

FCC Part 15 Report for
Nortel M2616CT
900 MHz Cordless Telephone.

FCC ID: AB6M2616CT

1.0 Exhibit 1

STATEMENT OF TEST RESULTS

FCC Paragraph	Test Requirements	Compliance (Yes / No)
15.249(a), 15.209 15.205	Transmitter Radiated Emissions & Harmonic Emissions	Yes
15.107	AC Power Conducted Emissions	Yes

2. EXHIBIT 2**GENERAL INFORMATION****2.1 Applicant:**

Northern Telecom, Inc. (NORTEL)
2305 Mission College Blvd.
Santa Clara, CA 95054

2.2 Manufacturer:

Northern Telecom, Inc. (NORTEL)
2305 Mission College Blvd.
Santa Clara, CA 95054

2.3 Description of Equipment:

Product Name: M2616CT
Serial Number: Pre-Production
Type of Equipment: Cordless Telephone Transmitters
Operating Frequency: 902.4 – 927.6 MHz
Channel Spacing: 200 kHz
Bandwidth (99% OBW): Handset: 118 kHz, Base: 92.1 kHz
Power Rating: Base Transmitter: 48.9 mV/m at 3m
Handset Transmitter: 46.8 mV/m at 3m
Antenna: Permanently attached
Emission Designation: 140K0F1D
For an average case of commercial telephony, the Necessary Bandwidth is calculated as follows:
For FM Digital Modulation:
Channel Spacing = 200 kHz, D=30 kHz max., K=1, M: 80/2 kb/s
 $B_n = 2M + 2D = 2(80/2) + 2(30)(1) = 140$ kHz
emission designation: 140K0F1D
Duty Cycle: Continuous
Input Supply: Base: 120 V, 60 Hz Handset: 3.6 Vdc rechargeable Battery
Power Supply: Anoma AC Power Adapter, Model AD-8730
AC in: 120 V, 60 Hz DC out: 7.5 V
Interface Ports: RJ11

Digital Cordless Telephone, M2616CT, consists of the following components:

- (1) M 2616CT Handset
- (2) M2616CT Base
- (3) Anoma AC Adapter, Model AD-8730

2.4 Related Submittal(s) / Grant

Not applicable

2.5 Test Methodology

These tests were conducted on a sample of the equipment for the purpose of certification compliance with the Code of Federal Regulations: 47CFR Part 15, Sub-Part C, paragraph 15.249, Low Power Transmitters operating in the Frequency Band 902.4 – 927.6 MHz.

Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4-1992 – American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

2.6 Test Facility

Testing was performed at the following Open Area Test Site:

CKC Laboratories, Inc.
1653 Los Viboras Rd.
Hollister, CA 95023

The Test was performed on May 22, 1998 on the 3 meter Open Area Test Site. Both Radiated Emissions and Power Line Conducted Emissions were performed on this site.

2.7 Units of Measurements

Measurements of conducted emissions are reported in units of dB referenced to one microvolt (dB μ V).

Measurements of radiated emissions are reported in units of dB referenced to one microvolt per meter (dB μ V/m) at the distance specified in the report, wherever it is applicable.

