

Enhanced Ethernet Interface (EEI) For The DMD20, DMD50, DMD2050, and MD2401

**White
Paper**

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Introduction

Just like the original Ethernet Bridge, Radyne's new Enhanced Ethernet Interface makes connecting LAN's via satellite easy to do. Simply select Ethernet as your terrestrial interface and plug your LAN into any of the four RJ-45 connectors on the back panel. With its multi-port interface, automatic Learning and Aging, Auto-Crossover, Auto-Polarity, Auto-Negotiation and embedded Quality of Service, the Enhanced Ethernet Interface offers true Plug-n-Play connectivity.

The Enhanced Ethernet Interface is backward compatible with the original and can be easily configured for the same bridge like operation. Allowing all higher level protocols like DHCP, UDP, TCP, HTTP, and FTP, etc. to pass transparently. And with it's line speed learning capability, traffic is forwarded immediately to the appropriate ports without any unnecessary startup delay.

For users who desire more control over their traffic, the EEl provides additional QOS controls and new features such as port based priorities, strict priority queuing, and the ability to operate in a FIFO like mode.

When it comes to performance, the full duplex capability of the standard 10/100 EEl allows it to pass up to 52 Mbps in each direction over the satellite when installed in a DMD50 or DMD2050. And for users who have high-speed networks and backbones, the Gigabit version of the EEl provides the necessary connectivity with three auto-sensing 10/100/1000BaseT ports.

Point-to-Point Applications

Figure 1 illustrates a typical application connecting a remote office to the corporate headquarters via satellite. Because the EEl places no restrictions on the IP addresses or subnet masks chosen for a particular implementation, there is no lengthy setup required and no need to change any existing network configurations. Simply connect the WAN port of each router to the Modem and your satellite network is up and running.

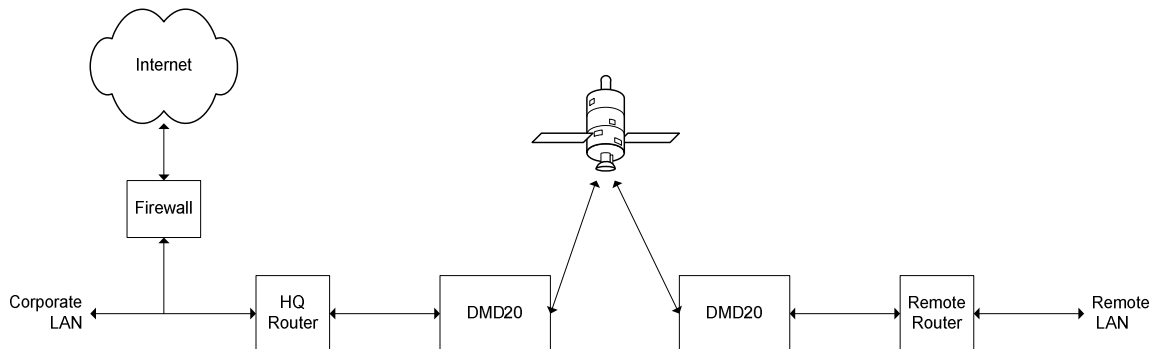


Figure 1. Point-to-Point Applications

The Importance of Transparent Operation

In some situations, the remote site may be nothing more than PC's that need to be connected to a central office for E-mail, File Transfers, or Internet access. In these cases, it's often desirable to have all of the network IP addresses assigned dynamically on an as needed basis by a DHCP server. Because the EEI can be configured to work like a bridge and not like a router, the DHCP Requests and Responses required to bring the remote PC's online, are passed transparently across the satellite link. In addition, the four-port switch interface on the standard 10/100 EEI allows small remote networks, as illustrated in Figure 2, to be set up without adding external switches or hubs.

