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# **T R A I N I N G   O U T L I N E**

### **RFL IMUX 2000 T1 ILS DACS – 3 DAY**

#### **1 INTRODUCTION**

- 1.1 Course Overview
  - 1.1.1 Day One
  - 1.1.2 Day Two
  - 1.1.3 Day Three

#### **2 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      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      MULTIPLEXER RELIABILITY**

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

### **5      MULTIPLEXER DIAGNOSTICS**

- 5.1    Status Monitoring
- 5.2    Test Jacks
- 5.3    Loopbacks



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# TRAINING OUTLINE

## 6 MULTIPLEXER ALARMS

- 6.1 Major Alarm Conditions
- 6.2 Minor Alert Conditions

## 7 IMUX 2000 MULTIPLEXER

- 7.1 IMUX System Specification
  - 7.1.1 Power Supply
  - 7.1.2 Optical Interface Adapters
  - 7.1.3 Alarms And Diagnostics
  - 7.1.4 Remote Access And Control
  - 7.1.5 Inputs
  - 7.1.6 T-1 Outputs
  - 7.1.7 Timing
  - 7.1.8 Environmental
- 7.2 Main Shelf
- 7.3 Expansion Self
- 7.4 T-1 Common Module (**CM3R**)
  - 7.4.1 Theory of Operation
  - 7.4.2 Set Up And Configuration
  - 7.4.3 Block Diagram
- 7.5 Common Module Interface Adapters (**MA210R, MA215R, OIARs**)
  - 7.5.1 Theory of Operation
  - 7.5.2 Set Up And Configuration
  - 7.5.3 Block Diagram
- 7.6 Power Supply Modules (**48Vdc, 125Vdc, 250Vdc, 120Vac**)
  - 7.6.1 Theory of Operation
  - 7.6.2 Set Up
  - 7.6.3 Block Diagram
- 7.7 Power Supply Alarm I/O Modules (**DC Input, AC Input, DC/AC Input**)
  - 7.7.1 Theory of Operation



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- 7.7.2 Set Up
- 7.8 Channel Modules & Modules Adapters (**VF-6, F-5A, VF-7A, VF-10B, VF-11B, VF-15, VF-16, VF-17, VF-18, DA-91, DA-191, DA-121, DS-562B, DS-64NC, DS-961D, MTS**)
  - 7.8.1 Theory of Operation
  - 7.8.2 Set Up And Configuration
  - 7.8.3 Block Diagram
- 7.9 Multiplexer Application
  - 7.9.1 Set up & Configuration of a Point-to-Point System
  - 7.9.2 Set up & Configuration of a Drop/Insert System
- 7.10 Troubleshooting
  - 7.10.1 Question And Answer
- 8 NETWORK MANAGEMENT SOFTWARE (NMS)**
  - 8.1 General Information
  - 8.2 System Requirements
  - 8.3 Software Installation
  - 8.4 Connecting PC To The Network
  - 8.5 Card Supported by NMS
  - 8.6 Using NMS Icons
  - 8.7 Using NMS
  - 8.8 Question And Answer
- 9 HANDS ON**
  - 9.1 Set-Up and Configuration of RFL IMUX2000 Multiplexer
    - 9.1.1 Point To Point System
    - 9.1.2 Drop/Insert System
  - 9.2 System Performance Test
    - 9.2.1 Channel Modules Test
    - 9.2.2 Alert & Alarm Test
    - 9.2.3 Power Supply Redundancy Test
  - 9.3 Troubleshooting



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- 10    IMUX 2000 INTELLIGENT LINE SWITCH (ILS)**
  - 10.1    Functional Description of the ILS
  - 10.2    ILS system Specification
    - 10.2.1    Power Supply
    - 10.2.2    Optical Interface Adapters (OIA)
    - 10.2.3    Alarms & Diagnostics
    - 10.2.4    DS1 Inputs/Outputs
    - 10.2.5    Propagation Delay
    - 10.2.6    Remote Access and Control
    - 10.2.7    Switch Time
    - 10.2.8    Environmental
  - 10.3    ILS Chassis
  - 10.4    ILS Processor Module
    - 10.4.1    Theory of Operation
    - 10.4.2    Set Up And Configuration
  - 10.5    ILS Module
    - 10.5.1    Theory of Operation
    - 10.5.2    Set Up And Configuration
    - 10.5.3    Block Diagram
  - 10.6    ILS Settings.
  - 10.7    Module Adapters (**MA220, MA225, MA230, OIA**)
    - 10.7.1    Theory of Operation
    - 10.7.2    Set Up And Configuration
  - 10.8    Power Supply Modules (**48Vdc, 125Vdc, 250Vdc, 120Vac**)
  - 10.9    Power Supply Alarm I/O Modules (**DC Input, AC Input, DC/AC Input**)
  - 10.10    ILS Application
    - 10.10.1 Point-To- Point System With ILS
    - 10.10.2 Drop/Insert System With ILS
    - 10.10.3 ILS in a Ring Configuration



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# **T R A I N I N G   O U T L I N E**

