SANMINA

EXHIBIT 2

Test Report Summary

Applicant: Northern Telecom Ltd.

For Certification on:

AB6NT1900SFRM

1 Introduction

This information is submitted in accordance with the FCC rules and regulations, Part 2, Subpart J, §2.1046 through §2.1057 for Certification of the Northern Telecom's (Nortel Networks) CDMA 1900 MHz Single carrier Flexible Radio Module (SFRM); henceforth referred to as equipment under test (EUT).

This 1900 MHz SFRM is intended for use in the Domestic Public Cellular Radio Telecommunications Service and is designed in accordance with the following standards:

- *CFR 47, Part 24, Subpart E, Broadband Personal Communications Service*
- *CFR 47, Part 2, Subpart J, Equipment Authorization Procedures – Certification*

1.1 Test Result Summary

Table 1 summarizes the measurement results for the CDMA 1900 MHz SFRM.

Table 1: Test Results Summary

FCC Measurement Specification	FCC Limit Specification	Description	Results	Test(s) Conducted By	Remarks
2.1046	24.232	RF Output Power	Compliant	Nortel Networks	See Exhibit 2A
2.1047		Modulation Characteristics	Not Applicable		
2.1049		Occupied Bandwidth	OBW= 1.2725 MHz	Nortel Networks	See Exhibit 2A
2.1051, 2.1057	24.238	Spurious Emissions at Antenna Terminals	Compliant	Nortel Networks	See Exhibit 2A
2.1053, 2.1057	24.238	Field Strength of Spurious Radiation	Compliant	Sanmina Canada ULC	See Exhibit 2B
2.1055	24.235	Frequency Stability	Compliant	Nortel Networks	See Exhibit 2A

Notes 1:

- Details of the configurations are described in the individual test reports (Exhibits 2A and 2B).
- Signal substitution was performed to verify compliance with the requirements (Exhibit 2B).
- Outdoor version of the EUT was tested with doors open to cover off the indoor version.

Note 2:

- See section 4 for EUT configurations during the applicable test.

2 Engineering Declaration

The CDMA 1900 MHz Single carrier Flexible Radio Module (SFRM) has been tested for radiated spurious emissions (field strength of spurious radiation) in accordance with the requirements contained in the Federal Communications Commission Rules and Regulations Parts 2 and 24.

To the best of my knowledge, this test was performed in accordance with good engineering practices using measurement procedures consistent with industry or commission standards and demonstrates that this equipment complies with the requirements for this test as required by the appropriate standards. All tests (including tests performed by Nortel Networks) were conducted on a representative sample of the equipment for which certification is sought as presented by Nortel Networks.

Report Prepared by

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Sanmina Canada on behalf of Nortel Networks
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Md. Sazzad Hossain — *Signature*

Dec 19, 2001 — *Date*

Reviewed and Approved by:

Glen Moore
Technical Manager – EMC Design Services
Sanmina Canada on behalf of Nortel Networks
Calgary, Alberta

Glen Moore — *Signature*

Dec 19/2001 — *Date*

Note: Engineering declaration for tests performed by Nortel Networks is in exhibit 2A.

3 Certification Application Requirements

3.1 Name of Applicant

The applicant is Northern Telecom (Nortel Networks) Limited.

3.2 Identification of Equipment

The equipment in this application for Certification is the Northern Telecom's (Nortel's) CDMA 1900 MHz Single carrier Flexible Radio Module (SFRM). The 1900MHz SFRM will be marketed under the model number NT1900SFRM. The FCC ID number sought is AB6NT1900SFRM.

3.3 Technical Description

See Exhibit 4.

3.4 Types of Emissions

The 1900 MHz SFRM assembly is designed to operate in digital mode. The emission type is F9W for CDMA mode. The emission designator is 1M25F9W. The emission designator was calculated based on the requirements of FCC Rules under Part 2, Subpart C - Emissions, section 2.201 and Section 2.202.

The emission designator is 1M25F9W - 1.25 MHz nominal bandwidth, F9W as per request of American TCB.

