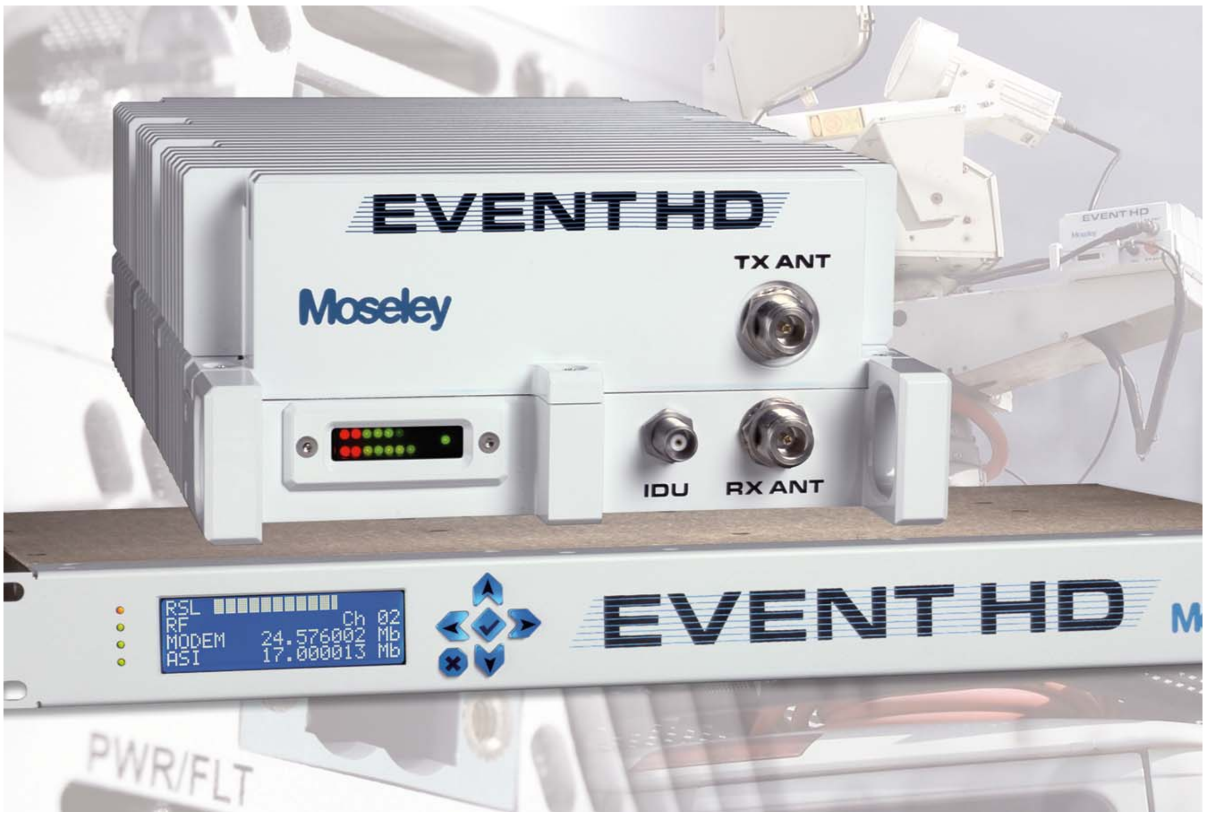
Event HD



User Reference and Installation Manual

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Table of Contents

List of Figures

List of Tables

Moseley

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1.Safety Precautions

PLEASE READ THESE SAFETY PRECAUTIONS!

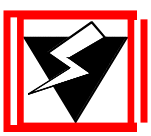
RF Energy Health Hazard

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

The radio equipment described in this guide uses radio frequency transmitters. Do not allow people to come in close proximity to the front of the antenna while the transmitter is operating. The antenna will be professional installed on fixed-mounted outdoor permanent structures to provide separation from any other antenna and all persons.

WARNING: RF Energy Exposure Limits and Applicable Rules for 6-38 GHz. It is recommended that the radio equipment operator refer to the RF exposure rules and precaution for each frequency band and other applicable rules and precautions with respect to transmitters, facilities, and operations that may affect the environment due to RF emissions for each radio equipment deployment site.

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



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.

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

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 of an ODU (if applicable) when the radio is active.

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.

Warning – 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.

Warning – Turn off all power before servicing

WARNING: Turn off all power before servicing.

Safety Requirements

Safety requirements require a switch be employed between the SDIDU™ external power supply and the SDIDU™ power supplies.

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.

2.System Description

2.1About This Manual

This manual is written for those who are involved in the "hands-on" installation of the EVENT HD 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.

2.2Introduction

The Moseley family of digital radios provides high capacity transmission, flexibility, features, and convenience for wireless digital communications networks. The Moseley 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.

The Moseley EVENT HD is a digital microwave radio terminal composed of a Software Defined Indoor Unit™ (SDIDU™) and Outdoor Unit (ODU). The SDIDU is common to all product lines whereas the ODU, the radio transceiver unit which establishes the frequency of operation, is selected by application and model. The ODU is fully interchangeable covering the licensed 2, 7, 13, 18, and 23 GHz bands as well as the unlicensed 5.3 and 5.8 GHz ISM bands. Some applications are:

Broadcast STL (Studio-to-Transmitter Link) and BAS (Broadcast Auxiliary Service) for for licensed half-duplex applications, FCC part 74.602, for data rates to 150 Mbps,

- 2 GHz band between 1990 to 2110 MHz in 12 MHz and 17 MHz channels.
- 6.5 GHz band between 6425 to 6525 MHz in 25 MHz channels.
- 7 GHz band between 6825 to 7125 MHz in 25 MHz channels.
- 13 GHz band between 12.7 to 13.25 GHz in 25 MHz channels.

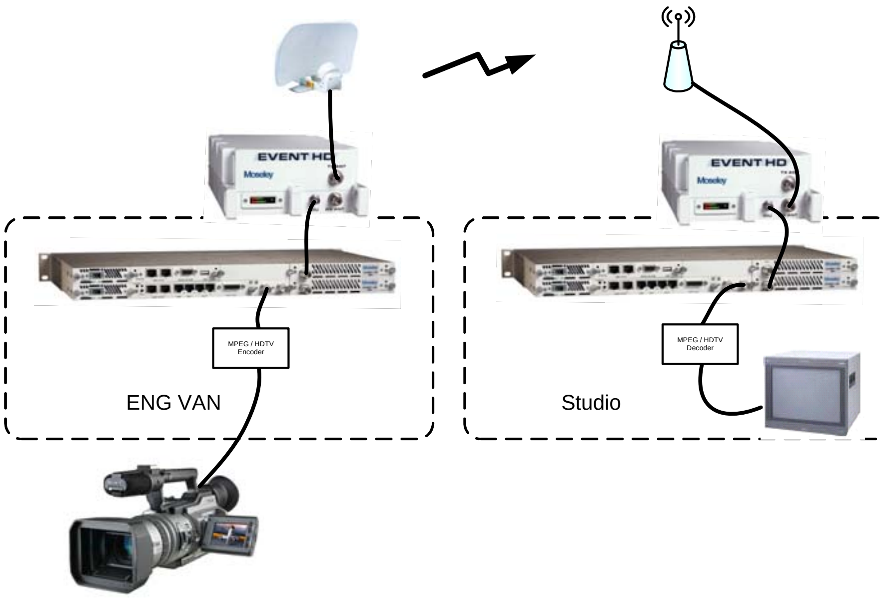


Figure 2-1. Typical Broadcast ENG Application

Unlicensed high-capacity full-duplex data and broadcast applications for data rates to 100 Mbps,

- 5.3 GHz band between 5.25 to 5.35 GHz for U-NII in 13, 20, and 30 MHz channels.
- 5.8 GHz band between 5.725 to 5.850 GHz for ISM in 12.5, 16.7, 25, and 30 MHz channels.

Licensed high-capacity full-duplex data and broadcast applications for data rates to 100 Mbps,

- 2/2.2 GHz band, Canada and Australia.
- 6.8 GHz band, FCC part 101.147, in 10 MHz channels.
- 6 GHz lower and upper, and 7 GHz ETSI.
- 18 and 23 GHz, US part 101.

The Event HD digital radios support diversity, 1+0, and 1+1 protection and ring architectures in a single 1 RU chassis. The modem and power supply functions are supported using easily replaceable plug-in modules. An additional feature of the SDIDU™ is provision for a second plug-in modem/IF module to provide diversity, repeater or east/west network configurations.

The Event HD 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. Furthermore, a highlight of the Event HD is scalability and the capability to support a ring-type architecture. This ring or consecutive point radio architecture is self-healing in the event of an outage in the link and automatically re-routes data traffic, thereby ensuring that service to the end user is not interrupted.

The Event HD digital radios enable 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 overall split mount architecture consists of a single 1RU rack mount Software Defined Indoor Unit (SDIDUTM) with a cable connecting to an Outdoor Unit (ODU) with an external antenna.

Figure 2-2. Microwave Split Mount Architecture

Table 2-2 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 and Advantages of the Event-HD Radios

Benefits	Advantages to Providers/Customers	Reference
Software Defined Indoor Unit (SDIDU™)		
Universal signal processing platform	Enables easy network interface options and network capacity growth in the future.	2.2 – 2.5
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.	

Benefits	Advantages to Providers/Customers	Reference
Easy to install units		
Straightforward modular system enables fast deployment and activation. Carrier-class reliability.	Fast return on investment. No monthly leased line fees.	3.1, 3.4, 3.6
Complete support of payload capacity with additional voice orderwire		
Aggregate capacity beyond basic network payload. Scalable and spectrally efficient system. Separate networks for radio overhead/management and user payload.	Increases available bandwidth of network. Allows customer full use of revenue-generating payload channel. Lowers total cost of ownership.	2.2 – 2.5
Ring Architecture		
Supports a ring (consecutive point) configuration, thus creating a self-healing redundancy that is more reliable than traditional point-to-point networks. In the event of an outage, traffic is automatically rerouted via another part of the ring without service interruption. Ring/consecutive point networks can overcome line-of-sight issues and reach more buildings than other traditional wireless networks. Networks can be expanded by adding more Software Defined IDU™ or more rings, without interruption of service. A separate management channel allows for a dedicated maintenance ring with connections to each Software Defined IDU™ on the ring.	Enables network scalability. Increases deployment scenarios for initial deployment as well as network expansion with reduced line-of-sight issues. Increases network reliability due to self-healing redundancy of the network. Minimizes total cost of ownership and maintenance of the network. Allows for mass deployment.	2.6
Adaptive Power Control		
Automatically adjusts transmit power in discrete increments in response to RF interference.	Enables dense deployment. Simplifies deployment and network management.	2.7
Comprehensive Link/Network Management Software		

Benefits	Advantages to Providers/Customers	Reference
A graphical user interface offers security, configuration, fault, and performance management via standard craft interfaces. Suite of SNMP-compatible network management tools that provide robust local and remote management capabilities.	Simplifies management of radio network and minimizes resources as entire network can be centrally managed out of any location. Simplifies troubleshooting of single radios, links, or entire networks. Simplifies network upgrades with remote software upgrades. Allows for mass deployment.	2.5, 2.8

2.3System Features

- Selectable Rates and Interfaces
  - o DVB-ASI interface application scalable from 10 to 100 Mbps.
  - o PDH Options
    - Up to 16 x E1/T1
    - 100BaseTX/Ethernet: Scalable 1-100 Mbps
    - DS-3/E-3/STS-1
  - o Super PDH Options
    - Up to 32 x E1/T1
    - 100 BaseTX/Ethernet: Scalable 1-100 Mbps
  - o SDH Options
    - 1-2 x SDH STM-1/OC-3 SONET
- Support for multiple configurations for both PDH and SDH
  - o 1+0, 1+1 protection/diversity
  - o Hot Standby
  - o 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 Voice Orderwire Channels
- Adaptive Power Control
- Standard high-power feature at antenna port
  - 5W (37 dBm) 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 160 E1s (200 T1s) to be mapped any-to-any between front-panel ports and RF link(s).

2.4Physical Description

The following section details the physical features of the Event HD™ digital radios.

- Model Types
- Front and rear panel configurations
- LED and I/O descriptions

2.4.1 Model Types

The following model types are available with associated ODU configuration:

Product Name	Band	Primary Data Interfaces	Primary Throughput	ODU
1. Event 2200	1990-2110	*ASI* *Ethernet*	*10-100 Mbps* *2 Mbps*	 *ODU2200*
2. Event 2200 FD	2025-2150	*16xE1/T1* *2xEthernet*	*up to 100 Mbps*	 *ODU2200FD*
	2200-2300	*16xE1/T1* *2xEthernet*	*up to 100 Mbps*	
3. Event 2500	2450-2500	*ASI* *Ethernet*	*10-100 Mbps* *2 Mbps*	 *ODU2500*
4. Event 5300	5250-5350	*16xE1/T1* *2xEthernet*	*up to 100 Mbps*	 *ODU5300*
5. Event 5800	5725-5850	*16xE1/T1* *2xEthernet*	*up to 100 Mbps*	 *ODU5800*
6. Event 6500	6425-6525	*ASI* *Ethernet*	*10-150 Mbps* *2 Mbps*	 *ODU6500*
7. Event 6800	6525-6875	*16xE1/T1* *2xEthernet*	*up to 100 Mbps*	 *ODU6800*
8. Event 7200	6875-7125	*ASI* *Ethernet*	*10-150 Mbps* *2 Mbps*	 *ODU7200*
9. Event 13G	*12700-13250*	*ASI* *Ethernet*	*10-150 Mbps* *2 Mbps*	 *ODU13G/18G/23G*

2.4.2 Front Panel

All models of the Event HD are available with an optional front panel to perform primary configuration functions such as change frequency and monitor receiver status and radio health parameters. The panel is shown in Figure 2-2.

Figure 2-2. Event-HD front panel (optional)

The menu structure is navigated with the arrow keys, using the “check” key to enter, and the **X** key to escape (go back one level). The menu structure gives access to three primary functions: Status, Configuration, and Alarms. The menus are navigated as follows:

Event Status Configuration Alarms		
Status Transmit Receive Versions		
Transmit Output Pwr: xx.xxxxx Freq : x.xxxxxx	Receive Freq: x.xxxxxx Modem Errors	Versions FP:xxxxxxxxxx IDU/ODU
	Modem RSL :-xx.xxxx SNR :x.xxxxxx Lock:xxxxxxxx	IDU/ODU Software/FPGA Configuration Firmware
	Errors Last Err sec:xxxxxx Err sec 24h:xxxxxx	Software/FPGA Kernel:xxxxxxxxxxxx Appl :xxxxxxxxxxxx FPGA :xxxxxxxxxxxx
		Configuration ODU :xxxxxxxxxxxxx Modes:xxxxxxxxxxxxx Chan :xxxxxxxxxxxxx
		Firmware ODU :xxxxxxxxx Boot :xxxxxxxxx Modm :xxxxxxxxx

Configuration ODU Control ODU Channel Administration		
ODU Control Str Tx Pwr:x.xxxxx Mute :xxxxxx State :xxxxxx	ODU Channel Link Loopback	Administration xxxx days xxh:xxm FP Network IDU Network
	Link Freq:x.xxxxxx Link:QPSK-10.5Mbaud dataR=BaudR*mod	FP Network IP :xxx.xxx.xxx.xxx Mask:xxx.xxx.xxx.xxx GW :xxx.xxx.xxx.xxx
	Loopback Type:combo of 3 LIU: combo Duration: combo	IDU Network IP :xxx.xxx.xxx.xxx Mask:xxx.xxx.xxx.xxx GW :xxx.xxx.xxx.xxx
Alarms Active Clear		
1) mm-dd-yy hh:mm:ss xxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxx	Are you sure?	
2) mm-dd-yy hh:mm:ss xxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxx	Alarms Cleared	

The front panel provides immediate and convenient access to these functions however much more extensive configuration and status information (status, alarm, graphical history, constellations, etc.) are provided via the NMS Ethernet interface and web GUI.

2.4.3Rear Panel Indicators

All models of the Event HD support a variety of rear panel configurations that are dependent on the network interface and capacity configurations.

Figure 2-2 provides an example of the Event HD 1+0 configuration and the associated LEDs displayed on the SDIDU^{TM} rear panel. The controller, standard I/O, and each modem card have a status LED.

Figure 2-2. Software Defined IDU™ LEDs: SDIDU™ Rear Panel Configuration for Software Defined IDU™, 1+0 Configuration

The modem status LED indicates the modem status as described in Table 2-2.

Table 2-2. 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 2-3. DVB-ASI Input 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 2-4. DVB-ASI Output 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)

The controller status LED is the primary rear 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.

The standard I/O and modem status LEDs are set to red when certain alarms are posted. A complete list of alarms is provided in Appendix 6.1.

The alarm description is also displayed in the Graphical User Interface (GUI) as described in the User Interface Reference Manual.

2.4.4Rear Panel Connections

Refer to the Figure 2-3 for an example of a Software Defined IDU™ rear panel followed by a description of the connections.

