Megaplex-4

SH-16

E1/Ethernet over SHDSL/SHDSL.bis 16-Port Module

- 32-wire modules for various combinations of Ethernet, E1 and PW services over 8W (4-pair), 4W (2-pair), or 2W (1-pair) SHDSL/SHDSL.bis lines

- Data rates of up to 22.8 Mbps for 8W, up to 11.4 Mbps for 4W and up to 5.7 Mbps for 2W

- EFM extended rate for ASMi-54L: Data rates of up to 15.3 Mbps per 2W

- STU-C/STU-R configuration

- Remote power feeding over 4 wires

- Extended range with RAD's SHDSL/SHDSL.bis repeater

- EFM (Ethernet First Mile) or M-pair bonding over SHDSL/SHDSL.bis

SH-16 is a 16-port Ethernet over SHDSL/SHDSL.bis module for the Megaplex-4 chassis that delivers digital data to customer premises over existing copper cables of the distribution network.

SHDSL/SHDSL.BIS

SH-16 modules provide a simple, low-cost connectivity solution using High Speed Digital Subscriber Line (SHDSL/SHDSL.bis) technology.

Each SHDSL/SHDSL.bis port is a multirate SHDSL/SHDSL.bis modem transmitting at user-selectable data rates of up to 5.7 Mbps on each pair.

SH-16 modules can operate as Central SHDSL.bis (STU-C) or Remote (STU-R) SHDSL.bis Termination Units working with up to 16 of the following remote devices:

- ASMi-54/ASMi-54L/ASMi-53 or ASMi-52 (E1 or V.35) standalone modems

- ETX-203AM, ETX-2i units

- ASMi-54C/SH-16 modules.

The selection is done per group of four lines (1-4, 5-8, 9-12, 13-16).

Using TC-PAM 64 line coding technology, the modems operate in full-duplex mode at up to 15 Mbps per port.

ETHERNET

The Ethernet services are provided by means of an internal Layer-2 Ethernet switch that fully complies with the IEEE 802.3/Ethernet V.2 standards, and has full VLAN support.

The Ethernet switch switches traffic between the module PCS ports and the CL module Ethernet subsystem (for connection via the CL GbE ports to a packet-switched network, or for transmission through the SDH network via virtually concatenated groups (VCGs).

SH-16 implements the IEEE's 802.1Q standards to provide VLAN-tagging with levels of prioritization, enabling carriers to offer differentiated Ethernet services. VLAN tagging can also be employed to separate traffic, ensuring transparency of the customer traffic and bolstering security of management traffic.

The processing and switching of Ethernet traffic over TDM (SHDSL) links is configured by means of PCS (Physical Coding Sublayer) using EFM or HDLC as the Layer-2 protocol.

EFM bonding on the Ethernet interface ensures that a failure or addition of a link does not drop the traffic being transmitted over the other wires in the group. The capacity of the group is not affected when a new link is added at a lower rate.

To increase the available SHDSL range, two or four pairs can be bonded to operate in the M-pair (HDLC) mode specified in ITU-T Rec. G.991.2. This type of bonding is available for lines handled by the same SHDSL section (ports 1 to 4, 5 to 8, 9 to 12 and 13 to 16).

TDM

To increase the available SHDSL range, up to four pairs can be bonded to operate in the M-pair (HDLC) mode specified in ITU-T Rec. G.991.2. Bonding is available for lines handled by the same SHDSL section (the section handling ports 1 to 4, ports 5 to 8, ports 9 to 12, or ports 13 to 16).

The framing mode is user-selectable, in accordance with the required processing of the port traffic: G.704 basic with or without signaling, or unframed.

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PSEUDOWIRE

A powerful pseudowire engine saves the need of two additional MPW-1 modules. The engine provides up to 16 protected PWs per module with up to 32 timeslots per each PW port.

Several fractional SHDSL E1-i links can be directly cross-connected within the module to a single PW.

SH-16 features a built-in jitter buffer with configurable depth of 125 msec.

The payload encapsulation methods are SAToPSN (for carrying unframed E1 data streams) and CESoPSN (framed data streams).

REMOTE POWER FEEDING AND EXTENDED RANGE

The remote power feeding version of the module delivers power and data over 4 wires to remote SHDSL/SHDSL.bis modems or repeaters.

Power feeding for each individual line is connected/disconnected via a software command. The power feeding status for each line and report of current overload conditions are displayed via CLI.

The SHDSL data transmission range can be significantly extended with RAD's new S-RPT/EFM repeater, with local or remote power feeding, thus greatly enhancing RAD's solution for migration to Next Generation networks.

