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DMS-10 Family

600-Series Generics

System Performance Specifications

07.01
For Generic 602.20 Standard August 2006

NORTEL

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Contents

Section 1: Introduction

Scope and purpose of this publication

This Nortel technical publication (NTP) provides various system capacity and performance figures, including signaling and transmission data, tone plans and other system feature applications, and functional specifications of individual circuit packs in the DMS-10 switch.

Organization

This NTP comprises the following sections:

- Introduction
- Operating conditions
- Line characteristics
- Transmission parameters
- Reliability
- Remote equipment and remote servicing equipment parameters
- Index

Section 2: Operating conditions

DMS-10 Physical Characteristics

Full-size DMS-10 Space and Load Requirements

Table 2-A:
Full-size DMS-10 space and load requirements (Series 400/500 style frames)

Parameter	Dimension
Equipment Bays	
Height (with cable duct)	94.3 in. (240 cm)
Height (maximum)	97.3 in. (247 cm)
Width (CE, ME, or PE)	32 in. (81 cm)
Width (LCE, SCE, or MVIE)	27 in. (69 cm)
Depth	18 in. (46 cm)
Depth (installed assembly)	20 in. (51 cm)
Aisle Spacing	
Maintenance aisle (front)	32 in. 81 cm)
Wiring aisle	24 in. (61 cm)
Main aisle, minimum (front)	36 in. (91 cm)
End aisle	24 in. (61 cm)
Ceiling Spacing	
Ceiling height (recommended)	120 in. (305 cm)
Ceiling height (required)	108 in. (274 cm)
Floor Loading	
CE, ME or PE bay (with standard dress panel option)	80 lb/ft^2 (391 kg/m^2)
CE, ME or PE bay (with Sleek Door dress panel option)	137 lb/ft^2 (669 kg/m^2)
LCE, SCE, or MVIE bay (with standard dress panel option)	100 lb/ft^2 (488 kg/m^2)
LCE, SCE, or MVIE bay (with Sleek Door dress panel option)	159 lb/ft^2 (776 kg/m^2)
Equipment Unloading/Maneuvering	
Unloading area	150 ft (14 m)
Building/office entrance	3 ft x 8 ft (0.9 m x 2.4 m)

Sleek Door floor load includes the Sleek Door Kit, Sleek Door Cable Trough Shield Kit, Sleek Door Cable Trough End Shield Kit, and the Sleek Door End Panel Kit.

Main Distribution Frame Specifications

Table 2-B:
Main distribution frame specifications

Type of Equipment	Type of Pin Block Used	Number of Pin Rows per Equipment Part
Peripheral Equipment		
Line, Loop Trunk, and Service Circuit Pack	240-pin blocks (30 rows x 8 pins)	One
E&M Trunk Circuit Pack	240-pin blocks (30 rows x 8 pins)	Two
Line Concentrating Equipment		
Line Subgroup	300-pin blocks (30 rows x 10 pins)	Seven

Blocks should be grouped on four horizontal rows so that each vertical row terminates one complete PE bay.

Blocks should be grouped on five horizontal rows so that each vertical row terminates one complete LCM.

Power Requirements

Table 2-C:
System Input Voltage Limits

Parameter	Minimum	Nominal	Maximum	Unit
-48 A (“A” battery)	-42.55	52.76	-56.00	Volts DC
-48 B (“B” battery)	-42.55	52.76	-56.00	Volts DC
-48 ABS (alarm battery supply)	-42.55	52.76	-56.00	Volts DC

Note: *System input voltage measured at the J0T75 Power Distribution Panel input with respect to the Ground Junction Bar must be within the range of -42.55 to -56.00 volts during all operating conditions.*

Table 2-D:
Total Battery Current Draw and Power Dissipation for One J1T30 CE-01 Bay

Shelf Assembly Equipped in the Bay	Number of Assemblies per Bay		Maximum Contribution to the Total Bay Current Draw @ -42.00 VDC per each Fully-provisioned Shelf Assembly	Contribution to the Total Bay Power Dissipation per each Fully-provisioned Shelf Assembly
	Min	Max		
Power and Cooling Module (J0T97)	1	1	1.36 Amps DC	57 Watts (195 BTU/hour)
Network Shelf (J1T31)	2	4	6.76 Amps DC	284 Watts (969 BTU/Hour)

Table 2-D: (Continued)
Total Battery Current Draw and Power Dissipation for One J1T30 CE-01 Bay

Shelf Assembly Equipped in the Bay	Number of Assemblies per Bay		Maximum Contribution to the Total Bay Current Draw @ -42.00 VDC per each Fully-provisioned Shelf Assembly	Contribution to the Total Bay Power Dissipation per each Fully-provisioned Shelf Assembly
	Min	Max		
MPU Shelf (J1T65)	0	1	11.00 Amps DC	462 Watts (1577 BTU/Hour)
GPIO Shelf (J1T81)	0	1	5.95 Amps DC	250 Watts (853 BTU/Hour)
DCI Shelf (J1T80)	0	1	3.64 Amps DC	153 Watts (522 BTU/Hour)
Total @ Max Assembly Configuration (with Power and Cooling Module)		6	39.40 Amps DC	1655 Watts (5648 BTU/Hour)

Table 2-E:
Total Battery Current Draw and Power Dissipation for one J1T30 CE-02 or CE-04 Bay

Shelf Assembly Equipped in the Bay	Number of Assemblies per Bay		Maximum Contribution to the Total Bay Current Draw @ -42.00 VDC per each Fully-provisioned Shelf Assembly	Contribution to the Total Bay Power Dissipation per each Fully-provisioned Shelf Assembly
	Min	Max		
Power and Cooling Module (J0T97)	1	1	1.36 Amps DC	57 Watts (195 BTU/hour)
MPU Shelf (J1T65)	0	4	11.00 Amps DC	462 Watts (1577 BTU/Hour)
DCI Shelf (J1T80)	0	5	3.64 Amps DC	153 Watts (522 BTU/Hour)
Total @ Max Assembly Configuration (with Power and Cooling Module)		6	49.00 Amps DC	2058 Watts (7023 BTU/Hour)

Table 2-F:
Total Battery Current Draw and Power Dissipation for one J0T76 CE-03 Bay

Shelf Assembly Equipped in the Bay	Number of Assemblies per Bay		Maximum Contribution to the Total Bay Current Draw @ -42.00 VDC per each Fully-provisioned Shelf Assembly	Contribution to the Total Bay Power Dissipation per each Fully-provisioned Shelf Assembly
	Min	Max		
Power and Cooling Module (J0T98)	1	1	1.36 Amps DC	57 Watts (195 BTU/hour)
CPU Shelf (J0T93)	2	2	3.77 Amps DC	158 Watts (539 BTU/Hour)
IOI Shelf (J1T51)	1	1	0.59 Amps DC	25 Watts (85 BTU/Hour)
Alarm and RInging Module (J0T72)	1	1	3.24 Amps DC	136 Watts (464 BTU/Hour)
Total @ Max Assembly Configuration (with Power and Cooling Module)		6	12.73 Amps DC	534 Watts (1822 BTU/Hour)

Table 2-G:
Total Battery Current Draw and Power Dissipation for one J1T83 CE-03 Bay

Shelf Assembly Equipped in the Bay	Number of Assemblies per Bay		Maximum Contribution to the Total Bay Current Draw @ -42.00 VDC per each Fully-provisioned Shelf Assembly	Contribution to the Total Bay Power Dissipation per each Fully-provisioned Shelf Assembly
	Min	Max		
Power and Cooling Module (J0T98)	1	1	1.36 Amps DC	57 Watts (195 BTU/hour)
CPU/Network Shelf (J1T72)	2	2	6.58 Amps DC	276 Watts (942 BTU/Hour)
IOI Shelf (J1T51)	1	1	0.59 Amps DC	25 Watts (85 BTU/Hour)
Alarm and RInging Module (J0T72)	1	1	3.24 Amps DC	136 Watts (464 BTU/Hour)
GPIO Shelf (J1T81)	0	1	5.95 Amps DC	250 Watts (853 BTU/Hour)
MPU Shelf (J1T65)	0	1	11.00 Amps DC	462 Watts (1577 BTU/Hour)
DCI Shelf (J1T80)	0	1	3.64 Amps DC	153 Watts (522 BTU/Hour)
Total @ Max Assembly Configuration (with Power and Cooling Module)		6	29.35 Amps DC	1232 Watts (4205 BTU/Hour)

Table 2-H:
Total Battery Current Draw and Power Dissipation for one J1T92 CE-01 Bay

Shelf Assembly Equipped in the Bay	Number of Assemblies per Bay		Maximum Contribution to the Total Bay Current Draw @ -42.00 VDC per each Fully-provisioned Shelf Assembly	Contribution to the Total Bay Power Dissipation per each Fully-provisioned Shelf Assembly
	Min	Max		
Power and Cooling Module (J0T97)	1	1	1.36 Amps DC	57 Watts (195 BTU/hour)
CNI Module (J8M75)	1	1	16.19 Amps DC	680 Watts (2321 BTU/Hour)
GPIO Shelf (J1T81)	1	1	5.95 Amps DC	250 Watts (853 BTU/Hour)
MPU Shelf (J1T65)	0	1	11.00 Amps DC	462 Watts (1577 BTU/Hour)
DCI Shelf (J1T80)	0	1	3.64 Amps DC	153 Watts (522 BTU/Hour)
Total @ Max Assembly Configuration (with Power and Cooling Module)		4	34.50 Amps DC	1449 Watts (4945 BTU/Hour)

Table 2-I:
Total Battery Current Draw and Power Dissipation for one J1T93 CE-03 Bay

Shelf Assembly Equipped in the Bay	Number of Assemblies per Bay		Maximum Contribution to the Total Bay Current Draw @ -42.00 VDC per each Fully-provisioned Shelf Assembly	Contribution to the Total Bay Power Dissipation per each Fully-provisioned Shelf Assembly
	Min	Max		
Power and Cooling Module (J0T98)	1	1	1.36 Amps DC	57 Watts (195 BTU/hour)
Alarm and RInging Module (J0T72)	1	1	3.24 Amps DC	136 Watts (464 BTU/Hour)
GPIO Shelf (J1T81)	0	1	5.95 Amps DC	250 Watts (853 BTU/Hour)
MPU Shelf (J1T65)	0	3	11.00 Amps DC	462 Watts (1577 BTU/Hour)
DCI Shelf (J1T80)	0	4	3.64 Amps DC	153 Watts (522 BTU/Hour)
Total @ Max Assembly Configuration (with Power and Cooling Module)		6	37.60 Amps DC	1579 Watts (5390 BTU/Hour)

Table 2-J:
Total Battery Current Draw and Power Dissipation for one J0T30E-1 PE Bay

Shelf Assembly Equipped in the Bay	Number of Assemblies per Bay		Maximum Contribution to the Total Bay Current Draw @ -42.00 VDC per each Fully-provisioned Shelf Assembly	Contribution to the Total Bay Power Dissipation per each Fully-provisioned Shelf Assembly
	Min	Max		
Bay Supervisory Panel (J1T60)	1	1	0.40 Amps DC	17 Watts (ABSBH) (58 BTU/hour)
Peripheral Shelf (J0T29)	0	4	1.14 Amps DC	48 Watts (ABSBH) (164 BTU/Hour)
Peripheral Shelf (J0T59) (equipped with line packs only)	0	4	1.23 Amps DC	52 Watts (ABSBH) (177 BTU/Hour)
Peripheral Shelf (J0T59) (equipped with non- line packs only)	0	4	1.00 Amps DC	42 Watts (143 BTU/Hour)
Peripheral Shelf (J0T90) (equipped with ACT/PMS)	0	2	1.57 Amps DC	66 Watts (225 BTU/Hour)
MPU Shelf (J1T65) (equipped with limited packfill)	0	2	6.76 Amps DC	284 Watts (969 BTU/Hour)
DCM Shelf (J0T13)	0	3	4.33 Amps DC	182 Watts (621 BTU/Hour)
Total @ Max Assembly Configuration (with Bay Supervisory Panel, two MPU shelves, and one DCM shelf)		6	18.25 Amps DC	767 Watts (2618 BTU/Hour)
Total @ Max Assembly Configuration (with Bay Supervisory Panel, four typical J0T59 line pack shelves, and one DCM shelf)		6	9.65 Amps DC	405 Watts (ABSBH) (1382 BTU/Hour)

Note: *ABSBH = Average Busy Season Busy Hour.*

Table 2-K:
Total Battery Current Draw and Power Dissipation for one J0T81 ME Bay

Shelf Assembly Equipped in the Bay	Number of Assemblies per Bay		Maximum Contribution to the Total Bay Current Draw @ -42.00 VDC per each Fully-provisioned Shelf Assembly	Contribution to the Total Bay Power Dissipation per each Fully-provisioned Shelf Assembly
	Min	Max		
Bay Supervisory Panel (J1T67)	1	1	0.03 Amps DC	1.6 Watts (5.46 BTU/hour)
Billing Media Converter (BMC)	0	2	3.92 Amps DC	165 Watts (563 BTU/Hour)
Packet Gateway Interface (J6T00A-1L1)	0	9	0.625 Amps DC	270 Watts (918 BTU/Hour)
500VA DC-AC Inverter (for IGZ loads, TTY)	0	2	16.09 Amps DC	176 Watts (601 BTU/Hour)
Inverter-powered loads				500 Watts (1706 BTU/Hour)
Various assemblies (HB0T81)	0	10	2.90 Amps DC Avg.	122 Watts Avg.

