	-34.6	-33.6	-31.0
Transducer Factor	dB	26.7	28.5	31.0	34.0
Level	dB(μV/m)	55.7	51.7	40.6	52.9

Note: Emissions 1, 2, 3, and 4 were the second, third, fourth, and sixth harmonic of the broadcast frequency of four 800 MHz Beta MFRM-3.

Substitution measurements were performed in the 1 to 10 GHz band. The highest signals from Configuration 1 and 2 were used. Results are entered in Table 6-4.

No significant signals associated with the transmitter were observed in the 10 kHz to 1 GHz band. The system actually passed the FCC Part 15 Subpart B Class B limits in the 30 MHz to 1 GHz band.

Pre-scan plots of the radiated E-field emissions measured are included in Appendix C: Radiated Emissions Plots on page 32.

Table 6-4: Substitution Measurement Test Results

Freq. (MHz)	Signal generator level (dBm)	Cable loss (dB)	Pol	Antenna gain (dB)	Prescan meter reading (dBuV)	Substitution meter reading (dBuV)	ERP (dBm)	Limit (dBm)	Margin (dB)
1766	-41.4	1.5	V	8.1	64.8	64.8	-37	-13	24
2649	-41.5	1.8	H	9.1	61.5	61.5	-36.4	-13	23.4
3531	-52.4	2.1	V	9.2	47.3	47.3	-47.5	-13	34.5
5297	-44.6	2.7	H	10.1	49.9	49.9	-39.4	-13	26.4

6.2 Prescan Measurement Uncertainties

The expanded measurement instrumentation uncertainty (with a 95% level of confidence) on E-field radiated emissions is ±3.8 dB between 10 kHz and 30 MHz, ±4.5 dB between 30 MHz and 1 GHz, and ±5.9 dB between 1 GHz and 10 GHz.

Uncertainty evaluation has been calculated according to the method described in CISPR 16 [8].

6.3 Calculation of the Compliance Margin

The following illustrates the manner in which the compliance margin is calculated:

ERP = Signal generator level – Cable losses + Antenna gain – Half wave dipole gain

Margin = Limit - ERP

6.4 Test Conclusion

The worst-case margin is 23.4 dB at 2649 MHz to FCC Part 22 and Industry Canada RSS-129 spurious emissions requirements. This worst-case margin was calculated using a substitution measurement.

Since all measured emissions indicate positive margins, it can be declared that the EUT has passed the radiated Spurious Emission tests with respect to FCC Part 22 and Industry Canada RSS-129 requirements.

6.5 Test Equipment List

Table 6-5: Test Equipment Used for E-field Radiated Emissions

Description	Make	Model Number	Asset Number	Cal. Due
Bilog Antenna	Antenna Research	LPB 2520A	SSG012299	1/3/2007
RF Amplifier	HP	8447D	SSG012405	2/9/2007
Double Ridged Horn Antenna	Emco	3115	SSG012298	12/29/2006
EMC Cable # 25, Sucotest Cable	Huber + Suhner	ST18/Nm/Nm/36	SSG012788	2/8/2007
Pre-Amplifier	BNR	LNA	SSG012360	2/9/2007
Power Supply	HP	6216A	SSG013063	2/11/2007
Quasi-Peak Adapter, (AFC # 2)	HP	85650A	SSG012620	4/12/2007
Spectrum Analyzer Display	HP	85662A	SSG012433	4/18/2007
Spectrum Analyzer (AFC #1)	HP	8566B	SSG012521	4/18/2007
Spec. A, RF PreSelector	HP	85685A	SSG012010	4/18/2007
EMC Cable #5, Sucoflex Cable	Huber & Suhner	104PEA	SSG012359	2/9/2007
EMC Cable #3, Sucoflex Cable	Huber & Suhner	106A	SSG012355	2/7/2007