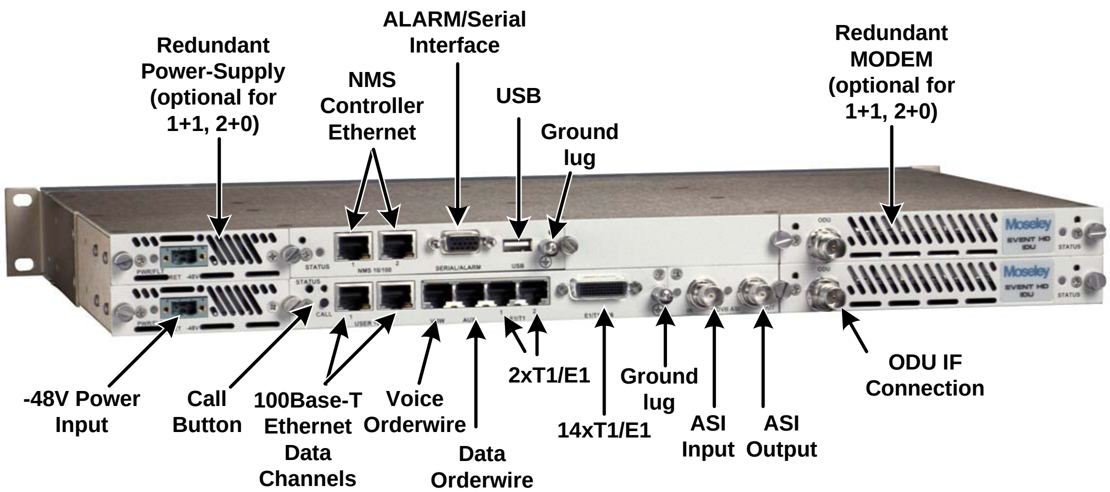


Figure 2-3. Software Defined IDU™-SB, 1+1 Protection: SDIDU™ Rear Panel Connections

Power Supply Input

DC Input **-48 VDC**	48v (Isolated Input); 2-pin captive power connector. The Software Defined IDU™ requires an input of 48 volts dc ±10% at the rear panel DC Input connector. The total required power is dependent on the option cards and protection configuration (1+0, 1+1). The SDIDU™ rear panel power connector pin numbering is 1 through 2, from left to right, when facing the unit rear panel. Pin 1 is the power supply return and is connected to unit chassis ground internally. Pin 2 should be supplied with a nominal 48 V 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 52 V dc at 2 Amps minimum. It is recommended that any power supply used be able to supply a minimum of 100 W to the SDIDU™. A mating power cable connector is supplied with the Software Defined IDU™. 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 48 Vdc is 18 AWG. The SDIDU™ supplies the ODU with all required power via the ODU/SDIDU™ Interconnect cable. The Software Defined IDU™ does not have a power on/off switch. When DC power is connected to the SDIDU™, the digital radio powers up and is operational. There can be up to 320 mW of RF power present at the antenna port (external antenna version). The antenna should be directed safely when power is applied.

Alarm/Serial Interface

Alarms/Serial	DB-15HD female connector for two Form-C relay alarm outputs (rated load: 1A @ 24 VDC), 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.

USB Interface

USB	USB connector, reserved.

Voice Orderwire Connector

Call Button	The voice orderwire provides a PTP connection via a PTT handset and buzzer. The call button initiates a ring. Only the SDIDU's™ link partner will receive the ring. VOW does not ring all nodes or support "party line" calls.
Voice Orderwire	RJ-45 modular port connector for voice orderwire interface.

Data Orderwire Connector

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

NMS 10/100 Network Management System Connections

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

100/Ethernet Models: Ethernet 100BaseT Connections

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.

T1 Channels

T1 1-2	Two T1/E1 (RJ-48C) interface connections.
T1 3-8/16	Single Molex 60-pin connector containing 14 T1/E1 connections.

DVB/ASI, DS-3, E-3, and STS-1Connection (Optional Mini IO)

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.

OC-3 Connection (Optional Mini IO)

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.

STM-1 Connection (Optional Mini IO)

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

ODU/SDIDU™ Interconnect

To ODU	TNC female connector. Used to connect the ODU to the SDIDU™. Provides –48VDC and 350 MHz Transmit IF to the ODU and receives 140 MHz Receive IF from the ODU.

Ground Connection

Ground Lug	Two ground lugs are provided on the rear panel. Either may be used to connect the SDIDU™ to ground.

2.4.5ODU LED Indicators

The ODU 2200, 6500, and 7200 has an externally visible LED meter that provides both RSL (Receive Signal Level) and transmit power. For full-duplex operation the ODU meter displays RSL on the top bar and transmit level on the bottom bar as shown in Figure 2-4.

Figure 2-4. ODU 2200 RSSI Output vs. Received Signal.

The upper RSL LED meter is calibrated to represent exactly 10 dB for each LED, going from -95 dBm at the far left (red) to -15 dBm at the far right (green). The brightness of each LED is modulated for levels between 0 to 10 dB such that the far left LED will be fully extinguished at -95 dBm and the far right LED will be fully illuminated at -15 dBm. When the RSL is in the red region (<-75 dBm) the signal level is approaching or has reached threshold (depends on modulation type).

The transmit LED indicates full power will all 8 LEDs illuminated to minimum power with 1 LED illuminated. For simplex applications the both rows indicate either RSL or transmit power.

2.5System Description

The overall Event-HD digital radio architecture consists of a single 1RU rack mount Software Defined Indoor Unit™ (SDIDU™) with a cable connecting to an Outdoor Unit (ODU). The IF signal between the SDIDU and ODU operates at a relatively low frequency compared with the RF signal allowing for extensive cable runs in excess of 250 m with inexpensive coaxial cable with no degradation in radio performance.

The Event-HD ODU is mounted to a fixed or telescoping antenna mast near the desired antenna location providing a short cable run between ODU and antenna at the RF frequency. This SDIDU /ODU architecture is advantageous when compared to a single IDU (no ODU) with external mount antenna as operating at these RF frequencies from the IDU rack to the antenna will result in significant signal degradation and require expensive low-loss coaxial cable or waveguide.

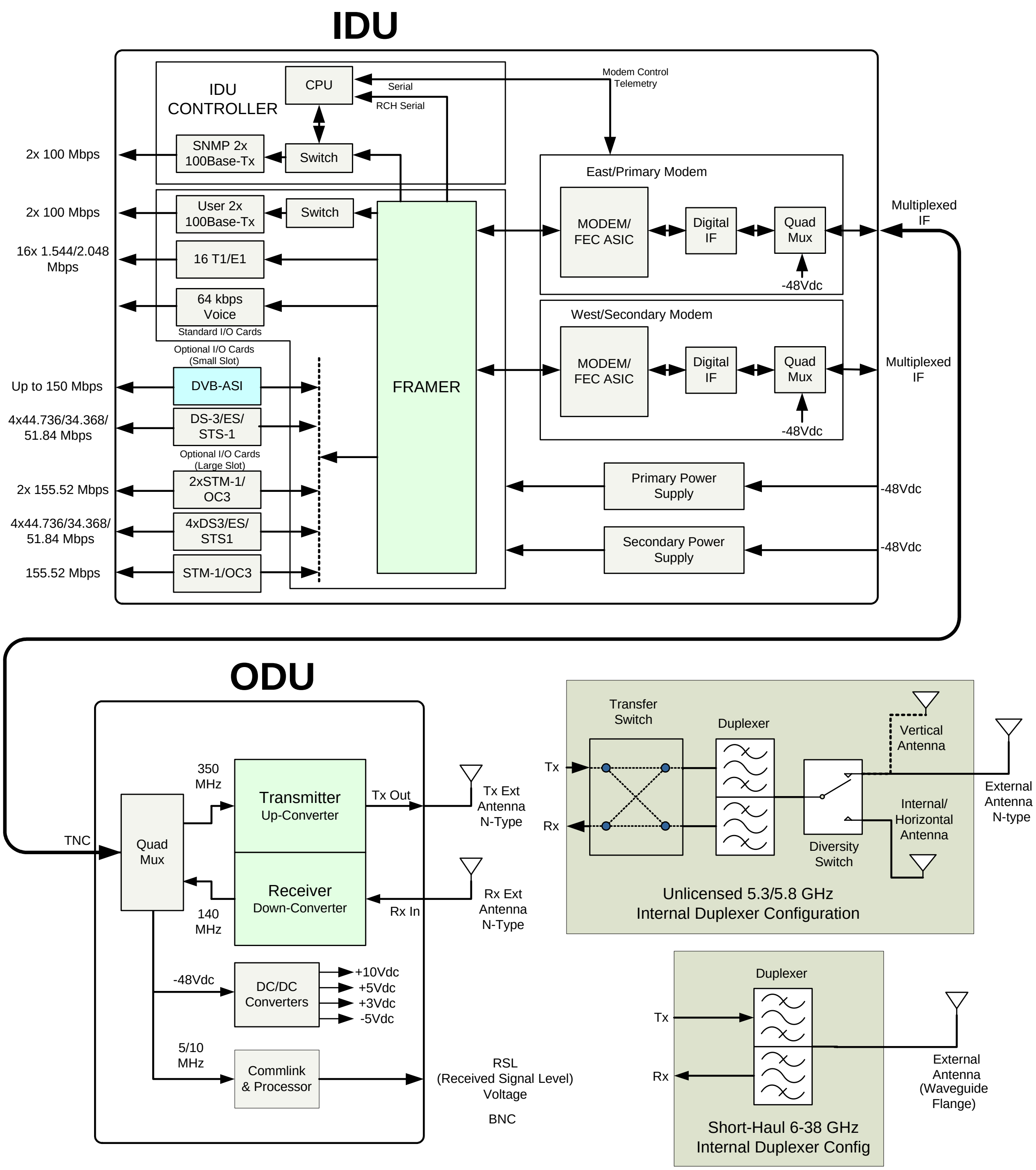


Figure 2-5. Event-HD Block Diagram

Figure 2-5 shows the Event-HD digital radio and interfaces from a functional point of view. The functional partitions for the I/O, Modem/IF, power supply modules, up/down converters, and internal RF duplexing partition are shown. The SDIDU™ 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 ODUs are interchangeable allowing use of a single IDU in licensed, unlicensed, and short-haul applications by swapping the RF component.

The Event-HD ODU 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-HD digital radio modem performs QPSK, 16-QAM, 32-QAM, 64-QAM, and 128-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 128 Quadrature Amplitude Modulation (QAM). Table 2-5 summarizes the TCM/convolutional code rates for each modulation type supported by the Event-HD.

Table 2-5. Event-HD 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	11/12

The major functions of the SDIDU™ can be summarized as follows:

- I/O Processing – Event-HD digital radio comes with a standard I/O capability that includes support for up to 16xT1/E1 and 2x100Base-TX user payloads, 2x100Base-TX for SNMP, and voice orderwire. 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-HD architecture is flexible and allows for the addition of other I/O types in the future.

- Switch/Framing – The Event-HD digital radio 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 – The Event-HD digital radio includes a Network Processor which performs SNMP and Network Management functions.

- Modem/IF – The Event-HD digital radio 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. The multiplexer function is built into an appliqué that resides in the Modem/IF Module. Two modems can be used for 1+1 protection or ring architectures.

- Power Supply – The Event-HD power supply accepts 48 Vdc and supplies the SDIDU™ and ODU with power. A second redundant power supply may be added as an optional module.

The Modem Processor and its associated RAM, ROM, and peripherals control the digital and analog operation. It also provides configuration and control for both the IF and I/O cards. The SDIDU interfaces with the ODU to receive and provide modulated transmit and receive waveforms.

The Event-HD digital radio also provides the physical interface for the user payload and network management. In transmit mode, the Framer merges user payload (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 SDIDU™ supports Scalable Ethernet data rates, such as 25 or 50 Mbps via the 100BaseT data interface port. The SDIDU™ 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 the SDIDU™ for configuration, control, and status monitoring. The CPU passes appropriate status information to the SDIDU™ rear panel display.

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

2.6Consecutive Point Architecture

The consecutive point network architecture is based upon 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 (see Figure 2-6). This architecture lets providers deliver high bandwidth with high availability to their customers.

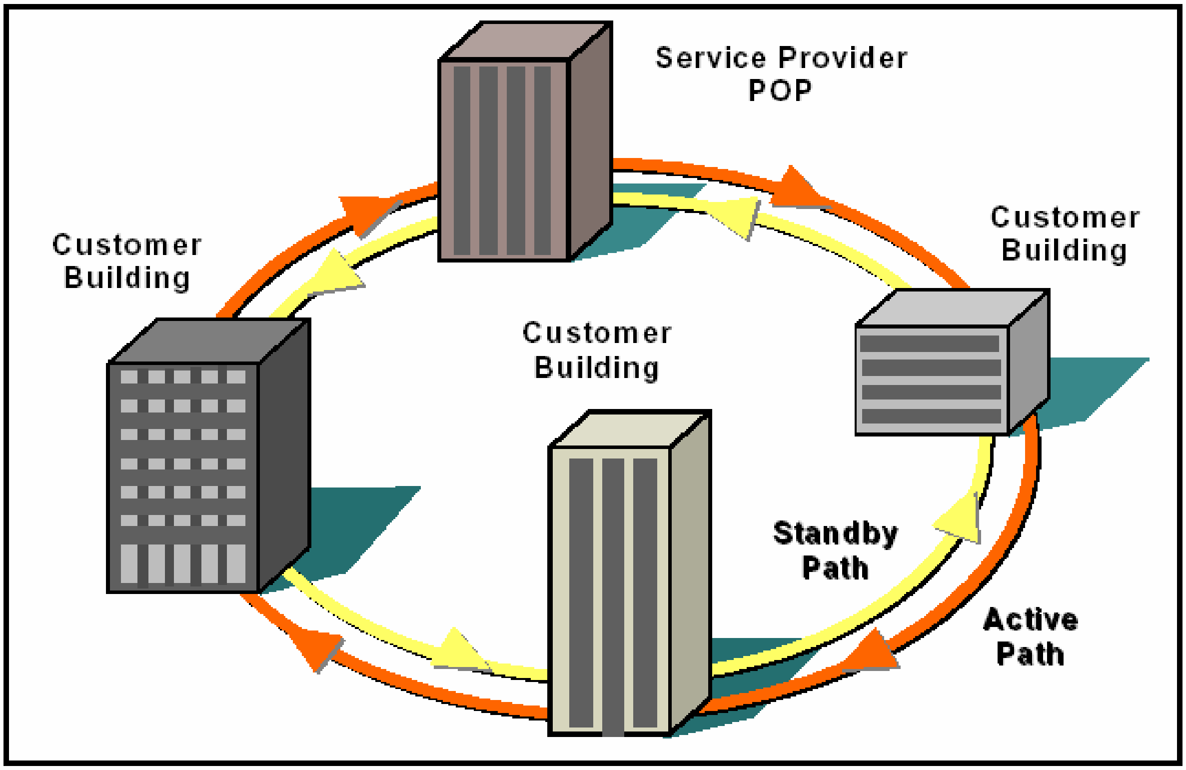


Figure 2-6. Ring Configuration

SONET/SDH rings are inherently self-healing. Each ring has both 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 Software Defined IDU™. 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 for an ethernet network in Figure 2-7. For 2 x 1+0 and 2 x 1+1 nodes payload and NMS connections need to be jumpered between two SDIDU™. For 1 x 2+0 nodes, there is no need for jumpers as there is a single SDIDU™. For SDH or SONET payloads, the configuration is similar but an external add/drop mux is required.

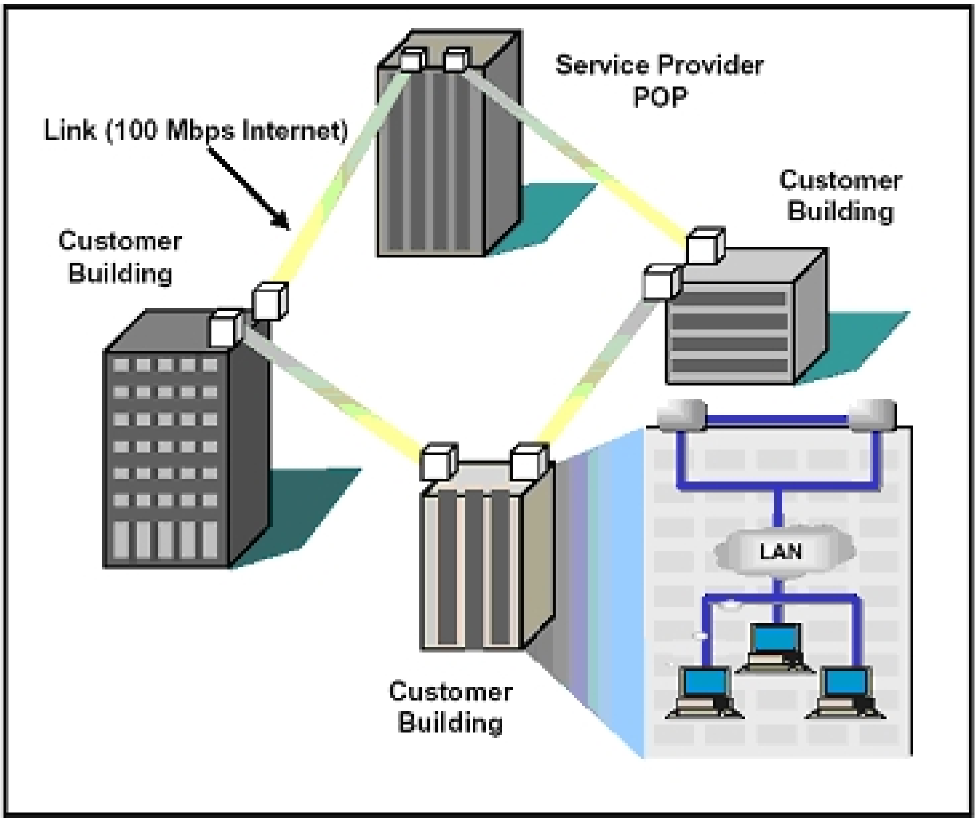


Figure 2-7. Consecutive Point Network

2.72 + 0 (East-West) Configuration

The Event-HD supports a 2+0, or east-west, configuration that allows a consecutive point architecture to be achieved with only a single 1 RU chassis at each location. In this configuration the SDIDU™ contains two modems and may contain two power supplies. One modem is referred to as the west modem and the other as the east modem. The SDIDU™ is connected to two ODUs, one broadcasting/receiving in one directing of the ring architecture and the other broadcasting/receiving in the other as shown in Figure 2-8.