Table 2-L:
Total Battery Current Draw and Power Dissipation for one NT6X03 LCE Bay

Shelf Assembly Equipped in the Bay	Number of Assemblies per Bay		Maximum Contribution to the Total Bay Current Draw @ -42.00 VDC per each Fully-provisioned Shelf Assembly	Contribution to the Total Bay Power Dissipation per each Fully-provisioned Shelf Assembly
	Min	Max		
Frame Supervisory Panel (NT6X35) with both ringing generators @ Max	1	1	3.50 Amps DC	74 Watts (ABSBH) (253 BTU/hour)
Line Card Module (NT6X04) (60 time slots active and 120 of 640 subscribers active)	1	2	9.37 Amps DC	321 Watts (ABSBH) (1096 BTU/Hour)
Total @ Max Assembly Configuration		3	22.24 Amps DC	716 Watts (2444 BTU/Hour)

Note: *ABSBH = Average Busy Season Busy Hour.*

Table 2-M:
Total Battery Current Draw and Power Dissipation for one J0T57E-1 MT Bay

Shelf Assembly Equipped in the Bay	Number of Assemblies per Bay		Maximum Contribution to the Total Bay Current Draw @ -42.00 VDC per each Fully-provisioned Shelf Assembly	Contribution to the Total Bay Power Dissipation per each Fully-provisioned Shelf Assembly
	Min	Max		
Circuit breaker panel (J0T17)	1	1	0.0 Amps DC	0.0 Watts (0.0 BTU/hour)
Mag Tape Unit (J0T67)	2	2	6.67 Amps DC	110 Watts (375 BTU/Hour)
Total @ Max Assembly Configuration		3	13.34 Amps DC	220 Watts (750 BTU/Hour)

Table 2-N:
Total Battery Current Draw and Power Dissipation for one J1T85 AMA Bay

Shelf Assembly Equipped in the Bay	Number of Assemblies per Bay		Maximum Contribution to the Total Bay Current Draw @ -42.00 VDC per each Fully-provisioned Shelf Assembly	Contribution to the Total Bay Power Dissipation per each Fully-provisioned Shelf Assembly
	Min	Max		
Power and Cooling Module (J0T97)	1	1	1.36 Amps DC	57 Watts (195 BTU/hour)
IOI Shelf (J1T51)	1	1	1.82 Amps DC	76 Watts (259 BTU/Hour)
1600 BPI Tape Drive (with Inverter) (ED1T85-08)	1	1	9.23 Amps DC	388 Watts (1324 BTU/Hour)
Total @ Max Assembly Configuration (with Power and Cooling Module)		3	12.41 Amps DC	521 Watts (1778 BTU/Hour)

Table 2-O:
Total Battery Current Draw and Power Dissipation for one NT6X01 SCE Bay

Shelf Assembly Equipped in the Bay	Number of Assemblies per Bay		Maximum Contribution to the Total Bay Current Draw @ -42.00 VDC per each Fully-provisioned Shelf Assembly	Contribution to the Total Bay Power Dissipation per each Fully-provisioned Shelf Assembly
	Min	Max		
Frame Supervisory Panel (NT0X28)	1	1	0.08 Amps DC	4.5 Watts (15 BTU/hour)

Table 2-O: (Continued)
Total Battery Current Draw and Power Dissipation for one NT6X01 SCE Bay

Shelf Assembly Equipped in the Bay	Number of Assemblies per Bay		Maximum Contribution to the Total Bay Current Draw @ -42.00 VDC per each Fully-provisioned Shelf Assembly	Contribution to the Total Bay Power Dissipation per each Fully-provisioned Shelf Assembly
	Min	Max		
Subscriber Carrier Shelf (NT6X02)	2	4	6.07 Amps DC	255 Watts (870 BTU/Hour)
Fan Shelf (NT3X90)	1	1	2.04 Amps DC	114 Watts (389 BTU/Hour)
Total @ Max Assembly Configuration		6	26.4 Amps DC	1139 Watts (3887 BTU/Hour)

Table 2-P:
Total Battery Current Draw and Power Dissipation for one NTQX90 MVIE Bay

Shelf Assembly Equipped in the Bay	Battery Feed	Maximum Contribution to the Total Bay Current Draw @ -42.00 VDC per each Fully-provisioned Shelf Assembly	Contribution to the Total Bay Power Dissipation per each Fully-provisioned Shelf Assembly
ESMA2 Unit 0 ESMA1 Unit 0	-48A1	8.80 Amps DC	370 Watts (1263 BTU/hour)
ESMA2 Unit 1 ESMA1 Unit 1	-48B1	8.80 Amps DC	370 Watts (1263 BTU/Hour)
Extension ESMA2 Unit 0 Extension ESMA1 Unit 0 Cooling Unit	-48A2	6.30 Amps DC	264 Watts (901 BTU/Hour)
Extension ESMA2 Unit 1 Extension ESMA1 Unit 1 Cooling Unit	-48B2	6.30 Amps DC	264 Watts (901 BTU/Hour)
Total @ Max Assembly Configuration		30.2 Amps DC	1268 Watts (4328 BTU/Hour)

Note 1: The Multivendor Interface Equipment (MVIE) bay (NTQX90) is powered by -48 V nominal (-42 V to -56 V).

Note 2: The MVIE bay is powered through four feeds. As shown in the table, the A1/A2 feeds provide power for Unit 0 of both ESMA shelves and the B1/B2 feeds provide power for Unit 1 of both ESMA shelves. The cooling units rely completely on the A2 and B2 feeds for power.

Environmental Requirements

Table 2-Q:
DMS-10 switch and indoor remotes environmental requirements

Parameter	Range
Temperature	
Normal	50° F to 86° F (10° C to 30° C)
Short-Term (System)	40° F to 120° F (5° C to 49° C)
Short-Term (Tape Drive)	40° F to 110° F (5° C to 43° C)
AMA disk and tape drives	40° F to 147° F (5° C to 64° C)
AMA tape media	40° F to 115° F (5° C to 46° C)
Air Contamination	The DMS-10 switch functions within the Contamination Standards listed in Bellcore Technical Reference TR-EOP-000063. Beyond the factory-provided filtering, no special conditioning of ambient air is required.
Humidity (non-condensing)	
Normal	20% to 55%
Short-Term	20% to 80%
Transportation Conditions	
Temperature	-40° F to 140° F (-40° C to 60° C)
Humidity	10% to 95%
Atmospheric Pressure	3.5 in Hg
Vibration (1.5 g)	5-28 Hz
Vibration (2.5 g)	28-44 Hz
Vibration (3.5 g)	44-50 Hz
Shock, Excluding Framework	30 g (11 ms)
Drop to Concrete, Vertical	39 in, 10 lb (99 cm, 5 kg) 20 in, 50 lb (48 cm, 23 kg) 10 in, 198 lb (25 cm, 90 kg)
Equipment Resonance	16 Hz

Short Term = 72 h duration per occuence, a maximum of 15 d/yr. Temperature and humidity are measured at a point 5 feet (1.254 m) above floor level and mid-aisle, or 15 in (381 mm) in front of the equipment (whichever is smaller). Rate of change should not exceed 15F (6.7F) per hour.

Equipment packed for shipment, excluding MDF, power bay, batteries, terminals, and printers.

Includes RSC-S, MVIE, RLCM, RSLE, RSLM.

Section 3: Line characteristics

Table 3-A:
PE line pack signaling features

Pack Name	Pack Code	Characteristics
Single-Party Line	NT2T00 NT2T69	-Single-frequency, Bridged -Loop Start
Two-Party Line	NT2T01 NT2T43	-Single-frequency, Divided or Bridged -Loop Start
Four-Party ANI Line	NT2T02	-Multifrequency, Bridged or Divided -Loop Start ***Note:*** *For the NT2T02, R1 and R2 are valid for two-party lines and only R1, R2, R3, and R4 are valid for four-party lines.*
Miscellaneous Line	NT2T03 NT2T44	-Single-frequency, Bridged or Divided Multifrequency, Divided or Bridged -Loop or Ground Start
Prepay Coin Line	NT2T04 NT2T45	-Ground Start/Loop Start -Coin Control Voltage on Tip and Ring
Eight-Party Line	NT2T05 NT2T75	-Multifrequency, Bridged or Divided -Loop Start
Superimposed-Ringing Line (2 dB)	NT2T67	-Single-frequency, Superimposed Bridged or Divided -Loop Start
Multifrequency Ringing Two-Party Line (2 dB)	NT2T07	-Multifrequency, Bridged or Divided -Loop or Ground Start
Extended Range Two-Party Line (2 dB)	NT2T08	-Single-frequency, Bridged or Divided -Loop Start

Table 3-A: (Continued)
PE line pack signaling features

Pack Name	Pack Code	Characteristics
		-Detection of 4500 ohms, including 200 ohms for telephone set
Extended Range Eight-Party Line (2 dB)	NT2T09	-Multifrequency, Bridged or Divided -Loop Start -Detection of 4500 ohms, including 200 ohms for telephone set

Where two pack codes are listed for an entry, the first pack code refers to the 2-dB line pack and the second to the 0-dB line pack.

Table 3-B:
LCE line card signaling features

Features	ANI	Type A Line Card	Type B Line Card	
		NT6X17AC/ NT6X17BA	NT6X18AA/ NT6X18BA	NT6X18AB
Residential lines				
Single-Party:				
20 Hz, Bridged (or Ring to Ground)	N/A	X	X	X
MF Bridged (or Ring to Ground)	N/A	X	X	X
Two-Party:				
20 Hz Divided	Yes	-	X	X
MF Divided	Yes	-	X	X
MF Bridged	No	X	X	X
Four-Party:				
MF Bridged	No	X	X	X
MF Divided	Yes	-	X	X
20 Hz Divided, Coded (Semiselective)	No	-	X	X
20 Hz Bridged, Coded	No	-	X	X
20 Hz Superimposed, Divided (Fully Selective)	Yes	-	-	X
Eight-Party:				
20 Hz Divided	No	-	X	X
MF Divided	No	-	X	X
20 Hz Superimposed, Divided, Coded (Semiselective)	No	-	X	X

Table 3-B: (Continued)
LCE line card signaling features

Features	ANI	Type A Line Card	Type B Line Card	
		NT6X17AC/ NT6X17BA	NT6X18AA/ NT6X18BA	NT6X18AB
Coin lines				
Dial Tone, Coin First (Loop Start):				
Rotary Dial		X	X	X
Touch Tone, +48V on Ring Fraud Prevention		-	-	X
Touch Tone, Tip/Ring Revertive Fraud Prevention		-	X	X
Touch Tone, no Fraud Prevention		X	X	X
Prepay, Coin First (Ground Start):				
Rotary Dial		-	X	X
Touch Tone, +48V on Ring Fraud Prevention		-	-	X
Touch Tone, tip/Ring Revertive Fraud Prevention		-	X	X
Touch Tone, no Fraud Prevention		X	X	X
Semi-Postpay		X	X	X
PBX lines				
Loop Start		X	X	X
Ground Start		-	X	X
Toll Diversion		-	X	X
Hotel/Motel		-	X	X
WATS and TWX		X	X	X

The symbol X indicates that the feature is available.

Ringing capacity

The DMS-10 switch has two types of ringing plant: one for PE-based peripherals and one for LCM-based peripherals. The PE ringing plant has the ability to ring 30 lines (3 telephones per line, Ring Equivalency Number 3, in the ringing state) simultaneously on each of the two distribution buses to the PE. The LCM ringing plant (one ringing plant located in each LCM bay) enables 24 of the 1280 lines in an LCM bay to be rung simultaneously. At 5 ccs per line terminating ABSBH traffic level, the DMS-10 switch can provide ringing to more than 12000 lines with 50% standard PE-based lines. Since LCM bays each have dedicated ringing plants, there are, in effect, no limitations on total ringing capacity for LCM-based lines.

