Event 5800

Installation & Reference Manual

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Table of Contents

List of Illustrations

List of Tables

Blank Page

1. Safety Precautions

PLEASE READ THESE SAFETY PRECAUTIONS!

Do not turn on power before reading Moseley's product documentation. This device has a -48V DC direct current input.

1.1 RF Energy Health Hazard

This symbol indicates a risk of personal injury due to radio frequency exposure.

The radio equipment described in this guide uses radio frequency transmitters. Although the power level is low, the concentrated energy from a directional antenna may pose a health hazard. Do not allow people to come in close proximity to the front of the antenna while the transmitter is operating. The antenna will be professionally installed on fixed-mounted outdoor permanent structures to provide separation from any other antenna and all persons.

WARNING: FCC RF exposure compliance requires a minimum separation distance of 33.9cm maintained between the user and antenna when the product is used with a 9dBi antenna. For point-to-point use with a 26dBi antenna, this distance must be increased to a user separation distance of 240cm.

Appropriate warning signs must be properly placed and posted at the equipment site and access entries.

1.2 Protection from Lightning

Article 810 of the US National Electric Department of Energy Handbook 1996 specifies that radio and television lead-in cables must have adequate surge protection at or near the point of entry to the building. The code specifies that any shielded cable from an external antenna must have the shield directly connected to a 10 AWG wire that connects to the building ground electrode.

1.3 Protection from RF Burns

It is hazardous to look into or stand in front of an active antenna aperture. Do not stand in front of or look into an antenna without first ensuring the associated transmitter or transmitters are switched off. Do not look into the waveguide port when the radio is active.

1.4 Risk of Personal Injury from Fiber Optics

DANGER: Invisible laser radiation. Avoid direct eye exposure to the end of a fiber, fiber cord, or fiber pigtail. The infrared light used in fiber optics systems is invisible, but can cause serious injury to the eye.

WARNING: Never touch exposed fiber with any part of your body. Fiber fragments can enter the skin and are difficult to detect and remove.

1.5 This is a Class A product

WARNING: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures to remedy the interference.

1.6 Turn off all power before servicing

WARNING: Turn off all power before servicing.

1.7 Power Supply Safety Requirements

Safety requirements require a switch be employed between the external DC power supply and the EVENT 5800 power supplies. The switch must disconnect both poles of the power supply. A single-pole disconnect device can be used to disconnect the line conductor where it is possible to rely on the identification of an earthed conductor in a DC MAINS SUPPLY. The supplied AC to DC converter alleviates this requirement since the AC MAINS connector can be unplugged to disconnect the power.

1.8 Battery must be replaced correctly

CAUTION: There is a danger of explosion if the battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

Panasonic (or equivalent) is the manufacturer of the battery (Part Number: 2032). Disposal instructions are available on the Panasonic website. Please dispose in accordance with local regulations.

1.9 Proper Disposal

The manufacture of the equipment described herein has required the extraction and use of natural resources. Improper disposal may contaminate the environment and present a health risk due to the release of hazardous substances contained within. To avoid dissemination of these substances into our environment, and to lessen the demand on natural resources, we encourage you to use the appropriate recycling systems for disposal. These systems will reuse or recycle most of the materials found in this equipment in a sound way. Please contact Moseley or your supplier for more information on the proper disposal of this equipment.

1.10 Equipment RF Protection

CAUTION: Do not operate the EVENT 5800 without an antenna, attenuator or load connected to the antenna port. Otherwise, damage may occur to the transmitter module due to excessive reflected RF energy.

CAUTION: Always attenuate the signal into the receiver antenna port to lest than –20 dBm (22.4 mV / 10 mW). This will prevent overload and possible damage to the receiver module.

1.11 Regulatory Notices

FCC Part 15 Notice

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Pursuant to Part 15.21 of the FCC Rules, any changes or modifications to this equipment not expressly approved by the manufacturer may cause harmful interference and void your authority to operate this equipment. Any external data or audio connection to this equipment must use shielded cables.

FCC Part 15 Equipment Authorization

The EVENT 5800 Transmitter has been granted Equipment Authorization under Part 15.247 of the FCC Rules and Regulations.

Equipment Class:	***Broadcast Transmitter Base Station***
Frequency Range:	***5725 -5850 MHz***
Emission Bandwidth:	***10/25/50 MHz***
FCC Identifier:	***CSUEVENT5800***

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2. System Description

This manual is written for those who are involved in the “hands-on” installation of the EVENT 5800 in a microwave point-to-point link, such as installation technicians, site evaluators, project managers, and network engineers. It assumes the reader has a basic understanding of how to install hardware, use Windows® based software, and operate test equipment. See the EVENT 5800 User Interface Guide (Moseley Document #602-15173-01) for information about how to operate the unit.

2.1 Introduction

The Moseley family of digital radios provides high capacity transmission, flexibility, features, and convenience for wireless digital communications networks. The digital point-to-point radios represent a new microwave architecture that is designed to address universal applications for video, audio, data, PDH and SDH platforms. This advanced technology platform is designed to provide the flexibility to customers for their current and future network needs.

EVENT 5800 supports a wide range of network interfaces and configurations:

- 16/32/42/63 x E1/T1
- 1/2 x 100BaseTX Ethernet
- 1000BaseTX Ethernet
- 1/2 x STM-1/OC-3

EVENT 5800 is spectrum and data rate scalable, enabling service providers or organizations to trade-off system gain with spectral efficiency and channel availability for optimal network connectivity. EVENT 5800 enables network operators (mobile and private), government and access service provides to offer a portfolio of secure, scalable wireless applications for data, video, and Voice over IP (VoIP).

The Moseley EVENT 5800 is a digital microwave radio terminal. A built-in radio transceiver unit establishes the frequency of operation over the Unlicensed 5.8 GHz ISM band. Some applications are described below:

2.1.1 Example Applications

EVENT 5800 can be used for unlicensed high-capacity full-duplex Telecommunications data and broadcast applications for data rates to 100 Mbps:

- 5.8 GHz band between 5.725 to 5.850 GHz for ISM in 5, 10, 20, and 30 MHz channels.

EVENT 5800 can be used for Unlicensed high-capacity full-duplex data and broadcast applications for data rates to 100 Mbps.

2.1.2 Operational Overview

EVENT 5800 digital radios support diversity, 1+0, and 1+1 protection and ring architectures. The modem and power supply functions are supported using easily replaceable plug-in modules. A second plug-in modem/IF module can also be installed to provide diversity, repeater or east/west network configurations.

EVENT 5800 includes integrated Operations, Administration, Maintenance, and Provisioning (OAM&P) functionality and design features enabling simple commissioning when the radio network is initially set up in the field at the customer’s premises. EVENT 5800 is scalable and capability of supporting a ring-type architecture. This ring or consecutive point radio architecture is self-healing. In the event of an outage in the link,

data traffic is automatically re-routed to ensure that service to the end user is not interrupted.

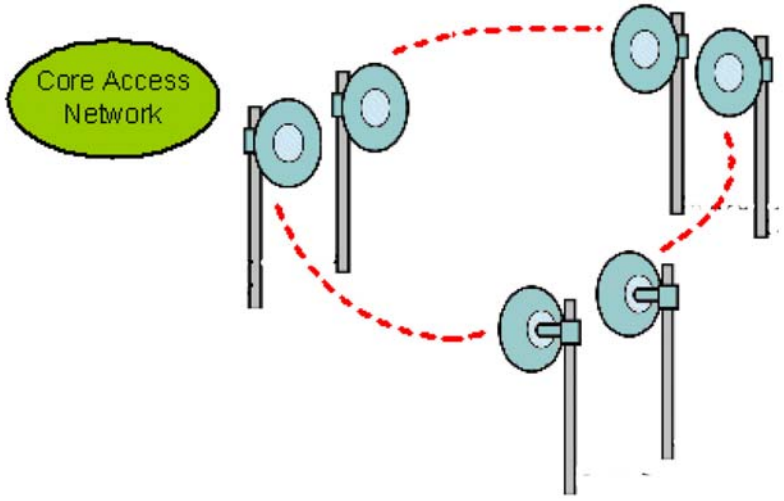


Figure 2-1. Example Installation

Table 2-1 shows key features that Moseley technology offers to those involved in the design, deployment and support of broadband fixed wireless networks.

Table 2-1. Key Benefits/Advantages

Component/Feature	Benefits	Advantages to Providers/Customers
EVENT 5800 System	Universal signal processing platform	Enables easy network interface options and network capacity growth in the future.
	Advanced Single Chip Modem ASIC	Cost effective solution; simplifying product logistics and overall product life cycle costs. The flexibility reduces capital and operating expenditures commonly associated with field installation, maintenance, training and spares.
	Integrated Forward Error Correction (FEC)	Frequency independent and Scalable.
	Powerful adaptive equalizer	Software defined flexibility enables selective modulation for spectral efficiency and adherence to worldwide regulatory emissions guidelines.
Easy to install units	Straightforward modular system enables fast deployment and activation.	Fast return on investment.
	Carrier-class reliability.	No monthly leased line fees.
Complete support of payload capacity	Aggregate capacity beyond basic network payload.	Increases available bandwidth of network.
	Scalable and spectrally efficient system.	Allows customer full use of revenue-generating payload channel.
	Separate networks for radio overhead/management and user payload.	Lowers total cost of ownership.
Ring Architecture	Supports a ring (consecutive point) configuration, thus creating a self-healing redundancy that is more reliable than traditional point-to-	Enables network scalability.

Component/Feature	Benefits	Advantages to Providers/Customers
	point networks.	
	In the event of an outage, traffic is automatically rerouted via another part of the ring without service interruption.	Increases deployment scenarios for initial deployment as well as network expansion with reduced line-of-sight issues.
	Ring/consecutive point networks can overcome line-of-sight issues and reach more buildings than other traditional wireless networks.	Increases network reliability due to self-healing redundancy of the network.
	Networks can be expanded by adding more IDUs or more rings, without interruption of service.	Minimizes total cost of ownership and maintenance of the network.
	A separate management channel allows for a dedicated maintenance ring with connections to each EVENT 5800 on the ring.	Allows for mass deployment.
Adaptive Power Control	Automatically adjusts transmit power in discrete increments in response to RF interference.	Enables dense deployment. Simplifies deployment and network management.
Comprehensive Link/Network Management Software	A web interface offers security, configuration, fault, and performance management via standard craft interfaces.	Simplifies management of radio network and minimizes resources as entire network can be centrally managed out of any location.
	Suite of SNMP-compatible network management tools that provide robust local and remote management capabilities.	Simplifies troubleshooting of single radios, links, or entire networks. Simplifies network upgrades with remote software upgrades. Allows for mass deployment.

2.2 System Features

- Selectable Rates and Interfaces
  - PDH Options: Up to 16 x E1/T1, 100BaseTX/Ethernet (Scalable 1-100 Mbps), DS-3/E-3/STS-1 (option; consult factory for availability)
  - Super PDH Options: Up to 32 x E1/T1, 100 BaseTX/Ethernet (Scalable 1-100 Mbps)
  - Ethernet Options: 100 BaseTX/Ethernet (Scalable 1-155 Mbps), 1000BaseTX/Ethernet (Scalable 1-300 Mbps)
  - SDH Options: 1-2 x SDH STM-1/OC-3 SONET
- Support for multiple configurations for both PDH and SDH
  - 1+0, 1+1 protection/diversity
  - Hot Standby
  - East/West Repeater (2 + 0)
- Selectable Spectral Efficiency of 0.8 to 6.25 bits/Hz (including FEC and spectral shaping effects)
- QPSK, 16–256 QAM Modulation
- Powerful Trellis Coded Modulation concatenated with Reed-Solomon Error Correction
- Built-in Adaptive Equalizer
- Support of Data Orderwire Channels
  - Up to 19.2 kbps asynchronous RS-232

- 64 kbps synchronous RS422

- Adaptive Power Control
- Standard high-power feature at antenna port
  - 5W (37 dBm in QPSK mode) in 2 GHz bands
  - 1W (30 dBm) in 5.8, 7, and 13 GHz bands
- Built-in Network Management System (NMS)
- Consecutive Point ring architecture
- Built-in Bit Error Rate (BER) performance monitoring
- Integrated Crosspoint switch: allows a total of 191 E1s (200 T1s) to be mapped any-to-any between front-panel ports and RF link(s)
- Optional STM-1 Mux/Demux: allows the SDIDU to extract up to 63 E1 (or 84 T1) from an STM-1. In conjunction with an integrated Crosspoint Switch, up to 223 E1 (284 T1s) can be mapped any-to-any between ports, STM-1, and RF link(s).

2.3 Physical Description

The following sections describe the physical features of EVENT 5800 digital radios.

2.3.1 Back Panel

The following illustration shows the general format of a EVENT 5800 back panel.

Figure 2-3. Transceiver Back Panel

This illustration shows the back panel of a transceiver unit that can be configured as a transmitter or receiver. The following illustration shows the back panel of a receiver-only unit.

Figure 2-4. Receiver-Only Back Panel

Note that the back panel of a EVENT 5800 unit will be slightly different depending on the number and type of hardware modules installed. Some modules are standard and included in all units. Optional modules may be ordered and installed to support specific functional requirements.

2.3.2 Hardware Modules

The lower section of the EVENT 5800 chassis is comprised of hardware modules. The number and type of modules depends on the type and required functionality. A maximum of eight of modules can be installed in the chassis. A minimum of five modules are required in a basic EVENT 5800 configured for 1+0 operation. They are:

- Power Supply Module
- Controller Module
- Modem & I/F Telemetry Module
- Master I/O Module
- Mini I/O Module

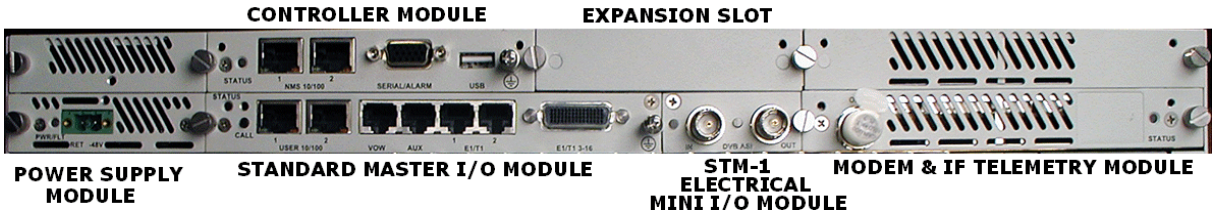


Figure 2-5. EVENT 5800 Modules

Power Supply Module: A second power supply module can be installed above this module and is required for 1+1 or 2+0 configurations.

Controller Module: This module is included in all EVENT 5800 units. It supports the interface to the LCD/keypad and includes connectors for attaching a PC for configuration and monitoring via the web, CLI, or SNMP interface.

Mini I/O Module: This module can be ASI, an OC3/STM-1 Optical or STM-1 Electrical Mini I/O Module.

Modem & IF/Telemetry Module: A second Modem & IF Telemetry module can be installed above this module and is required for 1+1 or 2+0 configurations. Either module can be replaced with a Wideband Modem & IF/Telemetry module. The standard Modem module supports 5-30 MHz channel bandwidths. The Wideband Modem module supports 7-56 MHz channel bandwidths.

Master I/O Module: The Master I/O Module can be one of the following:

Table 2-2. Master I/O Modules

Master I/O Module	Payload	E1/T1 Ethernet	STM-1 Mux/Demux	Jumbo Packets
Standard	1-16	10/100	No	No
GigE	1-2	10/100/1000	No	4000
Enhanced GigE (Super PDH)	1-2	10/100/1000	No*/Yes*	4000*/9728*
42xE1/T1	1-42	10/100	No	No
Enhanced	1-16	10/100	Yes	No

*Enhanced GigE Master I/O comes with two options: Support for STM-1 Mux/Demux with 4000 Jumbo Packets or support for 9728 Jumbo Packets.

Expansion Slot: The Expansion Slot can be populated with a 16xE1/T1 Expansion Module or 21xE1/T1 Expansion Module. The E1/T1 interface cards support up to 63 channels operating simultaneously. Mixing of E1 and T1 channels is not supported. The E1/T1 interface is in accordance with G.703. One or two E1/T1 channels can be used as wayside channels in other operating modes. The Standard Master I/O provides up to 16xE1/T1. The Super PDH Master I/O provides up to 42xE1/T1. Additional 16xE1/T1 or 21xE1/T1 are provided by separate Expansion I/O cards. The GigE Master I/O card provides up to 2xE1/T1. The total possible T1/E1 combinations are provided in the following table.

Table 2-3. Supported E1/T1 Combinations

Master I/O	Expansion I/O	E1/T1	
Standard	None	16xE1/T1	Includes 1-155 Mbps Fast Ethernet
Standard	16xE1 Expansion I/O	32xE1/T1	Includes 1-155 Mbps Fast Ethernet
Standard	21xE1 Expansion I/O	37xE1/T1	Includes 1-155 Mbps Fast Ethernet
42xE1/T1 Master I/O	None	42xE1/T1	Includes 1-155 Mbps Fast Ethernet
42xE1/T1 Master I/O	16xE1 Expansion I/O	48xE1/T1	Includes 1-155 Mbps Fast Ethernet

Master I/O	Expansion I/O	E1/T1	
42xE1/T1 Master I/O	21xE1 Expansion I/O	63xE1/T1	Includes 1-155 Mbps Fast Ethernet
GigE Master I/O	None	2xE1/T1	Includes 1-300 Mbps Gigabit Ethernet
GigE Master I/O	16xE1 Expansion I/O	18xE1/T1	Includes 1-300 Mbps Gigabit Ethernet
GigE Master I/O	21xE1 Expansion I/O	23xE1/T1	Includes 1-300 Mbps Gigabit Ethernet

All modules are inserted from the back panel of the chassis. All modules are hot swappable. The modularity allows for future upgrades via new hardware modules without a full replacement of a complete chassis. In addition, repair and maintenance costs are minimized since individual modules can be repaired or replaced.

2.3.3 Back Panel Connectors

The following illustration shows EVENT 5800 back panel connector locations in a typical, basic unit.

2.3.3.1 Power Supply Module Connector

-48V Power Input: -48V (Non-isolated Input); 2-pin captive power connector. EVENT 5800 requires an input of -48 Volts DC ±10% at the back panel DC Input connector. The total required power depends on the option cards and protection configuration (1+0, 1+1). Back panel power connector pins are numbered 1-2, from left to right, when facing the unit back panel. Pin 1 is the power supply return and is connected to chassis ground internally. Pin 2 should be supplied with a nominal -48V DC, with respect to the unit chassis (ground). A ground-isolated supply may be used, provided it will tolerate grounding of its most positive output.

The recommended power input is -44 to -52V DC at 2 Amps minimum. Any power supply used must be able to supply a minimum of 125 W to the EVENT 5800.

A mating power cable connector is supplied with EVENT 5800. It is a 2-pin plug, 5 mm pitch, manufactured by Phoenix Contact, P/N 17 86 83 1 (connector type MSTB 2, 5/2-STF). This connector has screw clamp terminals that accommodate 24 AWG to 12 AWG wire. The power cable wire should be selected to provide the appropriate current with minimal voltage drop, based on the power supply voltage and length of cable required. The recommended wire size for power cables under 10 feet in length supplying -48V DC is 18 AWG, minimum.

EVENT 5800 unit does not have a power on/off switch. When DC power is connected to the unit, the digital radio powers up and is operational. There can be up to 5 W of RF power present at the antenna port. The antenna should be directed safely when power is applied. The EVENT 5800 is normally supplied with an external power supply that has an on/off switch.

2.3.3.2 Controller Module Connectors

The following illustration shows the connectors on the Controller Module:

Serial/Alarm Interface: DB-15HD female connector for two Form-C relay alarm outputs (rated load: 1A @ 24V DC), two TTL alarm outputs, four TTL alarm inputs, and Serial Console. The two Form-C relay alarm outputs can be configured to emulate TTL alarm outputs by installing shorting jumpers JP6 and JP8 for relay alarm 1 and shorting jumper JP7 and JP9 for relay alarm 2. When configured as TTL, the 2 outputs can source/sink up to 10 mA at 5 VDC. When an alarm is present, Common is connected to Normally Closed. Otherwise it is connected to Normally Open.

USB Interface: USB connector, reserved.

NMS 10/100 1: 10/100Base-TX RJ-45 modular local port connector for access to the Network Management System (SNMP) and Web Interface.