Description	Make	Model Number	Asset Number	Cal. Due
EMC Cable #2, Sucoflex Cable	Huber & Suhner	106A	SSG012353	2/7/2007
EMC Cable #1, Sucoflex Cable	Huber & Suhner	106A	SSG012354	2/7/2007
EMC Cable # 12, Sucoflex Cable	Huber & Suhner	104PEA	SSG012716	4/19/2007
Notch Filter	Microwave Circuits	N0308821	S/N 3839-02	NR
High Pass Filter	FSY Microwave	HR 2380-11XNXN	S/N 003	NR
Network Analyzer	HP	8753C	SSG012382	02/08/2007
Signal Generator	Anritsu	69369A	SSG012138	10/04/2007
Double Ridged Horn Antenna	Emco	3115	SSG012508	12/21/2006
RF Cable	Micro-Coax	UFA 210B-1-1500-504504	SSG012376	12/28/2006

The measurement instrumentation conforms to ANSI C63.2 [7] and CISPR 16 [8]. Calibration of the measurement instrumentation is maintained in accordance with the supplier's recommendations, or as necessary to ensure its accuracy.

7. References

7.1 Applicable documents

1. Nortel, MFRM-3 800MHz Beta Product Integrity Test Plan (Ottawa), issue 00.01 draft, http://livelink2.ca.nortel.com/livelink/livelink.exe?func=ll&objId=19658467&objAction=browse&sort=nameMFRM3_800Beta_PI_TestPlanOttawa_Draft0001, November 30, 2006.

7.2 Reference documents

2. Standards Council of Canada, Scope of Accreditation for Solectron EMS Canada Inc. outlined at the following web site http://palcan.scc.ca/specs/pdf/95_e.pdf
3. Industry Canada, RSS 212, Test Facilities and Test Methods for Radio Equipment, Issue 1 (Provisional), February 27, 1999.
4. Solectron EMS Canada Inc. Quality Manual, K0000608-QD-QM-01-09, July 4 2006.
5. Solectron EMS Canada Inc. Lab Operations Manual KG000347-QD-LAB-01-08, July 4 2006.
6. ANSI C63.4-2003 for FCC CFR 47 and ANSI C63.4-2001 for Telcordia, Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz, 06 June 2001.
7. ANSI C63.2-1996, American National Standard for Electromagnetic Noise and Field Strength Instrumentation, 10 Hz to 40 GHz – Specifications.
8. CISPR 16 Publications (2003), Specification for Radio Disturbance and Immunity Measuring Apparatus and Methods - Part 1: Radio Disturbance and Immunity Measuring Apparatus.
9. TIA-603-C, Land Mobile FM or PM Communications Equipment Measurement and Performance Standards, August 2004
10. Solectron EMS Canada Inc., EMC General Lab Test Procedure, KP000270-LP-EMC-01-08, July 6, 2006.
11. CISPR 22 (1997 / A2 2002), Title: Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement.
12. FCC Rules for Radio Frequency Devices, Title 47 of the Code of Federal Regulations, Part 15, U.S. Federal Communications Commission, 2005.
13. ICES-003 Issue 4 (2004), “Spectrum Management: Interference-causing equipment standard (Digital Apparatus)”
14. Lab34 Edition 1, “The Expression of Uncertainty in EMC Testing”, UKAS, August 2002.
15. APLAC, Asia Pacific Laboratory Accreditation Cooperation, Website (http://www.aplac.org)

16. ILAC, International Laboratory Accreditation Cooperation, Website (http://www.ilac.org/)
17. ISO 9001:2000, Quality Management Systems – Requirements, third edition, 2000/12/15.
18. Code of Federal Regulations (Washington, DC: Federal Communications Commission), Title 47, Chapter 1, Part 24.
19. Code of Federal Regulations (Washington, DC: Federal Communications Commission), Title 47, Chapter 1, Part 2.
20. 2 GHz Personal Communications Services, Industry Canada, RSS-133, Issue 2, Revision 1, November 6, 1999
21. NAMAS Publication NIS 81: "The Treatment of Uncertainty in EMC Measurements", Edition 1, May 1994.
22. Industry Canada, RSS 212, Test Facilities and Test Methods for Radio Equipment, Issue 1 (Provisional), February 27, 1999.

