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# **T R A I N I N G   O U T L I N E**

### **IMUX 2000 T1 ILS DACS – 2 DAY**

#### **1.0 INTRODUCTION**

##### 1.1 Course Overview

1.1.1 Day One

1.1.2 Day Two

#### **2.0 T1 CARRIER THEORY**

##### 2.1 T-1 Basics

2.1.1 What is T-1

2.1.2 Why T-1

##### 2.2 How T1 Works

2.2.1 Pulse Code Modulation

2.2.2 Time Division Multiplexing

2.2.3 Understanding and calculating the 1.544 Mb/s T-1 Rate

2.2.4 Signal Regeneration

2.2.5 Optical Span

##### 2.3 THE DS-1 Signal Format

2.3.1 Alternate Mark Inversion

2.3.2 B8ZS, Signal Timing, and Ones Density

##### 2.4 DS-1 Framing

2.4.1 The D1 Frame

2.4.2 D4 Framing/SuperFrame (SF)

2.4.3 Extended SuperFrame (ESF)

2.4.4 CRC-6

2.4.5 The ESF Data Link

2.4.6 ESF's Enhanced Signaling Capability



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### **3.0   MULTIPLEXER FEATURES**

- 3.1 Synchronous Data
- 3.2 Asynchronous Data
- 3.3 Control Signal
- 3.4 Network Timing
- 3.5 Drop and Insert
- 3.6 Fallback Timing
- 3.7 Electrical or Fiber Optic T-1 Carrier System
- 3.8 Automatic Fiber Optic Gain Control
- 3.9 24 Channel Capability
- 3.10   Modular Construction
- 3.11   Substation Hardened ( SWC/Fast Transient/EMI)
- 3.12   Network Capability
- 3.13   Universal Time Slots
- 3.14   Remote Monitoring
- 3.15   S/W and DIP Switch Programmable
- 3.16   Upward compatible to SONET/SHD
- 3.17   Self Testing Diagnostics
- 3.18   Redundant Power Supplies

### **4.0   MULTIPLEXER RELIABILITY**

- 4.1 Average Reframe Time
- 4.2 Robustness
- 4.3 Through Channel Delay
- 4.4 Fallback Timing

### **5.0   MULTIPLEXER DIAGNOSTICS**

- 5.1 Status Monitoring
- 5.2 Test Jacks
- 5.3 Loopbacks



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# TRAINING OUTLINE

### 6.0 MULTIPLEXER ALARMS

6.1 Major Alarm Conditions

6.2 Minor Alert Conditions

### IMUX 2000 MULTIPLEXER

6.3 IMUX System Specification

6.3.1 Power Supply

6.3.2 Optical Interface Adapters

6.3.3 Alarms And Diagnostics

6.3.4 Remote Access And Control

6.3.5 Inputs

6.3.6 T-1 Outputs

6.3.7 Timing

6.3.8 Environmental

6.4 Main Shelf

6.5 Expansion Self

6.6 T-1 Common Module (**CM3R**)

6.6.1 Theory of Operation

6.6.2 Set Up And Configuration

6.6.3 Block Diagram

6.7 Common Module Interface Adapters (**MA210R, MA215R, OIAR's**)

6.7.1 Theory of Operation

6.7.2 Set Up And Configuration

6.7.3 Block Diagram

6.8 Power Supply Modules (**48Vdc, 125Vdc, 250Vdc, 120Vac**)

6.8.1 Theory of Operation

6.8.2 Set Up

6.8.3 Block Diagram

6.9 Power Supply Alarm I/O Modules (**DC Input, AC Input, DC/AC Input**)

6.9.1 Theory of Operation



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- 6.9.2 Set Up
- 6.10 Channel Modules & Modules Adapters (**VF-5, VF-6I, VF-8A, VF-10B, VF-11B, VF-15C, VF-16A, VF-25, DA-91I, DA-121I, DA-191A, DS-562I, DS-64NC, DS-961D, TS, TMX/TMR, STATUS**)
  - 6.10.1 Theory of Operation
  - 6.10.2 Set Up And Configuration
  - 6.10.3 Block Diagram
- 6.11 Multiplexer Application
  - 6.11.1 Set up & Configuration of a Point-to-Point System
  - 6.11.2 Set up & Configuration of a Drop/Insert System
- 6.12 Troubleshooting
  - 6.12.1 Question And Answer