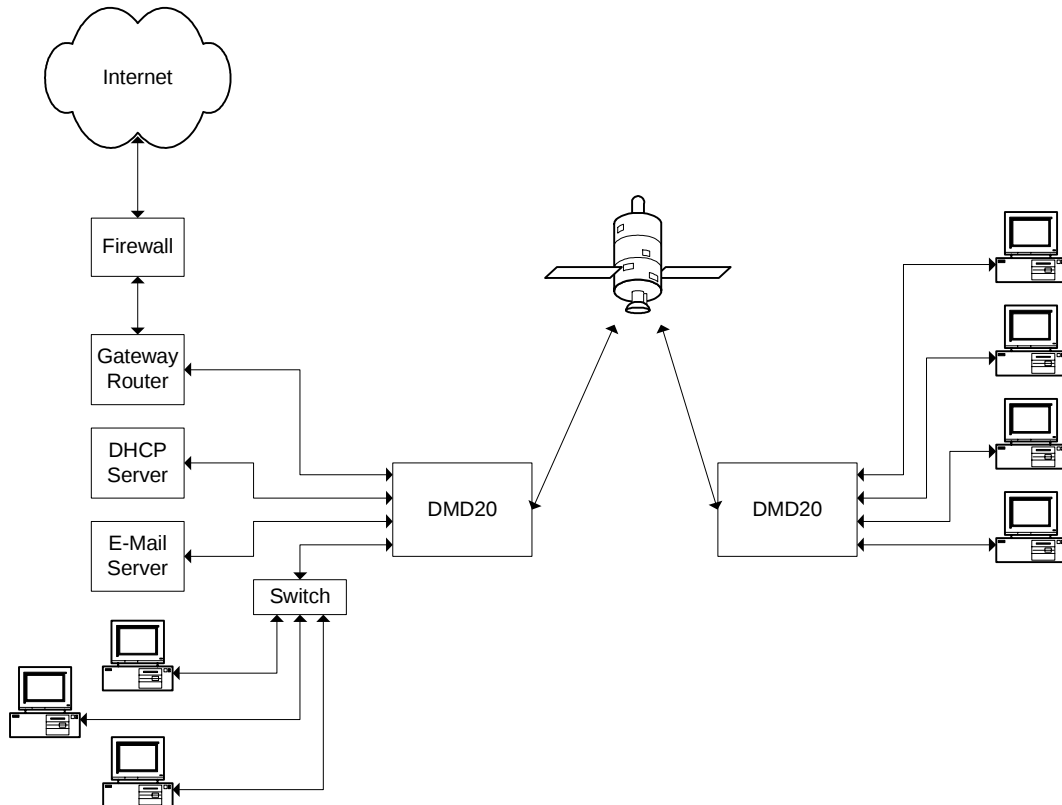


Figure 2 - Central Office Assigns Network Addresses and Controls all Services

Point-to-Multipoint Applications

In many instances, customers need to connect multiple remote sites to a central hub, and here again, the EEI provides exceptional value and ease of use. With its multi-port interface and daisy chain capability, your hub router doesn't need to know that there are multiple return paths. And as your network grows, you won't need to change your network configuration or buy additional router blades for your hub. Simply add the new hub demod to the end of your existing daisy chain and you can bring a new remote online without any disruption to the existing traffic.

Figure 3 illustrates how the DMD50, DMD20, and MD2401 multi demod can be utilized in the same network to provide a large outbound carrier and various return carriers, typical of an internet café application.