NMS 10/100 2: 10/100BaseTX RJ-45 modular remote port connector for access to the Network Management System (SNMP). This port to be used for consecutive point networks.

2.3.3.3 Standard Master I/O Module Connectors

The following illustration shows the connectors on the Standard Master I/O Module:

USER 10/100 1: 100Base-TX RJ-45 modular port connector for the local Fast Ethernet interface.

USER 10/100 2: 100Base-TX RJ-45 modular port connector. This port to be used for consecutive point networks.

AUX: Data Orderwire Connector: RJ-45 modular port connector for RS422/RS-232 data at 64 kbps.

E1/T1 1-2: Two E1/T1 (RJ-48C) interface connections.

E1/T1 3-16: Single Molex 60-pin connector containing 14 E1/T1 connections.

2.3.3.4 GigE Master I/O Module Connectors

The following illustration shows the connectors on the GigE and Enhanced GigE Master I/O Modules:

SFP: SFP Module slot for 1000Base-T, 1000Base-SX, or 1000Base-LX modules

USER 10/100/1000 1: 1000Base-T RJ-45 modular port connector

USER 10/100/1000 2: 1000Base-T RJ-45 modular port connector

USER 10/100/1000 3: 1000Base-T RJ-45 modular port connector

USER 10/100/1000 4: 1000Base-T RJ-45 modular port connector

AUX: Data Orderwire Connector: RJ-45 modular port connector for RS422/RS-232 data at 64 kbps.

E1/T1 1-2: Two E1/T1 (RJ-48C) interface connections.

2.3.3.5 42xE1/T1 Master I/O Module Connectors

The following illustration shows the connectors on the 42xE1/T1 Master I/O Module:

USER 10/100 1: 100Base-TX RJ-45 modular port connector for the local Fast Ethernet interface.

USER 10/100 2: 100Base-TX RJ-45 modular port connector. This port to be used for consecutive point networks.

AUX: Data Orderwire Connector: RJ-45 modular port connector for RS422/RS-232 data at 64 kbps.

E1/T1 1-2: Two E1/T1 (RJ-48C) interface connections.

E1/T1 3-16: Three Molex 60-pin connectors containing 14 E1/T1 connections each.

2.3.3.6 ASI Mini I/O Module Connectors

The following illustration shows the connectors on the ASI Mini I/O Module:

DVB/ASI Out: BNC connector for the DVB/ASI digital video and DS-3, E-3, and STS-1 interface.

DVB/ASI In: BNC connector for the DVB/ASI digital video and DS-3, E-3, and STS-1 interface.

2.3.3.7 Optional OC-3 Mini I/O Module Connectors

The following connectors are available on an optional OC-3 Mini I/O Module:

- **OC-3 Out**: OC-3 type SC connectors for the OC-3 interface.
- **OC-3 In**: OC-3 type SC connectors for the OC-3 interface.

2.3.3.8 Optional STM-1 Mini I/O Module Connectors

The following connectors are available on an optional STM-1 Mini I/O Module:

- **STM-1 Out**: BNC connector for the STM-1 interface.
- **STM-1 In**: BNC connector for the STM-1 interface.

2.3.4 LEDs

The following paragraphs describe the LEDs on the back panel, and optional configurations.

2.3.4.1 Back Panel LEDs

All models of the EVENT 5800 support a variety of back panel configurations that depend on the network interface and capacity configurations. The following illustration shows the location of LEDs on the back panel. A status LED is provided on the controller, standard I/O, and each modem card.

Figure 2-7. Back Panel LEDs

These LEDs are described in the following tables and paragraphs.

Table 2-5. Modem Status LED

LED	STATUS
GREEN	Active Locked Link
ORANGE	Standby Locked Link (1+1 Non-Diversity Only)
Flashing GREEN	Low SNR
Flashing ORANGE	Unlocked

Table 2-6. DVB-ASI In Status LED

LED	STATUS
GREEN	Good ASI input
RED	No ASI input
Alternating YELLOW/GRN	ASI exceeds radio bit rate (FIFO overflow)
Flashing RED	Loss-of-Frame
Flashing GRN	No ASI data

Table 2-7. DVB-ASI Out Status LED

LED	STATUS
GREEN	Active Locked ASI Link
Alternating RED/GREEN	No ASI, loss-of-frame
GREEN, occasionally flashing YELLOW	Locked ASI link with errors (yellow flashes)

Controller Status LED: This LED is the primary back panel indicator of alarms. An alarm is generated when a specific condition is identified and is cleared when the specified condition is no longer detected. When an alarm is posted,

1) The controller status LED turns orange for 5 seconds

2) The controller status LED turns off for 5 seconds

3) The controller status LED flashes orange the number of times specified by the first digit of the alarm code

4) The controller status LED turns off for 3 seconds

5) The controller status LED flashes orange the number of times specified by the second digit of the alarm code

Steps 2-5 are repeated for each alarm posted. The entire process is repeated as long as the alarms are still posted.

For all modules, a green LED indicates normal operation and a red LED indicates mdule fault. Alarms are also shown in the Web Interface, Command Line Interface (CLI), and . See the EVENT 5800 User Interface Guide (Moseley Document #602-15173-01).

2.3.5 External AC to DC Converter

The DTV LINK TX and RX both are supplied with a high reliability, universal input switching power supply capable of operating within an input range of 90 - 264 VAC; 47 - 63 Hz. The input is a standard IEC-320-C14 connector. The output voltage is -48V and is supplied with the 2-pin, 5mm plug.

2.4 Block Diagram & Functional Components

Figure 2-9 shows the EVENT 5800 digital radio and interfaces from a functional point of view.

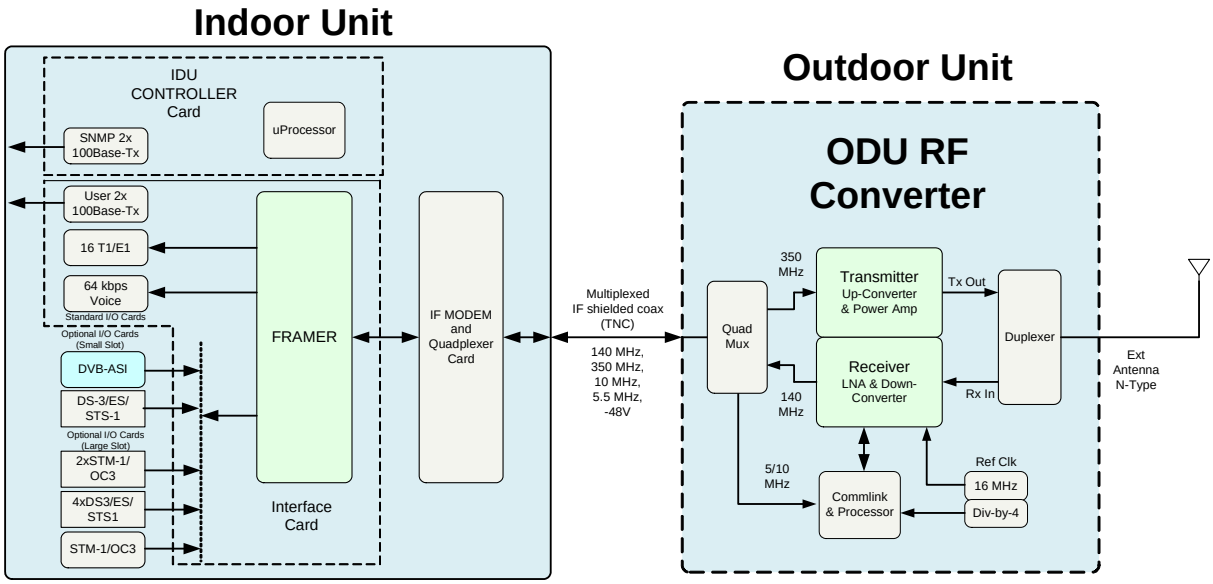


Figure 2-9. EVENT 5800 Block Diagram

The functional partitions for the I/O, Modem/IF, power supply modules, up/down converters, and internal RF duplexing partition are shown. EVENT 5800 comes with the standard I/O capability which can be upgraded. The Modem/IF function is modular allowing the addition of a second Modem to support protection or ring architectures. The power supply is similarly modular. In addition, the radio transceivers are interchangeable allowing use of a single EVENT 5800 in licensed, unlicensed, and short-haul applications by swapping the RF component.

The Radio Transceiver RF Up/Down Converter provides the interface to the antenna. The transmit section up converts and amplifies the modulated Intermediate Frequency (IF) of 350 MHz from the IF Processor and provides additional filtering. The receive section down

converts the received signal, provides additional filtering, and outputs an IF of 140 MHz to the IF Processor.

The EVENT 5800 digital radio modem performs QPSK, 16-QAM, 32-QAM, 64-QAM, 128-QAM and 256-QAM modulation and demodulation of the payload and forward error correction using advanced modulation and coding techniques. Using all-digital processing, the IF Modem uses robust modulation and forward error correction coding to minimize the number of bit errors and optimize the radio and network performance. The IF Modem also scrambles, descrambles and interleaves/deinterleaves the data stream in accordance with Intelsat standards to ensure modulation efficiency and resilience to sustained burst errors. The modulation will vary by application, data rate, and frequency spectrum. The highest order modulation mode supported is 256 Quadrature Amplitude Modulation (QAM). Table 2-5 summarizes the TCM/convolutional code rates for each modulation type supported by EVENT 5800.

Table 2-8. TCM/Convolutional Code Rates

Modulation Type	Available Code Rates
QPSK	1/2, 3/4, 7/8
16-QAM	3/4, 7/8
32-QAM	4/5, 9/10
64-QAM	5/6, 11/12
128-QAM	6/7, 13/14
256-QAM	7/8, 15/16

The major functions of the EVENT 5800 include:

- **I/O Processing** – EVENT 5800 comes with a standard I/O capability that includes support for up to 16xT1/E1 and 2x100Base-TX user payloads, 2x100Base-TX for SNMP. In addition, option cards for DVB-ASI, DS-3/E3/STS-1, 1-2 x STM-1/OC-3, and 4xDS-3/E3/STS-1 may be added. The EVENT 5800 architecture is flexible and allows for the addition of other I/O types in the future.
- **Switch/Framing** – EVENT 5800 includes an Ethernet Switch and a proprietary Framer that are designed to support 1+1 protection switching, ring architecture routing, and overall network control functions.
- **Network Processor** – EVENT 5800 includes a Network Processor which performs SNMP and Network Management functions.
- **Modem/IF** – The EVENT 5800 modem performs forward-error-correction (FEC) encoding, PSK/QAM modulation and demodulation, equalization, and FEC decoding functions. The IF chain provides a 350 MHz carrier and receives a 140 MHz carrier. Two modems can be used for 1+1 protection or ring architectures.
- **Power Supply** – The EVENT 5800 power supply accepts 48V DC and supplies the EVENT 5800 and radio transceiver with power. A second redundant power supply may be added as an optional module.

For the OC-3 configuration, a user rate clock is recovered from clock recovery NCO and provided to the OC-3/STM-1 I/O card. The Modem Processor and its associated RAM, ROM, and peripherals control Modem/IF operation. It also provides configuration and control for both the IF and I/O cards. EVENT 5800 interfaces with the internal Radio Transceiver to receive and provide modulated transmit and receive waveforms.

The 256-QAM Modem performs the modulation and demodulation of the payload/wayside/SNMP data and forward error correction using advanced modulation and

coding techniques. Using all-digital processing, the 256-QAM Modem uses robust modulation and forward error correction coding to minimize the number of bit errors and optimize the radio and network performances. The 256-QAM Modem also scrambles, descrambles and interleaves/deinterleaves the data stream in accordance with Intelsat standards to ensure modulation efficiency and resilience to sustained burst errors. The modulation will vary by application, data rate, and frequency spectrum. The highest order modulation mode supported is 256 Quadrature Amplitude Modulation (QAM).

The EVENT 5800 digital radio also provides the physical interface for the user payload and network management. In transmit mode, the Framer merges user payload (ASI, OC-3 or Fast Ethernet) with radio overhead-encapsulated network management data. This combined data stream is transmitted without any loss of user bandwidth. In the receive mode, the Framer separates the combined data stream received from the 256-QAM Modem. The EVENT 5800 supports Scalable Ethernet data rates, such as 25 or 50 Mbps via the 100BaseT data interface port. EVENT 5800 provides network management data on 10 Mbps ports accessible via the 10/100BaseTX port. The Central Processor Unit (CPU) provides the embedded control and network element functionality of the OAM&P. The CPU also communicates with other functions within EVENT 5800 for configuration, control, and status monitoring.

The power supply converts -48V DC to the DC voltage levels required by each component in the system.

2.5 Consecutive Point Architecture

The consecutive point network architecture is based on the proven SONET/SDH ring. Telecommunications service providers traditionally use the SONET/SDH ring architecture to implement their access networks. A typical SONET/SDH network consists of the service provider's Point of Presence (POP) site and several customer sites with fiber optic cables connecting these sites in a ring configuration. This architecture lets providers deliver high bandwidth with high availability to their customers.

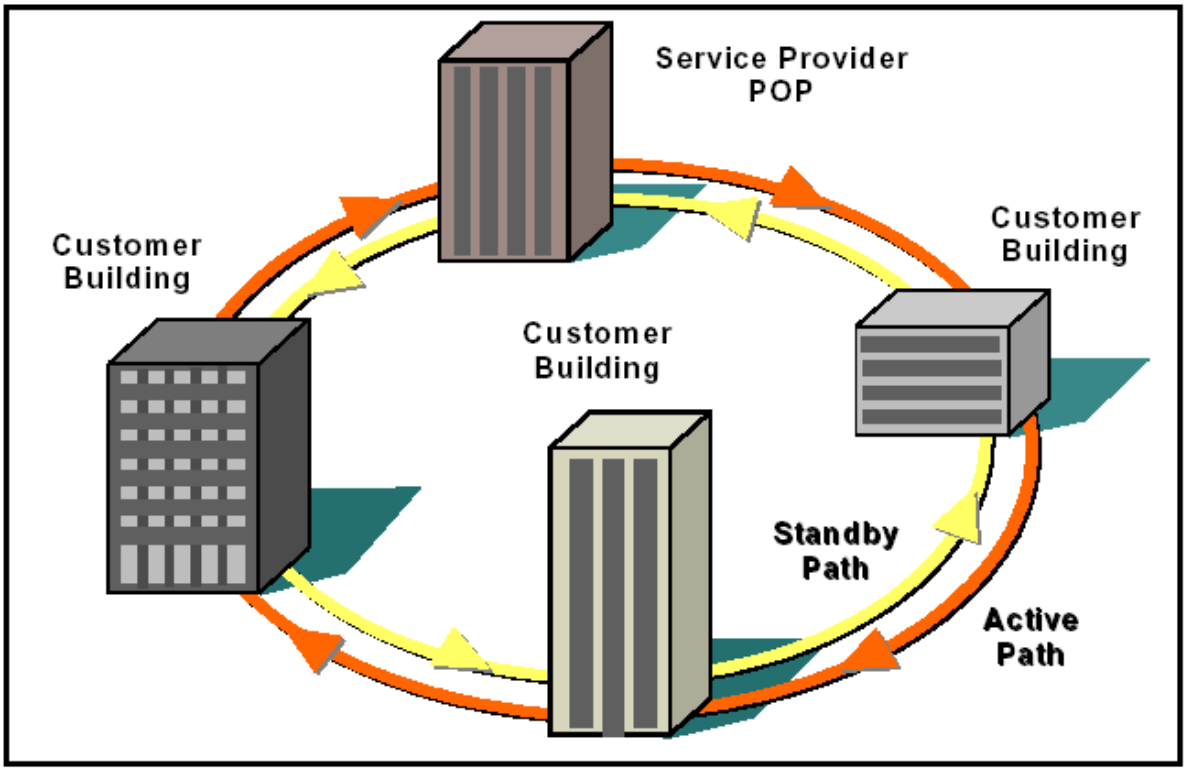


Figure 2-10. Ring Configuration

SONET/SDH rings are inherently self-healing. Each ring has an active path and a standby path. Network traffic normally uses the active path. If one section of the ring fails, the network will switch to the standby path. Switchover occurs in seconds. There may be a brief delay in service, but no loss of payload, thus maintaining high levels of network availability.

The consecutive point architecture implemented in the Moseley Digital Radio family is based on a point-to-point-to-point topology that mimics fiber rings, with broadband wireless links replacing in-ground fiber cable. A typical consecutive point network consists of a POP and several customer sites connected using a EVENT 5800. These units are typically in a building in an east/west configuration. Using east/west configurations, each unit installed at a customer site is logically connected to two other units via an over-the-air radio frequency (RF) link to a unit at an adjacent site.

Each consecutive point network typically starts and ends at a POP. A pattern of wireless links and in-building connections is repeated at each site until all buildings in the network are connected in a ring as shown in the following illustration for an Ethernet network. For 2 x 1+0 and 2 x 1+1 nodes, payload and NMS connections need to be jumpered between two EVENT 5800 units. For 1 x 2+0 nodes, there is no need for jumpers as there is a single EVENT 5800. For SDH or SONET payloads, the configuration is similar but an external add/drop mux is required.

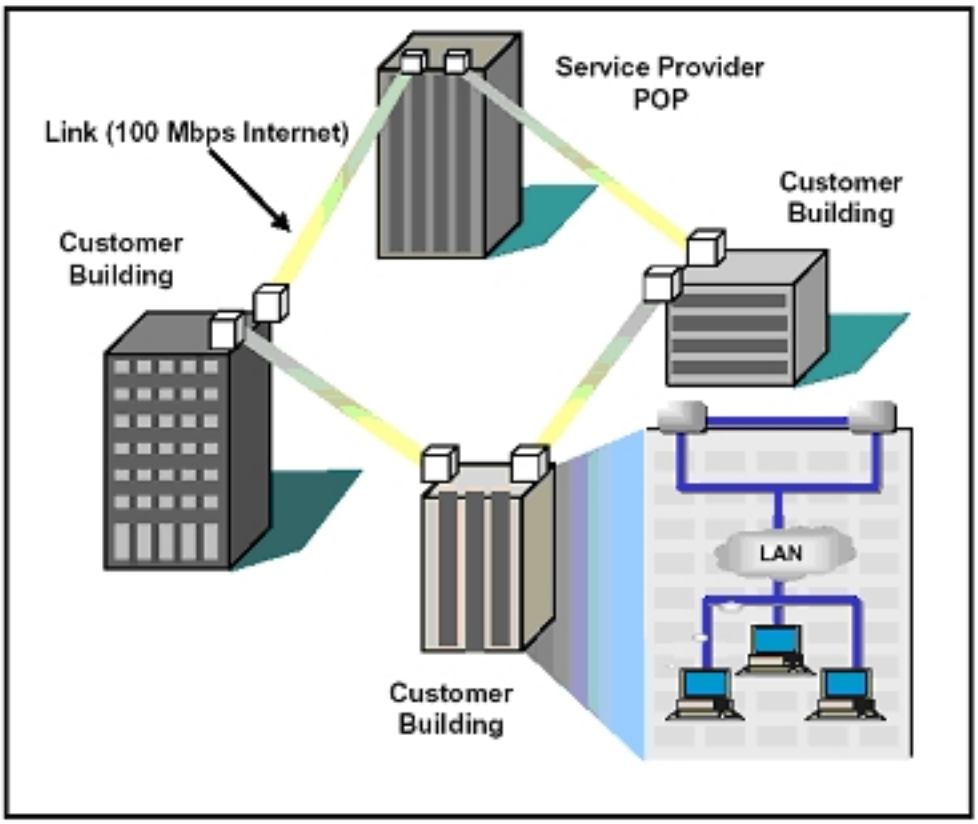


Figure 2-11. Consecutive Point Network

2.6 Spanning Tree Protocol (STP)

Spanning Tree Protocol (STP) keeps Ethernet loops from forming in a ring architecture. Without STP, loops would flood a network with packets. STP prevents loops by creating an artificial network break. In the event of a network outage, STP automatically removes the artificial break, restoring connectivity.

2.7 1+1 Protection

EVENT 5800 supports 1+1 protection as an option for a critical link. In this configuration, EVENT 5800 contains two power supplies and two modems. The power supply, radio transceiver, IF/telemetry and modem are protected. The digital framing and LIUs are not. One modem is referred to as the west modem and the other as the east modem. 1+1 protection can be run in two modes: Protected Non-Diversity and Protected Diversity.