Figure 2-8. 2 + 0 (East West) Configuration

2.8Spanning 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.

2.9 1+1 Protection

The Event HD supports 1+1 protection as an option for a critical link. In this configuration, protection is provided in a single 1 RU chassis. The SDIDUTM contains two power supplies and two modems. The power supply, ODU, 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 called Protected Non-Diversity and Protected Diversity.

2.9.1 Protected Non-Diversity (Hot Standby)

Figure 2-9 shows operation in Protected Non-Diversity mode, also called Hot Standby. In this mode, one ODU at each location transmits to two ODUs at the other location. This mode does not require the extra bandwidth or interference protection. It provides hitless receive switching and hot standby. The SDIDU™ automatically switches transmit ODU upon appropriate ODU alarm or ODU interface error, minimizing transmit outage time.

Figure 2-9. 1+1 Protection in Non-Diversity Mode

2.9.2 Protected Diversity

In Protected Diversity mode, the link between each pair of modems is the same, as shown in Figure 2-10, providing complete redundancy. This arrangement requires bandwidth for both links and non-interference between the links, but it provides hitless receive and transmit switching. The SDIDU™ supports both frequency and spatial diversity.

Figure 2-10. 1+1 Protection in Diversity Mode

2.9.2.1 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).

2.9.2.2 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).

2.9.2.2.1Single Transmitter

Protected Non-Diversity, or Hot Standby, is also referred to as Single Transmitter Spatial Diversity. For more information on this mode, see Section 2.9.1.

2.9.2.2.2Dual Transmitter

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

2.101 + 1 Multi-hop Repeater Configuration

The Event HD supports a 1 + 1 multi-hop repeater configuration with drop/insert capability as shown in Figure 2-11. This configuration provides individual 1 + 1 link protection as described in section 2.7, as well as the full-scale protection inherent in the consecutive point architecture as described in section 2.6. At each location within the network, data may be dropped or inserted. In this configuration each SDIDU™ contains two power supplies and two modems.

Figure 2-11. 1 + 1 Multi-Hop Repeater Configuration

2.11Data 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-IO 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.

2.12Crosspoint Switch

The SDIDU™ crosspoint switch provides any-to-any E1/T1 routing between rear panel ports and RF links, as shown in Figure 2-12. Flexible channel mapping allows selection from predefined routings or custom routing. Custom routings are uploaded to the SDIDU™ via FTP. Two examples of the crosspoint capability are to use the crosspoint switch to configure a repeater or an add/drop. These examples are shown in Figure 2-13. 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 rear-panel ports.

Figure 2-12. Crosspoint Switch

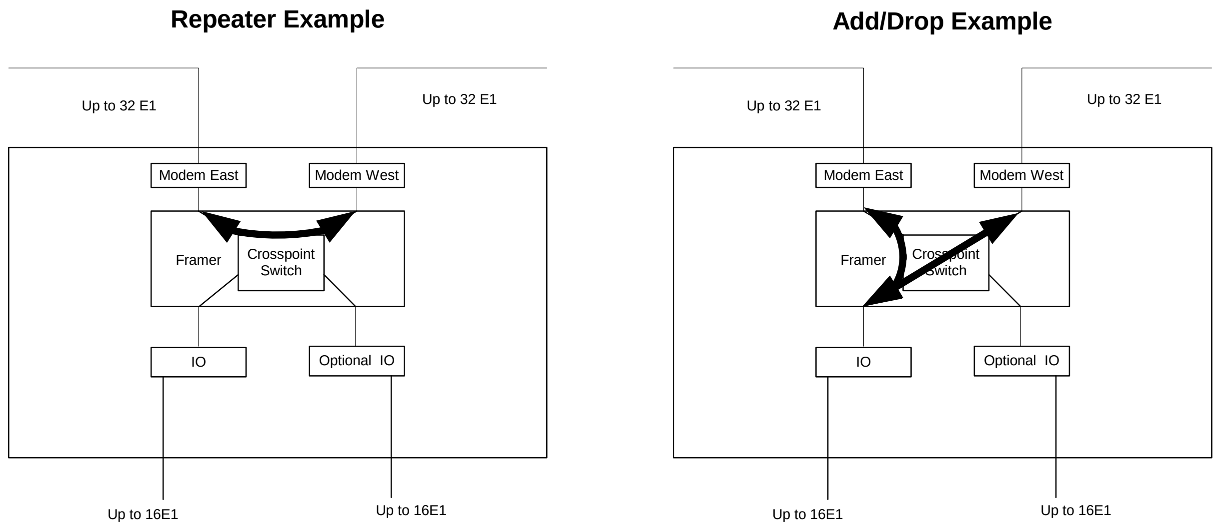


Figure 2-13. (a) Crosspoint Switch used a passthrough in repeater configuration. (b) Crosspoint Switch allows access for add/drop.

2.13 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 the Event-HD uses a unique power control technique called A_dTPC. A_dTPC enables Event-HD to transmit at the minimum power level necessary to maintain a link regardless of the prevailing weather and interference conditions. The Event-HD 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 Event-HD radios constantly monitor receive power and maintain 10^{-12} BER performance under varying interference and climate conditions. Each Event-HD 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-HD 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-HD units in a smaller area.

2.14 Event-HD Software and Network Management

All of the Event-HD parameters are accessible in three ways:

1. Using a standard web-browser via HTTP to access the built in web server.

2. Via SNMP using the fully featured MIB, allowing for automation of data collection and network management.

3. Via a command line client accessible from a terminal client connected to the serial port, or telnet over the NMS Ethernet.

The GUI (HTTP), SNMP, and CLI interfaces are discussed in detail in the Software Defined IDU™ User Interface Manual.

2.14.1 IP Address

Each Event-HD radio is configured independently for network parameters such as IP address, subnet, and gateway. However, the Event-HD also supports acting as a DHCP client, in which case the IP address can be assigned to the Event-HD radio using a DHCP server. A specific IP address may be associated with a particular Event-HD radio by configuring the DHCP server to serve IP addresses based upon the SDIDU™ Ethernet MAC address.

2.14.2 Network

The Event-HD uses an “Out-of-Band” NMS network which is separated from the payload Ethernet network. Each Event-HD contains a managed Layer 2 Ethernet switch that supports Spanning-Tree Protocol (STP) for managing NMS traffic. This allows the Event-

HD 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. The Event-HD acts as a network bridge via the Ethernet switch and STP. The Event-HD does not currently support NMS routing capability.

2.14.3NMS Network Operational Principles

The Event-HD does not provide routing capability. Therefore, *all Event-HD radios must be on the same subnet as the PC being used to access the Event-HD radios.* If the Event-HD radios and/or the PC are on different subnets, a router must be used, with the gateway addresses set appropriately. Figure 2-14 shows the PC and both Event-HD SDIDUs™ in the same subnet. In this case, no router is required. Figure 2-15 shows the PC and one of the Event-HD SDIDUs™ in one subnet and the other Event-HD SDIDU™ 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-HD SDIDU™ in the other subnet.

Figure 2-14. PC and Event-HD SDIDUs™ on Same Subnet

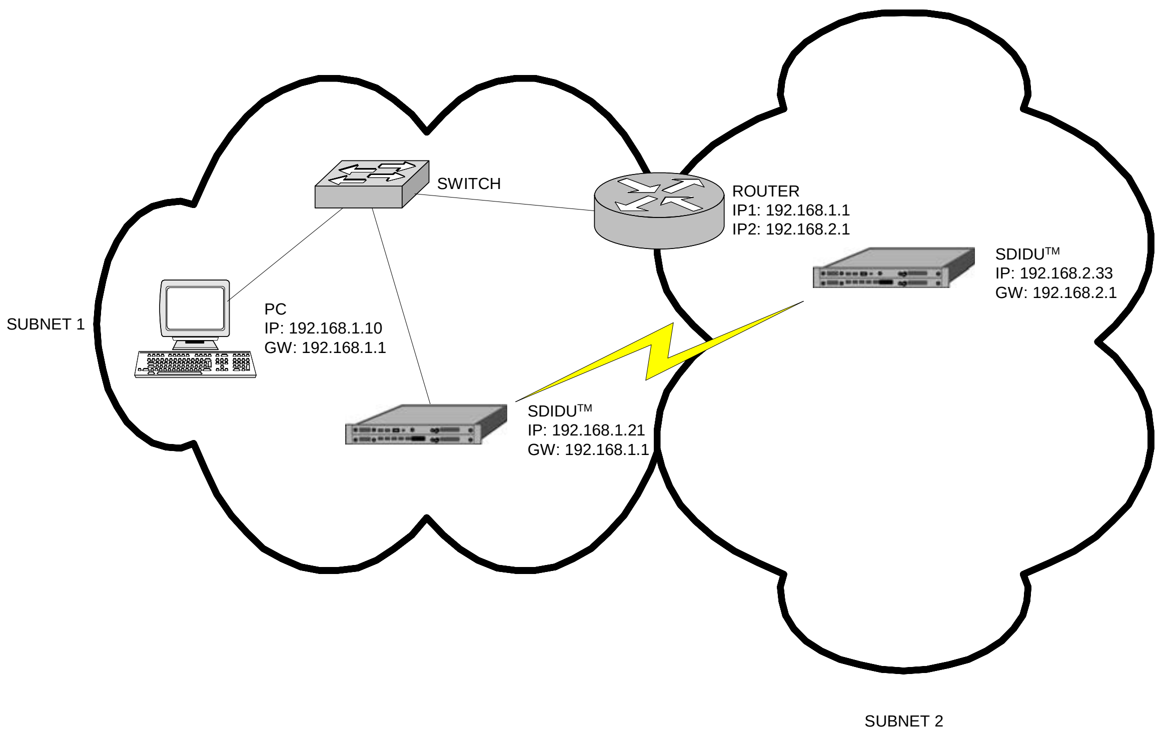


Figure 2-15. Event-HD SDIDUs™ on Different Subnets

2.14.4Third Party Network Management Software Support

The Event-HD SDIDU™ 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

The Event-HD SDIDU™ may also be managed via HTTP, TELNET, and SSH protocols.

2.15 System Loopbacks

The Event-HD SDIDU™ provides system loopbacks as a means for test and verification of a unit, link, and/or network. A variety of loopback points, including LIU selection, are available. Loopback points and duration are easily selected through the Graphical User Interface, for more information see the User Interface Guide.

3. Installation

3.1 Unpacking

The following is a list of possible included items.

Description	Quantity
Event-HD SDIDU™ (1RU chassis)	1
ODU (with hardware)	1
Manual (or Soft copy on a CD)	1

ODUs

SDIDU™

Figure 3-1. Event HD (1+0) Components

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.

3.2 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 ODU and SDIDU™ WHEN THE UNIT IS PLUGGED IN. TO PREVENT ELECTRICAL SHOCK, UNPLUG THE POWER CABLE BEFORE SERVICING. UNIT SHOULD BE SERVICED BY QUALIFIED PERSONNEL ONLY.

3.3 PRE-INSTALLATION NOTES

It may be useful to gain familiarity with the Software Defined IDU™ via back-to-back bench testing prior to final installation. We highly recommend installation of lightning protectors on the ODU/ SDIDU™ Interconnect Cable to prevent line surges from damaging expensive components.

3.4 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, TNC-male connectors on ODU interfaces.
- Three Inline RF attenuators, 2 x 30 dB (10 Watts min.) and 1 x 20 dB (2 Watts min.), rated for ODU frequency.

The Event-HD SDIDU™ and ODUs must be configured in an operational configuration and set-up as shown in Figure 3-2 for ODUs with transmit powers 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 operational configuration, no errors should be reported on the rear panel.

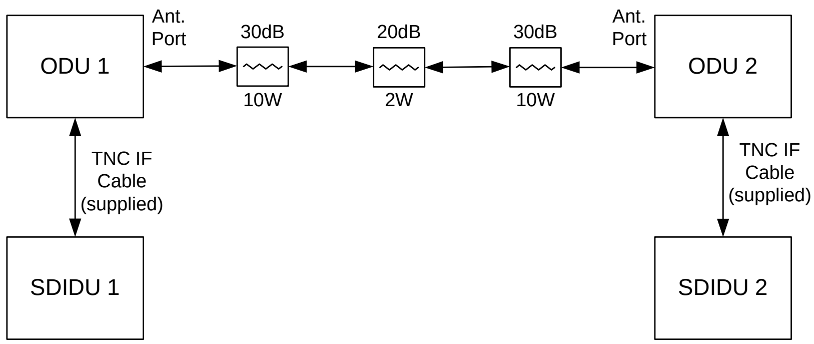


Figure 3-2. Event-HD Back-to-Back Testing Configuration

3.5 Overview of Installation and Testing Process

The installation and testing process is accomplished by performing a series of separate, yet interrelated, procedures, each of which is required for the successful implementation of a production Event-HD network. These procedures are as follows:

- Site Evaluation: gathering specific information about potential Event-HD radio™ installation sites.
- Cable and Installation: Testing and installing ODU cables and optional interface devices at installation sites.
- Event-HD ODU Mounting and Alignment: Mounting ODUs to a pole or wall, performing link alignment and radio frequency (RF) verification.
- Event-HD Digital Radio Configuration: Using Event-HD Link Manager software to install network- and site-specific parameters in the radios.
- Event-HD Digital Radio Testing: Performing cable continuity checks and RF tests for links, the payload/radio overhead channel, and the management channel.

The following diagram shows where installation and commissioning resides within the Event-HD network deployment life cycle and defines the sequence in which the processes that comprise installation and commissioning should be performed.

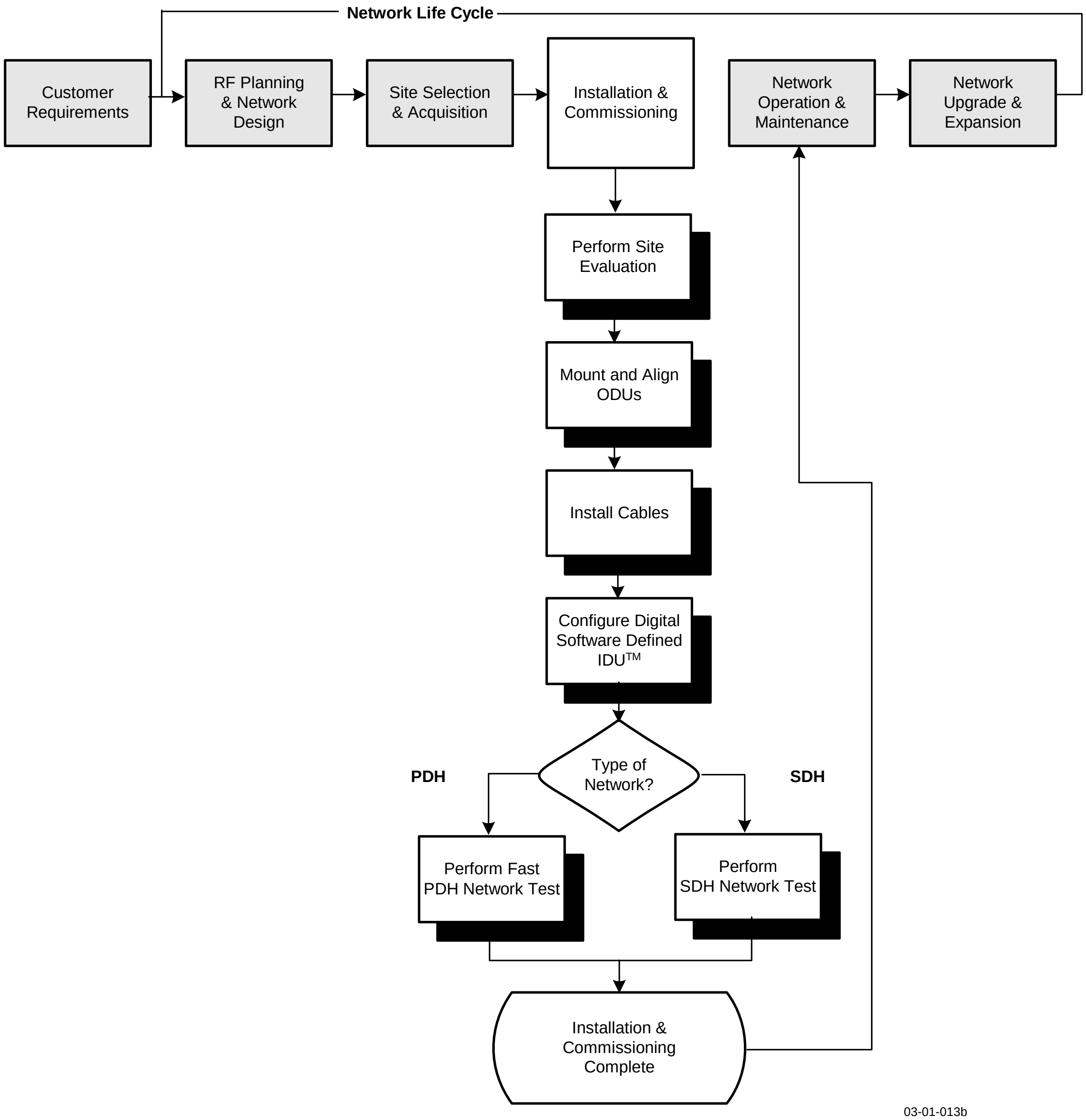


Figure 3-3. Network Deployment Lifecycle

3.6 Site Evaluation

A site evaluation consists of a series of procedures for gathering specific information about potential Event-HD 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
    - Event-HD ODU mounting locations
    - Site equipment locations
    - Cable routes
    - Any other potential RF sources
- Prepare site drawings and record site information

3.6.1 Preparing for a Site Evaluation

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")

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.