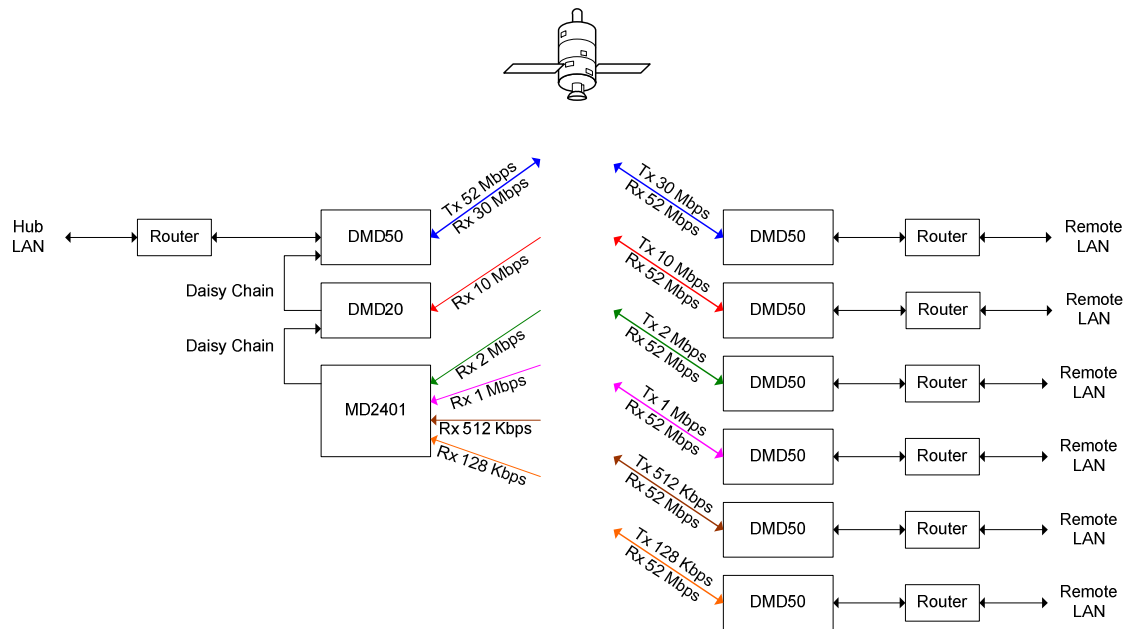


Figure 3 – Point to Multipoint – Large Outbound, Smaller Returns

High Speed Mesh Applications

As shown in Figure 4, the unique daisy chain capability of the EEI also lends itself to mesh networks. In this instance, the DMD50's have been configured with the optional three port Gigabit EEI, providing unsurpassed throughput capability. And as with the previous example, adding more nodes to your mesh system can be done without requiring additional router blades or disrupting the existing traffic.

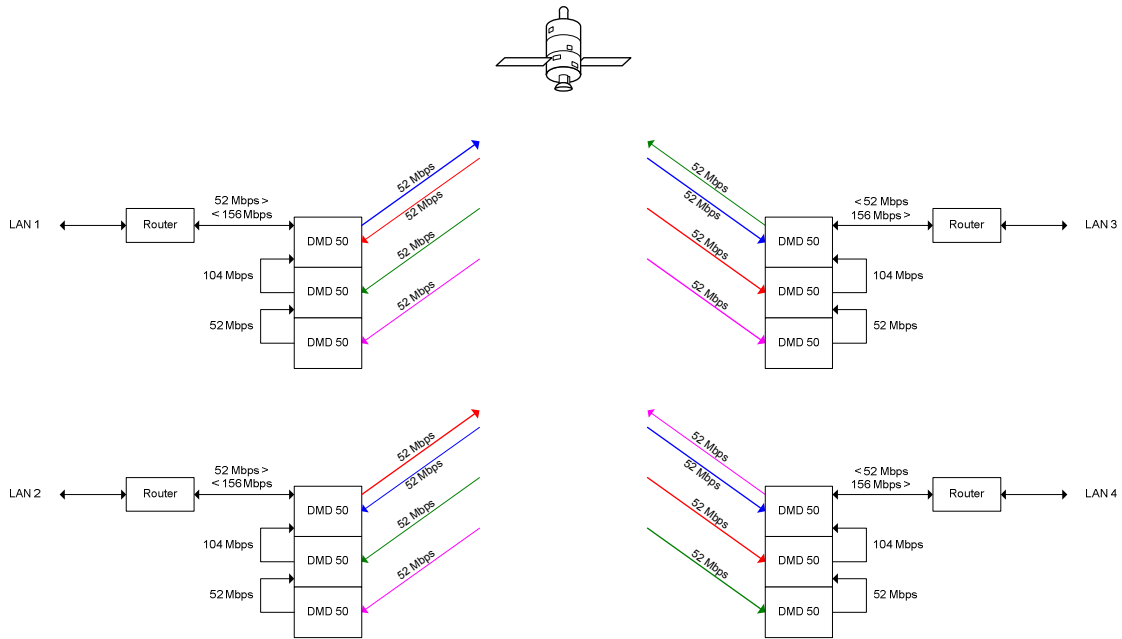


Figure 4 – High Speed Mesh
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Low Speed Mesh Applications

For mesh applications with data rates lower than 5 Mbps, the combination of a DMD20 and an MD2401 Multi-Demod as shown in Figure 5 can provide a simple 8PSK with Turbo solution that requires no IP configuration or network setup.

When configured with the Ethernet option, the MD2401 automatically muxes the packets received from the multiple data streams onto a single 10/100 Ethernet port.