3.5 Frequency Range

The 1900 MHz SFRM operates in the 1900 MHz cellular band where the operating frequency ranges are 1850 – 1910 MHz for the Receiver and 1930 – 1990 MHz for the Transmitter. The following table shows the valid CDMA channels within this band.

Table 2: CDMA Channel Numbers and Frequencies

Band	CDMA Channel Number	Transmitter Frequency Assignment (MHz)		Valid CDMA Frequency Assignment
		Mobile	Base	
A	0-24	1850.00-1851.20	1930.00-1931.20	In-Valid
	25-275	1851.25-1863.75	1931.25-1943.75	Valid
	276-299	1863.80-1864.95	1943.80-1944.95	Cond. Valid
D	300-324	1865.00-1866.20	1945.00-1946.20	In-Valid
	325-375	1866.25-1868.75	1946.25-1948.75	Valid
	376-399	1868.8-1869.95	1948.80-1949.95	Cond. Valid
B	400-424	1870.00-1871.20	1950.00-1951.20	In-Valid
	425-675	1871.25-1883.75	1951.25-1963.75	Valid

Band	CDMA Channel Number	Transmitter Frequency Assignment (MHz)		Valid CDMA Frequency Assignment
		Mobile	Base	
	676-699	1883.80-1884.95	1963.80-1964.95	Cond. Valid
E	700-724	1885.00-1886.20	1965.00-1966.20	In-Valid
	725-775	1886.25-1888.75	1966.25-1968.75	Valid
	776-799	1888.80-1889.95	1968.80-1969.95	Cond. Valid
F	800-824	1890.00-1891.20	1970.00-1971.20	In-Valid
	825-875	1891.25-1893.75	1971.25-1973.75	Valid
	876-899	1893.80-1894.95	1973.80-1974.95	Cond. Valid
C	900-924	1895.00-1896.20	1975.00-1976.20	In-Valid
	925-1175	1896.25-1908.75	1976.25-1988.75	Valid
	1176-1199	1908.80-1909.95	1988.80-1989.95	Cond. Valid

3.6 Range of Operating Power

The 1900 MHz SFRM range of operating RF power is 23 dBm to 42.3 dBm as per documentation provided by Nortel Networks.

3.7 Maximum Power Rating

The maximum RF power output of the CDMA 1900 MHz SFRM is 42.3 dBm.

3.8 Function of Each Active Circuit Device

See Exhibit 4 (Technical Description) and Exhibit 10 (Function Description) for a listing of devices incorporated in the SFRM.

3.9 Complete Circuit Diagrams

Exhibit 8 contains schematics of devices incorporated in the Transmit/Receive module.

3.10 User Manual

See Exhibit 10.

3.11 Tune-Up Procedure

The tune-up tests will be performed as part of the factory testing on the SFRM. This procedure includes power output levels, spurious emissions, and occupied bandwidth. There are no user adjustments that will have any effect on these settings. No tune-up testing is required in the field.

3.12 Description of Frequency Determining and Stabilizing Circuit

The Global Positioning Satellite Timing Module (GPSTM) operates within the Digital Enclosure framework of the CDMA system. The GPSTM is the primary source of reference frequency and timing signals. The frequency and timing reference signals from the GPSTM are synchronized to the Global Positioning System satellite constellation via a dedicated active antenna. The GPSTM is intended to be a stand-alone module capable of supplying the frequency and timing reference signals, but a provision is incorporated within the GPSTM to allow synchronization of the output signals from two GPSTM (via an allocated inter-GPSTM backplane link) within a single Digital Enclosure for redundancy purposes.

It consists of two outputs:

EVEN_SEC Clock and,
SYS_CLK (at 8fc or 9.8304 MHz)

In addition, the GPSTM has a 10 MHz reference output that can be used to synchronize external measurement equipment during system testing.

The GPSTM distributes the primary clock signals directly to the Control Module (CM) and the CORE modules (see Exhibit 4) which in-turn distributes the clock signals to the digital modules and to the SFRM via the high-speed optical link. The CORE and CM monitor the quality of the primary clock signals and report any deviations from normal operation. Secondary clock sources (PLLs for example) in the RFMs re-generate the clocks as required for local use. The PLLs are synchronized to the primary clocks distributed on the high speed optical links. The RFLO and Clock Recovery circuitry on the TRM produces all clocks and local oscillator sources for the SFRM.