3.6.2 Site Evaluation Process

The following steps must be completed to perform a successful site evaluation. Each step in the process is detailed in the following subparagraphs:

- 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.

- 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.

- 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.**

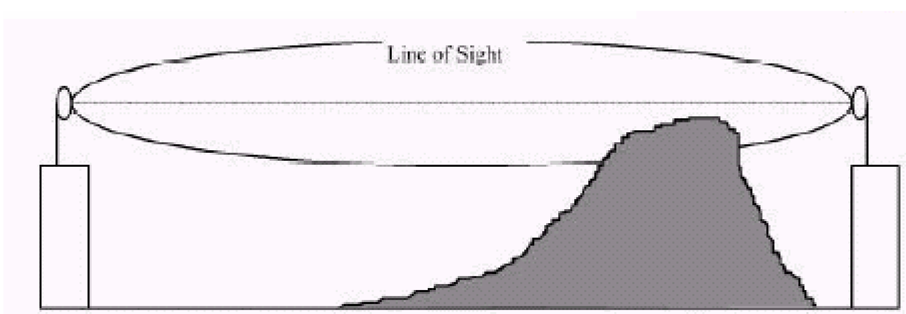
Event-HD radios must have a clear view of each other, or “line of sight”. Binoculars may be used evaluate the path from the desired location of the near antenna to the desired location of the far antenna.

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 Event-HD ODU can be mounted in the position required to correctly align the Event-HD ODU 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.

- Determine Event-HD ODU Mounting Requirements: Event-HD ODUs can be mounted on an antenna mast, brick, masonry or wall. Refer to detailed installation sections specific for each ODU and antenna type.

- Determine Event-HD Software Defined IDU™ Installation Location: Software Defined IDU™ can be installed tabletop or cabinet, wall mount, or rack mount. The site must provide DC power. Refer to detailed installation sections.

- Document Potential Sources of Co-location Interference: When Event-HD ODUs 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-HD ODU (horizontal and vertical)

    - Polarity (horizontal or vertical), if applicable

    - Transmit power level

    - Antenna direction

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

    - GPS: record the latitude and longitude for the near and far ODU 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.

    - 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.

- Select the Grounding Location for both the Event-HD ODU and SDIDU™: The Software Defined IDU™ must be properly grounded in order to protect it and the structure it is installed on from lightning damage. This requires

    - Grounding all Event-HD ODUs to antenna tower.

    - Grounding all SDIDU™ to the rack.

- Determine the Length of Interconnect Cable from Event-HD ODU to SDIDU™: The primary consideration for the outdoor interconnect cable from the Event-HD ODU to SDIDU™ is the distance and route between the Event-HD ODU and SDIDU™. This cable should not exceed 330 feet using Times Microwave LMR-200 cable. Guidelines are provided in Table 3-1. Exact distances should take ODU requirements into account.

Table 3-1. Maximum Cable Lengths

Cable Type	Loss at (dB/100 m) 140 MHz	Loss at (dB/100 m) 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.

- Confirm the Presence of DC Power for the Event-HD Software Defined IDU™.
- Ensure Building Aesthetics: Ensure that the ODU 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.
- Take Site Photographs
- Sketch the Site

3.6.3Critical System Calculations

3.6.3.1 Received Signal Level (RSL) and Link Budget

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

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

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) = $36.6 + 20\log_{10}(F*D)$

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)

3.6.3.2 Fade Margin Calculation

The fade margin is the difference between the actual received signal and the Event-HD 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.

3.6.3.3 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.*

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 as defined below:

Humid/Over Water: C = 4 (worst case channel)
Average Conditions: C = 1
Dry/Mountains: C = 0.25 (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.

3.6.4 Frequency Plan Determination

When configuring Event-HD units in a point-to-point or consecutive point configuration, careful engineering of the Event-HD 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 often 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 band of use. Desired 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 illustrated in Figures 3-3 through Figure 3-8 based on application frequency.

The channel assignments shown in the figures correspond to the channel numbers entered via the graphical user interface (GUI) or SNMP.

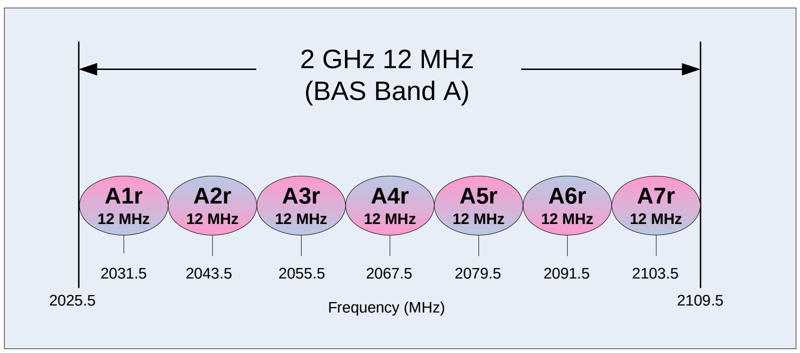


Figure 3-3. 2 GHz, 12 MHz BAS Frequency Plan

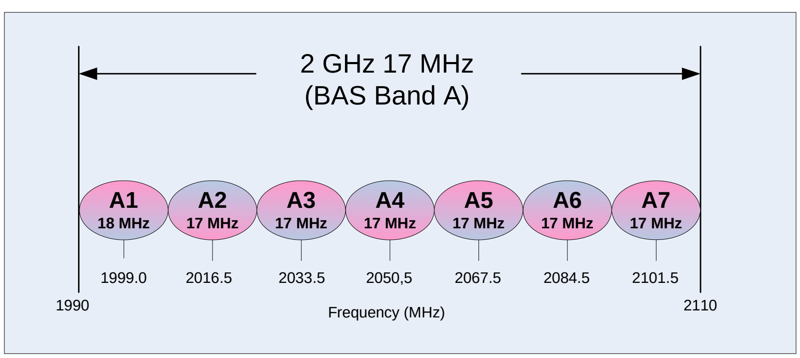


Figure 3-4. 2 GHz, 17 MHz Legacy BAS Frequency Plan

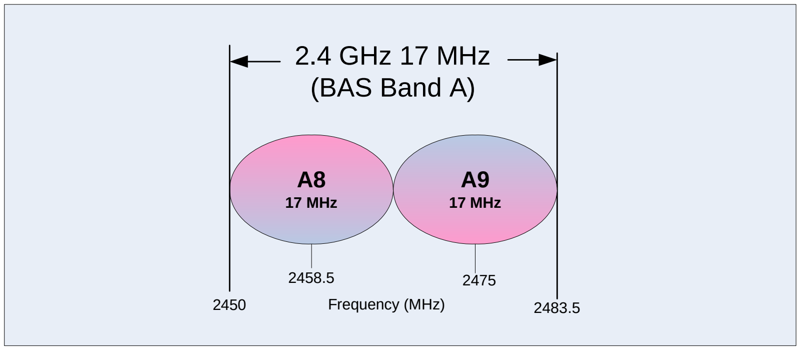


Figure 3-5. 2.4 GHz, 17 MHz BAS Frequency Plan

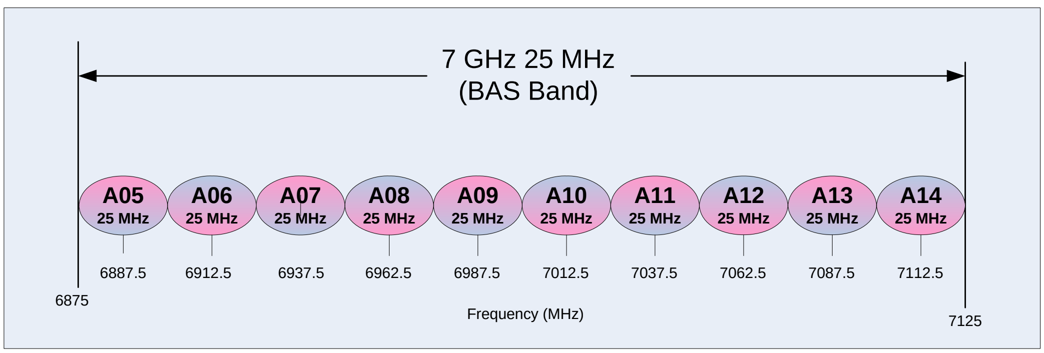


Figure 3-6. 7 GHz, 25 MHz BAS Frequency Plan

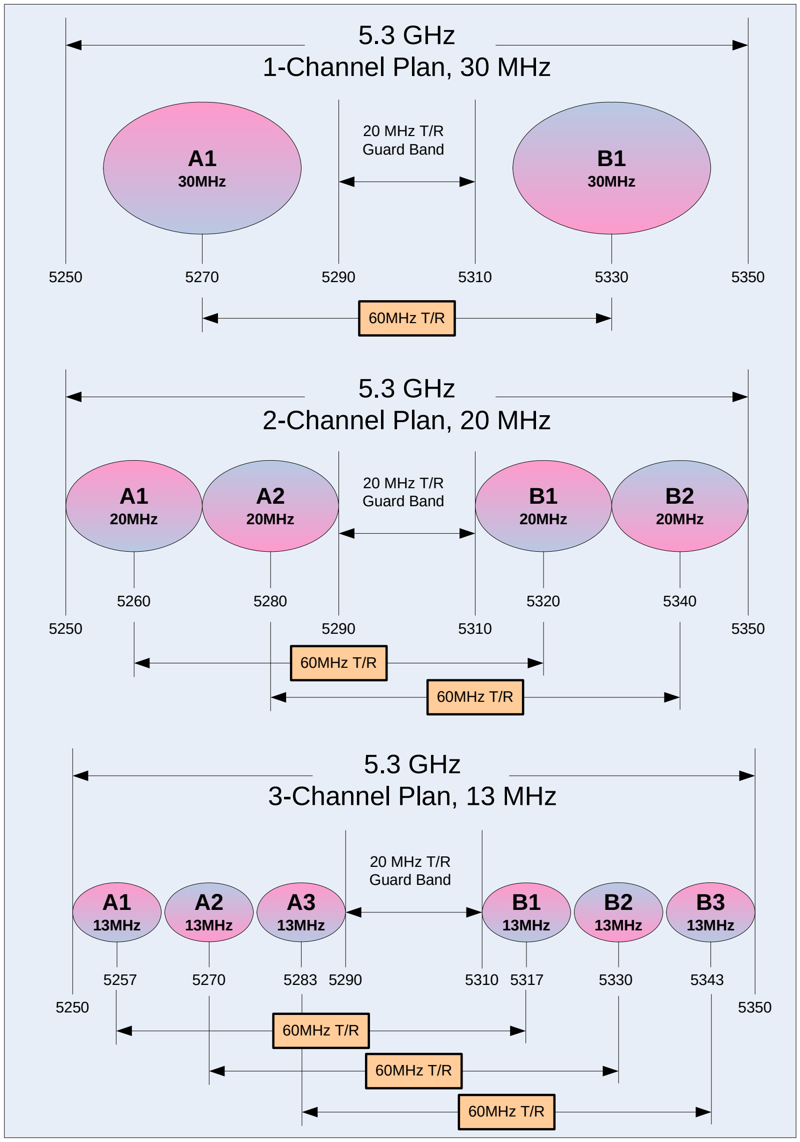


Figure 3-7. Event-HD 5.3 GHz Frequency Plan

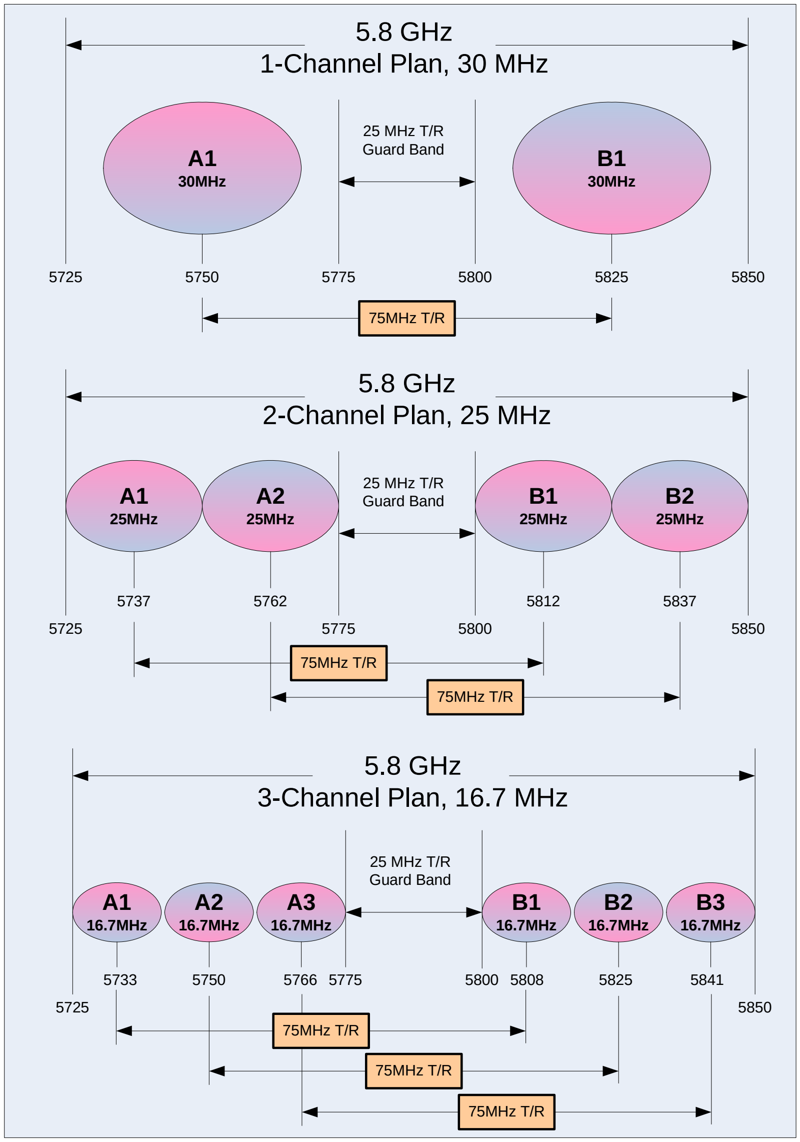


Figure 3-8. Event-HD 5.8 GHz Frequency Plan

3.6.5 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.

1. Select where the cable will enter the building from the outside.

2. 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.

3.6.6ODU Transmit Power Setup

Setting the ODU 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 2200 is 37 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 2200

Modulation	Backoff (dB)	Max.Output Power (dBm)
QPSK	0	37
16 QAM	-1	36
32 QAM	-2	35
64 QAM	-3	34
128 QAM	-4	33

3.6.6.1 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 ODU 5800 may therefore be operated at its maximum output power, +23 dBm, for maximum system gain.

EIRP is calculated for link budget with external antennas as,

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

For internal antenna (23 dBi) EIRP is,

EIRP(avg) = 46 dBm

3.6.6.2 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 3-1 for both internal antenna and external antenna ODU configurations, along with the operational bandwidths.

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.

3.6.6.2.1ODU with Internal Antenna

Table 3-3 indicates the maximum average transmit power setting that may be selected ODU 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).

3.6.6.2.2ODU with 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

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)

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

Table 3-3 also presents 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).

Antenna Diameter	Antenna Gain, dBi* (example)	Maximum Tx Power Setting, dBm 1 Channel Mode (30MHz BW)	Maximum Tx Power Setting, dBm 2 Channel Mode (20MHz BW)	Maximum Tx Power Setting, dBm 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 budget calculations,

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

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

3.7 Installation of the Event-HD

The following sections provide installation guides for:

- SDIDU™ Installation
- ODU Installation

3.7.1 Installing the Event-HD SDIDU™

The Event-HD SDIDU™ can be installed in the following three options:

1. Table top or cabinet
2. Wall mount
3. Rack mount

The Event-HD SDIDU™ 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 rear grounding post as well as the rear 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 and extremes of temperature (it is designed for indoor use).