3. EXHIBIT 3

SYSTEMS TEST CONFIGURATION

3.1 Test System Details

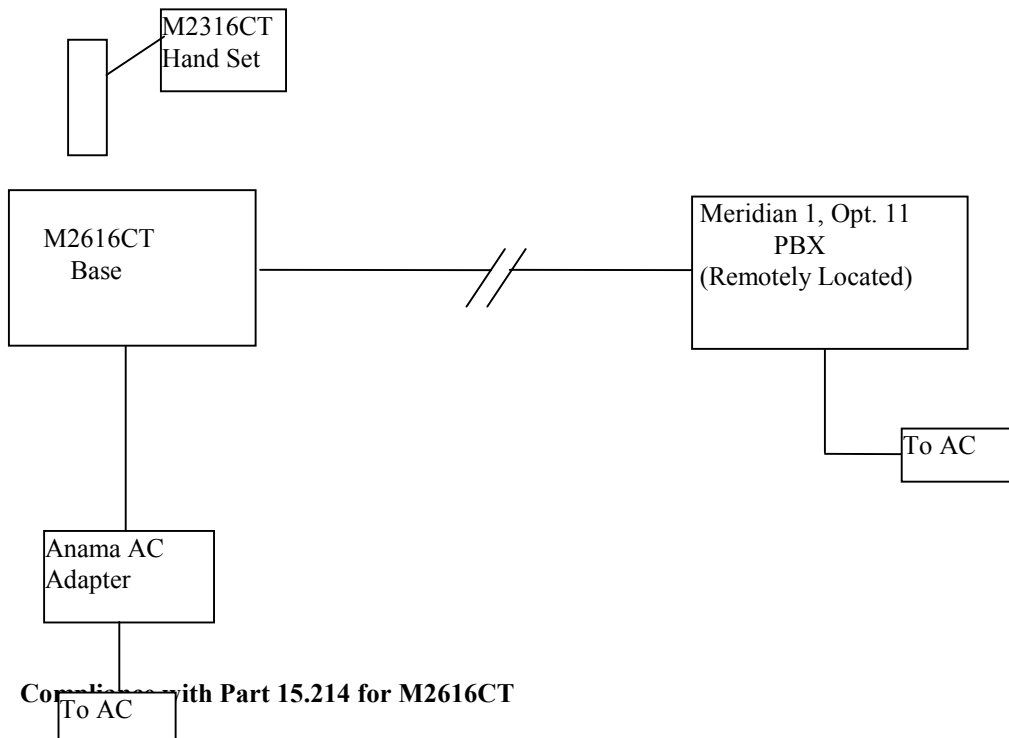
The following identifies the EUT, Peripherals, interconnecting cables, and other supporting equipment used during the testing of the EUT.

- (A) EUT:
M2616CT 900 MHz Digital Telephone, Base and Handset.
S/N: Pre-production
I/O cable: Telephone cord, 4-lead, Non-shielded
P/S cable: Non-shielded

- (B) Peripheral:
Meridian 1, Option 11 Key Telephone System
S/N: 04J0Y6
I/O Cable: Telephone Cord, 4-lead, Non-shielded
P/S Cable: Non-shielded

M2616 Corded Digital Telephone (Verified)
S/N:
I/O Cable: Telephone Cord, 4-lead, Non-shielded
P/S Cord: None

3.2 Block Diagram for Conducted & Radiated Emission Measurement



3.3 Compliance with Part 15.214 for M2616CT

The M2616CT telephone set used the following method of cordless voice / data security. The current method complies with Section 15.214(d)(2)(ii), which states “ Provide a fixed code that is continuously varied among at least 256 discrete digital codes as each telephone is manufactured.” This is achieved in the M2616CT in the following manner:

- As each B07 integrated circuit device is manufactured by the vendor, a 40-bit (5 Byte) ID code is written into the device’s EPROM. Three of these bytes represent a simple sequential number (hexadecimal), 1 byte represents a device vintage code (changes when there is a die or process change), and a 1-byte checksum of the other 4 bytes. One B07 IC is used per M2616CT.
- When the Base is first power-up with the handset in the cradle of the base, the base tells the handset what the PIN code is, via the metallic connection in the cradle.
- Both voice and data are transmitted across the RF link in packets (bursts) of 120 voice bits plus 40 data bits. For voice transmission with no data, the PIN code is included in the data portion of each burst. For data transmission, the PIN code is included in the first burst of each message (an individual message is allowed to span more than one burst). If the incoming PIN does not match the receiver’s PIN code, the receiver ignores the message (data) or burst (voice).
- In addition, an 8-bit encryption mask is applied to each burst. The encryption mask is obtained from the least significant byte of the PIN code.

3.4 Photograph for RF Emission Measurements

Test Setup for
AC Power Line Conducted Emissions Measurements
M2616CT Base Unit

REFER to FILE: COND-1.JPG and COND-2.JPG

Test Setup for
Radiated Emissions Measurements
M2616CT Base Unit

REFER to FILE: RAD-1.JPG

Test Setup for
Radiated Emissions Measurements
M2616CT Hand Set Unit

REFER to FILE: RAD-2.JPG

3.5 Calculation of Field Strength

The field strength is calculated by adding the calibrated antenna factor and cable loss, and subtracting the Amplifier gain (if any) from the measured reading. The equation is as follows.

$$\mathbf{FS(dB\mu V/m)} = \mathbf{RA(dB\mu V)} + \mathbf{AF(dB\ 1/m)} + \mathbf{CL(dB)} - \mathbf{AG(dB)}$$

Where: FS = Field Strength
 RA = Reading of Analyzer
 AF = Antenna Factor
 CL = Cable Loss
 AG = Antenna Gain

3.5 Justification

No deviation in either the configuration or operation from normal operation was required.