See Exhibit 4 (Technical Description) for technical details and Exhibit 11 for GPSTM OEM general specification.

The GPS module has a frequency stability of 0.8 ppb over the range of -5^{o} C to 70^{o} C based on information in exhibit 11.

3.13 Circuit Description for Suppression of Spurious Radiation

The TX band pass filter in the DPM (Duplexer Preselector Module)/TM (Triplexer Module) provides out of band emission rejection and permits only signals in the TX band to the antenna for emission. The TM units operate inside the MCBTS flexible radio module (FRM) as the receive and transmit duplexer plus receive front-end gain element. The main purpose of the triplexer is to combine two transmit signals onto one antenna to reduce the total number antennas required.

Exhibit 12 includes the verification reports of the duplexer and triplexer module. Tx rejection specifications (Test Results) of both DPM and TM summarizes that the attenuation is sufficient to reject out of band emissions. Also a comparative graph of MCBTS duplexer and triplexer filtering for the A/D band is attached; since the worst-case results (Verification Test) were found for the A/D band triplexer.

See Exhibit 12 for Technical Specification in detail on DPM (Duplexer Preselector Module) and TM (Triplexer Module).

3.14 Circuit Description for Limiting Modulation

This system employs digital modulation techniques producing CDMA forward and reverse channel air interfaces, which are compatible with ANSI J-STD-008, Personal Station – Base Station Compatibility Requirements for 1.8 to 2.0 GHz Code Division Multiple Access (CDMA) Personal Communications Systems.

3.15 Photographs

The reader is directed to exhibit 5 for External Photographs and exhibit 6 for Internal Photographs. Test setup photographs for “field strength of spurious radiation” test are included in the lab test report (See exhibit 2B).

3.16 Standard Test Conditions and Test Equipment

Test conditions are included in the individual test report and are listed in exhibit 2A and exhibit 2B of this document.

3.17 RF Radiation Exposure

An internal Nortel document, "RF Exposure Guidelines for Cellular and PCS Antenna Sites" (Document no: SI-EMR-R01.5), is used for the deployment and installation of Nortel’s wireless base station equipment with respect to the control of Electromagnetic Radiation (EMR) exposure. The objective of this document is to provide guidance on where antennas can be deployed, how to calculate power densities and safe distances, and how to protect users from excessive exposure to electromagnetic radiation. See exhibit 9 for details.

4 Test Configurations

4.1 Introduction

The Metro Cell Base Station Transceiver System (MCBTS) is an existing Nortel Networks product that supports CDMA 1900MHz SFRMs. Nortel Networks recommended two worst-case configurations of Metro Cell SFRM that were used for all tests as required for certification under FCC rules and regulations (Part 2 subpart J, Equipment Authorization Procedures and Part 24 Subpart E Broadband PCS). Two EUT (Equipment Under Test) configurations were used in the test cycle and both configurations include nine SFRMs.

EUT Configuration #1 was comprised of the following:

- A DE (Digital Enclosure) containing 12 XCEMs, 1 GPSTM, 2 CMs and 2 CORE modules.
- A RE (Radio Enclosure) with nine duplexer modules (3 duplexers per sector).

Test Configuraion # 1 represents maximum duplexer-only configuration supported by Nortel Networks and this configurations allows placement of one carrier in each of A/D, B/E and F/C PCS blocks. 9 SFRMs were configured in 3 Carrier/3 Sector (3 Duplexers per Sector) mode.

EUT Configuration #2 was comprised of the following:

- A DE (Digital Enclosure) contained 12 XCEMs, 1GPSTM, 2 CMs and 2 CORE modules.
- A RE (Radio Enclosure) with three duplexer (DPM) and three triplexer (TM) modules (1 duplexer/triplexer set per sector).