The module receives the power from the external MPF power feeder.

MANAGEMENT

Setup, control, and diagnostics are performed in the following ways:

- Via ASCII terminal connected to a supervisory port on the Megaplex-4 CL module

- Via management station connected to a dedicated 10/100BaseT Ethernet port on the Megaplex-4 CL module

- Using inband management with dedicated VLAN for managing remote units (ASMi-54C/SH-16/ASMi-54/ASMi-54L/ASMi-53)

- Using EOC from the central SH-16 module for managing remote units (ASMi-54L/ASMi-53 or ASMi-52 with E1 or V.35 interface).

MONITORING AND DIAGNOSTICS

Performance statistics for the SHDSL and PCS (Physical Coding Sublayer) ports may be obtained and analyzed via the Megaplex-4 management system.

The module features independent remote-on-remote diagnostic loopbacks on its SHDSL and PCS ports.

SH-16 modules feature the following diagnostics:

- Remote inband loopbacks on SHDSL and PCS ports of remote units

- Local and remote loopbacks on E1-i and DS1 ports of SH-16 module (per port/per timeslot)

- Local and remote loopbacks on E1 ports of remote units

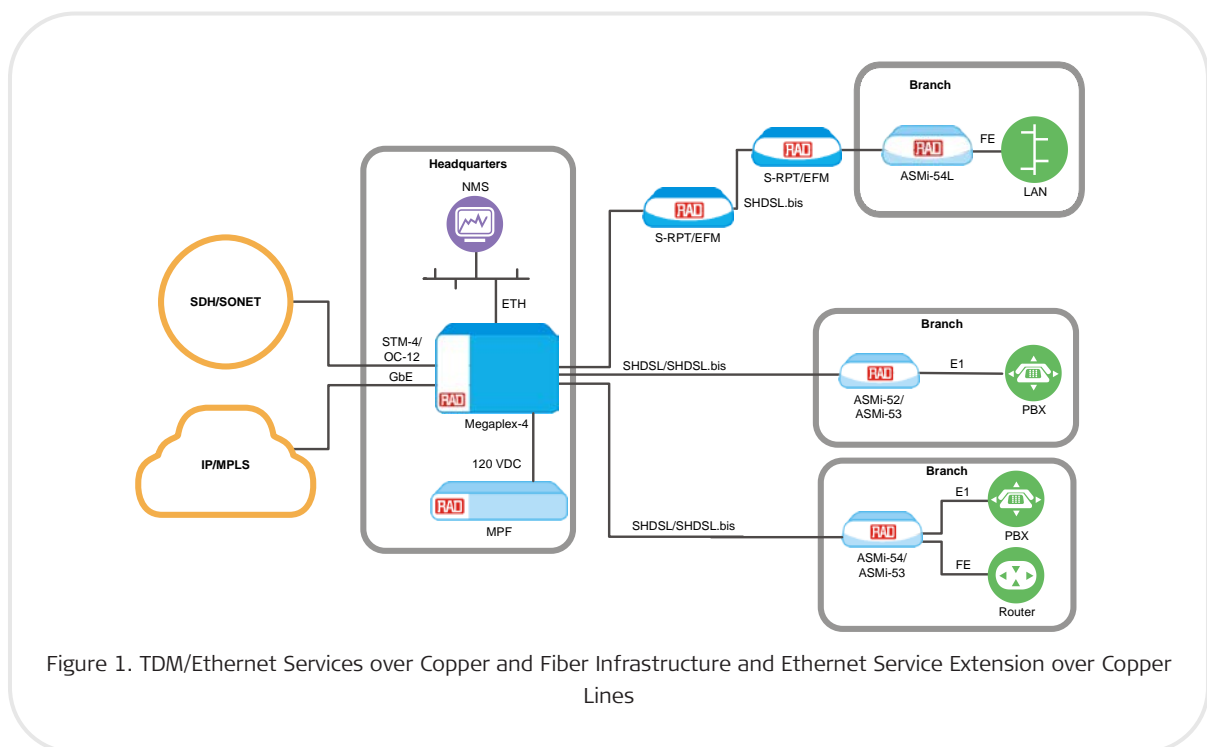- BER Test on E1-i ports of SH-16 module.

Figure 1. TDM/Ethernet Services over Copper and Fiber Infrastructure and Ethernet Service Extension over Copper Lines

TIMING

When the SHDSL line is in STU-R mode, the corresponding E1-i port can be selected as a clock source of the system.

