Spurious Emissions Test Report for the 1900 MHz Compact Metro Cell

FCC Part 24 and Industry Canada RSS-133

Document Number: **KP000913-TR-RAD-01-02**
Release Date: **August 31, 2004**

Prepared for: **Nortel Networks**
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Release Control Record

This document is based on CEI document template KG000347-TR-EMC-03.

Release no.	Reason for change	Date released
01	Original version	August 27, 2004
02	Added suggested corrections from Nortel Networks	August 31, 2004

Approvals

Function	Name	Job title	Signature
Document Release Approval	Steve Tippet	Design Validation Centre	31st Aug 2004
Author	Denis Lalonde	Radio Compliance Discipline Leader	August 31, 2004
Technical Reviewer	Jacques Rollin	EMC Advisor	Aug 31, 2004

Accreditations

C-MAC Engineering test facilities are accredited by the Standards Council of Canada (SCC) in accordance with the scope of accreditation outlined at the following website: http://www.scc.ca/scopes/reg126-eng-s.pdf

The Solectron Technical Centre 10-meter Ambient Free Chamber (AFC) complies with the Industry Canada (IC) requirements for Test Facilities and Test Methods [15] under reference file number 4180. Through IC MRAs, EMC measurements are accepted in the following countries: USA, Australia, Singapore, Chinese Taipei (Taiwan), and the Republic of Korea. Further information can be found at the IC Certification and Engineering Bureau web site http://strategis.ic.gc.ca/epic/internet/inceb-bhst.nsf/en/Home under the "conformity assessment bodies" link.

C-MAC Engineering is ISO 9001:2000 and ISO-IEC 17025 certified and its processes are documented in the C-MAC Engineering Quality Manual [4] and Lab Operations Manual [5].

Table of Contents

List of Figures

List of Tables

1. Executive Summary

The Compact Metro Cell provides wireless operators a unique option to stack base stations as they increase their capacity from one to nine carriers. This enables the Compact Metro Cell to be deployed in a variety of configurations to meet many market applications—in the same footprint.

At the request of Nortel Networks, C-MAC Engineering has evaluated the system 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 Compact Metro Cell system.

On the basis of measurements performed in July and August 2004, the 1900 MHz Compact Metro Cell is verified to be compliant with the radiated 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, C-MAC Engineering has evaluated the system 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 Compact Metro Cell system.

3. Compliance Summary

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

Table 3-1: Compliance Results Summary

Product Summary			
Product Name:	1900 MHz Compact Metro Cell	Project Leader:	Steve Tippet
Product Code:	NTRZ71CA	EMC Engineer:	Denis Lalonde
Product Release:		Tester:	Scott Turner, Rob Thrasher, Denis Lalonde
Product Status:		Date:	July 28, August 13 & 26, 2004

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

1. All the emissions measurements were performed at C-MAC Engineering Inc., Kanata, Ontario.

4. Equipment Under Test (EUT)

4.1 Product Functional Description

The Compact Metro Cell provides wireless operators a unique option to stack base stations as they increase their capacity from one to nine carriers. This enables the Compact Metro Cell to be deployed in a variety of configurations to meet many market applications—in the same footprint.

The Compact Dual Voltage Shelf is comprised of a common digital/radio shelf with backplane, and houses the entire Compact BTS that consists of TIIM, GPSTM, CM-2, CEM, RM, CCAM, DC Breaker Module, and Cooling Unit. The backplane provides the electrical interfaces that support the inter-module communication and DC power distribution to the modules housed within the BTS through a combination of D-sub connectors, 2 mm high density connectors, combo D-sub connectors and high power contacts.

The DC Breaker Module distributes DC power to the CCAM and fan tray via a 10A breaker, to the digital modules via a 20A breaker, and to each of the radio modules via a separate 40A breaker. The DC Breaker Module also allows for 2, 5A breakers for customer power.

The CM-2 digital module provides the call-processing capability, overall data flow control, the

T1/E1 back-haul interface, and OAM functionality plus the CDMA toolbox interface (DMI and Vortex).

The RM with duplexer provides the radio channel compensation and RF conversion. Once the RM is configured it becomes a data processing pipe with little activity that is not OAM related.

The GPSTM provides the timing reference for the BTS.

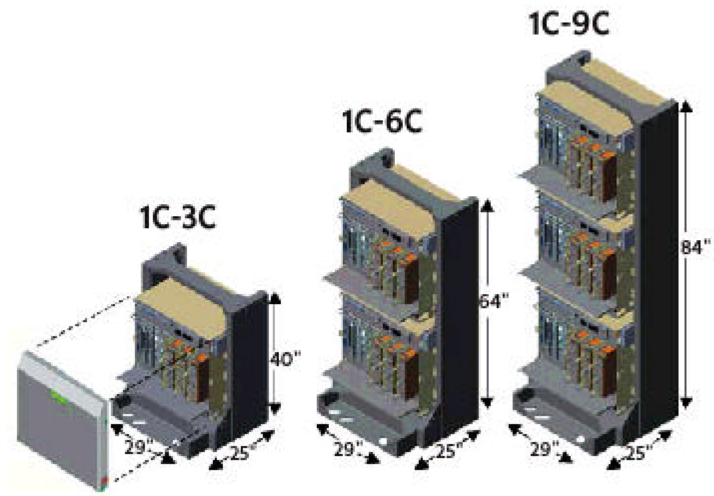
There are three different CEM digital module variants, the CEM64-PnP, CEM192, and DOM, that can be used in the Compact BTS. The CEM provides the cell site modem function, converting the encoded voice and data between the network and the air interface. The CEM64-PnP and CEM192 provide 1xRTT voice and data capability. The DOM is an OEM unit that provides 1xEV-DO capability, and also provides its own back-haul interface via T1/E1 or Ethernet.