8. Appendices

8.1 Appendix A: Glossary

Included below are definitions and abbreviations of terms used in this document.

Term	Definition
AD	Average Detector
AE	Auxiliary Equipment
AFC	Ambient Free Chamber
AM	Amplitude modulation
ANSI	American National Standards Institute
CSA	Canadian Standards Association
dB	Decibel
DC	Direct Current
EMC	Electromagnetic Compatibility
EUT	Equipment Under Test
FCC	Federal Communications Commission, USA
GND	Ground
IC	Industry Canada
LISN	Line Impedance Stabilization Network
MU	Measurement Uncertainty
NA	Not Applicable
NAMAS	National Measurement Accreditation Service
NBS/ NIST	National Bureau of Standards / National Institute of Standards and Technology
PA	Broadband Power Amplifier
PK	Peak Detector
RBW	Resolution Bandwidth
RE	Radiated Emissions
RF	Radio-Frequency
RMS	Root-mean-square
RSS	Radio Standards Specification
SA	Spectrum Analyzer, the ANSI C63.2 Compliant EMI meter
SCC	Standards Council of Canada
T	50 Ω Coaxial Termination (conducted emissions / immunity)
UL	Underwriters Laboratories, Inc.
UUT	Unit Under Test

Term	Definition
VBW	Video Bandwidth
ERP	Effective Radiated Power
MFRM	Multi-carrier Flexible Radio Module
CDMA	Code Division Multiple Access
BTS	Base-station Transceiver System
WR MPEM	Wide voltage Range Power Entry Module
WR HCPA	Wide voltage Range High Power Converter Assembly
PSU	Power Supply Unit

8.2 Appendix B: Test Set-up Photographs

This appendix presents all the set-ups used to cover all the tests presented in this Test Report.

Figure 8-1: 800 MHz Metro Cell Beta MFRM-3 Radiated Emission Set-up (Configuration 1: Four Operational MFRM-3, -50VDC Input Voltage) – Front View