2.7.1 Protected Non-Diversity (Hot Standby)

The following illustration shows operation in Protected Non-Diversity mode, also called Hot Standby. In this mode, one EVENT 5800 at each location transmits to two EVENT 5800 units at the other location. This mode does not require the extra bandwidth or interference protection. It provides hitless receive switching and hot standby. EVENT 5800 automatically switches between the two units when an appropriate alarm or interface error occurs, minimizing transmit outage time.

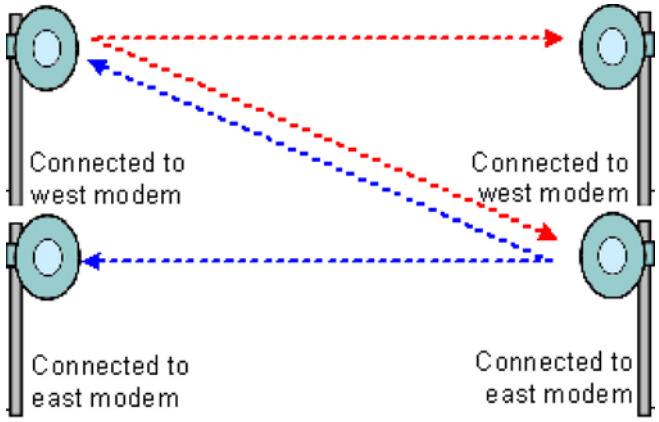


Figure 2-12. 1+1 Non-Diversity Mode Protection

2.7.2 Protected Diversity

This arrangement requires bandwidth for both links and non-interference between the links, but it provides hitless receive and transmit switching. EVENT 5800 supports both frequency and spatial diversity.

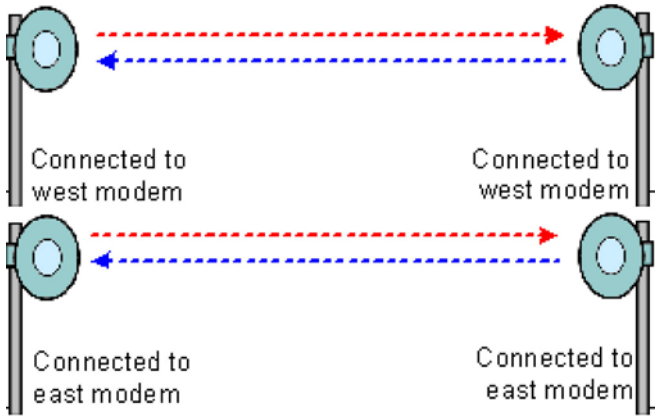


Figure 2-13. 1+1 Diversity Mode Protection

2.7.2.1 Frequency Diversity

In frequency diversity, two frequencies are used to achieve non-interference. The proprietary framer chooses the best, or error-free, data stream and forwards it to the Line Interface Units (LIUs).

2.7.2.2 Spatial Diversity

In spatial diversity, two non-interfering paths are used. The proprietary framer chooses the best, or error-free, data stream and forwards it to the Line Interface Units (LIUs).

Single Transmitter: Protected Non-Diversity, or Hot Standby, is also referred to as Single Transmitter Spatial Diversity.

Dual Transmitter: When using Dual Transmitter Spatial Diversity, two active transmitters are physically isolated to avoid crosstalk.

2.8 1+1 Multi-Hop Repeater Configuration

EVENT 5800 supports a 1+1 multi-hop repeater configuration with drop/insert capability as shown in the following illustration. This configuration provides individual 1+1 link

protection as well as the full-scale protection inherent in the consecutive point architecture. At each location within the network, data may be dropped or inserted. In this configuration each EVENT 5800 contains two power supplies and two modems.

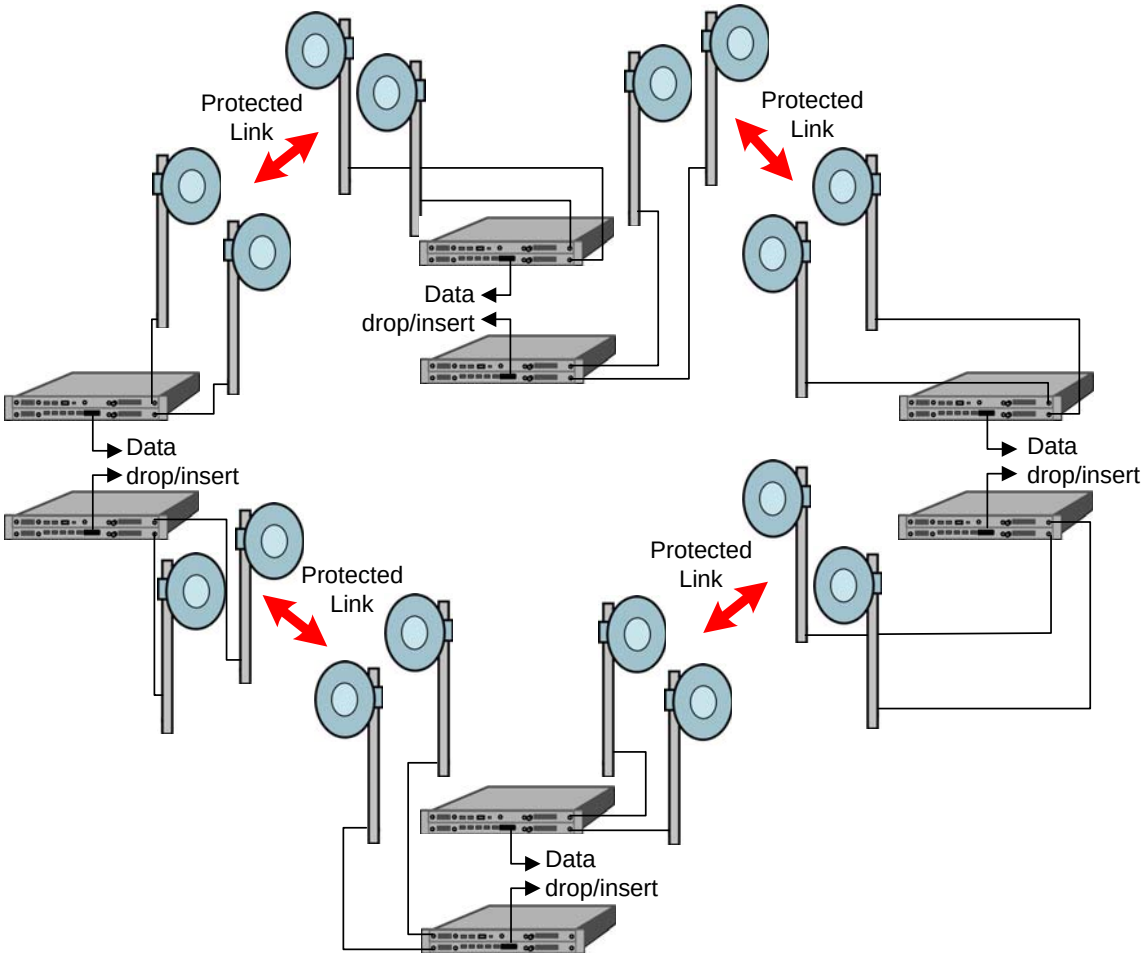


Figure 2-15. 1+1 Multi-Hop Repeater Configuration

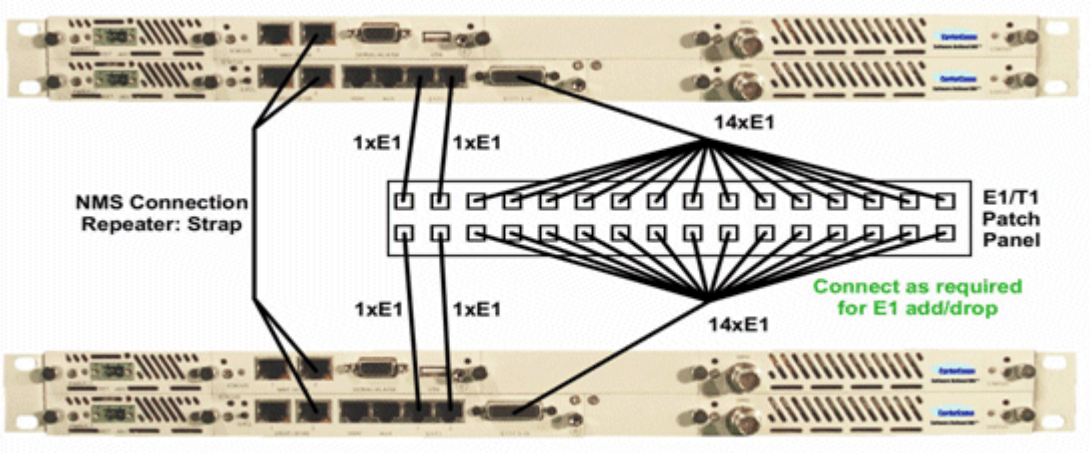


Figure 2-16. Back Panel Connections for Drop / Insert Capability

2.9 Data Interfaces

The primary interface for video and broadcast applications is the DVB-ASI interface located in the mini-I/O card slot. Alternatively this interface can be replaced with STM-1 Optical/OC-3 or STM-1 Electrical interfaces. The optical interface is single mode at 1300 nm. Consult factory for availability of Mini-I/O STM-1/OC-3 Module.

The I/O card has 2x100BaseTX interfaces that can be configured as either primary payload, or secondary wayside channels. The Over-the-air channel has a data-bandwidth capacity that is set by the frequency-bandwidth, modulation, and coding. The data-bandwidth may be allocated to various I/O card interfaces, including 155.52 Mbps for DVB-ASI or STM-1, 2 Mbps per E1, up to 100 Mbps Ethernet, and up to 1 Mbps NMS. Only up to 100 Mbps of data-bandwidth may be allocated for either net data, and the two I/O card 100BaseTX interfaces will share that 100 Mbps data-bandwidth.

2.10 100 Mbps Fast Ethernet

Scalable Ethernet data rates up to 100 Mbps can be achieved with the Standard, Enhanced and Super PDH (i.e., 42xE1/T1) Master I/O cards. Higher data rates can be achieved using the 155FE (Fast Ethernet) capability.

2.10.1 155Mbps Fast Ethernet

Ethernet payload rates over 100 Mbps (such as 155 Mbps) can be achieved on a Fast Ethernet EVENT 5800 by using both 100Base-TX payload ports. In this configuration, two Ethernet channels are provisioned in the payload frame. The maximum traffic rate for each Ethernet channel to the framer is defined in the modes file. This mode is not supported for 2+0 configuration.

2.10.2 Two Network Operation

This mode can be used to provide access to two separate Fast Ethernet users, and guarantee the throughput level for each. Different rates for each port are supported, as configured in the modes file. In this mode, each channel operates as a single channel would in a single port mode.

Figure 2-17. Two Network Operation

2.10.3 Single Network Operation

This configuration is an extension of the Two Network mode described above. There are no changes in the programming or operation of EVENT 5800. This mode allows a user to transmit data from a single network at a rate greater than 100 Mbps. The external router is required to handle the management of the trunk. The router must ensure that the same MAC address is not delivered to both ports.

Figure 2-18. Single Network Operation

2.11 Gigabit Ethernet (1000 Mbps)

Scalable Ethernet data rates up to 300 Mbps can be achieved with a Gigabit Ethernet scalable EVENT 5800. Data rates up to 155 Mbps are available with the Standard Modem/IF module. Data rates up to 300 Mbps are available with the Wideband Modem I/F module. EVENT 5800 can be configured to aggregate Ethernet bandwidth across two

or four links when operating as 2+0 or 4+0, allowing for a total throughput of up to 600 Mbps or 1000 Mbps, respectively.

Table 2-9. GigE Ethernet Throughput Examples by Modulation & Bandwidth

Bandwidth / Modulation	30MHz	40MHz	50MHz	56MHz
QPSK	30 Mbps	45 Mbps	55 Mbps	60 Mbps
16-QAM	80 Mbps	100 Mbps	130 Mbps	160 Mbps
32-QAM	100 Mbps	130 Mbps	160 Mbps	200 Mbps
64-QAM	125 Mbps	160 Mbps	200 Mbps	250 Mbps
128-QAM	150 Mbps	200 Mbps	250 Mbps	300 Mbps

2.11.1 GigE Port Based VLAN

The Gigabit Ethernet Port Based VLAN configures the EVENT 5800 to provide two independent Gigabit Ethernet networks with aggregate data rate up to 300Mbps. In this mode the Gigabit Master I/O module ports 1 and 2 are allocated to Network #1 and ports 3 and 4 are allocated to Network #2. The SFP port can be assigned to either network. Each network will be allocated a guaranteed bandwidth which is configured as part of the modes file. This capability is only available when operating as 1+0 or 1+1 and is not available when operating as 2+0.

Figure 2-19. GigE Port Based VLAN

2.12 Ethernet Quality of Service (QoS)

EVENT 5800 provides for Ethernet Quality of Server (QoS) configuration. Incoming packets are assigned to a weighted priority queue based on one or more of the following criteria:

- **Incoming Port**: Packets are assigned to a priority queue based on the port the packet arrived on.
- **802.1Q VLAN Tag Priority**: Packets are assigned to a priority queue based on the priority tag field in the VLAN TAG.
- **IPv4 TOS**: Packets are assigned to a priority queue based on the TOS field in the IPv4 header (not available with GigE Master I/O or Enhanced Master I/O)
- **DiffServ**: Packets are assigned to a priority queue based on the value of the DS field of the IPv4 header (not available with GigE Master I/O or Enhanced Master I/O)

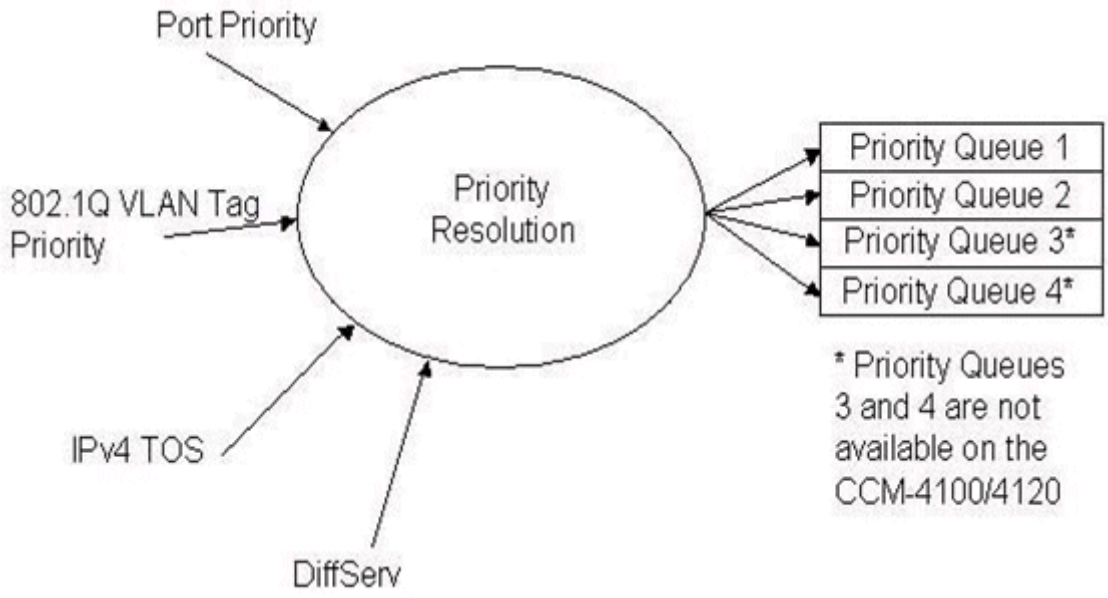


Figure 2-20. Ethernet Quality of Service (QoS)

2.13 Gigabit Ethernet Link Aggregation Configuration

2.13.1 2+0 East/East Configuration

EVENT 5800 is capable of aggregating link bandwidth in 2+0 mode to achieve up to 600 Mbps Ethernet throughput when used with the Wideband Modem/IF modules in 56MHz with 128-QAM capable Radio Transceivers. The 2+0 East/East configuration allows for the doubling of the throughputs.

When configured for 2+0 East/East, EVENT 5800 balances the traffic between the two links based on the source and destination MAC addresses of the Ethernet packets. Sufficient diversity of MAC addresses is required to achieve full usage of the 2+0 East/East configuration.

In the event of a link failure, throughput will only be reduced by one-half, and traffic on the failed link will be automatically re-routed to the remaining link.

2.13.2 4+0 East/East Configuration

In addition to aggregating two links, EVENT 5800 is capable of pairing with another EVENT 5800 to aggregate a total of four links to achieve a maximum throughput of 1000 Mbps when used with Wideband Modem/IF modules in 50MHz with 128-QAM capable Radio Transceivers.

As with 2+0 East/East, EVENT 5800 balances the traffic between the four links based on the source and destination MAC addresses of the Ethernet packets. Sufficient diversity of MAC addresses is required to achieve full usage of the 4+0 East/East configuration.

In the event of a link failure, throughput will only be reduced by one-quarter, and traffic on the failed link will be automatically re-routed to the remaining links

2.14 Crosspoint Switch

The EVENT 5800 crosspoint switch provides any-to-any E1/T1 routing between back panel ports and RF links. Flexible channel mapping allows selection from predefined routings or custom routing. Custom routings are uploaded to EVENT 5800 via FTP.

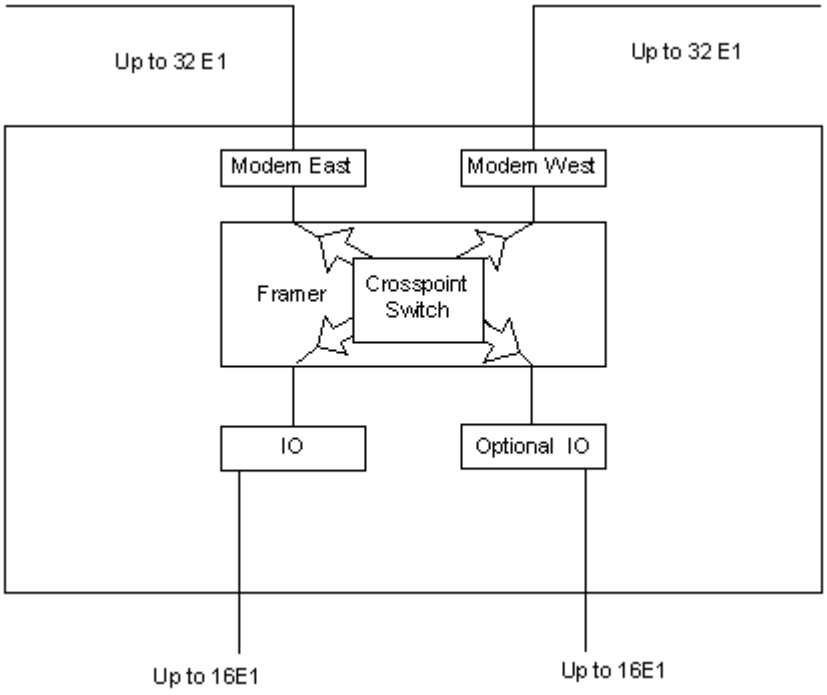


Figure 2-22. Crosspoint Switch

Two examples of the crosspoint capability are to use the crosspoint switch to configure a repeater or an add/drop. In the repeater example, the Crosspoint Switch is used as a passthrough to send E1/T1s from the east modem to the west modem. In the add/drop example, the crosspoint switch connects E1/T1s from the modems to the back-panel ports.

