Spurious Emissions Compliance Report for the 1900 MHz Metro Cell Beta MFRM-3
FCC Part 24 and Industry Canada RSS-133

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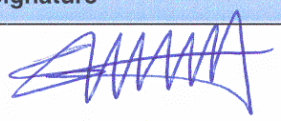
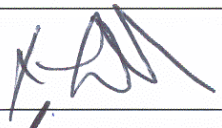
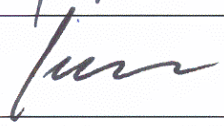
Approvals

Function	Name	Job title	Signature	Date
Document Release Approval	Steve Tippet	Manager, Product Engineering and Verification		28th May 2007
Author	Denis Lalonde	Radio Compliance Discipline Leader		May 25, 2007
Technical Reviewer	Jacques Rollin	EMC Advisor		May 28, 2007

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 [3]. The SCC is a signatory of the APLAC [16] and ILAC [17] Mutual Recognition Arrangements.

Solectron EMS Canada Inc.'s (SDE) quality management system is registered to ISO 9001: 2000 [18] and its processes are documented in the SDE Quality Manual [5] and Lab Operations Manual [6].

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1 Executive Summary

At the request of Nortel Networks, Solectron EMS Canada Inc. has evaluated the system's radiated spurious emissions. This report describes the test results of the FCC Part 24 and Industry Canada RSS-133 radiated emissions tests performed on the 1900 MHz Metro Cell Beta MFRM-3 system.

On the basis of measurements performed in March and April 2007, the 1900 MHz Metro Cell Beta MFRM-3 is verified to be compliant with the radiated spurious emissions requirements of FCC Part 24 and Industry Canada RSS-133. 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's radiated spurious emissions. This report describes the test results of the FCC Part 24 and Industry Canada RSS-133 radiated emissions tests performed on the 1900 MHz Metro Cell Beta MFRM-3 system.

3 Compliance Summary

This section summarizes all the measurements performed on 1900 MHz Metro Cell Beta MFRM-3 and its compliance to FCC Part 24 and Industry Canada RSS-133.

Table 3-1: Compliance Results Summary

Product Summary			
Product Name:	1900 MHz Metro Cell Beta MFRM-3	Project Leader:	William Kwong
Product Code:	Refer to Table 4-10 and Table 4-11 on pages 16 and 17	EMC Engineer:	Denis Lalonde
Product Release:		Tester:	S. Turner, W. Kwong, and D. Lalonde
Product Status:	Not Available	Date:	March 16 to April 2, 2007

Test Cases [1]					
Completed	**Description**	**Specification**	**Test Results**		**Notes**
			Pass	Fail	
■	Radiated Spurious Emissions (E-field)	FCC Part 24	■	□	
■	Radiated Spurious Emissions (E-field)	Industry Canada RSS-133	■	□	

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 Metro Cell 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 an EMI shield, thus providing maximum protection for 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

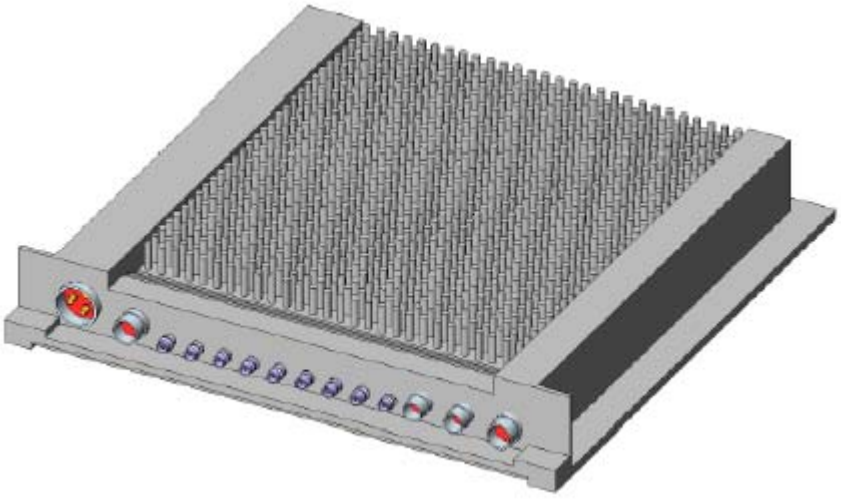


Figure 4-2: Fully Assembled MFRM-3

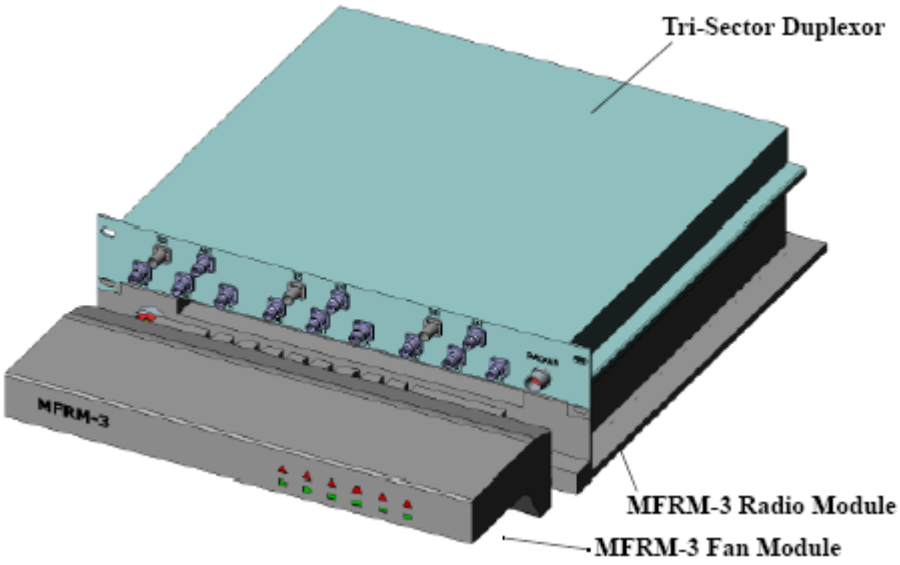
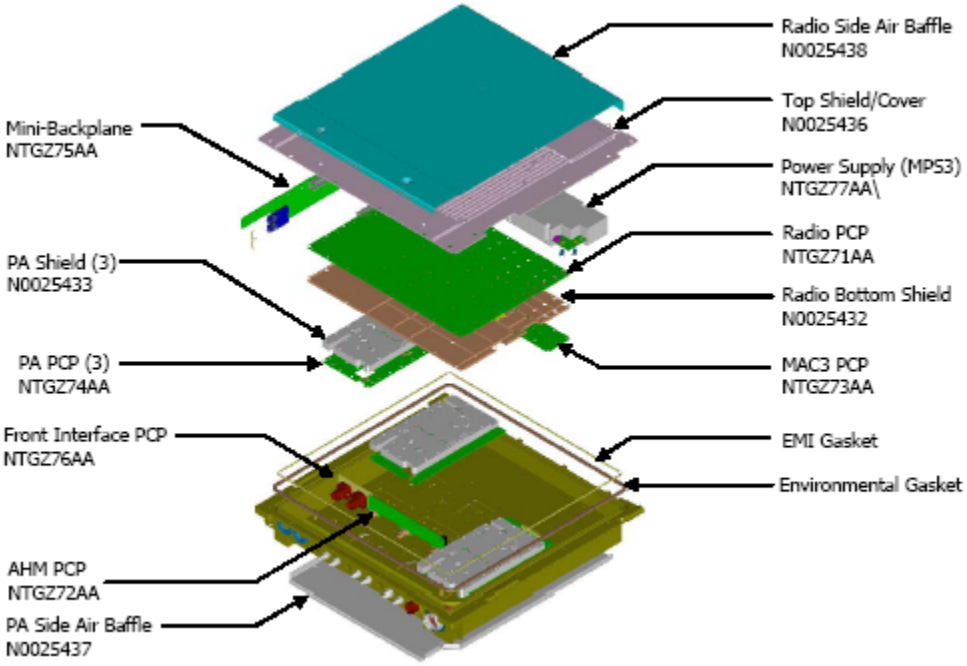