Table 3-C:
NT6X17 line card ringing codes

Party	Coded ringing	Multifrequency ringing	Superimposed ringing
1FR	None RNG TIP	None R1, R2 R3, R4	None R1, T1 RNG R3, T3 TIP
2FR	RNG TIP	R1, R2 R3, R4	R1, T1 RNG R3, T3 TIP
4FR	NA	R1, R2 R3, R4	R1, T1 R3, T3

Table 3-D:
NT6X18 line card ringing codes

Party	Coded ringing	Multifrequency ringing	Superimposed ringing
1FR	None RNG TIP R1 - R5 T1 - T5	None RNG, TIP R1 - R4 T1 - T4	None RNG, TIP R1 - R4 T1 - T4
2FR	RNG, TIP R1 - R5 T1 - T5	RNG, TIP R1 - R4 T1 - T4	RNG, TIP R1 - R4 T1 - T4
4FR	R1 - R5 T1 - T5	R1 - R4 T1 - T4	R1 - R4 T1 - T4
8FR	R1 - R5 T1 - T5	R1 - R4 T1 - T4	R1 - R4 T1 - T4
10FR	R1 - R5 T1 - T5	NA	NA

Table 3-E:
S221 line card ringing codes

Party	Coded ringing	Superimposed ringing
1FR	RNG, TIP R1 - R5 T1 - T5	RNG, TIP R1 - R4 T1 - T4
2FR	RNG, TIP R1 - R5 T1 - T5	RNG, TIP R1 - R4 T1 - T4
4FR	R1 - R5 T1 - T5	R1 - R4 T1 - T4
8FR	R1 - R5 T1 - T5	R1 - R4 T1 - T4
10FR	R1 - R5 T1 - T5	NA

Table 3-F:
RCU line pack services

Line Card Carrier Pack Code	Line Card Pack Code	Services
NT3A06A*x*	NT3A10A*x*	Single party
NT3A06A*x*	NT3A10H*x*	Single party
NT3A06B*x*	NT3A10A*x*	Single party
NT3A06B*x*	NT3A10H*x*	Single party, LPDS
NT3A07A*x*	NT3A10A*x*	Multi-party, ANI, MF
NT3A07A*x*	NT3A10H*x*	Multi-party, ANI, MF
NT3A07B*x*	NT3A10A*x*	Single party, MF
NT3A07B*x*	NT3A10H*x*	Single party, LPDS
NT3A19A*x*	NT3A10A*x*	Multi-party, ANI, CR
NT3A19A*x*	NT3A10H*x*	Multi-party, ANI, CR
NT3A27A*x*	NT3A27A*x*	COIN, LOOP/GND START
NT3A11A*x*	NT3A12A*x*	FXBS, Single party, LOOP/GND START, LPDS

Table 3-G:
Urban Common Equipment (UCE) ringing code assignment options for POTS - NT3A06A*x* (normal)

Party	Coded ringing	Multifrequency ringing	Superimposed ringing
1FR	None	None	None

Table 3-H:
Urban Common Equipment (UCE) ringing code assignment options for POTS - NT3A06B*x* / NT3A10H*x* (enhanced)

Party	Coded ringing	Multifrequency ringing	Superimposed ringing
1FR	None	None	None

Table 3-I:
Urban Common Equipment (UCE) ringing code assignment options for multi-frequency - NT3A07A*x* (normal)

Party	Coded ringing	Multifrequency ringing	Superimposed ringing
1FR	NA	None R1-R4	NA
2FR	NA	R1-R4	NA
4FR	NA	R1-R4	NA

Table 3-J:
Urban Common Equipment (UCE) ringing code assignment options for multi-frequency - NT3A07B*x* / NT3A10H*x* (enhanced)

Party	Coded ringing	Multifrequency ringing	Superimposed ringing
1FR	NA	None R1-R4	NA

Table 3-K:
Urban Common Equipment (UCE) ringing code assignment options for multi-party - NT3A19

Party	Coded ringing	Multifrequency ringing	Superimposed ringing
1FR	None RNG ANI TIP ANI R1-R5 ONI T1-T5 ONI	NA	None RNG TIP R1 T1
2FR	RNG ANI TIP ANI R1-R5 ONI T1-T5 ONI	NA	RNG TIP R1 T1
4FR	R1-R5 ONI T1-T5 ONI	NA	NA
8FR	R1-R5 ONI T1-T5 ONI	NA	NA
10FR	R1-R5 ONI T1-T5 ONI	NA	NA

Table 3-L:
Station digits for eight-party, semiselective lines

Code	Ringing Applied to	Digits to be Dialed
1	-Ring	2
1	-Tip	3
1	+Ring	4
1	+Tip	5
2	-Ring	6
2	-Tip	7
2	+Ring	8
2	+Tip	9

Table 3-M:
Ringing parameters for coded ringing

Ringing Code	Frequency (Hz)	DC Polarity	Side of Line Rung	Cadence Code
None	20	-	Ring	1
RNG	20	-	Ring	1
TIP	20	-	Tip	1
R1	20	-	Ring	1
T1	20	-	Tip	1

Table 3-M: (Continued)
Ringing parameters for coded ringing

Ringing Code	Frequency (Hz)	DC Polarity	Side of Line Rung	Cadence Code
R2	20	-	Ring	2
T2	20	-	Tip	2
R3	20	-	Ring	3
T3	20	-	Tip	3
R4	20	-	Ring	4
T4	20	-	Tip	4
R5	20	-	Ring	5
T5	20	-	Tip	5

Cadence Code: 1 (LCM, RCU, SLC) =1.5 s on
1 (PE) = 2 s on
2 (RCU, SLC) =1.5 s on, 0.5 s off, 1.5 s on
2 (LCM) = 1.5 s on, 1 s off, 1.5 s on
2 (PE) = 1.5 s on, 0.5 s off, 1.5 s on
3 (RCU, SLC) =1.5 s on, 0.5 s off, 0.5 s on
3 (LCM) =1.5 s on, 1 s off, 0.5 s on
3 (PE) =1.5 s on, 0.5 s off, 0.5 s on
4 (RCU, SLC) =1.5 s on, 0.5 s off, 0.5 s on, 0.5 s off, 0.5 s on
4 (LCM) =1.5 s on, 1 s off, 0.5 s on, 0.5 s off, 0.5 s on
4 (PE) =1.5 s on, 0.5 s off, 0.5 s on, 0.5 s off, 0.5 s on
5 (RCU, SLC) =1.5 s on, 0.5 s off, 0.5 s on, 0.5 s off, 1 s on
5 (LCM) =1 s on, 0.5 s off, 0.5 s on, 0.5 s off, 1 s on
5 (PE) = 1.5 s on, 0.5 s off, 0.5 s on, 0.5 s off, 1.5 s on

Cadence Code 1 stated values are ON time durations.

Normal ringing cycle duration is 6s, with an ON time duration deviation of +/- 20%.

Table 3-N:
Ringing parameters for multifrequency ringing

Ringing Code	Frequency (Hz)	DC Polarity	Side of Line Rung	Cadence Code
None	MF 1	-	Ring	1
RNG	MF 1	-	Ring	1
TIP	MF 1	-	Tip	1
R1	MF 1	-	Ring	1
T1	MF 1	-	Tip	1
R2	MF 2	-	Ring	1
T2	MF 2	-	Tip	1
R3	MF 3	-	Ring	1
T3	MF 3	-	Tip	1
R4	MF 4	-	Ring	1
T4	MF 4	-	Tip	1

Cadence Code: = 1.95s if the response to prompt MPRT in the CP prompting sequence of overlay CNFG is MFR1 (REA standard)

Cadence Code = 2s if the response to prompt MPRT in the CP prompting sequence of overlay CNFG is MFR2 (Bell standard)

Cadence Code 1 stated values are ON time durations.

Normal ringing cycle duration is 6s, with an ON time duration deviation of +/- 20%.

Table 3-O:
Ringing parameters for superimposed ringing

Ringing Code	Frequency (Hz)	DC Polarity	Side of Line Rung	Cadence Code
None	20	-	Ring	1
RNG	20	-	Ring	1
TIP	20	-	Tip	1
R1	20	-	Ring	1
T1	20	-	Tip	1
R2	20	+	Ring	1
T2	20	+	Tip	1
R3	20	-	Ring	2
T3	20	-	Tip	2
R4	20	+	Ring	2
T4	20	+	Tip	2

Cadence Code for PE lines: 1=2 s; 2=1.5 s on, 0.5 s off, 1.5 s on.
Cadence Code for LCE lines: 1=1.5 s; 2=0.5 s on, 1 s off, 0.5 s on.
Cadence Code for RCU: 1= 2 s.
Cadence Code for SLC: 1=2 s; 2=0.5 s on, 1 s off, 0.5 s on.

Cadence Code 1 stated values are ON time durations.

Normal ringing cycle duration is 6s, with an ON time duration deviation of +/- 20%.

Table 3-P:
Methods of revertive ringing (coded ringing)

Revertive Call		Method Specified			
		Both		Called	
		Ringing Applied to Line(s)			
From	To	Tip	Ring	Tip	Ring
T	R	Rev	Norm	None	Norm
R	T	Norm	Rev	Norm	None
T	T	Norm	Rev	Norm	None
R	R	Rev	Norm	None	Norm

Note: *T, tip side of line; R, ring side of line; Rev, revertive ringing (0.5-s burst of ringing); Norm, normal ringing (ringing code assigned to station); None, no ringing.*

Table 3-Q:
Standard interruption rates

Tone Interruption	Duty Cycle
Tone Interrupted at 60 ipm = Called Line Reached	500 ms on, 500 ms off
Tone Interrupted at 120 ipm = Switching Path Busy	200 ms on, 200 ms off
Tone Interrupted at 300 ipm	100 ms on, 100 ms off
Tone Interrupted at 10 ipm = Ringing Cadence	2 s on, 4 s off

Table 3-R:
Interdigit timing for dial pulse outpulsing

DC Signaling	Speed	Percent Break	Interdigit Timing	Pulses or Gaps
Dial Pulse Subscriber	10 pps (7.5 - 12 pps)	58%-70%	220 ms (Minimum)	6 - 8 ms Bridged
Dial Pulse Inpulsing, Trunk	7 - 13 pps	-	220 ms (Minimum)	6 - 8 ms Bridged
Dial Pulse Outpulsing, Trunk	10 $\pm$ 0.5 pps	58 $\pm$ 2 for E&M Pulse 63.5 $\pm$ 2 for Loop Pulse	300 to 900 ms (700 ms default)	Dial Pulse will not start in less than 700 ms after start dialing

Table 3-S:
North American Timed Base Tones

Base Tone	Frequency (Hz)	Power Level (dBm)	GTS Timing
MF Digit 0	1300/1500	-6	58 - 75 msec
MF Digit 1	700/900	-6	58 - 75 msec
MF Digit 2	700/1100	-6	58 - 75 msec
Coin Collect	700/1100	-6	480 - 700 msec
MF Digit 3	900/1100	-6	58 - 75 msec
MF Digit 4	700/1300	-6	58 - 75 msec
MF Digit 5	900/1300	-6	58 - 75 msec
MF Digit 6	1100/1300	-6	58 - 75 msec
MF Digit 7	700/1500	-6	58 - 75 msec
MF Digit 8	900/1500	-6	58 - 75 msec
Operator Released	900/1500	-6	480 - 700 msec
MF Digit 9	1100/1500	-6	58 - 75 msec
SP 1	900/1700	-6	480 - 700 msec
SP 2	1300/1700	-6	480 - 700 msec

Table 3-S: (Continued)
North American Timed Base Tones

Base Tone	Frequency (Hz)	Power Level (dBm)	GTS Timing
SP 3 (Ringback)	700/1700	-6	480 - 700 msec
KP (Coin Return)	1100/1700	-6	90 - 120 msec
STS (Coin Collect - Operator Released)	1500/1700	-6	58 - 75 msec
DTMF Digit 1	697/1209	-7	>50 msec
DTMF Digit 2	697/1336	-7	>50 msec
DTMF Digit 3	697/1477	-7	>50 msec
DTMF Digit 4	770/1209	-7	>50 msec
DTMF Digit 5	770/1336	-7	>50 msec
DTMF Digit 6	770/1477	-7	>50 msec
DTMF Digit 7	852/1209	-7	>50 msec
DTMF Digit 8	852/1336	-7	>50 msec
DTMF Digit 9	852/1477	-7	>50 msec
DTMF Digit *	941/1209	-7	>50 msec
DTMF Digit 0	941/1336	-7	>50 msec
DTMF Digit #	941/1477	-7	>50 msec
DTMF Digit A	697/1633	-7	>50 msec
DTMF Digit B	770/1633	-7	>50 msec
DTMF Digit C	852/1633	-7	>50 msec
DTMF Digit D	941/1633	-7	>50 msec

Power level is the combined level for tones with two or more frequencies.