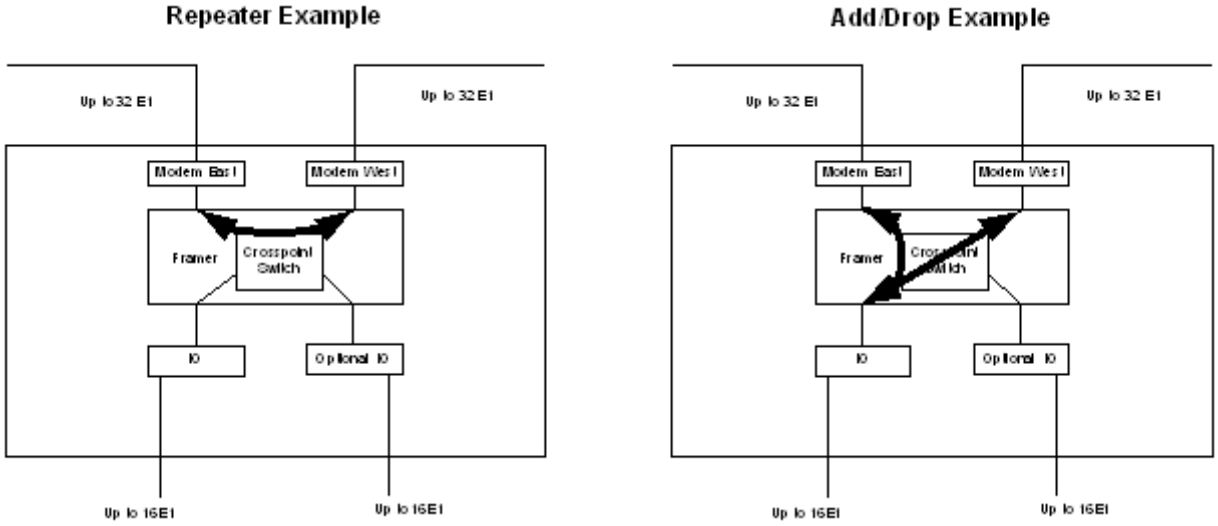


Figure 2-23. Crosspoint Switch (a) Repeater and (b) Add/Drop Examples

2.15 STM-1 Specifications

EVENT 5800 meets G.703, G.957 (S-1.1), G.825 standards for the STM-1/OC-3 signals passed across the RF link. Performance monitoring is not provided as the EVENT 5800 does not act as a regenerator. The EVENT 5800 does not support add/drop MUX (ADM) capability. The EVENT 5800 does support terminal MUX capability.

2.16 STM-1 Mux/Demux (Optional)

EVENT 5800 provides the ability to demultiplex 63xE1 or 63xT1 PDH signals from the SDH signal. The demultiplexed E1/T1s are routed via the crosspoint switch to the east modem, west modem, or . EVENT 5800 can act as an STM-1 Terminal Mux/Demux. In this case the STM1 transmit timing is slaved to the STM-1 receive timing at the STM-1 port. The STM-1 Mux/Demux feature requires an Enhanced Standard I/O Module.

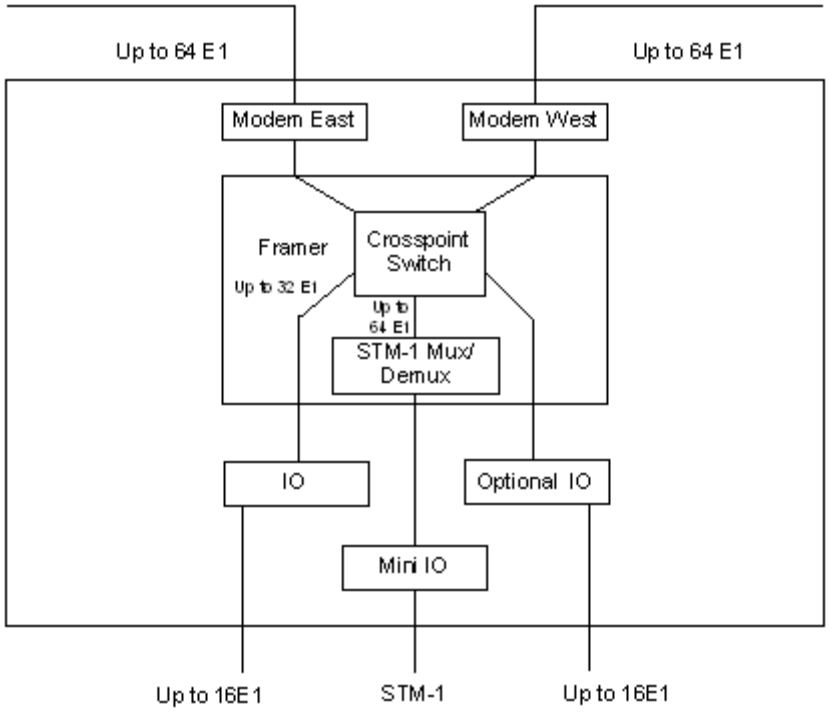


Figure 2-24. STM-1 Mux/Demux

2.17 Power Management

RF power management is a radio design feature that controls the power level (typically expressed in dBm) of the RF signal received from a transmitter by a receiver. The traditional goal of power management is to ensure that the RF signal at a receiver is strong enough to maintain the radio link under changing weather and link conditions.

The Quadrature Amplitude Modulation (QAM) is not a constant envelope waveform. Therefore, the average power and peak power are different. The difference in peak and average power depends on the constellation type and shaping factor, where spectral efficiency such as more constellation points or lower shaping factor leading to peak powers higher than average powers. The peak power is typically 5-7 dB greater than the average power and never exceeds 7 dB. Regulatory requirements are sometimes based on peak EIRP which is based on peak power and antenna gain.

Traditional power management techniques such as Constant Transmit Power Control (CTPC) and Automatic Transmit Power Control (ATPC) transmit at a high power level to

overcome the effects of fading and interference. However, these techniques continue to operate at a higher power level than needed to maintain the link in clear weather. Because transmit power remains high when the weather clears, the level of system interference increases.

Radios operating at high transmit power will interfere with other radios, even if the interfering source is miles away from the victim. High interference levels can degrade signal quality to the point that wireless radio links become unreliable and network availability suffers. The traditional solution to system interference is to increase the distance between radios. However, the resulting sparse deployment model is inappropriate for metropolitan areas.

In response to the need for a high-density deployment model, EVENT 5800 uses a unique power control technique called A_dTPC. A_dTPC enables EVENT 5800 to transmit at the minimum power level necessary to maintain a link regardless of the prevailing weather and interference conditions. EVENT 5800 is designed and manufactured to not exceed the maximum power allowed. The purpose of power management is to minimize transmit power level when lower power levels are sufficient. A_dTPC also extends the concept of power management by controlling not only the power (dBm) of the RF signal, but its quality (signal-to-noise ratio) as well.

In contrast to ATPC, the A_dTPC technique dynamically adjusts the output power based on both the actual strength and quality of the signal. Networked radios constantly monitor receive power and maintain 10^{-12} BER performance under varying interference and climate conditions. Each EVENT 5800 unit can detect when there is a degradation in the received signal level of quality and adjust the transmit power level of the far-end EVENT 5800 unit to correct for it.

A_dTPC provides maximum power in periods of heavy interference and fading and minimum power when conditions are clear. Minimal transmit power reduces potential for co-channel and adjacent channel interference with other RF devices in the service area, thereby ensuring maximum frequency re-use. The resulting benefit is that operators are able to deploy more EVENT 5800 units in a smaller area.

2.18 Network Management

EVENT 5800 parameters can be accessed using:

- a standard web-browser via HTTP to access the built in web server.
- an SNMP Agent using the fully featured MIB, allowing for automation of data collection and network management.
- a command line client accessible from a terminal client connected to the serial port, or telnet over the NMS Ethernet.
- the

These user interfaces are described in the EVENT 5800 User Interface Guide (Moseley Document #602-15173-01).

2.18.1 IP Address

Each EVENT 5800 radio is configured independently for network parameters such as IP address, subnet, and gateway. However, the radio can also be configured as a DHCP client. In this configuration, a DHCP server assigns an IP address to the radio. A specific IP address may be associated with a particular radio by configuring the DHCP server to assign IP addresses based on the Ethernet MAC address.

2.18.2 Network

EVENT 5800 uses an Out-of-Band NMS network that is separate from the payload Ethernet network. Each EVENT 5800 contains a managed Layer 2 Ethernet switch that supports Spanning-Tree Protocol (STP) for managing NMS traffic. This allows EVENT 5800 to be configured in a protected ring configuration where the STP will prevent an Ethernet loop in the ring. This will also allow the ring to re-configure in the event of an outage. EVENT 5800 acts as a network bridge via the Ethernet switch and STP. EVENT 5800 does not currently support NMS routing capability.

2.18.3 NMS Network Operational Principles

EVENT 5800 does not provide routing capability. Therefore, *all radios must be on the same subnet as the PC being used to access the radios.* If EVENT 5800 radios and/or the PC are on different subnets, a router must be used with the gateway addresses set appropriately. The following illustration shows the PC and both EVENT 5800 units in the same subnet. In this case, no router is required.

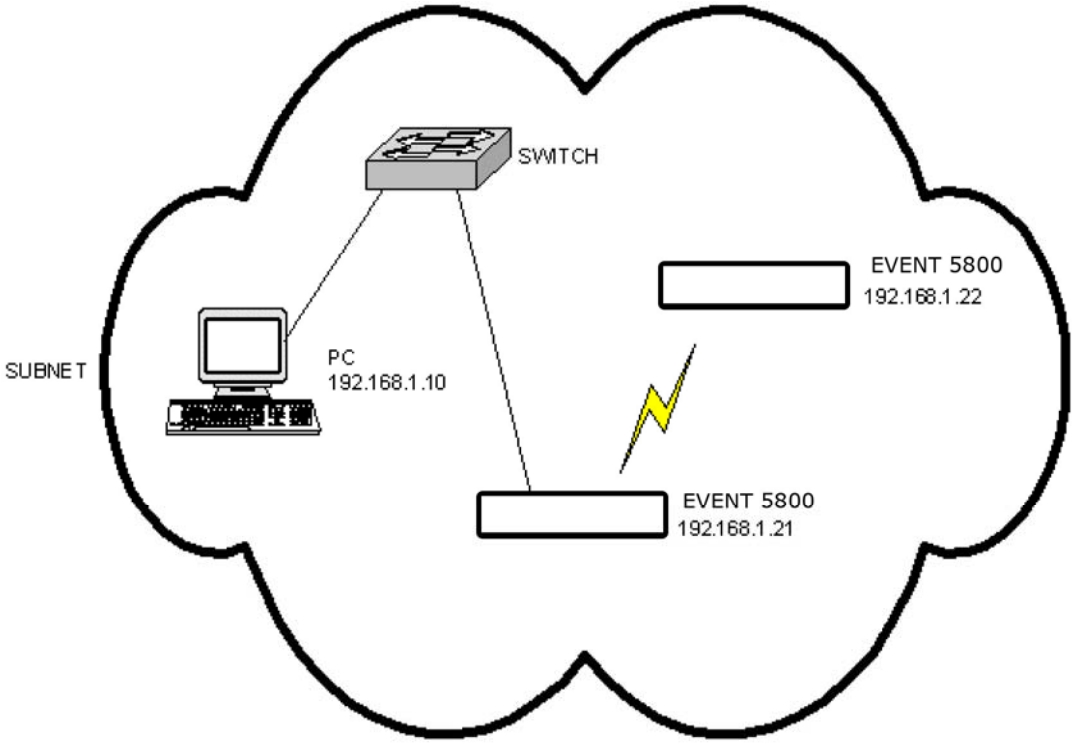


Figure 2-25. PC/EVENT 5800 on Same Subnet

The following illustration shows the PC and one EVENT 5800 in one subnet and the other EVENT 5800 in another. In this case, a router is required. Note how the GW addresses are set to allow communication from the PC to the EVENT 5800 in the other subnet.

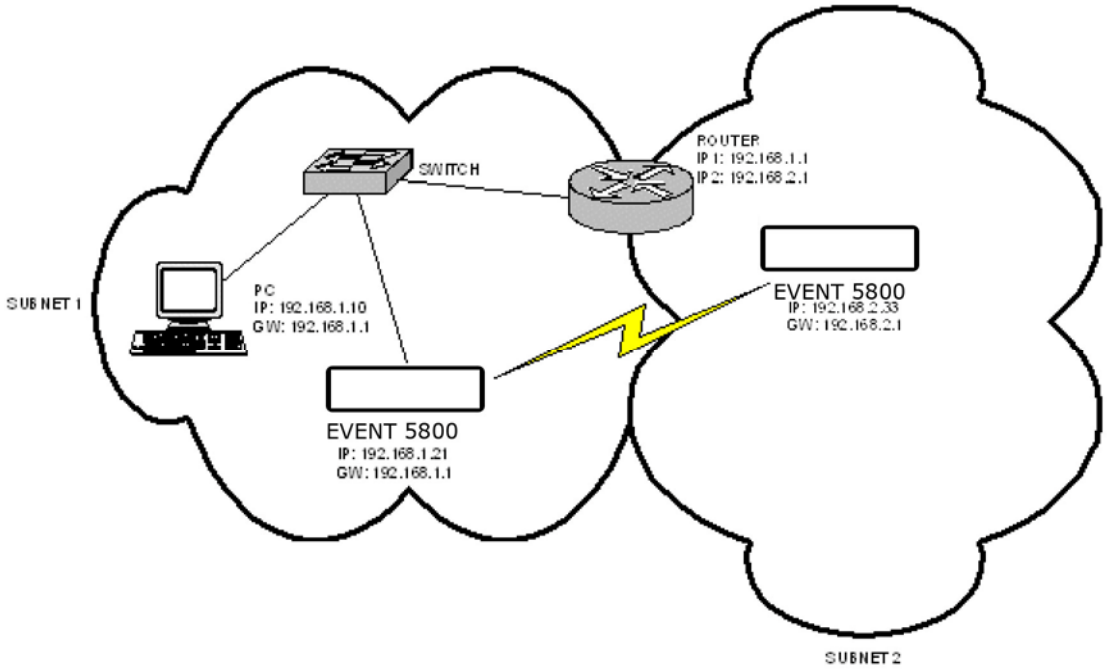


Figure 2-26. DTVLINKs on Different Subnets

2.18.4 Third Party NMS Support

EVENT 5800 supports SNMPv1, SNMPv2, and SNMPv3 protocols for use with third party network management software. The SNMP agent will send SNMP traps to specified IP addresses when an alarm is set or cleared. Information contained in the trap includes:

- IP address
- System uptime
- System time
- Alarm name
- Alarm set/clear detail

EVENT 5800 can also be managed via HTTP, TELNET, and SSH protocols.

2.19 System Loopbacks

EVENT 5800 supports system loopbacks that can be used to test and verify a unit, link, and/or network. A variety of loopback points, including LIU selection, are available. Loopback points and duration can be selected through the Web Interface or .

3. Pre-Installation Procedures

3.1 Site Evaluation

A site evaluation consists of a series of procedures for gathering specific information about potential installation locations. This information is critical to the successful design and deployment of a network. Site evaluations are required to confirm whether or not a building meets network design requirements. The main objectives are as follows:

- Confirm
  - Line of sight for each link
  - Site equipment locations
  - Cable routes
  - Any other potential RF sources
- Prepare site drawings and record site information

Required Tools: The following tools are required to perform a site evaluation:

- RF and network design diagrams (as required)
- Binoculars
- Global positioning system (GPS) or range finder
- Compass
- Measuring tape and/or wheel
- Digital camera
- Area map
- Aerial photograph (if available)
- List of potential installation sites (targeted buildings)

Pre-Site Evaluation Tasks: The following tasks must be completed prior to performing a site evaluation:

- Prepare the initial network design by performing the following:
  - Identify potential buildings by identifying targeted customers (applicable if you're a service provider)
  - Identify potential links by selecting buildings based on the high probability of line of sight
- Arrange for access with the facility personnel into the buildings, equipment rooms, and architectural plans to become familiar with the location of all ducts, risers, etc.

Site Evaluation Steps: The following steps must be completed to perform a successful site evaluation:

1) Ensure RF Safety compliance: Ensure that appropriate warning signs are properly placed and posted at the equipment site or access entry. For a complete list of warnings, refer the Safety Precautions listed at the beginning of this manual.

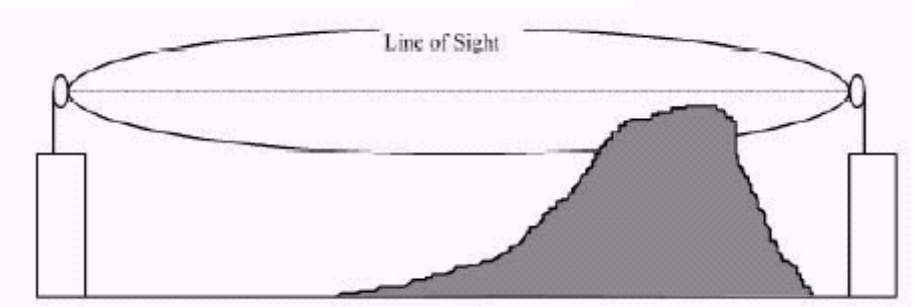
2) Ensure Compliance with Laws, Regulations, Codes, and Agreements: Ensure that any installation performed as a result of the site evaluation is in full compliance with applicable federal and local laws, regulations, electrical codes, building codes, and fire codes.

3) Establish Line of Sight between antennas: The most critical step in conducting a site evaluation is confirming clear radio Line of Sight (LOS) between a near antenna and a far antenna. If LOS does not exist, another location must be used.

Antennas must have a clear view of each other, or “line of sight”. Binoculars may be used evaluate the path from the desired location of the near antenna to the desired location of the far antenna. To confirm Line of Sight:

- Ensure that no obstructions are close to the transmitting/receiving path. Take into consideration trees, bridges, construction of new buildings, unexpected aerial traffic, window washing units, etc.
- Ensure that each antenna can be mounted in the position required to correctly align the antenna with its link partner.

The antennas must also have a clear radio line of sight. If a hard object, such as a mountain ridge or building, is too close to the signal path, it can damage the radio signal or reduce its strength. This happens even though the obstacle does not obscure the direct, visual line of sight. The Fresnel zone for a radio beam is an elliptical area immediately surrounding the visual path. It varies in thickness depending on the length of the signal path and the frequency of the signal. The necessary clearance for the Fresnel zone can be calculated, and it must be taken into account when designing a wireless links.



As shown in the picture above, when a hard object protrudes into the signal path within the Fresnel zone, knife-edge diffraction can deflect part of the signal and cause it to reach the receiving antenna slightly later than the direct signal. Since these deflected signals are out of phase with the direct signal, they can reduce its power or cancel it out altogether. If trees or other 'soft' objects protrude into the Fresnel zone, they can attenuate (reduced the strength of) a passing signal. In short, the fact that you can see a location does not mean that you can establish a quality radio link to that location. Consult factory for a link planner spreadsheet that calculates the Fresnel ratio and helps determine link feasibility.

4) Determine Antenna Mounting Locations: Antennas can be mounted on an antenna mast, brick, masonry or wall.

5) Determine EVENT 5800 Installation Locations: A EVENT 5800 can be installed on a tabletop or cabinet or rack mount. The site must provide DC power.

6) Document Potential Sources of Co-location Interference: When antennas are located on a roof or pole with other transmitters and receivers, an interference analysis may be required to determine and resolve potential interference issues. The interference analysis needs to be performed by an RF engineer. The specific information required for each transmitter and receiver includes the following:

- Transmitting and/or receiving frequency
- Type of antenna
- Distance from EVENT 5800 (horizontal and vertical)
- Polarity (horizontal or vertical), if applicable
- Transmit power level

- o Antenna direction

7) Measure the Link Distance: The two ways to measure link distance are as follows:

- o GPS: record the latitude and longitude for the near and far installation sites and calculate the link distance. Record the mapping datum used by the GPS unit and ensure the same mapping datum is used for all site evaluations in a given network.
- o Range finder: measure the link distance (imperial or metric units may be used).

Once the link distance has been measured, verify that the link distance meets the availability requirements of the link.

8) Select the Grounding Location: The EVENT 5800 must be properly grounded in order to protect it and the structure it is installed on from lightning damage.

9) Determine the Length of Interconnect Cable from IDU to the ODU. For a stand-alone EVENT 5800, this cable is included and is normally 8" long. For a EVENT 5800 with a secondary RF ODU unit the following applies. The primary consideration for the IDU/ODU interconnect cable is the distance and route between the primary EVENT 5800 and the secondary RF ODU unit. This cable should not exceed 330 feet using Times Microwave LMR-200 cable. Guidelines are provided in Table 3-1.

Table 3-1. Maximum IDU/ODU Cable Lengths

	Loss at (dB/100 m)*		
Cable Type	**140 MHz**	**350 MHz**	**Maximum Length***
LMR-200	12.6	20.1	100 m
LMR-300	7.6	12.1	165 m
LMR-400	4.9	7.8	256 m
RG-214	8	13.1	153 m
Belden 7808	8.6	14	143 m

*Does not account for connector loss.

10) Determine the optimum transmission line between the EVENT 5800 and the Antenna. This is normally part of the link analysis calculations.

11) Confirm the availability of Power for the EVENT 5800.