Figure 4-3: Exploded View of an MFRM-3 Radio Module



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	1900 MHz Metro Cell Beta MFRM-3
Model Number	1900 MHz TDPM (PEC code: NTGZ81xx) 1900 MHz MFRM-3 Radio Module Beta (PEC code: NTGZ70BA, Release N1) Fan Assembly Module (FAM) (PEC code: NTGZ85AA, Release N1/N2)
Primary Technical Contact	Andrew Kemp
Title	Technical Project Manager
Phone	+1 403 769 4943
E-mail	akemp@nortel.com

4.4 Power Requirements

The following tables describe the power requirements for the 1900 MHz Metro Cell Beta MFRM-3**.**

Table 4-1: -48V DC Power Requirement

Feed	Voltage	Current Rating	Current drawn during testing
A	-48 V DC	30 A max	~17.5A

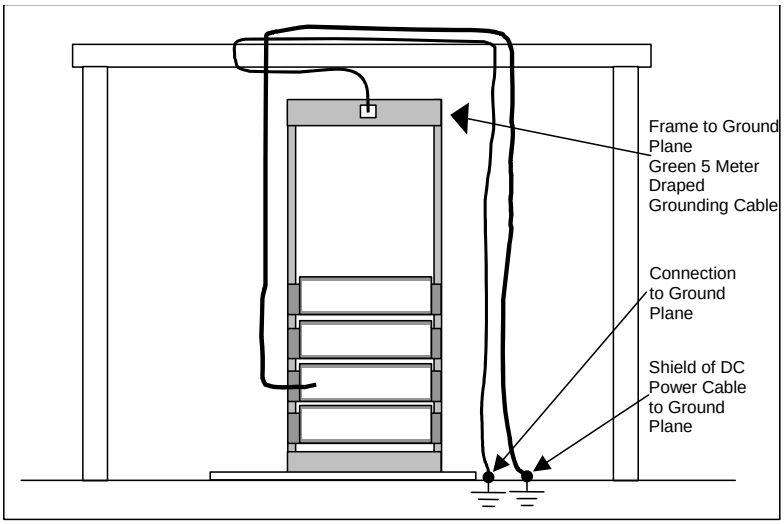
Table 4-2: +24V DC Power Requirement

Feed	Voltage	Current Rating	Current drawn during testing
A	+24V DC	50 A max	~35A

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)
1900 MHz Radio Module	NTGZ70BA	0.1536, 2.5, 7.3728, 19.2, 19.6608, 25, 31.9488, 33, 39.3216, 63.8976, 66, 78.6432, 96, 100, 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 Designation	Permanent Connection	Description (Shielded/ Unshielded)	Connect Point	Length (m)	MaxQty	Termination During Testing
1	-48V DC power cable	YES	Shielded DC power cable	MFRM-3 Main DC Power Connector	10	1 per MFRM3	Inline DC filter and -48V DC power supply
2	+24V DC power cable	YES	Shielded DC power cable	MFRM-3 Main DC Power Connector	10	1 per MFRM3	Inline DC filter and +24V DC power supply
3	Ground cable	YES	AWG 2 electrical cable	Frame ground	3	1	Earth ground
4	Antenna RF cables	YES	Radio RF output via a coaxial cable	TDM Alpha /Beta/ Gamma antenna port connector	6-10	3 per MFRM3	Load RF attenuators set or RF test boxes during Radiated Immunity testing
5	Multimode Tx/Rx optical fiber	YES	SC-SC optical connection	MFRM-3 Fiber Optics Connector	10	1 per MFRM3	CORE-2 module in digital shelf of a BTS
6	Alarm cable (Nortel PEC code: NTGZ8610)	YES	Unshielded customer alarm cable	Loopback	5	1 per MFRM3	Not terminated

Note: All cables listed above are indoor cables unless otherwise stated.

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 monitor	Dell	Ultrascan P991	MX-08376T-47741	Not required
Personal monitor	Dell	M782	MY-08G157-47603-373-B4UU	Not required
Cell phone/power supply/cable	Qualcomm	QSP1960	61-5537A-01	Not required
Nortel test box #2	Nortel	N/A	N/A	Not required
+24V DC power supply	XANTREX	LXQ 20-3	645906	Not required
+24V DC power supply	XANTREX	LXQ 20-3	645912	Not required
Capacitor bank (DC power filter)	Nortel	N/A	N/A	Not Required

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

Reference	Component	Nortel PEC Code	Release Number	Serial Number
SE_1	Digital Rack (AC)	NTGS35AA	70	SNMN5300M6DH
SE_1.4	BIP	NTGS36AA	10	SNMN5300M6NJ
		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	NNTM84C02C22
SE_1.2.5	CM-2	NTBW40BA	4	NNTM74X0WWVV
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	NNTMCL000118

4.9 System Set-up and Test Configurations

Three carriers per Radio were used for the MFRM-3 1900MHz Beta PI testing. Refer to Table 4-7.

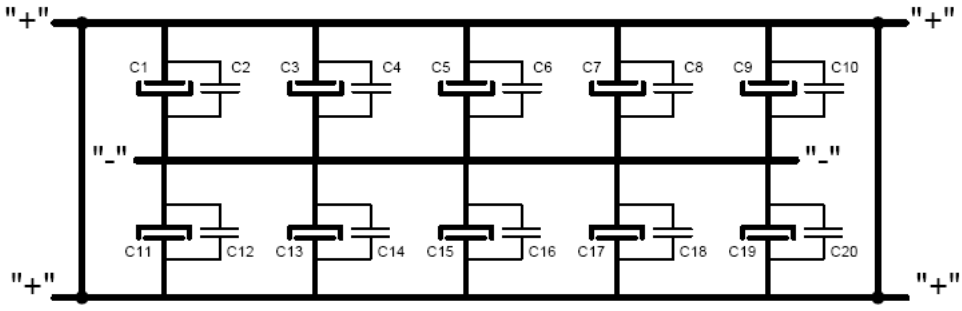
Table 4-7: 4xMFRM-3 Configuration, Transmission Carriers Frequencies

Radio	Band	Channel	Frequency (MHz)
Radio 1	AD	125	1936.25
		150	1937.5
		175	1938.75
Radio 2	BE	525	1956.25
		550	1957.50
		575	1958.75
Radio 3	CF	925	1976.25
		950	1977.50
		975	1978.75
Radio 4	CF	1125	1986.25
		1150	1987.50
		1175	1988.75

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).

The MFRM-3 product has strict limitation on external power lines inductance. Due to this limitation, the auxiliary DC filter that includes 2 parallel arrays of capacitors was used throughout the test program to compensate for excessive external inductance and reduce noise coming from external power supply. The EUTs external DC cables were connected through the auxiliary DC filter to external power supplies, with auxiliary DC filter between battery and return DC power lines. The DC filter is a parallel array of capacitors and is illustrated in Figure 4-5.