Requirements defined in TR-506.

Table 3-T:
North American Untimed Base Tones

Base Tone	Frequency (Hz)	Power Level (dBm)
Howler Tone	1400/2060/2450/2600	+3 to -6 per frequency
Misc. Tone	440	-13
Dial Tone	350/440	-10
Low Tone	480/620	-21
High Tone	480	-17
Audible Ringback	440/480	-16
Test Tone	1004	0
Coin Tone A (u-law)	1700/2200	-28 - 0 dBm,
Coin Tone B (u-law)	1537/2200	-28 - 0 dBm,

Table 3-T: (Continued)
North American Untimed Base Tones

Base Tone	Frequency (Hz)	Power Level (dBm)
Quiet Tone u-Law	N/A	N/A
Interrupt Tone DTMF None MF None	N/A	N/A
Customer Alert Signal	2130/2750	-15 dBm'

Power level is the combined level for tones with two or more frequencies.

This specification is per frequency. It is not the combined level for tones with two or more frequencies.

Requirements defined in TR-506.

Requirements defined in TR-30-CORE.

Table 3-U:
North American Simple Tones

Tones	Untimed Base Tone	Frequency	Power Level (dBm)	High-Level Timeout
Dial Tone	Dial Tone	350/440	-10	30 sec
Class of Service High	High Tone	480	-17	768 msec
Class of Service Low	Low Tone	480/620	-21	768 msec
Continuous Ringback	Audible Ringback	440/480	-16	5 sec
Low Tone	Low Tone	480/620	-21	30 sec
High Tone	High Tone	480	-17	30 sec
Short Dial Tone	Dial Tone	350/440	-10	5 sec
5-second Test Tone	Test Tone	1004	0	5 sec
9-second Test Tone	Test Tone	1004	0	9 sec
Quiet Tone	Interrupt Tone	N/A	N/A	30 sec
1-second Quiet Tone	Interrupt Tone	N/A	N/A	1024 msec
Call Waiting	Misc. Tone	440	-13	512 msec
Continuous Ringback	Audible Ringback	440/480	-16	19.2 sec
SWT Tone	Misc. Tone	440	-13	384 msec
DWT Tone	Misc. Tone	440	-13	384 msec
CLID Tone	N/A	1200/2200	-13	19.2 sec'
Call Waiting - Caller ID QT Tone	Interrupt Tone	N/A	N/A	2176 msec
P-Phone Continuous Ringing	n/a (dnld)	516/649 alternating at 9 Hz (warble)	0	19.2 sec
P-Phone DTMF digit 1	n/a (dnld)	697/1209	-7	128 msec
P-Phone DTMF digit 2	n/a (dnld)	697/1336	-7	128 msec

Table 3-U: (Continued)
North American Simple Tones

Tones	Untimed Base Tone	Frequency	Power Level (dBm)	High-Level Timeout
P-Phone DTMF digit 3	n/a (dnld)	697/1477	-7	128 msec
P-Phone DTMF digit 4	n/a (dnld)	770/1209	-7	128 msec
P-Phone DTMF digit 5	n/a (dnld)	770/1336	-7	128 msec
P-Phone DTMF digit 6	n/a (dnld)	697/1477	-7	128 msec
P-Phone DTMF digit 7	n/a (dnld)	852/1209	-7	128 msec
P-Phone DTMF digit 8	n/a (dnld)	852/1336	-7	128 msec
P-Phone DTMF digit 9	n/a (dnld)	852/1477	-7	128 msec
P-Phone DTMF digit 0	n/a (dnld)	941/1336	-7	128 msec
P-Phone DTMF digit *	n/a (dnld)	941/1209	-7	128 msec
P-Phone DTMF digit #	n/a (dnld)	941/1477	-7	128 msec

Timing provided through high-level timing queues.

Timing provided through CR timing.

Power level is the combined level for tones with two or more frequencies.

Broadcast tones from GTS.

Timing provided through DR timing.

Requirements defined in TR-30-CORE.

Table 3-V:
North American Compound Tones

Tones	Component Tones	GTS Timing	Repeated?	High-Level Timeout
Ringback Tone	Ringback Tone Interrupt Tone	2 sec 4 sec	Yes	155 sec
Overflow Tone	Low Tone Interrupt Tone	.25 sec .25 sec	Yes	30 sec
Howler Tone	Howler Tone Interrupt Tone	.1 sec .1 sec	Yes	30 sec
Busy Tone	Low Tone Interrupt Tone	.5 sec .5 sec	Yes	30 sec
Short Howler Tone	Howler Tone Interrupt Tone	.1 sec .1 sec	Yes	5 sec
Short Busy Tone	Low Tone Interrupt Tone	.5 sec .5 sec	Yes	5 sec
Short Overflow Tone	Low Tone Interrupt Tone	.25 sec .25 sec	Yes	5 sec
Short Ringback	Audible Ringback Interrupt Tone Audible Ringback Interrupt Tone	.5 sec .5 sec .5 sec Forever	No	5 sec

Table 3-V: (Continued)
North American Compound Tones

Tones	Component Tones	GTS Timing	Repeated?	High-Level Timeout
Ringback 2	Audible Ringback Interrupt Tone Audible Ringback Interrupt Tone Interrupt Tone	1 sec 1 sec 1 sec 1 sec 2 sec	Yes	80 sec
Special Dial Tone	Dial Tone Interrupt Tone Dial Tone Interrupt Tone Dial Tone	128 msec 128 msec 128 msec 128 msec Forever	No	31 sec
Confirmation Tone	Dial Tone Interrupt Tone Dial Tone Interrupt Tone	128 msec 128 msec 384 msec Forever	No	1792 msec
1 Blip Tone	High Tone Interrupt Tone	128 msec Forever	No	256 msec
2 Blip Tone	High Tone Interrupt Tone High Tone Interrupt Tone	128 msec 128 msec 128 msec Forever	No	512 msec
3 Blip Tone	High Tone Interrupt Tone High Tone Interrupt Tone High Tone Interrupt Tone	128 msec 128 msec 128 msec 128 msec 128 msec Forever	No	768 msec
ESB Overflow Tone	Low Tone Interrupt Tone	.25 sec .25 sec	Yes	128 - 4096 msec or 1 - 155 sec
SROH Tone	Howler Tone Interrupt Tone	.1 sec .1 sec	Yes	6 sec
Continuous Busy Tone	Low Tone Interrupt Tone	.5 sec .5 sec	Yes	19.2 sec
Trunk Ringback	Ringback Tone Interrupt Tone	2 sec 4 sec	Yes	9 sec
DROH Tone	Howler Tone Interrupt Tone	.1 sec .1 sec	Yes	6 sec

Table 3-V: (Continued)
North American Compound Tones

Tones	Component Tones	GTS Timing	Repeated?	High-Level Timeout
Barge-in Tone	Misc. Tone Interrupt Tone Misc. Tone Interrupt Tone Misc. Tone Interrupt Tone	.1 sec .1 sec .1 sec .1 sec .1 sec Forever	No	768 msec
Stutter Dial Tone	Dial Tone Interrupt Tone	128 msec 128 msec	Yes	30 sec
Nickel Tone	Coin Tone A Coin Quiet Tone or Coin Tone B Coin Quiet Tone	35 - 160 msec > 160 msec 35 - 160 msec > 160 msec	No	Timing for coin tones is described in TR-528.
Dime Tone	Coin Tone A Coin Quiet Tone Coin Tone A Coin Quiet Tone or Coin Tone B Coin Quiet Tone Coin Tone B Coin Quiet Tone	35 - 160 msec 25 - 160 msec 35 - 160 msec > 60 msec 35 - 160 msec 25 - 160 msec 35 - 160 msec > 60 msec	No	Timing for coin tones is described in TR-528.
Quarter Tone	Coin Tone A Coin Quiet Tone Coin Tone A Coin Quiet Tone Coin Tone A Coin Quiet Tone Coin Tone A Coin Quiet Tone Coin Tone A Coin Quiet Tone or Coin Tone B Coin Quiet Tone Coin Tone B Coin Quiet Tone Coin Tone B Coin Quiet Tone Coin Tone B Coin Quiet Tone Coin Tone B Coin Quiet Tone	20 - 100 msec 20 - 110 msec 20 - 60 msec 20 - 60 msec 20 - 60 msec 20 - 60 msec 20 - 60 msec 20 - 60 msec 20 - 100 msec > 60 msec 20 - 100 msec 20 - 110 msec 20 - 60 msec 20 - 60 msec 20 - 60 msec 20 - 60 msec 20 - 60 msec 20 - 60 msec 20 - 100 msec > 60 msec	No	Timing for coin tones is described in TR-528.

Table 3-V: (Continued)
North American Compound Tones

Tones	Component Tones	GTS Timing	Repeated?	High-Level Timeout
Dollar Tone	Coin Tone A Coin Quiet Tone Coin Tone B Coin Quiet Tone	600 - 700 msec >60 msec 600 - 700 msec >60 msec	No	Timing for coin tones is described in TR-528.
Distinctive CWT Tone followed by CAS Tone	Misc Tone DTMF None Misc Tone CAS Tone DTMF None	336 - 344 msec 304 - 312 msec 336 - 344 msec 80 - 88 msec Forever	No	1408 msec
CWT Tone followed by CAS Tone	Misc Tone CAS Tone DTMF None	336 - 344 msec 80 - 88 msec Forever	No	768 msec
Delayed Dial Tone	Interrupt Tone Dial Tone	256 msec Forever	No	30 sec
P-Phone Normal Ringing	P-Phone Cont. Ringing Interrupt Tone Interrupt Tone	2 sec 2 sec 2 sec	Yes	19.2 sec
P-Phone Distinctive Ringing	P-Phone Cont. Ringing Interrupt Tone P-Phone Cont. Ringing Interrupt Tone Interrupt Tone Interrupt Tone	.5 sec .5 sec .5 sec .5 sec 2 sec 2 sec	Yes	19.2 sec
Teen Distinctive CWT Tone	Misc Tone Interrupt Tone Misc Tone Interrupt Tone	.1 sec .1 sec .1 sec Forever	No	512 msec
Teen 2 Distinctive CWT Tone	Misc Tone Interrupt Tone Misc Tone Interrupt Tone Misc Tone Interrupt Tone	.1 sec .1 sec .1 sec .1 sec .1 sec Forever	No	768 msec
SDR Distinctive CWT Tone	Misc Tone Interrupt Tone Misc Tone Interrupt Tone Misc Tone Interrupt Tone	.1 sec .1 sec 304 msec .1 sec .1 sec Forever	No	896 msec

Table 3-V: (Continued)
North American Compound Tones

Tones	Component Tones	GTS Timing	Repeated?	High-Level Timeout
Teen Distinctive CWID Tone	Misc Tone Interrupt Tone Misc Tone CAS Tone DTMF None	.1 sec .1 sec .1 sec 80 - 88 msec Forever	No	768 msec
Teen 2 Distinctive CWID Tone	Misc Tone Interrupt Tone Misc Tone Interrupt Tone Misc Tone CAS Tone DTMF None	.1 sec .1 sec .1 sec .1 sec .1 sec 80 - 88 msec Forever	No	1024 msec
SDR Distinctive CWID Tone	Misc Tone Interrupt Tone Misc Tone Interrupt Tone Misc Tone CAS Tone DTMF None	.1 sec .1 sec 304 msec .1 sec .1 sec 80 - 88 msec Forever	No	1152 msec
CWID CPE Alert Signal	n/a (dnld) 400 2130/2750	 300 msec 80-85 msec	No	9728 msec or CLID done event from GTS

Timing provided through high-level timing queues.

Configurable timing provided through CR timing.

Timing provided through CR timing.

Timing for Coin tones is described in TR-528.