12) Ensure Building Aesthetics: For building-mounted units, ensure that the Antenna can be mounted so that it is aesthetically pleasing to the environment and to the property owner. Aesthetics must be approved by the property owner and the network engineer.

13) Take Site Photographs

14) Sketch the Site

3.2 Critical System Calculations

3.2.1 Received Signal Level (RSL) and Link Budget

The received signal level (RSL) can be estimated using the following formula:

$$\text{RSL (in dBm)} = P_{\text{TX}} + G_{\text{TX ANT}} - (L_{\text{Path}} + G_{\text{RX ANT}})$$

Where:

P_{TX} is the transmitter output power (in dBm)

$G_{TX\ ANT}$ is the gain of the transmit antenna (in dB)

$G_{RX\ ANT}$ is the gain of the receive antenna (in dB)

L_{Path} is the Path loss, defined by: L_P (dB) = 36.6 + 20log$_{10}$ (F*D)

Where:

F is the Frequency in MHz, D is the Distance of path in miles

This link budget is very important in determining any potential problems during installation. The expected RSL and measured RSL should be close (+/- 5 to 10 dB)

3.2.2 Fade Margin Calculation

The fade margin is the difference between the actual received signal and the digital radio's threshold for the modulation mode selected. The fade margin can be used to determine availability and should be at least 10 dB for most cases but is ultimately determined by required application reliability.

3.2.3 Availability Calculation

Availability of the microwave path is a prediction of the percent of time that the link will operate without producing an excessive BER due to multipath fading. Availability is affected by the following:

- Path length
- Fade margin
- Frequency
- Terrain (smooth, average, mountainous, valleys)
- Climate (dry, temperate, hot, humid)

Depending on the type of traffic carried over the link and the overall network design redundancy, fade margin should be included to support the desired availability rate. Critical data and voice may require a very high availability rate (99.999% or 5.3 minutes of predicted outage per year). To improve availability, the fade margin can be increased by shortening the path length, transmitting at a higher power level, or by using higher gain antennas. Availability can be computed using the following formula, which is known as the *Vigants-Barnett Method.*

$$\text{Availability} = 100 \times (1 - P)$$

$$P = 2.5 \times 10^{-9} \times C \times F \times D^3 \times 10^{(-FM/10)}$$

Where:

F is the frequency in MHz

D is the distance in miles

FM is the fade margin in dB

C is the climate/terrain factor: C=4 for Humid/Over Water (worst case channel), C=1 for Average Conditions, or C=0.25 for Dry/Mountains (best case channel)

Example: Assume 21 dB fade margin, over 5 miles with average climate/terrain. The availability comes out to be 99.9986. This corresponds to the link being unavailable for 7.6 minutes per year.

3.3 Frequency Plan Determination

When configuring EVENT 5800 units in a point-to-point or consecutive point configuration, careful engineering of the frequency plans and antenna locations should be performed in order to minimize potential interference between nearby radios. Nearby radios should operate on different frequencies, transmitting in the same band (high side or low side). Local frequency coordination efforts are a requirement for broadcast auxiliary service applications. When designing multi-radio configurations, antenna size, antenna polarization, and antenna location are critical.

The frequency plan is selected based on the band being used. Data rate and capacity is selected based on expected link conditions or fixed based on application. In a high interference environment or with lower gain antennas, higher bandwidth, more robust modulation formats must be employed. The available frequency plans are shown in the following illustrations based on application frequency.

The channel assignments shown in the figures correspond to the channel numbers assigned via the Web Interface or SNMP.

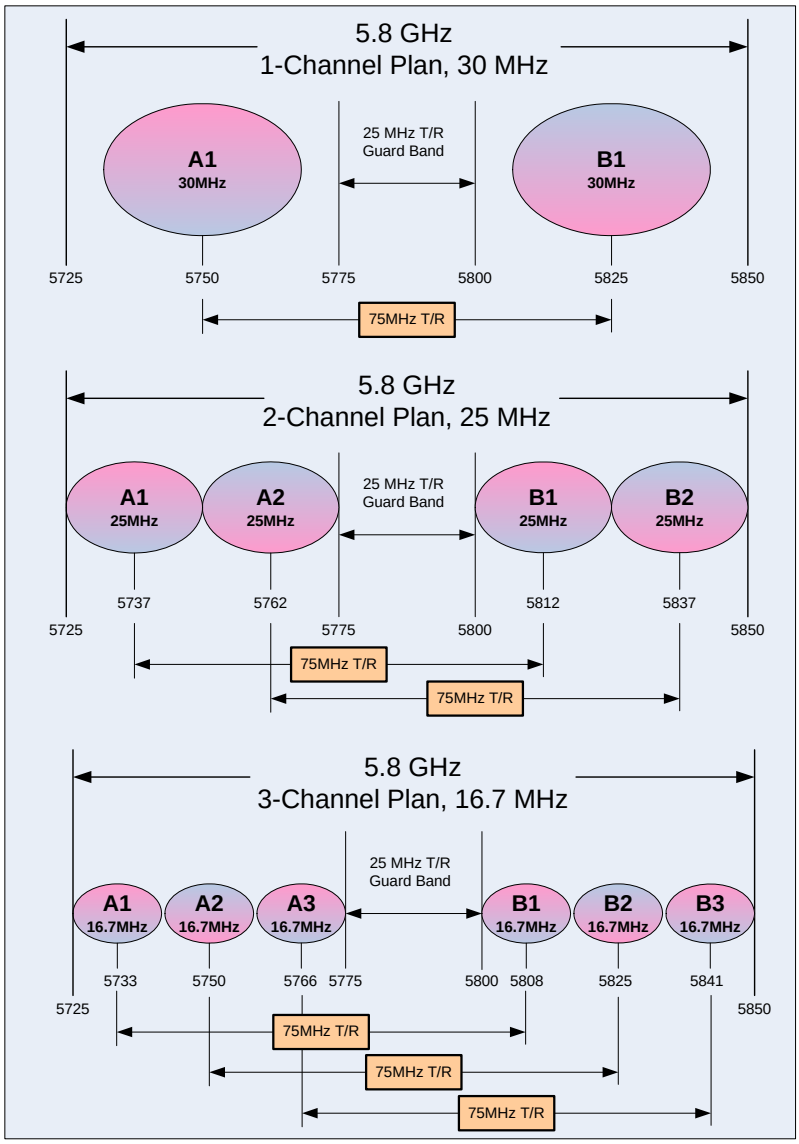


Figure 3-1. 5.8 GHz Frequency Plan

3.4 Facility Requirements

The site selected to house the DTV LINK should follow conventional microwave practice and should be located as close to the antenna as possible. This will reduce the RF transmission line losses, minimize possible bending and kinking of the line, and allow for the full range potential of the radio link.

The building or room chosen for installation should be free from excessive dust and moisture. The area should not exceed the recommended temperature range, allow for ample air flow, and provide room for service access to cables and wiring.

3.5 Antenna Planning

Larger antennas have the advantage of providing narrower beam widths and high isotropic gain, which yields better link performance (higher fade margin, better availability), and improves immunity to spatial interference (due to the smaller beam widths). However, larger antennas are more costly to purchase and install than smaller antennas and in some cases, they require special equipment for installation due to narrower beam widths. They are also more easily affected by wind.

- Select where the cable will enter the building from the outside.
- Determine the length of cable required. Allow three extra feet on each end to allow for strain relief, as well as any bends and turns.

3.6 Transmit Power Setup

Setting the transmit power is conditional on the band and application. The installer of this equipment is responsible for proper selection of allowable power settings. If there are any questions on power settings refer to your professional installer in order to maintain the FCC legal ERP limits.

This warning is particularly true for the 5.3 GHz and 5.8 GHz bands and special instructions are provided below for these bands. For the broadcast auxiliary service (BAS) applications the power should not exceed that necessary to render for satisfactory service.

It is also noted that as QAM mode order increases the linearity requirements also increase. As a rule to maintain requisite signal quality the transmit power should be lowered 1 dB for every order increase in QAM mode order. For instance, the maximum power for the EVENT 5800 is 27 dBm in QPSK mode. Therefore the maximum power backoff would follow Table 3-2 below:

Table 3-2. Maximum Output Power vs. Modulation Order for EVENT 5800

Modulation	Backoff (dB)	Max. Output Power (dBm)		
		0.5W Systems		
QPSK	0	27		
16 QAM	-1	26		
32 QAM	-2	25		
64 QAM	-3	24		
128 QAM	-4	23		
256 QAM	-5	22		

3.6.1 5.8 GHz Band

For fixed point-to-point applications in the United States the maximum EIRP (Effective Isotropic Radiated Power) is unlimited when using directional antennas in accordance with FCC part 15.247b(3). The EVENT 5800 5800 can be operated at its maximum output power, +23 dBm, for maximum system gain. For external antennas, EIRP is calculated as follows:

EIRP(avg) dBm = External Antenna Gain (dBi) + 23 dBm

For internal antenna (23 dBi) EIRP is calculated as follows:

EIRP(avg) = 46 dBm

3.6.2 5.3 GHz Band

In the 5.3 GHz U-NII band the peak EIRP (Effective Isotropic Radiated Power) is limited to +30 dBm at the antenna for bandwidths above 20 MHz and is reduced for narrower bandwidths in accordance with FCC part 15.407a(3).

The installer is responsible during set up of transmit power to not exceed FCC limits on transmission power. These maximum power levels are provided in Table 3-3 for both internal antenna and external antenna configurations.

Note that though regulatory limits are stated in terms of peak power, the system transmit power levels are calibrated as averaged power readings. Average power is used for link calculations. Therefore the levels provided in the following table is average power levels that have been certified to correspond with the maximum peak EIRP allowed.

3.6.2.1 Internal Antenna

Table 3-3 indicates the maximum average transmit power setting that may be selected EVENT 5800 5300 with internal (23 dBi) antenna.

The number of supported channels per band (low band or high band) is shown in the link configuration wizard. The greater number of channels supported the lower the emission bandwidth for each channel.

For link budget,

EIRP(Avg) = 23 dBi + Tx Power Setting (dBm).

3.6.2.2 External Antenna

When using external antennas with gains greater than 23 dBi, the transmit power must be reduced in dB from that given in Table 3-3 by the antenna gain difference above 23 dBi for the mode that is being used.

For example, using a 6 foot dish antenna with 37 dBi gain, the output power would be dropped by:

Antenna Gain (External) – 23 dBi = Antenna Gain Difference

Example:

37.6 dBi – 23 dBi = 14.6 dB

For mode 100FE1 (single channel configuration with 30MHz emission bandwidth) the power would be lowered from:

Tx Power (Internal Antenna) – Antenna Gain Difference = Tx Power (External Ant)

Example:

+5 dBm – 14.6 dB = -9.6 dBm (-10 dBm).

Table 3-3 also shows transmit power settings for various antenna dish sizes.

For link budget,

EIRP(Avg) dBm = 37 dBi + Tx Power Setting (dBm)

Table 3-3. Maximum Power Settings for 5.3GHz U-NII Band Operation (US)

		Maximum Tx Power Setting, dBm		
Antenna Diameter	**Antenna Gain, dBi* (example)**	**1 Channel Mode (30MHz BW)**	**2 Channel Mode (20MHz BW)**	**3 Channel Mode (13.3MHz BW)**
6 foot dish	37.6	-10	-11	-12
4 foot dish	34.6	-7	-8	-9
3 foot dish	31.2	-3	-4	-5
2 foot dish	28.0	0	-1	-2
1.5 foot dish	25.3	+3	+2	+1
Internal	23.0	+5	+4	+3

***NOTE**: Many antenna manufacturers rate antenna gain in dBd (dB referred to a dipole antenna) in their literature. To convert to dBi, add 2.15 dB.

Power settings for other modes of operation can be calculated as follows:

EIRP(Avg) dBm = Antenna Gain (dBi) + Tx Power

Transmitter radiated power is limited in the receiver benefits from gain of larger antennas.

4. Installation

4.1 Unpacking

The following is a list of possible included items for each box.

Description	Quantity
EVENT 5800 (3RU chassis)	1
External Power Supply & AC Mains cable	1 ea
Short TNC & Ethernet cables (may be already installed)	1 ea
Manual (or Soft copy on a CD)	1
Optional RF channel filter	1

Be sure to retain the original boxes and packing material in case of return shipping. Inspect all items for damage and/or loose parts. Contact the shipping company immediately if anything appears damaged. If any of the listed parts are missing, call the distributor or the factory immediately to resolve the problem.

4.2 Notices

CAUTION:

DO NOT OPERATE UNITS WITHOUT AN ANTENNA, ATTENUATOR, OR LOAD CONNECTED TO THE ANTENNA PORT. DAMAGE MAY OCCUR TO THE TRANSMITTER DUE TO EXCESSIVE REFLECTED RF ENERGY.

ALWAYS ATTENUATE THE SIGNAL INTO THE RECEIVER ANTENNA PORT TO LESS THAN -20 dBm. THIS WILL PREVENT OVERLOAD AND POSSIBLE DAMAGE TO THE RECEIVER MODULE.

WARNING

HIGH VOLTAGE IS PRESENT INSIDE THE EVENT 5800 WHEN THE UNIT IS PLUGGED IN. TO PREVENT ELECTRICAL SHOCK, UNPLUG THE POWER CABLE BEFORE SERVICING. UNIT SHOULD BE SERVICED BY QUALIFIED PERSONNEL ONLY.

4.3 Pre-Installation Notes

- Use back-to-back bench testing to become familiar with the EVENT 5800.
- We highly recommend installation of lightning protectors to prevent line surges from damaging expensive components.

4.4 Back-to-Back Bench Testing

Back-to-back bench testing prior to final installation is highly recommended in order to gain familiarity with the product. The following additional equipment is required for back-to-back testing:

- Low-loss cables, N-male connectors.
- Three Inline RF attenuators, 2 x 30 dB (10 Watts min.) and 1 x 20 dB (2 Watts min.), rated for the radio transceiver frequency.

EVENT 5800 units must be configured in an operational configuration and set-up as shown in the following illustration for units with transmit power of 1W and 5W. For 5.3 GHz and 5.8 GHz applications the 20 dB attenuator may be removed. When equipment is

connected in an operational configuration, no errors should be reported on the back panel.

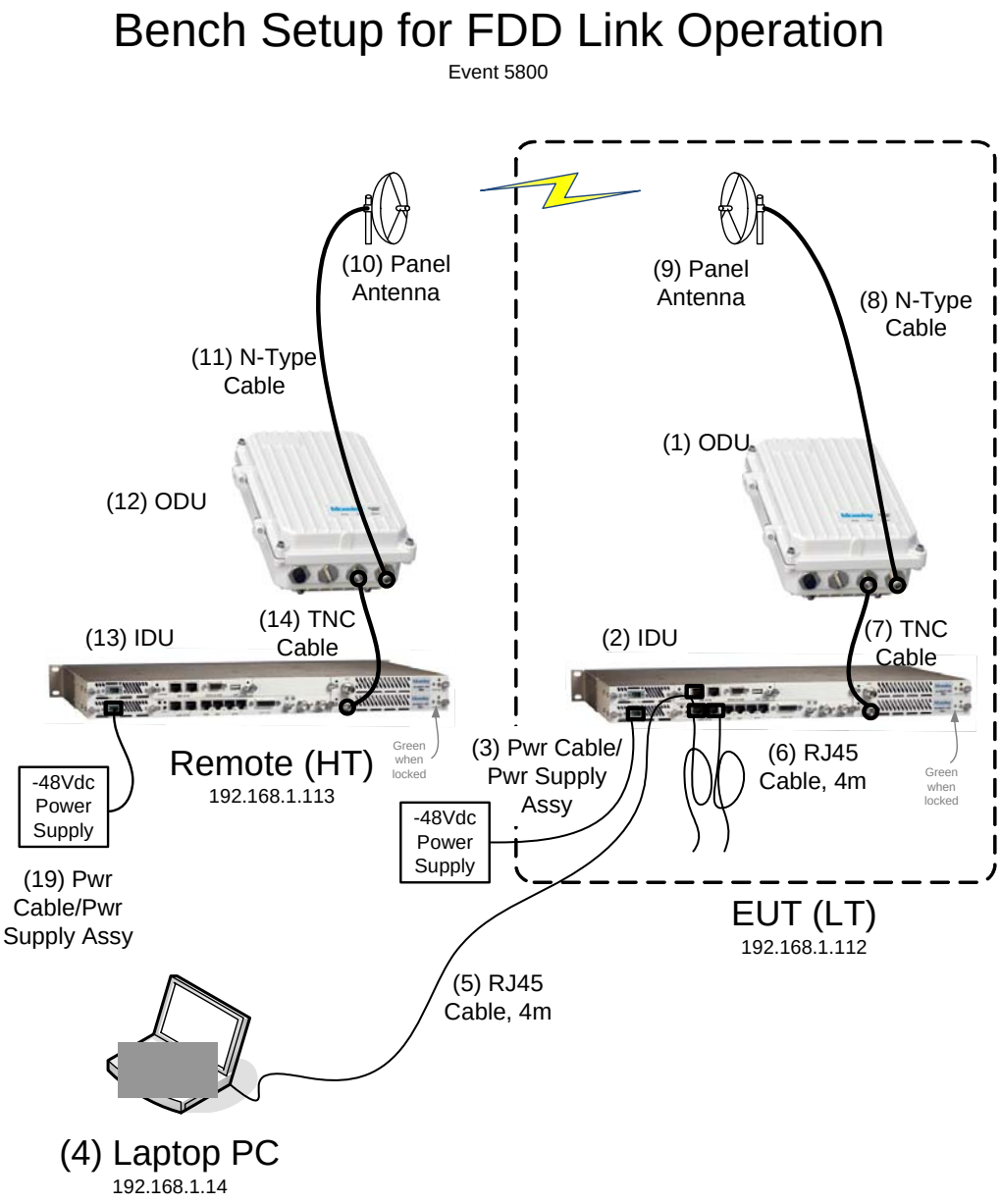


Figure 4-1. Back-to-Back Testing Configuration

4.5 EVENT 5800 Installations

A EVENT 5800 can be installed on a tabletop or cabinet or rack mount. The site must provide appropriate power. The EVENT 5800 should be:

- Located where you can easily connect to a power supply and any other equipment used in your network, such as a router or PC.
- In a relatively clean, dust-free environment that allows easy access to the back panel grounding post as well as the back panel controls and indicators. Air must be able to pass freely over the chassis, especially the rear.
- Accessible for service and troubleshooting.
- Protected from rain or moisture, dust and extremes of temperature (it is designed for indoor use).

4.5.1 Table Top or Cabinet Installation

The EVENT 5800 can be placed on a tabletop or cabinet shelf. In order to prevent possible disruption, it is recommended to use a strap to secure the EVENT 5800. It is important to allow adequate airflow at the rear of the unit.

4.5.2 Rack Installation

To maintain good airflow and cooling, it is preferred that the EVENT 5800 is installed in a slot that has blank spaces above and below the unit. It is important to allow adequate airflow at the rear of the unit.

4.5.3 External Waveguide Filter Installation

Optional External Waveguide Filters are available for the 7 and 13 GHz EVENT 5800s. The following drawings show the installation:

7 GHz Simplex	910-15230-01
7 GHz Duplex	910-15230-11
13 GHz Simplex	910-15231-01
13 GHz Duplex	910-15231-11

4.6 External Equipment Connections

4.6.1 Controller Module Connectors

The following illustration shows the connectors on the Controller Module:

NMS 10/100 1: 10/100Base-TX RJ-45 modular local port connector for access to the Network Management System (SNMP) and Web Interface.

NMS 10/100 2: 10/100BaseTX RJ-45 modular remote port connector for access to the Network Management System (SNMP). This port to be used for consecutive point networks.

Serial/Alarm Interface: DB-15HD female connector for two Form-C relay alarm outputs (rated load: 1A @ 24V DC), two TTL alarm outputs, four TTL alarm inputs, and Serial Console. The two Form-C relay alarm outputs can be configured to emulate TTL alarm outputs by installing shorting jumpers JP6 and JP8 for relay alarm 1 and shorting

jumper JP7 and JP9 for relay alarm 2. When configured as TTL, the 2 outputs can source/sink up to 10 mA at 5 VDC. When an alarm is present, Common is connected to Normally Closed. Otherwise it is connected to Normally Open.

USB Interface: USB connector, reserved.

Ground: 6-32 screw connection.