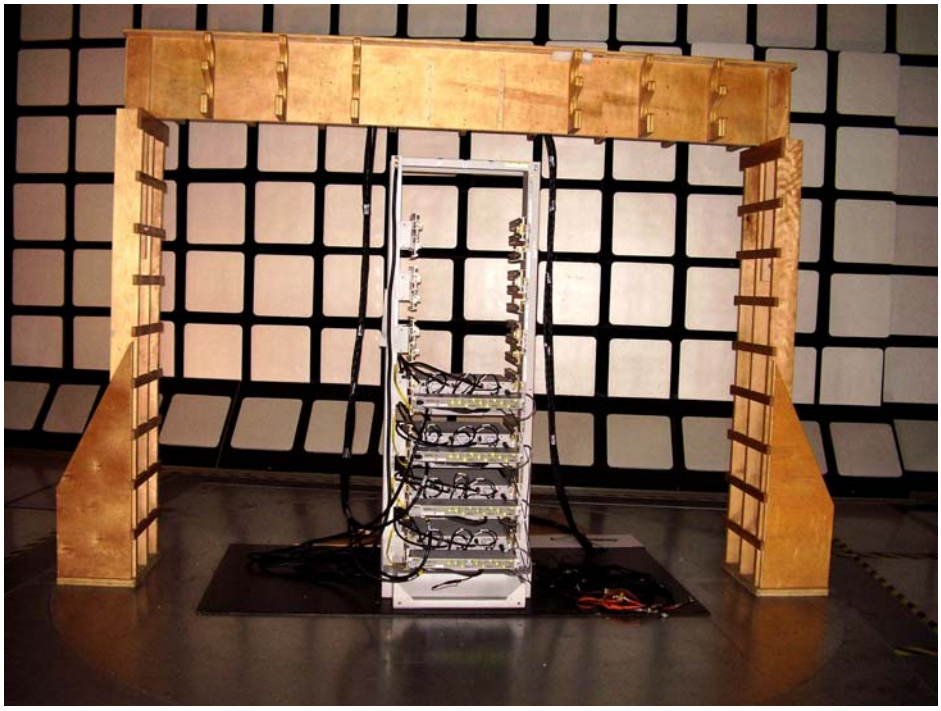
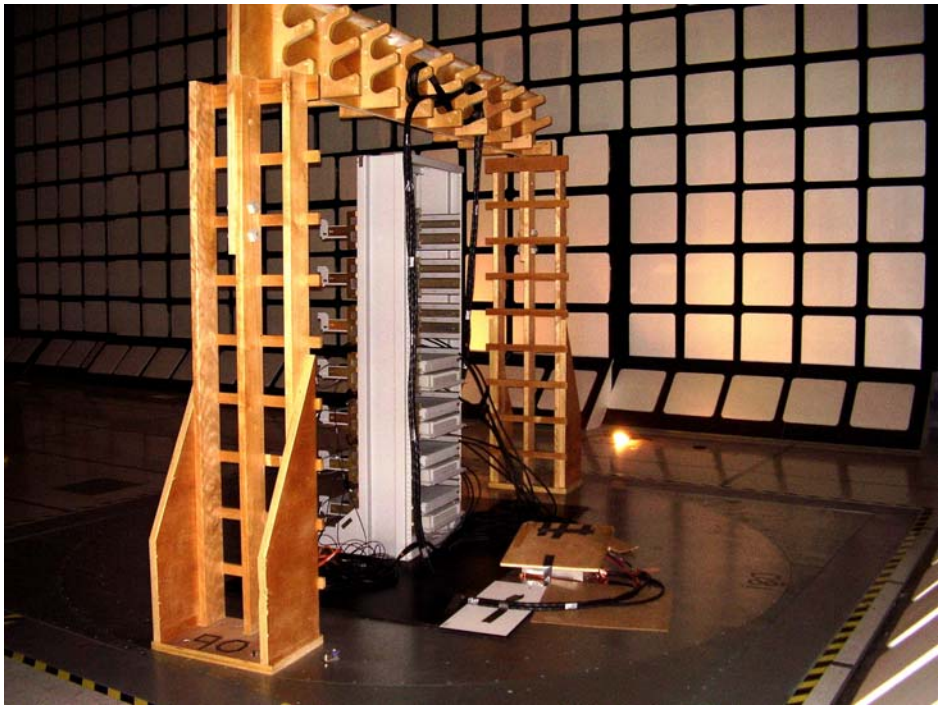


Figure 8-2: 800 MHz Metro Cell Beta MFRM-3 Radiated Emission Set-up (Configuration 1: Four Operational MFRM-3, -50VDC Input Voltage) – Auxillary View