3.6 EUT Operating Condition

The Nortel M2616CT Base and Handset units were set for the EUT to transmit or receive at the lowest, middle, and highest frequencies in the permitted band.

3.7 Special Accessories

No special accessories were required.

3.8 Equipment Modifications

A Fair Rite Magnetics ferrite, P/N 044164951, one turn, was added to the M2626CT at the base end of the DC Power Cord. This will be incorporated into production units.

4. EXHIBIT 4

TEST DATA

4.1 FCC Requirements

4.1.1 Transmitter Fundamental & Harmonic Radiated Emissions – FCC Part 15.249(a)

The field strength of emissions from intentional radiators operated with these frequency bands shall comply with the following:

FUNDAMENTAL FREQUENCY	Field Strength of Fundamental @ 3 m (dBµV/m)	Field Strength of Harmonics @ 3m (dBµV/m)
902.4 - 927.6 MHz	94.0	54.0
2400.0 - 2483.5 MHz	94.0	54.0
5725.0 - 5875.0 MHz	94.0	54.0
24.0 - 24.5 GHz	108.0	68.0

Remarks:

- Applies to harmonics / spurious emissions that fall in the restricted bands listed in Section 15.205. The maximum permitted average field strength is listed in Section 15.209.
- FCC Part 15, Paragraph 15.237(c) - The emission limits as specified above are based on measurement instrument employing an average detector. The provision in Paragraph 15.35 limiting peak emissions applies.

Part 15, Subpart C, Paragraph 15.205(a) – Restricted Frequency Bands

MHz	MHz	MHz	GHz
0.090 – 0.110	162.0125 – 167.17	2130 – 2390	9.3 – 9.5
0.49 – 0.51	167.72 – 173.2	2483.5 – 2500	10.6 – 12.7
2.1735 – 2.1905	240.0 – 285.0	2655 – 2900	13.25 – 13.4
8.362 – 8.366	322.0 – 335.4	3260 – 3267	14.47 – 14.5
13.36 – 13.41	399.9 – 410.0	3332 – 3339	15.35 – 16.2
25.5 – 25.67	608.0 – 614.0	3345.8 – 3358	17.7 – 21.4
37.5 – 38.25	960.0 – 1240.0	3600 – 4400	22.01 – 23.12
73.0 – 75.4	1300.0 – 1427.0	4500 – 5250	23.6 – 24.0
108.0 – 121.94	1435.0 – 1626.5	5350 – 5460	31.2 – 31.8
123.0 – 138.0	1660.0 – 1710.0	7250 – 7750	36.42 – 36.5
149.9 – 150.5	1718.8 – 1722.2	8025 – 8500	above 38.6
156.7 – 156.9	1100.0 – 2300.0	9000 – 9200	

4.1.2 Power Input:

Base: 120 V, 60 Hz
Hand Set: 3.6 Vdc rechargeable battery

4.1.3 Test Equipment:

<u>MFG.</u>	<u>Model</u>	<u>Description</u>	<u>S/N</u>	<u>Cal Due</u>
• HP	8568B	Spectrum Analyzer	2601A02738	09/04/98
• HP	85662A	Analyzer Section	2542A10641	09/04/98
• HP	8447D	Amplifier	2727A06124	01/26/99
• HP	85650A	QP Adapter	2043A00286	09/10/98
• HP	83017A	Amplifier	3132A00281	05/28/98
• AH Systems	SAS-200/542	Antenna, Bi-conical	157	09/15/98
• EMCO	3146	Antenna, Log Periodic	1315	03/23/99
• ARA	DRG-118.A	Antenna, Horn	1046	12/11/98
• Solar	8028-50-TS-24	LISN (Neutral)	874139	10/02/98
• Solar	8028-50-TS-24	LISN (AC Hot)	874140	10/02/98