3.7.1.1 Installing on a Table Top or Cabinet

The Event-HD Software Defined IDU™ 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 SDIDU™.

3.7.1.2 Installing on a Wall

An installation option for the Event-HD SDIDU™ is mounting the unit to a wall. Consult factory for details.

If the wall mount option is being considered, plan to position the Event-HD Software Defined IDU™ at a height that allows LEDs, the connectors on the rear panel, and the rear grounding post to be visible at all times and easily accessible. Also, including plastic clamps to support and arrange the ODU/ SDIDU™ Interconnect Cable should also be considered.

3.7.1.3 Installing in a Rack

To maintain good airflow and cooling, it is preferred that the Event-HD Software Defined IDU™ is installed in a slot that has blank spaces above and below the unit.

To rack-mount the SDIDU™, use the supplied mounting brackets (Moseley part number 2734001-0001) to secure the chassis to the rack cabinet. As shown in Figure 3-8, the brackets can be attached at any of four points on the sides of the enclosure – back, back, middle facing front, and middle facing back. This flexibility ensures compatibility with most rack mounting arrangements.

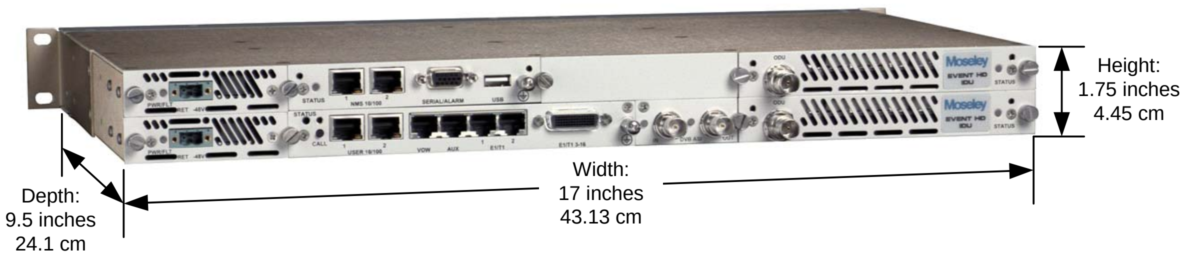


Figure 3-8. Software Defined IDU™ Dimensions

3.7.2 Installing the Event-HD ODU

The Event-HD ODU is intended for mounting on either a pole or antenna mast within close proximity to the antenna.

Each site must be assessed for the mounting method, location, and height. After defining the mounting location and height for the Event-HD, re-confirm the line of sight.

Note: When operating a 1+1 configured Event-HD, i.e. an SDIDU™ with two power supplies and two modem modules installed, an ODU must be connected to the modem in the bottom slot. If the ODU is connected to the modem in the top slot, the SDIDU™ will not communicate with the ODU, and a link cannot be established.

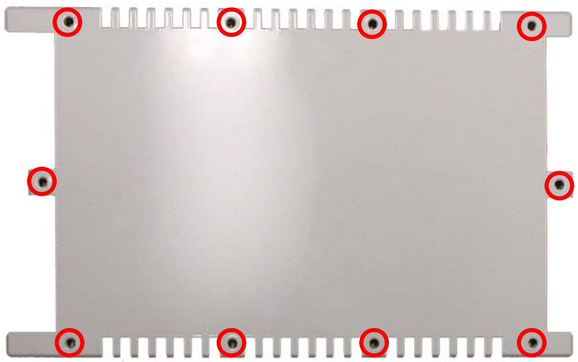
For proper support the antenna mast or mounting pole must be mounted in a vertical position (i.e., no tilt), preferably with a plum.

If the ODU utilizes an internal antenna, such as the ODU5300 and ODU5800 with internal antenna option, vertical tilt of the ODU is accomplished from the tilt mounting bracket. Also, it is important to note the direction in which the ODU will point when installing the mounting pole.

The antenna mast or mounting pole must be grounded. Different ODUs may require different mounting hardware and techniques. The next sections describe mounting techniques for various ODU families.

3.7.2.1 Installing ODU2200, ODU6500, ODU7200

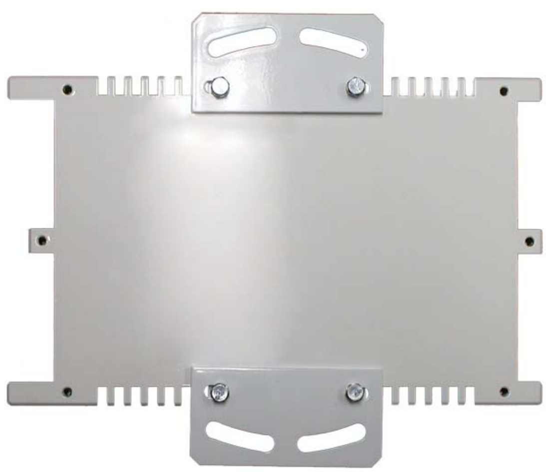
11. The ODUxx00 chassis family has mounting holes located on the underside of the unit. There are total of 10 threaded ¼-20 holes available for mounting directly to a plate or to a pole with optional pole mounting hardware. The threaded screw locations are shown below in red in Figure 3-9. It is recommended to use at least 4 ¾” screws with lock washers.



2

Figure 3-9. ¼-20 threaded mounting hole locations on ODU2200. Use any 4.

32. For pole mounting, optional brackets are installed in the location as shown below in Figure 3-10.



4

Figure 3-10. Pole Mounting Brackets on ODU2200

53. Install U-bolts to ODU brackets and tighten. Assembled pole-mounted ODU2200 is shown in Figure 3-11.

6

Figure 3-11. Completed Pole Mounting of ODU2200

3.7.2.2 Installing ODU5300, ODU5800

71. Remove the pole mount portion of the tilt bracket from the ODU5800 by loosening the middle bolts and removing the top and bottom bolts on each side.

Figure 3-12. Event ODU5800 Rear View

82. Mount the tilt bracket to the mounting pole using the U-Bolts and nuts. Insert the U-bolts around the pole and through the holes in the tilt bracket. Install a washer and nut to each side of the threaded U-bolt and hand tighten. Repeat this step for the second U-bolt.

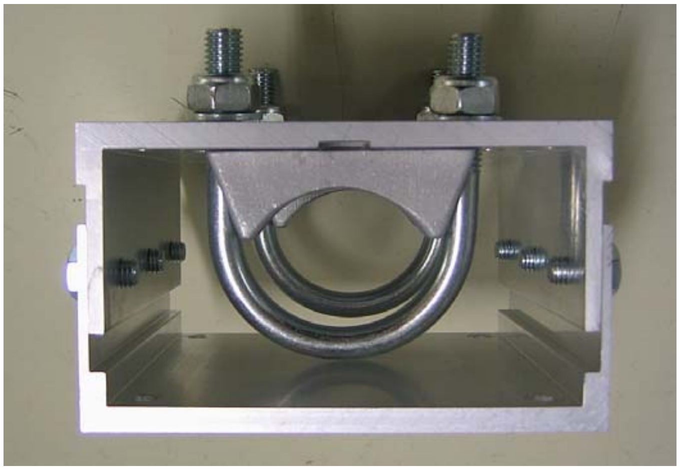


Figure 3-13. Tilt Bracket for Event ODU5800

93. Place the Event-HD ODU5800 on the mating half of the tilt bracket connected by the two center bolts.

104. Add the remaining four bolts to the tilt bracket but do not tighten until the antenna alignment is complete (only applies for internal antenna ODUs).

Figure 3-14. Event ODU5800 with Mounted Tilt Bracket

11

125. Manually point the ODU in the direction of the link partner ODU.

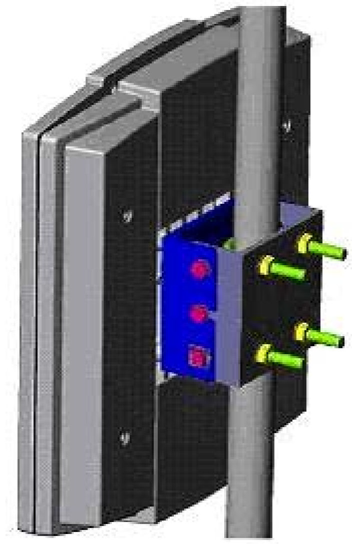


Figure 3-15. Completed Mounting for the Event ODU5800

3.7.3Routing the ODU/IDU Interconnect Cable

1. Select where the cable will enter the truck or building from outside.

2. 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. Route the cable.

The SDIDU™ is equipped with TNC female connector on the rear of the chassis. Depending on the ODU type, it will be equipped with either an N-type or TNC female connector at its interconnecting port. A length of coaxial cable (such as Times Microwave Systems LMR-400, LMR-300 or LMR-200) fitted with the appropriate N-type or TNC male connectors is required to connect the ODU to the SDIDU™. This cable assembly may be supplied in fixed lengths with the digital radio. Bulk coaxial cable of equivalent specification may also be used, with terminating connectors applied during cable installation.

Based on an evaluation of the cable routing path, pull the ODU/SDIDU™ Interconnect cable from one unit to the other, utilizing cable trays, ducts, or conduit as required. Take care that the ODU/ SDIDU™ Interconnect cable is not kinked or damaged in any way during installation. Be sure to protect the TNC connectors from stress, damage and contamination during installation (do not pull the cable by the connectors). If multiple ODU/ SDIDU™ Interconnect cables are to be installed along the same route, the cables should all be pulled at one time. Be sure the installed cable does not have any bends that exceed the specified cable bend radius. The ODU/ SDIDU™ Interconnect cable should be adequately supported on horizontal runs and should be restrained by hangers or ties on vertical runs to reduce stress on the cable. Outside the building, support and restrain the cable as required by routing and environmental conditions (wind, ice).

The Event-HD ODU/SDIDU™ and interconnection must be properly grounded in order to protect it and the structure it is installed on from lightning damage. This requires that the ODU, any mounting pole or mast and any exposed interconnect cable be grounded on the outside of the structure. The SDIDU™ must be grounded to a rack or structure ground that also has direct path to earth ground.

The ODU must be directly connected to a ground rod or equivalent earth ground. The ODU/ SDIDU™ interconnect cable should also be grounded at the ODU, where the cable enters the structure and at intermediate points if the exposed cable run is long (typically at intervals of 100 ft), with the cable manufacturer's grounding kits. Lightning protection devices used with the interconnect cable must be appropriate for the transmission of the interconnect signals (DC to 350 MHz).

Provide a sufficient but not excessive length of cable at each end to allow easy connection to the ODU and SDIDU™ without stress or tension on the cable. Excessive cable length, especially outdoors, should be avoided to minimize signal attenuation and provide a more robust and reliable installation. If installing using bulk coaxial cable, terminate the ODU/ SDIDU™ Interconnect cable at each end with a TNC male connector on the SDIDU™ side and either an N-type or TNC male connector on the ODU side that is appropriate for the cable type. Use of connectors, tools and termination procedures specified by the cable manufacturer is recommended.

Once the cable has been installed but before connection has been made to either unit, a simple DC continuity test should be made to verify the integrity of the installed cable. A DC continuity tester or digital multimeter may be used to verify a lack of DC continuity between the cable center conductor and outer conductor, with the opposite end of the cable unconnected. With a temporary test lead or shorting adapter connected to one end of the cable, DC continuity should be verified between the center and outer conductors at the opposite end.

3.8Quick Start Guide

Although configuration of the SDIDU™ does not require a connection to the ODU, it is suggested that the ODU and SDIDU™ are connected prior to configuring the SDIDU™.

Each SDIDU™ has a Graphical User Interface (GUI) installed that can be accessed through a computer connection. The GUI is described in detail in the User Interface Guide. The section below describes how to get started configuring the SDIDU ™ via the GUI.

3.8.1Materials Required

The following items are needed to configure an SDIDU™:

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

2. Digital voltmeter with test leads

3. SDIDU™ Serial Cable (optional)

4. Computer with networking capability, consisting of either:

- 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

- Networked computer with Windows 98/2000/XP/Vista operating system and an additional Ethernet cable providing access to the network.

5. Web Browser program, Internet Explorer 5.5 and above or Mozilla Firefox 1.0.6 and above *with Java environment installed,* available at http://www.java.com.

6. Site engineering folder with site drawings, or equivalent SDIDU configuration information

3.8.2Grounding the ODU

1. Place the grounding rod so as to allow for the shortest possible path from the grounding cable to the ODU.

2. Drive the grounding rod into the ground at least eight inches from the ground surface.

3. Attach a grounding clamp to the grounding rod. You will use this clamp to attach grounding wires for both the ODU and indoor junction box, reference Figure 3-16.

4. Connect a ground lug to one end of the grounding wire.

5. Remove one of the lower mounting screws of the mounting pole. Insert a screw through the grounding lug terminal and re-install it to the mounting pole.

6. Attach the grounding wire to the clamp on the grounding rod. If necessary, use wire staples to secure the grounding wire to the outside wall.

7. Install a grounding wire from the junction box to the grounding rod.

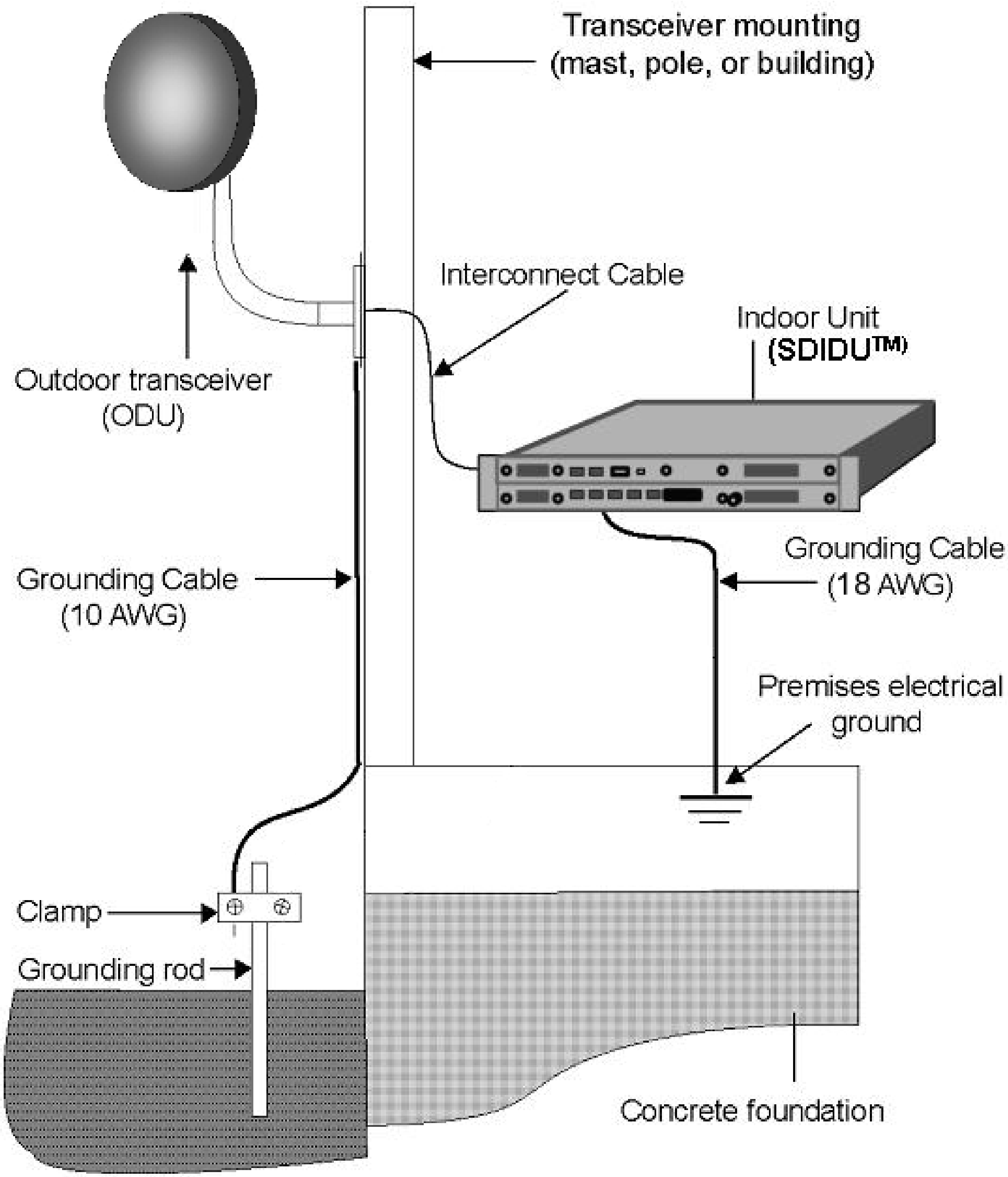


Figure 3-16. Ground Connections to ODU.

3.8.3 Grounding the SDIDU™

1. The SDIDU™ should be able to 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 on the rear 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.