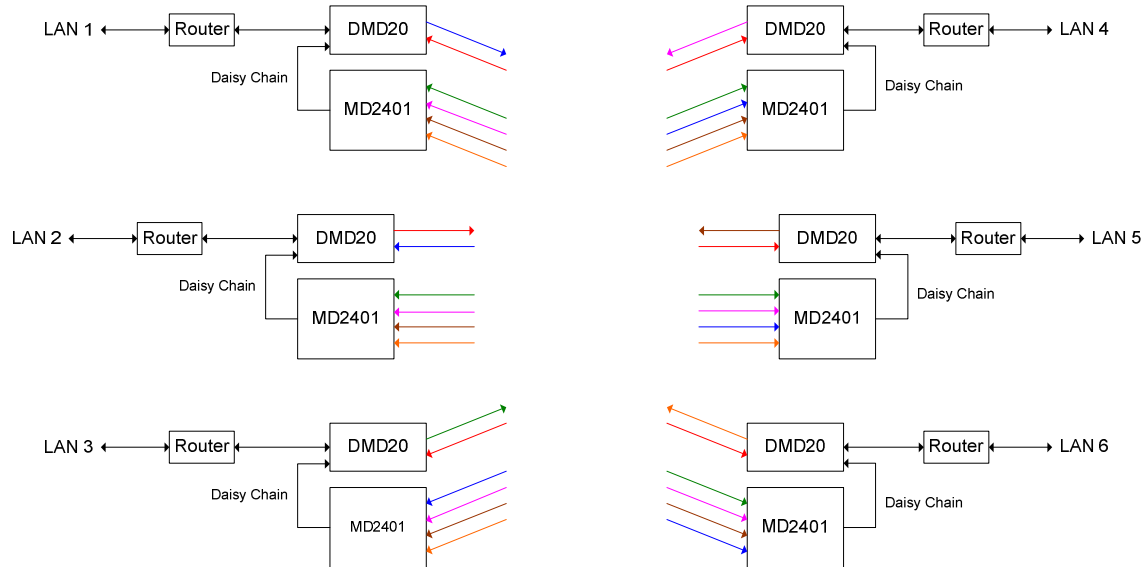


Figure 5 – Low Speed Mesh

Remote Monitor and Control via SNMP

Simple Network Management Protocol (SNMP) is the most widely used protocol for network management available today. It provides a secure, open network standard whereby a PC with a MIB Browser can be used to monitor and control almost any Cisco router, gateway, or Radyne modem. And because the Enhanced Ethernet Interface offers a multi-port Ethernet interface and daisy chain capability, every modem, even those in complex point to multi-point systems, can be easily controlled from one central location. All without requiring extensive network setup or additional equipment at every remote site.

Figure 6 illustrates complete Monitor and Control of all Radyne equipment from a centrally located PC at the Hub.