4.1.4 Frequency Spectrum to be investigated (Paragraph 2.997)

The spectrum is to be investigated from the lowest radio frequency signal generated in the equipment up to at least the tenth harmonic of the carrier frequency or to the highest frequency practicable in the present state of the art of measuring techniques, whichever is lower. Particular attention is to be paid to harmonics and sub-harmonics of the carrier frequency. Radiation at the frequencies of multiplier stages, if applicable, is to be checked. The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

4.1.5 Field Strength Spurious Emissions (Paragraph 2.993)

- (a) Measurements are to be made to detect spurious emissions radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data is to be supplied showing the magnitude of each of harmonic or other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph 2.989(c) as appropriate. For equipment operating on frequencies below 1 GHz, an Open Field Test is normal required, with the measuring instrument antenna located in the far field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurement will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections that might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with the reference to the rated power output of the transmitter, assuming all emission are radiated from half-wave dipole antennas.
- (b) Measurements specified in paragraph (a) of this section shall be made for the following equipment.
 - (1) Those in which the spurious emission are required to be 60 dB or more below the mean power of the transmitter.
 - (2) All equipment operating on frequencies higher than 25 MHz.
 - (3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.
 - (4) Other types of equipment as required, when deemed necessary by the commission.

4.1.6 Test Procedure

The tests were performed in accordance with ANSI C63.4.

4.1.7 Test Results

Complies

4.1.8 Test Personnel

Art Rice	Test Technician	CKC Laboratories	
Samuil Lisinker	Northern Telecom	EMC Engineer	Witness
John Shinn, P.E.	Northern Telecom	Sr. Engineer	Witness

4.1.9 Test Date

The test was performed on 22 May 1998.

4.2 Measurement Data

4.2.1 Test Configuration

- The lowest, middle, and highest channels were established at its full rated output power. The emissions were investigated from the lowest frequency generated by the transmitter up to the 10th harmonic of the fundamental emissions in each case. The measured level of the carrier was recorded and compared to the level of the emissions as required in Parts 15.249(c) or 15.209(a) whichever was applicable.
- The following measurements were the worst cases when the radiating antenna was placed in both horizontal and vertical polarization.
- The handset was placed in three different orthogonal positions to maximize the rf emission level.

The Base Phone was operated with the power supply connected to 120 V AC power. The handset was operated from the internal battery, fully charged. The Base phone is connected through 100 feet of phone line to the remote switch. The support phone is connected to the switch, and is also located 100 feet away from the units under test.

4.2.2 Fundamental and Harmonics

Fundamental Frequencies, M2616CT Base only

FREQ. (MHz)	PEAK RF LEVEL (dBµV/m)	AVG. RF LEVEL (dBµV/m)	Antenna Plane (H / V)	FCC AVG. LIMIT (dBµV/m)	MARGIN (dB)	PASS / FAIL
902.6		82.3	V	94.0	-11.7	PASS
902.6		86.4	H	94.0	-7.6	PASS
916.4		83.4	V	94.0	-10.6	PASS
916.4		88.9	H	94.0	-5.1	PASS
927.6		81.8	V	94.0	-12.2	PASS
927.6		87.0	H	94.0	-7.0	PASS

Fundamental Frequencies, M2616CT Handset only

FREQ. (MHz)	PEAK RF LEVEL (dBµV/m)	AVG. RF LEVEL (dBµV/m)	Antenna Plane (H / V)	FCC AVG. LIMIT (dBµV/m)	MARGIN (dB)	PASS / FAIL
902.6	67.0		V	94.0	-27.0	PASS
902.6	51.9		H	94.0	-42.1	PASS
916.4		80.5	V	94.0	-13.5	PASS
916.4	82.4		H	94.0	-11.6	PASS
927.6	64.4		V	94.0	-29.6	PASS
927.6	59.3		H	94.0	-37.4	PASS