The TIIM is designed for use as a secondary surge protection device on T1/E1 data lines and to provide T1/E1 routing to the CM-2 and DOM in the Compact BTS. The TIIM is installed in series between primary surge protection (customer supplied) and the CM-2 / DOM to be protected. A single unit can protect up to 8 T1/E1 lines, or eight paired circuits.

The CCAM supports 24 customer configurable alarms, a shared GPSTM, Cooling Unit alarm monitoring, and input DC voltage monitoring. Through an Inter-Shelf Alarm cable, the CCAM could also monitor the DC power and Cooling Unit alarm from an extension Compact BTS shelf.

The 1900 MHz Compact Metrocell is shown in Figure 4-1.

Figure 4-1: 1900 MHz Compact Metro Cell picture



4.2 Manufacturer Information

Company Name	Nortel Networks
Mailing Address	3500 Carling avenue, Ottawa, Ontario, Canada, K2H 8E9
Product Name	1900 MHz Compact Metro Cell
Primary Technical Contact	James Loo
Title	CDMA BTS RF Systems Development
Phone	613-765-2441
E-mail	james.loo@nortelnetworks.com

4.3 Power Requirements

For the purposes of EMC testing, the power requirements were as follows:

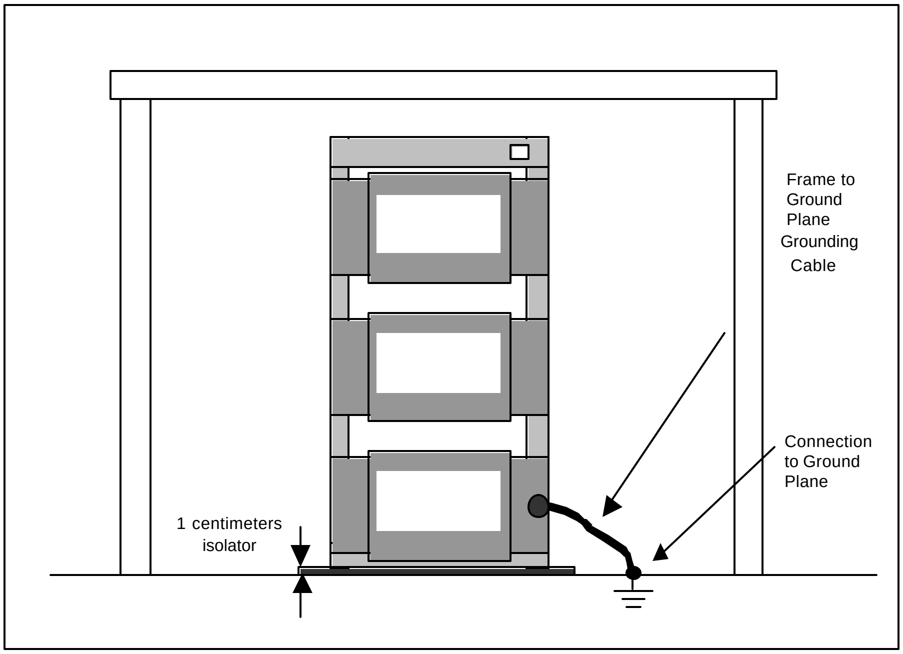
Table 4-1: Power Requirements

Voltage	Current
-48 V DC	35 A max

4.4 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 4-2.

Figure 4-2: System grounding



4.5 Clocks / Oscillators / Switching Power Supply Frequencies

The maximum clock frequency used to determine radiated emissions (E-Field) test frequency range is 2017.6 MHz.

The tests in this document were done with Tx_Freq = 1960.0 MHz

4.6 System Components

The system tested consists of the following units, as shown in Table 4-2 and Figure 4-1.

Table 4-2: System Components

Component	Code	Release	Quantity
CDMA Compact Shelf	NTRZ60AA	03	3
CCAM	NTRZ64AA	P4 / O4	3
TIIM	NTGS3188	04	3
GPSTM	NTBW50AA	09	3
CM-2	NTBW40BA	09	3
CEM_64 PnP	NTRZ80AA	02	6
CEM_192	NTRZ80BA	01	1
RM1	NTRZ71CA	T1	9

Component	Code	Release	Quantity
DPM	NTRZ69CA	P3	9

4.7 EUT Interfaces and Cables

The system contains the following interfaces, as shown in Table 4-3.