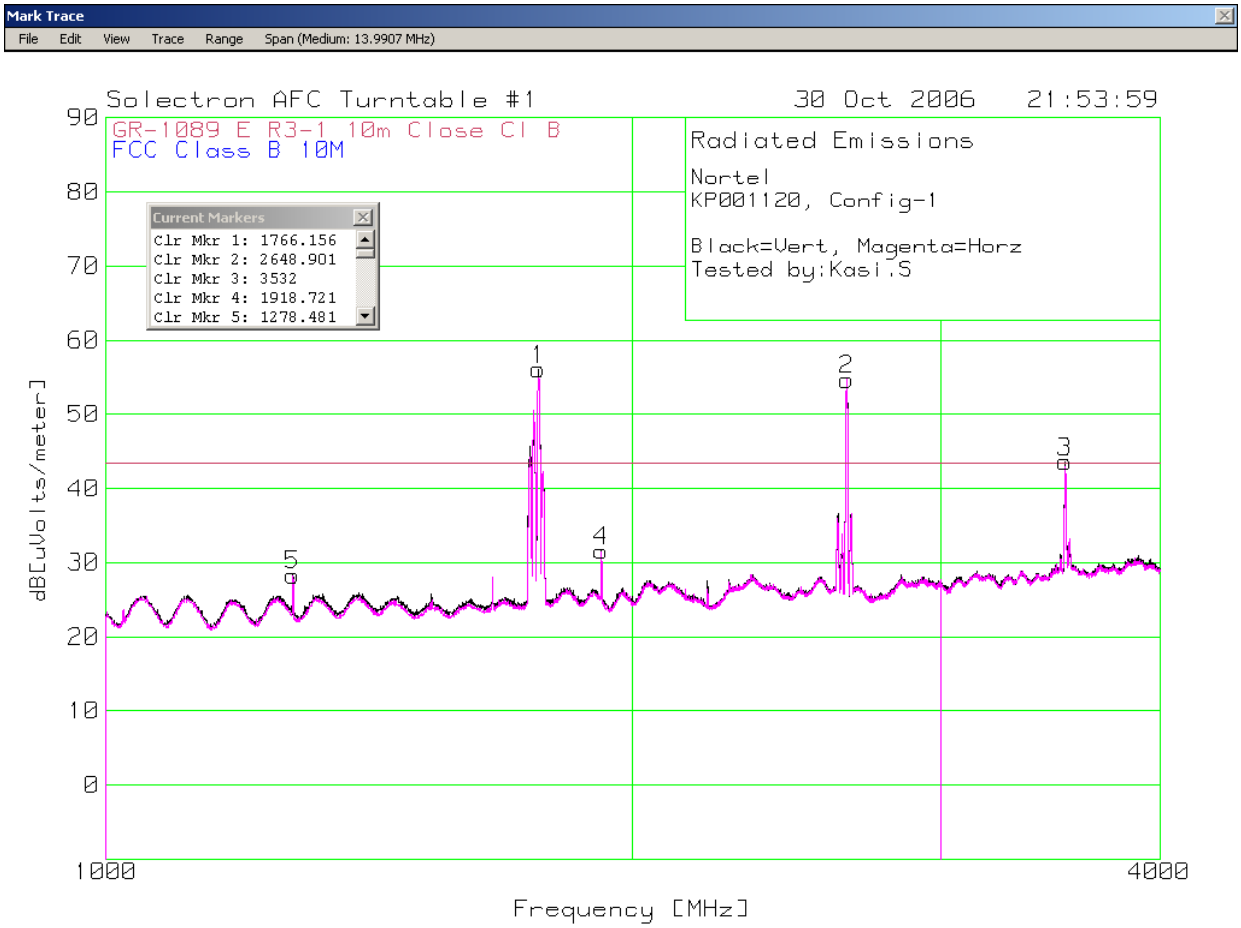
8.3 Appendix C: Radiated Emissions Plots

This appendix presents all radiated emissions plots for the test cases measured.

Radiated emissions were measured between the frequency range of 10 kHz to 10 GHz. No radio related emissions were observed in the 10 kHz to 1 GHz range.