Table 3-W:
Detection Parameters for Tones

Parameter	Dual-Tone Multifrequency		Multifrequency	
	Accepted	Rejected	Accepted	Rejected
Frequency Deviation	< 1.5%	> 3.5%	< 1.5% +5 Hz	-
Maximum Power (dBm)	0	0	0	0
Minimum Power (dBm)	-25	-25	-25	-25
Maximum Twist (dB)	+4/-8	+4/-8	6	6
Duration, Signal On (ms)	≥ 36	< 24	≥ 24	< 24
Duration, Signal Off (ms)	≥ 36	≤ 12	≥ 24	< 24
Signal On + Signal Off (ms)	≥ 84	< 84	≥ 96	< 96

Table 3-W: (Continued)
Detection Parameters for Tones

Parameter	Dual-Tone Multifrequency		Multifrequency	
	Accepted	**Rejected**	**Accepted**	**Rejected**
Special Signal, On (ms)	-	-	KP ≥ 48	KP < 48
Special Signal, Off (ms)	-	-	-	-

Table 3-X:
Frequency groups for multifrequency ringing

Decimonic	20 Hz	30 Hz	40 Hz	50 Hz	60 Hz
Harmonic	16 2/3 Hz	25 Hz	33 1/3 Hz	50 Hz	66 2/3 Hz
Synchromonic	20 Hz	30 Hz	42 Hz	54 Hz	66 Hz

Table 3-Y:
Digitone frequencies

Low-Frequency Group (Hz)	High-Frequency Group (Hz)			
	1209	1336	1477	1633
697	1	2	3	-
770	4	5	6	-
852	7	8	9	-
941	*	0	#	-

Section 4: Transmission parameters

Table 4-A:
Distortion limits

Parameter	Distortion Limit
Propagation Delay (1800 Hz) Distortion	1000 µs
Envelope Delay Distortion	
1,004 - 2,500 Hz	190 µs
1,004 - 2,600 Hz	250 µs
800 - 2,700 Hz	350 µs
600 - 3,000 Hz	500 µs
400 - 3,200 Hz	700 µs
Intermodulation Distortion	
Second Nonlinearity Order	≥ - 42 dB
Third Nonlinearity Order	≥ - 45 dB
Quantizing Distortion	
0 to - 30 dBm0	≥ - 33 dB
- 30 to - 40 dBm0	≥ - 27 dB
- 40 to - 45 dBm0	≥ - 22 dB
Phase Jitter	
Peak-to-Peak at 1004 Hz	≤ 2°

Assumes a 95% worst-case envelope delay distortion.

Measured in accordance with the four-tone method.

Assumes a sine wave signal of 1004 Hz applied to input.

Table 4-B: **Longitudinal balance limits (equipment in talking state)**	
Test Frequency (Hz)	**Balance Loss (dB)**
PE Lines and Trunks	
60	60
180	60
300	60
540	60
1004	60
2000	60
3000	60
3400	50
LCE Lines	
204	58
504	58
1004	58
3004	53

Table 4-C: **Return loss**	
Loss Parameter	**Return Loss**
Echo Return Loss	
Line Circuit (measured under normal talking conditions with 600 or 900 ohms and 2.16 μF in series)	≥ 24 dB
Two-Wire Trunk Circuit (measured under normal talking conditions with 600 or 900 ohms and 2.16 μF in series)	≥ 24 dB
Four-Wire Trunk Circuit (measured over 200-3400 Hz with 600 or 900 Ω)	≥ 20 dB
Four-Wire Trunk Circuit (trunk to line and trunk to two-wire connection)	≥ 27 dB
Singing Return Loss	
Line Circuit (measured under normal talking conditions with 600 or 900 ohms and 2.16 μF in series)	≥ 15 dB
Two-Wire Trunk Circuit(measured under normal talking conditions with 600 or 900 ohms and 2.16 μF in series)	≥ 15 dB
Four-Wire Trunk Circuit (measured over 200-3400 Hz with 600 or 900 Ω)	≥ 20 dB
Four-Wire Trunk Circuit (trunk to line and trunk to two-wire connection)	≥ 18 dB

Weighted average of the return losses for all frequencies in the echo range (500-2500 Hz)

Weighted average of the return losses in the singing bands (200-500 Hz and 2500-3400 Hz), measured as the lower of the two values (low or high band).

Table 4-D: **Discrimination limits for out-of-band signals**	
Input	**In-Band Signal at Output (dB)**
Line Circuit	≤ - 25
Trunk Circuit	≤ - 28

Table 4-E: **Limits for out-of-band signals at output**	
Input	**In-Band Signal at Output (dBm0)**
Line Circuit	≤ - 25
Trunk Circuit	≤ - 28

Table 4-F: **Inband attenuation distortion for 95% connections**	
Frequency of Input Signal for Specified Connection	**Output Signal Limits (dB)**
Frequency = 200 Hz	
Line to Line, PE (0 dB or 2 dB) to PE (0 dB or 2 dB)	-3.5 to +0.5
Line to Line, PE (0 dB or 2 dB) to LCE	-3.75 to +0.25
Line to Line, LCE to LCE	-4 to 0
Line to Trunk	-5 to 0
Trunk to Trunk	-2.5 to +0.3
Four-Wire Analog to Four-Wire Digital	-1.5 to +0.15
Frequency = 300 Hz	
Line to Line, PE (0 dB or 2dB) to PE (0 dB or 2 dB)	-2 to +0.5
Line to Line, PE (0 dB or 2 dB) to LCE	-1.75 to +0.5
Line to Line, LCE to LCE	-1.5 to +0.5
Line to Trunk	-1.5 to +0.5
Trunk to Trunk	-1.3 to +0.3
Four-Wire Analog to Four-Wire Digital	-0.65 to +0.15
Frequency = 2400 Hz	
Line to Line (Type 1 or 2 to Type 1 or 2)	-1 to +1
Line to Line (Type 1 or 2 to Type 3)	-1 to +1
Line to Line (Type 3 to Type 3)	-1 to +0.5
Line to Trunk	-1 to +0.5
Trunk to Trunk	-0.5 to +0.5
Four-Wire Analog to Four-Wire Digital	- 0.25 to +0.25

Table 4-F: (Continued) **Inband attenuation distortion for 95% connections**	
Frequency of Input Signal for Specified Connection	**Output Signal Limits (dB)**
Frequency = 3000 Hz	
Line to Line, PE (0 dB or 2dB) to PE (0 dB or 2 dB)	-1.5 to +1
Line to Line, PE (0 dB or 2dB) to LCE	-1.5 to +1
Line to Line, LCE to LCE	-1 to +0.5
Line to Trunk	-1 to +0.5
Trunk to Trunk	-0.5 to +0.5
Four-Wire Analog to Four-Wire Digital	-0.25 to +0.25
Frequency = 3200 Hz	
Line to Line, PE (0 dB or 2dB) to PE (0 dB or 2 dB)	-2.5 to +1
Line to Line, PE (0 dB or 2dB) to LCE	-2.5 to +1
Line to Line, LCE to LCE	-3 to +0.5
Line to Trunk	-1.5 to +0.4
Trunk to Trunk	-1.5 to +0.5
Four-Wire Analog to Four-Wire Digital	-0.75 to +0.25
Frequency = 3400 Hz	
Line to Line, PE (0 dB or 2dB) to PE (0 dB or 2 dB)	-3.5 to 0
Line to Line, (Type 1 or 2 to Type 3)	-3.75 to +0.25
Line to Line, LCE to LCE	-4 to 0
Line to Trunk	-3 to 0
Trunk to Trunk	-2.5 to 0
Four-Wire Analog to Four-Wire Digital	-1.25 to 0

Referenced to 0 dBm0.

Referenced to 1004-Hz output.

Type 1 line is a 2-dB PE line, Type 2 is a 0-dB PE line, and Type 3 is an LCE line.

Section 5: Reliability

Introduction

The following information describes reliability predictions for DMS-10 hardware components based on rigorous testing. Reliability information for remote equipment (such as RLCMs and OPMs) and remote servicing equipment (such as REMs, SCMs, SCM-10Ss, and SCM-10Us) can be found in this NTP in the section entitled "Remote equipment and remote servicing equipment parameters."

Table 5-A:
Hardware reliability for a system configured with 160 peripheral loops

Parameter	Reliability Factor
System	
Downtime (min/yr) 500-Series CPU system (NT3T98)	0.20
MTBF (yr) 500-Series CPU system (NT3T98)	127
Individual Line (PE)	
Downtime (min/yr)	9
MTBF(yr)	20
Individual Line (LCM)	
Downtime (min/yr)	6.4
MTBF (yr)	28.1
Individual Analog Trunk	
Downtime (min/yr)	9
MTBF (yr)	20.4
Individual Digital Trunk	
Downtime (min/yr)	17.7
MTBF (yr)	10.2
Probability of Cutoff Calls	
Line to Line (PE)	0.13×10^{-5}
Line to Line (LCM)	0.04×10^{-5}
Trunk to Trunk (Analog)	0.58×10^{-5}
Trunk to Trunk (Digital)	0.65×10^{-5}

Table 5-B:
System failure modes for a system configured with two network modules

Parameter	MTBF (yr)	Downtime (min/yr)	Service Impact
System Failure 500 CPU system	127	0.20	System is down, MTTR of 4 hours is assumed (unmanned sites)

MTBF, Mean Time Between Failures.

MTTR, Mean Time to Repair.

Table 5-C:
Network service-affecting failure rates

Parameter	MTBF (yr)	Downtime (min/yr)	Service Impact
Network Shelf (40 Ports)	118	1.02	Reduction in maximum Network capacity.
Network Interface (8 Loops)	100	1.2	Reduction in maximum capacity on eight loops.

MTBF, Mean Time Between Failures.

Table 5-D:
Peripheral shelf reliability

Parameter	MTBF (yr)	Downtime (min/yr)	Service Impact
DCM interface (24 digital trunks)	8.8	20.45	Loss of 24 trunks alternate routes available.
PE Shelf (13 analog trunks)	34.8	5.17	Loss of service on 13 trunks alternates available.
Analog Trunk	14.9	12.1	Individual trunk down alternate routes are available.
Individual Line	26	6.9	Subscriber line down.

MTBF, Mean Time Between Failures.

Table 5-E:
LCM reliability

Parameter	Reliability Estimates
Mean Time to Mate LCA Takeover (yr)	7.6
Mean Time to Two LCAs (one LCM) Down with Loss of 640 Lines (yr)	6780

Table 5-F:
DSI Trunking Module reliability (J0T80A-2 shelf)

State Descriptor	Duplex System Downtime (min/yr)	Simplex System Downtime (min/yr)
MLI - active side fault	0.02	NA
MLI - failure	0.24	6.12
DSI - active side fault	0.02	NA
DSI - failure	3.1	4.91
Switching outage during SWACT	2.54	NA
Total down time (48 trunks)	5.88	11.03

Table 5-G:
DSI Remote Module reliability (J0T80A-2 shelf)

State Descriptor	J1T80A-1 Shelf Downtime (min/yr)	J1T80A-2 Shelf Downtime (min/yr)
D3A - failure	6.02	6.02
DSI in SRI mode - failure	7.22	4.91
Total down time (48 channels)	13.24	10.93

Table 5-H:
Enhanced Subscriber Carrier Module Access (ESMA) shelf (NTMX8504) reliability

Parameter	Target MTBF (yr)	Predicted MTBF (yr)	Downtime (min/yr)
Any failure of equipment in shelf	1.5	1.87	96.26
Loss of all traffic through shelf	1440	2712	0.07
Loss of all traffic between any particular DS-1 and DMS-10 switch	144	186	0.97

MTBF, Mean Time Between Failures.