Figure 4-5: Auxillary DC Filter

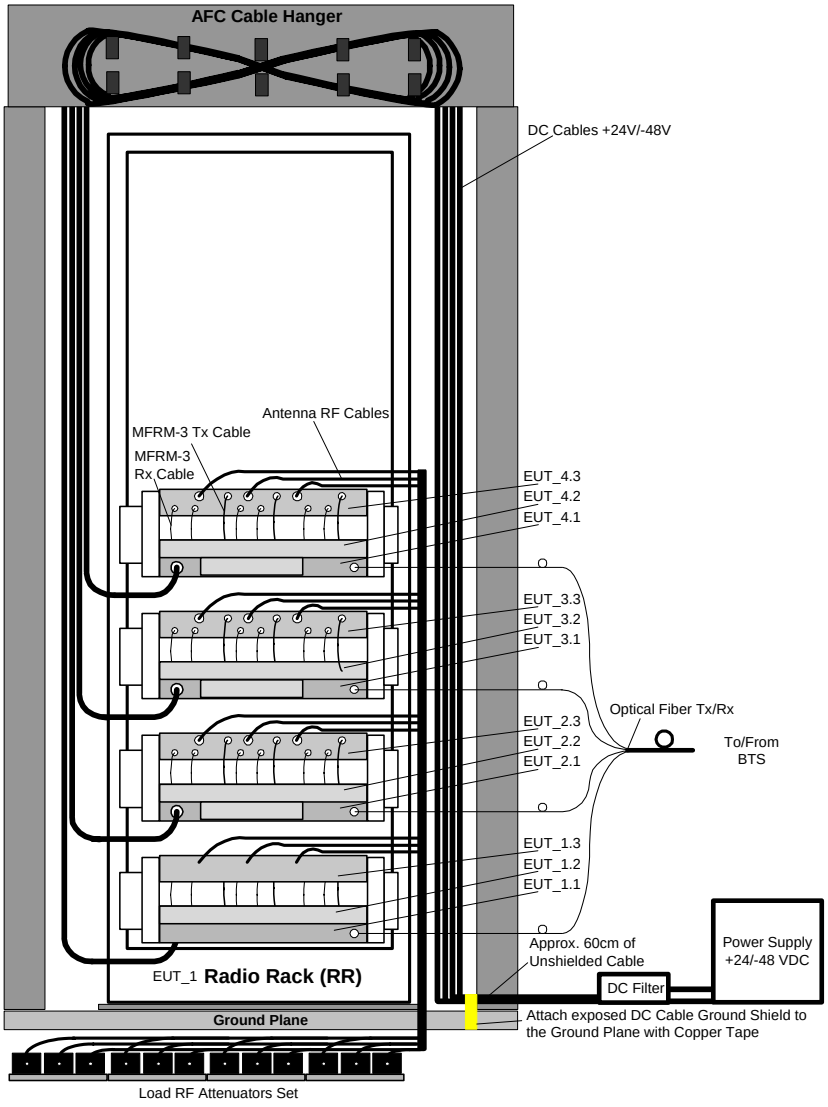


where :
C1, C3, C5, C7, C9, C11, C13, C15, C17, C19 : 10000 µF -10/+50% ; 100 VDC ; +85°C ; GAA Panasonic 052571 ; USA.

C2, C4, C6, C8, C10, C12, C14, C16, C18, C20 : 0.68 µF ; 250 V.

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 pair of 50 foot 535.3 MCM (1325#24) wiring was used to connect from the DC power supply to the DC filter. 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. The hardware setup for Configurations 1 and 2 is presented below.

Figure 4-6: Hardware Setup (Configurations 1 and 2) - +24V or +48V, 4 MFRM3 in a Frame (Radiated Emissions Only)



Configuration 2 had an identical set-up and optical fiber connections as Configuration 1, however, the four MFRM-3 were operating at +24VDC input voltage, instead of –48VDC input voltage.

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	mfrmthree140ug	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	Nortel PEC Code	Quantity
Radio Rack	NTRZ51AA	1
MFRM-3 1900MHz Beta	NTGZ70BA	4
FAM	NTGZ85AA	4
TDPM 1900MHz	NTGZ80xx	4

Table 4-10: MFRM-3 Inventory List for March 16th, 2007 Radiated Emissions Testing

Reference	Component	Nortel PEC Code	Release Number	Serial Number
EUT_1	Radio Rack	NTRZ51AA	03	NNTMGY000N2D
EUT_4.1	MFRM-3 1900MHz Beta	NTGZ70BA	N9	NNTMEEJ01016
EUT_4.2	FAM-3	NTGZ85AA	N2	NNTM84G027WV
EUT_4.3	TDPM 1900MHz CF-Band	NTGZ81CB	N/A	FICT010019
EUT_3.1	MFRM-3 1900MHz Beta	NTGZ70BA	N9	NNTMEEJ0100G
EUT_3.2	FAM-3	NTGZ85AA	N2	NNTM84G027WH
EUT_3.3	TDPM 1900MHz CF-Band	NTGZ81CB	N1	FICT020018P1
EUT_2.1	MFRM-3 1900MHz Beta	NTGZ70BA	N9	NNTMEEJ01018
EUT_2.2	FAM-3	NTGZ85AA	N2	NNTM84G027V4
EUT_2.3	TDPM 1900MHz BE-Band	NTGZ81BB	N1	FICT02001925
EUT_1.1	MFRM-3 1900MHz Beta	NTGZ70BA	N9	NNTMEEJ01017
EUT_1.2	FAM-3	NTGZ85AA	N1	NNTM84G027W9
EUT_1.3	TDPM 1900MHz AD-Band	NTGZ81AB	N1	FICT02001CC6

Table 4-11: MFRM-3 Inventory List for April 18th, 2007 Radiated Emissions Testing

Reference	Component	Nortel PEC Code	Release Number	Serial Number
EUT_1	Radio Rack	NTRZ51AA	03	NNTMGY000N2D
EUT_4.1	MFRM-3 1900MHz Beta	NTGZ70BA	S4	NNTMEEJ0101J
EUT_4.2	FAM-3	NTGZ85AA	N2	NNTM84G027X1
EUT_4.3	TDPM 1900MHz CF-Band	NTGZ81CB	N1	FICT010019
EUT_3.1	MFRM-3 1900MHz Beta	NTGZ70BA	N9	NNTMEEJ0100F
EUT_3.2	FAM-3	NTGZ85AA	N2	NNTM84G027WV
EUT_3.3	TDPM 1900MHz AD-Band	NTGZ81AB	N1	FICT02001CC6
EUT_2.1	MFRM-3 1900MHz Beta	NTGZ70BA	N9	NNTMEEJ01018
EUT_2.2	FAM-3	NTGZ85AA	N2	NNTM84G027V4
EUT_2.3	TDPM 1900MHz BE-Band	NTGZ81BB	N1	FICT02001925
EUT_1.1	MFRM-3 1900MHz Beta	NTGZ70BA	N9	NNTMEEJ01017
EUT_1.2	FAM-3	NTGZ85AA	N1	NNTM84G027W9
EUT_1.3	TDPM 1900MHz CF-Band	NTGZ81CB	N1	FICT020018P1

5 General Test Conditions

5.1 Test Facility

Radiated emissions testing were 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 [8] and CISPR 16 [9]. 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-133	Canada
FCC Part 2.1053, 2.1057 FCC Part 24.238	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 [20], 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 24.238

(a) On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB.

6.1.1.4 RSS-133 Section 6.3

Out of Block Emissions

(i) In the first 1.0 MHz bands immediately outside and adjacent to the licensee's frequency block, the power of emissions (per 1% of the emission bandwidth) shall be attenuated below the transmitter output power P (in watts) by at least 43 + 10 log10 (P), dB. It is only required to use

the plots from (a) and (b) to demonstrate that the out of blocks A and C emissions are met. (ii) After the first 1.0 MHz, the power of emissions shall be attenuated below the transmitter output power by at least 43 + 10 log10 (P), dB, per any MHz of bandwidth. (Note: If the test result using 1% of the emission bandwidth is used, then power integration over 1.0 MHz is required; alternatively, the spectrum analyzer resolution and video bandwidths can be increased to 1.0 MHz for this measurement). The search for these emissions shall be from the lowest frequency internally generated or used in the device (local oscillator, intermediate or carrier frequency), or 30 MHz, whichever is the lowest frequency, to the 5th harmonic of the highest frequency generated or used, without exceeding 40 GHz.

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 16 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 [11]. The test was performed as per the relevant test procedures in ANSI C63.4 [7] and TIA-603-C [10]:

- 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. The horn antenna was moved to a 3 m distance for measurements between 10 and 18 GHz. The measuring distance was further reduces to 1 m for measurements between 18 GHz and 20 GHz.
- 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 1960 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 calibrated Network Analyzer (HP 8753C, asset number: SSG012382, calibration due date: February 7th, 2008) and a calibrated Signal Generator (Anritsu 69369A, asset number: SSG012138, calibration due date: October 4th, 2007).
- 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 30.

