

363-205-003

**`SLC(R)'-2000 MULTI-SERVICE DISTANT TERMINAL FEATURE -
APPLICATIONS, PLANNING, AND ORDERING GUIDE - 363-205-003
- ISSUE 1**

Refer to Chapter 14

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1. About This Guide

1.1 Purpose

This guide provides descriptive, engineering, and ordering information to assist network planners and engineers in planning for *SLC(R)*-2000 Multi-Services Distant Terminal (MSDT) applications. These guidelines are designed to meet the following objectives:

- o Provide a description of services provided by the *SLC*-2000 MSDT
- o Provide direction in evaluation and layout of potential applications
- o Provide information to help estimate costs and coordinate implementation of the *SLC*-2000 MSDT.

1.2 Intended Audience

These applications, planning, and ordering guidelines are for individuals who participate in the planning and implementation of digital loop carrier systems, including the following:

- o Customers (telephone company personnel - headquarters staff, planners, and engineers)
- o AT&T marketing personnel and account representatives.

This document is written for individuals with a background in telephony and an understanding of basic digital transmission principles. Knowledge of digital loop carrier systems is helpful.

1.3 How to Use This Guide

This guide is organized as follows:

- o About This Guide

This section defines the purpose and intended audience for this document and tells how to obtain technical support on the *SLC*-2000 MSDT.

- o Chapter 2, Introduction

This chapter provides an overview and general description of the *SLC*-2000 MSDT in a *SLC* Series 5 remote terminal (RT) application.

- o Chapter 3, Features

This chapter describes the significant features of the *SLC-2000* MSDT.

- o Chapter 4, Applications

This chapter describes the applications of the *SLC-2000* MSDT and how it interfaces with the network.

- o Chapter 5, Product Description

This chapter provides an in-depth description of the *SLC-2000* MSDT feature plus a physical and functional description of the elements (remote terminal, optical fiber cable, and distant terminal) that comprise the system.

- o Chapter 6, Operations, Administration, and Maintenance

This chapter describes how the introduction of a *SLC-2000* MSDT into the loop affects system operation, administration, and maintenance.

- o Chapter 7, Planning and Engineering

This chapter describes the engineering and planning considerations for implementing the *SLC-2000* MSDT.

- o Chapter 8, Ordering

This chapter provides product codes required when ordering equipment and apparatus for a Fiber to the Home (FTTH) system.

- o Chapter 9, Product Support

This chapter provides a description of the AT&T customer support groups and systems available to assist in engineering, installing, and maintaining a *SLC* Carrier System featuring FTTH.

- o Chapter 10, Reliability and Quality

This chapter describes AT&T's reliability program and gives the reliability and maintainability specifications for the *SLC-2000* MSDT.

- o Chapter 11, Technical Specifications

This chapter gives the transmission specifications for the various types of services provided by *SLC* Carrier Systems featuring FTTH and the equipment located at the RT and distant terminal (DT) locations.

- o Appendix A, System Documentation

This appendix describes and lists the various types of documents on the *SLC-2000* Access System, *SLC* Series 5 Carrier System, and related systems and equipment.

- o Appendix B, Training

This appendix describes the AT&T training courses available for the Series 5 and *SLC-2000* systems.

1.4 System Feature Packages Supported

This guide supports the Series 5 system RT in the Feature Package F (FPF) configuration and the Series 5 system central office terminal (COT) in the Feature Package C (FPC) configuration.

1.5 Customer Assistance and Technical Support

AT&T will provide customer assistance on the Series 5 and *SLC-2000* systems including, but not limited to, troubleshooting assistance, technical consultation, operational problem consultation, procedural advice, and emergency recovery assistance from a qualified system support professional from the Regional Technical Assistance Center (RTAC).

Service is provided from the RTAC at 1-800-225-RTAC. This telephone number is monitored 24 hours a day, 7 days a week. During regular business hours your call will be answered by your local regional RTAC. Outside of normal business hours, all calls will be answered at a centralized technical assistance center where service-affecting problems will be dispatched immediately to your local RTAC. All other problems will be referred to your local RTAC on the next regular business day.

1.6 Related Documentation/Training

1.6.1 General

Appendix A provides a list of Series 5 and *SLC-2000* system documents and references on related systems and equipment. Appendix B describes the training courses available on the Series 5 and *SLC-2000* systems including the Fiber-To-The-Home Feature.

In this section, the headings that follow present an overview of Series 5 and *SLC-2000* documentation based on various features and system arrangements. These overviews attempt to guide the user to the documents that may be needed for each stage in implementing a system. The overviews indicate minimum documentation needed; see Appendix A [REF. 12] for a list of complete titles and document numbers.

In the overviews, most categories list more than one document. In

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some categories, the documents contain the same information with different levels of detail. In this case, the user's experience should determine which document is needed. In other cases, the documents contain information on different equipment; one or more documents may be needed depending on the equipment being installed or used.

1.6.2 Series 5 Documentation Overview for Universal Arrangements

Series_5_System_Planning

363-205-010 Series 5 System Applications and Planning Guide

Series_5_System_Engineering_and_Circuit_Design

363-005-101

thru -302 Series 5 System Data Sheets

915-710-115 Series 5 System Engineering

915-710-116 Series 5 System Channel Unit Applications

FPD 801-450-106-x Series 5 System Floor Plan Data Sheets

Series_5_System_Ordering

363-205-000 Series 5 System Ordering Guide

363-205-000,

Appendix A Series 5 System Quick Reference Ordering Guide

363-205-020 Series 5 System PC Configurator

Series_5_System_Remote_Terminal_(RT)_Installation_and_Splicing

631-600-240 80-Type Cabinets

631-600-241 80-Type Cabinet Feeder Distribution Interface (FDI)

640-250-217

thru -327 Outside Plant Documentation

Turnup Procedures --

Maintenance System	COT	RT	T1 Metallic Facility
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363-202-300	363-205-400	363-205-401	363-200-001
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Pair Gain Test Controller	Series 5 COT	Series 5 RT	T1 Preservice Tests
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363-205-300

Extended Test
Controller

End-to-End_System_Tests

363-205-406 Series 5 System End-to-End Tests

Channel_Unit_Installation

363-205-402 Series 5 System Channel Unit Installation Tests

System_Maintenance

363-205-500 Series 5 System Maintenance

1.6.3 `SLC(R)'-2000 MSDT Feature Documentation Overview

363-205-003

SLC-2000_MSDT_Feature_Planning

363-205-003 SLC-2000 MSDT Feature Applications, Planning, and Ordering Guide

SLC-2000_MSDT_Feature_Engineering_and_Circuit_Design

363-205-003 SLC-2000 MSDT Feature Applications, Planning, and Ordering Guide

SLC-2000_MSDT_Feature_Ordering

363-205-003 SLC-2000 MSDT Feature Applications, Planning, and Ordering Guide

SLC-2000_MSDT_Feature_Installation_and_Splicing

363-205-004 SLC-2000 MSDT Feature User/Service Manual

Turnup Procedures --

Maintenance System	COT	RT	DT
363-202-300	363-205-400	363-205-401	363-205-401
Pair Gain Test Controller	Series 5 COT	Series 5 RT	Series 5 RT
363-205-300			
Extended Test Controller			

End-to-End_System_Tests

363-205-406 Series 5 System End-to-End Tests (COT to RT and COT to DT) (also covers channel unit installation for basic telephone service - POTS only)

System_Maintenance

363-205-003 SLC-2000 MSDT Feature Applications, Planning, and Ordering Guide

363-205-004 SLC-2000 MSDT User/Service Manual

363-205-500 Series 5 System Maintenance

1.7 How to Order Documents

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Commercial Customers*	Customer Information Center Attention: Order Entry Center 2855 N. Franklin Road P.O. Box 19901	From Canada: 1-800-255-1242 Worldwide:

	Indianapolis, IN 46219	Toll: 1-317-352-8557 FAX: 1-317-352-8484
RBOC/BOC	Process through your Company Documentation Coordinator	

* For commercial customers, a check, money order, purchase order number, or charge card number is required with all orders. Make checks payable to AT&T. AT&T entities should use Form IND 1-80.80 FA, available through the Customer Information Center.

One-time orders include a binder (if applicable) and the document contents for the current issue in effect at the time of order. Also, you may request placement on the standing order list for all later reissues of any document. The standing order list for each document provides automatic distribution for all reissues of the document. RBOC/BOC customers should process document orders or standing order requests through their Company Documentation Coordinator.

1.8 How to Comment on This Document

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Feature Applications, Planning, and Ordering
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Appearance					//////////
Examples					

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2. Introduction

2.1 Overview

The *SLC(R)*-2000 Multi-Services Distant Terminal (MSDT) feature uses a single mode fiber and laser optics to provide bidirectional digital transmission between a central office and subscribers. It interfaces to a *SLC* Series 5 remote terminal (RT) equipped with optics shelves, an optics power shelf, optical jumpers, and a high density fiber interconnect (HDIC) at the RT site. Fiber distribution cable connects the RT to the *SLC*-2000 MSDTs located at or near customer premises. Metallic distribution drops then connect the *SLC*-2000 MSDTs to customer equipment.

The *SLC*-2000 MSDT is a compact, fiber-based terminal that provides a full range of narrowband services, from POTS to special services, for a wide range of applications. It permits lightguide fiber cable to be extended into the distribution plant from a *SLC* Series 5 RT, and in the future, from a *SLC*-2000 RT. The 24 DS0 line capacity of the *SLC*-2000 MSDT allows for sharing over several customers to achieve economic deployment compared to existing copper loops.

3. Features

3.1 Enclosure

The *SLC(R)*-2000 Multi-Services Distant Terminal (MSDT) (Figure 1) is provided as a compact and attractive enclosure. The metal enclosure measures approximately 24 inches high, 10 inches wide, and 16 inches deep and is designed to be pole, wall, or pedestal mounted.

3.2 Channel Unit Accommodation

The *SLC*-2000 MSDT houses a maximum of six Series 5 channel units or future *SLC*-2000 quad channel units. The six Series 5 channel units provide up to 12 customer channels, whereas, the *SLC*-2000 channel units provide up to 24 customer channels.

3.3 Multiple Powering Options

A variety of options for powering the *SLC*-2000 MSDT are available. By using the proper combination of power interface unit (PIU) and power converter unit (PCU), the *SLC*-2000 MSDT can be powered using one of the following methods:

- o 120 V AC local power
- o -48 V DC local power
- o -130 V DC central power.

3.4 Enhanced Maintenance

The *SLC*-2000 MSDT, in conjunction with the new RT channel unit and bank control unit (BCU), will provide standard alarm information to the maintenance center to help during fault detection and sectionalization, thereby speeding up the response to service disruptions. In addition to the DS1 alarms raised by the central office/remote terminal (CO/RT) digital facility, the MSDT will alert the maintenance center to failures.

3.5 Suitable for Any Environment

The *SLC*-2000 MSDT can operate in any uncontrolled outside plant environment. It is also designed to meet Federal Communications Commission (FCC) electromagnetic compliance (EMC) and *UL(R)* requirements for all applications, including customer premises.

3.6 Commonality with Other AT&T Products

System commonality with other AT&T products brings added advantages to

planning and operating your synchronous optical network (SONET). This will simplify craft personnel training and utilization of the various systems and user interfaces. Cross-product commonality will be met through a common maintenance philosophy and procedures, consistent handling of system functionality, testing, and software upgrade procedures and version recognition. User interfaces have a consistent appearance, system interfaces, cabling, circuit pack naming, temperature specifications, and electromagnetic compatibility.

4. Applications

4.1 Introduction

The *SLC(R)*-2000 Multi-Services Distant Terminal (MSDT) feature provides the local exchange carrier (LEC) with the opportunity to apply fiber optics and distant terminals (DTs) economically in the distribution plant. This chapter discusses the factors that should be considered for successful deployment of fiber optics and DTs in the distribution plant.

4.2 Suitability

The *SLC*-2000 MSDT feature may be applied economically in new residential developments or to rehabilitation of aging copper plant. Typical applications include fiber distribution to the following:

- o Individual homes - The MSDT can be located at curb side or at the rear lot line to provide service to a number of living units.
- o Condominiums, townhouses, and apartments - The MSDT can be placed in a common area or mounted on the side of the building. Where space is available, it may be located in an equipment closet within the building.
- o Small and midsize businesses - The MSDT brings fiber transport directly to small businesses providing voice and data transport.
- o College and university buildings - The MSDT is ideally suited for voice and data transport in residential academic communities with a high density of office, classroom, and living quarters.
- o Shopping centers - The MSDT provides separate lines to individual businesses within the same building.

In addition, the companion video system provides the capability of multi-channel community antenna television (CATV) transport for entertainment or educational (for example, classroom lectures) information.

4.3 RT Site Selection

The remote terminal (RT) equipment can be housed in a mini-hut, a controlled environment vault (CEV), or an 80E cabinet. In the 7-foot bay configuration, applicable to mini-huts and CEVs, each Fiber-To-The-Home (FTTH) bay can serve up to 768 DS0 channels when supported with the necessary high density fiber interconnect (HDIC) and RT powering equipment. The 80E cabinet configuration, which includes the HDIC and RT powering equipment, can also serve up to 768 DS0 channels.

When central powering is used, the length and cross section of power cabling may be a factor in determining RT placement. It may prove more economical to provide central powering from multiple sites than from one centralized RT site. Wherever central powering equipment is located, keep in mind that it must be located in a controlled environment.

4.4 DC Test Pair to RT

Whenever drop testing is performed without the use of a remote measurement unit (RMU), then a DC test pair such as the one presently used in metallic *SLC* Carrier Systems must be used. The DC test pair connects the test center to the RT site and is used strictly for the exchange of information during test sessions.

In order for the mechanized loop testing (MLT) measurements to be accurate, the DC test pair must meet the following parameters:

Series loop resistance: 2500 ohms maximum

Leakage resistances: >2500K ohms T-R, T-G, and R-G.

If the DC test pair does not meet these parameters, the MLT measurements may yield incorrect results.

4.5 RT to MSDT Cabling

A metallic test pair is not needed between the RT and the MSDTs. The allowable loss in the fiber cable is available in Chapter 7 - *Planning and Engineering*.

4.6 MSDT Site Selection

The MSDT enclosure can be mounted on a pole or a wall, or as a pedestal that can be stake or pad mounted. It should be placed as to facilitate craft personnel access to the enclosure with sufficient space to open the end doors. The MSDT placement is also dependent on access to the power source, distance to the customer, and possible use of the FTTH CATV feature.

The FTTH CATV feature requires an additional enclosure of the same size. Therefore, if FTTH CATV deployment is a possibility, sufficient mounting and access space must be allocated for both enclosures. In addition, MSDT placement may be affected by CATV service drop distance limits.

4.7 Service Drop Distance

The maximum length of metallic drop cable allowed between the *SLC-2000* MSDT and the network interface depends on the ringing generator

voltage and the resistance of the drop cable in combination with the resistance of the customer-premises wiring (CPW). The sum of these two resistances must be no greater than 132 ohms. In addition, MSDT placement may be affected by CATV service drop distance limits. By selection of the drop cable type, the distance that can be served from the MSDT may vary from 430 feet when using RG-6 coaxial cable to 650 feet when using RG-11 coaxial cable. Longer drop distances can be reached with special engineering.

4.8 Bandwidth Management

4.8.1 General

The number of telephony services that an MSDT can provide is determined by the bandwidth of the system. The engineering of the system and the sizing of its load bandwidth is similar to the engineering of transmission trunks and switching systems in that statistical factors and anticipated growth must be considered. The bandwidth limitations of a *SLC* Carrier System equipped with an MSDT is determined by the following:

- o Type of channel unit (CU) and provisioning of the CU slots in the RT channel bank
- o Maximum capacity (24 DS0 channels) of the RT-to-MSDT optical link
- o Type of CUs located in the MSDT.

The bandwidth limits for these network elements are discussed below. It is assumed that an AUA406 RT CU is configured to support a bandwidth equal to the bandwidth required at the corresponding MSDT.

4.8.2 RT Bandwidth and Bandwidth Shedding

The distribution fiber from the MSDT terminates in an AYB1B optical unit (OU) which connects to an AUA406 RT CU. The AUA406 CU provides a digital interface between the Series 5 Feature Package F (FPF) backplane and the AYB1B OU. One AUA406 CU is required for each MSDT. The AUA406 CU consists of a single printed wiring board attached to a faceplate that covers three physical CU slots on the RT shelf. As shown in Figure 2, the corresponding AYB1B OU must be installed in the optics shelf slot that has the same channel designation numbers as the left most RT CU slot occupied by the AUA406 CU.

The setting of the **SLOT ALLOCATION** switch on the AUA406 CU faceplate determines the number of physical CU slots accessed by an AUA406 CU. During normal operation, this setting is visible at the display on the AUA406 CU (Figure 2).

The number of physical CU slots accessed by an AUA406 CU may range from the three slots covered by the faceplate of the AUA406 CU all the way up to the 12 physical CU slots in a digroup (a group of 12

physical slots served by the same CO/RT DS1 signal). Since each physical CU slot corresponds to two DS0 time slots, the bandwidth accessed by an AUA406 CU ranges from 6 to 24 DS0 time slots.

The physical CU slots accessed start with the three slots occupied by the AUA406 CU and extend to the adjacent CU slots to the right of the AUA406 CU. The physical CU slots that the AUA406 CU accesses to its right must be vacant. The maximum number of physical CU slots available to an AUA406 CU is equal to the sum of the three slots occupied by the AUA406 CU plus one of the following:

- o The number of empty physical CU slots between the AUA406 CU and the right-hand edge of the digroup in which the AUA406 CU is installed

or

- o The number of physical CU slots between the AUA406 CU and the next CU installed to the right of the AUA406 CU.

If an AUA406 CU **SLOT ALLOCATION** switch is set for more physical CU slots than this restriction allows, the RT bank control unit (BCU) will grant the AUA406 CU access only to the number of slots allowed by the restriction. A configuration error will also be reported by means of the compatibility (**CMP**) indicator on the RT alarm display unit (ADU), and the **CONFIG** indicator and **SLOT ALLOCATION** display on the AUA406 CU.

This bandwidth selection feature allows the LEC to match the payload (the number of revenue earning channels plus spare capacity) between the RT and MSDT to the equipage of the MSDT. Physical CU slots not accessed by one AUA406 CU can be used by another AUA406 CU located in the same digroup. Unused RT/MSDT bandwidth is shed; only the selected time slots are served by the feeder.

As a result of the packing capability of the AUA406 CU, the number of AYB1B OUs needed per optics shelf is reduced. This same reduction also applies to the number of lightguide interconnection cables (LICs) terminating at the optics shelf and HDIC. Since each MSDT application is custom designed and the number of required OU slot positions are known, only the LICs associated with these slot positions are needed, resulting in substantial savings.

Note that a capacity exhaust risk exists at the RT that requires considerations similar to those for the MSDT. If the additional line take (ALT) at the MSDT exceeds the number of allocated time slots, a rearrangement of the CUs may be required. The design process described in Chapter 7 - *Planning and Engineering* should be applied.

4.8.3 RT-to-MSDT Optical Link

The fiber distribution link between the RT and the *SLC-2000* MSDT operates at the DS1 rate (1.544 Mb/s) carrying 24 DS0 channels with the actual payload depending on the configurations of the RT and the MSDT.

4.9 Increased Sharing

One *SLC-2000* MSDT may be deployed easily for service to a group of four living units or even to a single living unit (LU). However, economics suggest that a *SLC-2000* MSDT should be shared over more LUs to distribute the costs of electronics, media, and powering.

In order to share the MSDT over 12 or more LUs, the following new planning and outside plant (OSP) engineering tactics are suggested:

- o Deployment of a 25-pair metallic cable from the MSDT to a number of pedestal closures where drop pairs are then brought to the LUs. The number of LUs served from a pedestal closure is engineered according to local practices. This arrangement would fit well into current operations, administration, maintenance, and provisioning (OAM&P) systems.
- o Deployment of long drops from an MSDT to the LUs.

4.10 Powering Options

4.10.1 General

The *SLC-2000* MSDT allows a variety of powering options. By using the proper combination of power interface unit (PIU) and power converter unit (PCU), the MSDT can be powered from the following:

- o 120 V AC local powering (AUA414 PIU and AUA412 PCU)
- o -48 V DC local powering (AUA415 PIU and AUA412 PCU)
- o -130 V DC central powering (AUA416 PIU and AUA417 PCU).

The power option choice involves tradeoffs in initial costs, operating costs, maintenance costs, and other noneconomic factors.

4.10.2 Local Powering

The use of local power represents some departure from traditional telephony practice. Local powering is often the most simple but requires batteries at the *SLC-2000* MSDT to provide at least 8 hours of service during primary power failures. The introduction of batteries into the distribution plant also introduces the maintenance issue of battery replacement.

Commercial 120 V AC power for the MSDT can be obtained directly from the power utility, with or without a power meter, or from the customer

premises. Power from the customer premises can be supplied through either a circuit breaker or an adapter ring on the subscriber's power meter.

The use of 120 V AC power offers the following advantages:

- o Simple design
- o Low operating cost
- o High electrical efficiency.

Some issues to be aware of when considering the use of 120 V AC power include the following:

- o Coordination with the power utility and/or subscribers
- o Energy usage billing
- o Installation costs
- o Access.

The -48 V DC used in powering the *SLC-2000* MSDT is derived from the 120 V AC at the customer premises where a small power source provides conversion to -48 V DC. From there, the -48 V DC is routed to the MSDT by means of copper wire pairs that parallel the drop pairs. Several power sources from different customer premises may be paralleled to provide redundancy and a greater power capacity. Since this method of powering requires a 120 V AC connection to the power conversion electronics, the same 120 V AC powering issues described previously need to be taken into consideration. In addition, maintenance is required for the power wiring and converters, efficiency is decreased because of added transmission loss, and initial costs are higher than using the 120 V AC powering method.

An advantage of the -48 V DC local powering method is a lower voltage level which provides greater safety and allows the craft personnel to perform the installation. However, the number of powering modules required could increase costs significantly.

4.10.3 Central Powering

A single -130 V DC power plant, or several smaller -130 V DC power plants, can be located at the RT site or other reasonable site(s) and their power distributed to the *SLC-2000* MSDTs. The -130 V DC level is commonly accepted by established precedence in repeater applications and by conformance to the TR-57* interface specification. This approach requires a power distribution network and thus reintroduces copper into the OSP.

*Bellcore Technical Reference TR-TSY-000057 Issue 1, April 1987,

Functional Criteria for Digital Loop Carrier Systems.

Centralization of the power source offers the following advantages:

- o Centralizes batteries
- o Provides greater immunity to power utility outages
- o Allows a single point for a generator connection during extended power outages.

The disadvantages for using central powering include low efficiency, power network maintenance, and high initial costs for engineering, materials, and installation. Also, another item that may have to be taken into consideration before selecting central powering is the fact that maintenance terminating units (MTUs) are not compatible with central powering.

Efficient bulk conversion of -48 to -130 V DC is possible, but energy dissipated during transport results in lower overall electrical efficiency and in turn higher energy costs and larger power plant requirements.

The power distribution network for central powering typically parallels the fiber distribution network and resembles the metallic network that is replaced by fiber. Although smaller in cross-section than the metallic network, it still presents similar maintenance requirements along with the additional maintenance also required by the power processing equipment.

Engineering effort for the power plant and the distribution network is needed. This design differs somewhat from that for telephony plants and is discussed later in Chapter 7 - *Planning and Engineering*.

The costs for central powering equipment include the power plant, copper cabling, splices, and terminations. In those cases where an existing -48 V DC power plant has sufficient capacity to handle the additional load, only new -130 V DC converters and related downstream components are needed.

5. Product Description

5.1 Introduction

This chapter provides a detailed view of the *SLC(R)*-2000 Multi-Services Distant Terminal (MSDT) features. After a physical and functional description of new Series 5 remote terminal (RT) equipment and *SLC*-2000 MSDT equipment, the various powering options for the *SLC*-2000 MSDT are described.

5.2 `SLC(R)'-2000 MSDT Feature Architecture

The *SLC*-2000 MSDT feature uses a single optical fiber and laser optics to perform bidirectional digital transmission between an RT and an MSDT at 1310 nm wavelength. Initially, the *SLC*-2000 MSDT will be deployed from a *SLC* Series 5 Carrier System using the Feature Package F (FPF) RT, but will be capable from the outset to be fed from an AT&T *SLC*-2000 RT. The distribution fiber and the MSDT portions of the system remain the same regardless of the type of RT employed. The FPF RT works into a *SLC* Series 5 Carrier System Feature Package C (FPC) central office terminal (COT) as shown in Figure 3.

The *SLC*-2000 RT will be capable of operating with either of the two Bellcore standardized switch interfaces, TR-08* or TR-303**. The RT shields the *SLC*-2000 MSDT from the CO/RT interface so that the operation of the *SLC*-2000 MSDT does not change when the RT on which it homes is cut from one interface to another.

*Bellcore Technical Reference TR-TSY-000008 Issue 2, August 1987, *Digital Interface Between the SLC 96 Digital Loop Carrier System and a Local Digital Switch*.

**Bellcore Technical Reference TR-TSY-000303 Issue 1, September 1986, and all Revisions and Supplements, *Integrated Digital Loop Carrier System Generic Requirements, Objectives, and Interface*.

The FPF RT can also support the Fiber-To-The-Home (FTTH) distant terminal (DT) that was designed by AT&T as the first generation FTTH product. This feature, which supports fully tested backwards compatibility with the DT, allows the MSDT to be deployed along with the DT, with both being served from the same RT. As an example, this feature allows the MSDT to be used for growth or new features in a pre-existing application that used DTs. If DTs and MSDTs are to be served from a single RT, the DTs require the appropriate channel unit for the RT interface (AUA400, AUA401, AUA404, or AUA405). The RT channel units designed for the MSDT do not support the DTs.

5.3 Physical and Functional Description

5.3.1 Series 5 Remote Terminal

5.3.1.1 General

The equipment at the RT location to support the *SLC-2000* MSDT can be installed in either a mini-hut, controlled environment vault (CEV), or an 80E cabinet. The minimum configuration for an RT site consists of a Series 5 RT bay, a high density fiber interconnect (HDIC), and (when used) a central power source bay with the associated protection panel(s). Whenever the central powering equipment is located at the RT, it must be located in a controlled environment.

5.3.1.2 SLC Series 5 RT Bay

A fully equipped Series 5 RT bay, shown in Figure 4, contains up to two RT dual bank assemblies, four optics shelves, two fan units, and an optics power shelf. A fully equipped RT bay can serve up to 384 DS0 channels. An FPF Series 5 RT dual bank assembly permits the RT to interface with a Series 5 FPC COT in a universal configuration. In addition to the usual full complement of required circuit packs (provided in Chapter 8 - *Ordering*), the dual bank assembly consists of the following new or changed units:

- o MC97779A1 bank control unit (BCU)
- o AUA406 channel unit (CU).

Also, to support the optics shelf, the AYB1B optical unit (OU) and AUA402 alarm/fan control unit (A/FCU) are required in the optics shelf and optics power shelf, respectively.

The relative position of these units within the shelf or bay is shown in Figure 4.

The MC97779A1 BCU provides the proper firmware for correct dual bank assembly operation. One BCU is needed for each RT dual bank assembly.

The AUA406 CU provides the interface between the RT backplane and the optics shelf. The AUA406 CU occupies three physical slots in an RT digroup shelf and is capable of accessing from 6 to 24 of the DS0 time slots in the associated DS1 digroup signal. The DS0 time slots accessible by the CU includes the time slots associated with the three physical slots it spans plus any even number of DS0 time slots associated with the physical slots to the right of the CU. The number of time slots serviced by the CU is determined by the **SLOT ALLOCATION** switch setting on the CU faceplate. One AUA406 CU is required for each MSDT.

The J1C182PA RT optics shelf consists of one row of 48 slots that house the AYB1B OUs, which receive electrical DS1 rate (1.544 Mb/s) signals from AUA406 CUs and convert them to optical DS1 rate signals. Each optical signal is transmitted over one single mode fiber, using simultaneous bidirectional transmission at 1310 nm to the *SLC-2000* MSDT. One AYB1B OU is required for each MSDT. Two optics shelves are

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required for each RT dual bank assembly containing AUA406 CUs. Each pair of optics shelves is cooled by forced convection cooling supplied by the 2B or 2C fan units also located in the RT cabinet or bay, respectively.

The J1C182PB RT optics power shelf assembly consists of eight AUA11B or AUA11C power converter units (PCUs), one AUA402 A/FCU, and four 40D bank fuse units (BFUs) on one shelf. One RT optics power shelf assembly is required for powering up to four optics shelves, two or three fan shelves, and two dual bank assemblies.

The PCUs supply power to the OUs and bulk power for the entire bay is routed through the BFUs. The AUA402 A/FCU performs alarm functions and also controls the fan units.

5.3.1.3 HDIC Bay

The interconnection of lightguide cable at the RT location is accomplished using the HDIC. The HDIC (Figure 5) provides a flexible rearrangement point for connecting lightguide interconnection cables (LICs) from available OUs to the *SLC-2000* MSDT outside plant fibers. It also provides the means for cable completion testing and for standard maintenance access.

Each shelf in the HDIC is designed for a maximum of 24 fiber connections and is orderable individually. The MSDT applications typically use a small number of fibers so that only a small number of fiber termination shelves is needed. As an application grows so can the HDIC, to a maximum of 1,152 LIC fibers on the optical unit side with an out-count of 1,296 outside plant (OSP) fibers in a 7-foot RT frame. When incorporated into an 80E cabinet (Figure 6), the HDIC accommodates a maximum of 384 LIC fibers on the optical unit side and an out-count of 432 OSP fibers.

The HDIC utilizes a field of single mode *ST(R)* lightguide cable connector couplings to connect the LICs from the optics shelves to the OSP fibers. The OSP fibers are field terminated in *ST* lightguide cable connectors and then connected to the permanent field (inside) of the termination shelf. The single LIC fibers with factory equipped *ST* lightguide cable connectors are connected to the couplings in front of the termination shelf with provision for slack storage.

5.3.1.4 80E Cabinet

The RT equipment is also available in 80E cabinet configuration, as shown in Figure 6. This arrangement can serve up to 768 DS0 channels.

5.3.1.5 Central Powering

The RT site may also be equipped with a central powering system (CPS) if it has to provide central power to outlying MSDTs. The CPS (Figure 7) is located separately from the RT narrowband optoelectronics bays and is custom engineered for each application as described in Chapter 7

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The CPS is powered from a -48 V DC power plant. The -48 V DC power plant converts and rectifies 120 V AC commercial power to obtain the -48 V DC required for input to the -130 V DC converter plant. The existing -48 V DC power plant may be used to provide power if it has sufficient excess capacity. Otherwise, a new power plant or additional capacity will have to be installed at the RT site.

The -130 V DC converter plant operates from the -48 V DC supplied by the power plant and sends 100 VA limited outputs to the MSDTs. As an example, one fully equipped -130 V DC converter plant bay can provide power for up to 144 MSDTs, each equipped with 12 lines. A fully equipped -130 V DC converter plant bay contains the following:

- o One -48 V DC input fuse panel
- o One -130 V DC output fuse panel
- o One status panel
- o One output limiter shelf
- o Four converter shelves with each one containing up to two -48 to -130 V DC converters.

A lightning/power cross protection (PCP) panel is also required for use with the converter bay, but it is located separate from the converter bay.

To assure the safety of craft personnel handling components and wiring associated with the CPS, the CPS outputs are limited to 130 V DC and 100 VA. The CPS outputs conform to the TR-57 interface specification.