FREQ. (MHz)	PEAK RF LEVEL (dBµV/m)	AVG. RF LEVEL (dBµV/m)	Antenna Plane (H / V)	FCC AVG. LIMIT (dBµV/m)	MARGIN (dB)	PASS / FAIL
Channel 0						
1805.2	41.2		V	54.0	-12.8	PASS
1805.2	36.0		H	54.0	-18.0	PASS
2707.8	33.0		V	54.0	-21.0	PASS
2707.8	33.2		H	54.0	-20.8	PASS
3610.4	34.2		V	54.0	-19.8	PASS
3610.4	34.4		H	54.0	-19.6	PASS
Channel 11						
1832.6	30.1		V	54.0	-23.9	PASS
1832.6	30.7		H	54.0	-23.3	PASS
2749.1	29.8		V	54.0	-24.2	PASS
2749.1	29.1		H	54.0	-24.9	PASS
3665.6	31.0		V	54.0	-23.0	PASS
3665.6	30.2		H	54.0	-23.8	PASS
Channel 19						
1855.3	34.5		V	54.0	-19.5	PASS
1855.3	35.0		H	54.0	-19.0	PASS
2783.0	33.8		V	54.0	-20.2	PASS
2873.0	33.4		H	54.0	-20.6	PASS
3710.7	35.2		V	54.0	-18.8	PASS
3710.7	34.9		H	54.0	-19.1	PASS

No other significant harmonic and spurious emissions were found in the frequency range from 10 MHz to 10 GHz.

4.4.3 Radiated Emissions, General Requirements per Paragraph 15.209

Spurious frequencies for intentional radiator, 30 – 1000 MHz, except for 902 – 928 MHz band.

FREQ. (MHz)	PEAK RF LEVEL (dBµV/m)	QP RF LEVEL (dBµV/m)	Antenna Plane (H / V)	FCC QP LIMIT (dBµV/m)	MARGIN (dB)	PASS / FAIL
81.977	21.3		V	40.0	-18.7	PASS
81.982	19.6		H	40.0	-20.4	PASS
122.933	25.6		V	43.5	-17.9	PASS
122.963	29.9		H	43.5	-13.6	PASS
133.196	36.8		V	43.5	-6.7	PASS
133.218	28.5		H	43.5	-15.0	PASS
143.445	35.5		H	43.5	-8.0	PASS
143.463	37.4		V	43.5	-6.1	PASS
153.655	37.8		V	43.5	-5.7	PASS
153.688	35.8		H	43.5	-7.7	PASS
163.912	31.8		V	43.5	-11.7	PASS
163.955	34.8		H	43.5	-8.7	PASS
174.190	34.5		H	43.5	-9.0	PASS
174.194		38.0	V	43.5	-5.5	PASS
194.682		36.9	H	43.5	-6.6	PASS
194.681	24.8		V	43.5	-18.7	PASS
204.864	32.8		V	43.5	-10.7	PASS
204.919		38.8	H	43.5	-6.1	PASS

Spurious frequencies for intentional radiator, above 1000 MHz.

FREQ. (MHz)	PEAK RF LEVEL (dBµV/m)	AVG. RF LEVEL (dBµV/m)	Antenna Plane (H / V)	FCC AVG. LIMIT (dBµV/m)	MARGIN (dB)	PASS / FAIL
1693.613	39.6		H	54.0	-14.4	PASS
1693.680	45.3		V	54.0	-8.7	PASS
1705.598	36.7		H	54.0	-17.3	PASS
2173.000	43.7		V	54.0	-10.3	PASS
2610.150		40.5	H	54.0	-13.5	PASS
2610.275		36.7	V	54.0	-17.3	PASS
4698.000	37.8		V	54.0	-16.2	PASS
6318.000	45.5		V	54.0	-8.5	PASS

No other significant spurious emissions were found in the frequency range from 30 MHz to 10 GHz.

4.4.4 Occupied Bandwidth

REFER to FILE: OBW.JPG

4.4.5 AC Power Line Conducted Emission, Paragraph 15.107(a)

Test Conditions: The EUT was tested in accordance with ANSI C63.4. The base phone was operated from the power supply connected to the AC Power. The Base phone is also connected through 100 Ft. of phone line to the remote switch. The support phone was connected to the switch, and is also located 100 Ft. away from the EUT. AC line voltage was a nominal 115 VAC. The Handset was in the cradle (being charged). The base unit was communicating through the remote switch to the support phone.