4.6.2 Standard Master I/O Module Connectors

The following illustration shows the connectors on the Standard Master I/O Module:

USER 10/100 1: 100Base-TX RJ-45 modular port connector for the local Fast Ethernet interface.

USER 10/100 2: 100Base-TX RJ-45 modular port connector. This port to be used for consecutive point networks.

AUX: Data Orderwire Connector: RJ-45 modular port connector for RS422/RS-232 data at 64 kbps.

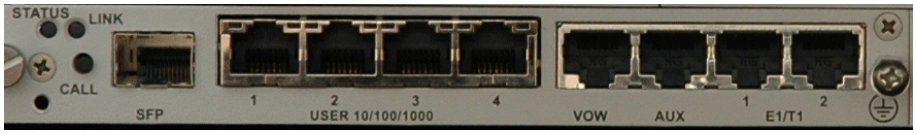
E1/T1 1-2: Two E1/T1 (RJ-48C) interface connections.

E1/T1 3-16: Single Molex 60-pin connector containing 14 E1/T1 connections.

Ground: 6-32 screw connection.

4.6.3 GigE Master I/O Module Connectors

The following illustration shows the connectors on the GigE and Enhanced GigE Master I/O Modules:



SFP: SFP Module slot for 1000Base-T, 1000Base-SX, or 1000Base-LX modules

USER 10/100/1000 1: 1000Base-T RJ-45 modular port connector

USER 10/100/1000 2: 1000Base-T RJ-45 modular port connector

USER 10/100/1000 3: 1000Base-T RJ-45 modular port connector

USER 10/100/1000 4: 1000Base-T RJ-45 modular port connector

AUX: Data Orderwire Connector: RJ-45 modular port connector for RS422/RS-232 data at 64 kbps.

E1/T1 1-2: Two E1/T1 (RJ-48C) interface connections.

Ground: 6-32 screw connection.

4.6.4 42xE1/T1 Master I/O Module Connectors

The following illustration shows the connectors on the 42xE1/T1 Master I/O Module:

USER 10/100 1: 100Base-TX RJ-45 modular port connector for the local Fast Ethernet interface.

USER 10/100 2: 100Base-TX RJ-45 modular port connector. This port to be used for consecutive point networks.

AUX: Data Orderwire Connector: RJ-45 modular port connector for RS422/RS-232 data at 64 kbps.

E1/T1 1-2: Two E1/T1 (RJ-48C) interface connections.

E1/T1 3-16: Three Molex 60-pin connectors containing 14 E1/T1 connections each.

Ground: 6-32 screw connection.

4.6.5 ASI Mini I/O Module Connectors

The following illustration shows the connectors on the STM-1 Electrical Mini I/O Module:

DVB/ASI Out: BNC connector for the DVB/ASI digital video and DS-3, E-3, and STS-1 interface.

DVB/ASI In: BNC connector for the DVB/ASI digital video and DS-3, E-3, and STS-1 interface.

4.6.6 Optional OC-3 Mini I/O Module Connectors

The following connectors are available on an optional OC-3 Mini I/O Module:

- **OC-3 Out**: OC-3 type SC connectors for the OC-3 interface.
- **OC-3 In**: OC-3 type SC connectors for the OC-3 interface.

4.6.7 Optional STM-1 Mini I/O Module Connectors

The following connectors are available on an optional STM-1 Mini I/O Module:

- **STM-1 Out**: BNC connector for the STM-1 interface.
- **STM-1 In**: BNC connector for the STM-1 interface.

4.7 Ground Connections

1) The EVENT 5800 should be connected to a system or building electrical ground point (rack ground or power third-wire ground) with a cable of 36" or less.
2) Connect the grounding wire to either grounding point (Controller I/O or Master I/O) on the back panel. Use 6-32x5/16 maximum length screws (not provided) to fasten the lug of the grounding cable.
3) Connect the other end of the ground to the local source of ground in an appropriate manner consistent with local electrical regulations.

4.8 Antenna/Feed System

4.8.1 Antenna Mounting

The antennas used as part of the EVENT 5800 system are directional. The energy radiated is focused into a narrow beam by the transmitting antenna and must be aligned towards the receiving antenna. The type of antenna used in a particular installation will depend on frequency band and antenna gain requirements. These parameters are determined by the path analysis.

The antenna is usually mounted on a pipe mount or tower, on top of a building, on a tower adjacent to building where the DTV LINK is installed, or on some structure that will provide the proper elevation. If the tower or antenna mounting mast is to be mounted on a building, an engineer should be consulted to ensure structural integrity. The antenna support structure must be able to withstand high winds, ice, and rain without deflecting more than one tenth of a degree. The optimum elevation is determined by the path analysis.

Mount the antenna onto its mounting structure but do not completely tighten the mounting bolts at this time. The antenna will need to be rotated during the path aligning process.

Information on how to perform a site survey and path analysis can be found in the Appendix, Path Evaluation Information.

4.8.2 Transmission Line

Run the transmission line in such a manner as to protect it from damage. Note that Heliax™ transmission line requires special handling to keep it in good condition. It should be unreeled and laid out before running it between locations. It cannot be pulled off the reel the same way as electrical wire. Protect the line where it must run around sharp edges to avoid damage. A kinked line indicates damage, so the damaged piece must be removed and a splice installed to couple the pieces together. At frequencies above about 2 GHz, waveguide is the preferred transmission line due to its lower-loss characteristics.

4.8.3 Environmental Seals

The connections at the antenna and the transmission line *must* be weather-sealed. This is best accomplished by completely wrapping each connection with Scotch #70 tape (or equivalent), pulling the tape tight as you wrap to create a sealed boot. Then, for mechanical protection over the sealed layer, completely wrap the connection again with Scotch #88 (or equivalent). Tape ends must be cut rather than torn—a torn end will unravel and work loose in the wind. Use plenty of tape for protection against water penetration and the premature replacement of the transmission line. Waveguide uses pressure seals and is usually pressurized to resist water intrusion.

4.8.4 Antenna & Transmission Line Testing

It is important to test the antenna and transmission line before attaching it to the EVENT 5800 to ensure that the maximum amount of power is being transferred to or from the antenna.

4.9 Connect the Power Source

1) Use the supplied power cable connector. Pin 2 (labeled **-V**) should be connected to the power supply terminal that supplies –48V DC. Pin 1 (labeled **RET**) should be connected to the power supply return. Use of a power supply with an inappropriate ground reference may cause damage to the EVENT 5800 and/or the supply.

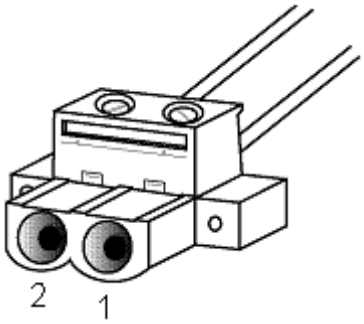


Figure 4-5. DC Power Cable Connector

2) Connect the EVENT 5800 power cable to the –48V DC power supply, and place the voltmeter probes on the unconnected EVENT 5800 end of the power cable, with the positive voltmeter probe on pin 2 (**-V**) of the cable connector and the negative probe on pin 1 (**RET**). The connector terminal screw heads may be used as convenient monitor points.

3) Turn on the –48V DC supply. Verify that the digital voltmeter reads between –44V DC and –52V DC when monitoring the cable points specified above. Adjust the power supply output voltage and/or change the connections at the power supply to achieve this reading.

4) Turn the –48V DC supply off.

5) Plug the power cable into the back panel DC Power connector (**DC Input**). Place the voltmeter probes on the cable connector terminal screw heads as per step 2 above. Note that the EVENT 5800 does not have a power on/off switch. When DC power is connected, the digital radio powers up and is operational. There can be up to 5W of RF power present at the antenna port. The antenna should be directed safely when power is applied. The external power supply provided usually has a power on/off switch.

6) Turn on the –48V DC power supply, and verify that the reading on the digital voltmeter is as specified in step 3 above.

4.10 Link Alignment

The Receive Signal Level (RSL) connector is a tool to aid antenna alignment.

4.10.1 EVENT 5800 RSL Output

To use the built-in tuning of the EVENT 5800, a complete link is required, with both ends of the link roughly pointed at each other, and transmitting.

Connect a voltmeter to the RSL (Receive Signal Level) BNC connector on the EVENT 5800 back panel. This mode outputs 0 to +2.5 Volts. Adjust the antenna for maximum voltage. The RSSI voltage is linearly calibrated from 2.5 Volts for maximum RSL (received signal level) at –20 dBm to 0 Volts for minimum RSL at -90 dBm. This mapping characteristic is plotted as shown in the following illustration.

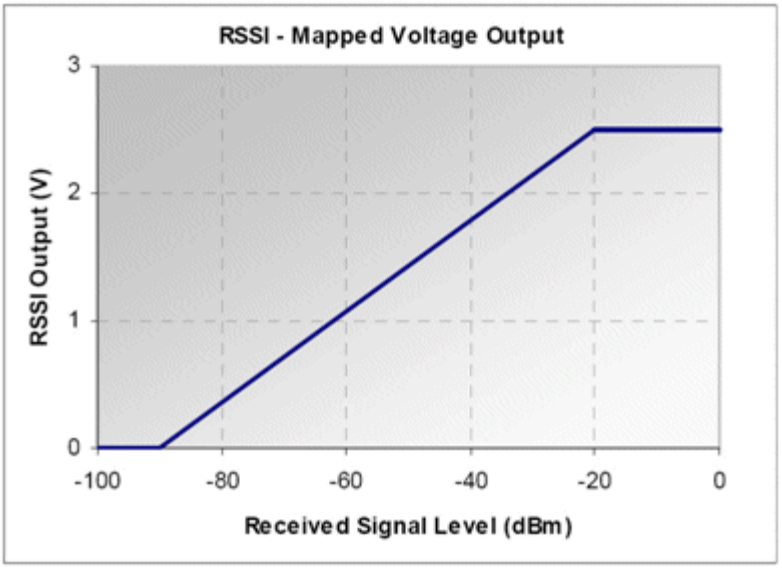


Figure 4-7. RSSI Output vs. Received Signal

5. Quick Setup Guide

It is highly recommended that you review this manual before you install the EVENT 5800. The information here is only a summary.

5.1 Quick Start Hardware Overview

5.1.1 Ensure coaxial Connections

The Event 5800 Coaxial Cable should be connected via some lightening protection that will pass following DC, 5.5MHz to 400MHz

5.1.1.1 PolyPhaser

BGXZ-60NFNF-ALT

Hybrid, ±60 Vdc pass RF protector

Hybrid, multistage, multi-strike, fast response, high current capacity, ±60 Vdc pass coaxial lightning protector configured with N female connectors for RF operating between 40 MHz and 400 MHz (telemetry 1.75 MHz to 25 MHz)

5.2 Quick Start Software Settings

The EVENT 5800 Web Interface can be accessed through a computer connection. The Web Interface is described in the EVENT 5800 User Interface Guide (Moseley Document #602-15173-01). This section describes how to setup the initial EVENT 5800 configuration via the Web Interface.

The following items are needed:

1) Power supply (-48V DC @ 2 Amps) **OR** optional AC/DC power supply and power cable

2) Serial Cable (optional)

3) Computer with networking capability, consisting of either: a laptop computer with Windows 98/2000/XP/Vista operating system, an Ethernet card with any necessary adapters and a Cat-5 Ethernet regular or crossover cable or a networked computer with Windows 98/2000/XP/Vista operating system and an additional Ethernet cable providing access to the network.

4) Web Browser program, Internet Explorer 5.5 (or later) or Mozilla Firefox 1.0.6 (or later) with Java environment installed, available at http://www.java.com.

5) Site engineering folder with site drawings or equivalent EVENT 5800 configuration information

5.2.1 PC Network Configuration

The Web Interface can be accessed via NMS by connecting a CAT5 patch cable between the EVENT 5800 back-panel NMS port and a PC. The PC's network interface must be

configured to an open IP address within the same subnet. For the default Moseley configuration, the IP address of the PC must be 192.168.1.x (where x=a value in the range 1-100). DHCP can also be used to set the PC's IP address if a DHCP server is configured on the same subnet. For additional instructions on adding an IP address on your PC, please review http://www.itsyourip.com/networking/how-to-add-multiple-ip-address-in-windows-2000xp2003/.

5.2.2 Default IP Address

The system is configured and tested at the factory using these default values:

Parameter	Value
IP Address	192.168.1.1xx
Netmask	255.255.255.0
Gateway	192.168.1.1

Where: xx=a value in the range 01-99. The IP address is indicated on the back panel as shown in the following illustration.

Figure 5-2. IP Address Label Location

After configuring the PC network interface, launch a web browser and enter the following URL (or as specified on the back panel) in the address bar to access the unit's Web Interface, e.g. http://192.168.0.101/

5.2.3 Default User Name/Password

A dialog box will request a user name and password. The default values are:

Table 5-1. Default User Names & Passwords

User Level	User Name	Password
Monitor	monitor	monitor
Operator	operator	col1ma
Administrator	administrator	d1scovery
Integrator	integrator	p1nacate

5.3 IP Address Configuration

1) The PC's network configuration must be set with the parameters provided at paragraph 5.2.1.

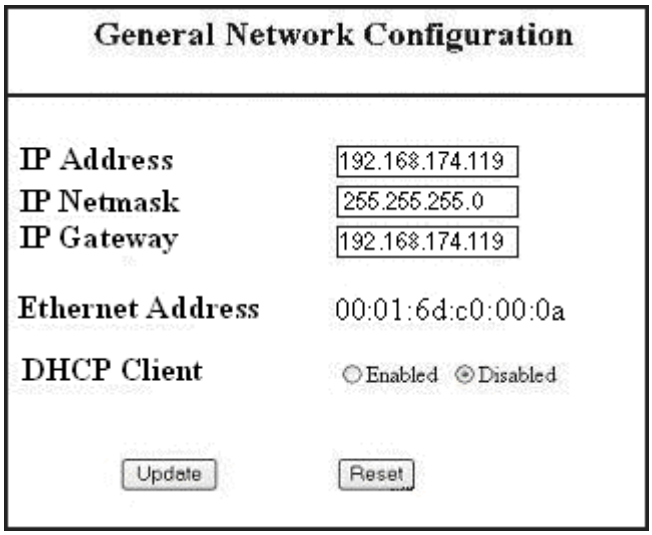
2) The EVENT 5800 should be accessible from your PC at the default IP address provided at paragraph 5.2.2. A network ping can be performed to verify connectivity to EVENT 5800.

3) Start a web browser and use the EVENT 5800 default IP address as the URL.

4) Log in at the login prompt. The user name and password are provided in paragraph 5.2.3.

5) The Web Interface includes a navigation menu in the left frame. If this navigation menu is not visible, make sure the Java environment is properly installed and active.

6) In the navigation panel, select: Administration->Network Configuration->General Network Configuration. The IP address, IP Netmask, and IP Gateway are shown.



7) Enter the new IP address, IP Netmask, and IP Gateway. Click Update to change the values.

8) To verify the new IP address, change the PC's network configuration to be on the same subnet as the new IP address set in the unit and a network ping may be performed to the new address.

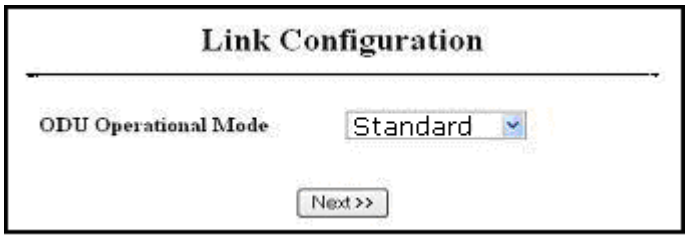
9) To continue using the Web Interface, point the web browser to the new IP address.

5.4 Link Configuration

The EVENT 5800 has been set up at the factory and is usable "out of the box". If needed, you can change the configuration using the Web Interface as follows:

1) To start the Web Interface, open a web browser and use the EVENT 5800 IP address (192.168.1.1xx or what you assigned) as the URL and log in when prompted.

2) In the navigation panel, select: Link Configuration->Radio Link->Link Configuration Link.



3) Select the operating mode. If the EVENT 5800 has one modem installed, select Standard. If the EVENT 5800 has two modems installed, select 1+1 diversity or 1+1 non-diversity for a protected link.

4) Follow the instructions provided by the link configuration wizard to enter the rest of the required settings. The "IDU Operational Mode" can be decoded as follows:

rrrAmmmWn[T|E]<mod><BW><TC>

where

rrr = ASI rate in Mbps {000-150}*

"A" indicates ASI

mmm = WAN (Ethernet) rate in Mbps {000-150}

"W" indicates WAN (Ethernet)

n=number of T1/E1 channels {0-g}
a=10, b=11, c=12, d=13, e=14, f=15, g=16

"[T|E]" indicates T1 or E1

<mod>=modulation type {QP,16,32,64,12,25}
QP = QPSK
16 = 16 QAM
32 = 32 QAM
64 = 64 QAM
12 = 128 QAM
25 = 256 QAM

BW = RF Bandwidth in MHz {10,12,14,17,20,25,28,30}

<TC>=Trellis Coding Error Correction {1,3,4,5,6,7,9,b,d,f}
1 = 1/2
3 = 3/4
4 = 4/5
5 = 5/6
6 = 6/7
7 = 7/8
9 = 9/10
b = 11/12
d = 13/14
f = 15/16

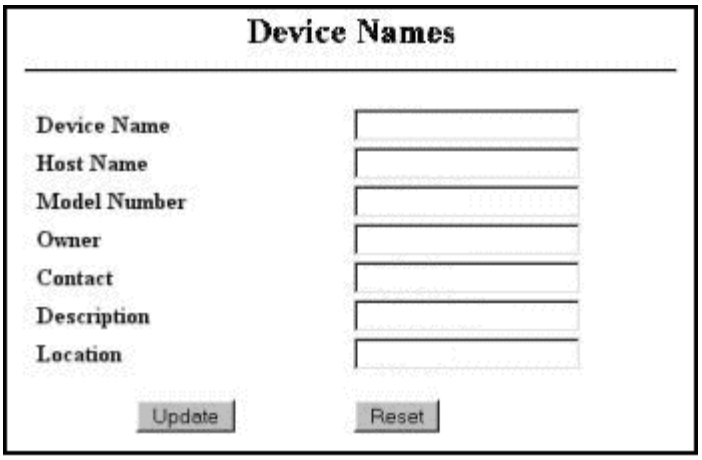
*Note: The available ASI payload rate is 2% less than the indicated rate:
ASI payload = ASI indicated ÷ 1.02

For example, **044A010W1T16253** is
44Mb ASI (43.1Mb ASI payload),
10Mb Wan (Ethernet),
1 T1 channel,
16 QAM modulation,
25 MHz RF channel, and
3/4 Trellis Coding Error Correction.

5.5 Site Attributes

Use the Web Interface to enter device information as follows:

1) In the navigation panel, select: Administration->Device Information->Device Names.



2) Enter the Owner, Contact, Description, and Location. These values are not required for operation, but will help keep a system organized.

5.6 Reset to Factory Defaults

WARNING: A Reset to Factory Defaults can disable your link! The EVENT 5800 may be reset to factory defaults during power up. A power on reset affects the IP address and the user login names and passwords. To perform a power on reset:

1) Power on the EVENT 5800

2) Make sure the call button is not active.

3) During bootup, the controller-card LED will flash alternating red/green for five seconds.

4) While the LED is flashing, press the call button and release it within one second of the LED changing to static green.

5.7 Command Line Interface (CLI) Access

The CLI can be accessed via the NMS Ethernet port or the Serial Port.

5.7.1 CLI Access via NMS Ethernet

The CLI can be accessed via NMS Ethernet after connecting and configuring the PC as described in the previous section. Use a Telnet client to telnet to the EVENT 5800 IP address. You will be prompted for a user name and password. Use the user name and password supplied at paragraph 5.2.3.

5.7.2 CLI Access via Serial Port

The CLI can be accessed via the back-panel serial port. Table 5-1 shows the pinout for constructing a DB-9 to HD-15 cable.

Table 5-2. Serial Cable Pinout

DB-9 Pin	HDB-15 Pin
2	2
3	3
5	5

The serial port parameters are show in Table 5-2.

Table 5-3. Serial Port Parameters

Parameter	Value

Parameter	Value
Speed	38400
Bits	8
Stop-Bits	1
Parity	None
Flow-Control	None

After power is supplied to the EVENT 5800, the CLI can be accessed by connecting the serial cable between the PC and the EVENT 5800. Launch and configure a terminal program (e.g. Hyperterm or TeraTermPro) and press the enter key. You will be prompted for a user name and password. See Section 5.2.3 for Default User Names & Passwords.