Table 4-3: System Cables Definition

Cable #	Cable Designation	Permanently Connected (Y/N)	Interface Description	Connection Point	Length (m)	Qty	Termination During Testing
1	-48V	YES	Power cable	Bus Bar	10	3	DC Power
2	Ethernet	NO	Craft Only Unshielded CAT 5	CM-2	10	3	PC
3	Ethernet	NO	Craft Only Unshielded CAT 5	CEM_64 PnP	10	6	PC
4	Ethernet	NO	Craft Only Unshielded CAT 5	CEM_192	10	3	PC
5	T1/E1	YES	Shielded	TIIM	10	3	Loop Back
6	Alarm (CCAM)	YES	Shielded	CCAM	10 m	3	Un-terminated
8	Main Antenna	YES	RF	RM	1	9	50 ohms termination
9	GPS	YES	BTS (Customer supplied)	GPS	5 m	3	GPS antenna

4.8 Support Equipment

The support equipment is defined in Table 4-4.

Table 4-4 Support Equipment

Support Equipment Name and Model Number	Support Equipment Serial No.	Cal due date
Dell PC GX200 733 Desktop	H0026630	Not required
Dell PC GX200 733 Desktop	H0040333	Not required

4.9 System Set-up and Test Configurations

The configuration used for radiated emissions is presented in Table 4-5.

Table 4-5 Channel assignment

Carrier	Channel	Base-band configuration	Output Power
Left carrier	575	CDMA2000 - QPSK	46 dBm (total power for 3 carriers)

Center carrier	600	CDMA2000 - QPSK	
Right carrier	625	CDMA2000 - QPSK	

Each DPM Main Antenna output was connected to a 50 ohm load.

4.10 EUT Operations and Software

To assess functionality of the EUT, several criteria are monitored. Vortex software is used to initiate a session with the EUT through an Ethernet crossover cable. The Vortex software is used to configure, control, and monitor the system functionality. A Markov call is used to simulate an active call. A Markov call is a special cellular call that is used to simulate a real traffic call and it also enables the measurement of the frame error rate (FER) of a cellular transmission.

All nine radios were set to simultaneously transmit on 3 CDMA (1.25 MHz) channels. The channels were 575, 600, and 625. The center frequency of this 3 carrier signal was 1960 MHz.

4.11 System Modifications

The following modifications were made to the tested equipment.

1. 100 pF caps (TDK #CD70-B2GA101KYAS) were added to the power rails on all of the shelves.
2. The shield in cable NTRZ6027, which connects the TIIM and the CM-2 was modified - the grounding was improved.
3. The radio handles were filed down to allow them to fit properly with the backplane. This was to correct an error in manufacturing.

4.12 System Inventory List

The EUT configuration is described in Table 4-6.

Table 4-6: Inventory List

Name/Model Number	Model Number	Release Number	Serial No.
TOP SHELF			
CDMA Compact Shelf	NTRZ60AA	03	NNTM536G2EJU
CCAM	NTRZ64AA	P4	NNTM74XL1TKD
TIIM	NTGS3188	04	NNTM74XL25L0
GPSTM	NTBW50AA	09	NNTM74TC1347
CM-2	NTBW40BA	09	NNTM74X0XH4X
CEM_64 PnP	NTRZ80AA	02	NNTM74X0TYRG
CEM_64 PnP	NTRZ80AA	02	NNTM74X0TVED
CEM_192	NTRZ80BA	02	NNTM74X0VC72
RM1	NTRZ71CA	T1	NNTM536G2J3G

Name/Model Number	Model Number	Release Number	Serial No.
DPM	NTRZ69CA	P3	CLWVWW100HBF
RM2	NTRZ71CA	T1	NNTM536G2J6K
DPM	NTRZ69CA	P3	CLWVWW100HBQ
RM3	NTRZ71CA	T1	NNTM536G2J4H
DPM	NTRZ69CA	P3	CLWVWW100HBI
MIDDLE SHELF			
CDMA	NTRZ60AA	03	NNTM536GREGR
CCAM	NTRZ64AA	P4	NNTM74XL1TL4
TIIM	NTGS3188	04	NNTM74XL25MG
GPSTM	NTBW50AA	09	NNTM74TC133T
CM-2	NTBW40BA	09	NNTM74X0XH5D
CEM_64 PnP	NTRZ80AA	02	NNTM74X0TVEJ
CEM_64 PnP	NTRZ80AA	02	NNTM74X0TVDP
CEM_192	NTRZ80BA	02	NNTM74X0VC73
RM1	NTRZ71CA	T1	NNTM536G2GLY
DPM	NTRZ69CA	P3	CLWVWW100HBH
RM2	NTRZ71CA	T1	NNTM536G2J5J
DPM	NTRZ69CA	P3	CLWVWW100HBL
RM3	NTRZ71CA	T1	NNTM536G2J1E
DPM	NTRZ69CA	P3	CLWVWW100HBE
BOTTOM SHELF			
CDMA	NTRZ60AA	03	SNMM53002FP1
CCAM	NTRZ64AA	O4	NNTM74XL2W51
TIIM	NTGS3188	04	NNTM74XL25JX
GPSTM	NTBW50AA	09	NNTM74TC136Q
CM-2	NTBW40BA	09	NNTM74X0XH5C
CEM_64 PnP	NTRZ80AA	02	NNTM74X0TVDN
CEM_64 PnP	NTRZ80AA	02	NNTM74X0TYRL
CEM_192	NTRZ80BA	02	NNTM74X0VC6M
RM1	NTRZ71CA	T1	NNTM536G2J0D
DPM	NTRZ69CA	P3	CLWVWW100HBM
RM2	NTRZ71CA	T1	NNTM536G2J2F
DPM	NTRZ69CA	P3	CLWVWW100HBK
RM3	NTRZ71CA	T1	NNTM536G2J7L
DPM	NTRZ69CA	P3	CLWVWW100HBD

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 Technical Centre, 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 C63.2-1996 [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-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 [12], 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 Field strength limit equivalent

The FCC and Industry Canada emission attenuation requirement is equivalent to measuring an Effective Radiated Power (ERP) of –13 dBm. This ERP can be approximated by measuring the field strength of radiated emissions.