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 1900 MHz 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
Frequency	MHz	3874.5	5812.0	7909.4
Azimuth	deg	154	300	352
Height	cm	227	259	154
Polarization		Vertical	Vertical	Vertical
Meter Reading	dB(μV)	58.0	50.7	38.7
Detector	PK, QP, AV	AV	AV	AV
Gain / Loss Factor	dB	-32.3	-28.6	-28.5
Transducer Factor	dB	32.0	34.0	36.8
Level	dB(μV/m)	57.7	56.1	47.0

Note: Emissions 1, 2, and 3 were the highest second, third, and fourth harmonic of the broadcast frequency of four 1900 MHz MFRM-3.

6.1.5.2 Configuration 2: Four 1900 MHz MFRM-3 (+24VDC Input Voltage)

Pre-scan results between 10 kHz to 1000 MHz and 10 GHz to 21 GHz 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
Frequency	MHz	3954.4	5812.7	7949.4
Azimuth	deg	134	357	292
Height	cm	180	182	115
Polarization		Vertical	Horz.	Horz.
Meter Reading	dB(μV)	56.9	39.0	30.4
Detector	PK, QP, AV	AV	AV	AV
Gain / Loss Factor	dB	-32.2	-28.6	-28.5
Transducer Factor	dB	32.2	34.0	36.8
Level	dB(μV/m)	56.9	44.4	38.7

Note: Emissions 1, 2, and 3 were the highest second, third, and fourth harmonic of the broadcast frequency of four 1900 MHz MFRM-3.

Substitution measurements were performed in the 1 to 10 GHz band. The highest signals from Configuration 1 and 2 were used. Test results can be found in Table 6-4.

No significant signals associated with the transmitter were observed in the 10 kHz to 1 GHz and 10 GHz to 21 GHz bands. 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 30.

Table 6-4: Substitution Measurement Test Results

Conf	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)
1	3874.5	-39.6	2.3	V	9.7	58	58	-34.4	-13	21.4
	5812	-43.1	3.6	V	11.1	50.7	50.7	-37.8	-13	24.8
	7909.4	-47.9	3.8	V	11.4	38.7	38.7	-42.5	-13	29.5
2	3954.4	-40.3	2.3	V	9.7	56.9	56.9	-35.1	-13	22.1
	5812.6	-42	3.6	H	11.1	39.0	39.0	-49.5	-13	36.5
	7949.4	-57.3	3.8	H	11.4	30.4	30.4	-51.9	-13	38.9

6.2 Prescan Measurement Uncertainties

Uncertainty evaluation has been calculated according to the method described in CISPR 16 [9].

The expanded measurement instrumentation uncertainty (with a 95 % level of confidence) on E-field RE is ± 3.8 dB between 10 kHz and 30 MHz, ± 4.5 dB between 30 MHz and 1 GHz, ± 5.9 dB between 1 GHz and 10 GHz, ± 5.8 dB between 10 GHz and 18 GHz, and ± 5.5 dB between 18 GHz and 26.5 GHz.

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 21.4 dB at 3874.5 MHz to FCC Part 24 and Industry Canada RSS-133 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 24 and Industry Canada RSS-133 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
Notch Filter (Nortel Item)	Microwave Circuits Inc	N0319603	S/N: 3839-02 DC0408	Not Required
High Pass Filter	FSY Microwave	HR 2380-11XNXN	S/N 003	Not Required
Spectrum Analyzer - Portable	HP	8564E	SSG012069	3/19/2008
Spectrum Analyzer (AFC #1)	HP	8566B	SSG012521	4/18/2007
Spec. A, RF Preselector	HP	85685A	SSG012010	4/18/2007
Double Ridged Horn	Emco	3115	SSG012298	17/1/2008
Pre-Amplifier	BNR	LNA	SSG012594	18/4/2007
Horn antenna 18 – 26.5 GHz	EMCO	3160-09	SSG012292	21/12/2007
Quasi-Peak Adapter (EMI # 2)	HP	85650A	SSG013046	10/4/2007
RF Amplifier, HP8447 # 1	Agilent	8447D	SSG013045	6/10/2007
EMC Cable # 12, Sucoflex Cable	Huber & Suhner	104PEA	SSG012716	19/4/2007
EMC Cable # 14, Sucoflex Cable	Huber & Suhner	104PEA	SSG012041	2/10/2007

Description	Make	Model Number	Asset Number	Cal. Due
EMC Cable # 3, Sucoflex Cable	Huber & Suhner	106A	SSG012455	2/5/2008
EMC Cable # 2, Sucoflex Cable	Huber & Suhner	106A	SSG012453	2/5/2008
EMC Cable # 1, Sucoflex Cable	Huber & Suhner	106A	SSG012454	2/5/2008
EMC Cable # 7, Sucoflex Cable	Huber & Suhner	104	SSG011801	18/4/2007
EMC Cable # H3, 10-18 GHz, Utiflex Cable	Micro-Coax	UFA 210B-1-1500-504504	SSG012376	21/12/2007
Spectrum Analyzer Display	HP	85662A	SSG012433	18/4/2007
EMC Cable # H4, 26.5-40 GHz, Sucoflex	Huber + Suhner	102A	SSG013084	21/12/2007
20 dB Attenuator	Weinschel	47-20-43	SSG012012	18/4/2007
Attenuator	Narda	768-10	SSG012714	29/11/2007
Network Analyzer	HP	8753C	SSG012382	07/02/2008
Signal Generator	Anritsu	69369A	SSG012138	04/10/2007
Double Ridged Horn Antenna	Emco	3115	SSG012267	29/01/2008
RF Cable	Micro-Coax	UFA 210B-1-1500-504504	SSG012376	21/12/2007

The measurement instrumentation conforms to ANSI C63.2 [8] and CISPR 16 [9]. 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. KP001120-TP-EMC-10-01, EMC Compliance Test Plan for 1900 MHz Metro Cell Beta MFRM-3
2. Nortel, MFRM-3 1900MHz Beta Product Integrity Test Plan (Ottawa), issue 00.02 draft, http://livelink2.ca.nortel.com/livelink/livelink.exe?func=ll&objId=20472506&objAction=browse&sort=name1900M2_PI_testPlanOttawa_Draft0002, March 2, 2007.

7.2 Reference documents

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

17. ILAC, International Laboratory Accreditation Cooperation, Website (http://www.ilac.org/)
18. ISO 9001:2000, Quality Management Systems – Requirements, third edition, 2000/12/15.
19. Code of Federal Regulations (Washington, DC: Federal Communications Commission), Title 47, Chapter 1, Part 24.
20. Code of Federal Regulations (Washington, DC: Federal Communications Commission), Title 47, Chapter 1, Part 2.
21. 2 GHz Personal Communications Services, Industry Canada, RSS-133, Issue 2, Revision 1, November 6, 1999
22. NAMAS Publication NIS 81: "The Treatment of Uncertainty in EMC Measurements", Edition 1, May 1994.
23. 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.