Table 5-I:
Nominal failure rates for printed circuit packs

Pack Number	Pack Name	MTBF (yr)
NT2T00	Single-Party Line	21
NT2T01	Two-Party Line	24
NT2T02	Four-Party ANI Line	21
NT2T03	Miscellaneous Line	33
NT2T04	Prepay Coin Line	27

Table 5-I: (Continued)
Nominal failure rates for printed circuit packs

Pack Number	Pack Name	MTBF (yr)
NT2T05	Eight-Party Line	20
NT2T07	Multifrequency-Ringing Two-Party Line	17
NT2T08	Extended-Range Two-Party Line	20
NT2T09	Extended-Range Eight-Party Line	21
NT2T10	Multifrequency Receiver	3
NT2T11	Digitone Receiver	16
NT2T12	Peripheral Control 1	35
NT2T13	Peripheral Control 2	50
NT2T14	Peripheral Maintenance Access	151
NT2T16	Incoming Test Trunk	39
NT2T17	Noller Test Trunk	65
NT2T19	Line and Trunk Test	20
NT2T20	Four-Wire E&M Trunk	37
NT2T21	Two-Wire E&M Trunk	38
NT2T23	Miscellaneous Loop Trunk	31
NT2T24	Outgoing Loop Trunk	30
NT2T26	Circuit Breaker	417
NT2T27	Four-Wire E&M Trunk with Pad Switching	35
NT2T30	Network Interface	71
NT2T31	Signaling Converter	72
NT2T32	Carrier Interface	108
NT2T33	Six-Loop Terminator	833
NT2T34	Network Buffer	75
NT2T35	Message Converter	77
NT2T36	Signaling Buffer	17
NT2T37	Remote Network	71
NT2T38	Remote Message	72
NT2T39	Remote Signaling	82
NT2T40	Auxiliary Ringing and Tone	75
NT2T41	Peripheral Shelf Controller	29
NT2T42	Peripheral Shelf Converter	36
NT2T43	0-dB General Line	17
NT2T44	0-dB Miscellaneous Line	25
NT2T45	0-dB Prepay Line	24
NT2T46	Peripheral Processor	23
NT2T47	Remote Alarm	151

Table 5-I: (Continued)
Nominal failure rates for printed circuit packs

Pack Number	Pack Name	MTBF (yr)
NT2T48	CAMA Position Signaling Circuit	33
NT2T50	Time Switch	49
NT2T51	System Processor	31
NT2T52	B-Word Processor	39
NT2T53	A-Bit Processor	41
NT2T54	Digroup	83
NT2T55	1-for-N Protection Switch	87
NT2T56	Protection Switch Fail-safe	54
NT2T67	0-dB Superimposed Ringing Line	17
NT2T69	0-dB Single Party Line	30
NT2T70	Peripheral Maintenance Processor	30
NT2T71	Peripheral Circuit Test	35
NT2T72	Facility Test	29
NT2T73	Signaling Processor	39
NT2T74	Control Processor	34
NT2T75	0-dB Eight-Party Line	56
NT2T85	Digital Recorded Announcement	15
NT2X06	Common Feature Power Converter	56
NT2X09	Multi-Output Power Converter	35
NT2X10	LTU Analog	49
NT2X11	LTU Digital	119
NT2X48	Digital 4-Channel Digitone Receiver	19
NT2X57	Miscellaneous Signal Distribution	46
NT2X59	Codec and Tone	102
NT2X70	Power Converter	167
NT2X90	Incoming/Outgoing Test Trunk	28
NT3T09	Serial Data Interface	90
NT3T10	Magnetic Tape Controller	33
NT3T11	Magnetic Tape Cable Interface	85
NT3T19	5/12 V Converter	49
NT3T25	Ringing Generator	96
NT3T27	Ringing Monitor	22
NT3T30	Fuse Alarm	2083
NT3T34	Control Bus Terminator, Type 1	555
NT3T47	Synchronous Clock	47
NT3T50	Data Link Controller	78

Table 5-I: (Continued)
Nominal failure rates for printed circuit packs

Pack Number	Pack Name	MTBF (yr)
NT3T51	Disk Drive	28
NT3T53	Alarm Processor	44
NT3T54	Alarm Signal Distributor	63
NT3T55	Alarm and Ringing Control	44
NT3T59	Dual Ringing Generator	70
NT3T70BC	System Bus Controller	185
NT3T71	Maintenance Interface	68
NT3T72AE	I/O Bus Extender	97
NT3T80	Dual SDI	48
NT3T81	Bay Power / Alarm	833
NT3T87	Input/Output Interface [IOI] Terminator; Input/Output Interface [IOI] Paddleboard	8330
NT3T88	Input/Output Interface paddleboard	2777
NT3T89	Power Converter	219
NT3T90BE	IOI Interface	29
NT3T93	Dual Integrated Modem	78
NT3T98	500-Series CPU	127
NT3X09	Metallic Test Access	64
NT4T00	Bus Terminator, Type 7	397
NT4T01	Tone & Digit Sender	37
NT4T02	Universal Tone Receiver	68
NT4T03AC	Conference	71
NT4T04	DS-30A Interface	12
NT4T05AA	Multiplex Loop Interface	7
NT4T05AE	Multiplex Loop Interface	113
NT4T06AA	Network	19
NT4T07BA	Bus Terminator, Type 8	1388
NT4T09	Subscriber Remote Interface	24
NT4T16	LAN/CPU Interface	54
NT4T18	LAN Shelf Controller	66
NT4T19	LAN Shelf Controller (LSC) paddleboard	56
NT4T20	LAN Application Controller	35
NT4T24	Span Interface Controller	93
NT4T31	Hard Disk Drive	7
NT4T32	Tape Drive Unit Pack	2
NT4T50AA	CALEA Dialed Digit Extraction (DDE) Interface	280

Table 5-I: (Continued)
Nominal failure rates for printed circuit packs

Pack Number	Pack Name	MTBF (yr)
NT6X17	Line Card, Type A	113
NT6X17BA	World Line Card, Type A	1388
NT6X18	Line Card, Type B	139
NT6X18BA	World Line Card, Type B	1190
NT6X21AA	P-phone Line Card	76
NT6X21AB	P-phone Line Card	119
NT6X21AC	P-phone Line Card	104
NT6X27BB	Ringing Generator	126
NT6X30	Ringing Generator	28
NT6X41	Speech Bus Formatter	30
NT6X42	Channel Supervision Message	26
NT6X43	Message Interface	32
NT6X44	Time Switch	46
NT6X45	Signaling Processor	76
NT6X46	Signaling Processor Memory	69
NT6X47	Master Processor Memory	49
NT6X50AB	DS-1 Interface	33
NT6X51	LCM Processor	29
NT6X52	Digroup Controller	38
NT6X53	LCM Power Converter	119
NT6X54AA	Bus Interface Circuit	52
NT6X54DA	ISDN Drawer Controller	52
NT6X60	Ringing Generator	63
NT6X69	Message Interface and Tone	44
NT6X71AA	Data Line Card	69
NT6X71AB	Data Line Card	60
NT6X71BA	Data Line Card	189
NT6X73	Link Control Card	44
NT6X74	RMM Control	31
NT6X75	Emergency Stand-Alone (ESA) Clock/Tone	60
NT6X78	CLASS Modem Resource	69
NT6X80	Ring/Pad	66
NT6X85	DS-1 Interface	24
NT6X86	A/B Derived Data Link	31
NT6X92	Universal Tone Receiver	90
NT6X99	Integrated Bit Error Rate Tester	60

Table 5-I: (Continued)
Nominal failure rates for printed circuit packs

Pack Number	Pack Name	MTBF (yr)
NT7X05	Flash Memory	51
NT8T04AA	DS30A/MLI Interface	96
NT8T06AA	Network Pack	139
NT8T90	SCSI Bus I/O and Disk Drive Pack	73
NT8X02	Battery Charge Controller	49
NT8X18	DS-30A Peripheral Interface	93
NT9Y00	OPSM Cabinet Controller	19
NT9Y12	Switching Matrix	15
NT9Y13	Remote Maintenance	14
NT9Y14	Processor	17
NT9Y16	RSLE Matrix	22
NT9Y17	RSLE Dual Host Interface and Clock	11
NT9Y18	RSLE Tones	30
NT9Y19	RSLE Emergency Stand-Alone	10
NT9Y20	RSLE Dual Host Interface	19
NT9Y22	RSLE Processor	18
NTAX74	Cellular Application Processor	46
NTBX01	Enhanced ISDN Processor	12
NTBX02	Enhanced D-channel Handler	25
NTBX27	2B1Q U-Interface ISDN line card	245
NTBX71	Point-of-Use Power Supply	167
NTMX72	Power Converter	151
NTMX73	PCM Signaling	30
NTMX74	DS-30A Interface	66
NTMX75	Time Switch	31
NTMX76	CSM and Messaging	25
NTMX77	Unified Processor	21
NTMX79	DS-60 Extension	45
NTMX81	Dual DS-1 Interface	160
NTMX87	PCM Quad Carrier	2777
NTTR60	6X60 Ringing Generator	761
NTTR73	Universal Maintenance Pack	138
NTTR77	Remote Controller Pack	154
NTTR87	Quad Carrier Pack	7605

MTBF, Mean Time Between Failures.

Based on head motion.

Section 6: Remote equipment and remote servicing equipment parameters

Introduction

This section provides parameters for selected LCE-based remote equipment and remote servicing equipment (such as the REM, SCM, and SCM-10S) in the DMS-10 system.

Remote Equipment Module

The following parameters apply to the Remote Equipment Module (REM), which is configured in Peripheral Equipment (PE). The REM consists of an Office Carrier Module (OCM) at the host DMS-10 switch and a Remote Carrier Module (RCM) at the remote end.

OCM parameters

The parameters provided below cover OCM limitations of carrier distance and error rate and loss.

Maximum carrier distance, Message distance. The message error correction system limits one-way delay on the carrier system to a maximum of 600 μs. This corresponds with a nominal carrier length of approximately 70 mi (112 km). As long as each of the two carrier lines in a basic REM system does not exceed this limit, there are no limitations to the difference in length between the two carrier lines.

Maximum carrier distance, Speech distance. The recommended listener-echo (near-singing) impairment limits the maximum carrier distance to approximately 40 mi (64 km).

Error rate and loss. When a carrier line has an error rate of 10-4 (worse than average), approximately 1 carrier message in 100 will be repeated. With this error rate, the system will mishandle approximately 1 call in 50,000 (0.002%) due to carrier errors.

Jitter

Received filter. On the received DS-1 signal, 32 bits of peak-to-peak jitter is possible at the remote end and 64 bits peak-to-peak jitter is possible at the local end without causing more than one initial frame slip to align the system.

Transmitted filter. A maximum of 30 ns of peak-to-peak jitter is imposed on the transmitted DS-1 signal by the 2.048/1.544 MHz clock conversion circuit.

Delay characteristics

Signaling delay. The maximum signaling message delay between local and remote network loops is 3.5 ms in each direction, assuming the following conditions:

- no messages are waiting in local or remote REM circuits
- maximum carrier delay (600 μs) occurs

Each time a signaling message from the carrier is received incorrectly and retransmitted, an additional 3 ms is added to the message delay.

Speech delay. Speech delay between local and remote loops in each direction is a maximum 170 μs plus carrier delay.

Zero code suppression

The lowest possible speech sample, or an idle channel, normally would contain all zeros. Zero code suppression is applied to the transmitted carrier signal to alleviate problems caused by a series of zeros. During zero code suppression, the seventh bit in an eight-bit word (00000000) is suppressed and a one is inserted (00000010).

Quantizing distortion

The quantizing distortion for calls on the REM is increased by approximately 2 dB because of the use of A and B bits.

Cable equalization

The 1.544 Mb/s line side can accommodate a maximum of 750 ft (228.6 m) of ABAM cabling (22 gauge) to a standard DS-1 type office repeater bay.

Three types of line equalizers are provided as part of the interface to accommodate the various cable lengths used. These lengths are shown in Table 6-A.

The appropriate equalizer is selected by manual operation of the DIP switches on the Carrier Interface pack (NT2T32). For the proper switch settings, refer to the NTP entitled *DIP Switch Settings for Printed Circuit Packs and Balance Networks* (297-3601-316).

Table 6-A: REM cable equalization range	
Distance	**Equalizer Type**
0 - 150 ft (45.7 m)	1
151 - 450 ft (137.2 m)	2
451 - 750 ft (228.6 m)	3

Power requirements

Assuming that the office supply voltage can vary between -43 and -52 V, the values given in Table 6-B show the maximum estimated current drain from the office supply for the different parts of a REM.

Table 6-B: REM power requirements	
REM Configuration	**Requirement**
Fully Equipped Local OCM Shelf	4.5 A
Fully Equipped Remote RCM Shelf	4.5 A
Fully Equipped Ringing Shelf	1.8 A
Each Fully Equipped PE Shelf	1.8 A

Subscriber Carrier Module

The following parameters apply to the Subscriber Carrier Module (SCM). The SCM is housed in a PE bay and provides a digital interface between a DMS-10 switch and the Remote Concentrating Terminal (RCT) of a DMS-1.

SCM/DMS-1 interface

To insure proper operation, the SCM output leading to the T-1 line must follow the T-1 line specifications. The line return to the SCM must meet the criteria listed in Table 6-C.

Reframe time

The maximum reframe time is less than 50 ms. This is the average time to reframe when the maximum number of bit positions must be examined for the framing pattern.

Delay

The maximum round trip digital delay from output to multiplex loop input through the SCM and the RCT is 2.0 ms.