The Prescan reference level for spurious radiation was taken with reference to an ideal dipole antenna excited by the rated output power according to the following relationship:

$$E\left(\frac{V}{m}\right) = \frac{1}{R(m)} \sqrt{30 \times Pt \times G}$$

Where,

E=Field Strength in Volts/meter,
R = Measurement distance in meters,
Pt = Transmitter Rated Power in Watts= 40 W
G = Gain of Isotropic Antenna (linear)= 1.0

Therefore:

$$E\left(\frac{V}{m}\right) = \frac{1}{10} \sqrt{30 \times 40.0 \times 1}$$

E = 3.46 V/m = 130.8 dBµV/m at 10 m

The spurious emissions must be attenuated by at least 43 + 10 log (40) = 59.0 dB

Therefore the field strength limit at 10 meters is:

E = 130.8 dBµV/m – 59.0 dB = 71.8 dBµV/m at 10m

The limit at 3 meters is: E = 82.3 dBµV/m

The limit at 1m is: E = 91.8 dBuV/m

The approximated field strength specification levels are shown in Table 6-2.

Table 6-2: Prescan Spurious emissions limits for FCC Part 24 and IC RSS-133

Frequency Range (MHz)	Measurement distance (m)	Field strength equivalent of -13 dBm ERP limit (dBuV/m)
30 - 1000	10	71.8
1000 - 10000	10	71.8
10000 - 18000	3	82.3
18000 - 20000	1	91.8

The worst emissions observed during prescan measurements were then re-evaluated using the substitution test method.

6.2 Test Facility Information

Location: C-MAC AFC

Date tested: July 28, August 13 & 26, 2004

Tested by: Scott Turner, Rob Thrasher, Denis Lalonde

6.3 Test Configurations

For radiated emissions test cases, the EUT hardware configuration/software load used is described in Sections 4.9 and 4.10.

One configuration of the equipment was evaluated;

- All nine radios were set to simultaneously transmit on 3 CDMA (1.25 MHz) channels. The channels were 575, 600, and 625. The center frequency of this 3 carrier signal was 1960 MHz.

6.4 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 in KP000270-LP-EMC-01-01 [9]. The test was performed as per the relevant Test procedures: ANSI C63.4-2003 [6].

The system was tested in the following manner:

- The EUT was placed on a turntable inside the AFC and it was 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 connected to the grounding system, in accordance with its installation specifications. No additional grounding connections are allowed.

- For tests between 30 MHz and 1 GHz a broadband bilog antenna was placed at a 10 m distance; a horn antenna, placed also at 10 m distance from the EUT, was used for high frequency measurements between 1 GHz and 10 GHz. 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.
- A pre-scan was performed to find emissions (frequencies) requiring detail measurement. The pre-scan (using a peak detector) 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, in steps of 1 meter, and for horizontal and vertical polarizations of the receiving antenna (for measurements above 30 MHz).
- Prescan optimization was performed based on the pre-scan data. All frequencies, having emission levels within 10 dB of the specification(s) limits, were optimized. For each such 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 of the search antenna. Then the maximum level measured was recorded.
- The frequency range investigated was 30 MHz to 20 GHz.
- Above 30 MHz and up to 1 GHz, a resolution bandwidth of 120 kHz was used.
- Above 1 GHz, a 1 MHz resolution bandwidth and 1 MHz video bandwidth were used.
- 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.

6.5 Test Results

This section presents the E-field radiated emissions results for all the test cases considered. These measurements were taken using a peak detector and compared to the specification limit lines. Graphical representations of the 1 GHz to 20 GHz measurements taken appear in Appendix C: Radiated Emissions Plots on page 28.

Note that a positive margin value in the "E-field Radiated Emissions Test Results" table below indicates a PASS and a negative margin value indicates a FAILURE.

Table 6-3 lists the highest emissions measured. All other emission of this configuration had more than 20 dB margin:

Table 6-3: Prescan E-field Radiated Emissions Test Results

Parameter		Unit	Emission 1	Emission 2	Emission 3
Frequency		(MHz)	3920	5880	7840
Antenna	Azimuth	(deg.)	8	336	352
	Height	(cm)	200	100	134
	Polarization		Vert.	Horz.	Horz.
Meter Reading		(dBµV)	52.0	31.1	33.2
Detector			PK	AVG	AVG
Gain / Loss Factor		(dB)	-33.1	-29.4	-26.9
Transducer Factor		(dB)	32.2	34.0	36.8
Level		(dBµV/m)	51.1	35.7	43.1
Limit (approximate)		(dBµV/m)	73.9	73.9	73.9

Substitution measurements were performed in the 1 to 10 GHz band. No significant signals associated with the transmitter were observed in the 30 MHz to 1 GHz band and in the 10 GHz to 20 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 28.