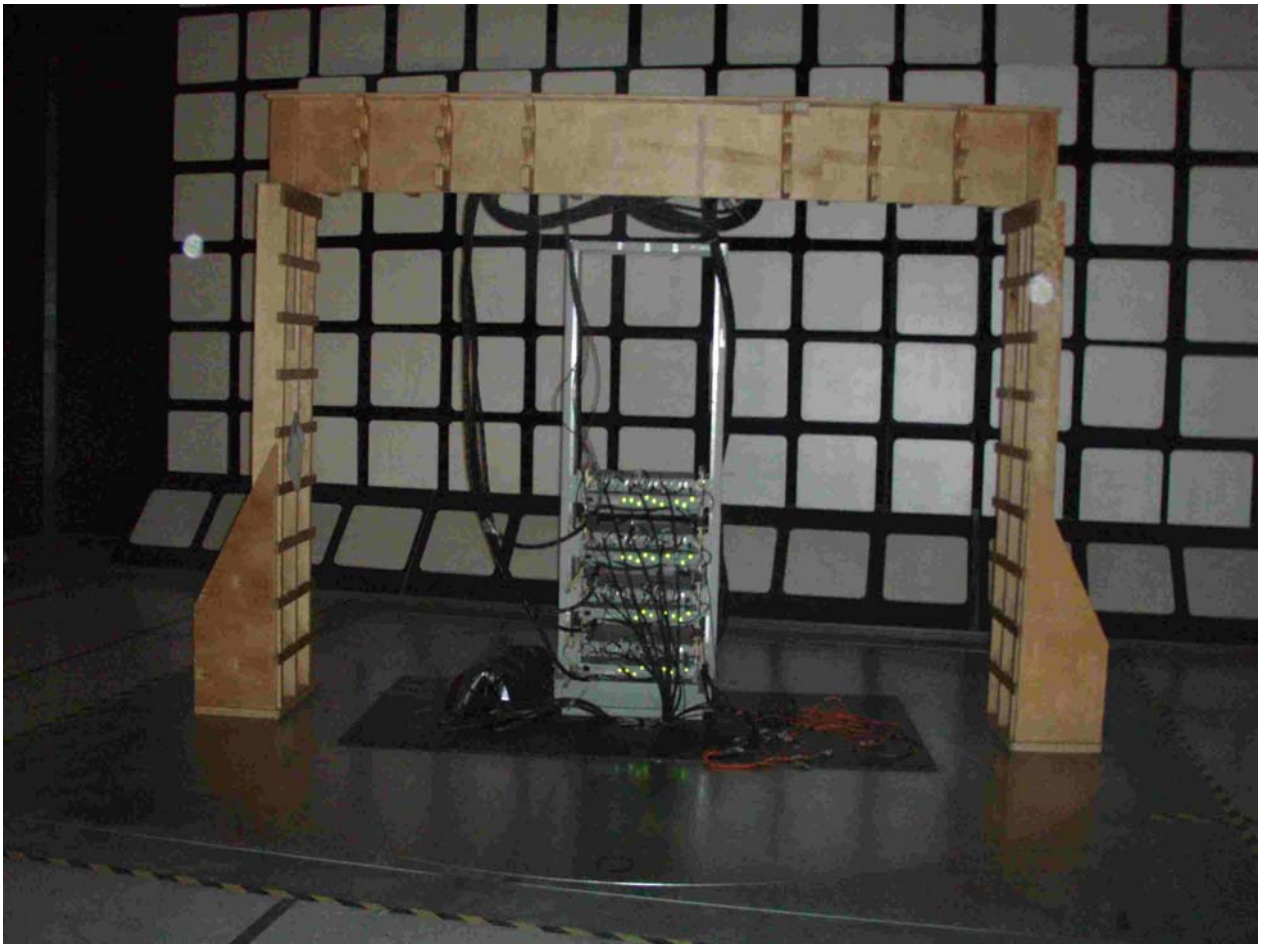
Term	Definition
1xRTT	IS-2000 Spreading Rate 1, i.e., using the same channel bandwidth as IS-95 (1.25 MHz), or one times the current RTT
AD	Average Detector
AE	Auxiliary Equipment
AFC	Ambient Free Chamber
AM	Amplitude modulation
ANSI	American National Standards Institute
BTS	Base-station Transceiver System
BTS	Base Station Transceiver Subsystem
CDMA	Code Division Multiple Access
CEM	Channel Element Module
CEM192	1xRTT CEM with six CSM5000 supporting 192 voice calls
CEM64	1xRTT CEM with two CSM5000 supporting 64 voice calls
CSA	Canadian Standards Association
dB	Decibel
DC	Direct Current
DR	Digital Rack
EMC	Electromagnetic Compatibility
ERP	Effective Radiated Power
EUT	Equipment Under Test
FCC	Federal Communications Commission, USA
FL	Forward Link
FOM	Fiber Optic Microcell
FRM	Flexible Radio Module
GND	Ground
IC	Industry Canada
LISN	Line Impedance Stabilization Network
MCBTS	Multi-Carrier Base Station Transceiver Subsystem
MFRM	Multi-carrier Flexible Radio Module
MU	Measurement Uncertainty
NA	Not Applicable

Term	Definition
NAMAS	National Measurement Accreditation Service
NBS/ NIST	National Bureau of Standards / National Institute of Standards and Technology
PA	Broadband Power Amplifier
PK	Peak Detector
PSU	Power Supply Unit
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)
TDM	Tri-Sector Duplexer Module
UL	Underwriters Laboratories, Inc.
UUT	Unit Under Test
VBW	Video Bandwidth
WR HCPA	Wide voltage Range High Power Converter Assembly
WR MPEM	Wide voltage Range Power Entry Module

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: 1900 MHz Metro Cell Beta MFRM-3 Radiated Emission Set-up (Configuration 1 and 2 – Front View)



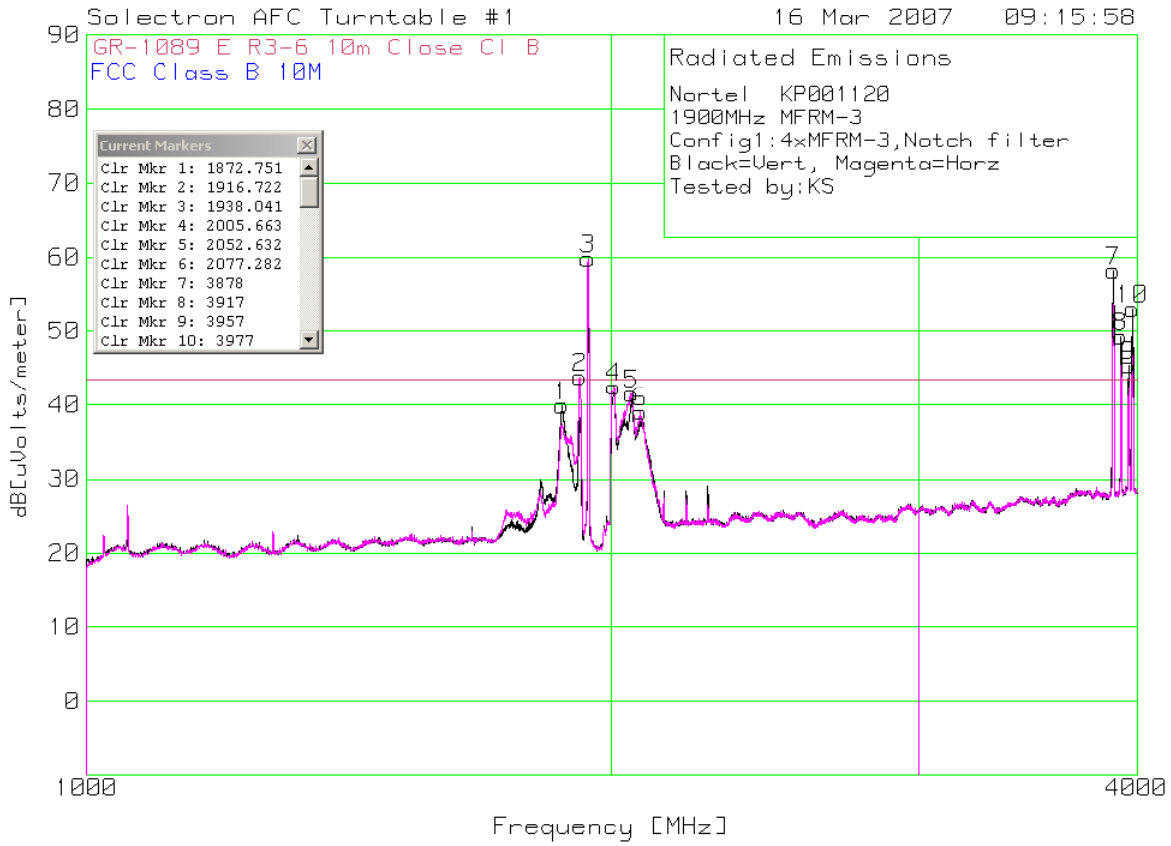
8.3 Appendix C: Radiated Emissions Plots

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.