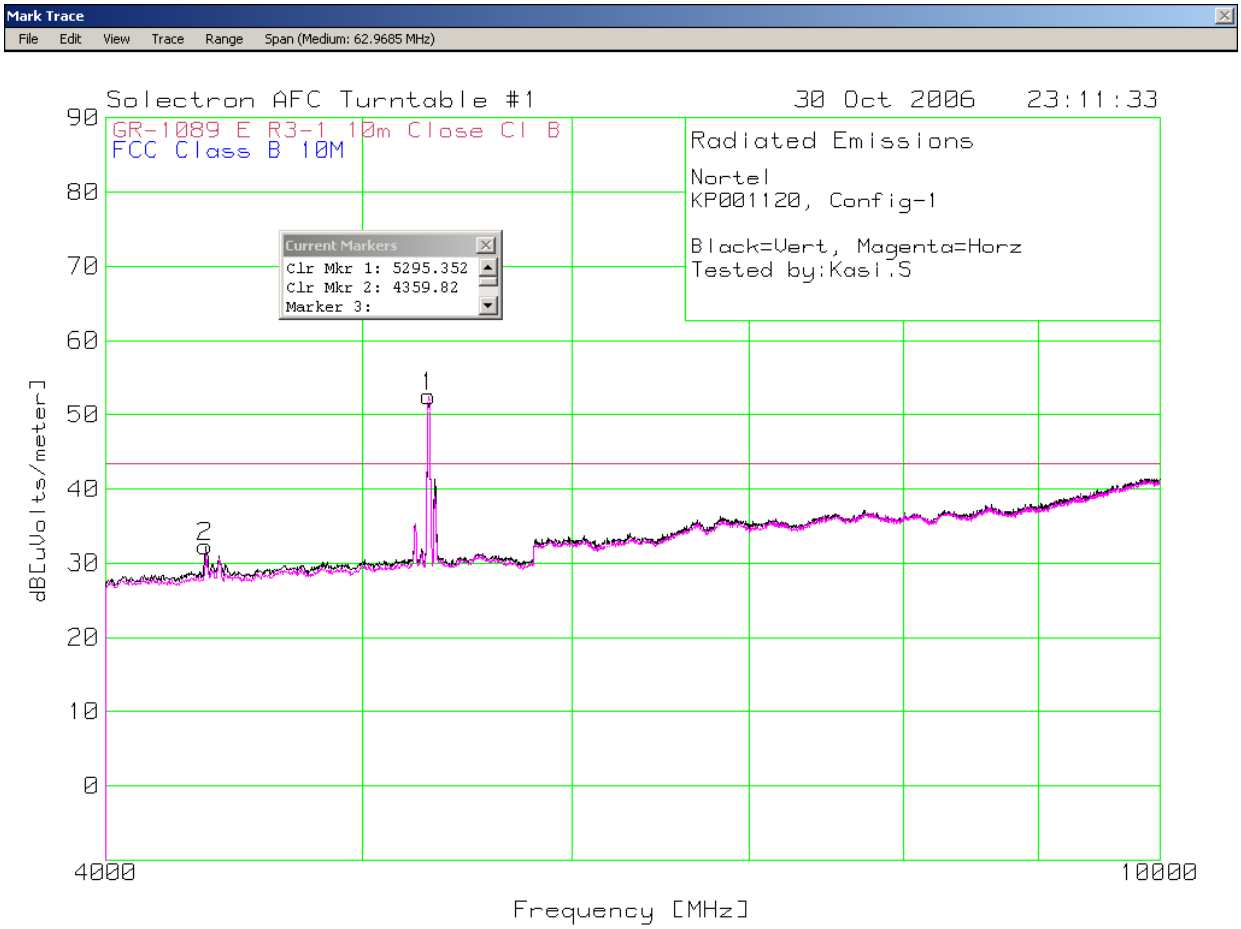
8.3.1 Configuration 1: Four 800 MHz Beta MFRM-3 (-50VDC Input Voltage)

Figure 8-3: RE 1 – 4 GHz



Note: A 880 MHz notch filter was placed between the horn antenna and pre-amplifier during this Radiated Emissions plot. Markers #1, #2, and #3 were the second, third, and fourth harmonic of the broadcast frequency of four 800 MHz Beta MFRM-3.