The CPS equipment also features alarm reporting and the future option of power shutdown to the companion community antenna television (CATV) system during power outages.

5.3.1.6 FTTH CATV

When deployed, FTTH CATV RT equipment is located separately from the narrowband optoelectronics bays. If CATV is required, a second and separate fiber is required for CATV transmission.

5.3.2 Optical Fiber Cable

Standard single mode fiber should be used. The HDIC and the MSDT both require *ST* lightguide cable terminations. Allowable signal attenuation is discussed in Chapter 7 - *Planning and Engineering.*

5.3.3 Distant Terminal Site

5.3.3.1 `SLC(R)'-2000 MSDT Arrangement

The *SLC-2000* MSDT (Figure 1) is a pedestal type enclosure that measures 24 inches high, 10 inches wide, and 16 inches deep. The enclosure can be pole or wall mounted or ground mounted by means of a stake or concrete pad. The *SLC-2000* MSDT provides a full range of narrowband services to the end user including the following:

- o Basic telephone service (POTS)
- o Coin service
- o 2-wire locally switched special services (including Centrex)
- o 2-wire nonlocally switched special services
- o 2-wire nonswitched special services
- o 4-wire voice-frequency (VF) special services
- o DDS service (digital data)
- o Alarm services.

The *SLC-2000* MSDT has two RT-to-MSDT time slot assignment modes: dual and quad. The dual mode optimizes the end-to-end system for the use of single- and dual-circuit CUs at the MSDT by assigning two DS0 time slots to each of the six physical CU slots at the MSDT. The quad mode optimizes the system for the use of *SLC-2000* quad-circuit CUs at the MSDT by assigning four DS0 time slots to each of the six physical CU slots at the MSDT. The mode assignment is set by means of the dual/quad connector located under the fiber storage assembly on the MSDT backplane. The MSDT is set to the dual mode when a shorting plug is installed in the dual/quad connector. When the shorting plug is absent, the MSDT is set to the quad mode.

The *SLC-2000* MSDT contains a backplane, similar to the backplane of the Series 5 dual bank assembly, that provides slots for housing the following plug-ins:

- (a) MC97780A1 backplane interface unit (BIU) -- Performs functions similar to a combination of the Series 5 transmit/receive unit (TRU), line interface unit (LIU), BCU, and alarm display unit (ADU).
- (b) AUA411 channel and drop test unit (CDTU) -- When accessed by a pair gain test controller (PGTC) or similar equipment, supports channel test between the CO and the *SLC-2000* MSDT CU and makes tests on the metallic drop.
- (c) Series 5 or *SLC-2000* CUs -- The *SLC-2000* MSDT accepts a maximum of six Series 5 dual or Service Net 2000 quad POTS or *SPOTS(R)* CUs to provide a maximum of 12 or 24 channels, respectively. A

variety of services can be provided by using the appropriate CUs in the MSDT. These services include POTS, coin, digital data system (DDS), a number of switched, nonlocally-switched, and nonswitched VF special services. The Service Net 2000 quad POTS and *SPOTS* CUs provide the same services as the AUA58 and AUA150 CUs, respectively, while also providing automatic loss compensation (ALC). The Series 5 CUs supported in the MSDT are listed in Table A.

(d)

BYB1B OU -- Performs electrical-to-optical conversions at 1310 nm and uses optical splitters to perform bidirectional digital transmission over a single optical fiber.

(e)

AUA414, AUA415, or AUA416 power interface unit (PIU) -- Provides a variety of input power options and is a source of power for the CATV adjunct. Refer to Table B for proper PIU applications.

(f)

AUA412 or AUA417 power converter unit (PCU) -- Provides power to all plug-ins in the *SLC-2000* MSDT according to input power. Refer to Table B for proper PCU applications.

(g)

AUA413 ringing generator unit (RGU) provides a negative-superimposed ringing voltage of 20 Hz, 80 Vrms to three lines simultaneously. Each line is allowed to have a maximum load of five ringer equivalent numbers (RENs).

Additional equipment items included in the *SLC-2000* MSDT enclosure are as follows:

- o Optional batteries for back-up power, with heater
- o Fiber organizer
- o Field wiring box (FWB) with lightning and power cross protection for input power leads
- o Fan unit
- o Tip and ring pair protectors
- o Tip and ring terminal block
- o Fiber splice storage.

5.3.3.2 MSDT Powering

The three methods of powering the MSDT are:

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- o 120 V AC local powering
- o -48 V DC local backpowering
- o -130 V DC central powering.

Refer to Chapter 7 - *Planning and Engineering* for descriptive and planning information concerning the powering options and equipment.

5.3.3.3 FTTH CATV

When deployed, the CATV adjunct is colocated with the *SLC-2000* MSDT but in a separate enclosure. The CATV adjunct must be located so that the length of the power and alarm wiring between it and the *SLC-2000* MSDT is no greater than 10 feet.

6. Operations, Administration, and Maintenance

6.1 Introduction

This section contains information pertinent to the operation, administration, and maintenance of *SLC(R)* Carrier Systems employing the *SLC-2000* Multi-Services Distant Terminal (MSDT).

6.2 Operation

The introduction of a *SLC-2000* MSDT into the loop does not change system operation. The operation of the channel units (CUs) in the MSDT is controlled by the bank control unit (BCU) in the Series 5 remote terminal (RT) and thus appears as though the CUs are located at the RT. Craft personnel activities such as CU provisioning would follow the same procedure as for metallic *SLC* Carrier Systems.

6.3 Administration

The Fiber-To-The-Home (FTTH) system is a double-star configuration and necessitates changes in facilities administration.

The facilities may be divided in two ways consistent with the facility assignment system (FACS) version 18.6 assignment.

Option 1:

- o F1 - Fiber channels between the central office (CO) and the *SLC-2000* MSDT
- o F2 - Copper between the MSDT and the end-user premises.

or

Option 2:

- o F1 - Fiber channels between the CO and the RT
- o F2 - Fiber channels between the RT and the MSDT
- o F3 - Copper between the MSDT and the end-user premises.

6.4 Maintenance

6.4.1 Pro-Active Maintenance

Fiber in the loop systems substantially increase the digital portion of the outside plant, having analog signals only on a very short subscriber drop. Digital transmission provides continuous on-line monitoring of signal quality making it possible to receive status

information about a failure or malfunction before subscriber complaints are received.

In addition to the DS1 alarms raised by the CO/RT digital facility which may be equipped with protection switching, the FTTH system will alert the maintenance center to AUA406 CU, RT/MSDT link, or MSDT common component failures.

6.4.2 Alarms and Fault Sectionalization

The *SLC-2000* MSDT and the RT CU can report status to the RT BCU where they are mapped into the system alarms. In conjunction with indicators on the RT BCU and alarm display unit (ADU), the AUA406 RT CU, and the MSDT, these alarms will assist in fault detection and sectionalization.

6.4.3 Channel and Drop Testing

The *SLC-2000* MSDT supports testing of locally switched nonprovisionable CUs using the pair gain test controller (PGTC) or similar procedures. The architecture allows for testing the end-to-end channel, the metallic drop beyond the MSDT, and the status of the optical link between the RT and the MSDT.

Although maintenance terminating units (MTUs) are not compatible with the MSDT centralized powering option, they can be used with MSDT local powering options. When used with MSDT local powering options, talking is permitted through the MTUs but they cannot be used for testing.

End-to-end channel testing is performed by the PGTC and supported by the AUA411 channel and drop test unit (CDTU) at the MSDT. This test checks the transmission and signaling capabilities of the channel up to the metallic tip/ring appearance at the MSDT channel unit.

During the end-to-end channel test set up, the AUA411 CDTU makes a series of tests on the metallic drop beyond the MSDT. The PASS/FAIL results of these tests are passed to the RT CU to be reported to mechanized loop testing (MLT) by means of the programmable DC signature feature. One of the following messages will be reported to MLT:

- o RT/MSDT link down
- o RT/MSDT link up and MSDT does not support testing
- o RT/MSDT link up and MSDT common equipment failure
- o RT/MSDT link up and drop test OK
- o RT/MSDT link up and drop open
- o RT/MSDT link up and leakage/FEMF on drop
- o RT/MSDT link up and receiver off-hook (ROH)

- o RT/MSDT link up and hazardous potentials on drop.

6.4.4 MLT Testing

Remote testing of the *SLC-2000* feature is accomplished using MLT and the PGTC. If the system is equipped with an extended test controller (XTC), the XTC must have a PGTC expansion shelf and the PGTC cable (P109) must be installed between the XTC and the central office terminal (COT) (Figure 8). The XTC uses only the PGTC capabilities during the testing; therefore, only the PGTC will be mentioned in the following description. The MSDT must be equipped with an AUA411 CDTU.

Trouble isolation on an individual customer circuit may be performed in response to a customer trouble report or to system alarms. Table C lists the software generics required for the automated repair service bureau (ARSB) equipment to support the maintenance plan for systems equipped with the *SLC-2000* MSDT feature. The loop test system (LTS) firmware issues required for use with the *SLC-2000* MSDT feature are listed in Table D.

Two tests are performed by MLT-2 to sectionalize trouble on a system equipped with the *SLC-2000* MSDT feature. The test paths taken by these two tests are described as follows:

- o End-to-end channel test: This test is performed by the derived PGTC to check the quality of the Series 5 subscriber loop. The channel test covers the COT CU, the COT-to-RT link, the RT CU, the RT-to-MSDT optical link, and the MSDT CU. A pass/fail test result indication is reported by the PGTC to MLT-2.
- o Drop Tests: The metallic (copper) segment of the subscriber loop, from the MSDT to the subscriber's station (telephone set), is tested by the AUA411 CDTU. The results of the drop test are transmitted by the MSDT backplane interface unit (BIU) and CDTU to the RT CU (AUA406), which converts them to one of the *SLC-2000* MSDT *DC signatures*. The MLT-2 measures the *DC signature* parameters using either the DC test pair (a metallic loop connecting the MLT to the RT) or a remote measurement unit (RMU). A single RMU can serve approximately 15 RT dual channel banks and should be used if the RT is out of range of an MLT test vehicle or if the COT-to-RT link is all fiber. The signatures are measured when the MLT performs a drop test. To identify the loop as being served by Fiber-To-The-Home, the DC signature always has 90.9K ohms resistors from tip-to-ground and from ring-to-ground; the tip-to-ring resistor is varied to indicate the testing results. Table E shows the breakdown of the *SLC-2000* MSDT feature system signatures.

When a customer trouble report is received, a repair service administrator (RSA) initiates an MLT test of the customer loop. Since the loop is fiber and not copper, one of the DC signatures is

generated for MLT by the RT CU. The signature is measured by MLT and trapped. During this time, the SLC Carrier System channel test is also being performed. When the results are returned, the usual display is masked by the trapping of the DC signature presented by the RT CU, and a user programmed narrative is displayed. One of the new programmable VER codes will be generated by MLT and displayed to the RSA indicating a system equipped with the SLC-2000 MSDT feature.

At this point, the trouble report is passed through a screening process based on the new VER code to a maintenance administrator (MA) for dispatch or further testing.

Depending on the signature value detected previously and the CU test results, the craftsperson is dispatched to the most probable trouble location as shown in Tables E and F. Other test systems may not have programmable DC signatures available; but if their test system is capable of measuring the DC resistances of the T-R-G delta equivalent circuit, they can also use Table E for craft personnel dispatch.

With these maintenance capabilities, even if a *test ok* is indicated to the MA, the customer could still have a failure. When this situation occurs, standard test procedures should be followed to check the subscriber's equipment.

As a reminder, the MLT system must be *programmed* to correctly interpret the DC signatures which will be presented by the RT CU, before a system equipped with the SLC-2000 MSDT feature may be tested.

This programming is performed using a system administration and maintenance (SAM) mask to accomplish the following:

- o Identify to MLT the values of the DC signatures and VER codes to be trapped during the loop test.
- o Provide new VER codes to allow for the proper screening of SLC-2000 MSDT trouble reports.

6.4.5 Fault Isolation Procedure

The normal maintenance test flow follows:

1. When trouble exists, the customer calls the repair service bureau (RSB) number and is connected to an RSA.
2. The RSA enters the telephone number of the SLC-2000 MSDT feature line into the LMOS terminal and requests a FULLX test. Then the following tests are performed automatically:
 - (a) End-to-end channel tests (COT-to-MSDT) of the SLC Series 5 Carrier System
 - (b) Drop tests (MSDT-to-subscriber's set) performed on the

metallic drop and supported by the AUA411 CDTU.

(c) Central office line circuit and dial tone tests.

3. After the channel tests are completed, the MLT-2 will trap a VER code to signal the pass or fail status of the pair gain channel. It will also trap the signature it measured, which is associated with an FTTH system. Instead of displaying this information, the TV mask narrative associated with the VER code and signature combination will appear on the LMOS terminal.
4. The first line of the MLT-2 TV mask narrative identifies the line as being part of a SLC-2000 MSDT feature by displaying the following: FIBER-TO-THE-HOME LOOP INDICATED. (The exact wording may vary according to local preference.) This shows that the MLT-2 system has successfully accessed the RT using the PGTC and in response to the test request, it has received one of the SLC-2000 MSDT feature signatures.
5. The second line of the TV mask text will indicate the state of the pair gain channel with one of the following responses: COT-TO-DT CHANNEL TEST OK or PAIR GAIN CHANNEL TEST FAILURE. Both messages are an indication that the RT-to-MSDT fiber link is in frame and functioning. The pair gain channel test failure message indicates an out-of-limit condition for one or more of the following tests:
 - o On-hook state
 - o Off-hook state
 - o Permanent ring ground
 - o Echo return loss
 - o Transmission channel loss
 - o Idle channel noise
 - o Ability to provide ringing voltage.

NOTE 1:

While a channel test failure message always means service degradation, it does not always mean an out-of-service condition. It is reasonable, therefore, to clear any drop test failures first, to reestablish service, and then to clear the channel faults.

NOTE 2:

Other test failures (such as CO faults) may occasionally cause the PAIR GAIN CHANNEL TEST FAILURE message to be displayed. Repeat testing with LOOPX test to eliminate these failures.

6. The RT-TO-DT FIBER LINK BAD - OOF message means a complete failure of the link. The fault can be in one or more of the following elements: RT CU, RT OU, HDIC, the fiber, MSDT OU, or the MSDT CU. Trouble clearing should begin at the RT.

6.4.6 MLT Setup

The *SLC-2000* MSDT uses the programmable DC signatures feature of MLT to report the results of testing since MLT cannot directly test the drop beyond the MSDT. This feature must be programmed in advance by the MLT facilities manager.

Series 5 with the *SLC-2000* MSDT feature exhibits one of the DC signatures found in Table E to the MLT, or an equivalent test system, during its drop test. The signature reflects the state of the metallic drop from the MSDT to the subscriber's equipment and the state of the RT-to-MSDT fiber link. The PGTC delivers pass or fail channel test results which MLT converts to VER codes, that show the condition of the pair gain channel from the CO to the MSDT CU.

NOTE:

When new service is just turned up and line records have not yet been built, the test system operator must use an appropriate override; for example, C40 for a *SLC 96* Carrier System, C41 for a *SLC* Series 5 Carrier System, etc. In this temporary case, the test results will depend on the CO equipment being used, the state of the test system, etc., and not on the loop. Unless the proper override is used, the test results returned are not predictable.

A total of 15 masks, covering all possible equipment configurations, test failures, and missing line records, are available. The number of programmable masks needed can be reduced to 10 if channel test failures are always cleared before drop test failures. The drop test results can also be interpreted from Table E directly.

Each signature is composed of a set of three resistance values. Detection of one of these unique *DC signatures* is an indication that the test results received are from a *SLC-2000* MSDT feature circuit. The Tip-to-Ground (T-G) and Ring-to-Ground (R-G) resistance values [R(T-G) and R(R-G)] of 90.9K ohms identify the circuit under test as a *SLC-2000* MSDT feature circuit. The Tip-to-Ring (T-R) resistance value [R(T-R)] is set by the RT CU to reflect the results of the drop test or the failed state of the RT-to-MSDT fiber link. Table E shows the resistance values associated with the possible drop test results.

In order for the MLT-2 measurements and signatures to be accurate, the DC test pair to the FTTH RT must meet the following parameters:

Series loop resistance: 2500 ohms maximum

Leakage resistances: >2500K ohms T-R, T-G, and R-G.

If the DC test pair does not meet these parameters, the MLT-2 measurements can have sufficient error to cause the wrong TV mask to appear (that is, the next higher or lower signature value TV mask may appear).

Figures 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37 and 38 show the suggested MLT-2 SAM masks for the *SLC-2000* MSDT feature with the enhanced test capability. Each SAM mask is associated with a TV mask typical for the condition. A graphic interpretation of the test results is also shown. An alternate SAM and TV mask for signature #10 is shown in Figures 39 and 40, respectively. The purpose of this alternate is to save on the number of SAM and TV masks. This test signature #10 (alternate) should be used if the MLT administrator wants to limit the number of programmable signatures to ten. It is a suggested replacement for signatures #10 through #15. If a customer reaches the limit of programmable signatures and is looking to increase the number of signatures, this alternate can be used as a solution. Signature #9 is not required if the testing region contains only *SLC-2000* MSDT equipment and not *SLC* Series 5 FTTH feature equipment.

6.5 Testing with Other Than MLT Equipment

When the local exchange carrier (LEC) uses a test system other than MLT, it may be possible to use that system to measure the DC signatures used to convey the status of the *SLC-2000* MSDT feature. The degree to which that testing system could be automated depends on the specific test system. This document provides adequate information to allow the LEC to use DC signatures with another test system.

7. Planning and Engineering

7.1 Introduction

This chapter contains system design information to be used as a guide for planning and engineering a Fiber-To-The-Home (FTTH) system using the *SLC(R)*-2000 Multi-Services Distant Terminal (MSDT). This information, presented in general terms, takes into account system capacities and limits and is intended for use by experienced system design personnel.

The items listed below must be determined at the outset of system design since they will significantly impact the procedure used to design the system:

1. Method of powering (120 V AC local powering, -48 V DC local powering, or -130 V DC central powering)
2. FTTH community antenna television (CATV) deployment.

The FTTH system design may be divided into three areas: outside plant (OSP), remote terminal (RT), and power point (PP). The PP is the power source for a group of centrally powered MSDTs and is not required when AC or DC local powering is used. The design process starts at the subscriber's location and terminates at the RT site. Since the segment of the system from the RT site to the central office terminal (COT) or switch location is not peculiar to the FTTH system, the design of this portion of the system is not covered in this chapter. If design information is desired on this portion of the system, refer to either AT&T 363-205-010 (Series 5 Carrier System Applications and Planning Guide) or 363-208-000 (*SLC*-2000 Access System Applications, Planning, and Ordering Guide). The following sections will discuss each portion of the design process in greater detail as it applies to new developments. For rehabilitation applications, many design decisions must be based on the existing arrangements.

The following items are used in the system design process and must be determined or obtained before or during the process:

- o Number of lines per living unit (LU)
- o Number of lines per business customer
- o Area maps - indicating houses, streets, and poles
- o Plats - indicating existing cables and pole lines
- o Exchange cable customer records.

The design process results in a detailed distribution area plan (DDAP)

and an equipment list. The DDAP must identify the following:

1. The ultimate pair requirements of each developed and undeveloped property within the distribution area
2. The ultimate distribution network configuration (cable routing) within the distribution area
3. MSDT and copper terminal locations and sizes
4. The proper number of drops to each residence/business
5. For central powering, the powering pairs required that are dependent upon the anticipated ultimate equipment usage and line resistance.

The equipment list must identify the following:

1. MSDT equipment
2. RT equipment
3. PP equipment (if central powering is used).

Depending on individual requirements, it may be necessary to prepare a written wiring limits chart and splicing detail schematic.

After completion of the DDAP, it will be necessary to calculate the loss budget for each individual fiber and complete a lightguide completion test loss data sheet (Figure 41). This information will be used during installation testing to verify the expected fiber loss.

For mechanized loop testing (MLT), a derived pair or copper DC test pair to the RT may be needed. For MLT measurements to be accurate, the DC test pair must meet the following requirements:

Series loop resistance: 2500 ohms max

Leakage resistance: >2500K ohms T-R, T-G, and R-G.

The information in this chapter does not provide detail applications of the FTTH CATV feature. However, FTTH CATV deployment may impact every aspect of the narrowband service design, as noted in the individual sections. For information on the CATV design process, refer to AT&T 363-205-005.

7.2 OSP Design

7.2.1 General

OSP design may be divided into the following tasks:

- o Determine the topology for the fiber network, for copper drops (for example, front or rear lot feed), and for any copper cable required for powering.
- o Design copper network
- o Design fiber network
- o Design power distribution network, if used.

Each network design task follows the same general procedure:

1. Establish pairs/fibers required for each MSDT/LU.
2. Aggregate these back towards the RT/PP.
3. Choose cable sizes, allowing for adequate spares.

7.2.2 Copper Cable/Drop Layout Rules

The two primary choices to be made concerning copper cable/drop are as follows:

- o Determine whether front lot or rear lot feed is to be used.
- o For front lot feed, determine whether distribution cable is placed on one or both sides of the street.

The choice between these alternatives can be affected by local constraints such as easements, street crossings, and access to (local) power for the MSDTs. In general, the most expensive alternative is front lot feed on both sides of the street because of doubled placement costs and longer copper runs. The least expensive choice is front lot feed on one side of the street, provided street-crossings of drops are economically reasonable.

7.2.3 Copper Network Design

7.2.3.1 General

The copper network connects an MSDT to the subscribers. The first step of copper network design is determining the network architecture. This includes determining the number of LUs/MSDT and the length and type of connections between the MSDTs and the LUs. The second step of copper network design is the detailed design of the network.

Where an MSDT is used to provide service to more than four living units, the local exchange carrier (LEC) may elect to place subtending copper terminal pedestals after the MSDT is placed to give convenient cross-connect points to the customer drops. In such an arrangement, 25-pair cable may be used to wire between the metallic appearances at the MSDT (up to 24) and each of the copper terminal pedestals. Such an arrangement is administrable under the facility assignment system

(FACS) version 18.6.

7.2.3.2 Copper Network Architecture

The number of LUs serviced by an MSDT is determined by the following:

- o The 24 DS0 channel capacity of the *SLC-2000* MSDT
- o Expected growth
- o Maximum drop length
- o Any LEC or local requirements.

In addition, if the FTTH CATV feature is to be used, the maximum CATV coaxial drop length may limit the maximum narrowband distribution drop length.

The *SLC-2000* MSDT can provide up to 24 DS0 channels. The design engineer determines the actual number of LUs served from an MSDT by considering the expected line-take and growth characteristics. Typical sites have been engineered for line-takes between 1.25 and 2.5. If channel capacity exhaust from an MSDT occurs, the penalty in the OSP is the placement of a new MSDT or routing of spare channel capacity from a nearby MSDT.

The maximum drop length serviced from the MSDT is 132 ohms loop resistance, including customer premises wiring (CPW) resistance. For convenience, Table G provides drop lengths for various wire gauges at 68<deg>F (typical maximum temperature for buried cable) and at 149<deg>F (typical maximum temperature for aerial cable). These lengths include a typical 30 ohm CPW resistance.

The copper pairs may be run between the MSDT and LUs with individual drops or with multipair cable which is then spliced at intermediate terminals. The multipair cable approach may be cheaper in some cases. Another advantage to using the multipair cable/terminal approach is the ability to provide a suitable conversion point for broadband-integrated services digital network (B-ISDN) upgrade when fibers will go directly to the LUs. Toward this end, it is desirable to loop the fiber cable (containing extra fibers for B-ISDN upgrade) into an above-ground terminal for future splicing.

7.2.3.3 Detailed Copper Network Design

In general, the detailed copper network design begins at those MSDTs in the site which are farthest from the RT. The LUs are grouped into clusters which can be served by an MSDT. Each member of a cluster must be within the service distance limit of the MSDT and also meet local restrictions (for example, crossing a boat launch ramp is generally undesirable.) In practice, this step interacts with the fiber network design process to minimize the number of fibers and associated MSDTs.

Special circumstances may prevail when designing copper networks. For example, a residential development scheduled for multiphase development over many years may call for an initial design that is not optimal in long-term MSDT capacity usage.

7.2.4 Fiber Cable Network Design

7.2.4.1 General

The fiber distribution network connects the MSDTs to the host RT. In addition to the customary considerations for *SLC* Carrier System deployment, considerations for the *SLC-2000* MSDT feature include sufficient space for possible CATV and central powering deployment.

Fiber distribution design must take into account the following factors:

- o Front/rear lot feed
- o Fiber loss and maximum fiber length
- o Cable network routing and layout
- o Number of fibers installed per MSDT.

7.2.4.2 Fiber Loss and Maximum Fiber Length

The OSP loss budget is the allowable loss of the OSP between the RT and the MSDT. The OSP loss budget includes fiber loss, splices, and provision for repairs. It does not include the losses of the termination connectors at the RT or MSDT or other RT or MSDT components, such as wavelength division multiplexers (WDMs) or splitters which may be added in the future. The loss budget calculations are made using 1310 nm transmission.

For the MSDT, the OSP loss budget is 9.8 dB. When a CATV system is planned, the optical loss for CATV transmission must be less than 8.0 dB. For reference, Table H gives 1310 nm loss values for some typical components.

As an example, for a narrowband-only system with two fusion splices and a 1.5 dB repair allowance:

OSP loss budget	9.8 dB
minus splice #1	0.2 dB
minus splice #2	0.2 dB
minus repair margin	1.5 dB

available fiber loss	7.9 dB

The maximum buried fiber length is calculated as follows:

363-205-003

$$7.9 \text{ dB}/0.5 \text{ dB/km} = 15.8 \text{ km}$$

In practice, fiber lengths are typically limited to carrier serving area (CSA) distances (12 kft). Fiber lengths can be longer with special engineering.

7.2.4.3 Fiber Cable Network Routing and Layout

To minimize costs, the cables should be run as directly as possible. This contrasts with conventional copper cable networks where the cables are allowed to meander. Also, in contrast with copper cable networks is the use of parallel fiber cables which is often more economical than using branches and taper splices.

7.2.4.4 Number of Fibers Installed Per MSDT

One fiber is needed for each MSDT. An additional fiber is needed for FTTH CATV, if used.

The fibers are aggregated by summing the fiber count for each distribution branch, then aggregating the branch counts toward the RT. A reasonable guideline is to use 10 to 20 percent spares. In practice, LECs generally have approved lists of fiber cables that provide the next larger size cable for a given branch count.

7.2.5 Power Distribution Design

7.2.5.1 General

For centralized powering applications, power sources are located at PPs to supply 130 V DC over one or more copper pairs (typically 19 to 24 gauge) to individual MSDTs. The distance between a PP and its satellite MSDTs determines the number and gauge of the wire pairs required.

The power distribution design consists of PP site determination and the design of the copper network. The power cables need to be connected to the MSDTs through copper terminals and drops. Presently, a power cable cannot be looped through an MSDT. However, the copper terminal could be housed in a hand hole cavity in the base of the MSDT. If CATV is also deployed, separate and additional copper pairs must be provided for CATV power distribution.

7.2.5.2 PP Site Determination

The first design decision to be made for PP site determination is whether there is to be one PP, typically located at the RT, or several smaller PPs spread throughout the area. Factors that influence this decision include the following:

- o First-cost of longer power cabling versus additional PPs
- o Real estate availability

- o Availability of sufficient resources to supply emergency power to all PPs.

In assessing the first-cost factor, it may be beneficial to try several different designs, especially for larger CSAs.

7.2.5.3 Power Distribution Network Design

The power distribution network design process involves finding the quantity and gauge of pairs required to power each MSDT and then combining these pairs into a cable network. The total number of channels served from the MSDT determines the maximum resistance allowed for the power pairs. This in turn determines the quantity and gauge of power pairs to each MSDT.

The wire resistance of a power pair(s) is determined by the gauge and quantity of copper pairs connected in parallel. The wire resistance as a function of gauge is available to OSP engineers from reference books.

When selecting the most appropriate wire gauge to use, the following factors should be kept in mind:

- o Coarser gauges may result in excess copper
- o Coarser gauges are generally available in smaller count cables
- o Coarser gauges require handling of fewer pairs
- o Different cost of different gauges.

In many cases, cables with 22-gauge pairs will turn out to be the least expensive.

The pairs are aggregated by totaling the pair count for each distribution branch, then aggregating the branch counts toward the PP. A reasonable guideline is to add enough spare pairs to serve one extra MSDT on each distribution branch. Since cables are typically available in multiples of 25, the next larger cable should be selected.

7.2.6 MSDT Configuration

The MSDT can be configured for either dual or quad channel unit modes of operation. In the dual mode, with dual channel units that provide two channels each, the MSDT has a total capacity of 12 lines. In the quad mode of operation, with quad channel units that provide four lines each, the MSDT has a total capacity of 24 lines.

In planning an application for the MSDT, the ultimate number of lines to be served from the MSDT should be considered. If the maximum number of lines expected is 12 or less, then the dual mode of operation is recommended. If, however, the maximum number of lines provided by the

MSDT is greater than 12, then the quad mode of operation should be selected.

When the dual mode of operation is selected, it is possible to serve two MSDTs from a single digroup on the RT using time slots 1 through 12 for one MSDT and time slots 13 through 24 for the second MSDT. It would, therefore, be possible to use all of the time slots in the digroup with dual channel units installed in the two MSDTs.

Conversely, if the quad mode of operation is selected for the DT, but dual channel units are used, then the fill on the RT digroup can never exceed 50 percent. To be able to derive 12 channels at the MSDT using dual channel units, all 24 feeder time slots are blocked with only 12 of the 24 channels being used.

If the MSDT is initially configured for dual mode operation and at a later date the number of lines required from the MSDT exceeds 12, it is possible to field-modify the MSDT to operate in the quad mode. The modification involves a short service interruption to change the connectorized protection block to a 12 line capacity and to change the front designation strip.

7.2.7 Number of Living Units per MSDT

The number of LUs that an MSDT can support is determined by looking for the appropriate balance among a number of considerations. The first item to be considered is the number of drops that may be routed to a single MSDT. For metallic distribution, the number of drops has often been four. For service provided by means of the MSDT, however, it is recommended that the MSDT serve as many LUs as possible to reduce the cost per LU.

The next item to be considered is the number of LUs that may be served from an MSDT without the probability of MSDT exhaust being too high. This is an important item of consideration since exhausting the MSDT capacity would require the installation of an additional MSDT and rearranging distribution facilities. To assure that the probability of MSDT exhaust is not too high, the number of LUs served from an MSDT is determined by statistical analysis using the Telco planner's knowledge of the average line take per LU in the area to be served. Table I provides the recommended maximum number of LUs as a function of the known average line take for the area served. The recommended number comes from a "three sigma" analysis, which means that if the recommendation is used and the assumed average line take is correct, then the probability of exceeding the capacity of a given MSDT is approximately 1 in 400.

7.3 RT Design

7.3.1 General

Series 5 channel banks, optics shelves, fiber jumpers, and a high density fiber interconnect (HDIC) are used in the RT. The engineering

of the RT site includes planning for the location of the channel units (CUs) (and optical units). Since the power plant and DS1 links to the CO are not peculiar to the SLC-2000 MSDT feature, their design will not be discussed here. Because most applications are expected to be high-sharing arrangements, vacant slots in the channel banks are normal.