Table 6-C: **Line return input to SCM**	
Parameter	**Value**
Line Rate	1.544 Mb/s (plus or minus 150 bits/s)
Line Code	Bipolar
Amplitude	1.5 to 3 V (peak)
Line Impedance	100 Ω at 772 kHz
Jitter	200 ns RMS max. (digroup failure threshold)
Signal-to-Noise Ratio	12 dB min.

The maximum allowable distance between an SCM and its RCT depends on the number of RCTs in the system. Intermediate power points are required beyond 25 miles on 22-gauge cable. Table 6-D provides figures for SCM to RCT distances.

Table 6-D: **Maximum SCM to RCT distances**	
RCTs	**Distance**
1	40 Miles (64 km)
2	35 Miles (56 km)
3	30 Miles (48 km)
4	25 Miles (40 km)

Tables 6-E through 6-F provide SCM operational requirements.

Table 6-E: **SCM environmental parameters**	
Parameter	**Limits**
Operating Temperature	32° F to 122° F (0° C to 50° C)
Storage Temperature	-58° F to 140° F (-50° C to +60° C)
Relative Humidity	20 to 55% at 95° F (35° C)
Maximum Transport Vibration	3.5 g
Maximum Operation Vibration	0.5 g

Table 6-F: **SCM power requirements**	
Power	**Requirement**
Minimum Voltage	-44 V dc
Nominal Voltage	-50 V dc
Maximum Voltage	-56 V dc
Maximum Battery Noise	-56 dBrnC or 300 mV (Single Tone)

Table 6-F: (Continued) **SCM power requirements**	
Power	**Requirement**
Battery Step	2 V
Maximum Change Rate	0.1 V per µs
Maximum Equipment Noise Output to Battery	22 dBrnC on 180 AH Battery
Ground Potential Variation Without Compensation	10 V

Outside Plant Module (OPM)

The OPM is a containerized version of the RLCM. OPM environmental parameters are given in Table 6-G.

Table 6-G: **OPM environmental parameters**	
Parameter	**Limits**
Continuous Ambient Air Temperature (Including Sun Load)	-40° F to 113° F (-40° C to 45° C)
Short Term Ambient Air Temperature (Including Sun Load)	-58° F to 122° F (-50° C to 50° C)
Shipping and Storage Ambient Air Temperature (Including Sun Load)	-58° F to 185° F (-50° C to 85° C)
Rate of Temperature Change	Up to 2° F/minute (1° C/minute)
Continuous Humidity	5 to 100% at less than 95° F (35° C)
Short Term Humidity	5 to 100% at less than 113° F (45° C)
Solar Exposure (Sun Loading)	Up to 69.5 W/ft 700 W/M
Continuous Wind Loading	Up to 72 mph (115 km/hr)
Short Term (Gusting) Wind Loading	Up to 109 mph (175 km/hr)
Rain Loading	Up to 5 min. @ 11.89 in/hr (30.5 cm/hr) Up to 10 min. @ 4.95 in/hr (12.7 cm/hr)
Ice and Snow Loading	Up to 551 lb/m (250 kg/m)
Operating Vibration	Up to 0.22 in (5.6mm) Displacement at 5 to 55 Hz
Shipping Vibration	Up to 3.0 g at 5 to 200 Hz
Shipping Shock	Up to 30 g Acceleration for 10 ms

72 hours continuous or 15 days maximum per year

Without batteries

Assumes OPM is properly bolted to its base

OPM power consumption

OPM power consumption is given in Tables 6-H through 6-H, based on the following assumptions:

- 100-ohm loop resistance
- 150-ohm phone resistance
- 200-ohm line card resistance (standard LCM line card)
- 0.5 km (0.3107 miles) average line length

Table 6-H:
OPM ac power load in watts

Item	At 5 ccs/line
-52 V load on rectifiers:	1300 W
Rectifier inefficiency (10%):	130 W
AC panel load:	50 W
Total Watts	1480W

Table 6-I:
OPM main compartment thermal load in watts

Item	At 5 ccs/line
-52 V internal dissipation	973 W
Rectifier dissipation	130 W
AC panel dissipation	50 W
Total Watts	1053W

Table 6-J:
OPM -52 power load in watts (W) and amps (A)

Parameter/Item	At 5 ccs/line		At 8 ccs/line	
	Unit W	Total W/A	Unit W	Total W/A
LCM, dissipated internally	558 W		802 W	
LCM, dissipated externally	164 W		272 W	
Subtotal, OPM LCM -52 V load		722 W/13.9 A		1074 W/20.7A
HIE Shelf internal ringers	25 W		45 W	
HIE shelf external ringers	10 W		10 W	
DS1 Interface and ESA (internal)	100 W		110 W	
Subtotal, HIE Shelf -52 V load		135 W/2.6 A		165 W/3.2 A
FSP, internal DS1 office repeaters	40 W		60 W	

Table 6-J: (Continued)
OPM -52 power load in watts (W) and amps (A)

Parameter/Item	At 5 ccs/line		At 8 ccs/line	
	Unit W	Total W/A	Unit W	Total W/A
FSP, external DS1 office repeaters	160 W		240 W	
Subtotal, FSP -52 V load		200 W/3.8 A		
RMM shelf load		150 W/2.9 A		300 W/5.8 A
Battery charging system		50 W/1 A		50 W/1 A
Fan(s)		40 W/0.77 A		40 W/1 A
Total Watts/Amps		1297 W/24.97 A		3269 W/34.6 A

OPM batteries

The OPM is equipped with sufficient batteries for supplying the energy required to support the OPM for eight hours at a traffic level of approximately 5 ccs/line. At 5 ccs per line, the -52 V dc load of the OPM is approximately 25 A for each of eight hours. Consequently, eight hours of backup requires 200 Amp hours. Each battery string in the OPM provides approximately one hour of backup power. A total of eight strings can be provisioned.

Outside Plant Access Cabinet (OPAC)

The OPAC is a containerized version of the RLCM which also provides additional space for transmission or operating company-provided equipment. OPAC environmental parameters are given in Table 6-L. OPAC electrical specifications are given in Table 6-K.

Table 6-K:
OPAC electrical specifications

Parameter	Specification
Input voltage commercial ac	220 V at 60 Hz
Power consumption	960 Watts
Current drain (not including operating company-provided equipment)	20 A
Maximum current consumption including provisionable NT packs	50 A
Thermal dissipation	592 Watts
Fusing requirements	30 A

Table 6-L:
OPAC environmental parameters

Parameter	Limits
Ambient air temperature (see ***Note 1***)	-40° F to 115° F (-40° C to 46° C)
Relative Humidity (see ***Note 1***)	5% through 95%; 80% at less than 70° F (21° C) and 30% at 120° F (49° C) are permissible
Temperature cycling	should not exceed 12° F (6.7° C) per hour
Air cleanliness	not worse than 100 000 (3.53 X 10^6 particles (each at lease 0.5 microns large) per cubic meter (100 000 particles per cubic foot)
Heat dissipation (see ***Note 2***)	592 Watts/frame/hour, not including the shelves that house operating company-provided equipment. Up to 10 min. @ 4.95 in/hr (12.7 cm/hr)
Drop tests	withstands shocks associated with dropping from six inches while packaged, or two inches while unpackaged
Solar Exposure (Sun Loading)	resistant to ultraviolet radiation as determined through the testing of BELLCORE TR-TSY-000487, section 5.1.3.8
Continuous Wind Loading	up to 100 mph
Ice and Snow Loading	up to 290 kg/m (60 lbs/sq.ft.)
Rain Loading	withstands wind-driven rain using the test methods of REA 345-79 PE-69, section 5.12.
Shipping vibration	withstands the vibration testing of Bellcore TR-TSY-000487, Section 5.1.4.11, without suffering damage or loosening of hardware attachments either in the housing or packaged contents
Shipping shock	sustains, without damage, the physical shock that occurs during commercial transportation and installation

Note 1: Extreme conditions based on a maximum duration of up to 72 continuous hours and up to 15 days per year.

Note 2: Assumes that the frame is equipped fully and all equipment is operating at maximum capacity.

OPAC batteries

Only Eagle-Picher (CF6V50FR-S6) 6 V batteries are available for purchase through Nortel Networks Corporation. Up to six 8-battery strings connected in three string-pairs may be provisioned in the OPAC. When four battery strings are installed and are operating at 100% capacity, their reserve power corresponds to 178 Ah. If the external temperature is 104° F (40° C), batteries at 80% capacity provide 8 hours of backup power at a call rate of 3 ccs/line.

Remote Subscriber Line Module (RSLM)

The RSLM supports up to 192 lines for a distance of up to 100 miles from the DMS-10 host central office switch.

RSLM power consumption

The RSLM Type A shelf dc power consumption from an ac converter is approximately 366 watts (7.04 amps at a nominal 52 V dc). The RSLM Type B shelf dc power consumption from an ac converter is approximately 439 watts (8.44 amps at a nominal 52 V dc). (See Table 6-M.)

The RSLM power consumption is based on the following assumptions:

- 100-ohm phone resistance
- 90-ohm loop resistance
- 0.5 km (0.3107 miles) average line length
- 0.13 Erlangs/line traffic

Table 6-M:
RSLM dc power consumption in watts

Item	Watts per item	RSLM Type A Shelf			RSLM Type B Shelf		
		Qty.	TW	IHD	Qty.	TW	IHD
NT6X53 (5/12 V Converter)	47	1	47	47	2	94	94
NT9Y14 (Processor)	12	2	24	24	2	24	24
NT9Y12 (SSC)	7.5	2	15	15	2	15	15
NT9Y15 (ESA)	10	1	10	10	1	10	10
NT9Y13 (RMP)	10	1	10	10	1	10	10
Line cards	0.15	256	39	39	192	29	29
Add'l power (line cards)	0.15	34	5	5	26	4	4
Converter efficiency	-	1	41	41	2	82	82
Subtotal (5/12 V Converter)	-	-	191	191	-	268	268
NT6X30 (Ringer)	30	1	30	10	2	60	20
Sub. line feed current	4.26	34	145	101	26	111	77
Subtotal (52 V direct)	-	-	175	111	-	171	97
RSLM Total Watts	-	-	366	302	-	439	365

Quantity of items per shelf.

Total watts per shelf.

Internal heat dissipation per shelf.

Outside Plant Subscriber Module (OPSM)

OPSM power consumption

With an RSLM Type A shelf, the OPSM dc power consumption from an ac converter is approximately 607 watts (11.67 amps at a nominal 52 V dc). With an RSLM Type B shelf, the OPSM dc power consumption from an ac converter is approximately 680 watts (13.08 amps at a nominal 52 V dc). An additional 52 watts (1 A at a nominal 52 V dc) is required for charging the OPSM batteries. (See Table 6-N.)

Table 6-N:
OPSM dc power consumption in watts

Item	Wattsper item	RSLM Type A Shelf			RSLM Type B Shelf		
		Qty.	TW	IHD	Qty.	TW	IHD
NT6X53 (5/12 V Converter)	47	1	47	47	2	94	94
NT9Y14 (Processor)	12	2	24	24	2	24	24
NT9Y12 (SSC)	7.5	2	15	15	2	15	15
NT9Y15 (ESA)	10	1	10	10	1	10	10
NT9Y13 (RMP)	10	1	10	10	1	10	10
Line cards	0.15	256	39	39	192	29	29
Add'l power (line cards)	0.15	34	5	5	26	4	4
NT9Y00 (Cabinet Controller)	5	1	5	5	1	5	5
Converter efficiency	-	1	41	41	2	82	82
Subtotal (5/12 V Converter)	-	-	196	196	-	273	273
NT6X30 (Ringer)	30	1	30	10	2	60	20
QRY18 and QPP519	7/8	3	22	10	3	22	10
Fans (3-4" and 1-6")	13/17	4	56	34	4	56	34
Sub. line feed current	4.26	34	145	101	26	111	77
Battery relays	1.7	4	7	7	4	7	7
Battery charge current	-	12	52	52	12	52	52
Rectifier efficiency	-	2	99	99	2	99	99
Subtotal (52 V direct)	-	-	411	313	-	407	299
OPSM Total Watts	-	-	607	509	-	680	572

Quantity of items per shelf.

Total watts per shelf.

Internal heat dissipation per shelf.

The OPSM power consumption is based on the RSLM shelf power consumption and on the following additional assumptions:

- 70% efficiency for dc/dc converter
- 85% efficiency for rectifier converter

- -52 V float charge for dc voltage
- -48 V discharge voltage
- 1% of capacity for battery charge current
- 3 dc circulation fans, running continually
- 1 dc heat exhaust fan, running continually

(Actual fan usage is as necessary.)