3.8.4 Connecting the SDIDU™ to the PC and Power Source

1. Using the supplied power cable connector, pin 2 (labeled **-V**) should be connected to the power supply terminal supplying -48 V dc, while pin 1 (labeled **RET**) should be connected to the power supply return. Refer to Figure 3-17. Use of a power supply with an inappropriate ground reference may cause damage to the SDIDU™ and/or the supply.

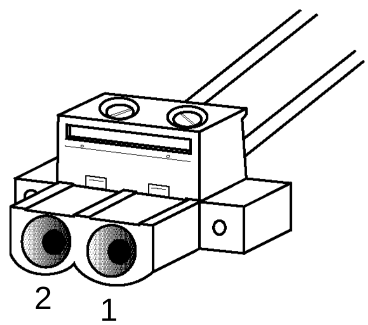


Figure 3-17. SDIDU DC Power Cable Connector

2. Connect the SDIDU™ power cable to the 48 V dc power supply, and place the voltmeter probes on the unconnected SDIDU™ 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. Refer to Figure 3-17.

3. Turn on the –48 V dc supply. Verify that the digital voltmeter reads between 44 V dc and 52 V 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 48 V dc supply off.

5. Plug the SDIDU™ power cable into the SDIDU™ rear panel DC Power connector (**DC Input**). Place the voltmeter probes on the cable connector terminal screw heads as

per step 2 above. Refer to Figure 3-17. Note that the Software Defined IDU™ SDIDU™ 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 5 W of RF power present at the antenna port. The antenna should be directed safely when power is applied.

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

7. Connect the SDIDU™ to the laptop computer, using a Cat-5 Ethernet cable <u>or</u> connect the SDIDU™ to a computer network, using a Cat-5 Ethernet cable. Connect the Ethernet cable to **the NMS 1 or 2** connector on the SDIDU™ rear panel. Refer to Figure 3-18 for the SDIDU™ rear panel connections.

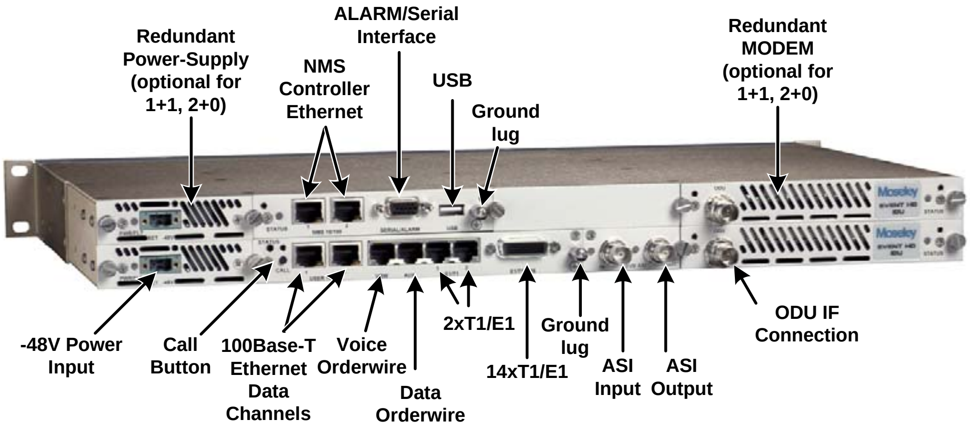


Figure 3-18. Software Defined IDU™-SB, 1+1 Protection, Rear Panel Connections

3.8.5 SDIDU™ Configuration

Although basic configuration of the Event-HD SDIDU™ does not require a connection to the ODU, it is recommended that the ODU and SDIDU™ are connected prior to configuring the SDIDU™. A connection to the ODU must be established prior to running the Link Configuration process (section 5.2) in order to configure ODU related parameters.

Using the site attributes identified in the site assessment or equivalent configuration information, configure each IDU by completing the following procedures:

- Setting the SDIDU™ IP Address and Network Parameters
- Configuring the SDIDU™
- Setting the SDIDU™ Device Information

3.8.5.1 Setting the IDU IP Address

1. The PC's network configuration must be set with the parameters provided at the end of this guide.

2. The IDU should be accessible from your PC at the default IP address provided at the end of this guide. A network 'ping' can be done to verify connectivity to the IDU.

3. Start web browser and use the SDIDU™ default IP address as the url.

4. Log in at the login prompt. The username and password are provided at the end of this guide.

5. The GUI 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. In the navigation menu, select Administration, then Network Configuration, and then General. The IP address, IP Netmask, and IP Gateway are shown.

6. Enter the new IP address, IP Netmask, and IP Gateway. The gateway must be in the same subnet as the IP address for proper operation. Click "Update" to change the values.

7. 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.

8. To continue using the GUI, point the web browser to the new IP address.

3.8.5.2 Link Configuration

Use the GUI to configure the SDIDU™ as follows:

1. To start the GUI, open a web browser and use the SDIDU™ IP address (192.168.1.1xx) as the URL and log in when prompted.

2. Use the frame on the left side of the window to navigate to "Radio Link."

3. Select the subcategory "Link Configuration."

4. Select the operating mode. If the SDIDU™ has one modem installed and is connected to one ODU, select standard. If the SDIDU™ has two modems installed and is connected to two ODUs, select 1+1 diversity or 1+1 non-diversity for a protected link or east-west for a 2+0 ring configuration.

5. Follow the wizard located here to enter the rest of the required settings.

3.8.5.3 Configuring the Site Attributes

Use the GUI to enter device information as follows:

1. In the navigation menu, select Administration, then Device Information, and then Device Names.
2. Enter the Owner, Contact, Description, and Location. These values are not required for operation, but will help keep a system organized.

3.8.5.4 Power on Reset to Factory Defaults

The SDIDU™ may be reset to factory defaults during power up. A power on reset affects the IP address and the user logins/passwords. To perform a power on reset:

1. Power on the SDIDU™
2. During bootup, the SDIDU™ will flash the controller-card LED alternating red/green for five seconds.
3. Make sure the call button is not active at the start of this five second period.
4. While the LED is flashing, press the call button and release it within one second of the LED changing to static green.

3.8.5.5 CLI Access via NMS Ethernet

The CLI may be accessed via NMS Ethernet after connecting and configuring the PC as described in the previous section. Then using a Telnet client, telnet to the SDIDU™ IP address. You will be prompted for a username and password. Use the username and password supplied at the end of this guide.

3.8.5.5.1CLI Access via Serial Port

The CLI for configuring/monitoring the SDIDU™ may be accessed via the front-panel serial port. Table 3-3 shows the pinout for constructing a DB-9 to HD-15 cable.

Table 3-3: Serial Cable Pinout

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

The serial port parameters are show in Table 3-4.

Table 3-4: Serial Port Parameters

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

After powering-on the SDIDU™, the CLI may be accessed by connecting the serial cable between the PC and the SDIDU™, launching and configuring a terminal program (e.g. Hyperterm) and pressing the enter key. You will be prompted for a username and password, which are supplied at the end of this guide.

3.8.6ODU Antenna Alignment

Receive signal level indication at the antenna/ODU location is a power tool to aid antenna alignment at the time of installation. The following provides ODU specific information regarding the receive signal.

3.8.6.1 ODU 2200, 6500, 7200

The ODU 2200, 6500, and 7200 has an externally visible LED meter that provides both RSL (Receive Signal Level) and transmit power. For full-duplex operation the ODU meter displays RSL on the top bar and transmit level on the bottom bar as shown in Figure 3-19.

Figure 3-19. ODU 2200 RSSI Output vs. Received Signal.

The upper RSL LED meter is calibrated to represent exactly 10 dB for each LED, going from -95 dBm at the far left (red) to -15 dBm at the far right (green). The brightness of each LED is modulated for levels between 0 to 10 dB such that the far left LED will be fully extinguished at -95 dBm and the far right LED will be fully illuminated at -15 dBm. When the RSL is in the red region (<-75 dBm) the signal level is approaching or has reached threshold (depends on modulation type).

The transmit LED indicates full power will all 8 LEDs illuminated to minimum power with 1 LED illuminated.

For simplex applications such as broadcast STL or ENG where the ODU is a receiver or a transmitter only then both LED bars represent either RSL for receiver ODU or transmit power for transmitter ODU. For RSL each LED represents 5 dB, with brightness modulated from off for 0 dB to fully on for 5 dB increments.

3.8.6.2 ODU 5300/5800

To use the built-in tuning of the ODU 5300 or 5800 antenna, a complete link is required, with both ends of the link roughly pointed at each other, and transmitting.

Once the links are roughly pointed, connect the voltmeter to the RSSI (Receive Signal Strength Indication) BNC connector seen on the ODU. 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 0Volts for minimum RSL at -90 dBm. This mapping characteristic is plotted below in Figure 3-20.

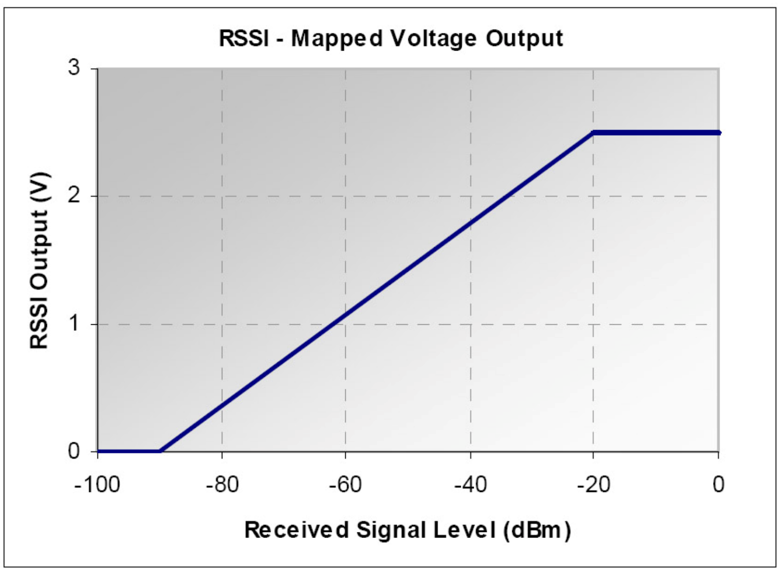


Figure 3-20. ODU RSSI Output vs. Received Signal.

3.8.7Quick Start Settings

PC Network Configuration

The Web GUI may be accessed via NMS by connecting a CAT5 patch cable between the SDIDU™ front-panel NMS port and a PC. The PCs network interface must be configured to an open IP address within the same subnet. For the default Moseley Event-HD configuration, the IP address of the PC needs to be 192.168.1.x, where x (between 1 and 100) provides an available IP address. DHCP may also be used to set the PC IP address if a DHCP server is configured on the same subnet.

Event-HD IP Address

The Event-HD system will be configured and tested as link prior to delivery to the customer. The IP address will be set at the factory to these default values:

Parameter	Value
IP Address	192.168.1.1xx
Netmask	255.255.255.0
Gateway	192.168.1.1

Where xx is in the range from 01 to 99. The IP address is indicated on the rear panel as shown in Figure 3-21.

Figure 3-21. IDU IP address label location

After configuring the PCs network interface, a web browser may be launched and the following URL entered into the address bar to access the unit’s Web GUI:

http://192.168.0.101/

or as specified on the rear panel.

Username and Password

A dialog box will show requesting a username and password:

- User: administrator
- Pass: d1scovery

3.9SDIDU™ Service

At times, it may be necessary to service the SDIDU™. This may include installing, removing, or replacing an SDIDU™ module. There may be up to 8 modules installed in a single SDIDU™ chassis. Figure 3-22 shows the rear panel of the SDIDU™ 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 IO Module. These basic procedures are described below. Variations are described in sub-items beneath each step.

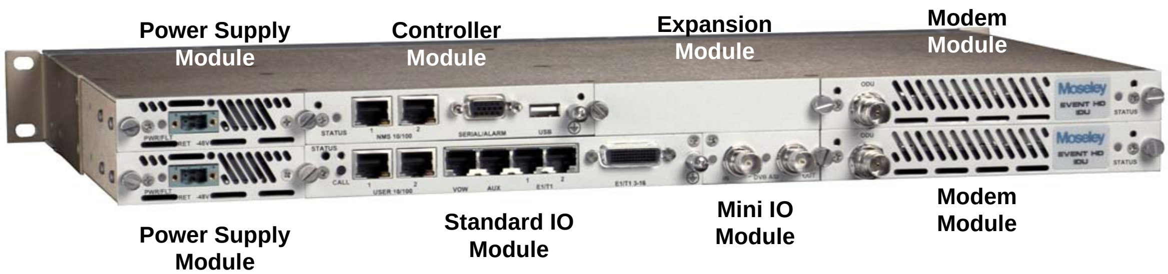


Figure 3-22. SDIDU™ Modules

3.9.1Removing a Module

9. 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.

10. Remove rear panel connections to the module.

11. Remove the two thumbscrews on either side of the module. Figure 3-23 shows the locations of these thumb screws.

    a. The thumbscrew for the Standard IO Module is located on the right side of the Mini IO Module slot.

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

    c. When removing only the Mini IO card, remove the corner screw indicated in Figure 3-23 and one thumb screw.

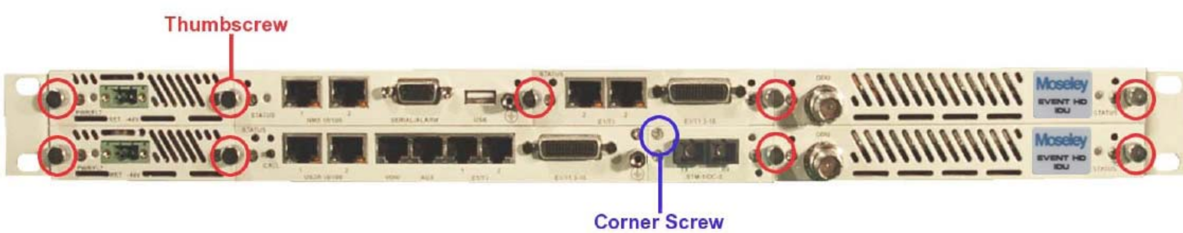


Figure 3-23. Thumbscrew and Corner Screw Locations

12. Thread thumbscrew(s) into hole(s) shown in Figure 3-24. Remove the module by grasping the thumbscrew(s) and pulling module straight out of the SDIDU™. Both thumbscrews should be used for all modules except the Power Supply and the Mini IO Modules.

    a. The Power Supply and Mini IO Modules have only one threaded hole each.

    b. When removing the Standard IO Module, the ground lug indicated in Figure 3-24 is used as the second threaded hole. If the SDIDU™ 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 SDIDU™ 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.

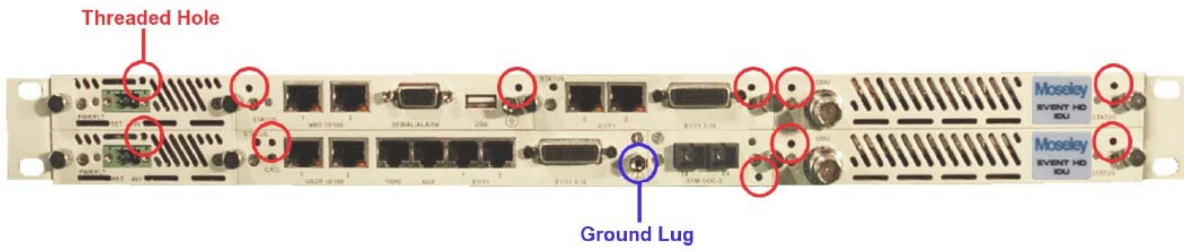


Figure 3-24. Threaded Hole Locations

3.9.2 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 SDIDU™. Figure 3-25 shows a photo of the guides. As the module face plate comes flush with the face of the SDIDU™, connectors on the rear of the module will engage with the SDIDU™ 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 IO Module only has one guide on the right side. Take care to insert the Mini IO module carefully and correctly engage the rear connector with its mate on the Standard IO Module.

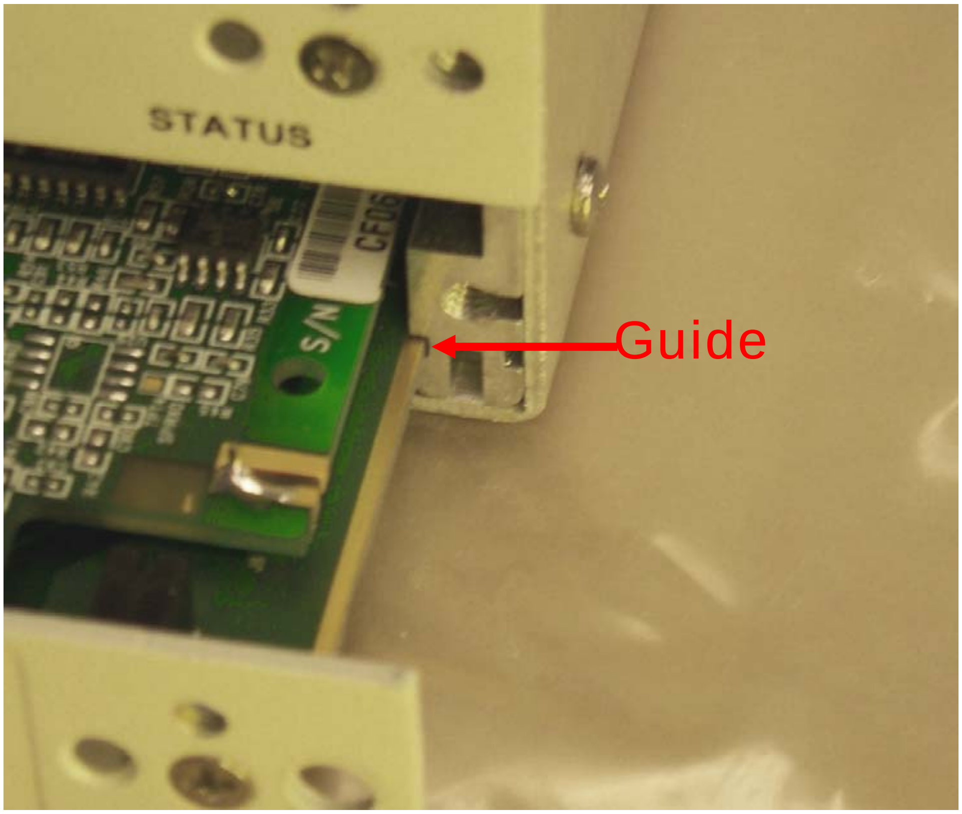


Figure 3-25. Guides

3. Install thumbscrews on either side of the module as shown in Figure 3-24.

   a. The Mini IO card has a corner screw, which should be installed. This corner screw is shown in Figure 3-23.