The FTTH narrowband RT equipment is currently available in an 80E cabinet configuration and in a 7-foot bay configuration suitable for controlled environment vaults (CEVs) and huts. The following sections will discuss only the bay arrangement as the 80E cabinet arrangement is prepackaged and is identical in terms of circuit pack population rules. It should be noted that the CATV equipment is currently available only in the 7-foot bay configuration.

7.3.2 Series 5 Channel Banks

In the FTTH arrangement, a bay can serve up to 384 channels, or alternatively, from 16 to 64 AUA406 CUs. An AUA406 CU can be set to provide from 6 to 24 DS0 channels through an AYB1B optical unit (OU) to the associated MSDT.

The proper planning for the number of channels allocated to MSDTs is essential for optimal utilization of RT and feeder equipment. It is desirable to keep the possibility of channel capacity exhaust very low because its occurrence may require rearrangement of the AUA406 CU, the AYB1B OU, the optical jumper, and the lines at the CO.

To decrease the probability of exhaust, the number of channels allocated for each MSDT, from the RT back towards the CO, should be made as large as possible (for example, use the AUA406 CU at higher physical channel unit settings).

Alternatively, allocation of the fewest possible DS0 channels per MSDT increases the probability of exhaust and yields better feeder utilization at the cost of more RT rearrangements.

7.3.3 Optics Shelves

Each 7-foot bay contains up to 4 optics shelves that can serve up to 384 channels. Each optics shelf can handle 48 OUs. One OU is needed per MSDT. Because most applications are expected to be high-sharing arrangements, vacant slots in the optics shelves are normal.

The optics shelves connect to the Series 5 channel banks by means of the channel bank's tip and ring connectors for subscriber loops. Each optics shelf is connected to one channel bank having an AUA406 CU(s). Thus, two optics shelves are required for a Series 5 dual channel bank assembly having AUA406 CUs in both banks.

7.3.4 Fiber Jumpers

One single-mode jumper is needed per MSDT. Since each MSDT

application is custom designed, only the lightguide interconnection cables (LICs) associated with the required OU slot positions are needed.

7.3.5 HDIC

The HDIC bay holds up to 54 of the following two types of interconnection shelves:

- o Fiber termination shelves: These shelves interconnect OSP fibers to the narrowband optics shelves or to the video equipment bays.
- o Optical processing shelves: These shelves interconnect OSP fibers to the video equipment bays and insert optical splitters in the path.

Narrowband services use only the fiber termination shelves, which provide for 24 fiber terminations. CATV services use the optical processing shelves, which provide for different numbers of fiber-in/fiber-out counts depending on the splitter ratio and other factors. Space should be reserved for the optical processing shelves if the future addition of CATV is a possibility.

7.4 `SLC(R)'-2000 MSDT Powering Design

7.4.1 General

The flexibility of the *SLC*-2000 MSDT power interface allows a variety of methods for providing external power to the *SLC*-2000 MSDT. Each method of powering is supported by a different power interface unit and power converter unit combination as shown in Table J.

- o **120 V AC Local Powering:** Commercial 120 V AC is supplied to a curb side *SLC*-2000 MSDT through a direct hook-up with the power utility and to a premises-mounted *SLC*-2000 MSDT through either a connection to premises AC wiring or by placing an adapter ring on the end user's power meter. An advantage of the 120 V AC local powering method is that the LEC does not have a power distribution system to maintain. However, installation costs must include the cost of electrical contractors who must be hired to handle the 120 V AC connections.
- o **-48 V DC Local Backpowering:** This method of powering is accomplished by using -48 V DC (Class II, National Electric Code) sources placed at one to five living units to collectively power the *SLC*-2000 MSDT. The advantage of this powering method is that the power and voltage levels are within the limits that LEC personnel are accustomed to handling.
- o **-130 V DC Central Powering:** A DC power plant is located at the RT or other suitable site to power the entire serving area or several smaller power plants are located within the serving area

to serve a small number of *SLC-2000* MSDTs. To carry the power to the *SLC-2000* MSDTs, a metallic distribution network must be installed and maintained along side the fiber network. Voltage and power levels are kept within the limits of less than -130 V DC, with respect to ground, and 100 W at the power plant output. These limits are defined by Bellcore and the National Electric Code for telephone equipment and cables.

The local powering methods place backup batteries in the *SLC-2000* MSDT enclosure to provide a minimum of 8 hours of operation during commercial power outages, whereas the central powering method centralizes battery maintenance operations. In addition, the central powering method makes feasible the use of a generator to provide power for *SLC-2000* MSDTs during long outages. Note that the use of generators is more practical when a single generator can be placed at an RT site to power the whole serving area as opposed to several generators dispersed throughout the serving area.

The *SLC-2000* MSDT can accept up to three battery strings. The number of battery strings required is determined using Table K.

7.4.2 Local Backpowering

7.4.2.1 General

The -48 V DC power used in powering the MSDT is derived from 120 V AC power at the customer premises where a small power source provides conversion to -48 V DC. From the customer premises, the -48 V DC is routed to the MSDT via copper pairs that parallel the customer drop pairs. In practice, a multipair drop cable is generally used with sufficient pairs for DC power leads as well as the pairs supporting telephone service.

The MSDT, when equipped for -48 V DC powering, will accommodate -48 V DC inputs from one to five subscribers. This allows several power sources from different subscribers to be paralleled to provide redundancy and greater power capacity.

The backpowering system consists of the following:

- o A DC backpowering source that is mounted on one or more living units
- o Copper pairs that conduct the -48 V DC power from each backpowering source to the MSDT
- o MSDT plug-ins AUA412 power control unit (PCU) and AUA415 power interface unit (PIU)
- o A field wiring box (FWB) that provides the connection point and protectors at the interface between the copper pairs and the MSDT.

7.4.2.2 Backpowering Source

The type of enclosure used to house the DC backpowering source is left to the discretion of each individual telephone company. However, some examples of approved enclosures that are available are described in the following paragraphs. The option number below each enclosure in Figure 42 correlates to the option number in the following description.

OPTION 1

A J806HPL *UL* Listed, oiltight, dust free, fiberglass outdoor enclosure measuring 8 inches high, 6 inches wide, and 4-3/8 inches deep. The enclosure has silicone gaskets, integral mounting feet, and a fiberglass door with stainless steel piano-type hinges, a latch, and padlock hasp. The enclosure can be purchased from Robroy Industries, Belding, MI. In addition to the DC power source, the enclosure must be equipped with the following:

- o *ST-1* Myers Hub or Thomas & Betts 370 Hub mounted through the box wall to act as an entrance hole for AC power line connection
- o Surface mount utility box measuring 4 inches long and 2-1/8 inches wide
- o Single position 120 V AC outlet
- o Single position outlet coverplate
- o -48 V DC entrance grommet (COMCODE 803764208 or AT&T Part Number WP 92128, L3) mounted through the bottom of the box to act as an entrance hole for the DC metallic drop cable
- o Right and left backpowering power source mounting brackets (COMCODE 846513893 and 846513885, respectively). Also orderable with the -48 V DC entrance grommet through AT&T Part Number WP 92128, L3.

OPTION 2

A J606HPL outdoor enclosure (COMCODE 406177014 or AT&T Part Number 92128, L2), measuring 6 inches high, 6 inches wide, and 4-3/8 inches deep, is equipped with the -48 V DC local power source and a flexible conduit power cord. This enclosure must be used with a lockable enclosure such as a *HOFFMAN*(R) A-6R44 3R unit or an *EKSTROM*(R) enclosure/power ring in order to receive AC powering. The enclosure/power ring can be purchased from Ekstrom Industries, Inc., Farmington Hills, MI. Due to the various types of power meter pans/sockets used by the power companies, coordination between the telephone company, the power company, and Ekstrom

Industries is required in order to assure that the power ring adapters are compatible with the meter pans/sockets. Before installing this enclosure, verify that it is equipped with an 8 amp circuit breaker.

OPTION 3

An enclosure/power ring assembly with an enclosure measuring 6 inches high, 6 inches wide, and 4-3/8 inches deep. This enclosure/power ring is equipped with a 120 V AC outlet, a circuit breaker, and power source mounting brackets. This enclosure/power ring can be purchased from Ekstrom Industries, Inc., Farmington Hills, MI. Due to the various types of power meter pans/sockets used by the power companies, coordination between the telephone company, the power company, and Ekstrom Industries is required in order to assure that the power ring adapters are compatible with the meter pans/sockets.

OPTION 4

A J606HPL outdoor metal enclosure measuring 6 inches high, 6 inches wide, and 4-3/8 inches deep. This enclosure is equipped with a 120 V AC outlet, circuit breaker, and power source mounting brackets. Two models of this enclosure are available: model 1000-SP2493 is equipped with a 1/2-inch conduit hub on the back and model 1000-SP2484 is equipped with a 1/2-inch conduit hub on the top. This enclosure can be purchased from Ekstrom Industries, Inc., Farmington Hills, MI.

7.4.3 Power Point Design

The central powering equipment at the PP consists of rectifiers, battery strings, -130 V DC converters, 100 VA limiters, lightning protection, interconnection to the OSP, and a status panel. The power required at the MSDTs must have been computed previously from the number of MSDTs before the PP can be designed. For simplicity, the power lost in transmission is assumed to be the maximum allowable. The design process will identify the quantity of components needed in the PP for narrowband services. Additional components and capacity are needed for CATV services. Note that component modularity can result in overcapacity when a PP serves a relatively small number of LUs. For 400 or more LUs, PP costs per LU decrease significantly.

Power point rectifier and battery requirement calculations are required for the following circumstances:

1. When the PP is not colocated with the FTTH transmission equipment (requiring a separate power plant)
2. To determine if additional capacity is needed for the existing rectifier and battery plant if the PP is colocated with FTTH transmission equipment.

In a PP design, the MSDT power needs are determined statistically because all MSDTs do not simultaneously experience maximum power demand. The time-average power depends on the MSDTs and the call traffic. Design traffic load under normal and emergency (power failure) conditions are contained in interface specification TR-57 and listed below:

Condition	Traffic Load
Normal:	9 hundred call seconds (CCS) per customer line
Emergency:	18 CCS per line for 3 hours; then 6 CCS per line for 5 hours

The PP design steps determine the quantities of the following:

- o Rectifiers
- o Battery strings
- o Converters
- o Fuse, shunt, status panels
- o Current limiters
- o OSP interconnects.

The following simplified steps assume that the MSDTs are uniformly loaded and uniformly distributed in distance from the RT.

7.4.4 Power Point Rectifiers

Rectifier power is calculated for 9 CCS/line, the normal traffic load as specified by Bellcore. Each rectifier supplies 50 amps at 48 volts, or 2,400 watts. To determine the number of rectifiers required, divide the available power per rectifier into the total power needed by all MSDTs. Some conversion and circuit pack losses are taken into account. Determine the required number of rectifiers according to the following procedure:

1. Find the power (needed at the PP) per MSDT from Table L.
2. Find the total power for all MSDTs by multiplying the value from Table L by the number of MSDTs.
3. To obtain the number of rectifiers, divide the total power for all MSDTs by 2,100 (rectifier rating minus losses), round up to the next larger integer, and add the quantity of spares (one is usually sufficient).

One full bay is dedicated to PP rectifiers only. A typical configuration is shown in Figure 43.

7.4.5 Power Point Battery Strings

Power point battery power is calculated for 18 CCS/line for 3 hours and then for 6 CCS/line for 5 hours; the emergency traffic load specified by Bellcore. Each battery string supplies 375 amp-hours. The battery design procedure consists of totaling the capacity needed by all MSDTs and then dividing this value by the available capacity per battery to determine the number of batteries required. Some conversion and circuit pack losses are also taken into account. Determine the required number of battery strings according to the following procedure:

1. From Table M, locate the power per MSDT needed at the PP for the first 3 hours of emergency operation.

NOTE:

Tables L, M, and N show the power required at the PP for an MSDT placed at the maximum resistance limits from the PP. Consequently, they may give a somewhat conservative sizing of the PP.

2. From Table N, locate the power per MSDT needed at the PP for the next 5 hours of emergency operation.
3. Find the total battery capacity required for all MSDTs by using the following:

Required Battery Capacity=[(Table M power x 3 hrs.)+(Table N power x 5 hrs.)] x number of MSDTs on PP.

4. To obtain the total number of battery strings required, divide the total capacity required for all MSDTs by 13,800 (battery string rating minus losses) and round up to the next larger integer. Spare battery strings are not usually allocated.

Two battery strings fully occupy one bay. A typical configuration is shown in Figure 44.

7.4.6 Power Point 130 V DC Converters

Converter capacity is calculated for 18 CCS/line, the maximum emergency traffic load as specified by Bellcore. Each converter supplies 780 watts. The converter design procedure consists of totaling the power needed by all MSDTs, then dividing by the available power per converter to determine the number of converters needed. Some circuit pack losses are taken into account.

1. From Table M, locate the power per MSDT required at the PP.
2. Find the total power for all MSDTs by multiplying the value from Table M by the number of MSDTs.

3. To obtain the total number of converters required, divide the total power for all MSDTs by 755 (rectifier rating minus losses), round up to the next larger integer, and add the quantity of spares (one is recommended).

Six converters occupy one full bay. A typical converter bay configuration is shown in Figure 45.

7.4.7 Panels

Each PP bay is also equipped with the following:

- o One 48 V fuse panel
- o Three 130 V fuse panels
- o One shunt panel
- o One status panel
- o One limiter shelf.

7.4.8 Power Point Current Limiters

Determine the number of current limiter shelves and AUA418 current limiter unit (CLU) circuit packs housed in the shelves using the following information:

- o One AUA418 CLU is needed per MSDT
- o Each current limiter shelf houses up to 24 CLUs
- o Each bay can house up to 3 current limiter shelves.

Each current limiter shelf also requires one AUA419 shelf common unit (SCU).

8. Ordering

8.1 Introduction

This chapter is designed to facilitate the equipment engineer's job of issuing a telephone equipment order (TEO). It is not intended to replace standard engineering documentation, for example, schematic drawings, equipment drawings, etc.

This chapter covers ordering information for a *SLC(R)*-2000 Multi-Services Distant Terminal (MSDT) closure and associated equipment and plug-in units. The remote terminal (RT) equipment and plug-in units that are dedicated to the *SLC*-2000 MSDT feature are also covered in this chapter. Since the central office terminal (COT) equipment used in a Feature Package C (FPC) universal configuration is not unique to the *SLC*-2000 MSDT feature, ordering information for this equipment will not be covered in this chapter but can be found in AT&T 363-205-000 (Ordering Guide).

At the present time, the following requirements apply to the *SLC*-2000 MSDT feature:

- o The COT bank must be arranged for FPC.
- o The common units for the COT must be chosen using the existing circuit pack selection rules for FPC COTs (refer to AT&T 363-205-000) and must include the following units:
 - MC97755A1 2 bank control unit (BCU)
 - AUB2 or AUB2B channel test unit (CTU).
- o The RT bank must be arranged for Feature Package F (FPF).
- o The common units for the RT must be chosen using the existing circuit pack selection rules for Feature Package B (FPB) RTs and must include the following units:
 - MC97779A1 BCU
 - AUB27 alarm display unit (ADU)
 - Any C or D series line interface unit (LIU)
 - AUA105 transmit/receive unit (TRU).
- o The RT must be arranged for *Bulk Power*.
- o The RT dual bank assembly must be J1C182AE-1, L().
- o The RT may be equipped with the following channel units:

- AUA406 channel unit (CU) (when working into a *SLC-2000* MSDT)
- AUA400, AUA401, AUA404, or AUA405 CU [when working into a 900-type distant terminal (DT)].
- AUA57 frequency selective ringing (FSR) CU (for dial tone access at the RT site)
- AUA403 test CU.

When ordering the *SLC-2000* MSDT feature equipment in the ED-7C683-30 bulk powered 24-foot controlled environment vault (CEV) platform or in the new 80E bulk power cabinet, the user *must* separately order *all* RT and optical equipment being located in the *SLC* Carrier System bay (including associated circuit packs) since these items are not furnished with the structure (refer to AT&T 363-205-000). The installation of *SLC-2000* MSDT feature equipment in any other RT structure or location must be engineered and ordered on a job basis.

8.2 Remote Terminal Location

8.2.1 CEV or Hut Installation

8.2.1.1 General

Remote terminal carrier equipment installed in a CEV or hut consists of two main components: the RT carrier bay and the high density fiber interconnect (HDIC) bay.

8.2.1.2 RT Bay

The RT framework contains the Series 5 RT banks and the associated optical conversion equipment. The J1C182AE-1, L() dual channel bank assembly with common circuit packs arranged for FPF is required and only the AUA406 channel unit may be used at the RT with the *SLC-2000* MSDT. Two optics shelves containing associated optical unit (OU) circuit packs are required with each dual channel bank assembly to provide the electrical-to-optical and optical-to-electrical conversions required to interface with the fiber distribution plant. One 2B or 2C fan assembly is required per each pair of optics shelves for cooling. One optics power shelf with associated circuit packs is also required to provide power for the RT banks and associated optical equipment mounted in a common carrier bay. A typical 7-foot RT carrier bay is shown in Figure 46.

8.2.1.3 High Density Fiber Interconnect (HDIC) Bay

The HDIC bay is a generic term for the facility used to interconnect the fibers from the optics shelves in the RT carrier bays to the outside plant (OSP) cable fibers. The lightguide interconnect (LIC) cables, containing up to 48 single fibers and equipped with *ST(R)* lightguide cable connectors at both ends, are run from the optics

shelves to the HDIC bay for connection to the assigned OSP fibers. Up to 1,296 OSP and 1,152 LIC fibers may be terminated in one 7-foot frame using the HDIC. The HDIC hardware consists of three main components: the FM1-type fiber apparatus mounting, the FTS1-24ST fiber termination shelf, and the HD1-20 cable clamp bracket assembly. The FM1 mounting comes in either a 400 or 600 zone size; therefore, two bay arrangements are available. The typical 400 zone layout is shown in Figure 47, and the 600 zone layout is shown in Figure 48.

8.2.1.4 Typical Bay Layouts and Ordering Tables

Typical bay layouts and ordering information for *SLC-2000* MSDT feature RT equipment are provided in figures and tables as shown in Table O.

8.2.2 80E Cabinet Installation

An 80E bulk powered cabinet contains the Series 5 RT banks, the associated optical conversion equipment, and fiber interconnect equipment. The J1C182AE-1, L() dual channel bank assembly with common circuit packs arranged for FPF is required, and only the AUA406 channel unit may be used at the RT with the *SLC-2000* MSDT. Two optics shelves containing associated OU circuit packs are required with each dual channel bank assembly to provide the electrical-to-optical and optical-to-electrical conversions required to interface with the fiber distribution plant. One 2B fan assembly is required per each pair of optics shelves for cooling. Two optics power shelves with associated circuit packs are also required to provide power for the RT banks and associated optical equipment mounted in an 80E cabinet. Ordering information for an 80E cabinet equipped with *SLC-2000* MSDT feature RT equipment is provided in Table R.

8.3 'SLC(R)'-2000 MSDT Equipment

The *SLC-2000* MSDT consists of an enclosure that houses a card cage for the common and channel unit circuit packs, a field wiring box, and batteries. The MSDT enclosure mounts on a pole, a wall, or on the ground. When mounted on the ground, the MSDT can be mounted by means of a stake or concrete pad. The MSDT power interface allows a variety of methods for providing external power to the MSDT including 120 V AC local powering, -48 V DC local powering, or -130 V DC central powering.

Ordering information for the MSDT enclosure and associated plug-in units is provided in Tables S and T, respectively.

8.4 Powering Equipment

As mentioned previously, there are three methods for providing external power to the MSDT: 120 V AC local powering, -48 V DC local powering, or -130 V DC central powering. Although it is not possible

to list all of the equipment needed to support all possible methods of providing 120 V AC local power, the following is a list of equipment needed for the more widely used methods.

- o *HOFFMAN* A-6R44 3R unit or *EKSTROM* enclosure/power ring (Orderable from Ekstrom Industries, Inc., 23850 Freeway Park Drive, Farmington Hills, Michigan 48024-1197)
- o Surface mount AC utility box (4" x 21/8")
- o Single position 120 V AC outlet
- o AC power cord housed in a flexible conduit.

A list of the equipment required to support the -48 V DC local powering option is given in Table U.

8.5 Maintenance Equipment

Installation, maintenance, and testing of *SLC-2000* MSDT feature systems will require certain items of test equipment. See AT&T 363-205-004 for detailed maintenance information. Listed in Table V are some of the primary items of test equipment required for turn-up and maintenance of *SLC-2000* MSDT feature systems.

8.6 Documentation

A list of the documentation containing information pertinent to the *SLC-2000* MSDT feature is included in Table W.

8.7 Ordering Example

Table X provides an example of the items that must be ordered for a pedestal mounted MSDT installation that is powered by 120 V AC local power and provides 24 lines of service. Table Y provides an example of the items that must be ordered for a pole mount MSDT installation that is powered by -130 V DC central power and provides 12 lines of service.

9. Product Support

9.1 Engineering and Installation Services

The AT&T Customer Support and Operations (CS&O) organization is committed to providing customers with quality product support services. Whether you need assistance in engineering, installation, normal system maintenance, or disaster recovery, the support staff provides you with the quality technical support you need to get your job done. Each segment of the CS&O organization regards the customer as its highest priority and understands your obligation to maintain quality service for your customer.

Within the CS&O organization, the Engineering and Installation Services group provides a highly skilled force of support personnel to provide customers with quality engineering and installation services. These engineering and installation specialists use state-of-the-art technology, equipment, and procedures to provide customers with highly competent, rapid response services. These services include analyzing your equipment request, preparing a detailed specification for manufacturing and installation, creating and maintaining job records, installing the equipment, and testing and turning over a working system.

When the CS&O organization provides job records and installs the equipment, operationally effective changes to the system are automatically identified and applied to the system at no additional cost.

The Engineering and Installation Services group provides the customer with an individually tailored, quality-tested job that meets our published high standards and the customer's operational requirements. The group ensures that the customer's system order is integrated into a complete working system tailored to office conditions and preferences. This process provides for the customer's complete needs. It includes provisions for cabling, lighting, power equipment, and ancillary connections to local and/or remote alarm systems. The group will also respond to any customer changes that occur during installation.

All equipment engineered and installed by AT&T is thoroughly tested and integrated into a reliable system at cutover. Once approved by AT&T's Quality Assurance Test group (the industry's toughest), the system is turned over to the customer.

The group also provides any specialized engineering and installation services required for unusual or highly individualized applications. These specialized services may include engineering consultations and data base preparation. Your local Account Executive can provide more information about these services.

9.2 Technical Support

Assistance in maintaining your installed system is available through the Regional Technical Assistance Center (RTAC) and the Technical Support Organization (TSO). As shown in Figure 49, your single point of contact is the RTAC. RTAC personnel troubleshoot field problems 24 hours-a-day over the phone and, if necessary, on-site. For technical assistance, simply call **1-800-225-RTAC**. One call guarantees support.

RTAC organizations are supported by a centralized TSO for transmission products.

The TSO maintains a close relationship with Bell Laboratories and other AT&T organizations to expedite resolutions and maintain contact with the development community. This association provides continuous accessibility to every phase of a product life cycle and assures a prompt resolution to all inquiries.

The TSO has also established a technical support medium: the customized on-line aid for customer help (COACH) customer support tools. COACH is a system of on-line support tools aimed at providing product news and bulletins, diagnostic services, compatibility information, and on-line documents. COACH tools provide you with the most up-to-date product information so that problems are either prevented or quickly resolved. COACH tools reside on a dedicated time-share computer accessible over toll-free lines and are available 24 hours a day, 7 days a week.

Many transmission products are currently supported by COACH, and this product will be among them.

Once connected to COACH, the user specifies which product to access and COACH grants the appropriate combination of tools and commands. The user reaches each one of these tools and commands through a centralized, menu-driven computer program. Every screen provides help in making appropriate menu selections. COACH users will achieve proficiency quickly because of the consistency of menu selections among products.

The following COACH tools are available to the user:

Diagnostic dictionary	The diagnostic dictionary contains histories of previously encountered problems and the descriptions of the solutions or workarounds. Your support staff can use this tool when published documentation or standard diagnostic procedures fail to address a problem. Your support staff is allowed to enter problems and solutions into the customer input area of the diagnostic dictionary. TSO personnel evaluate the data daily and, when appropriate, the data is moved to the
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general area.

News and bulletins

Immediately after a user logs into the COACH tools, the news and bulletins tool displays bulletins containing urgent information relating to all the user's products. All users are automatically notified about urgent matters such as problems with scheduled releases, recalls of hardware or software, or scheduled maintenance for computer support. Less urgent messages are distributed through news items that can be sent to individuals or categories of users. Notification of news appears on the screen immediately following current bulletins.

Compatibility data

Occasionally, hardware/software configuration problems arise when new software generics are issued. The compatibility data tools permit users to view the correct hardware configuration associated with a specific software generic. The user simply enters the appropriate software generic number and COACH responds with page-formatted lists of circuit packs compatible with the selected software generic.

Ordering guides

With the COACH ordering guide tool, users can obtain an electronic copy of the latest version of the ordering guide for selected products served by COACH tools. This eliminates the time-consuming delays experienced in distributing hard-copy documentation.

COACH user's guide

COACH supplies an on-line version of its user's guide. The COACH user's guide includes instructions on using the customer support tools and documents any changes to the previous version of the guide.

The TSO strives to provide proactive and responsive technical customer support for all its products. Through the combined efforts of the individual customer support groups and through COACH tools, the TSO provides you with the best possible customer support.

9.3 Documentation Support

The AT&T Document Development Organization provides a contact to report errors or to ask questions about information in this document.

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The document support telephone number is **1-800-334-0404** or
1-910-727-6681 (Monday through Friday, 8 a.m. to 4 p.m. EST).

10. Reliability and Quality

10.1 Introduction

POLICY- Quality excellence is the foundation for the management of our business and the keystone of our goal of customer satisfaction. It is, therefore, our policy to:

- o Consistently provide products and services that meet the quality expectations of our customers.
- o Actively pursue ever-improving quality through programs that enable each employee to do his or her job right the first time.

Robert E. Allen, AT&T Chairman and CEO

This AT&T Quality Policy guided the development of the *SLC(R)*-2000 Multi-Services Distant Terminals (MSDTs) and will continue affecting this product throughout its lifetime. The primary tool ensuring product quality is the Quality Plan, used with the AT&T Transmission Systems Reliability Program.

10.2 Reliability Program

Reliability is a key ingredient of the product life cycle, beginning at the earliest planning stage. Major efforts at the start of the project were system reliability modeling, creating the project quality team (with representatives of all major activity areas), and writing and imposing the quality plan. A key part of the quality plan is the reliability plan.

During the design and developmental stage, reliability predictions, qualification and selection of components, definition of quality assurance audit standards, and prototyping of critical areas of the system ensured built-in reliability.

During manufacturing and field deployment, techniques such as premanufacturing, qualification, production quality tracking, failure mode analysis, and feedback and correction further enhance the ongoing reliability of the *SLC*-2000 MSDT.

10.3 Reliability Specifications

Reliability specifications for the *SLC*-2000 MSDT specify channel unavailability ≤ 4 minutes/year.

10.4 Maintainability Specifications

The following are the *SLC*-2000 MSDT maintenance specifications:

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- o Periodic Maintenance Required -- None
- o Mean Time Between Maintenance Activity -- Optical \geq 70,000 hours.
- o Maintenance action per 100 lines per year = 2.6 actions.

11. Technical Specifications

11.1 Terminal-to-Terminal VF Transmission Specifications

The channel units (CUs) used in the central office terminal (COT) and Multi-Services Distant Terminal (MSDT) determine the voice-frequency (VF) transmission characteristics. The specifications for plain old telephone services (POTS), *SPOTS*(R), and coin CUs are given in Table Z. Table AA lists the specifications for multiparty and frequency selective ringing (FSR) CUs. Specifications for the dual ringing repeater channel unit are listed in Table AB. Table AC lists the specifications for 2- and 4-wire special services. The specifications for quad POTS/*SPOTS* CUs are similar to the specifications for the AUA158 and AUA159 CUs.

The *SLC*(R)-2000 MSDT includes the following features to optimize its performance for shorter loop lengths:

- o When Series 5 CUs are used in the MSDT, the maximum allowable loop resistance is 132 ohms as determined by the AUA413 MSDT ringing generator unit (RGU). Refer to Chapter 7 - *Planning and Engineering* for additional information.
- o Since the *SLC*-2000 MSDT is designed to serve shorter loop lengths, the MC97780A1 backplane interface unit (BIU) introduces additional VF loss into the transmission path to give appropriate loss from the central office to the end user. Table AD provides the proper amount of VF loss required for each CU. Refer to Chapter 5 - *Product Description* for a description of the CUs.

11.2 Digital Data Performance

The AUA52(B) office channel unit (OCU) dataport is designed to provide end links in Digital Data System (DDS). These end links have certain features as follows:

- o One 4-wire circuit per plug-in pair.
- o Data rate -- 2.4, 4.8, 9.6, 56, 19.2 (AUA52B), or 64 (AUA52B) kb/s.
- o Error correction. A digital line bit error rate of 10^{-3} , is improved to 10^{-8} , for any data rate without reducing the channel capacity of the bank.
- o Zero Code Allowed option. Allows an all-zero byte to be transmitted toward the digital line (which must be optioned for B8ZS zero code suppression).
- o Secondary channel. An option which permits a feature of DDS that provides the customer with a low-speed telemetry channel

supplementing the primary data channel at any data rate. (See AT&T RL83-01-163.)

11.3 Physical and Environmental Specifications

11.3.1 Series 5 Remote Terminal

The *SLC* Series 5 Carrier System dual bank assembly and associated Fiber-To-The-Home (FTTH) equipment are designed to be installed in either a controlled environment vault (CEV), hut, or an 80E cabinet. When located in a CEV or hut, the FTTH equipment is installed in a 7-foot high bay and arranged according to Figure 50. In an 80E cabinet, there is space to mount a maximum of four dual bank assemblies with associated FTTH equipment and a DDM-1000 multiplexer (Figure 51). The following is a description of each of these arrangements:

(a) **80E Cabinet:**

- o Houses up to eight 96-line Series 5 systems (four dual channel banks, maximum) with DDM-1000 90-Mb/s lightwave multiplexer with batteries and auxiliary power equipment.
- o Physical size: 74 inches high, 106 inches wide, and 14 inches deep.
- o Input power: 120 V AC, 60 Hz.
- o Operating temperature range: -40<deg>F to +115<deg>F (outside).
- o Operating relative humidity range: 5% to 95% (outside).
- o Has primary lightning protection.

(b) **Bulk Powered 7-Foot Frame:** For use in huts and CEVs.

- o Houses four 96-line Series 5 systems (two dual channel banks), a power shelf, and a fan shelf.
- o Physical size: 84 inches high, 26 inches wide, and 12 inches deep.
- o Input power: -48 V DC (-54.5 V DC maximum, -42 V DC minimum).
- o Operating temperature range: +40<deg>F to +100<deg>F. Short term temperature range of +35<deg>F to +120<deg>F maximum.

11.3.2 `SLC'(R)-2000 MSDT

The *SLC*-2000 MSDT measures 24 inches high, 10 inches wide, and 16 inches deep for a ground mounted enclosure. The pole/wall mounted

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enclosure measures 22 inches high, 10 inches wide, and 16 inches deep.