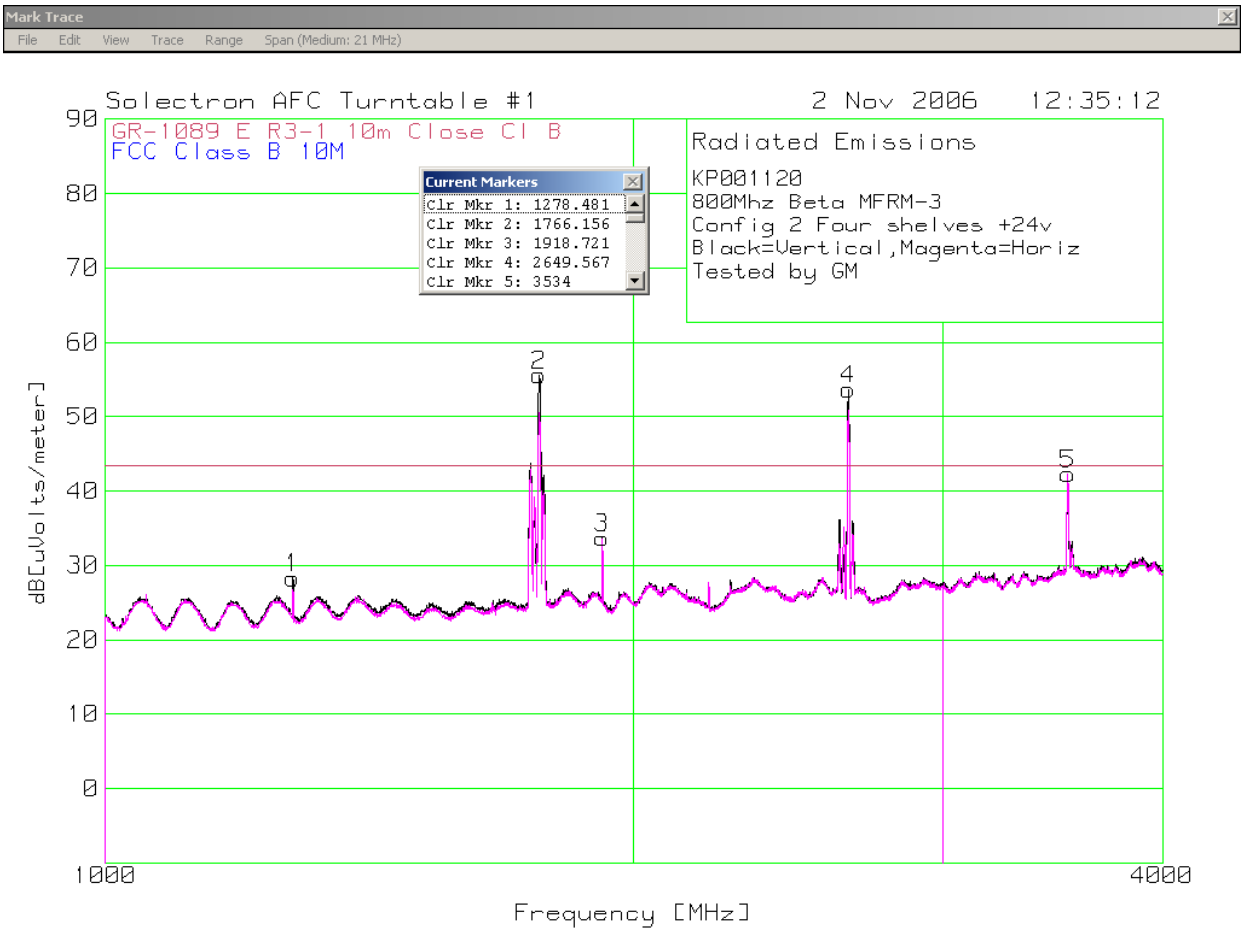
Figure 8-4: RE 4 – 10 GHz



Note: A high pass filter was placed between the horn antenna and pre-amplifier during this Radiated Emissions plot. Markers #1 and #2 were the sixth and fifth harmonic of the broadcast frequency of four 800 MHz Beta MFRM-3.