## **7.0 NETWORK MANAGEMENT SOFTWARE (NMS)**

- 7.1 General Information
- 7.2 System Requirements
- 7.3 Software Installation
- 7.4 Connecting PC To The Network
- 7.5 Card Supported by NMS
- 7.6 Using NMS Icons
- 7.7 Using NMS
- 7.8 Question And Answer

## **8.0 HANDS ON**

- 8.1 Set-Up and Configuration of RFL IMUX2000 Multiplexer
  - 8.1.1 Point To Point System
  - 8.1.2 Drop/Insert System
- 8.2 System Performance Test
  - 8.2.1 Channel Modules Test
  - 8.2.2 Alert & Alarm Test
  - 8.2.3 Power Supply Redundancy Test
- 8.3 Troubleshooting



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### **9.0 IMUX 2000 INTELLIGENT LINE SWITCH (ILS)**

#### 9.1 Functional Description of the ILS

#### 9.2 ILS system Specification

- 9.2.1 Power Supply
- 9.2.2 Optical Interface Adapters (OIA)
- 9.2.3 Alarms & Diagnostics
- 9.2.4 DS1 Inputs/Outputs
- 9.2.5 Propagation Delay
- 9.2.6 Remote Access and Control
- 9.2.7 Switch Time
- 9.2.8 Environmental

#### 9.3 ILS Chassis

#### 9.4 ILS Processor Module

- 9.4.1 Theory of Operation
- 9.4.2 Set Up And Configuration

#### 9.5 ILS Module

- 9.5.1 Theory of Operation
- 9.5.2 Set Up And Configuration
- 9.5.3 Block Diagram

#### 9.6 ILS Settings.

#### 9.7 Module Adapters (**MA220, MA225, MA230, OIA**)

- 9.7.1 Theory of Operation
- 9.7.2 Set Up And Configuration

#### 9.8 Power Supply Modules (**48Vdc, 125Vdc, 250Vdc, 120Vac**)

#### 9.9 Power Supply Alarm I/O Modules (**DC Input, AC Input, DC/AC Input**)

#### 9.10 ILS Application

- 9.10.1 Point-To- Point System With ILS
- 9.10.2 Drop/Insert System With ILS
- 9.10.3 ILS in a Ring Configuration



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# **T R A I N I N G   O U T L I N E**

### **10.0 HANDS ON**

- 10.1 Set-Up and Configuration of IMUX2000 Multiplexer With ILS
  - 10.1.1 Point To Point System
  - 10.1.2 Drop/Insert System
  - 10.1.3 Ring Topology
- 10.2 System Performance Test
  - 10.2.1 Channel Modules Test
  - 10.2.2 Alert & Alarm Test
  - 10.2.3 Power Supply Redundancy Test
  - 10.2.4 ILS Functional Test
- 10.3 Troubleshooting
  - 10.3.1 Question And Answer

### **11.0 IMUX 2000 MINI-DIGITAL CROSS-CONNECT SYSTEM ( MINI-DACS)**

- 11.1 Functional Description of the MINI-DACS
- 11.2 MINI-DACS System Specification
  - 11.2.1 Power Supply
  - 11.2.2 Optical Interface Adapters (OIA)
  - 11.2.3 Alarms & Diagnostics
  - 11.2.4 DS1 Inputs/Outputs
  - 11.2.5 Propagation Delay
  - 11.2.6 Remote Access and Control
  - 11.2.7 DS0/TS1 Alternate Map
  - 11.2.8 Environmental
- 11.3 MINI-DACS Chassis
- 11.4 MINI-DACS Processor Module
  - 11.4.1 Theory of Operation
  - 11.4.2 Set Up And Configuration
- 11.5 MINI-DACS Module
  - 11.5.1 Theory of Operation
  - 11.5.2 Set Up And Configuration