A fully equipped *SLC-2000* MSDT enclosure, including batteries, weighs approximately 125 pounds. The operating temperature of the *SLC-2000* MSDT is between -40<deg>F and +115<deg>F. The operating relative humidity range is between 5% and 95% (outside). The *SLC-2000* MSDT can be equipped to operate with either 120 V AC (60 Hz), -48 V DC, or -130 V DC input power.

The MSDT flood height will vary depending upon the type of mounting used and minor variations in each installation. The concrete and plastic pad mount with 1-1/2 or 6 inch base provides a flood height of approximately 10 or 14 inches, respectively. The flood height for the stake mounted MSDT is approximately 10 inches, but the height will vary according to how deep the base is buried in the ground.

12. Appendix A - System Documentation

12.1 Overview

Documentation for AT&T Network Systems products may include some or all of the following types of documents:

- o Sales/marketing brochures (presale)
- o Product announcement package
- o 9-digit numbered AT&T documents (postsale)
- o Equipment/apparatus drawings.

The 9-digit numbered AT&T documents include: AT&T practices, manuals, handbooks, quick-reference guides, input/output (I/O) manuals, application guides, administrative documents, engineering documents, descriptive documents, data sheets, recent change/verify (RC/V) documents, user guides/manuals, reference guides/manuals, document indexes, customer information releases (CIRs), procedural documents, task-oriented practices (TOPs), installation documents, maintenance documents, ordering guides, etc.

AT&T practice refers to a document style that uses numbered paragraphs and marked text headings (similar to the original Bell System Practices) and is designated as a practice in the document header. Many of the current AT&T documents are practices, but the practice style is not suited to documents like manuals and applications guides. Several different styles have been used for 9-digit numbered documents that were not suitable for the practice format. In an effort to consolidate and reconcile the different formats that currently exist and to produce consistent documentation, a new multiweight format has been developed. This format is part of the corporate standard that will specify the content and format for all AT&T documentation. Most new documents will be done with the multiweight format; documents to be reissued will be evaluated for conversion. This appendix has been produced using the multiweight format.

12.2 Series 5 System Documentation

12.2.1 General

The following categories of 9-digit numbered documents provide most of the Series 5 system documentation:

- o Indexes
- o Applications and planning guides
- o Ordering guides

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- o Descriptive documents
- o Engineering documents
- o Data sheets
- o TOPs
- o User guides/manuals
- o CIRs.

See information under Outside Plant Documentation [12.3] and under Drawings [12.4] for additional documentation on the Series 5 system and related equipment.

12.2.2 Division 363 Document Index

The numerical index for each division (first 3 digits of the 9-digit number) lists the current issue of the available AT&T documents in that division. The index also lists appendixes and addenda to the current issue. Currently, active indexes are being updated about four times a year. AT&T 363-000-000, *Numerical Index -- Division 363, Loop Transmission Systems* lists all 9-digit numbered documents (that start with 363) for Series 5, SLC(R)-2000, and other loop transmission systems. The Division 363 Index layers (second 3 digits) include data sheets (363-005), CIRs (363-099), SLC 96 Carrier System documents (363-202), and Series 5 system documents (363-205).

The Series 5 documents in the 363-205 division include the following:

- o AT&T 363-205-000, *SLC Series 5 Carrier System, Ordering Guide*
- o AT&T 363-205-002, *SLC Series 5 Carrier System, Fiber-To-The-Home Feature User's Manual*
- o AT&T 363-205-010, *SLC Series 5 Carrier System, Applications and Planning Guide*
- o AT&T 363-205-101, *Craft Interface Unit, Description*
- o AT&T 363-205-103, *SLC Series 5 Carrier System, Centralized Operations and Provisioning, Installation, Test, and Maintenance*
- o AT&T 363-205-104, *SLC Series 5 Carrier System, Integrated Network Access -- Remote Terminal (INA-RT) User's Manual*
- o AT&T 363-205-106, *SLC Series 5 Carrier System, AUA90 T-BRITE Channel Unit for ISDN, Installation and Maintenance*
- o AT&T 363-205-107, *SLC Series 5 Carrier System, AUA93 BRITE II*

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Channel Unit for ISDN, Installation and Maintenance

- o AT&T 363-205-300, *Extended Test Controller, Description, Installation, and Maintenance*
- o AT&T 363-205-400, *SLC Series 5 Carrier System, COT Acceptance and Turnup (TOP)*
- o AT&T 363-205-401, *SLC Series 5 Carrier System, RT Acceptance and Turnup (TOP)*
- o AT&T 363-205-402, *SLC Series 5 Carrier System, Channel Unit Installation (TOP)*
- o AT&T 363-205-406, *SLC Series 5 Carrier System, End-to-End Tests (TOP)*
- o AT&T 363-205-500, *SLC Series 5 Carrier System, Trouble Clearing (TOP)*

12.2.3 Applications and Planning Guides

These documents provide guidelines for network planners for system applications. The applications and planning guide provides a high-level description of system features, arrangements, interfaces, components/equipment, and operations, administration, maintenance, and provisioning (OAM&P). Applications typically are presented as block diagrams showing various system arrangements, equipment interfaces, and how the system fits into the network. Some engineering information may be given, and training may be covered. Appendixes provide details on special features of the system. AT&T 363-205-003, *SLC-2000 Multi-Services Distant Terminal Feature Applications, Planning, and Ordering Guide*, contains a system description and applications, equipment description, OAM&P, engineering, powering, references, and training.

12.2.4 Ordering Guide

The ordering guide provides ordering information (equipment and apparatus codes) for the system. It includes information on how many of each unit, shelf, bank, and/or bay is required for each system arrangement. Also listed are miscellaneous units and special test equipment. AT&T 363-205-000, *Series 5 System Ordering Guide*, has tables listing the units for the system feature packages, some discontinued availability (DA) equipment, common and channel units, cabinet arrangements, miscellaneous equipment, and channel and digital line test equipment.

12.2.5 Descriptive Documents

Descriptive documents usually include physical and functional characteristics and features in a technical style. Depending on the

unit, descriptive information may be combined with engineering, installation, and/or operation information. Descriptive documents may contain procedural information in the step-procedure format (used mainly for short, simple procedures) or flowchart format (used typically for trouble clearing). The data sheet is a descriptive document that may contain procedures. Some AT&T practices use the step-procedure format. AT&T 363-205-101, *Craft Interface Unit Description*, includes a functional description at the block-diagram level, a description of the physical features of the unit, and a summary of the operating characteristics.

12.2.6 Engineering Documents

Engineering documents specify requirements for engineering a system. The requirements may include equipment constraints, customer considerations, circuit or facility design information, physical design constraints, etc. In digital and loop transmission systems, engineering is covered in two separate documents: one for facility design or system engineering, and one for circuit design (prescription setting).

The Series 5 system has two engineering documents. AT&T 915-710-115, *Series 5 System Engineering*, covers central office considerations, remote terminal arrangements, system alarm requirements, digital facility engineering (including fault-locating and order-wire requirements), test facility engineering, distribution (loop) considerations, circuit assignment for nonprovisionable channel units, and miscellaneous considerations (forms/records and acceptance testing). AT&T 915-710-116, *Series 5 Channel Unit Application and Prescription Setting* (structured like the D4 channel unit engineering document), covers special service and data applications, prescription setting for the provisionable channel units, and a summary of carrier serving area (CSA) guidelines.

12.2.7 Data Sheets

The data sheets provide detailed information for plug-in units (usually just circuit packs, not shelves). The data sheet gives a detailed description of the unit's operation, controls, and indicators, and provides figures showing a functional block diagram of the unit and a line drawing of the faceplate and circuit board. Some data sheets may contain details on unit maintenance including test procedures. For example, AT&T 363-005-132, *AUA75 2-Wire PLAR Channel Unit Data Sheet*, has procedures to set the option switches on the channel unit and test channel unit transmission and signaling end-to-end.

The Series 5 data sheets (AT&T 363-005-101 through 363-005-302) cover the common units, channel units, Fiber-To-The-Home units, and miscellaneous units (adapters, test extenders, etc.). Each data sheet is assigned a unique 9-digit number within the range of numbers for the system. (Series 5 data sheets are within the range AT&T 363-005-101 to 363-005-399.)

12.2.8 Task-Oriented Practices (TOPs)

Procedures for acceptance or installation testing and maintenance are given in a highly-structured format in task-oriented practices. These documents exist in two different formats. The older TOPs were done in a flowchart style turned sideways on each page (flowchart TOP). A newer, text style format (vertical page TOP) was developed later that uses numbered steps in a list format with if-then questions replacing the decision blocks used in the flowchart style. The TOP uses layered procedures with the different layers coded for identification. The TOP system is explained in a 10-page training package (always coded TNG-893) in the back of every TOP.

The Series 5 TOPs are listed below:

AT&T 363-205-400

Central Office Terminal Acceptance and Turnup TOP -- procedures for accepting the Series 5 COT, installing the common units for each feature package, converting feature packages, and turning up the system.

AT&T 363-205-401

Remote Terminal Acceptance and Turnup TOP -- procedures for accepting the Series 5 RT, installing the common units for each feature package, converting feature packages, and turning up the system.

AT&T 363-205-402

Channel Unit Installation TOP -- procedures for installing channel units for each system configuration and testing channel unit transmission and signaling from COT to RT for nonprovisionable channel units and end-to-end for provisionable channel units.

AT&T 363-205-406

End-To-End Tests TOP -- procedures for changing the system status from preservice to in-service and verifying that the system works end-to-end.

AT&T 363-205-500

Maintenance and Trouble-Clearing TOP -- procedures for clearing alarms on the system, trouble isolation on the digital facility, and clearing channel failure.

12.2.9 User Guides/Manuals

The definition given here for user guides/manuals differs from the definitions given in the new AT&T documentation standard. As the standards are implemented, this category should become more consistent. In the definition given here, the words "guide" and "manual" have the same meaning.

For a stand-alone product (for example, the DDM-2000 network multiplexer) or independent system feature (for example, the Series 5 Fiber-To-The-Home feature), the user's guide/manual provides a single document containing all the information needed to use the product or feature. It explains when, why, and how to use the feature or product, briefly describes the product's hardware, software, and features, and may provide step-by-step instructions for installation, operation, and maintenance. A user guide/manual may be part of a documentation package that includes one or two other documents, such as an applications and planning guide.

AT&T 363-205-002, *Series 5 Fiber-To-The-Home Feature User's Manual*, contains applications, a physical and functional description, system engineering, operations and administration, construction and installation, maintenance, and appendixes (ordering information, data sheets, etc.).

12.2.10 Customer Information Releases (CIRs)

The purpose of CIRs is to provide customers with timely information. CIRs were developed after divestiture to replace the AT&T general department letters (system letters, recommendation letters, and engineering letters). CIRs may be updated at the discretion of project management, or the information from the CIR may be incorporated into the system documentation upon reissue.

Several different styles of CIRs are used: marketing information letter (ML), product sheet (PS), network planning letter (NP), information release (IR), technical description (TD), technical specification (TS), and maintenance/operations release (MG/MA/MR). Each CIR has a 9-digit number; a different suffix identifies each style. The maintenance/operations release (MOR) uses a color-coded heading to identify the importance of the information. Some styles of CIRs provide additional information in an attachment. The format for each CIR style is given in Table AE, which states how many sheets (one sheet is two pages) are used for the CIR and attachment (if applicable).

Marketing information letters provide information on how to best present Business Services products. These letters are aimed at telephone company marketing personnel and provide the following:

- o Product news about service offerings
- o Portray end-user advantages.

Product sheets are quick overviews that include benefits, features, applications, and a brief technical description. The PS is designed to stimulate customer interest in the product so that the customer will request more information.

Network planning letters provide news on product developments. The NP suggests how a product will fit into the network by describing general

characteristics, primary features, potential benefits, and applications. As development continues, additional product information is supplied for planning and scheduling.

Information releases are general announcements on a wide range of topics, from training programs to new generic releases or special service arrangements. The IR may be used to announce availability of more information on a product.

Technical descriptions provide technical detail to help the customer select a product. The TD provides a functional description, site preparation data, operations and maintenance considerations, ordering, and training information. The TD should be updated when standard ordering information is available.

Technical specifications provide physical, functional, environmental, and interface characteristics, and performance objectives of the product. The TS may provide the following:

- o Product description
- o Interface information
- o The basis for product inspection
- o The technical basis for the warranty.

The maintenance/operations release emphasizes information about upgrades or changes in operations and maintenance procedures associated with current products. The maintenance/operations release has three different levels of importance: routine, coded MG (green); caution, coded MA (amber); and emergency, coded MR (red).

12.3 Outside Plant Documentation

Outside plant documentation on transmission apparatus, cables, and enclosures spans several divisions. Division 622 covers conduit, manholes, and cable vaults, including the concrete hut and controlled environment vaults used for Series 5 systems. Division 626 (cables, wire, and apparatus - general) documents the different kinds of cables and provides ordering information and lettering guidelines for the 80-type outside plant cabinets. Division 631 (cable terminals) documents exchange cable identification, different types of connector blocks, and splicing information for pedestals and cabinets. Division 640 (outside plant - carrier apparatus) covers carrier apparatus cases (which house repeaters for digital lines), SLC Carrier System splicing in various cabinets and enclosures, and lightguide cable systems. Refer to AT&T 000-000-002, *AT&T 9-Digit Numbered Documents Master Index*, for other divisions of outside plant documentation.

Outside plant documentation (a partial list) on the Series 5 system includes the following:

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- AT&T 622-506-050, *Controlled Environment Vaults (CEVs), Description*
- AT&T 622-506-052, *KS-23038 Controlled Environment Vault Description*
- AT&T 622-506-235, *Concrete Hut ED-7C285-30, Description and Installation*
- AT&T 622-506-236, *KS-23038 Controlled Environment Vault Installation*
- AT&T 622-506-237, *KS-23038 Controlled Environment Vault Operation and Maintenance*
- AT&T 626-500-105, *80-Type Cabinet, Coding Scheme, Ordering Information, and Lettering Guidelines*
- AT&T 627-320-011, *Placing Lashed Aerial Cable, General*
- AT&T 628-200-216, *Lightguide Cable Placing, Underground*
- AT&T 629-200-206, *Guidelines for Placing Buried Plant*
- AT&T 629-200-215, *Buried Plant, Plowing*
- AT&T 629-240-001, *Plowing Guidelines for Placing Lightguide Cable*
- AT&T 629-240-220-1, *Clustered Pedestal DT Closure, Installation*
- AT&T 631-600-240, *80 B, C, and D Size Cabinets, Installation*
- AT&T 631-600-241, *80 B, C, and D Size Cabinet, Splicing Information*
- AT&T 636-299-103, *Lightguide Distribution Shelves, Description and Installation*
- AT&T 636-299-110, *Lightguide Sheath Preparation, Grounding, Blocking, and Buffering*
- AT&T 636-299-115-1, *High Density Fiber Interconnect System, Installation Instructions*
- AT&T 640-250-223, *80-Type Cabinet Remote Terminal, Installation and Splicing (Metallic Systems)*
- AT&T 640-250-224, *Remote Terminal Splicing, Precabled Structures Using Bulk Protection*

- AT&T 640-250-237, *51A RT Cabinet (ED-7C601-30) Placement, SLC Series 5 System*
- AT&T 640-250-247, *SLC Series 5 Carrier System Dual Channel Banks (Metallic), Field Installation of SLC Series 5 Carrier System Remote Terminal Into 80-Type Cabinets Precabled for the SLC Series 5 Carrier System*
- AT&T 640-250-248, *Precabled Structure Using Bulk Protection Metallic Remote Terminal Splicing SLC Series 5 Carrier System*
- AT&T 640-250-250, *Precabled Structures Using Bulk Power and Protection, Splicing, and Cabling Arrangements (Metallic and Fiber SLC Carrier Systems)*
- AT&T 640-250-251, *16-Foot and 24-Foot Platforms Description SLC Series 5 Carrier System*
- AT&T 640-250-252, *80D Cabinet (Fiber) Group 80 Description, Installation, and Splicing, SLC Series 5 Carrier System*
- AT&T 640-250-255, *80D Cabinet (Fiber) Group 90, 91, 92 Description, Installation, and Splicing, SLC Series 5 Carrier System*
- AT&T 640-250-256, *80E Cabinet (Fiber) Group 90 and 91, Description, Installation, and Splicing, SLC Series 5 Carrier System and SXSS Repeater Shelf*
- AT&T 640-250-259, *80E-BP (Bulk Power) Cabinet (Group 1) Splicing and Cabling Arrangements for FTTH (Fiber-To-The-Home) Feature*
- AT&T 640-250-280, *Precabled 24-Foot CEV Using Bulk Power and Protection, Splicing and Cabling Arrangements*
- AT&T 640-250-325, *80 D Cabinet Description, Installation, and Splicing SLC Series 5 Carrier System*
- AT&T 640-250-327, *80E Cabinet Remote Terminal, Description, Installation, and Splicing*
- AT&T 640-252-106, *OTDR (Optical Time Domain Reflectometer), Description and Use*
- AT&T 640-252-125, *LGA 2 Lightguide Cable Splicing and Splice Testing*
- AT&T 640-252-176, *Lightguide Cable, Single-Mode and Multimode RMS (Rotary Mechanical Splice)*

- AT&T 640-252-177, *Rapid Ribbon Splicing, Lightguide Ribbon Cable*
- AT&T 640-252-310, *Concrete Hut (ED-7C285-30) Splicing (Metallic and Fiber Systems), Combined SLC 96 and SLC Series 5 Carrier Systems*
- AT&T 640-252-311, *C Equipment Platform Splicing (Metallic and Fiber Systems), Combined SLC 96 and SLC Series 5 Carrier Systems*
- AT&T 640-252-312, *80-Type Cabinets, Description, Installation, and Splicing, Combined SLC 96 and SLC Series 5 Carrier Systems*
- AT&T 644-203-155, *80-Type Cabinet, Repair and Replacement Parts*

12.4 Drawings

Equipment drawings (J drawings), apparatus drawings (A drawings), schematic drawings (SDs), and circuit descriptions (CDs) provide detailed wiring, cabling, schematic, and physical information. Circuit descriptions (when available) use the same number as the schematic drawing. There may be limited availability on some drawings. Refer to Division 801 for J drawings and other equipment specifications.

The following drawings contain detailed information on Series 5 equipment and related systems.

- SLC(R) *Series 5 Carrier System Ordering Guide*, ED-7C628-10
- *Writing Shelf*, ED-30335-70
- *Central Office Terminal Channel Bank Schematic*, SD-/CD-7C115-01
- *Central Office Terminal Application and Bay Wiring Schematic*, SD-/CD-7C116-01
- *Remote Terminal Dual Channel Bank Schematic*, SD-/CD-7C117-01
- *Remote Terminal Application and Bay Wiring Schematic*, SD-/CD-7C118-01
- *Remote Terminal Power Shelf Schematic*, SD-/CD-7C119-01
- *Extended Test Controller Control Shelf*, SD-/CD-7C127-01
- *Remote Terminal Optics Power Shelf Schematic*, SD-7C150-01
- *Remote Terminal Optical Shelf Schematic*, SD-7C151-01
- *Fiber-To-The-Home Analyzer Schematic*, SD-7C154-01

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- o SLC-2000 MSDT Channel Bank Schematic, SD-7C166-01
- o SLC-2000 MSDT Application Schematic, SD-7C167-01
- o Pair Gain Test Controller Control Shelf, SD-/CD-97760-01
- o Floor Plan Data Sheet, SLC Series 5 Carrier System Fiber-To-The-Home Feature, 7-foot 0-inch Frame (Two Dual Channel Banks), FPD 801-450-107-1

12.5 Related Documentation

The following documents contain information on systems and equipment related to the Series 5 system. The numerical index for each division (for example, AT&T 363-000-000, *Numerical Index -- Division 363, Loop Transmission Systems*) lists the current issue of the AT&T documents in that division. Refer to the numerical index for availability of AT&T documents listed below.

- o AT&T 100-101-401, *197A Battery Load Test Set, Description and Operation*
- o AT&T 157-627-101, *Storage Battery, KS-21906 Sealed, Rechargeable, Lead-Acid, Description, Installation, and Maintenance*
- o AT&T 363-005-zzz, *SLC Series 5 Carrier System Data Sheets*
- o AT&T 363-202-300, *Pair Gain Test Controller, Description and Installation*
- o AT&T 363-206-100, *DDM-1000 Multiplexer User's Manual*
- o AT&T 363-206-200, *DDM-2000 Network Multiplexer, Applications and Planning Guide*
- o AT&T 902-200-115, *Digital Line Engineering Program (DILEP)*
- o AT&T 919-240-302, *16-Foot Controlled Environment Vault Engineering Considerations*

12.6 Bell Communications Research Documents

- o BR-680-203-023, *Assignment Procedures for the Series 5 Carrier System*
- o BR-902-200-120, *Outside Plant Engineering, Digital Line Engineering Program II (DILEP II)*

13. Appendix B - Training

13.1 Courses and Scheduling

AT&T Product Training Services announces a training program for the Series 5 system. Course TR4601 is available for technicians, supervisors, and maintenance personnel who are involved in operating the *SLC(R)* Series 5 Carrier System. Also, course TR4602 on the *SLC* Series 5 Carrier System Fiber-To-The-Home (FTTH) feature is now available and may be taken after completing TR4601.

These courses cover the operation, maintenance, and installation of the central office terminal (COT), remote terminal (RT), and FTTH feature. Students will go through a hands-on turnup of the carrier system using a functional system and associated test equipment.

Courses are available now and will be offered several times each month. To register for a class or obtain scheduling information, call your company's training coordinator. If your company does not have a designated training coordinator, call this toll-free number to order a product training catalog, get more information on a course, find out about new courses, or register for a class:

1-800-TRAINER

When you call 1-800-TRAINER, you will be given five options. Press the option that is appropriate for the training you want:

Option 1:

For information on *UNIX(R)* System Education, PRESS 1 (all *UNIX* system courses and curricula).

Option 2:

For information on AT&T product training for technicians, PRESS 2 (technical and maintenance courses for technicians and technical support personnel).

Option 3:

For information on engineering, manufacturing, and computer system education, PRESS 3 (AT&T employee training only).

Option 4:

For information on management, business, and trainer development education, PRESS 4 (Management, Business, Finance, Marketing, and Training Development Education at the Corporate Education Center in Hopewell, NJ).

Option 5:

For information on AT&T product training for managers and professionals, PRESS 5 (technical, maintenance, administration, and engineering courses for managers and professionals).

13.2 TR4601 - SLC(R) Series 5 Carrier System Turnup and Test

13.2.1 General

Course TR4601 covers the operation and maintenance of both the COT and RT. Also, this course covers the identification of central office and remote terminal functions, system configurations, modes of operations, procedures for isolating and correcting system troubles, and performing a complete system turnup and test. Students perform T1 line verification, turn up a COT and RT, do end-to-end testing, fault-locate the T1 line, and test overall system performance.

13.2.2 Who Should Take TR4601?

This course is designed for central office technicians, outside plant, and maintenance personnel. Also, the course may be beneficial for staffers, planners, sales people, and managers.

13.2.3 Length of the Class

The length of course TR4601 is 5 days.

13.2.4 Prerequisites

Students need a background in telephony and an understanding of basic transmission principles.

13.2.5 Media

Course TR4601 is a combination of instructor lectures and group discussions reinforced with 60 percent hands-on exercises on operational systems that are representative of those in the field.

13.2.6 Location

Course TR4601 is taught at the AT&T National Product Training Center in Dublin, Ohio.

13.2.7 Class Size

Classes are limited to 12 students.

13.3 TR4602 - SLC Series 5 Carrier System Fiber-To-The-Home Feature

13.3.1 General

Course TR4602 covers the operation and installation of the FTTH feature of the SLC Series 5 Carrier System. Students go through a hands-on turnup of the carrier system using a functional system and associated test equipment. This Phase One version covers plain old telephone service (POTS). As cable TV access is added, the course will be updated.

13.3.2 Who Should Take TR4602?

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Course TR4602 is designed primarily for telephone company outside plant engineers and maintenance personnel. The course may help staffers, planners, sales people, and managers.

13.3.3 Length of the Class

The length of course TR4602 is 2 days.

13.3.4 Prerequisites

For course TR4602 , students need a working knowledge of the *SLC* Series 5 Carrier System as provided by course TR4601, Series 5 Turnup and Test.

13.3.5 Media

Course TR4602 is a combination of instructor lectures and group discussion reinforced with practical hands-on exercises on an operational system. Students gain experience working with a *SLC* Series 5 Carrier System equipped with the FTTH feature.

13.3.6 Location

Course TR4602 is taught at the AT&T National Product Training Center in Dublin, Ohio.

13.3.7 Class Size

Classes are limited to 12 students.

13.4 TR4621 - SLC(R) Series 5 Carrier System Fiber-To-The-Home Feature Seminar

13.4.1 General

Course TR4621 covers the operation and installation of the FTTH feature of the Series 5 system. This Phase One version covers POTS. As cable TV access is added, the course will be updated.

13.4.2 Who Should Take TR4621?

Course TR4621 is designed primarily for telephone company outside plant engineers and maintenance personnel. The course may help staffers, planners, sales people, and managers.

13.4.3 Length of the Class

The length of course TR4621 is 1 day.

13.4.4 Prerequisites

Students need a working knowledge of the *SLC* Series 5 Carrier System as provided by course LE1010, *SLC* Series 5 Seminar.

13.4.5 Media

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Course TR4621 is a combination of instructor lectures and group discussion.

13.4.6 Location

Course TR4621 is taught at the AT&T National Product Training Center in Dublin, Ohio.

13.4.7 Class Size

Classes are limited to 24 students.

13.5 LE1010 -- SLC Series 5 Carrier System Management Overview

13.5.1 General

Course LE1010 is designed to familiarize management personnel with the *SLC Series 5 Carrier System* architecture, features, operations, service capabilities, applications, and economics. This course provides the information necessary to identify the various support systems used for maintenance. Students learn the channel unit provisioning process and learn to identify planning and economic considerations that are part of *SLC Series 5* carrier implementation.

13.5.2 Who Should Take LE1010?

This course is designed for telecommunication managers responsible for the planning, implementation, and maintenance of the *SLC Series 5* Carrier System.

13.5.3 Length of the Class

The length of course LE1010 is 2 days.

13.5.4 Prerequisites

Students should have a background in telephony and an understanding of basic digital transmission principles.

13.5.5 Media

Course LE1010 is a combination of instructor lectures and class discussion.

13.5.6 Location

Course LE1010 is taught at the AT&T National Product Training Center in Dublin, Ohio.

13.5.7 Class Size

Classes are limited to 24 students.

14. Legal and Support Information

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The ordering number for this document is AT&T 363-205-003. To order this document, call 1-800-432-6600 or 1-317-352-8557. RBOC/BOC customers should process document orders or standing order requests through their Company Documentation Coordinator. For more ordering information, refer to How to Order Documents in the section About This Guide.

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Developed by the AT&T Document Development Organization.

List of Tables

Table A: Series 5 Channel Units Supported in the `SLC(R)'-2000 MSDT

CU Code	CU Type	Services and Functions Provided
AUA25B[1][2]	POTS/M SPOTS(R)	POTS, Centrex Line, FX Trunk, FX Line, WATS Trunk, WATS Line, PBX- CO Trunk, Off-Premises Extension, Secretarial Line, Off-Premises Station (OPS) (station end)
AUA27	POTS + VerSuS(R) Alarms	POTS, VerSuS Alarms
AUA31[2][3]	POTS CS	OPS (PBX end)
AUA32[2]	POTS/SPOTS CS	Same as AUA31
AUA38[2][3]	POTS CS + OHT	Same as AUA31
AUA39[2]	POTS/SPOTS CS + OHT	Same as AUA31
AUA45B[4]	Ringdown Repeater	Private Line Ringdown
AUA51[1][2]	POTS/SPOTS	Same as AUA25B
AUA53	Coin	Coin
AUA55[5]	Multiparty	Multiparty
AUA56	DID	PBX-CO DID Trunk
AUA57	FSR	Frequency Selective Ringing
AUA58B[1][2]	POTS + OHT	POTS, Telemetry, FX Line, Off-Premises Extension, WATS Line, Secretarial Line, OPS (station end), Centrex Line
AUA59[1]	POTS/SPOTS	Same as AUA25B
AUA75	Private Line Automatic Ringdown	Private Line Ringdown
AUA150[2]	POTS/SPOTS + OHT	Same AUA25B, Telemetry
AUA158[2]	ALC POTS + OHT	Same as AUA58B
AUA159[2]	ALC POTS/SPOTS + OHT	Same as AUA150
AUA41	4W VF CF	DX4: PBX tie trunk, DX signaling normal or reverse polarity; FXS: Foreign exchange line or trunk, no toll diversion, loop- or ground-start, normal or reverse polarity.
AUA41	4W VF CF	FXT: Foreign exchange trunk, toll diversion, loop- or ground-start, normal or reverse polarity; TO: Transmission only.
AUA42	E SPOTS CS	FXO: OPS, (PBX end); TO: Transmission only.
AUA43	E SPOTS CF	FXS: Foreign exchange line or trunk with toll diversion; OPS line (station end); TO: Transmission only.
AUA44	4W VF CS	FXO: OPS (PBX end), loop- or ground-start, normal or reverse polarity
AUA52[4]	Dataport	DDS/BDS (2.4, 4.8, 9.6, and 56 k/s)
AUA52B[4]	All-Rate Dataport	DDS/BDS (2.4, 4.8, 9.6, 19.2, 56, and 64 k/s)
AUA54[3][6]	4W VF E&M	EM4: PBX tie trunk, E&M signaling, Type I or II; PLR: PBX tie trunk, inverted-polarity E&M signaling

- [1]When these units are matched with an AUA39 CU in the COT and used in a loop start (LS) application employing a 5ESS(R) switch, or any digital switch that leaves the Tip-Ground open (floating), the line will be dead for up to 4 seconds after going off-hook with a ringing telephone at the MSDT.
- [2]To reduce costs, local exchange carriers (LECs) should consider using POTS or POTS/SPOTS CUs at the MSDT for nonlocally-switched and nonswitched special services. See the detailed specifications of these CUs to determine if these CUs are compatible with local practices for these services.
- [3]An MSDT housing one, or more, AUA31, AUA38, and AUA54 CUs must be used only in end-user premises applications because protection against outside-plant electrical hazards is not incorporated in these CUs.
- [4]The AUA45B, AUA75, AUA52, and AUA52B CUs are intended for business applications and will only be supported with 12 physical CU slots allocated to the AUA406.
- [5]On multiparty circuits provided by the AUA55, the MSDT supports two-party, fully-selective ringing and does not support four-party, fully selective ringing. The ringing generator unit (RGU) provides only negative-superimposed ringing; both negative- and positive-superimposed ringing are required to provide four-party, fully-selective ringing.
- [6]An MSDT tip/ring cabling arrangement without protectors is provided for the support of E&M CUs (refer to Chapter [REF. 1] - Ordering, SLC-2000 MSDT Equipment). Tip/ring wiring assignments for E&M CUs will be included with MSDT engineering drawings. Due to LEC administrative issues and because the E&M CU provides a single circuit, the E&M CU will only be supported in a dual-mode MSDT. Also, due to LEC administrative issues, SLC-2000 quad-circuit CUs will not be supported in an MSDT equipped with E&M CUs.