Test Configuration # 2 represents maximum duplexer/triplexer configuration supported by Nortel Networks. Both duplexer and triplexer were used in the test configuration. A duplexer and a triplexer per sector allow channel placement in only 4 of the 6 PCS blocks (A/D and B/E, A/D and C/F or B/E and C/F). 9 SFRMs were configured in 3 Carrier/3 Sector (1 Duplexers and 1 Triplexer per Sector) mode.

The EUT and identification list for all tests are included in the individual test reports and attached in Exhibit 2A and 2B of this document.

4.2 Hardware module releases

During testing, there were some differences in the Equipment Under Test (EUT) used by Nortel Networks and Sanmina-SCI. The latest releases of 1900 TRM and 1900 PAM modules were used by Sanmina-SCI. Nortel Networks used the old releases of 1900 TRM and 1900 PAM modules. New releases of those modules include some design changes mainly for cost reduction purpose. The manufacturer has ensured that there were no changes in-between releases of the modules that affect test results to obtain product's compliance as per FCC rules and regulations.

Exhibit 13 captures the differences between releases of the TRM and PAM, as provided by Nortel Networks.

Transmit Receive Module (TRM) & Power Amplifier Module (PAM)

Release 31 (NTGS58CA) of 1900 MHz TRM Module and Release BB of 1900 MHz PAM Module were used for the tests that are performed by Nortel Networks.

Sanmina Canada used the latest releases of these modules for radiated emissions test.
i.e. Release 65 (NTGS58CA) of 1900 MHz TRM module and release CU (NTGS57AA) of 1900 MHz PAM module.

5 Test Method and Test Result

5.1 Tests performed by Nortel Networks

The BTS digital enclosure was configured via the BTS controller to enable the SFRM to transmit at maximum rated power. The emissions were investigated from 1 MHz to 20 GHz (10^{th} harmonic of the fundamental emission). Measurements were performed on the bottom, middle and top channels of each licensed band. Channels in the A and D bands were tested using both the A/D DPM and upper A/D Triplexer. Channels in the B and E bands were tested using the B/E DPM. Channels in the C and F bands were tested using the C/F DPM.

Summaries of the test results are shown below that are provided by Nortel Networks. Details of the test results data, test instrumentations, test setups are included in the report provided by Nortel Networks. See exhibit 2A for test results in details provided by Nortel Networks.

RF Power Output
The maximum measured RF output power was:
- 42.10 dBm (Using DPM configuration) and
- 41.70 dBm (Using DPM/TM configuration).

Occupied Bandwidth
The maximum measured occupied bandwidth was 1272.50 kHz.

Spurious Emissions at Antenna Terminals
Minimum pass margin:
- 1 MHz upper and lower band edge measurements was 12.63 dB
- 1 MHz to 20 GHz measurements was 12.67 dB.

Frequency Stability
The GPS module has a frequency stability of 0.8 ppb over the range of -5^{o} C to 70^{o} C.

5.2 Test conducted by Sanmina Canada ULC

Radiated spurious emission (Field strength of spurious radiation) test was conducted in the Sanmina Canada PI Lab. The EUT was setup on channels in the A and D bands using both the A/D DPM and Upper A/D Triplexer. It should be noted that the EUT was tested with doors open that represents the worst case for the radiated spurious emissions test. The result obtained from such a configuration encompasses the “Indoor” version of this system, which has no cabinet doors.

As per the results provided by Sanmina-SCI PI Lab, the EUT (1900 MHz SFRM) met the FCC requirements for radiated spurious emission from 30 MHz to 20 GHz.

Radiated Emission Test Results from 30 MHz to 1 GHz
The minimum pass margin :31.18 dB for H-Pol
:36.30 dB for V-Pol

Radiated Emission Test Results from 1 GHz to 20 GHz
The minimum pass margin :30.15 dB for H-Pol
:26.05 dB for V-Pol

See exhibit 2B for the lab test report in details.

Note: EUT configuration reflects configuration #2 (DPM/TM combination). Latest releases of TRM and PAM modules were used for this test. Based on customer input this configuration was deemed the worst-case configuration for radiated emission test.