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6. On-Site Service

At times, it may be necessary to service the EVENT 5800. This may include installing, removing, or replacing a EVENT 5800 module. There may be up to 8 modules installed in a single EVENT 5800 chassis. The following illustration shows the back panel of the EVENT 5800 with each module labeled. The basic procedure for removing and installing a module is common to all the modules, with slight variations for the Power Supply Module, Controller Module, and Mini I/O Module.

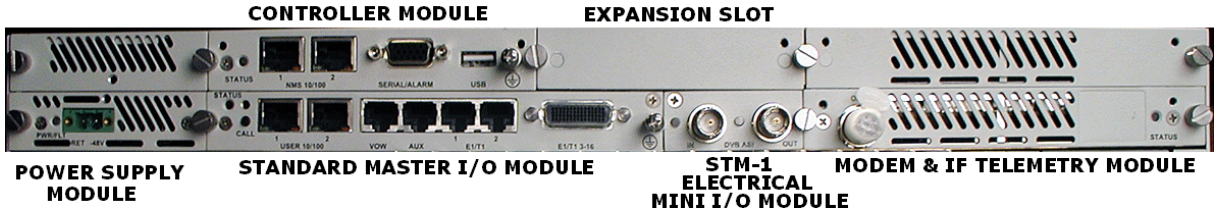

Figure 6-1. EVENT 5800 Modules

6.1 Removing a Module

1) Modules are static sensitive and should only be handled in an ESD-safe environment. When packaging modules for shipment or storage, place in an ESD bag.

2) Remove back panel connections to the module.

3) Remove the two thumbscrews on either side of the module and install them in the adjacent threaded empty screw holes. The following illustration shows the locations of these thumb screws.

a) The thumbscrew for the Standard I/O Module is located on the right side of the Mini I/O Module slot.

b) If a Mini I/O module is installed and the Standard I/O Module is to be removed, both modules will be removed as one unit.

c) When removing only the Mini I/O card, remove the corner screw indicated in the following illustration and one thumb screw.

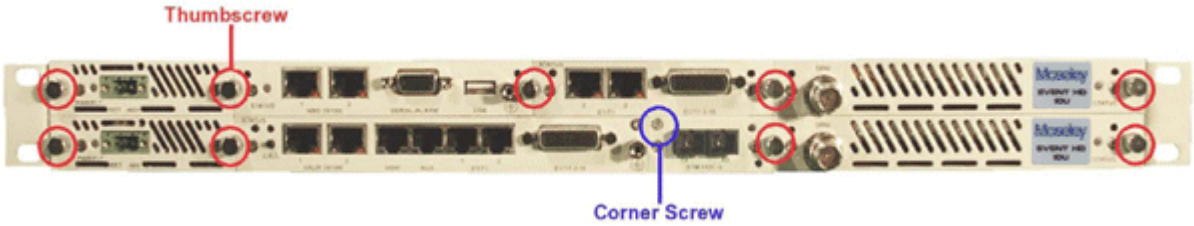

Figure 6-2. Thumbscrew and Corner Screw Locations

4) Remove the module by grasping the thumbscrew(s) and pulling the module straight out of the chassis. Both thumbscrews should be used for all modules except the Power Supply and the Mini I/O Modules.

5) The Power Supply and Mini I/O Modules have only one threaded hole each.

a) When removing the Standard I/O Module, the ground lug shown in the following illustration is used as the second threaded hole. If the EVENT 5800 is to remain powered on and the ground lug is being used to ground the unit, first move the ground connection to the ground lug located on the Controller Module.

The EVENT 5800 retains its current configuration when a module is removed, unless that module is the Controller Module. In which case, the IP addresses will need to be reprogrammed.

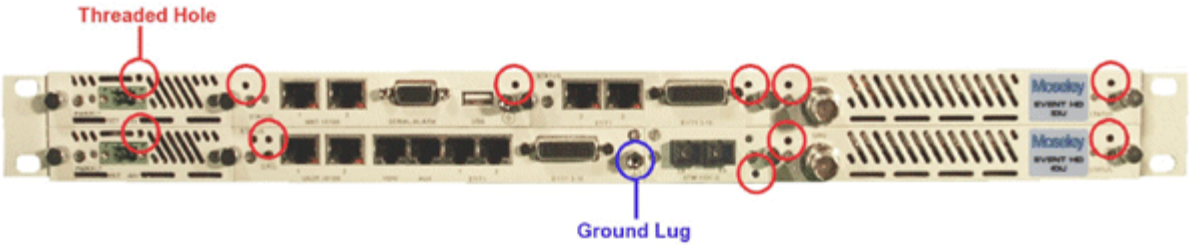

Figure 6-3. Threaded Hole Locations

6.2 Installing a Module

1) Modules are static sensitive and should only be handled in an ESD-safe environment. When packaging modules for shipment or storage, place in an ESD bag.

2) Line up the module board with the guides in the chassis and slide the module into the EVENT 5800. The following illustration shows a photo of the guides. As the module face plate comes flush with the face of the EVENT 5800, connectors on the rear of the module will engage with the EVENT 5800 backplane. It is possible to encounter interference from adjacent module rear panels. If this occurs, loosen the thumbscrews holding the neighboring panels and shift them as necessary to ensure fit.

a) The Mini I/O Module only has one guide on the right side. Take care to insert the Mini I/O module carefully and correctly engage the rear connector with its mate on the Standard I/O Module.

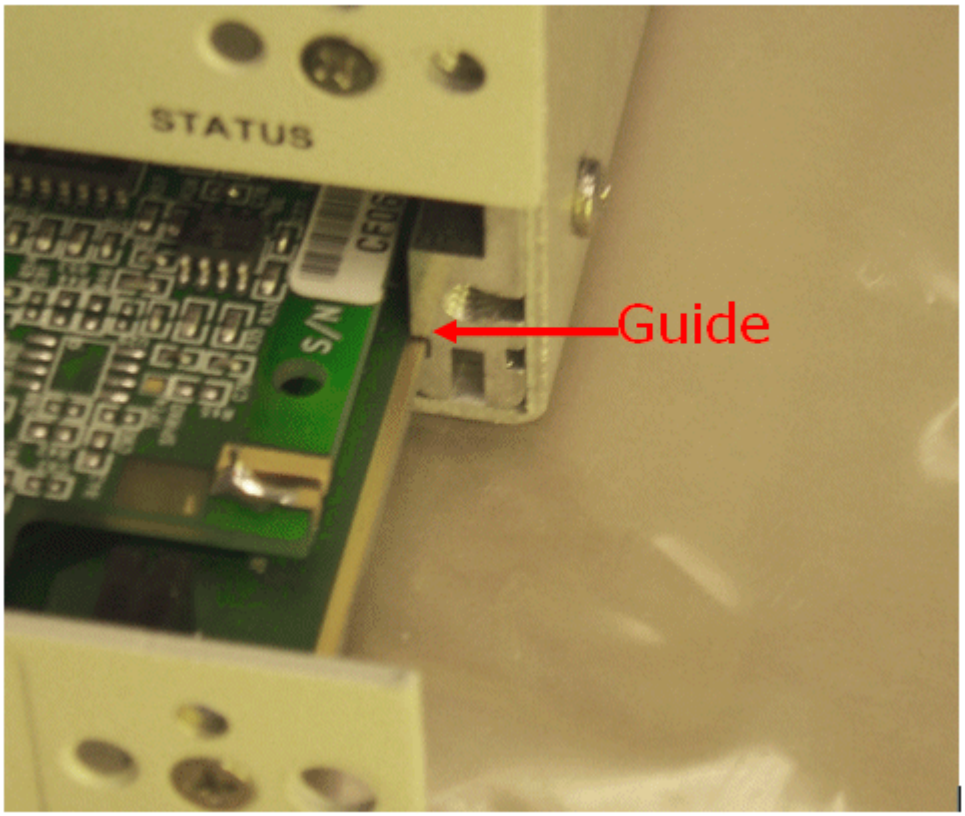

Figure 6-4. Guides for Installing Cards

3) Install thumbscrews on either side of the module as shown in Figure 6-2. The Mini I/O card has a corner screw, which should be installed. This corner screw is shown in Figure 6-2.
4) Make rear panel connections to the module and power on the EVENT 5800 if necessary.
5) Verify proper operation of the unit. If the Controller Module has been changed, reprogram the IP addresses.

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7. Specifications

7.1 System Specifications

Parameter	EVENT 5800
System	
Frequency Bands	5.725-5.850
Output Power (Typical)	27dBm (0.5W)
Channelization (others available on request)	10, 25, 50 MHz
Payload Capacity	150Mbps ASI 1-150 Mbps Ethernet 1-2 T1/E1 Various combinations of above
Input Sensitivity	-84 dBm (or better, based on selected mode)
Modulation	QPSK, 16, 32, 64, 128, 256 QAM
Radio Interfaces	
External Antenna	N-Type Female
SDIDU™ /ODU Link	TNC Female
Data Interfaces	
Payload DVB/ASI Ethernet T1/E1	 75 Ω BNC Female (2) 10/100/1000Base-T RJ-45 Female (4) 100 Ω / 120 Ω Balanced, RJ-48C Female (2)
SNMP	10/100Base-T RJ-45 Female
Control	
Network Management	SNMP, Proprietary Web GUI, Telnet, CLI
NMS Connector	10/100Base-T RJ-45 Female
Auxiliary Data (64 kbps)	RS422 via RJ-45
Encryption (Consult Moseley Sales)	AES
Alarm Port	2 Form C (SPDT), 2 TTL Output, 4 TTL Input, DB-15HD
Power/Environment	

Parameter	EVENT 5800
DC Power	-48 Vdc ±10%, <125 W
AC Power (External PS)	100-240 Vac, 47-63 Hz, <3.2 A
Operational Temperature	-30 to 55 ºC
Humidity	0 to 95%, non-condensing
Altitude	15,000 feet / 4572 meters, maximum
Physical Dimensions	
Size (W x H x D) IDU	19.0 x 1.75 x 11.5 inches (48.3 x 4.45 x 29.2 cm)
Weight	
EIA Rack Mount	19 inch/48.3 cm, 1 rack units

7.2 Ethernet Performance

7.2.1 100 Base TX Ethernet Performance

Bridging Type: Store and forward switching, dynamic address learning, spanning tree protocol capable. Supports 802.1D-2004:

- Section 9 Encoding of bridge protocol data units
- Section 14 Bridge Management (partial support via Web Interface and proprietary MIB)
- Section 16 Bridge Performance
- Section 17 Rapid Spanning Tree Protocol

MAC Address Capacity: EVENT 5800 supports three MAC addresses: NMS, and payload. In addition, internal Ethernet switches can learn up to 4096 addresses (Standard Master I/O/Enhanced Master I/O), 42 x E1/T1 Master I/O can learn up to 1024 addresses.

Buffering: Standard & Enhanced Master I/O: 160KB, 42xE1/T1 Master I/O: 64KB

Table 7-1. 100 Base TX Ethernet % Nominal Throughput

Frame Size	10Mbps Through put	50Mbps Through put	100Mbps Through put	150Mbps Through put	200Mbps Through put	250Mbps Through put	300Mbps Through put
64	106.3%	106.0%	100.0%	-	-	-	-
128	103.4%	102.6%	100.0%	-	-	-	-
256	100.0%	101.4%	99.8%	-	-	-	-
512	100.0%	100.4%	99.8%	-	-	-	-
1024	100.0%	100.3%	99.9%	-	-	-	-
1280	99.9%	100.3%	100.0%	-	-	-	-
1518	99.9%	100.2%	100.0%	-	-	-	-

*Rates above 100Mbps are only possible with GigE card

Table 7-2. 100 Base TX Ethernet Latency (msec)

Frame Size	10Mbps Data Rate	50Mbps Data Rate	100Mbps Data Rate	150Mbps Data Rate	200Mbps Data Rate	250Mbps Data Rate	300Mbps Data Rate
64	3.25	0.718	0.377	-	-	-	-
128	3.32	0.73	0.407	-	-	-	-
256	3.42	0.75	0.437	-	-	-	-
512	3.67	0.8	0.469	-	-	-	-
1024	4.19	0.89	0.559	-	-	-	-
1280	4.3	0.931	0.621	-	-	-	-
1518	4.64	0.973	0.725	-	-	-	-

*Rates of above 100Mbps are only possible with GigE card

Packet Size for Standard & Enhanced Master I/O: Min = 64 bytes, Max = 1536 bytes

VLAN Support: VLAN tagged packets are passed through without modification. Port based VLANs are supported, but not user-configurable as they are used to implement 155FE and Port-based VLAN modes. EVENT 5800 uses VLAN TAG Priority (802.1Q-203 Section 9 Tagged Frame Format) for QoS.

Operation Full duplex / Half Duplex / Auto sensing: Auto Sensing and manual configuration

Support for routing: Support for IP based routing is not provided at this time

Quality of Service (QoS): QoS is implemented using weighted priority queues. Incoming packets are assigned to a priority queue based on one or more of the following criteria:

- Incoming Port: port based priority allows assignment to a priority queue based on the port the packet arrived on
- 802.1Q VLAN Tag Priority: packets are assigned to a priority queue based on the priority tag field in the VLAG TAG
- IPv4 TOS (Standard Master I/O & Enhanced Master I/O only): packets are assigned to a priority queue based on the TOS field in the IPv4 header
- DiffServ (42xE1/T1 Master I/O only): packets are assigned to a priority queue based on the value of the DS field of the IPv4 header (the DS field is the redefined IPv4 TOS field)

- Priority Queues (Standard Master I/O & Enhanced Master I/O): 2
- Priority Queues (42xE1/T1 Master I/O): 4

NOTE: The weighted ratios are fixed for 802.1Q VLAN TAG priority and for IPv4 TOS priority even though they are selectable via the Web Interface. The Low priority queue flows may be starved under some traffic conditions (Standard Master I/O & Enhanced Master I/O only).

Flow Control: Flow control is supported in both full-duplex and half-duplex. Full-Duplex is implemented with respect for PAUSE packets as well as generation of PAUSE packets. Half-Duplex is implemented with back-pressure.

7.2.2 Gigabit Ethernet (GigE) Performance

Bridging Type: Store and forward switching, dynamic address learning, spanning tree protocol capable. Supports 802.1D-2004:

- Section 9 Encoding of bridge protocol data units
- Section 14 Bridge Management (partial support via Web Interface and proprietary MIB)
- Section 16 Bridge Performance
- Section 17 Rapid Spanning Tree Protocol

MAC address capacity: EVENT 5800 supports two MAC addresses. One is for the NMS and the other is for payload. In addition, internal Ethernet switches can learn up to 1024 addresses (GigE Master I/O & Enhanced GigE Master I/O).

Buffering: GigE Master I/O & Enhanced GigE Master I/O: 128KB

Table 7-3. Gigabit Ethernet % Nominal Throughput

Frame Size	10Mbps Throughput	50Mbps Throughput	100Mbps Throughput	150Mbps Throughput	200Mbps Throughput	250Mbps Throughput	300Mbps Throughput
64	125.0%	128.3%	128.2%	132.8%	128.6%	133.1%	132.4%
128	112.6%	114.1%	114.7%	117.5%	115.5%	117.2%	116.2%
256	106.2%	106.4%	107.3%	108.9%	107.5%	110.6%	108.9%
512	103.1%	103.6%	104.6%	105.3%	104.4%	105.5%	104.5%
1024	100.0%	101.5%	102.0%	103.6%	102.1%	104.5%	103.5%
1280	99.9%	101.4%	101.3%	103.4%	101.7%	104.3%	102.5%
1518	99.9%	101.4%	101.1%	103.3%	101.4%	104.2%	102.3%

Table 7-4. Gigabit Ethernet Latency (msec)

Frame Size	10 Mbps Data Rate	50 Mbps Data Rate	100 Mbps Data Rate	150 Mbps Data Rate	200 Mbps Data Rate	250 Mbps Data Rate	300 Mbps Data Rate
64	3.29	0.718	0.416	0.261	0.187	0.156	0.133
128	3.34	0.73	0.422	0.265	0.191	0.160	0.136
256	3.44	0.752	0.435	0.274	0.198	0.165	0.141
512	3.66	0.797	0.459	0.291	0.212	0.178	0.152
1024	4.07	0.887	0.508	0.325	0.241	0.202	0.174
1280	4.27	0.932	0.532	0.342	0.255	0.214	0.185
1518	4.48	0.937	0.555	0.358	0.268	0.225	0.195

Packet Size for GigE I/O Card:

- Min = 64 bytes
- Max = 1522 bytes for GigE Master I/O & Enhanced GigE Master I/O
- Max = 2048 bytes for 42xE1/T1 Master I/O
- Max = 4000 bytes for GigE Master I/O JUMBO
- Max = 9728 bytes for Enhanced GigE Master I/O JUMBO

VLAN support: VLAN tagged packets are passed through without modification. Port based VLANs are supported, but not user-configurable as they are used to implement 155FE and Port-based VLAN modes. EVENT 5800 uses VLAN TAG Priority (802.1Q-203 Section 9 Tagged Frame Format) for QoS.

Operation Full duplex / Half Duplex / Auto sensing: Auto Sensing

Support for routing: Support for IP based routing is not provided at this time

Quality of Service (QoS): QoS is implemented using weighted priority queues. Incoming packets are assigned to a priority queue based on one or more of the following criteria:

- Incoming Port: port based priority allows assignment to a priority queue based on the port the packet arrived on
- 802.1Q VLAN Tag Priority: packets are assigned to a priority queue based on the priority tag field in the VLAG TAG
- DiffServ: packets are assigned to a priority queue based on the value of the DS field of the IPv4 header (the DS field is the redefined IPv4 TOS field)
- Priority Queues: 4

Flow Control: Flow control is supported in both full-duplex and half-duplex. Full-Duplex is implemented with respect for PAUSE packets as well as generation of PAUSE packets. Half-Duplex is implemented with back-pressure.

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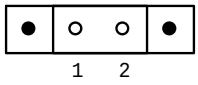
8. Connectors

8.1 DC Input (Power) Connector

MSTB 2,5/ 2-GF



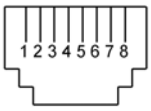
PIN	TYPE	SIGNAL
1	POWER	Power supply return
2	POWER	48V DC, nominal

Mating Connector: MSTB 2,5/ 2-STF

Ordering Information: Phoenix Contact Part Number 1786831

8.2 Ethernet 100BaseTX Payload Connector

RJ-45 Female

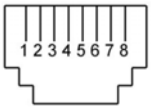


PIN	TYPE	SIGNAL
1	INPUT	RX+
2	INPUT	RX-
3	OUTPUT	TX+
4	N/A	N/A
5	N/A	N/A
6	OUTPUT	TX-
7	N/A	N/A
8	N/A	N/A

Mating Connector: Standard RJ-45 Plug

Ordering Information: Tyco Electronics/Amp Part Number 5-554169-3 or equivalent

8.3 Ethernet 1000BaseT Payload Connector

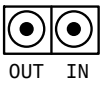
RJ-45 Female	PIN	TYPE	SIGNAL
	1	I/O	DA+
	2	I/O	DA
	3	I/O	DB+
	4	I/O	DC+
	5	I/O	DC
	6	I/O	DB
	7	I/O	DD+
	8	I/O	DD-

Mating Connector: Standard RJ-45 Plug, Tyco Electronics/Amp Part Number 5-554169-3 or equivalent

Cable: CAT 5E or CAT6 with RJ-45 connector, maximum length 100m/ 328 ft

8.4 SONET Payload Connector

SC Duplex Female Fiber



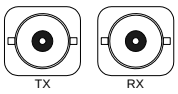
PIN	TYPE	SIGNAL
OUT	OUTPUT	SONET OC-3 payload output (optical)
IN	INPUT	SONET OC-3 payload input (optical)

Mating Connector: SC-Duplex Male

Ordering Information: Molex Part Number 86066-4000 or equivalent

8.5 STM-1 Payload Connector

BNC Female



PIN	TYPE	SIGNAL
TX	OUTPUT	SDH STM-1 payload output (electrical)
RX	INPUT	SDH STM-1 payload input (electrical)

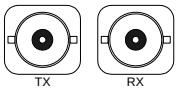
Mating Connector: BNC Male

Ordering Information: Tyco Electronics/Amp Part Number 225395-2 or equivalent

8.6 DVB/ASI, DS-3, E-3, STS-1 Payload Connector

Consult factory for availability.