[REF. 1] 8

Table B: `SLC(R) '-2000 MSDT Powering Interface

Power Source	PIU Required	PCU Required
120 V AC	AUA414	AUA412
-48 V DC	AUA415	AUA412
-130 V DC	AUA416	AUA417

Table C: Software Generics

ARSB Equipment	Software Generic
Loop Maintenance Operations System (LMOS) Host	G4 or later
LO CAP Front End - LMOS or HI CAP Front End - LMOS	G5, Iss. 2.1 or later G1, Iss. 1.0 or later
Front End - MLT	G5, Iss. 1.0 or later

Table D: Firmware Issues

Equipment	Issue
LTS (PGTC)	5
LTS (XTC)	6

Table E: `SLC(R) '-2000 MSDT Feature DC Signatures for Drop Tests

DC Signature (Resistance T-R (Ohms))	Indication	Dispatch To
15K-24K	RT/MSDT link up and MSDT does not support testing	MSDT
24K-34K	RT/MSDT link up and MSDT common equipment failure	MSDT or as indicated by channel test
34K-44K	RT/MSDT link up and drop test OK	As indicated by channel test
44K-54K	RT/MSDT link up and drop open	MSDT
54K-64K	RT/MSDT link up and leakage/FEMF on drop	MSDT
64K-74K	RT/MSDT link up and receiver off hook (ROH)	MSDT or customer premises
74K-86K	RT/MSDT link up and hazardous potentials on drop	MSDT
>2500K	RT/MSDT link down	RT

Table F: `SLC(R) '-2000 MSDT Feature PGTC Channel Test Results

VER Code: Returned	DC Signature (Resistance T-R) (Ohms)	Channel Test Indication	Dispatch To
VER 95	24K-86K	Pass, channel good from COT to MSDT	As indicated by drop test[1]
VER 99[2]	24K-86K	Fail, fiber link good to MSDT, channel test fails, DC signature may indicate drop test failure	MSDT or as indicated by drop test
--	15K-24K	Fiber link good RT to MSDT, no channel test	MSDT
--	>2500K	Fiber link bad (OOF) RT to MSDT, no channel test	RT

[1]If drop and channel tests are ok, make a test call to subscriber location.

[2]The VER 99 code may also appear for problems other than the ones listed here.

Table G: Maximum Drop Cable Lengths

Cable/Drop Length (Kft.)

Wire Gauge	68<deg>F (20<deg>C)	149<deg>F (65<deg>C)
19	6.2	5.3
22	3.1	2.6
24	2.0	1.7
26	1.2	1.0

Table H: Single Mode OSP Loss Budget (Linear Design)

Environment (Note 1)	Ribbon or Lightpack(R) Cable Loss (Note 2)						Units
UG/B	0.50						dB/km
NORM	0.50						
EXTN	0.55						
ST(R) Connector Loss							Units
UG/B	0.6						dB/Connector
NORM	0.6						
EXTN	0.8						
Splice Loss							
	Active Rotary or ERMS*	CSL Fusion	LightSplice(TM) System	Passive Rotary Array	or ERMS*	SRRS*	Units
UG/B	0.10	0.2	0.23	0.5	0.25	0.5	dB/Splice
NORM	0.12	0.2	0.25	0.6	0.25	0.6	
EXTN	0.15	0.2	0.27	0.8	0.30	0.8	

Notes:

1. All loss budgets apply at 1310 nm and 1550 nm environments.
 - o UG/B -- Underground/buried environment (+15<deg>F to +170<deg>F)
 - o NORM -- Normal aerial environment (-10<deg>F to +170<deg>F)
 - o EXTN -- Extended aerial environment (-40<deg>F to +170<deg>F).
2. The maximum individual fiber loss (MIFL) is specified.

* SRRS = Single-mode rapid ribbon splice
 ERMS = Enhanced rotary mechanical splice.

Table I: Maximum Number of LU Per Average Line Take

Planning Area Avg. Lines/LU	Recommended Max. LUs/MSDT
1.10	18
1.15	16
1.20	15
1.25	14
1.30	13
1.40	12
1.50	11
1.60	10
1.70	9
1.80	9
1.90	8
2.00	7

Table J: `SLC(R) '-2000 MSDT Powering Interface

Power Source	PIU Required	PCU Required
120 V AC	AUA414	AUA412
-48 V DC	AUA415	AUA412
-130 V DC	AUA416	AUA417

Table K: `SIC(R) '-2000 MSDT Battery Requirements

Number of Lines Equipped	Number of Battery Strings
1 -- 4	1
5 -- 8	2
9 -- 24	3

Table L: Time-Average PP Power Per MSDT (9 CCS/Line)

Lines/LU	LU/PP: <250				>250			
	LU/MSDT:				LU/MSDT:			
	4	8	12	16	4	8	12	16
	PP Power (Watts)				PP Power (Watts)			
1.1	23	30	38	45	20	26	32	37
1.25	23	31	39	47	21	27	33	39
1.5	24	33	43	*	22	29	36	*
2.0	26	38	*	*	24	33	*	*

* Not recommended due to the probability of MSDT exhaust.

Table M: Time-Average PP Power Per MSDT (18 CCS/Line)

Lines/LU	LU/PP: <250				>250			
	LU/MSDT:				LU/MSDT:			
	4	8	12	16	4	8	12	16
	PP Power (Watts)				PP Power (Watts)			
1.1	27	39	51	59	23	32	41	48
1.25	28	40	52	63	24	34	43	53
1.5	29	43	57	*	26	37	48	*
2.0	33	50	*	*	29	43	*	*

* Not recommended due to the probability of MSDT exhaust.

Table N: Time-Average PP Power Per MSDT (6 CCS/Line)

Lines/LU	LU/PP: <250				>250			
	LU/MSDT:				LU/MSDT:			
	4	8	12	16	4	8	12	16
	PP Power (Watts)				PP Power (Watts)			
1.1	21	27	33	38	19	24	29	33
1.25	22	28	35	41	20	25	30	35
1.5	22	30	38	*	21	27	33	*
2.0	24	34	*	*	22	30	*	*

* Not recommended due to the probability of MSDT exhaust.

Table O: Figures and Tables for Typical Bay Layouts

Equipment Bay Type	Typical Bay Layout	Ordering Information
RT Carrier Bay	Figure [REF. 1]	Table [REF. 2]
HDIC Bay with FM1-400	Figure [REF. 3]	Table [REF. 4]
HDIC Bay with FM1-600	Figure [REF. 5]	Table [REF. 4]

[REF. 1] 46

[REF. 2] P

[REF. 3] 47

[REF. 4] Q

[REF. 5] 48

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Table P: RT Carrier Bay Equipment

Qty of Order	Order Wording	COMCODE	CLEI Code	Bay Bay		Description	Notes
				Min	Max		
	ED-8C500-50, G5	601019458	--	1	1	7-foot Network Bay Framework	
	J1C182AE-1, List 1	601164866	5SMRA22	1	2	RT Dual Channel Bank	1,2
	J1C182AE-1, List 3	601286214	5SMRA43B	1	2	RT Dual Channel Bank	1,2,3
	AUA406 Circuit Pack	105516447	5SCF660EAA	1	64	6-24 DSO Optical Channel Unit	4
	MC97779A1 Circuit Pack	106486087	5SXTA04BAA	1	4	Bank Control Unit	
	AUB27 Circuit Pack	103841235	5SCSAA0BXX	1	4	Alarm Display Unit	
	AUA105 Circuit Pack	104194550	5SPQAALAXX	1	8	Transmit/Receive Unit	
	AUA61C Circuit Pack	104411459	5SLI1A3AXX	1	20	Line Interface Unit	
	AUA62C Circuit Pack	104411467	5SLI123AXX	1	20	Line Interface Unit	
	AUA64C Circuit Pack	104411475	5SLI143AXX	1	20	Line Interface Unit	
	AUA61D Circuit Pack	105703946	5SLI1A4AXX	1	20	Line Interface Unit	
	AUA62D Circuit Pack	106314305	5SLI125AXX	1	20	Line Interface Unit	
	AUA64D Circuit Pack	105703961	5SLI145AXX	1	20	Line Interface Unit	
	2C Fan Unit	106382336	--	1	2	RT Cooling Fan Assembly	2
	J1C182PA-1, List 1, A, B	601272065	5SMRC50C	2	4	Optical Shelf	2,5
	J1C182PB-1, L1	601236193	--	1	1	Optics Power Shelf	
	AYB1B Circuit Pack	105550461	5SCF24ABXX	1	192	OU, Optical Unit	5
	AUA11C Circuit Pack	105728042	5SCD4J2AXX	4	8	PCU, Power Converter Unit	6
	AUA402 Circuit Pack	104432877	5SCF300CXX	1	1	A/FCU, Alarm Fan Control Unit	7
	AUG11	106193485	5SCB3B0HAA	2	4	BFU, Bank	8

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Bank Fuse Unit			Fuse Unit		
FS48E-E-35 LIC Cable	105642565 --	1	4	Lightguide Interconnect Cable 35 feet	9
FS1E-E Lightguide Jumper	846238384 --	1	64	Single Lightguide Jumper 18 feet	

Notes:

1. Order common units for the J1C182AE-1, L() dual channel banks per AT&T 363-205-000.
2. For minimum bay configuration, the lower two optics shelves, the lower dual channel bank assembly, and the lower fan unit are installed along with the power shelf.
3. Order J1C182AE-1, L3 when electromagnetic compliance (EMC) is required.
4. The AUA406 CU provides between 6 and 24 channels of service to a single MSDT and occupies three adjacent channel unit slots in the dual bank assembly. The AUA406 has full channel test capability, and drop test capability when used in conjunction with the AUA411 channel and drop test unit at the MSDT.
5. Each J1C182PA1 optics shelf may contain up to 48 AYB1B OUs. One AYB1B OU is required for each AUA406 CU.
6. The AUA11B/C PCU is required in the optics power shelf to provide +-5 V DC to the AYB1B OUs. Each PCU provides power for 24 OU slots. Do not use the AUA11 PCU [rated discontinued availability (DA)] for SLC(R)-2000 MSDT feature applications.
7. The AUA402 A/FCU is located in the optics power shelf.
8. The AUG11 BFUs are located in the optics power shelf and supply power to the dual banks, PCU, fan units, and A/FCU.
9. One LIC cable assembly is required for each optics shelf (J1C182PA-1). This cable is used to jumper the fibers from the optical shelf to the HDIC bay for interconnection to the OSP cable fibers. The LIC cable assembly is 35 feet in length and consists of four bundles of 12 fibers each for a total of 48 fibers. Each fiber is tagged at both ends and each bundle has a blank system decal at each end of the spiral wrap for identification purposes.

Table Q: High Density Fiber Interconnect Bay

Qty of Order	Order Wording	COMCODE	Bay Min	Bay Max	Description	Notes
	ED-8C500-50, G5	601019458	1	1	7-foot Network Bay Framework	
	147A1 Bracket	105574735	1	1	Door Bracket Package	1
	ED-6C321-50, G3	601248404	1	1	Duct Doors	1
	HD1-20 Bracket	105566194	1	1	Cable Clamp Bracket	2
	FM1-600 Apparatus Mtg. ---- (or) ----	105566186	1	2	600 Zone Apparatus Mtg.	3
	FM1-400 Apparatus Mtg.	105566178	1	3	400 Zone Apparatus Mtg.	
	FRS1-24ST(R) Shelf	105733042	1	54	Shelf, Fiber Termination	10
	FTS1-24ST Shelf	105566202	1	54	Shelf, Fiber Termination	4
	FTS1-24ST-C Shelf	106011943	1	54	Shelf, Fiber Termination	11
	C3000A2 Coupling	105271142	1	1,296	Coupling, ST Single Mode	5
	P3020AC-125 Connector	105271118	1	1,296	Connector, ST Single Mode	6
	12A1 Clamp	104384490	2	20	Cable Clamp	7
	1032B Tool Kit	105536767	--	--	Tool Kit	8
	136A Bracket	103838843	2	2	Bracket	9
	26A Shelf	103808713	1	1	Work Shelf	9

Notes:

1. The doors and associated hardware are required to provide security for the OSP and LIC fiber connections.
2. The HD1-20 bracket assembly provides clamping and grounding positions for a maximum of 20 OSP cables and will accommodate up to twenty 12A1 cable clamps.
3. The FM1 apparatus mountings provide space and material for routing, storing, and organizing the OSP fibers and the LIC fibers incoming from the RT carrier bay optics shelves. The FM1-400 will accommodate up to 18 FTS1-24ST termination shelves and the FM1-600 will accept up to 27 FTS1-24ST shelves.
4. Each FTS1-24ST fiber termination shelf provides for the termination of 24 ST connectors. Up to 24 C3000A2 couplers may be field installed in the termination shelf. The OSP fibers are terminated on the rear of

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- the couplers using field installed P3020AC-125 connectors. The LIC fibers are connected to the coupling on the front of the panel.
5. The C3000A2 couplers are field installed in the FTS1-24ST shelf. See Note 4 above.
 6. Provide one P3020AC-125 connector for each individual outside plant fiber terminated on the C3000A2 coupling. The connector is provided with a dust cap and strain relief boot.
 7. One 12A1 clamp is required for each outside plant fiber cable. When using the HD1-20 bracket (HDIC bays), order and install the 12A1 clamps in pairs only. When using the LST1U shelf (LGX(R) frames), two 12A1 clamps may be mounted on each LST1U shelf.
 8. The 1032B tool kit is required to install the P3020AC-125 connectors to the outside plant fibers. Provide as required.
 9. Provide two 136A brackets and one 26A shelf if a work shelf is desired on the HDIC bay.
 10. The FSR1-24ST fiber termination shelf is equipped with 24 ST connectors and 2 mini fanouts.
 11. The FTS1-24ST-C fiber termination shelf is equipped with 24 ST connectors.

Table R: RT Carrier 80E Bulk Power Cabinet

Qty of Order	Order Drawing	Wording Grp	Max. Per Cab.	Description	Notes
	128E Bracket	--	1	Used when casting concrete pad for the 80E cabinet.	1
	ED-7C707-30	G1	1	Cabinet assembly, wiring and apparatus configured to accommodate one DDM-1000 multiplexer and up to four SLC(R) Series Series 5 dual channel banks (DCBs) equipped with the FTTH feature. Includes one Fm1-400 fiber apparatus mounting and one HD1-20 bracket.	2,3
	ED-7C707-30	G2	2	Required in addition to G1 to provide one SLC Series 5 DCB (first or third), one RT optics power shelf assembly (first or second), two optical shelves (first and second or fifth and sixth), two 2B fan units, and five fiber termination shelves.	
	ED-7C707-30	G3	2	Required in addition to G1 to provide one SLC Series 5 DCB (second or fourth), two optical shelves (third and fourth or seventh and eighth), one 2B fan unit, and four fiber termination shelves.	
	ED-7C707-30	G4	1	Required in addition to G1 to provide one FS48E-E lightguide interconnect cable and (48) 18-foot jumpers (four bundles A, B, C, D). This assembly is enough for one optical shelf (1-95 odd numbers only).	
	ED-7C707-30	G5	1	Required in addition to G1 to provide one FS12E-A lightguide interconnect cable and (12) 18-foot jumpers (bundle A). This assembly is enough to equip one quarter of an optical shelf (1-23 odd numbers only).	
	ED-7C707-30	G6	1	Required in addition to G1 to provide one FS12E-E-B lightguide interconnect cable and (12) 18-foot jumpers (bundle B). This assembly is enough to equip one quarter of an optical shelf (25-47 odd numbers only).	
	ED-7C707-30	G7	1	Required in addition to G1 to provide one FS12E-E-C lightguide interconnect cable and (12) 18-foot jumpers (bundle C). This assembly is enough to equip one quarter of an optical shelf (49-71 odd numbers only).	
	ED-7C707-30	G8	1	Required in addition to G1 to provide one FS12E-E-D lightguide interconnect cable and (12) 18-foot jumpers (bundle D). This assembly is enough to equip one quarter of an optical shelf (73-95 odd numbers only).	
	ED-7C707-30	G9	As Req'd.	Required in addition to G1 to provide one FS1E-E lightguide interconnect cable and one 18-foot jumper. This optional cable	

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can be used for testing or as a spare jumper. No cable number or system identification is provided.

	ED-7C707-30	G10	1	Provides cabling to install one remote measurement unit (RMU) (excludes the RMU which must be ordered separately).	
--	ED-7C707-30	G11 thru G29	--	(unassigned)	
	ED-7C707-30	G30	1	Required in addition to G1 to provide an AC power system which includes AC power panel with interlock, generator inlet enclosure equipped with a HUBBELL(R) 430B9W receptacle (30-amp pin and sleeve 240 V AC 249 V AC 3-phase standard), conduit, and wiring.	2
--	ED-7C707-30	G31 thru G33	--	(unassigned)	
	ED-7C707-30	G34	1	Required in addition to G1 to provide an AC power system which includes an an AC power panel, conduit, and wiring.	2
	ED-7C707-30	G35	1	Required in addition to G1 to provide an AC power system which includes an AC power panel, leg-mounted transfer switch equipped with a Hubbell 2715 (30-amp twist-lock) receptacle, conduit, and wiring.	
--	ED-7C707-30	G36, G37	--	(unassigned)	
	ED-7C707-30	G38	1	Required in addition to G1 to provide an AC power system which includes an AC power panel with interlock, generator inlet enclosure equipped with a HUBBELL 43012W (30-amp pin and sleeve 120/240 V AC standard), receptacle, conduit, and wiring.	2
--	ED-7C707-30	G39, G40	--	(unassigned)	
	ED-7C707-30	G41	1	Required in addition to G1 to provide an AC power system which includes an AC power panel with interlock, generator inlet enclosure equipped with a HUBBELL 2715 (30-amp twist-lock) receptacle, conduit, and wiring.	2
	ED-7C707-30	G42	1	Required in addition to G1 to provide an AC power system which includes an AC power panel, a leg-mounted transfer switch equipped with a HUBBELL 430B9W (30-amp pin	2

and sleeve 240 V AC 3-phase standard) receptacle, conduit, and wiring.

ED-7C707-30	G43	1	Required in addition to G1 to provide an AC power system which includes an AC power panel, leg-mounted transfer switch equipped with a HUBBELL 430B12W (30-amp sleeve 120/240 V AC standard) receptacle, conduit, and wiring.	2
ED-7C707-30	G44	1	Required in addition to G1 to provide an AC power system which includes an AC power panel, leg-mounted transfer switch equipped with a HUBBELL 4100B9W (100-amp pin and sleeve 240 V AC 3-phase standard) receptacle, conduit, and wiring.	2,3
ED-7C707-30	G45	1	Required in addition to G1 to provide an AC power system which includes an AC power panel, leg-mounted transfer switch equipped with a HUBBELL 4100B12W (100-amp pin and sleeve 120/240 V AC standard) receptacle, conduit, and wiring.	2,3
ED-7C707-30	G46	1	Required in addition to G1 equipped with G44 or G45 to provide AC service to a collocated cabinet.	3
--	ED-7C707-30 G47 thru G50	--	(unassigned)	
ED-7C707-30	G51	1	Required for G1 when equipped with one or two G93s. Provides apparatus and wiring for up to two SXSS T-repeater shelves, SXSS shelves must be ordered separately.	4
--	ED-7C707-30 G52, G53	--	(unassigned)	
ED-7C707-30	G54	1	Required in addition to G1 to provide a 307/tie block DSX. (DSX jumpers are not provided.)	
ED-7C707-30	G55	1	Required in addition to G1 to provide an 800 series DSX. (DSX jumpers are not provided.)	
ED-7C707-30	G56	1	(unassigned)	
ED-7C707-30	G57	1	Required in addition to G1 to provide a 307/tie block DSX with DSX jumpers arranged for four SLC Series 5 DCBs and (24) T-repeaters.	
ED-7C707-30	G58		(unassigned)	
ED-7C707-30	G59	1	Required in addition to G1 to provide and 800 series DSX with DSX jumpers	

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arranged for four SLC Series 5 DCBs and (24) T-repeaters.

	ED-7C707-30	G60	1	Always required in addition to G1 to provide the -48 volt bulk power system.	
	ED-7C707-30	G61		(unassigned)	
	ED-7C707-30	G62	4	Required in addition to G1 to provide cables and associated apparatus for one 100 Ah string of Chloride(R) 3VB11 batteries. (Batteries not included.)	
	ED-7C707-30	G63	4	Required in addition to G1 to provide cabling and associated material for one 110 Ah string of AT&T Lineage 2000, VR Series batteries. (Batteries not included.)	
--	ED-7C707-30	G64 thru G80	--	(unassigned)	
	ED-7C707-30	G81	1	Required in addition to G1 to provide a DDM-1000 multiplexer, one 2B fan unit, and associated wiring.	
--	ED-7C707-30	G82 thru G84	--	(unassigned)	
	ED-7C707-30	G85	1	Required in addition to G1 to provide a cable assembly required to activate the fan units for humidity control in sparsely equipped cabinets.	
--	ED-7C707-30	G86 thru G92	--	(unassigned)	
	ED-7C707-30	G93	2	Required in addition to G1 and G51 to provide an SXSS T-repeater shelf. (Plug-in protector units are provided.)	5

Notes:

1. The comcode for the 128E bracket is 104439831. This bracket is used to accurately locate the mounting inserts and cable openings in the concrete pad and becomes a permanent part of the pad.
2. One AC power system (G30, G34, G38, G41, G42, G43, G44 or G45) must be ordered for each G1 cabinet order. The AC power system is shipped (factory installed) with each cabinet.
3. One G46 must be provided for G1 cabinets equipped with G44 or G45 to provide AC service to a collocated cabinet.
4. Order SXSS T-repeater shelves per G93.
5. G93 provides one SXSS T-repeater shelf (J98725CA-1).

Table S: `SIC(R) '-2000 MSDT Enclosure

Qty of	Order Wording			
Order	Drawing	Grp	Description	Notes
	ED-7C712-30	G1	AT&T light gray, Fiber-In-The-Loop basic enclosure	1,2
--	ED-7C712-30	G2 thru G9	(unassigned)	
	ED-7C712-30	G10	Equipment required in addition to G1 to provide a card cage and backplane (MSDT channel bank) arranged for dual mode operation, which can accommodate up to six channel units (12 lines).	3,4,5
	ED-7C712-30	G11	Equipment required in addition to G1 to provide a card cage and backplane (MSDT channel bank) arranged for quad mode operation, which can accommodate up to six channel units (24 lines).	3,5,6
--	ED-7C712-30	G12 thru G19	(unassigned)	
	ED-7C712-30	G20	Equipment required in addition to G1 to accept 120 V AC local input power.	
	ED-7C712-30	G21	Equipment required in addition to G1 to accept -48 V DC local input power from up to four external sources.	
	ED-7C712-30	G22	Equipment required in addition to G1 to accept -48 V DC local input power from up to eight external sources.	
	ED-7C712-30	G23	Equipment required in addition to G1 to accept -130 V DC central input power.	7
--	ED-7C712-30	G24 thru G29	(unassigned)	
	ED-7C712-30	G30	Equipment required in addition to G20, G21, G22 to provide a battery compartment and heater for up to three strings of KS-21906, L20 batteries.	7
--	ED-7C712-30	G31 thru G39	(unassigned)	
	ED-7C712-30	G40	Equipment required in addition to G10 to provide a backplane cover, binding post terminations, gas tube protectors, and wiring for 12 telephone lines.	4
	ED-7C712-30	G41	Equipment required in addition to G11 to provide a backplane cover, binding post terminations, gas tube protectors, and wiring for 24 telephone lines.	6

	ED-7C712-30	G42	Equipment required in addition to G10 to provide a backplane cover, insulation displacement (Quick Clip) terminations, gas tube protectors, and wiring for 12 telephone lines.	4
	ED-7C712-30	G43	Equipment required in addition to G11 to provide a backplane cover, insulation displacement (Quick Clip) terminations, gas tube protectors, and wiring for 24 telephone lines.	6
	ED-7C712-30	G44	Equipment required in addition to G10 and G11 to provide splice terminations with no protectors for up to 24 telephone lines.	4,6,8
--	ED-7C712-30	G45 thru G59	(unassigned)	
	ED-7C712-30	G60	Equipment required in addition to G1 and G100 or G101 to provide a 1-1/2 inch high base for concrete or plastic pad mounting.	
	ED-7C712-30	G61	Equipment required in addition to G1 and G100 or G101 to provide a base for stake mounting.	
	ED-7C712-30	G62	Equipment required in addition to G1 and G100 or G101 to provide brackets for pole mounting.	
	ED-7C712-30	G63	Equipment required in addition to G1 and G100 or G101 to provide brackets for wall mounting.	
	ED-7C712-30	G64	Equipment required in addition to G1 and G100 or G101 to provide a 6-inch high base for concrete or plastic pad mounting.	
--	ED-7C712-30	G65 thru G69	(unassigned)	
	ED-7C712-30	G70	Equipment required in addition to G1 to provide door alarm switches for both doors.	
--	ED-7C712-30	G71 thru G79	(unassigned)	
	ED-7C712-30	G80	Equipment required for field upgrade of G10 to G11 for enclosures requiring binding post terminations and gas tube protectors.	9
	ED-7C712-30	G81	Equipment required for field upgrade of G10 to G11 for enclosures requiring insulation displacement (Quick Clip) terminations and gas tube protectors.	10

	ED-7C712-30	G82	Equipment required for field upgrade of G10 to G11 for enclosures with no protectors (for example, those already equipped with G44).	11
--	ED-7C712-30	G83 thru G99	(unassigned)	
	ED-7C712-30	G100	Equipment required in addition to G1 to provide an adjunct enclosure to house CATV service circuit packs and provide one CATV coaxial output.	1,12,13
	ED-7C712-30	G101	Equipment required in addition to G1 to provide an adjunct enclosure to house CATV service circuit packs and provide eight CATV coaxial outputs.	1,12,13
	ED-7C712-30	G102	Interface cable required to connect G1 to G100 or G101 for pedestal mounted applications	2,12,13
	ED-7C712-30	G103	Interface cable required to connect G1 to G100 or G101 for pole or wall mounted applications	2,12,13

Notes:

1. The following items shall be ordered separately in addition to items ordered per this drawing:
 - o All plug-in circuit packs
 - o Batteries (if required)
 - o Concrete or plastic pads for pedestal mounting.
 Refer to AT&T 363-205-005, SLC-2000 CATV Feature User's Manual, for detailed ordering information for G100 or G101 and associated equipment. Refer to AT&T 363-205-004, SLC-2000 Multi-Services Distant Terminal Feature User/Service Manual, for enclosure installation and wiring information for G1.
2. For the G1 enclosure application and wiring schematic, refer to SD-7C167-01.
3. Single, dual, and quad channel units can be used in both G10 and G11. In general, using single and dual channel units in G10 and quad channel units in G11 maximizes efficient use of the system. If the system is eventually expected to be run in the quad mode of operation, however, G11 should be ordered.
4. Group 10 should be equipped with G40, G42, or G44 for up to 12 telephone lines. If G44 is used, the 12 extra splice pairs and terminations can be stored for potential future use. To upgrade G10 (dual mode) to G11 (quad mode), G80, G81, or G82 can be added later.
5. E&M channel units shall only be used with G10 equipped with G44. Quad channel units shall not be used with E&M channel units.
6. Group 11 should be equipped with G41, G43, or G44 for up to 24 telephone lines.
7. Group 30 is not required when G23 (-130 V DC central input power) is ordered. The battery back-up for -130 V DC will be located with the -130 V DC central power node source.
8. Group 44 should be ordered when no protectors or fixed terminations (binding posts or insulation displacement) are required. Group 44 consists of a 24-pair raw-ended harness that is spliced to the drop pairs (inside or outside the enclosure) using 709-type Quick Snap(R) connectors. Twenty-four 709-type connectors are supplied when G44 is ordered.

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9. Group 80 includes binding post terminations and gas tube protectors for (24) pairs, cables, card cage designation strip, and upgrade instructions.
10. Group 81 includes insulation displacement (Quick Clip) terminations and gas tube protectors for (24) pairs, cables, card cage designation strip, and upgrade instructions.
11. Group 82 includes a card cage designation strip, (24) 709-type Quick Snap connectors, and upgrade instructions.
12. For the G100 and G101 application and wiring schematic, refer to SD-7C167-01.
13. Groups 100 or 101, and G102 or G103 can be ordered with G1 or ordered at a later date for field upgrade. In both cases, they will be shipped in a separate container and must be assembled to G1 in the field.

Table T: `SIC(R) '-2000 MSDT Plug-In Units

Qty of Order	Order Wording	COMCODE	CLEI Code	Qty per MSDT	Description
	BYB1B Circuit Pack	106446727	5SCT300AAA	1	OU, Optical Unit
	MC97780A1 Circuit Pack	106383540	5SCT420AAA	1	BIU, Backplane Interface Unit
	AUA411 Circuit Pack	106275696	5SPQAA3AAA	1	CDTU, Channel and Drop Test Unit
	AUA412 Circuit Pack	106275969	5SPQAAAXAAA	1	PCU, Power Converter Unit
	AUA413 Circuit Pack	106275977	5SPQ10SAAA	1	RGU, Ringing Generator Unit
	AUA414 Circuit Pack	106296957	5SPQAAWAAA	1	PIU, Power Interface Unit
	AUA415 Circuit Pack	106296965	5SPQAA6AAA	1	PIU, Power Interface Unit
	AUA416 Circuit Pack	106358161	5SPQAAZAAA	1	PIU, Power Interface Unit
	AUA417 Circuit Pack	106436504	5SPQAA1AAA	1	PCU, Power Converter Unit

Table U: -48 V DC Local Powering Equipment

Equipment	Apparatus Code	COMCODE
-48 V DC Local Power Source Enclosure - Available from Robroy Industries, Belding, MI, Part No. J806HPL	--	--
Myers ST-1 Hub or Thomas & Betts 370 Hub	--	--
Surface Mount AC Utility Box (4" x 21/8")	--	--
Single Position 120 V AC Outlet	--	--
Single Position Outlet Coverplate	--	--
-48 V DC Entrance Grommet	WP 92128, L3	803764208*
Right Mounting Bracket	WP 92128, L3	846513893*
Left Mounting Bracket	WP 92128, L3	846513885*
Local Power Source	WP 92128, L1	406177006
Local Power Source Plus Enclosure With AC Power Cord	WP 92128, L2	406177014
Local Power Source Mounting Screws (6 machine screws, No. 8/32, 1/4" long)	--	--
E-Type Armored Service Drop Burial Wire 22 Ga., 4-Conductor	AT-8776	--
C-Type Service Wire 22 Ga., 2- or 5-Conductor	AT-8545	--
E-Type Burial Wire 19 Ga., 2-Conductor	AT-8483	--

* Order all three items together using COMCODE 406185488.