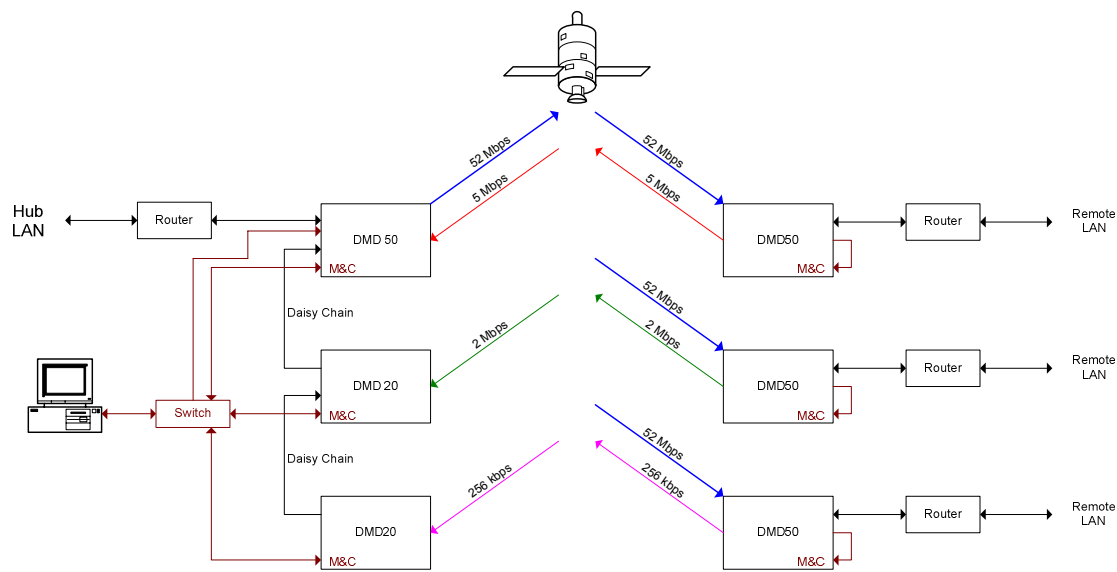


Figure 6 – Remote Monitor and Control

Enhanced Quality of Service (QOS)

Most networks are comprised of various types of real-time and non real-time services. With its four prioritized output queues, the EEI can insure that higher priority traffic like voice and network controls are not backed up behind low priority traffic such as bulk transfers and games. In addition, EEI provides the operator with more control over how the QOS determination is made and how the queues are processed. And in all cases, the QOS determinations and queuing is performed at line speed.

Figure 7 illustrates the prioritized queues and the traffic normally associated with those queues.

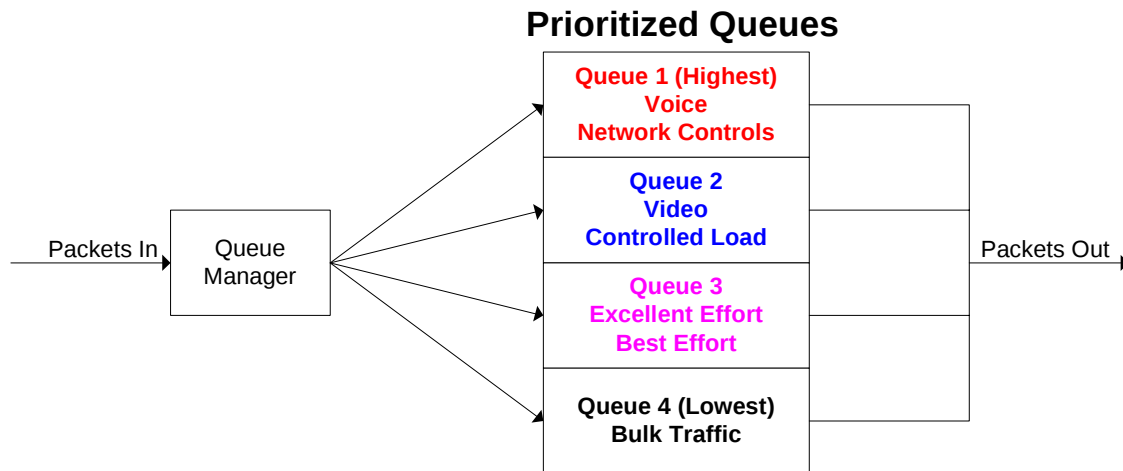


Figure 7 – Prioritized Traffic Queues

Normal QOS

When Normal QOS is selected, the determination of traffic priority and queuing is based on information contained in the packet. This type of QOS is the default on the original Ethernet Bridge and is typically what most users require. Normal QOS uses the following packet information:

When a packet contains an IEEE802.3ac Tag (this tag is optional), the EEI uses the IEEE802.1p priority information embedded in the Tag.

When a packet does not contain the optional Tag, priority is determined using the

IPv4 Type of Service / Differentiated Service field
or
IPv6 Traffic Class field

Port Based QOS

When Port Based QOS is selected, the EEI ignores and QOS information embedded in the headers and instead priority and queuing is based on the port on which the traffic arrives. This type of QOS is typically used when the operator wants to control bandwidth allocation based upon ports. However, it can also be used to create a FIFO like operation where the data is transmitted in the exact order it is received. With Port Based QOS, Port 1 has the highest priority and Port 4 on the standard 10/100 EEI or Port 3 on the Gigabit EEI has the lowest priority.

Fair Weighted Queuing

A fair weighted priority scheme allows higher priority traffic to move quickly through the system, while at the same time insuring that lower priority traffic isn't stalled indefinitely. Fair weighted queues are the default on the original Ethernet Bridge. When Fair Weighted queuing is selected, packets will be transmitted at a rate of 8, 4, 2, and 1 from the highest to lowest priority queues respectively.