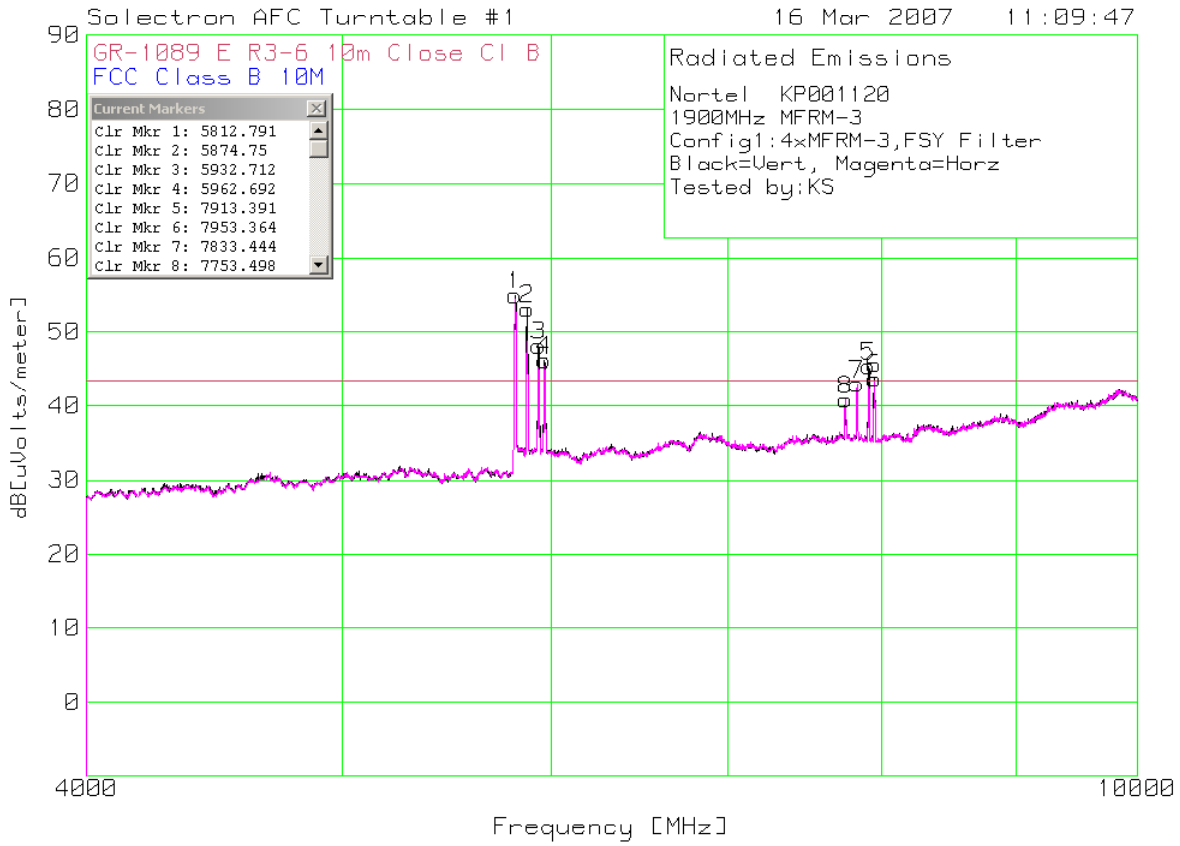
8.3.1 Configuration 1: Four 1900 MHz Beta MFRM-3 (-50VDC Input Voltage)

Figure 8-2: RE 1 – 4 GHz



Note: A 1960 MHz notch filter was placed between the horn antenna and pre-amplifier during this Radiated Emissions plot.

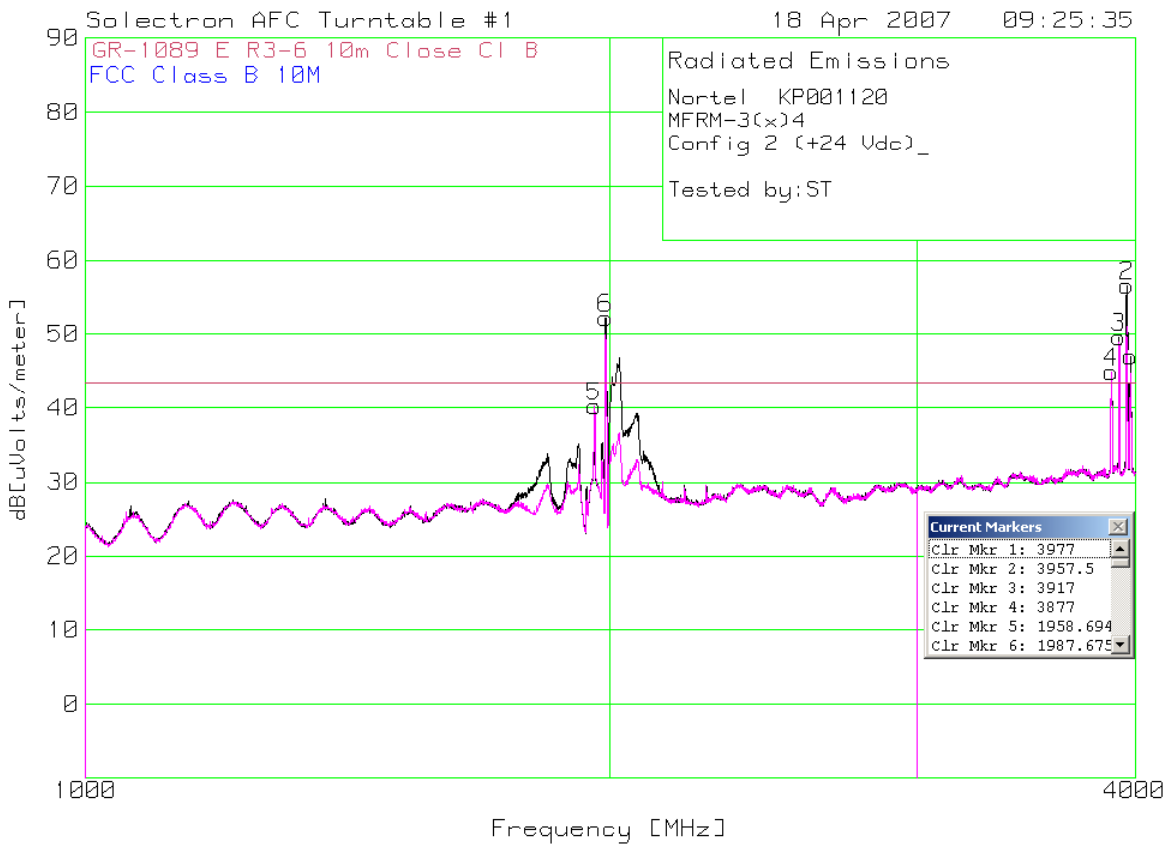
Figure 8-3: RE 4 – 10 GHz



Note: A high pass filter was placed between the horn antenna and pre-amplifier during this Radiated Emissions plot.