Table V: `SLC(R) '-2000 MSDT Feature Maintenance Equipment

Qty of Order	Order	Wording	COMCODE	CLEI	Code	Min Qty	Description	Notes
	J99407TA-1,	L1	601252604	--		1	Analyzer	1
	J99404TA-1,	L2	601202674	5STE101AAA		1	Craft Interface Unit	2
	J99409OB-1,	L1	601300742	--		1	Optical Backplane Maintenance Kit	3
	KS-23557,	L1	405772591	--		1	Access Shelf	4
	Allen-type	Wrench	840841324	--		1	Door Access Tool	
	216C	Tool	--	--		1	Door Access Tool	
	WP91067,	L6	405525809	--		1	Test Cord	5

Notes:

- The DT analyzer is a modified DT and is used for installation and maintenance testing. It comes shock mounted in a portable carrying case. It is designed to isolate faulty circuit components and interconnections. The analyzer is powered by rechargeable batteries, and is supplied with a D test cord plus the following circuit packs: ASJ1, ASH1, AYB1B, and AUA403. When COT-to-RT tests are performed, the associated AUA406 CU is replaced with the AUA403 CU. RT-to-analyzer testing requires an AUA400, AUA401, AUA404, or AUA405 CU at the RT.
- The CIU is required for end-to-end system tests and provisioning during turn-up of a SLC(R)-2000 MSDT with special service channels.
- The optical backplane maintenance kit (OBMK) is used to clean the optical backplane couplings of any dust particles deposited on the optical sleeves. The OBMK also serves to insert or remove the protective plug on the circuit pack side of the backplane couplings during turn-up or customer service termination. The following consumables may be ordered as required for use with the OBMK:
 - CXM50 FLEXTIPS(TM)
 - MiniSwabs
 - Chemtronics, Inc.
 - Hauppauge, NY 11788
 - Comcode 405865916
 - Protective Plug
 - Comcode 846238202
 One MiniSwab and 20 protective plugs are supplied with the OBMK.
- The access shelf is required when there is a need to access the backplane of the optical shelf for initial installation of the lightguide jumper cable or for replacement of a defective jumper and/or backplane coupling.
- Allows access to tip/ring jacks on faceplate of channel units.

Table W: `SLC(R) '-2000 MSDT Feature Documentation

Document	Title
AT&T 363-005-262	Data Sheet AYB1B Circuit Pack
AT&T 363-005-271	Data Sheet BYB1B Circuit Pack
AT&T 363-005-272	Data Sheet MC97780A1 Circuit Pack
AT&T 363-005-273	Data Sheet AUA406 Circuit Pack
AT&T 363-005-275	Data Sheet AUA411 Circuit Pack
AT&T 363-005-276	Data Sheet AUA412 Circuit Pack
AT&T 363-005-277	Data Sheet AUA413 Circuit Pack
AT&T 363-005-278	Data Sheet AUA414 Circuit Pack
AT&T 363-005-279	Data Sheet AUA415 Circuit Pack
AT&T 363-005-280	Data Sheet AUA416 Circuit Pack
AT&T 363-005-281	Data Sheet AUA417 Circuit Pack
AT&T 363-005-282	Data Sheet AUA418 Circuit Pack
AT&T 363-005-283	Data Sheet AUA419 Circuit Pack
AT&T 363-205-004	SLC(R)-2000 Multi-Services Distant Terminal Feature User/Service Manual
AT&T 363-205-005	SLC-2000 CATV Feature User's Manual

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Table X: MSDT Ordering Example A - Pedestal Mount, 24 Service Lines, 120 V AC
Locally Powered MSDT

Item	Order Code
MSDT enclosure	ED-7C712-30, G1
Quad mode operation	ED-7C712-30, G11
120 V AC local power	ED-7C712-30, G20
Battery backup capability	ED-7C712-30, G30
Binding post terminations	ED-7C712-30, G41
Pedestal mount	ED-7C712-30, G60

Required at MSDT Location

AUA411 CDTU	106275696
AUA412 PCU	106275969
AUA413 RGU	106358856
AUA414 PIU	106296957
BYB1B OU	106446727
FHA1 BIU	106383540
Quad channel units	--
KS-21906, L20 batteries *	406405217
Pedestal pad	ED-7C715-01

Required at RT Location

AUA105 TRU	104194550
AUB27 ADU	103841235
MC97779A1 BCU	106486087
AUA406 CU	105516447
AYB1B OU	105550461

* Two or three strings, as needed.

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Table Y: MSDT Ordering Example B - Pole Mount, 12 Service Lines, -130 V DC Centrally Powered MSDT

Item	Order Code
MSDT enclosure	ED-7C712-30, G1
Dual mode operation	ED-7C712-30, G10
-130 V DC central power	ED-7C712-30, G23
Insulation displacement terminations	ED-7C712-30, G42
Pole mount	ED-7C712-30, G62

Required at MSDT Location

AUA411 CDTU	106275696
AUA413 RGU	106358856
AUA416 PIU	106358161
AUA417 PCU	106436504
BYB1B OU	106446727
FHA1 BIU	106383540
AUA58B dual channel units	105710297

Required at RT Location

AUA105 TRU	104194550
AUB27 ADU	103841235
MC97779A1 BCU	106486087
AUA406 CU	105516447
AYB1B OU	105550461

* Two or three strings, as needed.

Table Z: Transmission Specifications - VF Channel Units with Fixed Settings

Parameter	Value (Measured at 25<deg>C)		
	POTS	SPOTS(R) Uni	Coin
Loop Resistance (Beyond the RT Excluding the Set)	0-1500ohm	CSA Loops	0-1500ohm
Loop Current	> 20mA		> 23mA
1000-Hz Loss (+-0.5dB Typical, 1dB (REXT <= 1100 +-100) [1] +-1.0dB Max)	0dB [2] 0dB (REXT >= 1100 +-100) [1]		
Bandwidth (Relative to the 1000-Hz Loss)	0 to -3.0dB at 300Hz and 3000Hz 0 to -1.5dB at 400Hz and 2800Hz		
Return Loss at the COT [3]	ERL >= 18dB, SRL >= 12dB		
Return Loss at the RT [4]	ERL >= 18dB, SRL >= 15dB		
Idle Channel Noise (at the RT)	20dBrnC Maximum		
Signal-to-Distortion Ratio (at -10dBm)	> 33dB		
Dial Pulse Distortion [Peak to Average Ratio (PAR)]	> 90		
Gain Tracking (1004Hz) -37dBm0 to +3dBm0 -50dBm0 to -37dBm0	+-0.5dB Maximum (+-0.25dB Average) +-1.0dB Maximum (+-0.5dB Average)		
Intermodulation Distortion (-13dBm0 Input)	A-B (R2) Product: > 43dB 2A-B (R3) Product: > 44dB		
Single Frequency Distortion (0-12kHz 0dBm0)	< -28dBm0		
Impulse Noise [5]	<= 15 Counts in 15 Minutes		
Overload at COT and RT	>= +3dBm0		
Longitudinal Balance at the RT [6] (Minimum)	200Hz, 500Hz, 1000Hz: >= 58dB 3000Hz: >= 53dB		

Notes:

- [1] Measured as insertion loss between 900ohm terminations. REXT includes both the loop resistance and the station set resistance. Actual threshold value for REXT is 1100ohms +-100ohms.
- [2] Measured as the ICL with the RT terminated in 600ohms and with the COT terminated in 900ohms.
- [3] Measured with respect to 900ohms and 2.16uF with the 4-wire path broken or with the other end terminated in 1100ohms in parallel with 0.03uF.
- [4] Measured with respect to 600ohms and 2.16uF with the 4-wire path broken or with the other end terminated in 900ohms and 2.16uF.
- [5] Measured with a holding tone of -13dBm0 and a threshold of 59dBrnC0.
- [6] Measured by Institute of Electrical and Electronics Engineers (IEEE) method 455-1976.

Table AA: Transmission Specifications - Multiparty and FSR Channel Units

Value (Measured at 25<deg>C)

Parameter	Multiparty	FSR
Loop Resistance (Beyond the RT Excluding the Set)	0-1500ohm	0-900ohm
1004Hz On-hook Loss	<=5dB Over 1004Hz Off-hook Loss	On-hook Transmission Not Supported
Loop Current	> 20mA	
1000-Hz Loss (+-0.5dB Typical, +-1.0dB Max)	1dB	
Bandwidth (Relative to the 1004-Hz Loss) [1]	-0.5 to +1.0dB at 400Hz and 2800Hz	
Return Loss at the COT [2]	ERL >= 18dB, SRL >= 10dB	
Return Loss at the RT [3]	ERL >= 18dB, SRL >= 10dB	
Idle Channel Noise (at the RT)	20dBrnC Maximum	
Signal-to-Distortion Ratio (at -10dBm)	> 33dB	
Dial Pulse Distortion [Peak to Average Ratio (PAR)]	> 90	
Gain Tracking (1004Hz) -37dBm0 to +3dBm0 -50dBm0 to -37dBm0	+-0.5dB Maximum (+-0.25dB Average) +-1.0dB Maximum (+-0.5dB Average)	
Intermodulation Distortion (-13dBm0 Input)	A-B (R2) Product: > 43dB 2A-B (R3) Product: > 44dB	
Single Frequency Distortion (0-12kHz 0dBm0)	< -28dBm0	
Impulse Noise [4]	<= 15 Counts in 15 Minutes	
Overload at COT and RT	>= +3dBm0	
Longitudinal Balance at the RT [5] (Minimum)	200Hz, 500Hz, 1000Hz: >= 58dB 3000Hz: >= 53dB	

[1]Measured with a signal level of 0dBm0. + means more loss, - means less loss.

[2]Measured with respect to 900ohms and 2.16uF and with 900ohms in series with 2.16uF in parallel with a hold coil at the RT.

[3]Measured with respect to 900ohms in series with 2.16uF with a hold coil at the RT and with -48 V battery feed terminated with 900ohms in series with 2.16uF at the COT.

[4]Measured with a holding tone of -13dBm0 at a threshold of 59dBrnC0.

[5]Measured by IEEE method 455-1976.

Table AB: Transmission Specifications - AUA45 Dual Ringing Repeater Channel Unit

Parameter	Value (Measured at 25<deg> C)
Loop Design	The AUA45 channel unit is not limited to CSA design rules. Maximum cable loss should not exceed 9dB, split in any proportion between the two end cable links. Total combined loop resistance (not including the terminating equipment) should not exceed 1500ohms.
Structural Impedance	900ohms +2.16uF
Balance Impedance	900ohms +2.16uF
1000-Hz Loss [1] (+-0.5dB typical, +-1.0dB max)	0dB or 3dB (switch selectable)
Bandwidth (Relative to the 1000-Hz loss)	+1 to -0.5dB at 400Hz and 2800Hz
Return Loss [2] (end-to-end)	ERL >= 26dB, SRL >= 20dB
Idle Channel Noise [3]	20dBrnC Maximum
Signal-to-Distortion Ratio (at -10dBm)	> 33dB
Peak to Average Ratio (PAR) (dial pulse distortion) at -13dBm	> 90
Gain Tracking (1004Hz) -37dBm0 to +3dBm0 -50dBm0 to -37dBm0	+ -0.5dB Maximum + -1.0dB Maximum
Intermodulation Distortion (-13dBm0 Input)	A-B (R2) Product: > 43dB 2A-B (R3) Product: > 44dB
Single Frequency Distortion (0-12kHz 0dBm0)	< -28dBm0
Impulse Noise at 47dBrnC0	<= 15 Counts in 15 Minutes
Overload at COT and RT	at +3dBm0 is <= 0.5dB compression
Longitudinal Balance at the RT [4]	200Hz, 500Hz, 1000Hz: >= 58dB 3000Hz: >= 53dB
Equal-Level Crosstalk	Better than -65dB (200Hz to 3400Hz)

[1]Measured as insertion loss between 900-ohm terminations.

[2]Measured with respect to 900ohms and 2.16uF with the opposite end terminated in 900ohms in series with 2.16uF.

[3]Measured with 900-ohm terminations on both ends.

[4]Measured with IEEE Method 455-1976.

Table AC: Transmission Specifications - VF Channel Units with Adjustable Settings

Parameter	2-Wire E SPOTS(R) CUs (AUA42, AUA43)	4-Wire CUs (AUA41, AUA44, AUA54)
Loop Resistance (beyond RT, excluding telset)	CSA loops	0-2800 ohms (loop start, ground-start) 0-5000 ohms (DX)
Gain Range (Granularity)		
Metallic Interface to digital line	-1.0dB to 6.75dB (in 0.25dB steps)	Range depends on function code
Digital line to metallic interface	-8.0dB to 1.5dB (in 0.25dB steps)	Granularity = 0.1dB
Gain Tracking		
Input -37 to +3dBm	+/-0.25dB	+/-0.25dB
Input -50 to -37dBm	+/-0.50dB	+/-0.50dB
Equalization	(Slope type) Equalized CSA cable rolloff at 0.4kHz varies from 0.0dB to 1.1dB; at 2.8kHz, rolloff varies from 0.3dB to 1.75dB	Post-equalization of cable less than 15dB (H88) or 18kft (NL) is comparable to D4 4FXS CU (J98726SB). Pre-equalization and post-equalization available by emulating 150-ohm mismatch
Structural Impedance	600 ohms + 2.16uF or 900 ohms + 2.16uF	600 ohms or 1200 ohms
ERL/SRL (2-wire return loss with 4-wire path broken)	28/20dB	
RL (any Hz)/RL (1kHz)		23/28dB
Balance Capability, CSA loops	ERL better than 12dB at digital line interface of channel unit facing loop.	--
Longitudinal Balance (IEEE method)	AUA42 AUA43	
200Hz	63dB 58dB	67dB
500Hz	63dB 58dB	67dB
1000Hz	63dB 58dB	67dB
3000Hz	58dB 58dB	62dB
Equal-Level Crosstalk, C-message weighted between 0.2 and 3.4kHz	-65dB	-65dB (channel unit) -65dB (inter-unit crosstalk)
Idle-Channel Noise	23dBrc0 for AUA42/AUA43 pair	20dBrc0 per channel unit, each direction
Impulse Noise, no more than 15 counts in 15 minutes at	59dBrc0	59dBrc0
Signal Distortion	> 33dB	> 33dB

363-205-003

(at -10dBm)

Single-Frequency distortion 0dBm0 input tone at any frequency from 0 to 12kHz)	-28dBm0 for AUA42/AUA43 pair	-28dBm0 per channel unit
Intermodulation Distortion, -13dBm0 input (IM products)	A-B (R2) < -43dB 2A-B (R3) < -44dB	R2 < -49dB R3 < -51dB
Pulse Distortion [Peak to Average Ratio (PAR)]	not less than 90	not less than 94

Table AD: Channel Unit Losses

CU	Loss (dB) (Note)	Additional Loss (dB)
AUA25B	2	3
AUA27	1	3
AUA31	0	0
AUA32	0	0
AUA38	0	0
AUA39	0	0
AUA45B	0 or 3 (switch)	3
AUA51	1/0	3
AUA58	1	3
AUA59	0	3
AUA75	0 or 3 (switch)	3
AUA150	0	3
AUA158	Automatic Loss Compensation (ALC)	0
AUA159	ALC	0
AUA53	0	4
AUA55	1	3
AUA56	0	4
AUA57	1	3
SLC(R)-2000		
Quad POTS	ALC	0
SLC-2000		
Quad POTS/SPOTS(R)	ALC	0
AUA41	Provisionable	0
AUA42	Provisionable	0
AUA43	Provisionable	0
AUA44	Provisionable	0
AUA52	N/A	0
AUA52B	N/A	0
AUA54	Provisionable	0

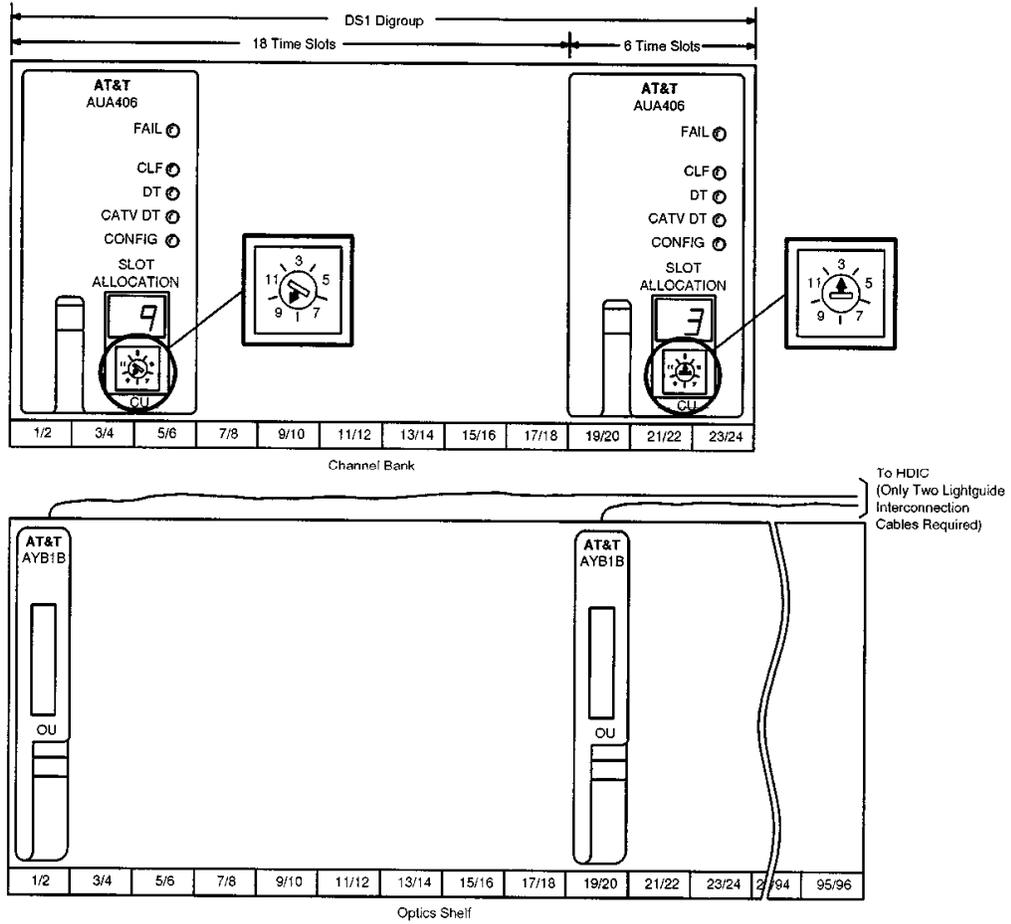
Note: Nominal loss at 1000 Hz.

Table AE: CIR General Specifications (Number of Sheets)

CIR Type	Number of Sheets (Note)	
	CIR	Attachment
ML	5	Not Applicable
PS	1	Not Applicable
NP	2	Multipage
IR	1	Multipage
TD	1	Multipage
TS	1	Multipage
MOR:		
MG (Routine)	1	Multipage
MA (Caution)	1	Multipage
MR (Emergency)	Multipage	Not Applicable

Note: 1 sheet = 2 pages (front and back)

Figure 2: Remote Terminal CU Bandwidth Management



Note: The left most CU slot number (that is, the slot that accepts the circuit board) corresponds to the OU slot number.