Strict Priority Queuing

A strict priority scheme means that the highest priority traffic will always be transmitted first, even if it means that the lower priority traffic is stalled indefinitely. When Strict Priority queuing is selected, packets in the highest priority queue will be transmitted until that queue is empty. At that time, packets from the next highest priority queue will be transmitted until it is either empty or a higher priority packet arrives. If a higher priority packet arrives before a lower priority queue is empty, it will immediately go to the head of the line and be the next packet transmitted. Care needs to be taken when selecting this option as it is entirely possible that data in a lower priority queue might never be transmitted.

Satellite Packet Error Checking

Packet error checking is a standard part of any terrestrial Ethernet system and is performed using the CRC contained in the Ethernet wrapper. When a CRC error is encountered, the packet is discarded by the router, switch, or hub in which the error was detected.

A similar methodology is utilized over the satellite link where bit errors result in a corrupted packet with a bad CRC. And for the majority of the situations, the standard process of discarding these packets when they are encountered is the preferred methodology as the packet can simply be retransmitted.

However, there are some cases where the end device would rather receive the erred packet than no packet at all. Scenarios involving cryptography or where the end device has additional error correction capability are examples of two such situations. For these customers, the EEl provides the ability to turn off the satellite packet error checking and packets with bit errors will be output with a valid CRC so that they will pass through any routers or switches in between the modem and the receiving device.

For both sets of customers, the EEl maintains and reports satellite link statistics on total packets, erred packets, and packet error rate (PER).

Automatic Learning and Aging

The Automatic Learning and Aging function allows the EEl to be connected to a network without requiring extensive setup and programming by the operator. The learning process insures that local LAN traffic stays on the local LAN and that only traffic that is not destined for other equipment on the local LAN gets forwarded over the satellite link.

The aging process allows equipment to be shut off, moved, or even completely removed from the network without tying up resources or requiring operator intervention. For instance, a particular user might carry a laptop from remote office to remote office and use it to check their e-mail back at the corporate office. The apparent movement of the laptop's MAC address from one position in the network to another is automatically handled by the EEl.

The learned address database maintained by the EEl can hold up to 1024 MAC addresses. When a new LAN address is learned, it is placed in the database and an aging timer is started. Then, every time this learned address is heard from, its aging timer is reset and restarted. Finally, when the learned address has not been heard from for more than 5 minutes, it is removed from the database. All of the processing required for learning, searching, and aging is handled at line speed and without any unnecessary delay at startup.

Internal Buffer and Throttle

The Enhanced Ethernet Interface provides 120K bytes of internal data storage for buffering of Ethernet traffic. When this buffer is almost full, industry standard backpressure or an IEEE 802.3x Pause Frame is used to prevent the buffer from being overrun. Together the two provide an effective rate exchange and throttle between the Ethernet port and the satellite link.

Adding Acceleration, Compression, Network Security, and Traffic Shaping

Today, there are various acceleration, compression, IP security, and traffic shaping solutions available from numerous third party vendors. Some are proprietary implementations, while others are based on open standards such as MIL-STD-2045-44000 and CCSDS 714.0-B-1. Some may even be implemented in your current network and routers. And while different solutions (including none at all) make sense for different types of networks, the EEI is compatible with all of them.

Any Data Rate, Any Modulation Type, Any FEC, Any Application

The Enhanced Ethernet Interface can be used in conjunction with the appropriate DMD20, DMD50, or DMD2050 to provide a transparent satellite connection at data rates ranging from 4.8 kbps all the way up to 52 Mbps. It can be used with any available FEC and Modulation Type including DVB-S2. It can be ordered with the standard four port 10/100 interface or with the optional three port 10/100/1000 configuration. The modems and interface options can be mixed and matched to meet your network and throughput needs. And it offers plug and play connectivity regardless of the protocols used to transfer data between applications:

- IPv4 or IPv6
- Older standards such as UDP and TCP
- Newer standards such as RTP for MPEG Video and HTTPS for secure Internet access
- The latest SCTP usage as a transport mechanization for SIP
- With or without IPSec and regardless of how its implemented
- Proprietary acceleration, an open network standard, or no acceleration at all
- 10/100/1000BaseT

If the data is transmitted via Ethernet, the EEI will pass it transparently from one end of the satellite link to the other.