Only those emissions that were found to be within 10 dB of the limit are listed. All others were found to be greater than 10 dB below the “Class B Conducted Emissions Limit.”

AC Hot lead

Frequency (kHz)	Cond. Voltage (dBµV)	Spec Limit (dBµV)	Margin (dB)
453.791	43.0	48.0	-5.0
471.232	43.0	48.0	-5.0
474.256	43.0	48.0	-5.0
484.123	42.8	48.0	-5.2
505.356	42.3	48.0	-5.7
519.763	42.8	48.0	-5.2
538.720	41.7	48.0	-6.3
550.095	41.6	48.0	-6.4
558.436	41.0	48.0	-7.0
570.190	41.1	48.0	-6.9
589.526	41.2	48.0	-6.8
593.318	41.2	48.0	-6.8
598.626	40.2	48.0	-7.8
638.057	39.1	48.0	-8.9
647.915	38.6	48.0	-9.4
655.356	38.1	48.0	-9.9
693.413	38.1	48.0	-9.9

AC Neutral lead

Frequency (kHz)	Cond. Voltage (dBµV)	Spec Limit (dBµV)	Margin (dB)
450.000	39.6	48.0	-8.4
460.237	39.6	48.0	-8.4
466.303	39.5	48.0	-8.5
485.640	39.1	48.0	-8.9
493.223	39.6	48.0	-8.4
497.773	39.2	48.0	-8.8
519.005	39.6	48.0	-8.4
532.654	39.3	48.0	-8.7
553.128	38.2	48.0	-9.8

5. EXHIBIT 5

5.1 FCC Label Information

The label on the base unit will be located on the bottom of the phone.
REFER to FILE: LABEL1.JPG

The label on the handset will be located on the back under the battery.
REFER to FILE: LABEL2.JPG

5.2 Photographs of EUT

Photo of M2616CT Base with Handset, Front
REFER to FILE: M2616CT-A.JPG

Photo of M2616CT Base with Handset, Rear
REFER to FILE: M2616CT-B.JPG

Photo of M2616CT Handset only, Front
REFER to FILE: M2616CT-C.JPG

Photo of M2616CT Handset only, Rear
REFER to FILE: M2616CT-D.JPG

Photo of M2616CT Interior with bottom cover removed
REFER to FILE: M2616CT-E.JPG

5.3 Photographs of Circuit Boards

Photos of M2616CT Base RF Radio Board
REFER to FILES: M2616CT-01.JPG and M2616CT-02.JPG

Photos of M2616CT Handset Board
REFER to FILES: M2616CT-03.JPG and M2616CT-04.JPG

Photos of M2616CT Base Motherboard
REFER TO FILES: M2616CT-05.JPG and M2616CT-06.JPG

5.4 Schematic Diagrams

Schematic Diagram of M2616CT RF Radio Board

REFER TO FILES: M2616CT-07.JPG
M2616CT-08.JPG
M2616CT-09.JPG
M2616CT-10.JPG
M2616CT-11.JPG
M2616CT-12.JPG

Schematic Diagram of M2616CT Base Motherboard

REFER TO FILES: M2616CT-13.JPG
M2616CT-14.JPG
M2616CT-15.JPG
M2616CT-16.JPG
M2616CT-17.JPG

Schematic Diagram of M2616CT Handset Board

REFER TO FILES: M2616CT-18.JPG
M2616CT-19.JPG
M2616CT-20.JPG
M2616CT-22.JPG
M2616CT-23.JPG
M2616CT-24.JPG
M2616CT-25.JPG
M2616CT-26.JPG

5.5 Customer Information in User's Manual

The following information is included in the Customer's users manual.

M2316CT 900MHz Cordless Telephone**Information to User**

- **CAUTION:** As with all cordless telephones, **Privacy of communications may not be ensured when using this Telephone.**

- **CAUTION:** Changes or modifications not expressly approved by NORTEL could void the users authority to operate the M2616CT cordless telephone.

- **NOTE:** This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, and uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
 - Reorient or relocate the receiving antenna.
 - Increase the separation between the equipment and receiver.
 - Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
 - Consult the dealer or an experienced radio/TV technician for help.