4. Make rear panel connections to the module and power on the SDIDU™ if necessary.

5. Verify proper operation of the unit.

   a. If the Controller Module has been changed, reprogram the IP addresses.

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4.Summary Specification

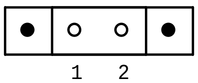
Parameter	Event 2200, 2200FD, 2400 2GHz	Event 6500, 6800, 7200, 7400 6-7 GHz	Event 5800 5.8 GHz	Event 5300 5.3 GHz
System				
Frequency Bands (others available on request)	1.990-2.110 2.200-2.300 2.450-2.500	6.425-6.525 6.525-6.875 6.875-7.125 7.125-7.425	5.725-5.850	5.250-5.350
Output Power (avg. max.)	4 Watts	1 Watt	200 mW	+5 dBm
Channelization (others available on request)	12, 17 MHz	20, 25, 28, 30 MHz	12.5, 16.7, 25, 30 MHz	13.3, 20, 30 MHz
Capacity	150Mbps ASI 2-100 Mbps Ethernet 1-16 T1/E1 Various combinations of above			
Input Sensitivity	-84 dBm (or higher, based on selected mode)			
Modulation	QPSK, 16, 32, 64, 128 QAM			
Radio Interfaces				
External Antenna	N-Type Female			
SDIDU™ /ODU Link	TNC Female			
Data Interfaces				
Payload DVB/ASI Ethernet 2 T1/E1 14 T1/E1	 BNC Female (2) 10Base-T/100Base-Tx RJ-45 Female (2) 100 Ω / 120 Ω Balanced, RJ-48C Female (2) Molex High-Density 60-pin (14)			
SNMP	10Base-T/100Base-Tx RJ-45 Female			
Control				
Network Management	SNMP, Proprietary GUI			

Parameter	Event 2200, 2200FD, 2400 2GHz	Event 6500, 6800, 7200, 7400 6-7 GHz	Event 5800 5.8 GHz	Event 5300 5.3 GHz
NMS Connector	10Base-T/100Base-Tx RJ-45 Female (2)			
Voice Orderwire	RJ-45 for PTT handset			
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				
DC Power	-48 Volts ±10%, <100 W	-48 Volts ±10%, <100 W	-48 Volts ±10%, <70 W	-48 Volts ±10%, <70 W
SDIDU™ Operational Temperature	-5º to 55º C			
ODU Operational Temperature	-30º to 55º C			
SDIDU™ Humidity	0 to 95%, non-condensing			
ODU Humidity	0 to100% at 45º C			
Altitude	15,000 feet/4572 meters, maximum			
Physical Dimensions				
SDIDU™ Size (WxHxD)	17.2 x 1.75 x 9.4 inches (43.7 x 4.5 x 23.9 cm)			
SDIDU™ Weight	7 lbs (3.12 Kg)			
SDIDU™				
EIA Rack Mount	19 inch/48.2 cm, 1 rack unit			
ODU Size (WxHxD)	14.0 x 8.5 x 4 inches	14.0 x 8.5 x 4 inches	14.6 x 15.4 x 2.6 inches	14.6 x 15.4 x 2.6 inches
ODU Weight	16.3 lbs (7.4 kgs)	16.3 lbs (7.4 kgs)	15 lbs (6.8 kgs)	15 lbs (6.8 kgs)
ODU				
Mounting	Custom Bracket			

5.Rear Panel Connectors

5.1DC Input (Power) Connector

MSTB 2,5/ 2-GF



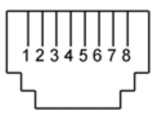
PIN	TYPE	SIGNAL
1	POWER	Power supply return
2	POWER	48 Vdc, nominal

Mating Connector: MSTB 2,5/ 2-STF

Ordering Information: Phoenix Contact Part Number 1786831

5.2Ethernet 100BaseTX Payload Connector 1-2

RJ-45 Female



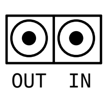
PIN	TYPE	SIGNAL
1	INPUT	RX+
2	INPUT	RX-
3	OUTPUT	TX+
4	N/A	N/A
5	N/A	N/A
6	OUTPUT	TX-
7	N/A	N/A
8	N/A	N/A

Mating Connector: Standard RJ-45 Plug

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

5.3SONET Payload Connector

SC Duplex Female Fiber



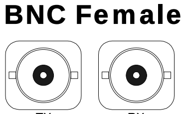
PIN	TYPE	SIGNAL
OUT	OUTPUT	SONET OC-3 payload output (optical)
IN	INPUT	SONET OC-3 payload input (optical)

Mating Connector: SC-Duplex Male

Ordering Information: Molex Part Number 86066-4000 or equivalent

5.4STM-1 Payload Connector

BNC Female



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

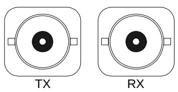
Mating Connector: BNC Male

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

5.5DVB/ASI, DS-3, E-3, STS-1 Payload Connector

Consult factory for availability.

BNC Female



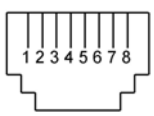
PIN	TYPE	SIGNAL
TX	OUTPUT	DVB-ASI, DS-3, E-3, STS-1 payload output
RX	INPUT	DVB-ASI, DS-3, E-3, STS-1 payload input

Mating Connector: BNC Male

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

5.6NMS 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

5.7Alarm/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

DB-15HD Female

PIN	TYPE	SIGNAL
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.

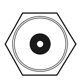
****** Form C Contacts are hardware jumper configurable to emulate TTL outputs

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

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

5.8 ODU Connector

TNC Coaxial Female



PIN	TYPE	SIGNAL
Center	I/O	350 MHz TX IF / 140 MHz RX IF / -48 VDC
Shield	N/A	Shield / Chassis GND

Mating Connector: TNC Male

Cable Type	Ordering Information
LMR-200	Times Microwave Systems Part Number TC-200-TM
LMR-300	Times Microwave Systems Part Number TC-300-TM
LMR-400	Times Microwave Systems Part Number TC-400-TM
RG-214	Tyco Electronics/Amp Part Number 225550-8 or equivalent
Belden 7808	Tyco Electronics/Amp Part Number 1-225550-3 or equivalent

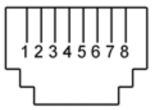
5.9 T1/E1 - Channels 1-2 Connector

RJ-48C Female

100 Ω /120 Ω Balanced

PIN	TYPE	SIGNAL
1	INPUT	RX+
2	INPUT	RX-
3	N/A	GND

RJ-48C Female



PIN	TYPE	SIGNAL
4	OUTPUT	TX+
5	OUTPUT	TX-
6	N/A	GND
7	N/A	N/A
8	N/A	N/A

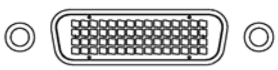
Mating Connector: Standard RJ-45 Plug

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

5.10T1/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

Molex LFH Matrix 50 Receptacle

PIN	TYPE	SIGNAL
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
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

Molex LFH Matrix 50 Receptacle

PIN	TYPE	SIGNAL
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

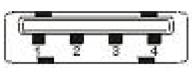
Mating Connector: Molex LFH Matrix 50 Plug

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

5.11USB

Consult factory for availability.

USB Type A Receptacle

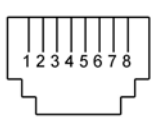


PIN	TYPE	SIGNAL
1	OUTPUT	+5V
2	I/O	-Data
3	I/O	+Data
4	N/A	GND

Mating Connector: USB Type A Plug

5.12Voice Order Wire

RJ-45 Female



PIN	TYPE	SIGNAL
1	N/A	NC
2	INPUT	PTT
3	N/A	GND
4	OUTPUT	PO-
5	OUTPUT	PO+
6	INPUT	TI-
7	N/A	GND
8	N/A	NC

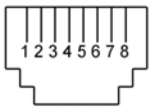
Mating Connector: Standard RJ-6 Plug or Standard RJ-45 Plug

Ordering Information: Tyco Electronics/Amp Part Number 5-554710-3 or equivalent for RJ-6. Tyco Electronics/Amp Part Number 5-554169-3 or equivalent for RJ-45.

5.13 Data Order Wire

5.13.1 RS422

RJ-45 Female



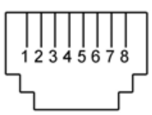
PIN	TYPE	SIGNAL
1	OUTPUT	TX Clock -
2	OUTPUT	TX Clock +
3	OUTPUT	TX Data -
4	INPUT	RX Data -
5	INPUT	RX Data +
6	OUTPUT	TX Data +
7	INPUT	RX Clock -
8	INPUT	RX Clock +

Mating Connector: Standard RJ-45 Plug

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

5.13.2 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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6.Appendix

6.1Alarm Descriptions

Alarm	Affected Component	Description	LED to RED	Alarm Code	Severity
Modem Fault Lower	Modem	The specified Modem card has indicated a fault. Fault detection is via reading Modem Hardware Status from MODEM during start-up and polling GPIO for MODEM fault indication. Polling interval 5 sec.	N/A	11	Critical
Modem Comm Failure Lower	Modem	The Controller Card is unable to communicate with the specified Modem card.	Modem Lower	12	Critical
Modem Card Removed Lower	Modem	The specified Modem card has been removed from the IDU (only if the specified Modem card has been enabled for use). Fault detection via card-detect logic.	N/A	13	Major
Modem Card Installed Lower	Modem	The specified Modem card has been installed into the IDU (only if the specified Modem card is not enabled for use). Fault detection via card-detect logic. Alarm is raised then lowered.	Modem Lower	14	Info
Modem Unlock Lower	Modem	The demodulation functional components of the modem have lost lock to the incoming signal. The data received through the RF link is not valid. Fault detection via modem status polling. Polling interval: 1 sec.	N/A	N/A	Critical
RSL Low Lower	Modem	RSSI is approaching the minimum operational level of the link as set during configuration. Fault detection via modem status polling, comparing RSSI value to threshold value in configuration table. Polling interval 5 sec.	N/A	N/A	Major

Alarm	Affected Component	Description	LED to RED	Alarm Code	Severity
Synthesizer Unlock Lower	Modem	Modem synthesizer has unlocked. Fault detection via modem status polling. Polling is done in conjunction with Modem Unlock polling.	N/A	N/A	Critical
SNR Low Lower	Modem	The signal-to-noise ratio is below the minimum operational level of the link as set during configuration. Fault detection via modem status polling, comparing Eb/N0 value to threshold value in configuration table. Polling interval 5 sec.	N/A	N/A	Major
Modem Fault Upper	Modem	The specified Modem card has indicated a fault. Fault detection is via reading Modem Hardware Status from MODEM during start-up and polling GPIO for MODEM fault indication. Polling interval 5 sec.	N/A	16	Critical
Modem Comm Failure Upper	Modem	The Controller Card is unable to communicate with the specified Modem card.	Modem Lower	17	Critical
Modem Card Removed Upper	Modem	The specified Modem card has been removed from the IDU (only if the specified Modem card has been enabled for use). Fault detection via card-detect logic.	N/A	18	Major
Modem Card Installed Upper	Modem	The specified Modem card has been installed into the IDU (only if the specified Modem card is not enabled for use). Fault detection via card-detect logic. Alarm is raised then lowered.	Modem Upper	19	Info
Modem Unlock Upper	Modem	The demodulation functional components of the modem have lost lock to the incoming signal. The data received through the RF link is not valid. Fault detection via modem status polling. Polling interval 1 sec.	N/A	N/A	Critical

Alarm	Affected Component	Description	LED to RED	Alarm Code	Severity
RSL Low Upper	Modem	RSSI is approaching the minimum operational level of the link as set during configuration. Fault detection via modem status polling, comparing RSSI value to threshold value in configuration table. Polling interval 5 sec.	N/A	N/A	Major
SNR Low Upper	Modem	The signal-to-noise ratio is below the minimum operational level of the link as set during configuration. Fault detection via modem status polling, comparing Eb/N0 value to threshold value in configuration table. Polling interval 5 sec.	N/A	N/A	Major
Synthesizer Unlock Upper	Modem	Modem synthesizer has unlocked. Fault detection via modem status polling. Polling is done in conjunction with Modem Unlock polling.	N/A	N/A	Critical
Fan Failure	Controller	The Fan rotational speed is too low. (Controller card LED flashed red rather than orange). Fault detection via polling fan controller status. Polling interval 10 sec.	Controller	21	Major
Controller Card Fault	Controller	The CPU has detected a fault in the controller card. (Controller card LED flashes red rather than orange). Fault detection via software.	Controller	22	Critical
Low Battery Voltage	Controller	The CPU has detected a low-battery voltage condition. (Controller card LED flashes red rather than orange). Fault detection via software polling RTC via controller FPGA.	Controller	23	Info
Power Supply Fault Lower	Power Supply	The Power Supply card has indicated a fault. Fault detection via polling GPIO. Polling interval 5 sec.	N/A	31	Critical

Alarm	Affected Component	Description	LED to RED	Alarm Code	Severity
Power Supply Card Removed Lower	Power Supply	The specified Power Supply card has been removed from the IDU. Fault detection via card-detect logic.	N/A	32	Major
Power Supply Fault Upper	Power Supply	The Power Supply card has indicated a fault. Fault detection via polling GPIO. Polling interval 5 sec.	N/A	36	Critical
Power Supply Card Removed Upper	Power Supply	The specified Power Supply card has been removed from the IDU. Fault detection via card-detect logic.	N/A	37	Major
Standard I/O Card Removed	StdIO	The Standard I/O card has been removed from the IDU. Fault detect via card-detect logic.	N/A	41	Critical
Ethernet Payload Disconnect	StdIO	There is no cable detected at either Ethernet payload on Standard I/O card (only if Ethernet mode enabled). Fault detection via polling of Ethernet PHY. Polling interval 5 sec.	Standard I/O	42	Critical
Framer Initialization Timeout	StdIO	There is an initialization wait for Framer to turn ON the Framer Receiver side after turning ON the Modem/ODU. Fault detection via polling. Poll only after timeout to detect.	Standard I/O	43	Critical
Mini I/O Card Removed	MiniIO	The Mini I/O card has been removed from the IDU (only if Mini I/O card has been enabled for use). Fault detection via card-detect logic.	Standard I/O	46	Critical
Mini I/O Card Installed	MiniIO	The Mini I/O card has been installed into the IDU (only if Mini I/O card is noted enabled for use). Fault detection via card-detect logic. Alarm is raised then lowered.	Standard I/O	47	Info

Alarm	Affected Component	Description	LED to RED	Alarm Code	Severity
Optional I/O Card Removed	OptIO	The Optional I/O card has been removed from the IDU (only if the Optional I/O card has been enabled for use). Fault detection via card-detect logic.	N/A	26	Critical
Optional I/O Card Installed	OptIO	The Optional I/O card has been installed into the IDU (only if the Optional I/O card is not enabled for use). Fault detection via card-detect logic. Alarm is raised then lowered.	Optional I/O	27	Info
T1/E1 Channel Alarm Ch x	StdIO (1-16) OptIO (17-32)	There is either no cable detected at the specified E1/T1 channel port on Standard I/O Card or there is an AIS condition detected (only for active T1/E1 channels). Fault detection via polling of LIUs on Standard I/O card and Optional I/O Card when installed. Polling interval 2 channels per 1 sec. Report of this alarm in the GUI/Syslog/Alarm history indicates whether this is a disconnect or AIS condition. If both conditions are present, the disconnect alarm will take precedence over the AIS alarm.	Standard I/O when 1-16 Optional I/O when 17-32 Turn LED orange rather than RED	51-58 (1-16) 61-68 (17-32)	Critical
T1/E1 Test Mode	StdIO	The user has selected a T1/E1 test mode (loopback or Tx Data). This alarm will be set when the user sets the test mode for any of the T1/E1 channels, and cleared when all T1/E1 channels are not in loopback and Tx Data is normal.	N/A	59	Info
BERT/LB/CW Test Mode	StdIO	This alarm will be set when the user enables either BERT, Loopback, or CW mode, and cleared when all BERT, Loopback and CW modes are disabled.	N/A	69	Info