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)	EIRP (dBm)	Limit (dBm)	Margin (dB)
3920	-44.6	2.5	V	9.6	52.0	52.0	-37.5	-13	24.5
5880	-63.3	3.4	H	11.1	31.1	31.1	-55.6	-13	42.6
7840	-56.0	3.5	H	11.3	33.2	33.2	-48.2	-13	35.2

6.6 Prescan Measurement Uncertainties

The expanded measurement uncertainty (with a 95% level of confidence) on E-field radiated emissions measurements are: ± 5.0 dB between 30 MHz and 1 GHz and ± 5.6 dB between 1 GHz and 10 GHz.

Uncertainty evaluation has been calculated according to the method described in NAMAS NIS 81 (May 1994), "The Treatment of Uncertainty in EMC Measurements" [14].

6.7 Calculation of the Compliance Margin

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

EIRP = Signal generator level – Cable losses + Antenna gain

Margin = Limit - EIRP

6.8 Test Conclusion

The worst-case margin is 24.5 dB at 3920 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.

6.9 Test Equipment List

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

Description	Make	Model	Serial Number	Cal. Due
Active Loop Antenna (H Field)	EMCO	6502	SSG012080	8-Sep-04
Active Monopole Antenna	EMCO	3301B	SSG012083	5-May-05
Bilog Antenna	Antenna Research	LPB 2520A	SSG012299	2-Mar-05
Cable, 18-26.5 GHz	Micro-Coax	UFB 142A-1-1440-20X20	SSG012288	29-Dec-04
Double Ridged Horn	Emco	3115	SSG012298	29-Dec-04
Double Ridged Horn	Emco	3115	SSG012507	24-Feb-05
Horn Antenna (18 - 26.5 GHz)	Emco	3160-09	SSG012292	29-Dec-04
Pre-Amplifier	Narda DBS Microwave	DB95-0040R	SSG012296	29-Dec-04
Pre-Amplifier	BNR	LNA	SSG012360	11-Feb-05
Quasi-Peak Adapter, HP85650A, (EMI # 2)	HP	85650A	SSG013046	25-Nov-04
RF Amplifier, HP8447 # 1	Agilent	8447D	SSG013045	25-Oct-04
Signal Generator	Anritsu	69369A	SSG012138	25-Oct-04
Signal Generator	Anritsu	68247B	SSG012401	13-Feb-05
Spectrum Analyzer Display, HP 85662A	HP	85662A	SSG012433	29-Apr-05

Description	Make	Model	Serial Number	Cal. Due
Spectrum Analyzer- portable	HP	8564E	SSG012069	28-Apr-05
Spectrum Analyzer, HP8566B, (AFC #1)	HP	8566B	SSG012521	29-Apr-05
Spectrum Analyzer, HP8566B, (AFC #2)	HP	8566B	SSG012584	20-Apr-05
Sucoflex Cable	Huber & Suhner	104PEA	SSG012219	6-Nov-04
Sucoflex Cable, EMC Cable # 1	Huber & Suhner	106A	SSG012454	12-Feb-05
Sucoflex Cable, EMC Cable # 2	Huber & Suhner	106A	SSG012453	12-Feb-05
Sucoflex Cable, EMC Cable # 5	Huber & Suhner	104PEA	SSG012359	11-Feb-05
Sucoflex Cable, EMC Cable # 6	Huber & Suhner	106A	SSG012456	12-Feb-05
Sucoflex Cable, EMC Cable # 8	Huber & Suhner	104	SSG012302	29-Dec-04
Utiflex Cable	Micro-Coax	UFA 210B-1-1500-504504	SSG012376	22-Apr-05
Utiflex Cable, EMC Cable # 4	Micro-Coax	UFA 147B-1-0300-70X70	SSG012309	24-Jan-05

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. KP000913-TP-EMC-01-01 EMC Compliance Test Plan for 1900 MHz Compact Metro Cell

7.2 Reference documents

2. Standards Council of Canada Scope of Accreditation Letter SCC 1003-15/163 dated 2001-02-16 (Scope of accreditation is effective until 2002-10-05 and includes FCC Part 15 and ICES-003).
3. Federal Communications Commission Letter dated May 25, 1999 (in response to submission EF-00049-99, Measurement facility located at Kanata Anechoic chamber (3 & 10 meters), FCC Registration Number 94326).
4. C-MAC Engineering Inc. Quality Manual, Document No. KG000347-QD-QM-01-04, Issue 04, December 2001.
5. C-MAC Engineering Inc. Lab Operations Manual, Document No. KG000347-QD-QM-01-05, June 2004.
6. ANSI C63.4-2003, Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz, January 2004.
7. ANSI C63.2-1996, American National Standard for Electromagnetic Noise and Field Strength Instrumentation, 10 Hz to 40 GHz – Specifications.
8. CISPR 16-1, Specification for Radio Disturbance and Immunity Measuring Apparatus and Methods - Part 1: Radio Disturbance and Immunity Measuring Apparatus, Edition 2.0, 1999-10.
9. C-MAC Engineering Inc., EMC General Lab Test Procedure, KP000270-LP-EMC-01-01 Feb 2004.
10. Code of Federal Regulations (Washington, DC: Federal Communications Commission), Title 47, Chapter 1, Part 15.
11. Code of Federal Regulations (Washington, DC: Federal Communications Commission), Title 47, Chapter 1, Part 24.
12. Code of Federal Regulations (Washington, DC: Federal Communications Commission), Title 47, Chapter 1, Part 2.
13. 2 GHz Personal Communications Services, Industry Canada, RSS-133, Issue 2, Revision 1, November 6, 1999
14. NAMAS Publication NIS 81: "The Treatment of Uncertainty in EMC Measurements", Edition 1, May 1994.