Figure 3: SLC(R)-2000 Multi-Services Distant Terminal System Architecture

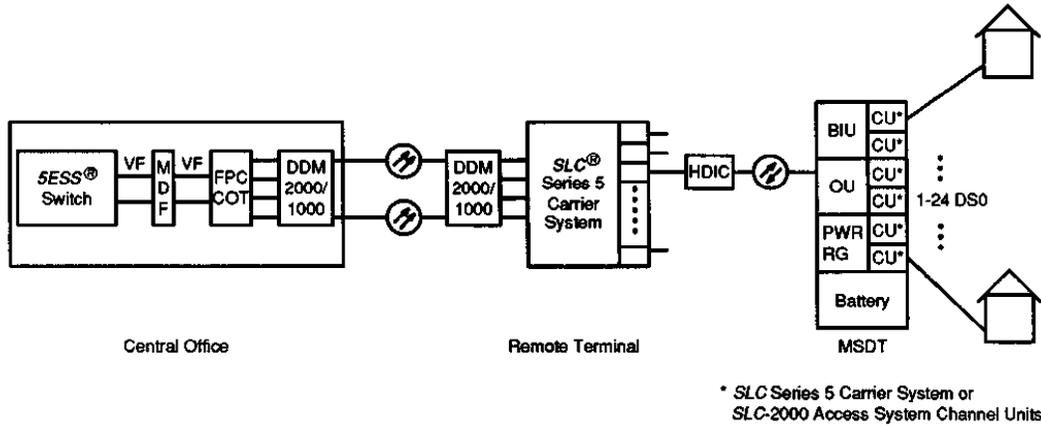


Figure 4: Remote Terminal Arrangement

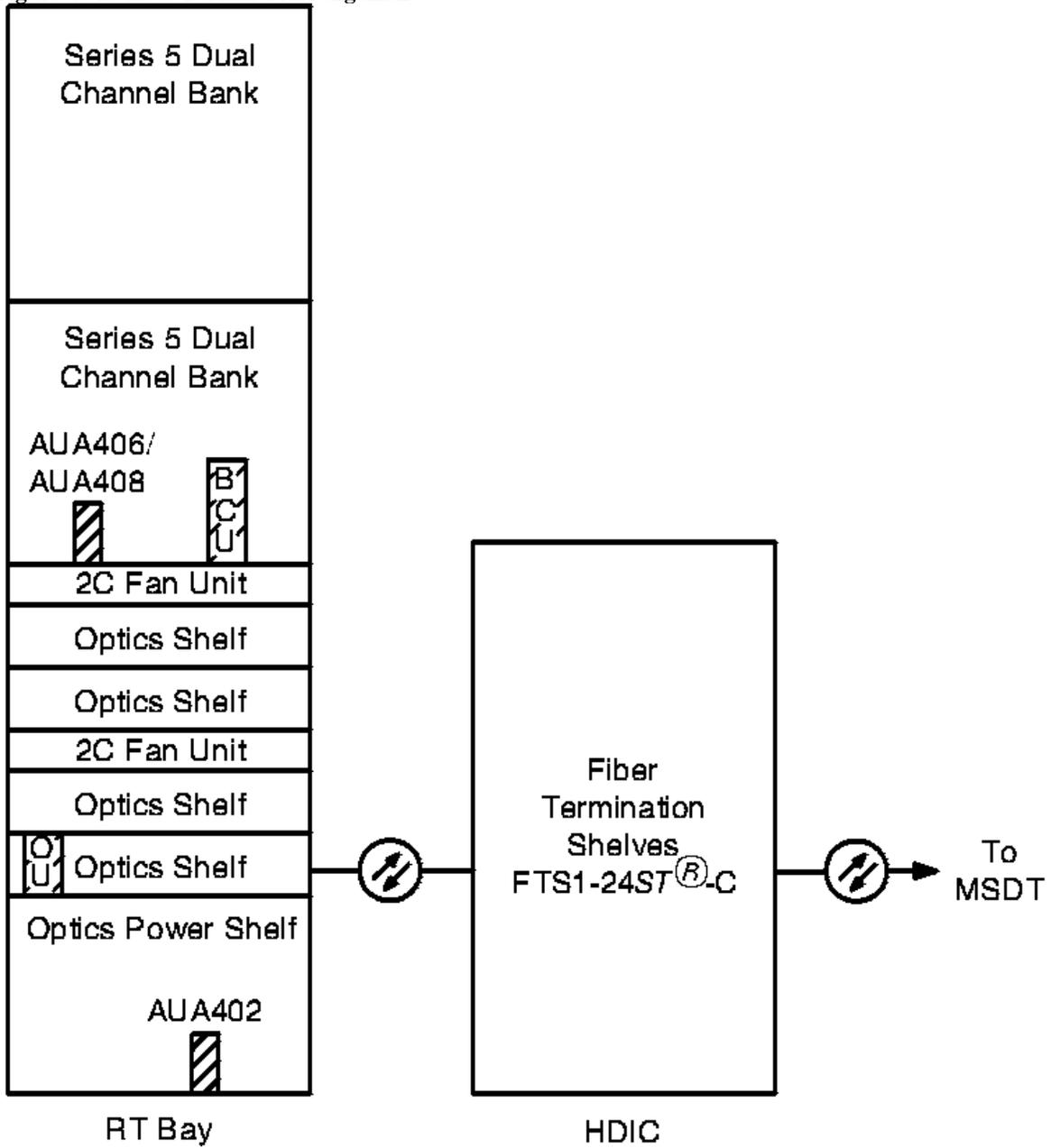


Figure 5: High Density Fiber Interconnect

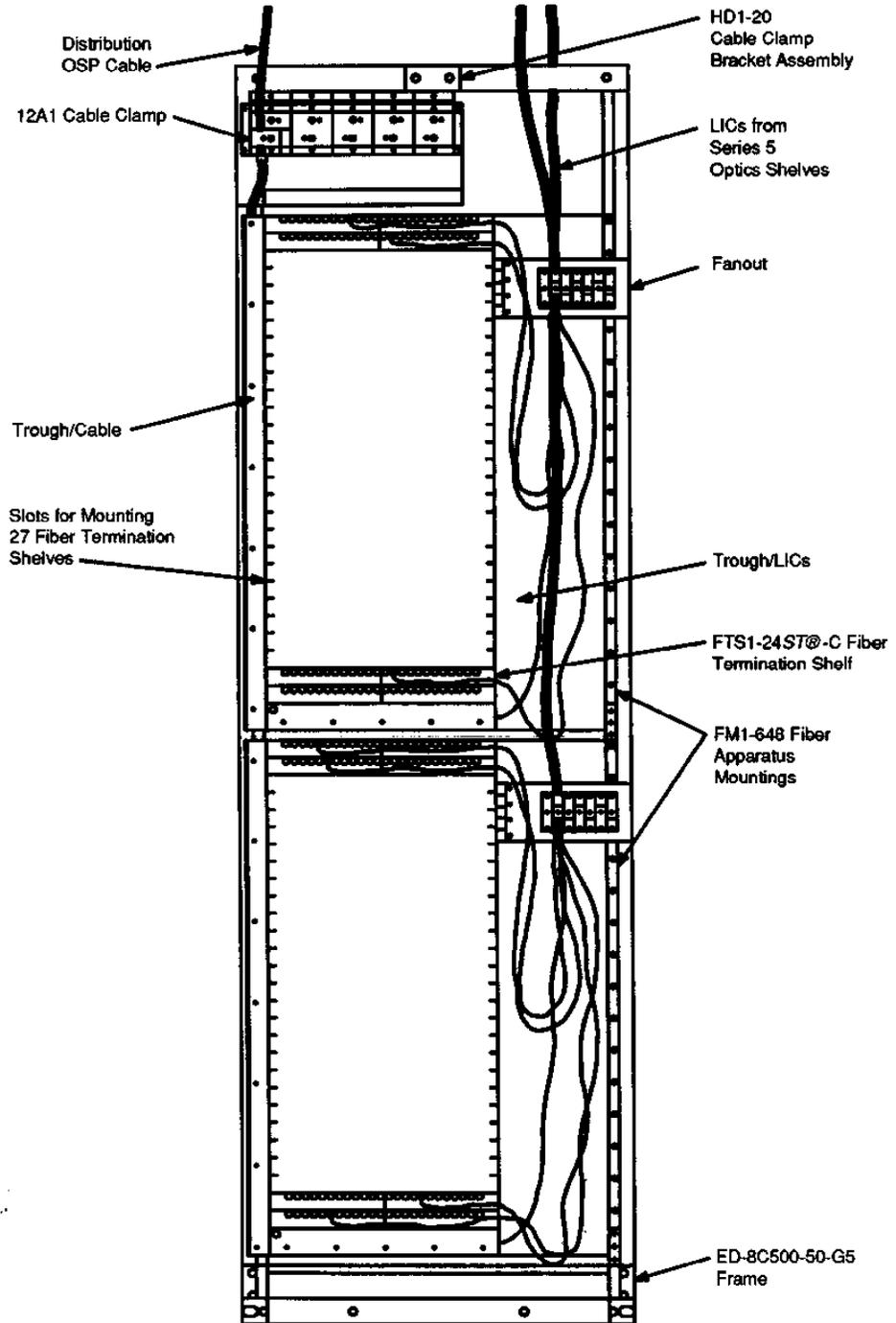


Figure 6: SLC(R)-2000 MSDT Feature RT Equipment in an 80E Cabinet

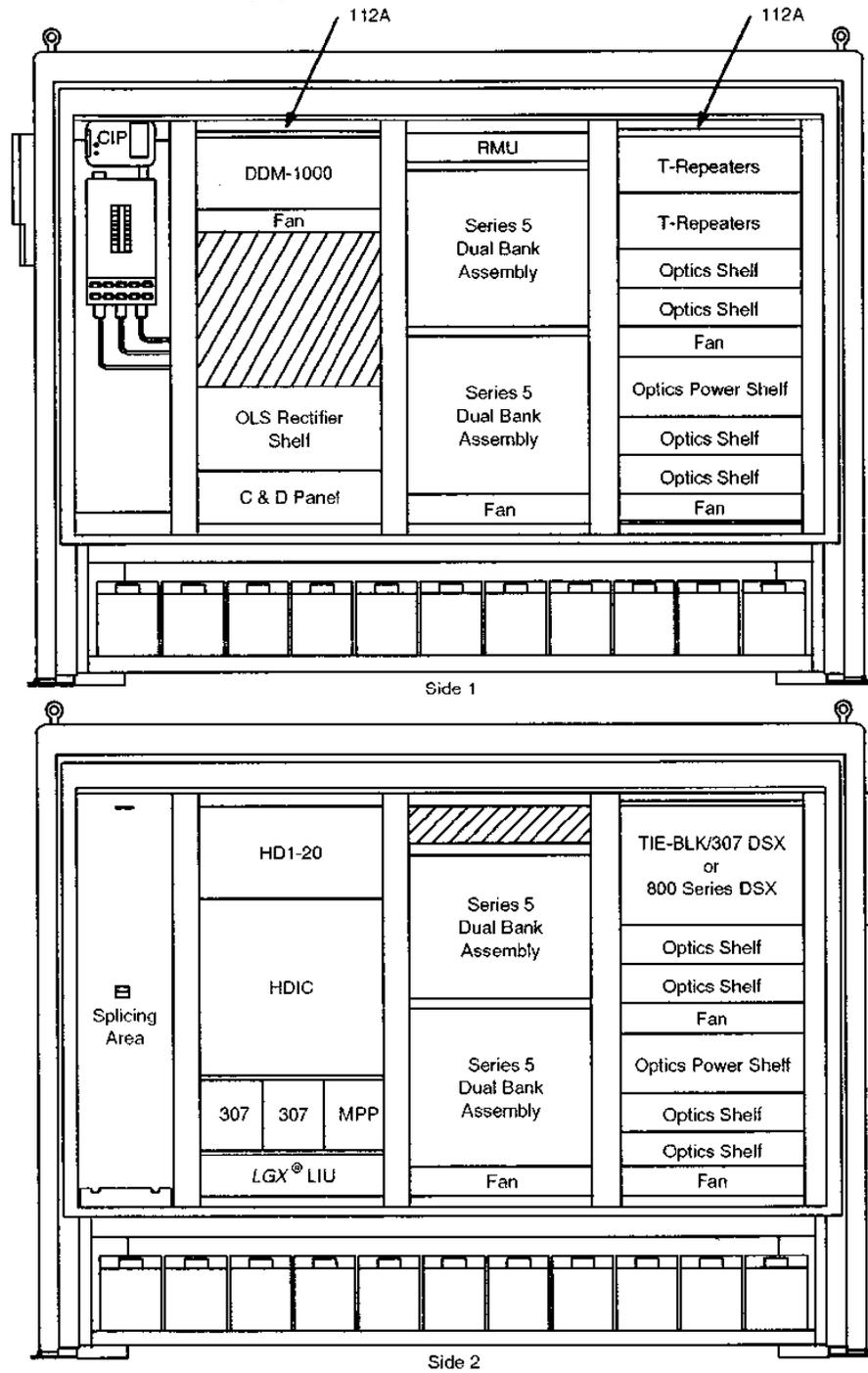


Figure 7: Central Powering System Architecture

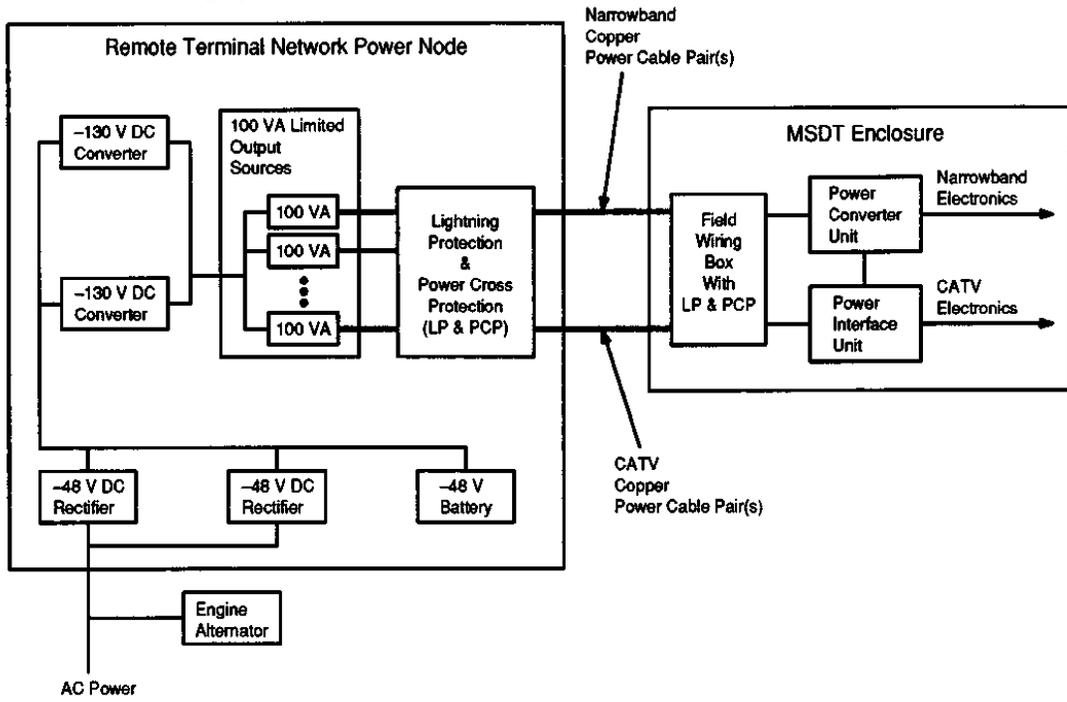


Figure 8: MLT-2/PGTC Test Paths for MSDT Testing Capability

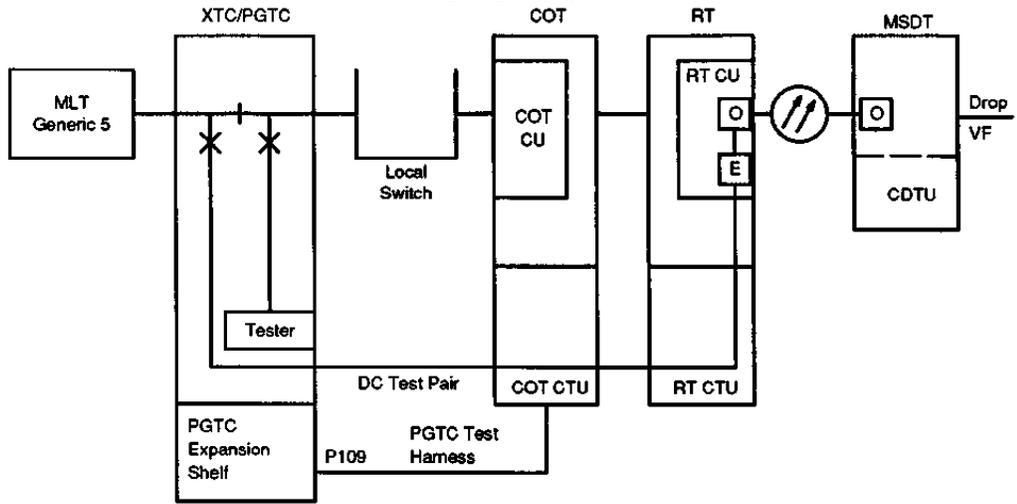


Figure 9: SAM Mask for Test Signature #1

```

SAM      SYSTEM:  m2      PRTR:      BY:
REQ:    DVER -N 1      NPANNX:      EXK:
NEXT (Y/N):      STATUS:
INPUT:
      VER:      MLT:      DC SIGNATURE
      KOHMS      VOLTS
      MIN      MAX      MIN      MAX
      86.00  99.00      -4.0  +4.0  T-R  ( ) VER
      84.00  96.00      -4.0  +4.0  T-G  ( Y ) SIGNATURE
      84.00  96.00      -4.0  +4.0  R-G  ( ) VER OR SIGNATURE
      ( ) VER AND SIGNATURE
OUTPUT:
VER:1X * FIBER-TO-THE-HOME LOOP INDICATED *
      * RT-TO-DT FIBER LINK GOOD *
      * CHANNEL AND DROP TESTS NOT AVAIL. *
      * (DISPATCH TO DT) *
      * *
      * *

```

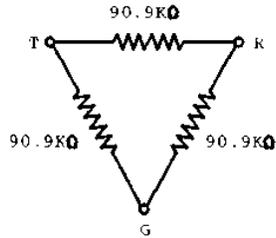


Figure 10: TV Mask for Test Signature #1

TV	EC 123	PRTR W020	REQ BY DML	CB 201 386 448703-18-88 0900A		
TN	MDF	STATUS	CALLBACK TIME	FRAME	CABLE/PAIR	COMMENT
1. 305 386 7163				5 201 386 2805	K1023/415	WHIPPAN
TN 305 386 7163				SW: ESS-1 OE: 233-008-051		
REQ	L#	CMT	CA	CO: SLC SERIES 5		
	TEMP(F)		PR OVER	OSP:		
&FULLX				TERM: SINGLE PARTY		
VER:IX	FIBER-TO-THE-HOME LOOP INDICATED (DISPATCH TO DT)					
	RT-TO-DT FIBER LINK GOOD					
	CHANNEL AND DROP TESTS NOT AVAIL.					
CRAFT:	DC SIGNATURE	MLT:	DC SIGNATURE	AC SIGNATURE		
	KOHMS VOLTS		KOHMS VOLTS	KOHMS		
	62 T-R		94 T-R	36		T-R
	61 T-G		92.00 T-G	35		T-G
	61 R-G		92.00 R-G	35		R-G

Interpretation:

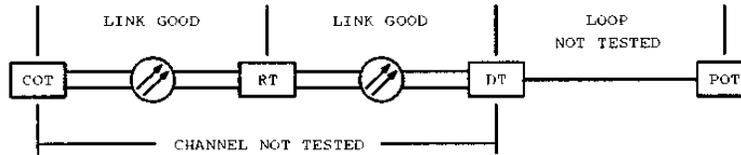


Figure 11: SAM Mask for Test Signature #2

```

SAM      SYSTEM: m2      PRTR:      BY:
REQ:    DVER -N 2      NPANNX:      EXK:
NEXT    (Y/N):      STATUS:
INPUT:

      VER:      MLT:      DC SIGNATURE
              KOHMS      VOLTS
              MIN      MAX      MIN      MAX
      2500.      3500.
      84.00      96.00      -4.00      +4.00      T-R      ( ) VER
      84.00      96.00      -4.00      +4.00      T-G      ( Y ) SIGNATURE
      84.00      96.00      -4.00      +4.00      R-G      ( ) VER OR SIGNATURE
                                          ( ) VER AND SIGNATURE

OUTPUT:
VER: 2X * FIBER-TO-THE-HOME LOOP INDICATED *
        * RT-TO-DT FIBER LINK BAD - OOF *
        * CHANNEL AND DROP TESTS NOT DONE *
        * (DISPATCH TO RT) *
        * *
        * *

```

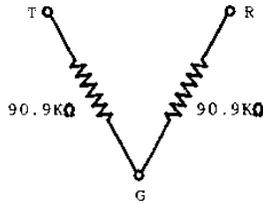


Figure 12: TV Mask for Test Signature #2

```

TV   EC 123  PRTR W020  REQ BY DML          CB 201 386 448703-18-88 0900A

      TN      MDF STATUS CALLBACK TIME  FRAME  CABLE/PAIR COMMENT
1. 305 386 7163                               5 201 386 2805 K1023/415 WHIPPAN

TN 305 386 7163                               SW: ESS-1 OE: 233-008-051
REQ      L#      CMT      CA      CO: SLC SERIES 5
      TEMP(F)      PR  OVER      OSP:
&FULLX                                     TERM: SINGLE PARTY
VER:IX  FIBER-TO-THE-HOME LOOP INDICATED (DISPATCH TO RT)
      RT-TO-DT FIBER LINK BAD - OOF
      CHANNEL AND DROP TESTS NOT DONE

CRAFT: DC SIGNATURE      MLT: DC SIGNATURE      AC SIGNATURE
      KOHMS  VOLTS      KOHMS  VOLTS      KOHMS
      184      0  T-R      3500      T-R      54      T-R
      91      0  T-G      91.37      T-G      36      T-G
      91      0  R-G      91.12      R-G      36      R-G
    
```

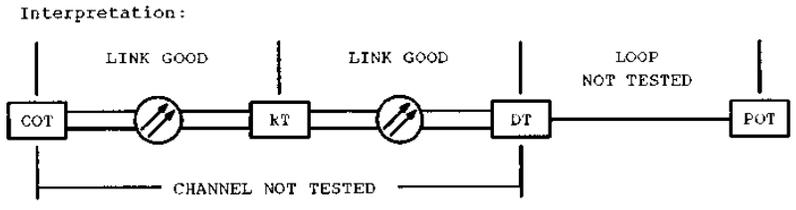


Figure 13: SAM Mask for Test Signature #3

```

SAM      SYSTEM:  m2      PRTR:      BY:
REQ:    DVER -N 3      NPANX:      EXK:
NEXT   (Y/N):      STATUS:
INPUT:
      VER: 95  MLT:  DC SIGNATURE
              KOHMS      VOLTS
              MIN      MAX  MIN  MAX
      24.00  34.00      T-R  (  ) VER
      84.00  96.00  -4.00 +4.00 T-G  (  ) SIGNATURE
      84.00  96.00  -4.00 +4.00 R-G  (  ) VER OR SIGNATURE
              ( Y ) VER AND SIGNATURE

OUTPUT:
VER:3X  * FIBER-TO-THE-HOME LOOP INDICATED  *
        * COT-TO-DT CHANNEL TEST OK        *
        * DT COMMON EQUIP. FAILURE          *
        * (DISPATCH TO DT)                 *
        *                                     *
        *                                     *

```

Figure 14: TV Mask for Test Signature #3

TV	EC 123	PRTR W020	REQ BY DML	CB 201 386 4487	03-18-88 0900A	
TN	MDF	STATUS	CALLBACK TIME	FRAME	CABLE/PAIR	COMMENT
1. 305 386 7163			5 201 386 2805		K1023/415	WHIPPAN
TN 305 386 7163				SW: ESS-1	OE: 233-008-051	
REQ	L#	CMT	CA		CO: SLC SERIES 5	
	TEMP(F)		PR	OVER	OSP:	
&FULLX					TERM: SINGLE PARTY	
VER: 3X FIBER-TO-THE-HOME LOOP INDICATED (DISPATCH TO DT)						
COT-TO-DT CHANNEL TEST OK						
DT COMMON EQUIP. FAILURE						
CRAFT: DC SIGNATURE		MLT: DC SIGNATURE		AC SIGNATURE		
KOHMS	VOLTS	KOHMS	VOLTS	KOHMS		
26	T-R	30.67	T-R	21	T-R	
52	T-G	91.58	T-G	35	T-G	
52	R-G	91.54	R-G	36	R-G	

Interpretation:

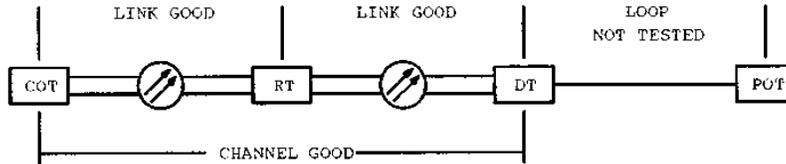


Figure 15: SAM Mask for Test Signature #4

```

SAM      SYSTEM:  m2      PRTR:      BY:
REQ:    DVER -N 4      NPANNX:      EXK:
NEXT    (Y/N):      STATUS:
INPUT:
      VER: 95  MLT:    DC SIGNATURE
              KOHMS      VOLTS
              MIN      MAX      MIN      MAX
      34.00  44.00      T-R  ( ) VER
      84.00  96.00  -4.00 +4.00  T-G  ( ) SIGNATURE
      84.00  96.00  -4.00 +4.00  R-G  ( ) VER OR SIGNATURE
              ( Y ) VER AND SIGNATURE

OUTPUT:
      VER:4X  * FIBER-TO-THE-HOME LOOP INDICATED  *
              * COT-TO-DT CHANNEL TEST OK        *
              * DROP TEST OK                      *
              *                                    *
              *                                    *
              *                                    *

```

Figure 16: TV Mask for Test Signature #4

TV	EC 123	PRTR W020	REQ BY DML	CB 201 386 4487	03-18-88 0900A	
TN	MDF	STATUS	CALLBACK TIME	FRAME	CABLE/PAIR	COMMENT
1. 305 386 7163			5 201 386 2805		K1023/415	WHIPPAN
TN 305 386 7163				SW: ESS-1	OE: 233-008-051	
REQ	L#	CMT	CA		CO: SLC SERIES 5	
	TEMP(F)		PR	OVER	OSP:	
ΔFULLX					TERM: SINGLE PARTY	
VER: 4X FIBER-TO-THE-HOME LOOP INDICATED						
COT-TO-DT CHANNEL TEST OK						
DROP TEST OK						
CRAFT: DC SIGNATURE		MLT: DC SIGNATURE		AC SIGNATURE		
KOHMS VOLTS		KOHMS VOLTS		KOHMS		
34		T-R	41.42	T-R	25	T-R
54		T-G	91.40	T-G	35	T-G
54		R-G	91.42	R-G	35	R-G

Interpretation:

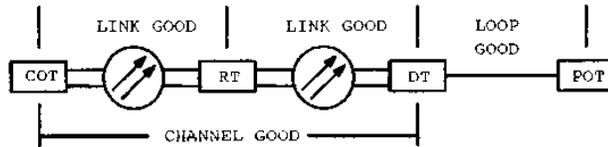


Figure 17: SAM Mask for Test Signature #5

```

SAM      SYSTEM:  m2      PRTR:      BY:
REQ:    DVER -N 5      NPANNX:      EXK:
NEXT    (Y/N):      STATUS:
INPUT:
VER:     95  MLT:     DC SIGNATURE
          KOHMS      VOLTS
          MIN    MAX    MIN    MAX
          44.00  54.00      T-R  ( ) VER
          84.00  96.00  -4.00  +4.00  T-G  ( ) SIGNATURE
          84.00  96.00  -4.00  +4.00  R-G  ( ) VER OR SIGNATURE
                                     (Y) VER AND SIGNATURE

OUTPUT:
VER:5X  * FIBER-TO-THE-HOME LOOP INDICATED *
        * COT-TO-DT CHANNEL TEST OK      *
        * DROP TEST FAILS - OPEN         *
        *                                *
        * (DISPATCH TO DT)              *
        *                                *

```

Figure 18: TV Mask for Test Signature #5

TV	EC 123	PRTR W020	REQ BY DML	CB 201	386 4487	03-18-88	0900A
	TN	MDF	STATUS	CALLBACK	TIME	FRAME	CABLE/PAIR COMMENT
1.	305 386	7163		5	201 386	2805	K1023/415 WHIPPAN
TN 305 386 7163				SW: ESS-1	OE:233-008-051		
REQ	LH	CMT	CA	CO: SLC SERIES 5			
	TEMP(F)	PR	OVER	OSP:		TERM: SINGLE PARTY	
&FULLX							
VER:5X FIBER-TO-THE-HOME LOOP INDICATED							
COT-TO-DT CHANNEL TEST OK							
DROP TEST FAILS - OPEN							
CRAFT: DC SIGNATURE		MUT: DC SIGNATURE		AC SIGNATURE			
KOHMS VOLTS		KOHMS VOLTS		KOHMS			
40		T-R	51.51	T-R	28	T-R	
56	0	T-G	91.35	0	T-G	36	T-G
56	0	R-G	91.41	0	R-G	36	R-G

Interpretation:

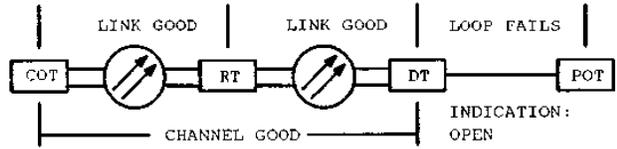


Figure 19: SAM Mask for Test Signature #6

```
SAM SYSTEM: m2 PRTR: BY:
REQ: DVER -N 6 NPANNX: EXK:
NEXT (Y/N): STATUS:
INPUT:
VER: 95 MLT: DC SIGNATURE
      KOHMS VOLTS
      MIN MAX MIN MAX
      54.00 64.00 -4.00 +4.00 T-R ( ) VER
      84.00 96.00 -4.00 +4.00 T-G ( ) SIGNATURE
      84.00 96.00 -4.00 +4.00 R-G ( ) VER OR SIGNATURE
      ( Y ) VER AND SIGNATURE
OUTPUT:
VER: 6X * FIBER-TO-THE-HOME LOOP INDICATED
        * COT-TO-DT CHANNEL TEST OK *
        * DROP TEST FAILS - FEMF/LEAKAGE *
        * WARNING!!! CHECK DROP FOR HAZARDOUS *
        * VOLTAGES! *
        * (DISPATCH TO DT) *
```

Figure 20: TV Mask for Test Signature #6

TV	EC 123	PRTR W020	REQ BY DML	CB 201 386 4487	03-18-88 0900A	
TN	MDF	STATUS	CALLBACK TIME	FRAME	CABLE/PAIR	COMMENT
1. 305 386 7163			5 201 386 2805		K1023/415	WHIPPAN
TN 305 386 7163				SW: ESS-1	OE: 233-008-051	
REQ	L#	CMT	CA		CO: SLC SERIES 5	
	TEMP(F)		PR	OVER	OSP:	
&FULLX					TERM: SINGLE PARTY	
VER:6X	FIBER-TO-THE-HOME LOOP INDICATED			WARNING!!! CHECK DROP FOR HAZARDOUS		
	COT-TO-DT CHANNEL TEST OK			VOLTAGES!		
	DROP TEST FAILS - FEMF/LEAKAGE			(DISPATCH TO RT)		
CRAFT: DC SIGNATURE		MLT: DC SIGNATURE		AC SIGNATURE		
KOHMS	VOLTS	KOHMS	VOLTS	KOHMS		
46	T-R	61.65	T-R	30	T-R	
57	0 T-G	91.39	0 T-G	35	T-G	
57	0 R-G	91.37	0 R-G	35	R-G	

Interpretation

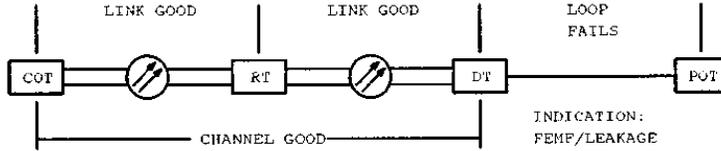


Figure 21: SAM Mask for Test Signature #7

```

SAM      SYSTEM:  m2      PRTR:      BY:
REQ:    DVER -N 7      NPANNX:      EXK:
NEXT   (Y/N):      STATUS:
INPUT:
      VER: 95  MLT:      DC SIGNATURE
              KOHMS      VOLTS
              MIN  MAX      MIN  MAX      T-R  ( ) VER
              64.00 74.00      -4.00 +4.00  T-G  ( ) SIGNATURE
              84.00 96.00      -4.00 +4.00  R-G  ( ) VER OR SIGNATURE
              84.00 96.00      -4.00 +4.00      (Y) VER AND SIGNATURE
OUTPUT:
      VER:7X * FIBER-TO-THE-HOME LOOP INDICATED *
            * COT-TO-DT CHANNEL TEST OK *
            * DROP TEST FAILS - RECEIVER OFF HOOK *
            * *
            * (DISPATCH TO DT) *
            * *

```

Figure 22: TV Mask for Test Signature #7

TV	EC 123	PRTR W020	REQ BY DML	CB 201 386 4487	03-18-88	0900A
----	--------	-----------	------------	-----------------	----------	-------

TN	MDF	STATUS	CALLBACK TIME	FRAME	CABLE/PAIR	COMMENT
1. 305 386 7163			5 201 386 2805		K1023/415	WHIPPAN

TN 305 386 7163	SW: ESS-1	OE: 233-008-051		
REQ	L#	CMT	CA	CO: SLC SERIES 5
	TEMP(F)	PR	OVER	OSP:
&FULLX				TERM: SINGLE PARTY

VER: 7X FIBER-TO-THE-HOME LOOP INDICATED

COT-TO-DT CHANNEL TEST OK (DISPATCH TO DT)

DROP TEST FAILS - RECEIVER OFF HOOK

CRAFT: DC SIGNATURE	MLT: DC SIGNATURE	AC SIGNATURE
KOHMS VOLTS	KOHMS VOLTS	KOHMS
51 T-R	71.61 T-R	32 T-R
59 0 T-G	91.38 0 T-G	35 T-G
58 0 R-G	91.18 0 R-G	36 R-G

Interpretation:

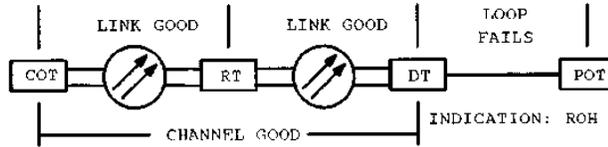


Figure 23: SAM Mask for Test Signature #8

```

SAM      SYSTEM: m2          PRTR:      BY:
REQ:    DVER -N 8          NPANX:      EXK:
NEXT    (Y/N):            STATUS:
INPUT:
      VER: 95      MLT:      DC SIGNATURE
                   KOHMS      VOLTS
                   MIN      MAX      MIN      MAX
      74.00      86.00
      84.00      96.00      -4.00      +4.00      T-R      ( ) VER
      84.00      96.00      -4.00      +4.00      T-G      ( ) SIGNATURE
      84.00      96.00      -4.00      +4.00      R-G      ( ) VER OR SIGNATURE
                                           (Y) VER AND SIGNATURE

OUTPUT:
      VER:8X * FIBER-TO-THE-HOME LOOP INDICATED      *
            * RT-TO-DT FIBER LINK GOOD                *
            * DROP TEST FAILS - HAZARDOUS VOLTAGE!    *
            * WARNING!! TAKE PROPER PRECAUTIONS!!     *
            * (DISPATCH TO DT)                       *
            *                                           *

```

Figure 24: TV Mask for Test Signature #8

```

TV   EC 123  PRTR W020   REQ BY DML           CB 201 386 4487   03-18-88 0900A

      TN      MDF  STATUS CALLBACK TIME      FRAME      CABLE/PAIR  COMMENT
1.  305 386 7163                5 201 386 2805      K1023/415  WHIPPAN

TN 305 386 7163                SW: ESS-1  OE: 233-008-051
REQ      L#    CMT      CA                CO: SLC SERIES 5
      TEMP(F)      PR    OVER            OSP:
&FULLX                TERM:
VER:8X FIBER-TO-THE-HOME LOOP INDICATED      WARNING!! TAKE PROPER PRECAUTIONS!!
      RT-TO-DT FIBER LINK GOOD                (DISPATCH TO DT)
      DROP TEST FAILS - HAZARDOUS VOLTAGE!

CRAFT: DC SIGNATURE      MLT: DC SIGNATURE      AC SIGNATURE
      KOHMS  VOLTS                KOHMS  VOLTS                KOHMS
      56      T-R                81.40   T-R                34      T-R
      60      0 T-G                91.40   0 T-G                35      T-G
      60      0 R-G                91.42   0 R-G                36      R-G
    
```

Interpretation:

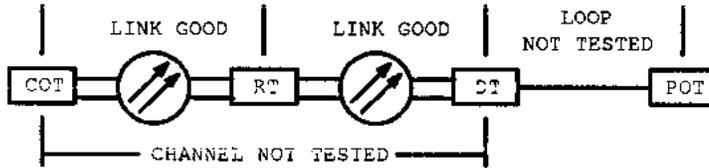


Figure 25: SAM Mask for Test Signature #9

```

SAM      SYSTEM: m2          PRTR:      DY:
REQ:     DVER -N 8          NPANNX:          EXK:
NEXT (Y/N):                  STATUS:
INPUT:
  VER:           MLT:      DC SIGNATURE
                KOHMS          VOLTS
                MIN    MAX    MIN    MAX
                15.00 24.00  -4.00  +4.00  T-R  ( ) VER
                84.00 96.00  -4.00  +4.00  T-G  (Y) SIGNATURE
                84.00 96.00  -4.00  +4.00  R-G  ( ) VER OR SIGNATURE
                ( ) VER AND SIGNATURE

OUTPUT:
  VER:9X * FIBER-TO-THE-HOME LOOP INDICATED *
        * RT-TO-DT FIBER LINK GOOD *
        * BASIC FTTH DT - NO CHANNEL TEST *
        * NO DROP TEST - (DISPATCH TO DT) *
        * * *
        * * *

```

Figure 26: TV Mask for Test Signature #9

TV	EC 123	PRTR W020	REQ BY DML	CB 201 386 4487	03-18-88 0900A
	TN	MDF	STATUS CALLBACK TIME	FRAME	CABLE/PAIR COMMENT
1.	305 386 7163		5 201 386 2805	K1023/415	WHIPPAN
	TN 305 386 7163			SW: ESS-1	OE: 233-008-051
REQ	L#	CMT	CA	CO: SLC SERIES 5	
	TEMP(F)		PR OVER	OSP:	
	&FULLX			TERM:	
	VER:9X FIBER-TO-THE-HOME LOOP INDICATED			NO DROP TEST - (DISPATCH TO DT)	
	RT-TO-DT FIBER LINK GOOD				
	BASIC FTTH DT - NO CHANNEL TEST				
	CRAFT: DC SIGNATURE	MLT: DC SIGNATURE	AC SIGNATURE		
	KOHMS VOLTS	KOHMS VOLTS	KOHMS		
	18 T-R	20.45 T-R	16 T-R		
	50 0 T-G	91.26 0 T-G	35 T-G		
	50 0 R-G	91.30 0 R-G	36 R-G		

Interpretation:

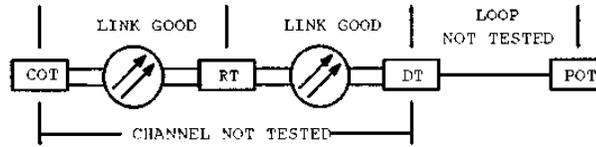


Figure 27: SAM Mask for Test Signature #10

```

SAM      SYSTEM:  m2      PRTR:      BY:
REQ:    DVER -N 10      NPANNX:      EXK:
NEXT (Y/N):      STATUS:
INPUT:
  VER:    99  MLT:      DC SIGNATURE
           KOHMS      VOLTS
           MIN  MAX      MIN  MAX
           24.00 34.00      T-R  ( ) VER
           84.00 96.00  -4.00 +4.00  T-G  ( ) SIGNATURE
           84.00 96.00  -4.00 +4.00  R-G  ( ) VER OR SIGNATURE
                                           (Y) VER AND SIGNATURE

OUTPUT:
  VER:3C * FIBER-TO-THE-HOME LOOP INDICATED      *
          * PAIR GAIN CHANNEL TEST FAILURE        *
          * DT COMMON EQUIP. FAILURE              *
          * (DISPATCH TO DT)                     *
          *                                         *
          *                                         *
  
```

Figure 28: TV Mask for Test Signature #10

TV	EC 123	PRTR W020	REQ BY DML	CD 201 386 4487	03-18-88 0900A
----	--------	-----------	------------	-----------------	----------------

TN	MDF	STATUS	CALLBACK TIME	FRAME	CABLE/PAIR	COMMENT
1. 305 386 7163			5 201 386 2805		K1023/415	WHIPPAN

TN 305 386 7163	SW: ESS-1	OE: 233-008-051			
REQ	L#	CMT	CA	CO: SLC SERIES 5	
	TEMP(F)		PR	OVER	OSP:

&FULLX

VER:3C FIBER-TO-THE-HOME LOOP INDICATED

PAIR GAIN CHANNEL TEST FAILURE

DT COMMON EQUIP. FAILURE

TERM: SINGLE PARTY (DISPATCH TO DT)

CRAFT: DC SIGNATURE	MLT: DC SIGNATURE	AC SIGNATURE
KOHMS VOLTS	KOHMS VOLTS	KOHMS
26 T-R	30.68 T-R	21 T-R
52 0 T-G	91.46 0 T-G	36 T-G
52 0 R-G	91.42 0 R-G	37 R-G

Interpretation:

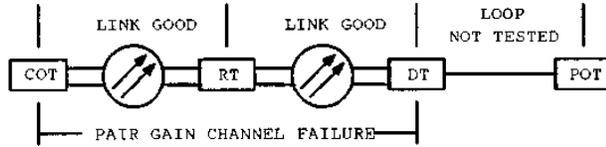


Figure 29: SAM Mask for Test Signature #11

```

SAM      SYSTEM:  m2          PRTR:      BY:
REQ:     DVER -N 11          NPANX:          EXK:
NEXT (Y/N):                  STATUS:
INPUT:
      VER:  99  MLT:      DC SIGNATURE
              KOHMS          VOLTS
              MIN  MAX      MIN  MAX
      34.00  44.00          T-R  ( ) VER
      84.00  96.00  -4.00  +4.00  T-G  ( ) SIGNATURE
      84.00  96.00  -4.00  +4.00  R-G  ( ) VER OR SIGNATURE
                                           (Y) VER AND SIGNATURE

OUTPUT:
      VER:4C * FIBER-TO-THE-HOME LOOP INDICATED      *
              * PAIR GAIN CHANNEL TEST FAILURE        *
              * DROP TEST OK                          *
              * (DISPATCH TO DT)                      *
              *                                         *
              *                                         *

```

Figure 30: TV Mask for Test Signature #11

TV	EC 123	PRFR W020	REQ BY DML	CB 201 386 4487	03-18-88 0900A		
	TN	MDF	STATUS	CALLBACK TIME	FRAME	CABLE/PAIR	COMMENT
1.	305 386 7163			5 201 386 2805		K1023/415	WHIPPAN
TN 305 386 7163				SW: ESS-1 OE: 233-008-051			
REQ	L#	CMT	CA	CO: SLC SERIES 5			
		TEMP(F)	PR	OVER	OSP:		
&FULLX				TERM: SINGLE PARTY			
VER:4C FIBER-TO-THE-HOME LOOP INDICATED				(DISPATCH TO DT)			
PAIR GAIN CHANNEL TEST FAILURE							
DROP TEST OK							
CRAFT: DC SIGNATURE		MLT: DC SIGNATURE		AC SIGNATURE			
	KOHMS	VOLTS		KOHMS	VOLTS	KOHMS	
	34	T-R		41.39	T-R	25	T-R
	54	0 T-G		91.16	0 T-G	36	T-G
	54	0 R-G		91.24	0 R-G	36	R-G

Interpretation:

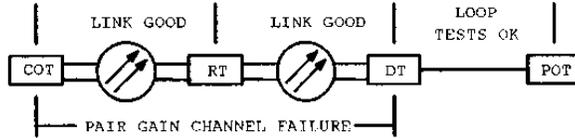


Figure 31: SAM Mask for Test Signature #12

```

SAM      SYSTEM:  m2          PRTR:      BY:
REQ:    DVER -N 12          NPANNX:      EXK:
NEXT   (Y/N):              STATUS:
INPUT:
      VER:   99  MLT:      DC SIGNATURE
              KOHMS          VOLTS
              MIN   MAX      MIN   MAX
      44.00  54.00          T-R   ( ) VER
      84.00  96.00  -4.00  +4.00  T-G   ( ) SIGNATURE
      84.00  96.00  -4.00  +4.00  R-G   ( ) VER OR SIGNATURE
                                           (Y) VER AND SIGNATURE
OUTPUT:
      VER:5C * FIBER-TO-THE-HOME LOOP INDICATED      *
              * PAIR GAIN CHANNEL TEST FAILURE        *
              * DROP TEST FAILS - OPEN                *
              *                                        *
              * (DISPATCH TO DT)                      *
              *                                        *

```

Figure 32: TV Mask for Test Signature #12

TV	EC 123	PRTR W020	REQ BY DML	CB 201 386 4487	03-18-88 0900A	
TN	MDF	STATUS	CALLBACK TIME	FRAME	CABLE/PAIR	COMMENT
1. 305 386 7163			5 201 386 2805	K1023/415	WHIPPAN	
TN 305 386 7163				SW: ESS-1	OE: 233-008-051	
REQ	L#	CMT	CA		CO: SLC SERIES 5	
	TEMP(F)		PR	OVER	OSP:	
&FULLX					TERM: SINGLE PARTY	
VER:5C FIBER-TO-THE-HOME LOOP INDICATED						
PAIR GAIN CHANNEL TEST FAILURE				(DISPATCH TO DT)		
DROP TEST FAILS - OPEN						
CRAFT: DC SIGNATURE		MLT: DC SIGNATURE		AC SIGNATURE		
KOHMS	VOLTS	KOHMS	VOLTS	KOHMS		
40	T-R	51.55	T-R	28	T-R	
56	0 T-G	91.46	0 T-G	35	T-G	
56	0 R-G	91.48	0 R-G	36	R-G	

Interpretation:

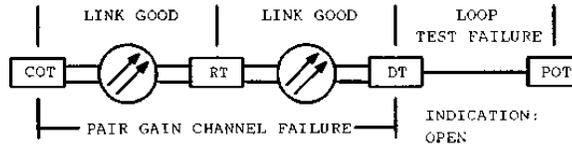


Figure 33: SAM Mask for Test Signature #13

```

SAM      SYSTEM:  m2      PRTR:      BY:
REQ:    DVER  -N 13      NPANNX:      EXK:
NEXT   (Y/N):      STATUS:
INPUT:
      VER: 99  MLT:      DC SIGNATURE
              KOHMS      VOLTS
              MIN    MAX    MIN    MAX
      54.00  64.00      T-R    ( ) VER
      84.00  96.00  -4.00  +4.00  T-G    ( ) SIGNATURE
      84.00  96.00  -4.00  +4.00  R-G    ( ) VER OR SIGNATURE
                                           ( Y ) VER AND SIGNATURE

OUTPUT:
      VER:6C * FIBER-TO-THE-HOME LOOP INDICATED      *
              * PAIR GAIN CHANNEL TEST FAILURE        *
              * DROP TEST FAILS - FEMF/LEAKAGE        *
              * WARNING!!! CHECK DROP FOR HAZARDOUS   *
              * VOLTAGES!                              *
              * (DISPATCH TO DT)                      *
    
```

Figure 34: TV Mask for Test Signature #13

```

TV   EC 123  PRTR W020  REQ BY DML                CB 201 386 4487  03-18-88 0900A

      TN      MDF  STATUS CALLBACK TIME      FRAME      CABLE/PAIR  COMMENT
1. 305 386 7163                                5 201 386 2805  K1023/415  WHIPPAN

TN 305 386 7163                                SW: ESS-1 OE: 233-008-051
REQ      LH      CMT      CA                CO: SLC SERIES 5
      TEMP(F)      PR      OVER      OSP:
&FULLX                                TERM: SINGLE PARTY
VER:6C  FIBER-TO-THE-HOME LOOP INDICATED  WARNING!!! CHECK DROP FOR HAZARDOUS
      PAIR GAIN CHANNEL TEST FAILURE  VOLTAGES!
      DROP TEST FAILS - FEMF/LEAKAGE  (DISPATCH TO RT)

CRAFT: DC SIGNATURE      MLT: DC SIGNATURE      AC SIGNATURE
      KOHMS VOLTS      KOHMS VOLTS      KOHMS
      46      T-R      61.44      T-R      30      T-R
      57      0 T-G      91.57      0 T-G      35      T-G
      57      0 R-G      91.31      0 R-G      36      R-G
    
```

Interpretation:

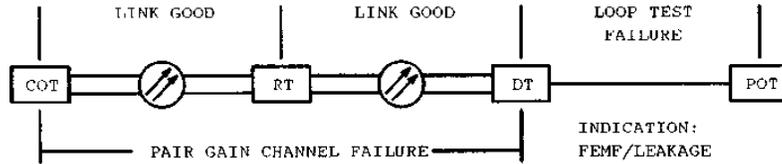


Figure 35: SAM Mask for Test Signature #14

```
SAM      SYSTEM:   m2      PRTR:      BY:
REQ:    DVER -N 14      NPANNX:      EXK:
NEXT  (Y/N):      STATUS:
INPUT:
      VER: 99  MLT:  DC SIGNATURE
              KOHMS      VOLTS
              MIN      MAX      MIN      MAX      T-R      ( ) VER
      64.00  74.00      -4.00  +4.00  T-G      ( ) SIGNATURE
      84.00  96.00      -4.00  +4.00  R-G      ( ) VER OR SIGNATURE
              ( Y ) VER AND SIGNATURE

OUTPUT:
      VER:7C * FIBER-TO-THE-HOME LOOP INDICATED      *
            * PAIR GAIN CHANNEL TEST FAILURE          *
            * DROP TEST FAILS - RECEIVER OFF HOOK    *
            *                                          *
            * (DISPATCH TO DT)                       *
            *                                          *
```

Figure 36: TV Mask for Test Signature #14

TV EC 123 PRTR W020 REQ BY DML CB 201 386 4487 03-18-88 0900A

LN	TN	MDF	STATUS	CALLBACK TIME	FRAME	CABLE/PAIR	COMMENT
1.	305 386 7163			5 201 386 2805		K1023/415	WHIPPAN

TN 305 386 7163 SW: ESS-1 OE: 233-008-051
 REQ LH CMT CA CO: SLC SERIES 5
 TEMP(F) PR OVER OSP:
 &FULLX TERM: SINGLE PARTY

VER:7C FIBER-TO-THE-HOME LOOP INDICATED
 PAIR GAIN CHANNEL TEST FAILURE (DISPATCH TO DT)
 DROP TEST FAILS - RECEIVER OFF HOOK

CRAFT: DC SIGNATURE		MLT: DC SIGNATURE		AC SIGNATURE	
KOHMS	VOLTS	KOHMS	VOLTS	KOHMS	
51	T-R	71.73	T-R	32	T-R
59	0 T-G	91.30	0 T-G	35	T-G
59	0 R-G	91.24	0 R-G	36	R-G

Interpretation

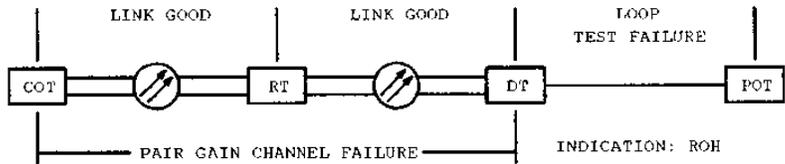


Figure 37: SAM Mask for Test Signature #15

```

SAM      SYSTEM:  m2          PRTR:          BY:
REQ:    DVER -N 10          NPANNX:          EKK:
NEXT   (Y/N):          STATUS:
INP01:

      VER: 99  MLT:      DC SIGNATURE
                KOHMS          VOLTS
                MIN    MAX      MIN    MAX      T-R  ( ) VER
                74.00  86.00    -4.00  +4.00  T-G  ( ) SIGNATURE
                84.00  96.00    -4.00  +4.00  R-G  ( ) VER OR SIGNATURE
                ( Y ) VER AND SIGNATURE

OUTPUT:
      VER: 8C  * FIBER-TO-THE-HOME LOOP INDICATED  *
                * PAIR GAIN CHANNEL TEST FAILURE    *
                * DROP TEST FAILS - HAZARDOUS VOLTAGE! *
                * WARNING!! TAKE PROPER PRECAUTIONS!! *
                * (DISPATCH TO RT)                  *
                *                                     *

```

Figure 38: TV Mask for Test Signature #15

TV	EC 123	PRTW W020	REQ BY DML	CB 201 386 4487	03-18-88 0900A	
TN	MDF	STATUS	CALLBACK TIME	FRAME	CABLE/PAIR	COMMENT
1. 305 386 7163			5 201 386 2805	K1023/415	WHIPPAN	
TN 305 386 7163				SW: ESS-1	OE: 233-008-051	
REQ	L#	CMT	CA		CO: SLC SERIES 5	
	TEMP (F)		PR	OVER	OSP:	
&FULLX					TERM: SINGLE PARTY	
VER:8C	FIBER-TO-THE-HOME LOOP INDICATED			WARNING!! TAKE PROPER PRECAUTIONS!!		
	PAIR GAIN CHANNEL TEST FAILURE			(DISPATCH TO RT)		
	DROP TEST FAILS-HAZARDOUS VOLTAGE!					
CRAFT: DC SIGNATURE	MLT: DC SIGNATURE		AC SIGNATURE			
KOHMS VOLTS	KOHMS VOLTS		KOHMS			
56 T-R	81.40 T-R	34	T-R			
60 0 T-G	91.40 0 T-G	35	T-G			
60 0 R-G	91.42 0 R-G	36	R-G			

Interpretation:

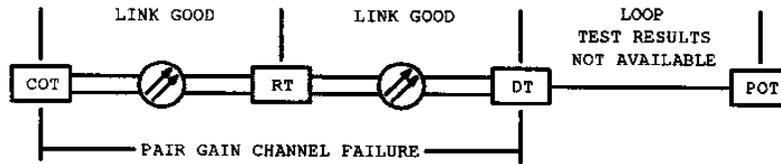


Figure 39: SAM Mask for Test Signature #10 (Alternate)

```
SAM      SYSTEM: m2      PRTR:      BY:
REQ: DVER -N 10      NPANNX:      EXK:
NEXT (Y/N):      STATUS:
INPUT:
VER: 99  MLT:      DC SIGNATURE
          KOHMS      VOLTS
          MIN      MAX      MIN      MAX      T-R      ( ) VER
          15.00  86.00      -4.00  +4.00  T-G      ( ) SIGNATURE
          84.00  96.00      -4.00  +4.00  R-G      ( ) VER OR SIGNATURE
          84.00  96.00      -4.00  +4.00  ( Y ) VER AND SIGNATURE
```

OUTPUT:

```
VER: 4C  * FIBER-TO-THE-HOME LOOP INDICATED  *
          * COT-TO-DT CHANNEL TEST FAILS      *
          * RT-TO-DT FIBER LINK GOOD          *
          * DROP TEST NOT INTERPRETED         *
          * (DISPATCH TO RT)                 *
          *
```

Figure 40: TV Mask for Test Signature #10 (Alternate)

TV	EC 123	PRTR W020	REQ BY DML	CB 201 386 4487	03-18-88 0900A
	TN	MDF	STATUS CALLBACK TIME	FRAME	CABLE/PAIR COMMENT
1.	305 386 7163		5 201 386 2805	K1023/415	WHIPPAN
TN 305 386 7163			SW: ESS-1 OE: 233-008-051		
REQ	L#	CHT	CA	CO: SLC SERIES 5	
	TEMP(F)		PR	OVER	OSP:
&FULLX			TERM: SINGLE PARTY		
VER:4C	FIBER-TO-THE-HOME LOOP INDICATED		DROP TEST NOT INTERPRETED		
	COT-TO-DT CHANNEL TEST FAILS		(DISPATCH TO RT)		
	RT-TO-DT FIBER LINK GOOD				
CRAFT: DC SIGNATURE		MLT: DC SIGNATURE		AC SIGNATURE	
	KOHMS	VOLTS	KOHMS	VOLTS	KOHMS
	34	T-R	41.42	T-R	25
	54	0 T-G	91.40	0 T-G	35
	54	0 R-G	91.42	0 R-G	36

Interpretation:

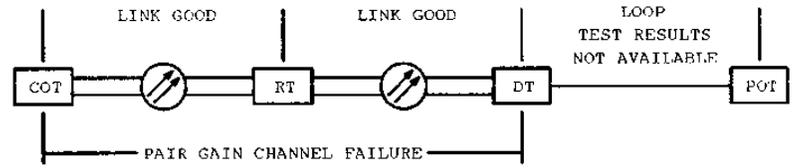


Figure 41: Typical Lightguide Cable Completion Test Loss Data Sheet

FORM:

Page ___ of ___

Date: _____

**Lightguide Cable Completion Test
Loss Data Sheet**

Cable Identification _____ Date of Test _____

Section, End A Location _____

Section, End B Location _____

Operators: End A _____ End B _____

Test Requirements:

Wavelength: _____

Wavelength: _____

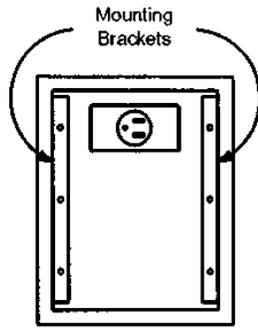
Max. Expected Loss _____ dB

Max. Expected Loss _____ dB

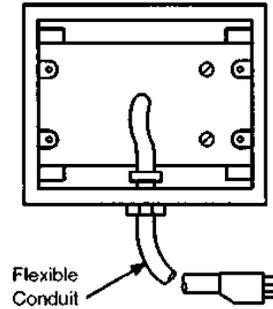
Unit Number _____

Fiber Number	Wavelength (nm)	Loss Reading at A (dB) LA	Loss Reading at B (dB) LB	Outside Plant Loss (LA+LB) / 2 = L OSP (dB)
	1310			
	1550			
	1310			
	1550			

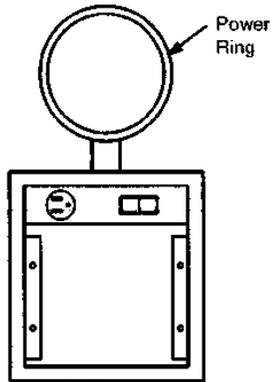
Figure 42: -48 V DC Local Power Source Enclosures



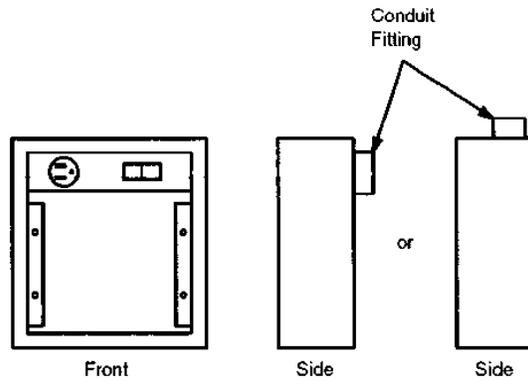
Option 1



Option 2



Option 3



Option 4

Figure 43: Power Point Rectifier Bay

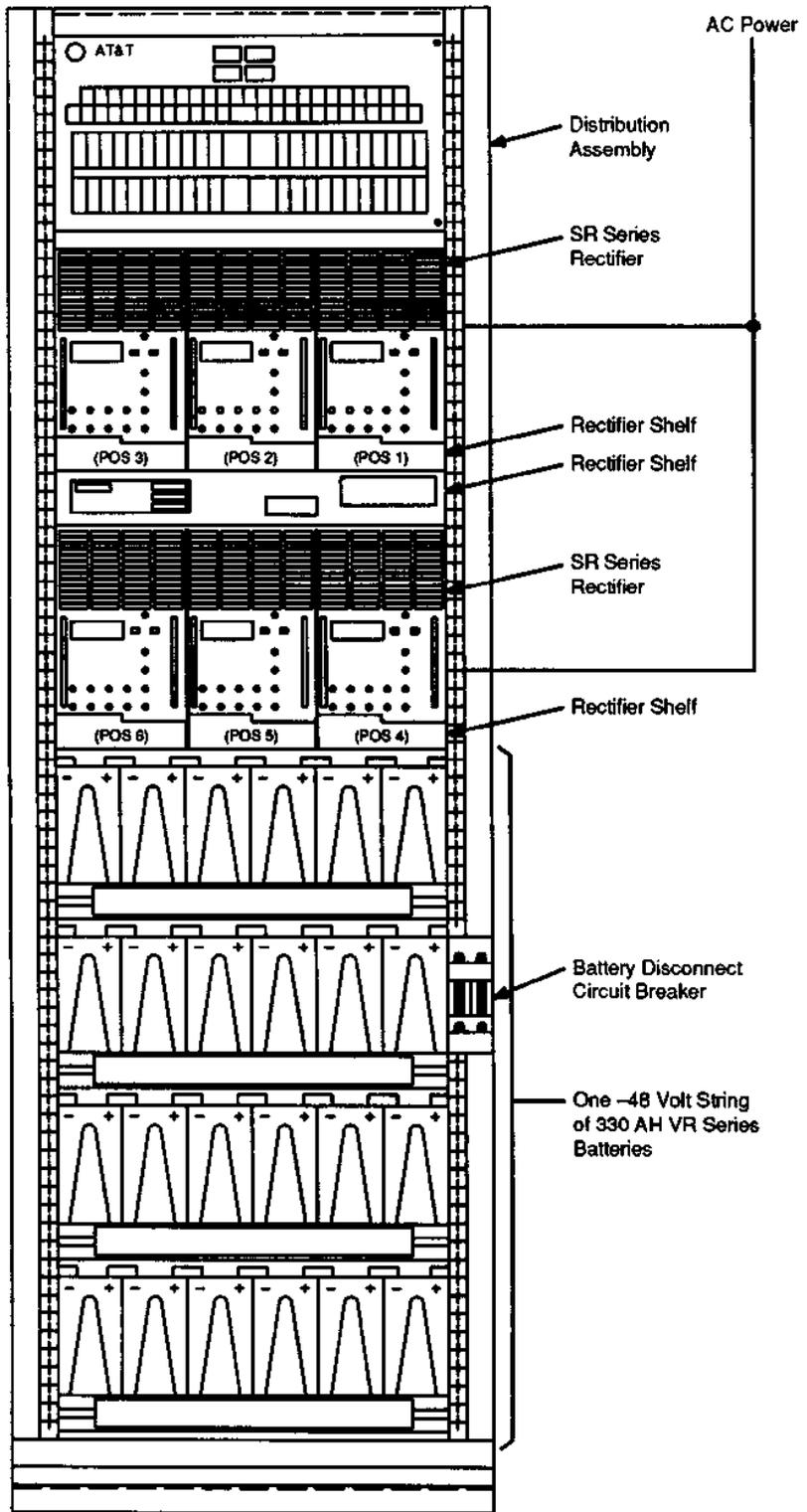


Figure 44: Power Point Battery Bay

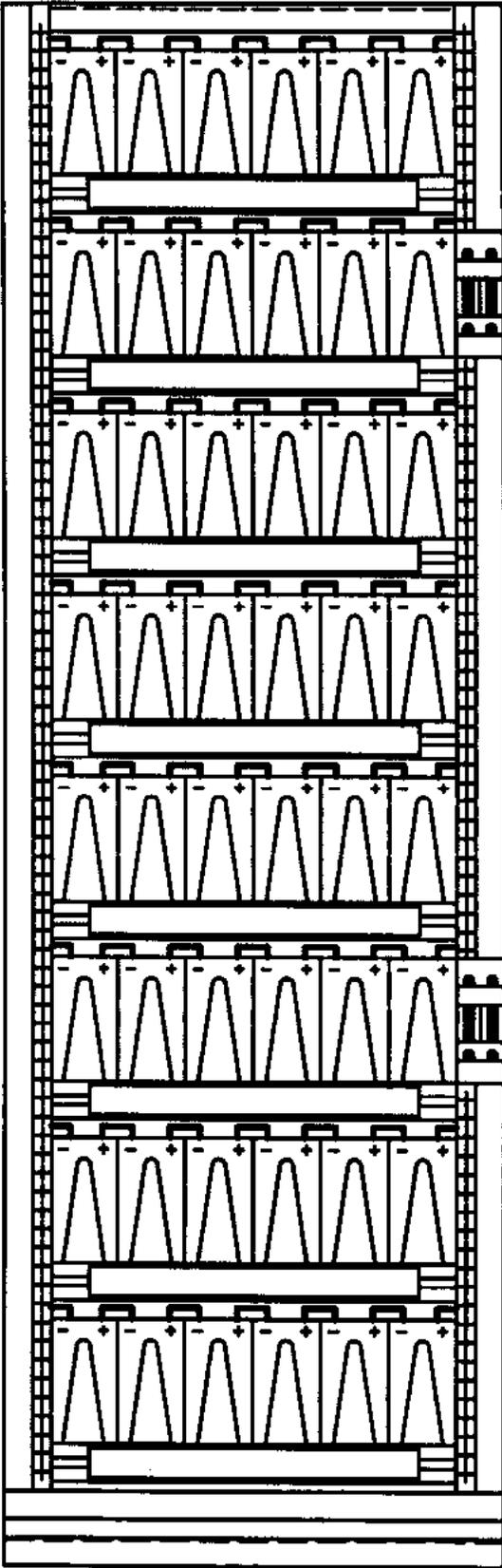


Figure 45: Power Point Converter Bay

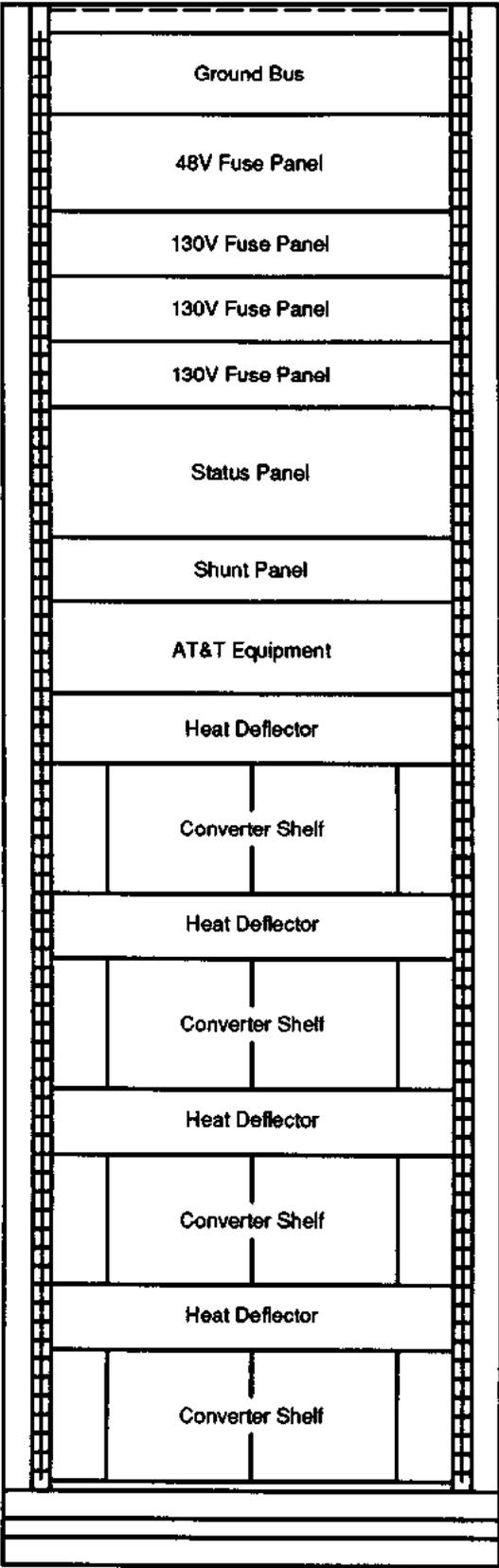


Figure 46: Typical Layout for RT Carrier Bay

<p>SLC[®] Series 5 Carrier System Dual Bank Per J1C182AE-1, L()</p> <p>(2)</p>
<p>SLC Series 5 Carrier System Dual Bank Per J1C182AE-1, L()</p> <p>(1) *</p>
<p>2C Fan Assembly (2)</p>
<p>J1C182PA-1, L1,A,B Optics Shelf (4)</p>
<p>J1C182PA-1, L1,A,B Optics Shelf (3)</p>
<p>2C Fan Assembly (1) *</p>
<p>J1C182PA-1, L1,A,B Optics Shelf (2) *</p>
<p>J1C182PA-1, L1,A,B Optics Shelf (1) *</p>
<p>J1C182PB-1, L1 Optics Power Shelf Assembly *</p>

* Indicates equipment required
for minimum configuration.

Figure 47: Typical Layout for High Density Interconnect Bay FM1-400 Zone Arrangement (Doors Not Shown)

**HD1-20 Cable Clamp
Bracket E/W Max of
20-12A1 Cable Clamps**

**FM1-400 Apparatus
Mounting E/W
Maximum of 18
FTS1-24ST³ Fiber
Termination Shelves**

363-205-003

Figure 48: Typical Layout for High Density Interconnect Bay FM1-600 Zone Arrangement (Doors Not Shown)

<p>HD1-20 Cable Clamp Bracket * E/W Max of 20-12A1 Cable Clamps</p>
<p>FM1-600 Apparatus Mounting E/W Maximum of 27 FTS1-24ST[®] Fiber Termination Shelves</p> <p>(1) *</p>
<p>FM1-600 Apparatus Mounting E/W Maximum of 27 FTS1-24ST Fiber Termination Shelves</p> <p>(2)</p>

* Indicates equipment required
for minimum configuration

Figure 49: Product Support

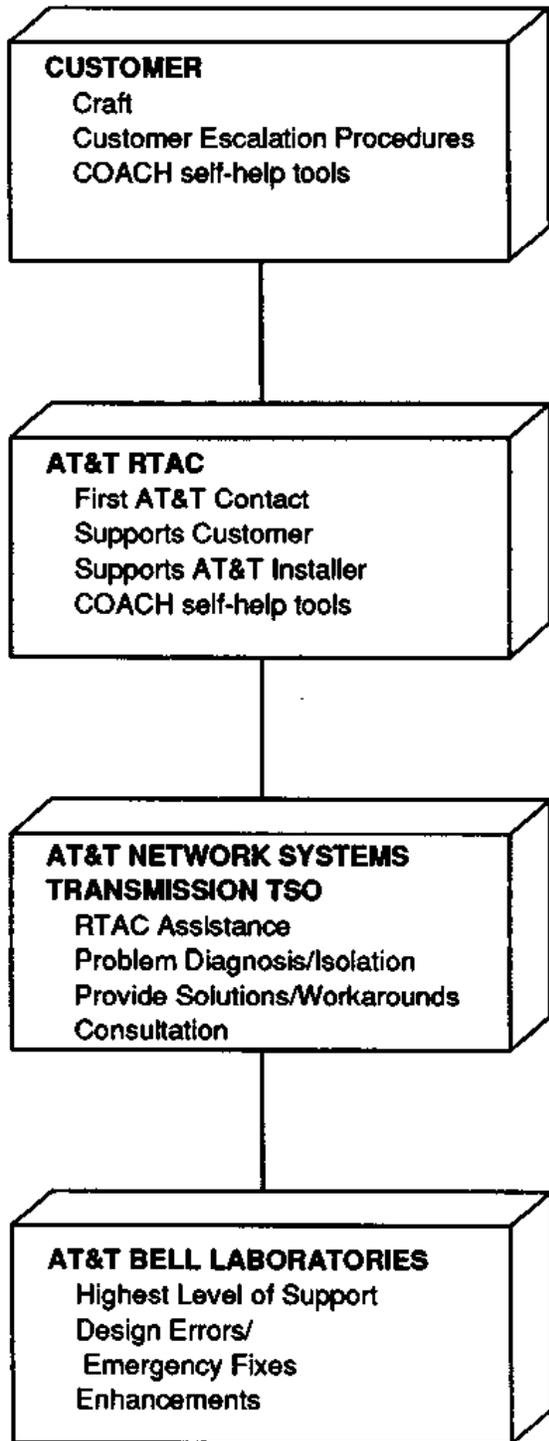


Figure 50: FTTH Remote Terminal Bay Layout

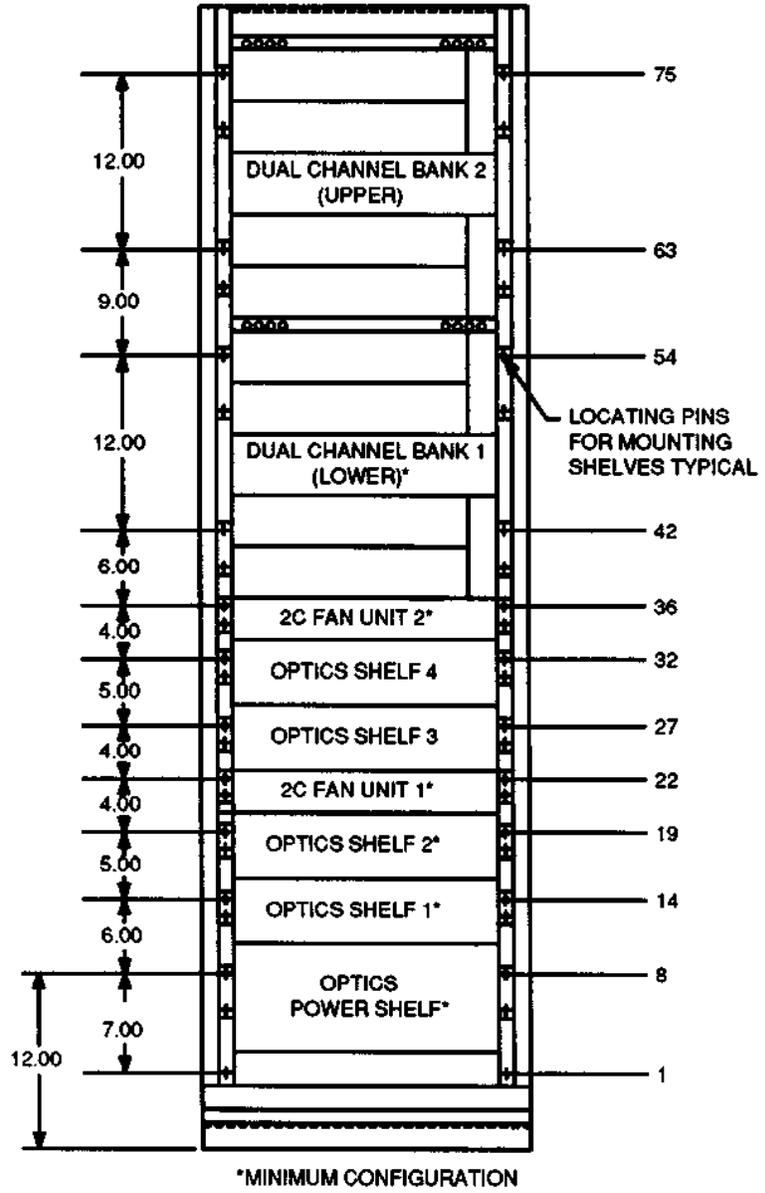


Figure 51: 80E Cabinet FTTH Layout