Alarm	Affected Component	Description	LED to RED	Alarm Code	Severity
ODU Fault Lower	ODU	The ODU has indicated a fault condition. Fault detection via polling of ODU or unsolicited message, if supported. Polling interval 5 sec. Polling done via API functional call. Report of this alarm in the GUI/Syslog/Alarm history indicates the fault code from the ODU.	N/A	71	Critical
ODU Comm Failure Lower	ODU	The IDU is unable to communicate with the ODU. This could be a problem with the ODU or a problem with the cable connecting the ODU to the IDU.	N/A	72	Critical
ODU Fault Upper	ODU	The ODU has indicated a fault condition or unsolicited message, if supported. Fault detection via polling of ODU. Polling interval 5 sec. Polling done via API function call. Report of this alarm in the GUI/Syslog/Alarm history indicates the fault code from the ODU.	N/A	73	Critical
ODU Comm Failure Upper	ODU	The IDU is unable to communicate with the ODU. This could be a problem with the ODU or a problem with the cable connecting the ODU to the IDU.	N/A	74	Critical
Protection Switch	MODEM/ODU	This alarm will be set when an AL1 command is received from the active MODEM/ODU. Cleared when an AL2 command is received from the standby MODEM/ODU. Report of this alarm in the GUI/Syslog/Alarm history indicates the fault code from the ODU, if received.	N/A	75	Major

Alarm	Affected Component	Description	LED to RED	Alarm Code	Severity
East ATPC Tx at Max Power	ODU	The IDU is unable to increase the Tx Power as requested by link partner due to maximum power being reached. Maximum power is specified in the configuration table.	N/A	76	Info
West ATPC Tx at Max Power	ODU	The IDU is unable to increase the Tx Power as requested by link partner due to maximum power being reached. Maximum power is specified in the configuration table.	N/A	78	Info
Link Fault	IDU	Failed to receive link heartbeat from link partner via Radio Overhead (ROH) channel. Fault detection via timeout counter, which is reset via reception of link heartbeat message.	N/A	81	Critical
Remote Fault	IDU	Link Partner IDU indicating it has a fault condition. Local IDU receives Link Partner Fault detection via Radio Overhead (ROH) channel message.	N/A	82	Info
Encryption Failure	IDU	Data is not being decrypted properly due to encryption key mismatch between link partners. Fault detection via software detection of unreadable ROH messages from link partner.	N/A	83	Critical
Encryption OneWay	IDU	Only one IDU has data encryption enabled. Fault detection via software messages to/from link partner.	N/A	84	Major
External Alarm 1	External	The external Alarm 1 input has been activated. Fault detection via polling GPIO. Polling interval 1 sec.	N/A	91	Info
External Alarm 2	External	The external Alarm 2 input has been activated. Fault detection via polling GPIO. Polling interval 1 sec.	N/A	92	Info

Alarm	Affected Component	Description	LED to RED	Alarm Code	Severity
External Alarm 3	External	The external Alarm 3 input has been activated. Fault detection via polling GPIO. Polling interval 1 sec.	N/A	93	Info
External Alarm 4	External	The external Alarm 4 input has been activated. Fault detection via polling GPIO. Polling interval 1 sec.	N/A	94	Info
Remote IDU Alarm	Link Partner IDU	The link partner IDU has indicated an alarm condition via ROH.	N/A	95	Major
Remote IDU External Alarm 1	Link Partner External	The link partner IDU has indicated via ROH its external alarm input 1 has been activated.	N/A	96	Info
Remote IDU External Alarm 2	Link Partner External	The link partner IDU has indicated via ROH its external alarm input 2 has been activated.	N/A	97	Info
Remote IDU External Alarm 3	Link Partner External	The link partner IDU has indicated via ROH its external alarm input 3 has been activated.	N/A	98	Info
Remote IDU External Alarm 4	Link Partner External	The link partner IDU has indicated via ROH its external alarm input 4 has been activated.	N/A	99	Info
STM Loss of Clock	IDU	The SDH/SONET clock has lost lock. Fault detection via polling of LIU.	N/A	Solid	Critical
STM RS_LOS	IDU	The SDH/SONET has a Loss of Signal Defect. Fault detection via polling of LIU.	N/A	Solid	Critical
STM RS_B1	IDU	The SDH/SONET Mux/Demux has a B1 Defect. Fault detection via polling of RS_B1_T bit in STM-1 Core. Alternate detection via Interrupt enabled in STM-1 core.	N/A	Solid	Major

Alarm	Affected Component	Description	LED to RED	Alarm Code	Severity
STM RS_LOF	IDU	The SDH/SONET Mux/Demux has a Loss of Frame Defect. Fault detection via polling of RS_LOF_T bit in STM-1 Core. Alternate detection via Interrupt enabled in STM-1 core.	N/A	Solid	Critical
STM RS_OOF	IDU	The SDH/SONET Mux/Demux has an Out of Frame Defect. Fault detection via polling of RS_OOF_T bit in STM-1 Core. Alternate detection via Interrupt enabled in STM-1 core.	N/A	Solid	Critical
STM RS_TIM	IDU	The SDH/SONET Mux/Demux has a Trace Identifier Mismatch Defect. Fault detection via polling of RS_TIM_T bit in STM-1 Core. Alternate detection via Interrupt enabled in STM-1 core.	N/A	Solid	Major
STM MS-AIS	IDU	The SDH/SONET Mux/Demux has detected an AIS at the Multiplexer Level. Fault detection via polling of MS_AIS_T bit in STM-1 Core. Alternate detection via Interrupt enabled in STM-1 core.	N/A	Solid	Critical
STM MS-REI	IDU	The SDH/SONET Mux/Demux has detected a Remote Error at the Multiplexer Level. Fault detection via polling of MS_REI_T bit in STM-1 Core. Alternate detection via Interrupt enabled in STM-1 core.	N/A	Solid	Major
STM MS-RDI	IDU	The SDH/SONET Mux/Demux has detected a Remote Defect at the Multiplexer Level. Fault detection via polling of MS_RDI_T bit in STM-1 Core. Alternate detection via Interrupt enabled in STM-1 core.	N/A	Solid	Major

Alarm	Affected Component	Description	LED to RED	Alarm Code	Severity
STM MS_B2	IDU	The SDH/SONET Mux/Demux has a B2 Defect at the Multiplex level. Fault detection via polling of MS_B2_T bit in STM-1 Core. Alternate detection via Interrupt enabled in STM-1 core.	N/A	Solid	Major
STM AU-AIS x	IDU	The SDH/SONET Mux/Demux has detected an AIS at the AU Level. Fault detection via polling of AU_AIS_T bit in STM-1 Core. Where ‘x’ is the HP index. Alternate detection via Interrupt enabled in STM-1 core.	N/A	Solid	Critical
STM AU-LOP x	IDU	The SDH/SONET Mux/Demux has detected a Loss of Pointer Defect at the AU Level. Fault detection via polling of AU_LOP_T bit in STM-1 Core. Where ‘x’ is the HP index. Alternate detection via Interrupt enabled in STM-1 core.	N/A	Solid	Critical
STM HP-UNEQ x	IDU	The SDH/SONET Mux/Demux HP number ‘x’ is Unequipped. Fault detection via polling of HP_UNEQ_T bit in STM-1 Core. Where ‘x’ is the HP index. Alternate detection via Interrupt enabled in STM-1 core.	N/A	Solid	Major
STM HP-TIM x	IDU	The SDH/SONET Mux/Demux HP number ‘x’ has a Trace Identifier Mismatch. Fault detection via polling of HP_TM_TIM_T bit in STM-1 Core. Where ‘x’ is the HP index. Alternate detection via Interrupt enabled in STM-1 core.	N/A	Solid	Major

Alarm	Affected Component	Description	LED to RED	Alarm Code	Severity
STM HP-REI x	IDU	The SDH/SONET Mux/Demux HP number ‘x’ has a Remote Error Indication. Fault detection via polling of HP_REI_T bit in STM-1 Core. Where ‘x’ is the HP index. Alternate detection via Interrupt enabled in STM-1 core.	N/A	Solid	Major
STM HP-RDI x	IDU	The SDH/SONET Mux/Demux HP number ‘x’ has a Remote Defect Indication. Fault detection via polling of HP_RDI_T bit in STM-1 Core. Where ‘x’ is the HP index. Alternate detection via Interrupt enabled in STM-1 core.	N/A	Solid	Major
STM HP-PLM x	IDU	The SDH/SONET Mux/Demux HP number ‘x’ has a Path Identifier Mismatch. Fault detection via polling of HP_PLM_T bit in STM-1 Core. Where ‘x’ is the HP index. Alternate detection via Interrupt enabled in STM-1 core.	N/A	Solid	Critical
STM HP_B3 x	IDU	The SDH/SONET Mux/Demux HP number ‘x’ has a CRC Error. Fault detection via polling of HP_B3_T bit in STM-1 Core. Where ‘x’ is the HP index. Alternate detection via Interrupt enabled in STM-1 core.	N/A	Solid	Major
STM TU-LOM lkm	IDU	The SDH/SONET Mux/Demux TU number ‘x’ has a Loss of Multiframe. Fault detection via polling of TU_LOMF_T bit in STM-1 Core. Where ‘lkm’ is the TU index as LKM numbering. Alternate detection via Interrupt enabled in STM-1 core.	N/A	Solid	Critical

Alarm	Affected Component	Description	LED to RED	Alarm Code	Severity
STM TU-AIS lkm	IDU	The SDH/SONET Mux/Demux TU number 'x' has an AIS. Fault detection via polling of TU_AIS_T bit in STM-1 Core. Where 'lkm' is the TU index as LKM numbering. Alternate detection via Interrupt enabled in STM-1 core.	N/A	Solid	Critical
STM TU-LOP lkm	IDU	The SDH/SONET Mux/Demux TU number 'x' has a Loss of Pointer Defect. Fault detection via polling of TU_LOP_T bit in STM-1 Core. Where 'lkm' is the TU index as LKM numbering. Alternate detection via Interrupt enabled in STM-1 core.	N/A	Solid	Critical
STM LP-UNEQ lkm	IDU	The SDH/SONET Mux/Demux LP number 'x' is Unequipped. Fault detection via polling of LP_UNEQ_T bit in STM-1 Core. Where 'lkm' is the LP index as LKM numbering. Alternate detection via Interrupt enabled in STM-1 core.	N/A	Solid	Major
STM LP-TIM lkm	IDU	The SDH/SONET Mux/Demux LP number 'x' has a Trace Identifier Mismatch. Fault detection via polling of LP_TM_TIM_T bit in STM-1 Core. Where 'lkm' is the LP index as LKM numbering. Alternate detection via Interrupt enabled in STM-1 core.	N/A	Solid	Major
STM LP-REI lkm	IDU	The SDH/SONET Mux/Demux LP number 'x' has a Remote Error Indication. Fault detection via polling of LP_REI_T bit in STM-1 Core. Where 'lkm' is the LP index as LKM numbering. Alternate detection via Interrupt enabled in STM-1 core.	N/A	Solid	Major

Alarm	Affected Component	Description	LED to RED	Alarm Code	Severity
STM LP-RDI lkm	IDU	The SDH/SONET Mux/Demux LP number ‘x’ has a Remote Defect Indication. Fault detection via polling of LP_RDI_T bit in STM-1 Core. Where ‘lkm’ is the LP index as LKM numbering. Alternate detection via Interrupt enabled in STM-1 core.	N/A	Solid	Major
STM LP-PLM lkm	IDU	The SDH/SONET Mux/Demux LP number ‘x’ has a Path Identifier Mismatch. Fault detection via polling of LP_PLM_T bit in STM-1 Core. Where ‘lkm’ is the LP index as LKM numbering. Alternate detection via Interrupt enabled in STM-1 core.	N/A	Solid	Critical
STM LP-RFI lkm	IDU	The SDH/SONET Mux/Demux LP number ‘x’ has a Remote Fault Indication. Fault detection via polling of LP_RFI_T bit in STM-1 Core. Where ‘lkm’ is the LP index as LKM numbering. Alternate detection via Interrupt enabled in STM-1 core.	N/A	Solid	Critical
STM LP-BIP2 lkm	IDU	The SDH/SONET Mux/Demux LP number ‘x’ has a CRC Error. Fault detection via polling of LP_BIP2_T bit in STM-1 Core. Where ‘lkm’ is the LP index as LKM numbering. Alternate detection via Interrupt enabled in STM-1 core.	N/A	Solid	Major
SDIDU Power-Up	IDU	During power-up raise then lower this alarm.	N/A	Solid	Info
SDIDU Re-boot	IDU	When a user reboots the SDIDU, raise then lower this alarm prior to re-booting.	N/A	Solid	Info

Alarm	Affected Component	Description	LED to RED	Alarm Code	Severity
NTP Update	IDU	When the system time is updated via NTP raise then lower this alarm. The previous system time and new system time should be noted in the alarm log, SNMP trap, and syslog messages.	N/A	Solid	Info
Remote Reconfiguration Failure	IDU	When a remote reconfiguration fails and the original configuration is restored after timeout, raise then lower this alarm.	N/A	Solid	Info
FPGA Programming Failure	IDU	When the FPGA programming fails, this alarm will be set.	N/A	Solid	Critical

Abbreviations & Acronyms

A_dTPC	Adaptive Power Control
AIS	Alarm Indication Signal
BER	Bit Error Rate
Codec	Coder-Decoder
CPU	Central Processing Unit
DB	Decibel
DBm	Decibel relative to 1 mW
DCE	Data Circuit-Terminating Equipment
DTE	Data Terminal Equipment
EIRP	Effective Isotropic Radiated Power
FEC	Forward Error Correction
FPGA	Field Programmable Gate Array
GPIO	General Purpose Input/Output
IF	Intermediate frequency
IP	Internet Protocol
LED	Light-Emitting diode
LOS	Line of Sight
MIB	Management Information Base
Modem	Modulator-demodulator
Ms	Millisecond
NC	Normally closed
NMS	Network Management System
OAM&P	Operations, Administration, Maintenance, and Provisioning
OC-3	Optical Carrier level 3
ODU	Outdoor Unit
PCB	Printed circuit board
POP	Point of Presence
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
RF	Radio Frequency
RSL	Received Signal Level (in dBm)
RSSI	Received Signal Strength Indicator/Indication

RX	Receiver
SDH	Synchronous Digital Hierarchy
SNMP	Simple Network Management Protocol
SNR	Signal-to-Noise Ratio
SDIDU™	Software Defined Indoor Unit (Moseley trademark)
SONET	Synchronous Optical Network
STM-1	Synchronous Transport Module 1
TCP/IP	Transmission Control Protocol/Internet Protocol
TTL	Transistor-transistor logic
TX	Transmitter

Conversion Chart

microvolts to dBm (impedance = 50 ohms)

microvolts	dBm	microvolts	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	22.36 mV	-20 (10 mW)
60	-71.4	70.7 mV	-10(100 mW)

microvolts	dBm	microvolts	dBm
70	-70.1	223.6 mV	0 (1 mW)
80	-68.9	707.1 mV	+10 (10mW)
90	-67.9	2.23 V	+20 (100 mW)
100	-67.0	7.07 V	+30 (1 W)
120	-65.4	15.83 V	+37 (5 W)
140	-64.1	22.36 V	+40 (10 W)
160	-62.9		

IN CASE OF DIFFICULTY...

Moseley products are designed for long life and trouble-free operation. However, this equipment, as with all electronic equipment, may have an occasional component failure. The following information will assist you in the event that servicing becomes necessary.

TECHNICAL ASSISTANCE

Technical assistance for Moseley products is available from our Technical Support Department by phone or email. When calling, please give the complete model number of the radio, along with a description of the trouble/symptom(s) that you are experiencing. In many cases, problems can be resolved over the telephone, without the need for returning the unit to the factory. Please use one of the following means for product assistance:

Phone: 805 968-9621 E-Mail: mailto:Support@moseleysb.com

FAX: 805 685-7772 Web: http://www.moseleysb.com/mb

For all sales related questions please call your sales representative or for general inquires please email sales@moseleysb.com.

FACTORY SERVICE

Component level repair of radio equipment is not recommended in the field. Many components are installed using surface mount technology, which requires specialized training and equipment for proper servicing. For this reason, the equipment should be returned to the factory for any PC board repairs. The factory is best equipped to diagnose, repair and align your radio to its proper operating specifications.

If return of the equipment is necessary, you will be issued a Service Request Order (SRO) number and return shipping address. The SRO number will help expedite the repair so that the equipment can be repaired and returned to you as quickly as possible. Please be sure to include the SRO number on the outside of the shipping box, and on any correspondence relating to the repair. No equipment will be accepted for repair without an SRO number.

A statement should accompany the radio describing, in detail, the trouble symptom(s), and a description of any associated equipment normally connected to the radio. It is also important to include the name and telephone number of a person in your organization who can be contacted if additional information is required.

The radio must be properly packed for return to the factory. The original shipping container and packaging materials should be used whenever possible.


EVENT HD
TX ANT
Moseley
IDU
RX ANT
RSL
RF Ch 02
MODEM 24.576002 Mb
ASI 17.000013 Mb
EVENT HD
PWR/FLT