The OPSM ac power consumption with ac power is 600 watts when the batteries are fully charged and 1,625 watts when the batteries are empty. When the OPSM is operated with battery power, the total dc load may be lower, but the battery capacity required for eight hours of operation is 66 amp hours (AH). The batteries provisioned in the OPSM consist of 3 strings of 48 volts each and each string provides 25 AH for a total of 75 AH. The OPSM heat dissipation is given in Table 6-O.

Table 6-O:
Total dissipation in watts of the OPSM

Parameters	With RSLM Type A Shelf	With RSLM Type B Shelf
Total external dissipation	98 watts	108 watts
Total maximum dissipation	607 watts	680 watts

When powered by commercial ac. During an ac outage, these figures are lower because of -48 V dc battery discharge voltage, as opposed to -52 V dc rectifier output.

OPSM operating conditions

The OPSM will remain operable after being subjected to three cycles of thermal shock ranging from -50° C (-58° F) to +40° C (+104° F) at a rate of 1° C/minute (33.8° F/minute).

An OPSM, packaged for shipping and without batteries, will withstand shocks of 30 g acceleration for a duration of 10 ms and vibrations of 3.9 g acceleration at 5 to 200 Hz without damage to the cabinet or its contents. An installed and operational OPSM will withstand vibrations of 0.5 g at 5 to 100 Hz without damage or malfunction.

A separate sunshade over the OPSM is recommended in very hot areas with strong solar radiation.

Lastly, the OPSM, which contains only fungus-resistant material, is designed to withstand unauthorized entry attempts with small hand tools.

OPSM environmental parameters are given in Table 6-P. OPSM environmental controls are described in Table 6-Q.

Table 6-P:
OPSM environmental parameters

Parameter	Limits
Ambient Air Temperature Continuous Short Term Shipping and Storage	 -40° F to +110° F (-40° C to +44° C) -58° F to +110° F (-50° C to +44° C) -58° F to +158° F (-50° C to +70° C)
Continuous Humidity	20% to 95% at less than 95° F (35° C) and 5.3 kPa (0.77 psi) vapor pressure
Short Term Humidity	20% to 95% at less than 104° F (40° C) and 5.3 kPa (0.77 psi) vapor pressure
Solar Exposure (Sun Loading)	Up to 69.5 W/ft2 700 W/M2
Continuous Wind Loading	Up to 72 mph (115 km/hour)
Short Term (Gusting) Wind Loading	Up to 109 mph (175 km/hour)
Rain Loading	Up to 5 minutes of rainfall at a rate of 300 mm/hour (11.79 inches/hour) or Up to 10 minutes of rainfall at a rate of 130 mm/hour (5.11 inches/hour) or Up to 5 minutes of rainfall at a rate of 130 mm/hour (5.11 inches/hour), followed by winds at a velocity of up to 65 km/hour (40.39 miles/hour) for an additional 15 minutes.
Ice and Snow Loading	Up to 0.36 psi (250 kg/m)
Salt fog	Up to 5% salt fog for a period of 96 hours without noticeable film delamination, color loss, blistering, or corrosion of the mechanical parts.

Measured in the shade.

6 hours each day for one week.

Without batteries.

Assumes OPSM is properly bolted to its base.

Table 6-Q:
OPSM environmental controls

Device	On	Off
Circulation fans (2)	122° F (50° C)	113° F (45° C)
Exhaust fan	113° F (45° C)	104° F (40° C)
Damper	109° F (43° C) (open)	105° F (38° C) (close)
Equipment heater	86° F (30° C)	95° F (35° C)
Battery heater	32° F (0° C)	41° F (5° C)

Note: *The temperatures given represent ambient air temperatures inside the OPSM. When ambient air temperature inside the OPSM cabinet reaches 131.5°F (55.5°C), an over-temperature alarm is set. If the ambient air temperature temperature inside the OPSM cabinet reaches 149.5°F (65.5°C), thermostats TH1 and TH2, which are mounted on the ceiling of the equipment compartment (near the rear door), operate to shut the system down. TH1 trips the main dc circuit breaker; TH2 trips the main ac circuit breaker.*

Remote Subscriber Line Equipment (RSLE)

The RSLE supports up to 1024 lines for a distance of up to 100 miles from the DMS-10 host central office switch.

RSLE power consumption

An RSLE bay configured for 512 lines has a dc power consumption from an ac converter of approximately 604 watts (11.62 amps at a nominal 52 V dc) (see Table 6-R). An RSLE bay configured for 640 lines has a dc power consumption from an ac converter of approximately 832.5 watts (16.00 amps at a nominal 52 V dc) (see Table 6-S). An RSLE bay configured for 1024 lines has a dc power consumption from an ac converter of approximately 1,115.5 watts (21.45 amps at a nominal 52 V dc) (see Table 6-T).

The RSLE power consumption is based on the following assumptions:

- 100-ohm phone resistance
- 90- ohm loop resistance
- 0.5 km (0.3107 miles) average line length
- 0.13 Erlangs/line traffic

Table 6-R:
RSLE 512-line bay dc power consumption in watts

Item	Watts per item	Qty.	TW	IHD
NT6X53 (5/15 V Converter)	47	2	94	94
NT9Y22 (RSLE Processor)	6	2	12	12
NT9Y20 (DHI)	6	0	0	0
NT9Y19 (RSLE ESA)	11.5	1	11.5	11.5
NT9Y18 (RSLE Tones)	3.5	1	3.5	3.5
NT9Y17 (DHI and Clock)	6.5	2	13	13
NT9Y16 (RSLE Matrix)	6.5	2	13	13
NT9Y13 (RMP)	10	2	20	20
Line cards	0.15	512	77	77
Add'l power (line cards)	0.15	68	10	10
Subtotal (5/15 V Converter)	-	-	254	254
NT6X30 (Ringer)	30	2	60	40
Sub. line feed current	4.26	68	290	202
Subtotal (52 V direct)	-	-	350	242
RSLE Total Watts	-	-	604	496

Quantity of items per bay configuration.

Total watts consumed per bay configuration.

Internal heat dissipation per bay configuration.

Table 6-S:
RSLE 640-line bay dc power consumption in watts

Item	Watts per item	Qty.	TW	IHD
NT6X53 (5/15 V Converter)	47	4	188	188
NT9Y22 (RSLE Processor)	6	4	24	24
NT9Y20 (DHI)	6	2	12	12
NT9Y19 (RSLE ESA)	11.5	1	11.5	11.5
NT9Y18 (RSLE Tones)	3.5	2	7	7
NT9Y17 (DHI and Clock)	6.5	2	13	13
NT9Y16 (RSLE Matrix)	6.5	4	26	26
NT9Y13 (RMP)	10	2	20	20
Line cards	0.15	640	96	96
Add'l power (line cards)	0.15	85	13	13
Subtotal (5/15 V Converter)	-	-	410.5	410.5
NT6X30 (Ringer)	30	2	60	40

Table 6-S: (Continued)
RSLE 640-line bay dc power consumption in watts

Item	Watts per item	Qty.	TW	IHD
Sub. line feed current	4.26	85	362	252
Subtotal (52 V direct)	-	-	422	292
RSLE Total Watts	-	-	832.5	702.5

Quantity of items per bay configuration.

Total watts consumed per bay configuration.

Internal heat dissipation per bay configuration.

Table 6-T:
RSLE bay dc power consumption in watts

Item	Watts per item	Qty.	TW	IHD
NT6X53 (5/15 V Converter)	47	4	188	188
NT9Y22 (RSLE Processor)	6	4	24	24
NT9Y20 (DHI)	6	2	12	12
NT9Y19 (RSLE ESA)	11.5	1	11.5	11.5
NT9Y18 (RSLE Tones)	3.5	2	7	7
NT9Y17 (DHI and Clock)	6.5	2	13	13
NT9Y16 (RSLE Matrix)	6.5	4	26	26
NT9Y13 (RMP)	10	2	20	20
Line cards	0.15	1024	154	154
Add'l power (line cards)	0.15	136	20	20
Subtotal (5/15 V Conv.)	-	-	475.5	475.5
NT6X30 (Ringer)	30	2	60	40
Sub. line feed current	4.26	136	580	404
Subtotal (52 V direct)	-	-	640	444
RSLE Total watts	-	-	1115.5	919.5

Quantity of items per bay configuration.

Total watts consumed per bay configuration.

Internal heat dissipation per bay configuration.

Remote Switching Center (RSC-S)

The RSC-S is a remote switching system comprised of a family of DMS-100 remote peripherals, based on Common Peripheral Module (CPM) architecture. The RSC-S provides a low cost alternative to HSO/SSO configurations and increased DMS-10 line capacity as a result of line concentration and Intraswitching. The RSC-S supports up to 4400 lines for a distance of up to 100 miles from the DMS-10 host central office switch.

RSC-S environmental requirements and physical dimensions

Environmental parameters for an RSC-S are given in Table 6-U. RSC-S physical dimensions are given in Table 6-V. RSC-S trunk reliability figures are given in Table 6-W.

Table 6-U:
RSC-S environmental parameters

Parameter	Limits
Ambient Air Temperature Continuous Short Term (maximum of 72 hours, total of less than 15 days per year)	 77° F to 88.2° F (25° C to 49° C) 39.2° F to 100.4° F (4° C to 38° C)
Continuous Humidity Continuous Short Term	 20% to 55% 20% to 80%
Atmospheric Pressure	78.8 kPa
Altitude	2134 M
Air Intake Temperature	122° F (50° C)
Air Temperature between Circuit Packs	158° F (70° C)
Heat Dissipation	Up to 150 watts per square foot for any individual cabinet or Up to 120 watts per square foot averaged over a 20-ft by 20-ft area

Table 6-V:
RSC-S physical dimensions

Parameter	Limits
Dimensions	28 x 28 x 72 inches, including doors
Floor loading	meets Network Equipment Building Systems (NEBS) floor loading requirement (NEBS 2.1.4) of a maximum of 155 lbs per square foot, averaged over equipment foot print and aisle area
CRSC Weight	810 lb, not including weight of cable tray or cabling supported by the cabinet (estimate: 200 lb per cabinet). Maximum allowable weight based on the NEBS requirement is 1431 lb per cabinet (28 x 28 inch cabinet and 36 inch aisle = 12.4 square feet).

Table 6-W:
RSC-S trunk reliability based on LSSGR downtime guidelines

Trunks	Condition (due to any cause)	Down time in minutes per year
1	Downtime	28
48	Long term average downtime	20
at least 120	Simultaneous downtime	15

Star Remote system

The Star Remote system provides a remote line concentrating system that supports up to 1152 lines, using standard DMS line cards. The Star Remote system comprises two products - the Star Module and the Star Hub.

Star Hub

The Star Hub communicates with the host DMS-10 switch through a maximum of 16 DS-1 links (minimum of two) using DMSX protocol.

Star Hub power consumption

The Star Hub is powered by an external -48V power supply which conforms to the following requirements:

- voltage level within -42V to -60V (-48V nominal)
- ripple voltage is less than 0.02V
- maximum power requirement is 410 Amp/hour

Table 6-X shows the power requirements for the Star Hub configuration.

Table 6-X:
Star Hub Maximum Power Requirements

Pack	Power per Pack (Watts)	Number of Packs	Total Power (Watts)	Heat Dissipation (Watts)
NTTR60	172.8	2	16.25	4
NTTR73	18.54	2	37.08	37.08
NTTR74	4.8	1	4.8	4.8
NTTR75	1.44	1	1.44	1.44
NTTR76	4.8	1	4.8	4.8
NTTR77	11.7	2	23.4	23.4
NTMX81	1.745	24	39.98	39.98
NTTR87	0	6	0	0
NT6X53	480	4	0	0
NT6X54	6	18	108	108
Idle NT6X17BA	0.15	627	94.05	94.05
active NT6X17BA	0.45	247	111.15	111.15
Idle NT6X18BA	0.15	27	4.05	4.05
active NT6X18BA	0.9	27	26.1	26.1
NTBX27	0.7	112	75.4	75.4
NTBX71	48	18	864	180
Talk Battery - internal	0.4	269	107.6	107.6
Talk Battery - external	2.4	269	645.6	0
Power supply loss	25% x power	all except talk battery	240	240
TOTAL			2403.7	1061.85

At 25% of ringing capacity

Assuming power requirement through all other packs is taken into account

Assuming maximum number of ISDN drawers

Assuming 30% of POTS lines are offhook

Assuming 10% of active lines are coin lines

Assuming 20% power loss for all packs (except talk battery)

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DMS-10 Family

600-Series Generics

System Performance Specifications

NTP number: NTP 297-3601-180
Release: 07.01
For Generic 602.20
Status: Standard
Date: August 2006