BNC Female



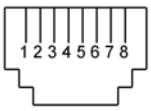
PIN	TYPE	SIGNAL
TX	OUTPUT	DVB-ASI payload output
RX	INPUT	DVB-ASI payload input

Mating Connector: BNC Male

Ordering Information: Tyco Electronics/Amp Part Number 225395-2 or equivalent

8.7 NMS 10/100BaseTX Connector 1-2

RJ-45 Female



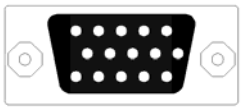
PIN	TYPE	SIGNAL
1	OUTPUT	TX+
2	OUTPUT	TX-
3	INPUT	RX+
4	N/A	N/A
5	N/A	N/A
6	INPUT	RX-
7	N/A	N/A
8	N/A	N/A

Mating Connector: Standard RJ-45 Plug

Ordering Information: Tyco Electronics/Amp Part Number 5-554169-3 or equivalent

8.8 Alarm / Serial Port Connector

DB-15HD Female



PIN	TYPE	SIGNAL
1	OUTPUT	TTL Alarm Output 3
2*	INPUT/ Output	RS-232 RX/TX
3*	OUTPUT/ Input	RS-232 TX/RX
4	OUTPUT	TTL Alarm Output 4
5	N/A	GROUND
6**	N/A	Alarm 1 Form C Contact Normally Open
7**	N/A	Alarm 1 Form C Contact Normally Closed
8**	N/A	Alarm 2 Form C Contact Common
9	INPUT	TTL Alarm Input 1
10	INPUT	TTL Alarm Input 3
11**	N/A	Alarm 1 Form C Contact Common
12**	N/A	Alarm 2 Form C Contact Normally Open
13**	N/A	Alarm 2 Form C Contact Normally Closed
14	INPUT	TTL Alarm Input 2
15	Input	TTL Alarm Input 4

* Pins 2 and 3 are hardware jumper configurable for DCE or DTE operation.

** Form C Contacts are hardware jumper configurable to emulate TTL outputs

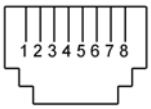
Mating Connector: HD-DSUB15 Male (15 pins in a DB9 shell)

Ordering Information: Norcomp Part Number 180-015-102-001 or equivalent

8.9 T1 / E1 Channels 1-2 Connector

RJ-48C Female

100 Ω /120 Ω Balanced



PIN	TYPE	SIGNAL
1	INPUT	RX+
2	INPUT	RX-
3	N/A	GND
4	OUTPUT	TX+
5	OUTPUT	TX-
6	N/A	GND
7	N/A	N/A
8	N/A	N/A

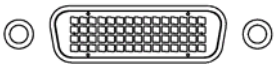
Mating Connector: Standard RJ-45 Plug

Ordering Information: Tyco Electronics/Amp Part Number 5-554169-3 or equivalent

8.10 T1/E1 Channels 3-16 Connector

Molex LFH Matrix 50 Receptacle

100 Ω / 120 Ω Balanced



PIN	TYPE	SIGNAL
1	OUTPUT	T1 Channel 13 Transmit Tip
2	OUTPUT	T1 Channel 14 Transmit Tip
3	OUTPUT	T1 Channel 15 Transmit Tip
4	OUTPUT	T1 Channel 16 Transmit Tip
5	OUTPUT	T1 Channel 9 Transmit Tip
6	OUTPUT	T1 Channel 10 Transmit Tip
7	OUTPUT	T1 Channel 11 Transmit Tip
8	OUTPUT	T1 Channel 12 Transmit Tip
9	OUTPUT	T1 Channel 5 Transmit Tip
10	OUTPUT	T1 Channel 6 Transmit Tip
11	OUTPUT	T1 Channel 7 Transmit Tip
12	OUTPUT	T1 Channel 8 Transmit Tip
13	OUTPUT	T1 Channel 3 Transmit Tip
14	OUTPUT	T1 Channel 4 Transmit Tip
15	NC	NC
16	NC	NC
17	OUTPUT	T1 Channel 4 Transmit Ring
18	OUTPUT	T1 Channel 3 Transmit Ring
19	OUTPUT	T1 Channel 8 Transmit Ring
20	OUTPUT	T1 Channel 7 Transmit Ring
21	OUTPUT	T1 Channel 6 Transmit Ring
22	OUTPUT	T1 Channel 5 Transmit Ring
23	OUTPUT	T1 Channel 12 Transmit Ring
24	OUTPUT	T1 Channel 11 Transmit Ring
25	OUTPUT	T1 Channel 10 Transmit Ring
26	OUTPUT	T1 Channel 9 Transmit Ring
27	OUTPUT	T1 Channel 16 Transmit Ring
28	OUTPUT	T1 Channel 15 Transmit Ring
29	OUTPUT	T1 Channel 14 Transmit Ring
30	OUTPUT	T1 Channel 13 Transmit Ring
31	INPUT	T1 Channel 16 Receive Tip
32	INPUT	T1 Channel 15 Receive Tip

Molex LFH Matrix 50 Receptacle

PIN	TYPE	SIGNAL
33	INPUT	T1 Channel 9 Receive Tip
34	INPUT	T1 Channel 14 Receive Tip
35	INPUT	T1 Channel 10 Receive Tip
36	INPUT	T1 Channel 13 Receive Tip
37	INPUT	T1 Channel 11 Receive Tip
38	INPUT	T1 Channel 4 Receive Tip
39	INPUT	T1 Channel 12 Receive Tip
40	INPUT	T1 Channel 3 Receive Tip
41	INPUT	T1 Channel 5 Receive Tip
42	INPUT	T1 Channel 8 Receive Tip
43	INPUT	T1 Channel 6 Receive Tip
44	INPUT	T1 Channel 7 Receive Tip
45	NC	NC
46	NC	NC
47	INPUT	T1 Channel 7 Receive Ring
48	INPUT	T1 Channel 6 Receive Ring
49	INPUT	T1 Channel 8 Receive Ring
50	INPUT	T1 Channel 5 Receive Ring
51	INPUT	T1 Channel 3 Receive Ring
52	INPUT	T1 Channel 12 Receive Ring
53	INPUT	T1 Channel 4 Receive Ring
54	INPUT	T1 Channel 11 Receive Ring
55	INPUT	T1 Channel 13 Receive Ring
56	INPUT	T1 Channel 10 Receive Ring
57	INPUT	T1 Channel 14 Receive Ring
58	INPUT	T1 Channel 9 Receive Ring
59	INPUT	T1 Channel 15 Receive Ring
60	INPUT	T1 Channel 16 Receive Ring

Mating Connector: Molex LFH Matrix 50 Plug

Ordering Information: Molex Part Number 70929-2000 (connector) + Molex Part Number 51-24-2021 (pins, Qty 4 per connector)

8.11 USB (for Future)

Consult factory for availability.

USB Type A Receptacle

PIN	TYPE	SIGNAL

USB Type A Receptacle

PIN	TYPE	SIGNAL
1	OUTPUT	+5V
2	I/O	-Data
3	I/O	+Data
4	N/A	GND

Mating Connector: USB Type A Plug

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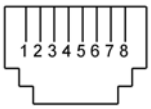
8.12 Data Order Wire

8.12.1 RS-422

RJ-45 Female



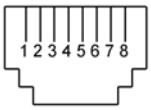
PIN	TYPE	SIGNAL
1	OUTPUT	TX Clock -
2	OUTPUT	TX Clock +
3	OUTPUT	TX Data -
4	INPUT	RX Data -
5	INPUT	RX Data +
6	OUTPUT	TX Data +
7	INPUT	RX Clock -
8	INPUT	RX Clock +

Mating Connector: Standard RJ-45 Plug

Ordering Information: Tyco Electronics/Amp Part Number 5-554169-3 or equivalent

8.12.2 RS-232

RJ-45 Female



PIN	TYPE	SIGNAL
1	N/A	NC
2	N/A	NC
3	N/A	Signal GND
4	N/A	NC
5	INPUT	RX Data +
6	OUTPUT	TX Data +
7	N/A	NC
8	N/A	NC

Mating Connector: Standard RJ-45 Plug

Ordering Information: Tyco Electronics/Amp Part Number 5-554169-3 or equivalent

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Appendix A. Abbreviations & Acronyms

A_dTPC	Adaptive Transmit Power Control
AIS	Alarm Indication Signal
ASI	Asynchronous Serial Interface
BAS	Broadcast Auxiliary Service
BER	Bit Error Rate
Codec	Coder-Decoder
CPU	Central Processing Unit
dB	deciBel
dBm	deciBel relative to 1 mW
DS3	Digital Signal 3 (T-carrier)
DCE	Data Circuit-Terminating Equipment
DTE	Data Terminal Equipment
DVB	Digital Video Broadcasting
EIRP	Effective Isotropic Radiated Power
ETSI	European Telecommunications Standards Institute
FEC	Forward Error Correction
FPGA	Field Programmable Gate Array
GPIO	General Purpose Input/Output
IF	Intermediate Frequency
IP	Internet Protocol
ISM	Industrial, Scientific and Medical Radio Bands
LED	Light-Emitting Diode
LOS	Line of Sight
MIB	Management Information Base
Modem	Modulator-demodulator
NC	Normally Closed
NMS	Network Management System
OAM&P	Operations, Administration, Maintenance, and Provisioning
OC-3	Optical Carrier level 3
PCB	Printed circuit board
PDH	Plesiochronous Digital Hierarchy
POP	Point of Presence
PTT	Push-To-Talk
PTP	Point-To-Point

QAM	Quadrature Amplitude Modulation
QoS	Quality of Service
QPSK	Quadrature Phase Shift Keying
RF	Radio Frequency
RSL	Received Signal Level (in dBm)
RSSI	Received Signal Strength Indicator/Indication
RX	Receive or Receiver
SDH	Synchronous Digital Hierarchy
SFP	Small Form-factor Pluggable, "hot-pluggable" optical transceiver
SNMP	Simple Network Management Protocol
SNR	Signal-to-Noise Ratio
SDIDU	Software Defined Indoor Unit (Moseley trademark)
SONET	Synchronous Optical Network
STL	Studio-to-Transmitter Link
STM-1	Synchronous Transport Module 1
STP	Spanning Tree Protocol
TCP/IP	Transmission Control Protocol/Internet Protocol
TTL	Transistor-transistor logic
TX	Transmit or Transmitter
U-NII	Unlicensed National Information Infrastructure
VLAN	Virtual Local Area Network (LAN)
VoIP	Voice over IP

Appendix B. µV – dBm Conversion Chart

µV to dBm (impedance = 50 ohms)

µV	dBm	µV	dBm
0.10	-127.0	180	-61.9
0.25	-119.0	200	-61.0
0.50	-113.0	250	-59.0
0.70	-110.1	300	-57.4
1.0	-107.0	350	-56.1
1.4	-104.1	400	-54.9
2.0	-101.0	450	-53.9
2.5	-99.0	500	-53.0
3.0	-97.4	600	-51.4
3.5	-96.1	700	-50.1
4.0	-94.9	800	-48.9
4.5	-93.9	900	-47.9
5.0	-93.0	1,000	-47.0
6.0	-91.4	1,200	-45.4
7.0	-90.1	1,400	-44.1
8.0	-88.9	1,600	-42.9
9.0	-87.9	1,800	-41.9
10	-87.0	2,000	-41.0
11	-86.2	2,500	-39.0
12	-85.4	3,000	-37.4
14	-84.1	3,500	-36.1
16	-82.9	4,000	-34.9
18	-81.9	4,500	-33.9
20	-81.0	5,000	-33.0
25	-79.0	6,000	-31.4
30	-77.4	7,000	-30.1
35	-76.1	8,000	-28.9
40	-74.9	9,000	-27.9
45	-73.9	10,000	-27.0
50	-73.0	7.07 mV	-30 (1 µW)

µV	dBm	µV	dBm
60	-71.4	22.4 mV	-20 (10 µW)
70	-70.1	70.7 mV	-10 (100 µW)
80	-68.9	224 mV	0 (1 mW)
90	-67.9	707 mV	+10 (10mW)
100	-67.0	2.23 V	+20 (100 mW)
120	-65.4	7.07 V	+30 (1 W)
140	-64.1	11.2 V	+36 (4 W)
160	-62.9	22.4 V	+40 (10 W)

Appendix C. FCC Applications Information

FCC Form 601

The DTV Link operates as Studio-Transmitter Link (STL). It is FCC type verified for use in licensed Part 74 and Part 101bands of 7 & 13 GHz (6,425 to 6,525 MHz, 6,875 to 7,125 MHz and 12,700 to 13,250 MHz respectively). It is the operator's responsibility to acquire proper authorization prior to radio operation. This is accomplished by submitting FCC 601 Main Form and Form 601 Schedule I.

The main form is 103 pages. However for the Microwave Broadcast Auxiliary Service, only the following sections apply:

- Form 601 Instructions (22 pages)
- Main Form 601 (4 pages)
- Schedule I Instructions (18 pages)
- Schedule I Form with supplements (5 pages)

Form FCC 601, Schedule I, is a supplementary schedule for use with the FCC Application for Wireless Telecommunications Bureau Radio Service Authorization, FCC 601 Main Form. This schedule is used to apply for an authorization to operate a radio station in the Fixed Microwave and Microwave Broadcast Auxiliary Services, as defined in 47 CFR, Parts 101 and 74.The FCC 601 Main Form must be filed in conjunction with this schedule. The forms may be found online:

FCC 601 Main Form
http://www.fcc.gov/Forms/Form601/601.pdf

FCC 601 Schedule I Form for Fixed Microwave and Microwave Broadcast Auxiliary Services
http://www.fcc.gov/Forms/Form601/601i.pdf

The data that follows is intended to assist the user in completing the required information in Form 601, Schedule I, Supplement 4 where the radio-specific information is required.

Form 601, Schedule I, Supplement 4 Information:

Item	Description	Entry for FCC 601 Sched. I, Supp. 4
4	Lower or Center Frequency (MHz)	Enter the assigned center frequency in MHz
5	Upper Frequency (MHz)	Not used here (leave blank)
6	Frequency Tolerance (%)	.005%
7	Effective Isotropic Radiated Power (dBm)	(Tx Output Power+ Tx ant. gain – Tx cable loss + 2.15) dBm
8	Emission Designator	RF channel bandwidth(MHz)+"M0D7W" e.g.: 25M0D7W
9	Baseband Digital Rate (kbps)	See formula, below*
10	Digital Modulation Type	QPSK, 16 QAM, 32 QAM, 64 QAM, 128 QAM, or 256 QAM
11	Transmitter Manufacturer	Moseley Associates, Inc.
12	Transmitter Model	EVENT 5800
13	Automatic Tx Power Control	No

*Baseband Digital Rate (kbps) = RF channel bandwidth (MHz) x Baseband Efficiency (bps/Hz) from table below x 1000 kbps/Mbps

Digital Modulation Type	Bandwidth Efficiency (bps/Hz)	TCM	Baseband Efficiency (bps/Hz)
QPSK	1.74	1/2	0.80
		3/4	1.20
		7/8	1.40
16QAM	3.48	3/4	2.39
		7/8	2.79
32QAM	4.35	4/5	3.19
		9/10	3.59
64QAM	5.22	5/6	3.99
		11/12	4.39
128QAM	6.09	6/7	4.79
		13/14	5.19
256QAM	6.96	7/8	5.59
		15/16	5.99

As an example, for a 25MHz RF channel using 16QAM modulation with a TCM of 3/4, the Baseband Digital Rate (kbps) = 25 MHz x 2.39 bps/Hz x 1000 kbps/Mbps = 59,750 kbps.

Appendix D. Customer Service

Moseley Associates will assist its product users with difficulties. Most problems can be resolved through telephone consultation with our technical service department. When necessary, factory service may be provided. If you are not certain whether factory service of your equipment is covered, please check your product Warranty/Service Agreement.

- Do not return any equipment to Moseley without prior consultation.
- The solutions to many technical problems can be found in our product manuals; please read them and become familiar with your equipment.

We invite you to visit our Internet web site at http://www.moseleysb.com/.

D.1 Technical Consultation

Please have the following information available prior to calling the factory:

- Model number and serial number of unit;
- Shipment date or date of purchase of an Extended Service Agreement;
- Any markings on suspected subassemblies (such as revision level); and
- Factory test data, if applicable.

Efficient resolution of your problem will be facilitated by an accurate description of the problem and its precise symptoms. For example, is the problem intermittent or constant? What are the indications? If applicable, what is your operating frequency?

Technical consultation is available at (805) 968-9621 from 8:00 a.m. to 5:00 p.m., Pacific Time, Monday through Friday. During these hours a technical service representative who knows your product should be available. If the representative for your product is busy, your call will be returned as soon as possible. Leave your name, station call letters if applicable, type of equipment, and telephone number(s) where you can be reached in the next few hours.

Please understand that, in trying to keep our service lines open, we may be unable to provide “walk-through” consultation. Instead, our representative will usually suggest the steps to resolve your problem; try these steps and, if your problem remains, do not hesitate to call back.

After-Hours Emergencies: Emergency consultation is available at (805) 252-2133 from 5:00 p.m. to 10:00 p.m. Pacific Time, Monday to Friday, and from 8:00 a.m. to 10:00 p.m. Pacific Time on weekends and holidays. Please do not call during these hours unless you have an emergency with installed equipment. Our representative will not be able to take orders for parts, provide order status information, or assist with installation problems.

D.2 Factory Service

Arrangements for factory service should be made only with a Moseley technical service representative. You will be given a Return Authorization (RA) number. This number will expedite the routing of your equipment directly to the service department. Do not send any equipment to Moseley Associates without an RA number.

When returning equipment for troubleshooting and repair, include a detailed description of the symptoms experienced in the field, as well as any other information that well help

us fix the problem and get the equipment back to you as fast as possible. Include your RA number inside the carton.

If you are shipping a complete chassis, all modules should be tied down or secured as they were originally received. On some Moseley Associates equipment, printing on the underside or topside of the chassis will indicate where shipping screws should be installed and secured.

Ship equipment in its original packing, if possible. If you do not have the original box, contact Technical Services and have them send you a complete shipping box. If you are shipping a subassembly, please pack it generously to survive shipping. Make sure the carton is packed fully and evenly without voids, to prevent shifting. Seal it with appropriate shipping tape or nylon-reinforced tape. Mark the outside of the carton "Electronic Equipment - Fragile" in large red letters. Note the RA number clearly on the carton or on the shipping label, and make sure the name of your company is listed on the shipping label. Insure your shipment appropriately. All equipment must be shipped prepaid.

The survival of your equipment depends on the care you take in shipping it. Address shipments to:

MOSELEY ASSOCIATES, INC.
Attn: Technical Services Department
82 Coromar Drive
Santa Barbara, CA 93117-3093

Moseley Associates, Inc. will return the equipment prepaid under Warranty and Service Agreement conditions, and either freight collect or billed for equipment not covered by Warranty or a Service Agreement.

D.3 Field Repair

Some Moseley Associates equipment will have stickers covering certain potentiometers, varicaps, screws, and so forth. Please contact Moseley Associates technical service department before breaking these stickers. Breaking a tamperproof sticker may void your warranty.

When working with Moseley's electronic circuits, work on a grounded antistatic surface, wear a ground strap, and use industry-standard ESD control.

Try to isolate a problem to a module or to a specific section of a module. Then compare actual wave shapes and voltage levels in your circuit with any shown on the block and level diagrams or schematics. These will sometimes allow the problem to be traced to a component.

Spare Parts Kits: Spare parts kits are available for all Moseley products. We encourage the purchase of the appropriate kits to allow self-sufficiency with regard to parts. Information about spares kits for your product may be obtained from our sales department or technical service department.

Module Exchange: When it is impossible or impractical to trace a problem to the component level, replacing an entire module or subassembly may be a more expedient way to correct the problem. Replacement modules are normally available at Moseley Associates for immediate shipment. Arrange delivery of a module with our technical services representative. If the shipment is to be held at your local airport with a telephone number to call, please provide an alternate number as well. This can prevent unnecessary delays.

Field Repair Techniques: Moseley recommends that you do NOT attempt to repair your equipment at the component level. Surface-mount technology is small and fragile, and

requires specialized equipment and skills to affect a proper repair. Return the suspect module to the factory for repair or replacement.