In SH-16 modules with PW ordering options, the timing clocks can be regenerated using the adaptive method, according to the monitored received packet rate from the IP network. The timing is then also passed on to the I/O modules.

End-to-end synchronization between circuits is maintained by deploying advanced clock recovery mechanisms.

Specifications

SHDSL/SHDSL.bis INTERFACE

Number of Ports
16

Number of Wires
2, 4, 8

Compliance
ITU-T G.991.2, ETSI TS 101524
EFM bonding per IEEE 802.3ah
    clauses 61, 63

Max. Data Rate
30592 kbps (2 pairs/TC-PAM 64,
    ASMi-54L)
22784 kbps (4 pairs/TC-PAM 32, ASMi-54,
    ASMi-54LRT, ETX-203AM, ETX-2i)
Note: *For complete data rate table, see the*
Megaplex-4 I/O Modules Installation and Operation
Manual.

Line Coding
With remote ASMi-52 (E1 or V.35):
    TC-PAM 16
With remote ASMi-54, ASMi-53,
ETX-203AM, ETX-2i: TC-PAM 16/32
With remote ASMi-54L:
    TC-PAM 16/32/64

Impedance
135Ω

Connectors
2 DB-26 connectors convertible to 8 RJ-45 connectors via adaptor cable

Typical Range
See *Table 1*

PSEUDOWIRE

Standard Compliance
IETF: RFC 4553 (SAToP), RFC 5086
    (CESoPSN)

MFA Forum: IA 8.0.0

MEF 8

Number of PW Connections
32 per module (up to 640 per chassis)

Jitter Buffer Size

0.25–256 msec, in 1 μsec steps with
125 μsec granularity (the value entered by the user is rounded upward to the closest n*125 sec value)

DIAGNOSTICS

Remote inband loopbacks on SHDSL and
    PCS ports of remote units
Local and remote loopbacks on E1-i ports
    of SH-16 module (per port/per timeslot)
Local and remote loopbacks on E1 ports
    of remote units
BER Test on E1-i ports of SH-16 module

Table 1. Typical Ranges over 2W@26 AWG Cable

Data Rate	Ranges	
[kbps]	[km]	[mi]
192	6.6	4.1
1536	4.9	3.0
2048	4.5	2.8
4096	3.2	2.0
4608	3.0	1.9
5696	2.6	1.6
15296	0.70	0.43

Notes: The SHDSL data rate depends on the distance, number of wires and far-end device.

The typical ranges are based on error-free lab tests without noise and obtained on a 26 AWG cable line simulator (DLS-6100, DLS-6300).

MONITORING

Performance monitoring per ITU-T Rec G.991.2, G.826

GENERAL

Indicators

16 dual-color LED indicators per port:

- Lights steadily in green: the corresponding port is operating properly

- Lights in red: the corresponding port detects loss of synchronization

- Flashes in green: the corresponding port is in synchronization process

- Off: the corresponding port is not connected.

Power Consumption

SH-16, SH-16/E1: 20.3W
SH-16/E1/PW: 21.3W
SH-16/PF, SH-16/E1/PF: 20.8 W
SH-16/E1/PW/PF: 21.8 W

Note: *When power feeding is enabled, additional power consumption from MPF (see MPF Data Sheet) should be taken into account.*

Remote Power Feed

Number of Remote Units: Up to 16
Power Feeding: 120 VDC at 70 mA
    maximum per line
Maximum power per chassis: 5A

Environment

Operating temperature:
-10°C to 55°C (14°F to 131°F)
Storage temperature: -20°C to 70°C (-4°F
    to 158°F)
Humidity: up to 95%, non-condensing

Ordering

RECOMMENDED CONFIGURATIONS

MP-4100M-16SHDSL
Ethernet over SHDSL/SHDSL.bis 16-port module

MP-4100M-16SHDSL/PF
Ethernet over SHDSL/SHDSL.bis 16-port module with remote power feeding

MP-4100M-16SHDSL/E1

E1/Ethernet over SHDSL/SHDSL.bis 16-port module

MP-4100M-16SHDSL/E1/PW

E1/Ethernet over SHDSL/SHDSL.bis 16-port module with PW support

OPTIONAL ACCESSORIES

CBL-DB26-8SHDSL
Cable for splitting a single 26-pin SHDSL.bis connector to 8 x RJ-45 connectors

Note: *This cable is required for the module operation. It can either be ordered from RAD or manufactured by the customer according to pinouts provided in the manual.*

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