15. 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.

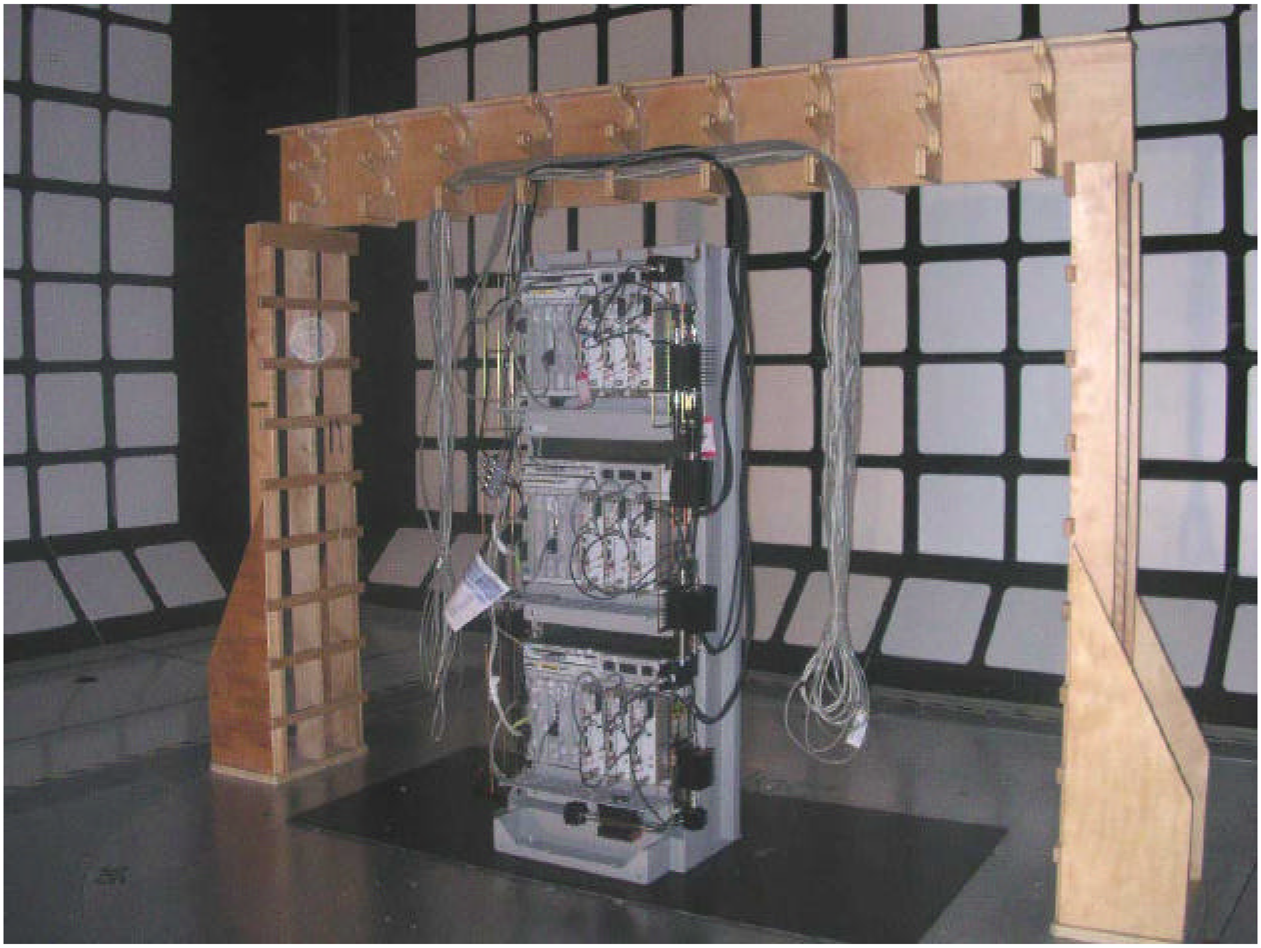
Term	Definition
AD	Average Detector
AE	Auxiliary Equipment
AFC	Ambient Free Chamber
AM	Amplitude modulation
ANSI	American National Standards Institute
CSA	Canadian Standards Association
dB	Decibel
DC	Direct Current
EMC	Electromagnetic Compatibility
EUT	Equipment Under Test
FCC	Federal Communications 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.