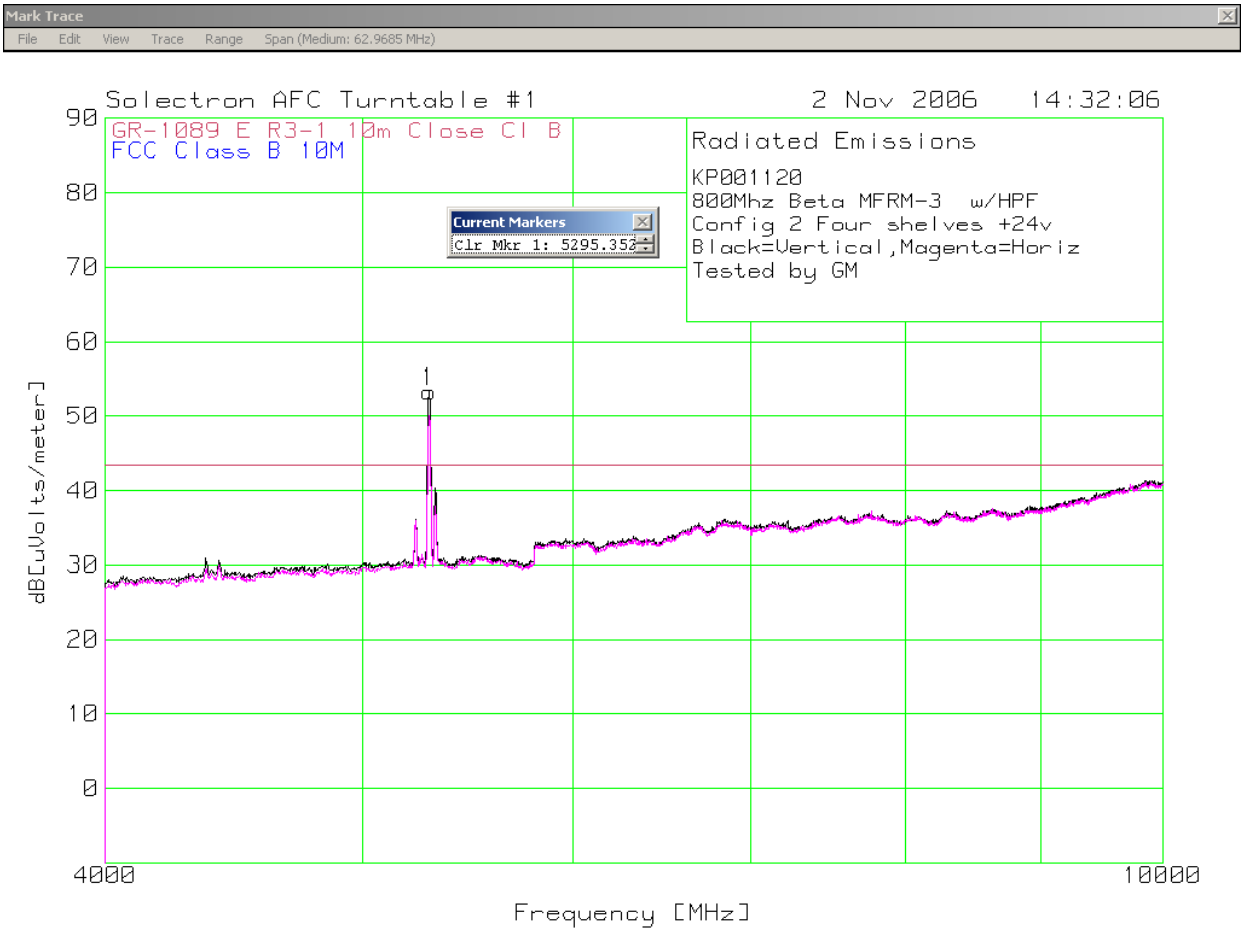
8.3.2 Configuration 2: Four 800 MHz Beta MFRM-3 (+30VDC Input Voltage)

Figure 8-5: RE 1 – 4 GHz



Note: A 880 MHz notch filter was placed between the horn antenna and pre-amplifier during this Radiated Emissions plot. Markers #2, #4, and #5 were the second, third, and fourth harmonic of the broadcast frequency of four 800 MHz Beta MFRM-3.

Figure 8-6: RE 4 – 10 GHz



Note: A high pass filter was placed between the horn antenna and pre-amplifier during this Radiated Emissions plot. Marker #1 was the sixth harmonic of the broadcast frequency of four 800 MHz Beta MFRM-3.

Solectron EMS Canada Inc.

Design and Engineering

Spurious Emissions Compliance Report for the 800 MHz Metro Cell Beta MFRM-3

FCC Part 22 and Industry Canada RSS-129

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