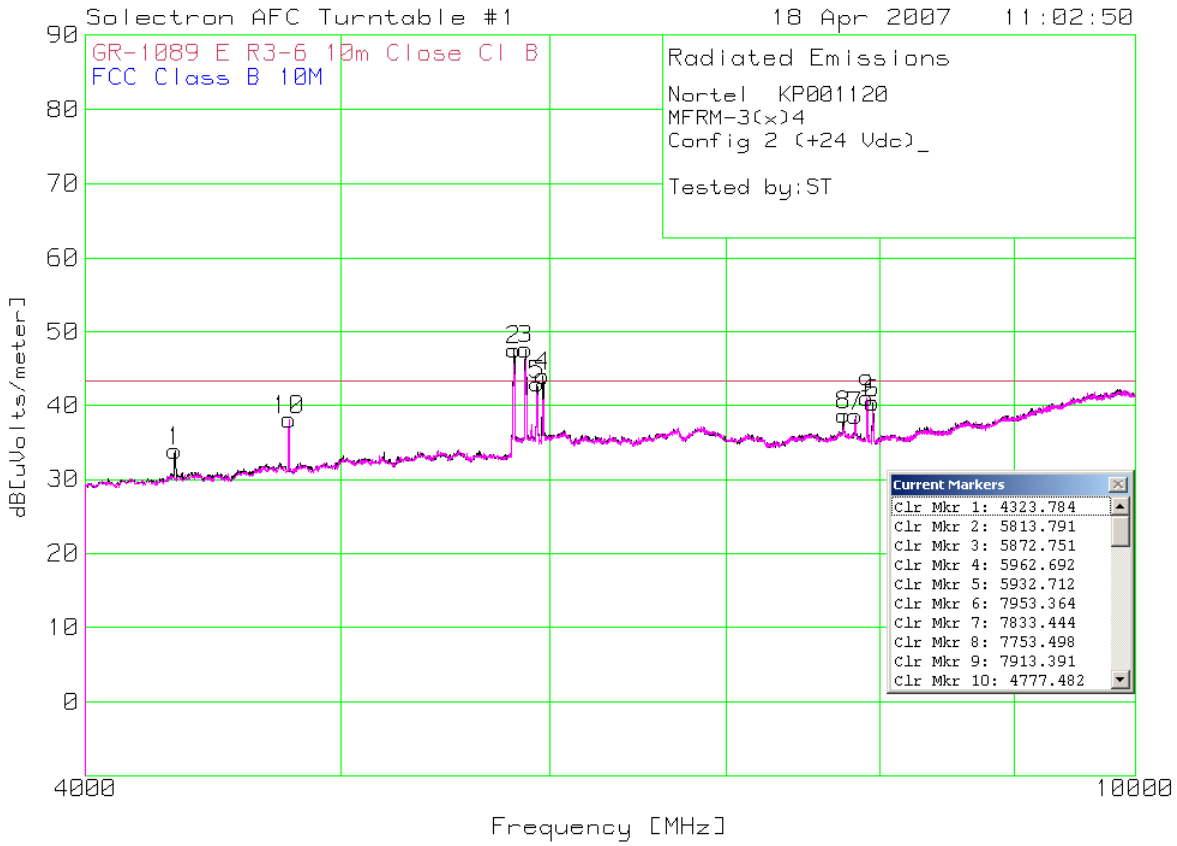
8.3.2 Configuration 2: Four 1900 MHz Beta MFRM-3 (+24VDC Input Voltage)

Figure 8-4: RE 1 – 4 GHz



Note: A 1960 MHz notch filter was placed between the horn antenna and pre-amplifier during this Radiated Emissions plot.

Figure 8-5: RE 4 – 10 GHz



Note: A high pass filter was placed between the horn antenna and pre-amplifier during this Radiated Emissions plot.

8.4 Appendix D: RF Characterization of the Filters Used in the Radiated Emissions Testing.

This appendix presents the RF characterization of the notch filter and the high pass filter. The notch filter (Nortel item, made by Microwave Circuits Inc., model number: N0319603, serial number: 3839-02 DC0408, calibration not required) was used in the range of 1000 to 4000 MHz radiated emissions measurements. The high pass filter (Solectron item, made by FSY Microwave, model number: HR 2380-11XNXN, serial number: 003, calibration not required) was used in the range of 4000 to 21000 MHz radiated emissions measurements.

Figure 8-6: Characteristic of the Microwave Circuit Inc. Notch Filter in the range of 1400 to 2400 MHz

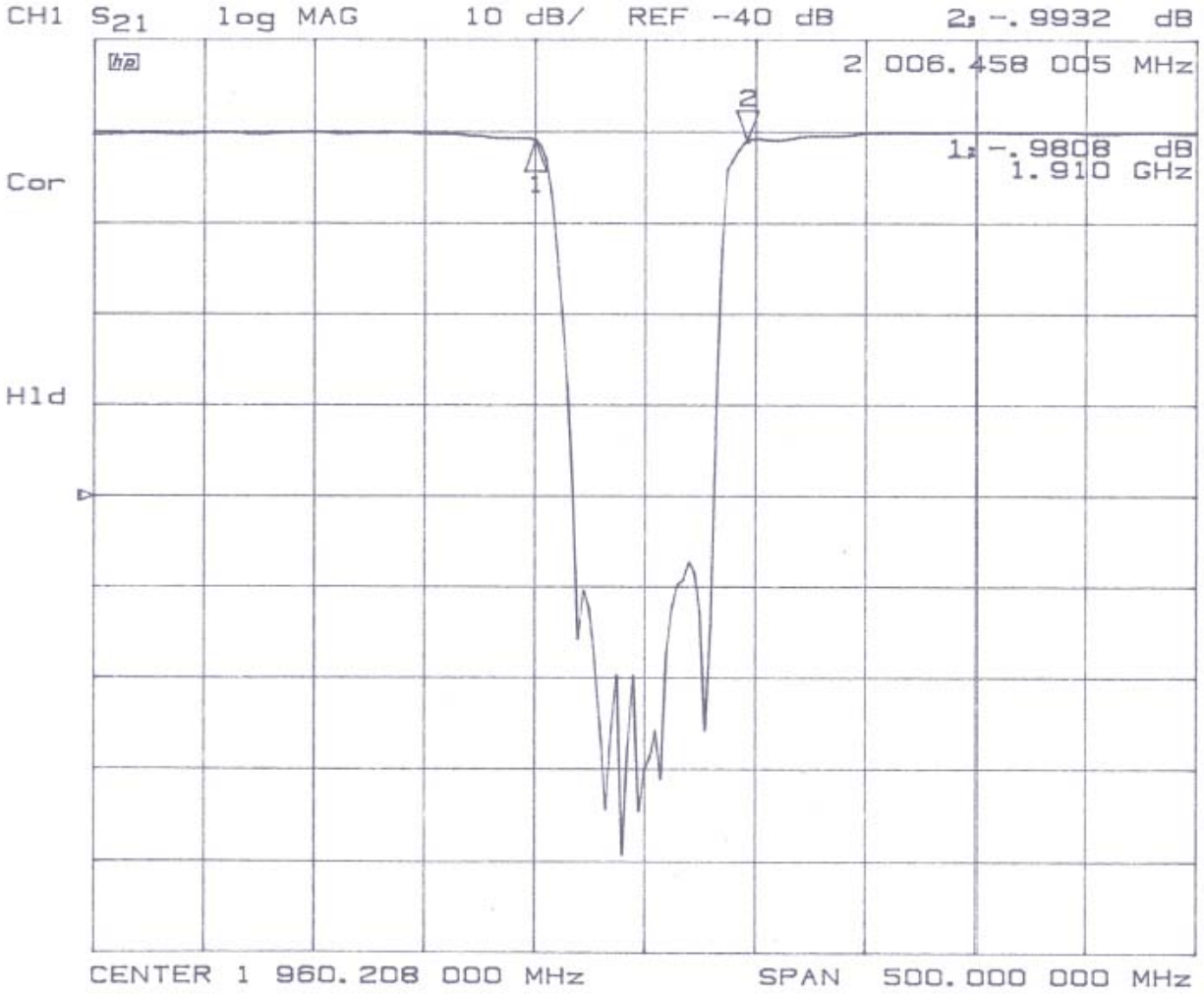


Figure 8-7: Characteristic of the Microwave Circuit Inc. Notch Filter in the range of 3 to 4000 MHz