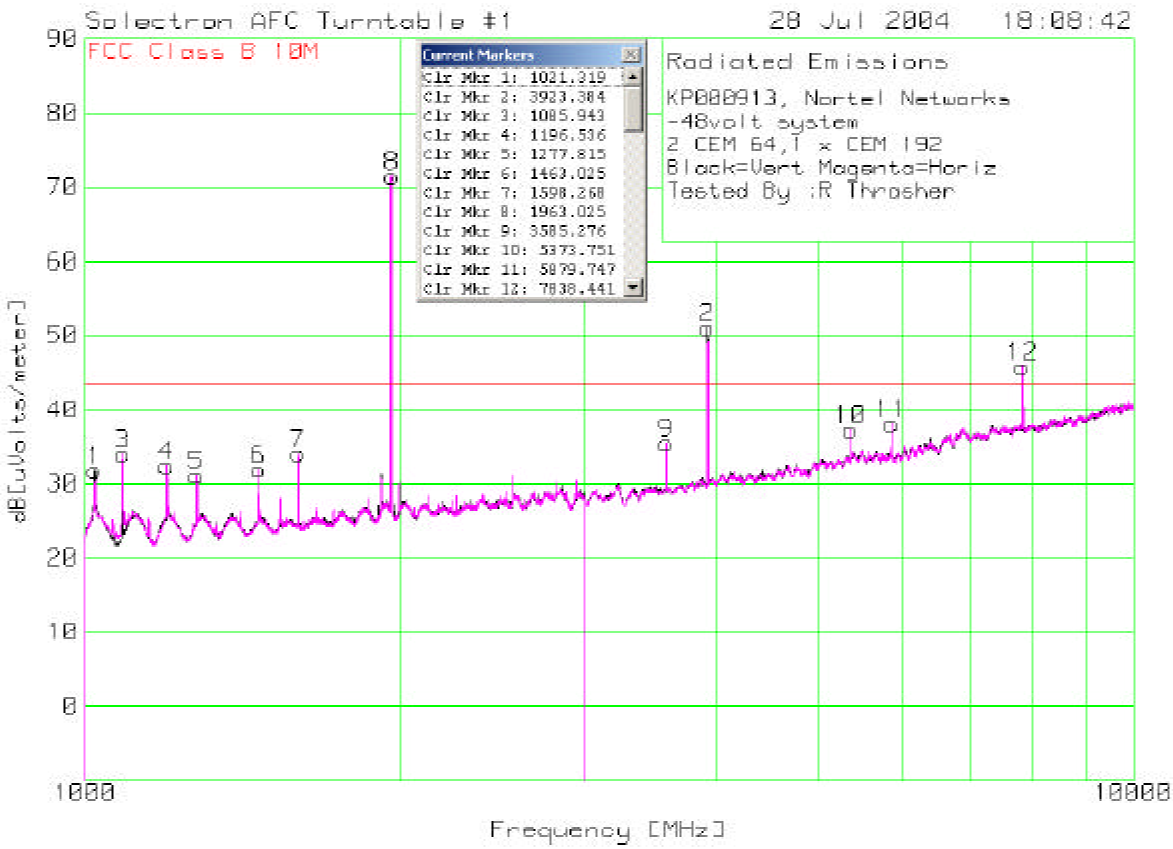
Figure 8-1: 1900 MHz Compact Metro Cell radiated emission set-up



8.3 Appendix C: Radiated Emissions Plots

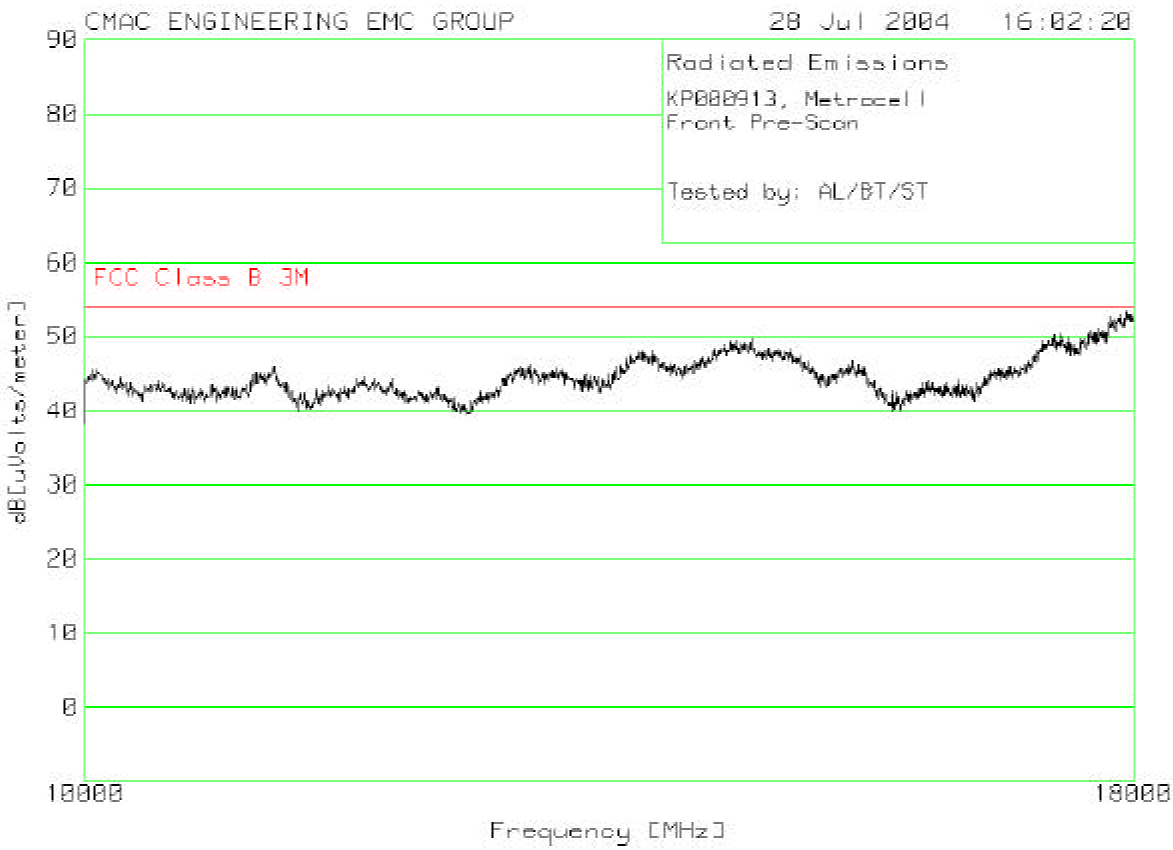
This appendix presents all radiated emissions plots for the test cases measured.