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- 11.5.3 Block Diagram
- 11.6 Modules Adapters (**MA220, MA225, MA230, OIA**)
  - 11.6.1 Theory of Operation
  - 11.6.2 Set Up And Configuration
  - 11.6.3 Block Diagram
- 11.7 MINI-DACS Settings
- 11.8 MINI-DACS Mapping
  - 11.8.1 DS0 Grooming
  - 11.8.2 Robbed Bit Signaling
  - 11.8.3 Facility Data Link (FDL)
- 11.9 Power Supply Modules (**48Vdc, 125Vdc, 250Vdc, 120Vac**)
- 11.10 Power Supply Alarm I/O Modules (**DC Input, AC Input, DC/AC Input**)
- 11.11 MINI-DACS Application
  - 11.11.1 Point-To-Point System With MINI-DACS
  - 11.11.2 Drop/Insert System With MINI-DACS
  - 11.11.3 MINI-DACS in a Ring Configuration
- 12.0 HANDS ON**
  - 12.1 Set-Up and Configuration of IMUX2000 Multiplexer With MINI-DACS
    - 12.1.1 Point To Point System
    - 12.1.2 Drop/Insert System
    - 12.1.3 Ring Topology
  - 12.2 System Performance Test
    - 12.2.1 Channel Modules Test
    - 12.2.2 Alert & Alarm Test
    - 12.2.3 Power Supply Redundancy Test
    - 12.2.4 MINI-DACS functional Test
  - 12.3 Troubleshooting
    - 12.3.1 Question And Answer



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### **13.0 HANDS ON**

- 13.1 Set-Up and Configuration of IMUX2000 Multiplexer with ILS and MINI-DACS
  - 13.1.1 Ring Topology
- 13.2 System Performance Test
  - 13.2.1 Channel Modules Test
  - 13.2.2 Alert & Alarm Test
  - 13.2.3 Power Supply Redundancy Test
  - 13.2.4 MINI-DACS functional Test
- 13.3 Troubleshooting
  - 13.3.1 Question And Answer

### **14.0 IMUX 2000 CUSTOMER EQUIPMENT**

- 14.1 Customer Block Diagram
- 14.2 Set-Up and Configuration of IMUX2000 Multiplexer
- 14.3 Set-up and Configuration of IMUX2000 MINI-DACS
- 14.4 System Performance Test
  - 14.4.1 Channel Modules Test
  - 14.4.2 Alert & Alarm Test
  - 14.4.3 Power Supply Redundancy Test
  - 14.4.4 MINI-DACS Functional Test
- 14.5 Troubleshooting
- 14.6 Maintenance
- 14.7 Question And Answer

### **15.0 OVERVIEW OF IMUX2000 MANUAL**

- 15.1 Manual has 19 sections
- 15.2 Introduction Section contains safety summary info, table of contents, list of illustrations and tables.
- 15.3 Section 1 contains product information on the Multiplexer, ILS, Mini-DACS and IMUX modules.
- 15.4 Section 2 contains the Multiplexer functional description.
- 15.5 Section 3 contains functional description for the ILS
- 15.6 Section 4 contains functional description for the DACS.



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- 15.7 Section 5 contains overview of the Multiplexer channel modules.
- 15.8 Section 6 contains the configuration and setup for the T1 through the CM-3B/C.
- 15.9 Section 7 contains Network Management Software Information.
- 15.10 Section 8 contains remote configuration for the modules
- 15.11 Section 9 contains installation and check-out information
- 15.12 Section 10 contains information on troubleshooting
- 15.13 Section 11 contains Power Supply and Power Supply alarm I/O information
- 15.14 Section 12 contains information on the OIA
- 15.15 Section 13 contains reference data information
- 15.16 Section 14 contains the Index
- 15.17 Section 15 contains the Asynchronous Data Channel modules info
- 15.18 Section 16 contains the Synchronous Data Channel modules info
- 15.19 Section 17 contains the voice modules information
- 15.20 Section 18 contains the DS-TT Transfer Trip Module info
- 15.21 Section 19 has the customer system drawings and other customer's document.

## **16.0 GENERAL QUESTION AND ANSWER**

- 16.1 Multiplexer
- 16.2 ILS
- 16.3 MINI-DACS
- 16.4 NMS
- 16.5 Application