### **11    HANDS ON**

- 11.1    Set-Up and Configuration of IMUX2000 Multiplexer With ILS
  - 11.1.1 Point To Point System
  - 11.1.2 Drop/Insert System
  - 11.1.3 Ring Topology
- 11.2    System Performance Test
  - 11.2.1 Channel Modules Test
  - 11.2.2 Alert & Alarm Test
  - 11.2.3 Power Supply Redundancy Test
  - 11.2.4 ILS Functional Test
- 11.3    Troubleshooting
  - 11.3.1 Question And Answer

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

- 12.1    Functional Description of the MINI-DACS
- 12.2    MINI-DACS System Specification
  - 12.2.1 Power Supply
  - 12.2.2 Optical Interface Adapters (OIA)
  - 12.2.3 Alarms & Diagnostics
  - 12.2.4 DS1 Inputs/Outputs
  - 12.2.5 Propagation Delay
  - 12.2.6 Remote Access and Control
  - 12.2.7 DS0/TS1 Alternate Map
  - 12.2.8 Environmental
- 12.3    MINI-DACS Chassis
- 12.4    MINI-DACS Processor Module
  - 12.4.1 Theory of Operation
  - 12.4.2 Set Up And Configuration
- 12.5    MINI-DACS Module
  - 12.5.1 Theory of Operation
  - 12.5.2 Set Up And Configuration



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# **T R A I N I N G   O U T L I N E**

- 12.5.3 Block Diagram
- 12.6 Modules Adapters (**MA220, MA225, MA230, OIA**)
  - 12.6.1 Theory of Operation
  - 12.6.2 Set Up And Configuration
  - 12.6.3 Block Diagram
- 12.7 MINI-DACS Settings
- 12.8 MINI-DACS Mapping
  - 12.8.1 DS0 Grooming
  - 12.8.2 Robbed Bit Signaling
  - 12.8.3 Facility Data Link (FDL)
- 12.9 Power Supply Modules (**48Vdc, 125Vdc, 250Vdc, 120Vac**)
- 12.10 Power Supply Alarm I/O Modules (**DC Input, AC Input, DC/AC Input**)
- 12.11 MINI-DACS Application
  - 12.11.1 Point-To-Point System With MINI-DACS
  - 12.11.2 Drop/Insert System With MINI-DACS
  - 12.11.3 MINI-DACS in a Ring Configuration
- 13 HANDS ON**
  - 13.1 Set-Up and Configuration of IMUX2000 Multiplexer With MINI-DACS
    - 13.1.1 Point To Point System
    - 13.1.2 Drop/Insert System
    - 13.1.3 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



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# **T R A I N I N G   O U T L I N E**

### **14    HANDS ON**

- 14.1    Set-Up and Configuration of IMUX2000 Multiplexer with ILS and MINI-DACS
  - 14.1.1    Ring Topology
- 14.2    System Performance Test
  - 14.2.1    Channel Modules Test
  - 14.2.2    Alert & Alarm Test
  - 14.2.3    Power Supply Redundancy Test
  - 14.2.4    MINI-DACS functional Test
- 14.3    Troubleshooting
  - 14.3.1    Question And Answer

### **15    IMUX 2000 CUSTOMER EQUIPMENT**

- 15.1    Customer Block Diagram
- 15.2    Set-Up and Configuration of IMUX2000 Multiplexer
- 15.3    Set-up and Configuration of IMUX2000 MINI-DACS
- 15.4    System Performance Test
  - 15.4.1    Channel Modules Test
  - 15.4.2    Alert & Alarm Test
  - 15.4.3    Power Supply Redundancy Test
  - 15.4.4    MINI-DACS Functional Test
- 15.5    Troubleshooting
- 15.6    Maintenance
- 15.7    Question And Answer

### **16    OVERVIEW OF IMUX2000 MANUAL**

- 16.1    Manual has 19 sections
- 16.2    Introduction Section contains safety summary info, table of contents, list of illustrations and tables.
- 16.3    Section 1 contains product information on the Multiplexer, ILS, Mini-DACS and IMUX modules.
- 16.4    Section 2 contains the Multiplexer functional description.
- 16.5    Section 3 contains functional description for the ILS
- 16.6    Section 4 contains functional description for the DACS.



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- 16.7 Section 5 contains overview of the Multiplexer channel modules.
- 16.8 Section 6 contains the configuration and setup for the T1 through the CM-3B/C.
- 16.9 Section 7 contains Network Management Software Information.
- 16.10 Section 8 contains remote configuration for the modules
- 16.11 Section 9 contains installation and check-out information
- 16.12 Section 10 contains information on troubleshooting
- 16.13 Section 11 contains Power Supply and Power Supply alarm I/O information
- 16.14 Section 12 contains information on the OIA
- 16.15 Section 13 contains reference data information
- 16.16 Section 14 contains the Index
- 16.17 Section 15 contains the Asynchronous Data Channel modules info
- 16.18 Section 16 contains the Synchronous Data Channel modules info
- 16.19 Section 17 contains the voice modules information
- 16.20 Section 18 contains the DS-TT Transfer Trip Module info
- 16.21 Section 19 has the customer system drawings and other customer's document.

## **17 GENERAL QUESTION AND ANSWER**

- 17.1 Multiplexer
- 17.2 ILS
- 17.3 MINI-DACS
- 17.4 NMS
- 17.5 Application

## **18 CONCLUSION**