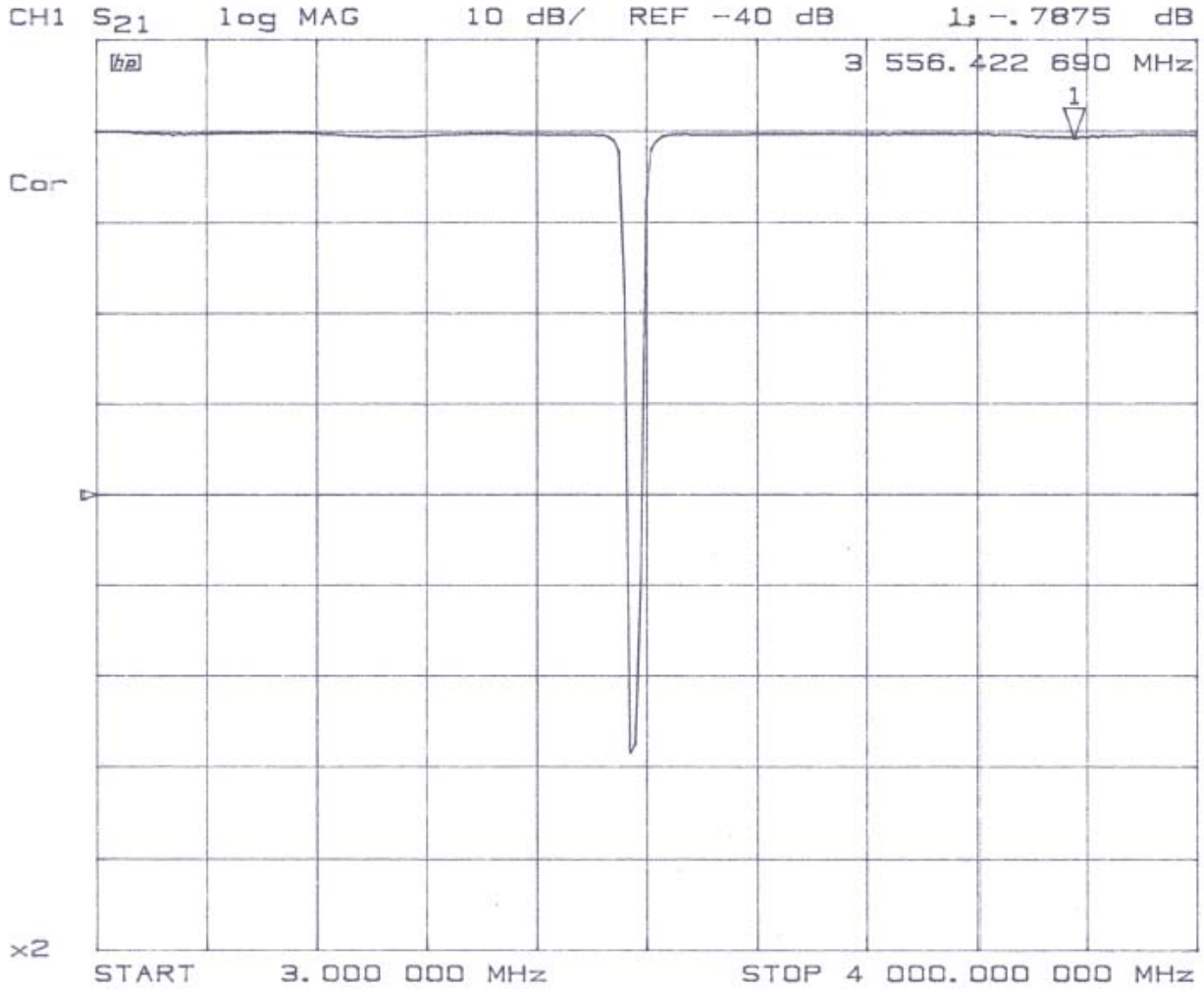
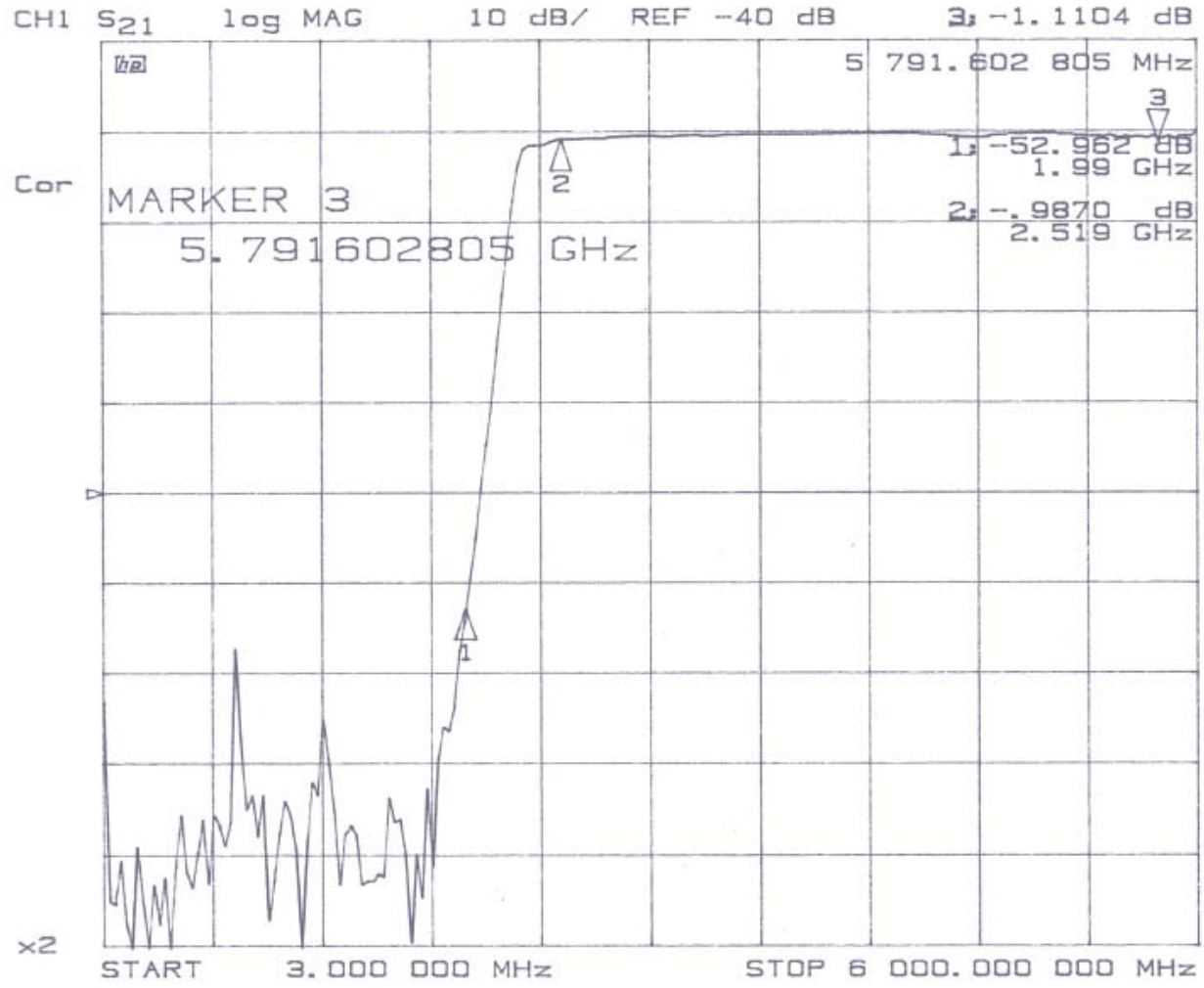


Figure 8-8: Characteristic of the FSY Microwave High Pass Filter in the range of 3 to 6000 MHz



Note: The high pass filter was also evaluated between 6 to 21 GHz. Less than 1dB of insertion loss was observed in that range.

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