Figure 8-2: E-field Radiated Emissions, 1 GHz – 10 GHz



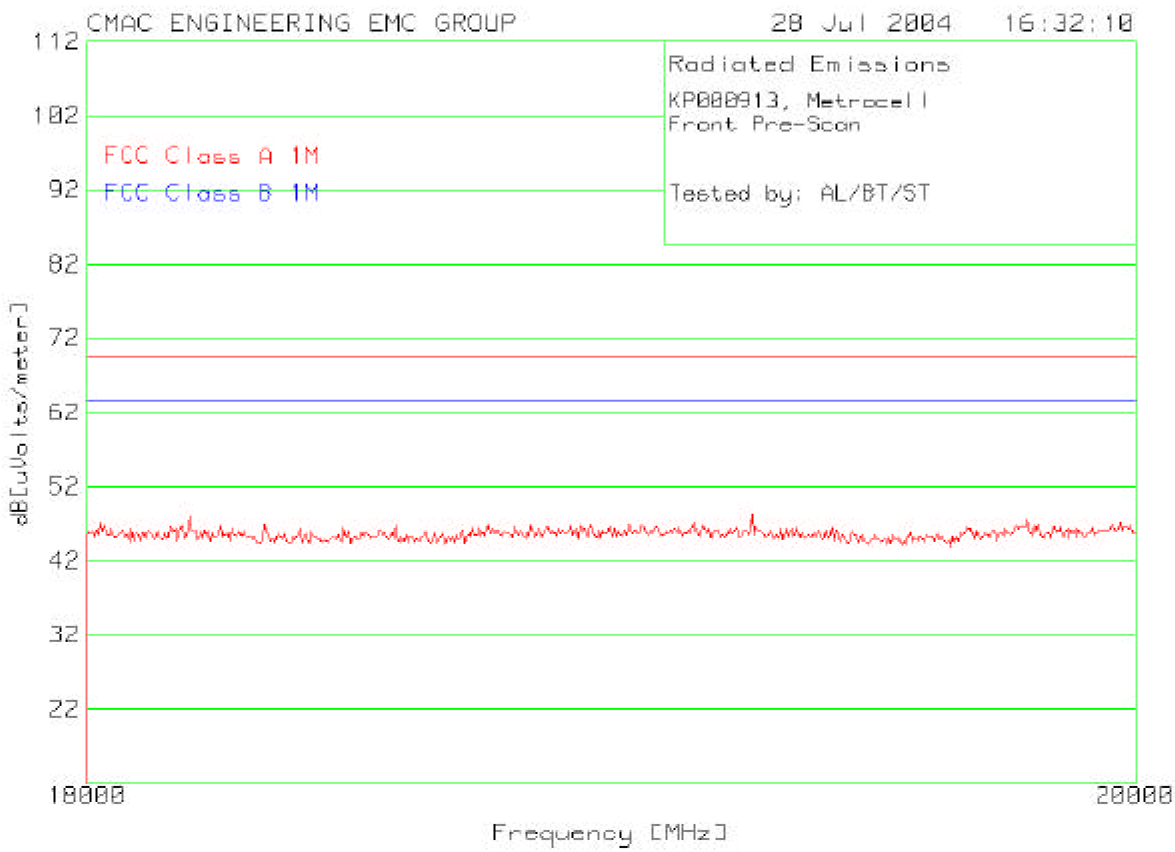
Note: the 1960 MHz emission is RF leakage of the transmitter signal from the 50 ohms terminations.

Figure 8-3: E-field Radiated Emissions, 10 GHz – 18 GHz



Note: the EUT was scanned on its 4 sides in both vertical and horizontal polarizations. All 4 recorded scans gave identical results.

Figure 8-4: E-field Radiated Emissions, 18 GHz – 20 GHz



Note: this scan was repeated on the 4 sides of the EUT with both vertical and horizontal polarizations. Identical test results were observed.

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FCC Part 24 and Industry Canada RSS-133