Trend´s E1/T1 Guide

Pocket Guide for E1 and PDH Testing

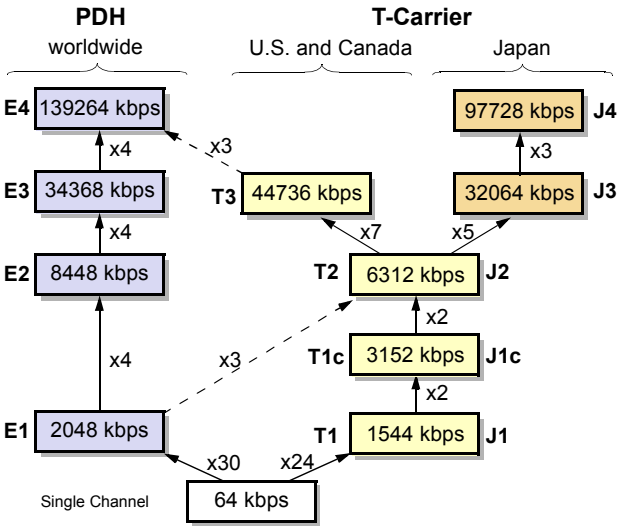


Figure 1 PDH and T-carrier hierarchies

AuroraTango E1
A hand-held Telecom and Datacom tester up to 2 Mbit/s with double analyser. G.703 balanced and unbalanced, V.11, V.24, V.35, V.36 and EIA530 interfaces. All the features needed for in-depth analysis, from Pulse mask check to jitter generation and analysis, including transfer and tolerance tests.

VictorPlus
A hand-held analyzer and generator for Telecoms and Data networks of 2 Mbps and below, with physical interfaces for G.703, V.11, V.24, V.35 and V.36, it can perform in-service and out-of-service measurements. It can be remotely managed through a TCP/IP network.

VictoriaFamily
A touch-screen hand-held family of testers which includes all ETSI/ANSI interfaces up to 2.5 Gbps with functions such as TCM, APS, M/N alarms G.783 sequences, frequency deviation and *n* x 64 and *n* x 56kbps tests at E1 and DS1 levels. Remote control through a TCP/IP network.

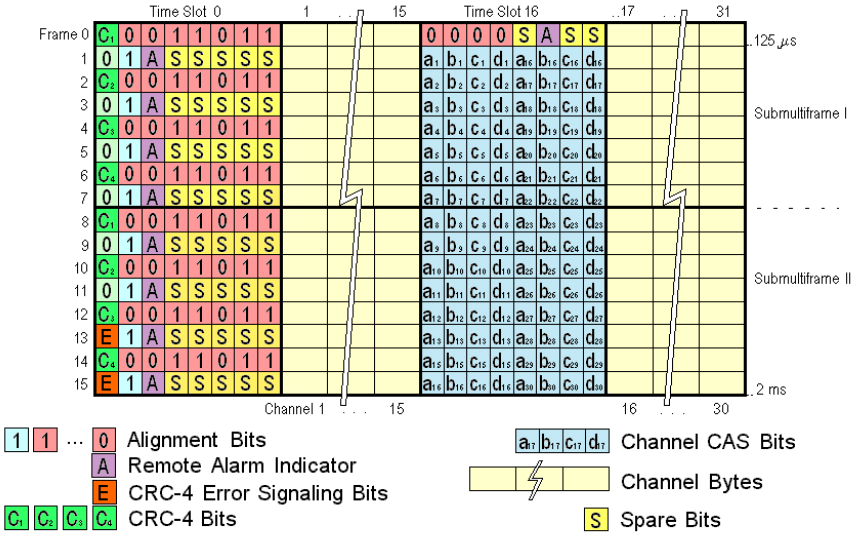


Figure 2 The E1 frame is the first hierarchy level.

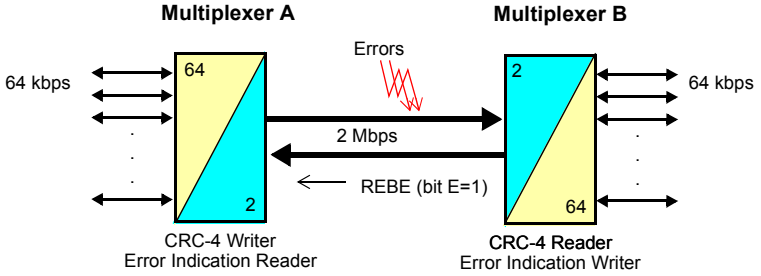


Figure 3 The A multiplexer calculates and writes the CRC code, and the multiplexer B reads and checks the code.

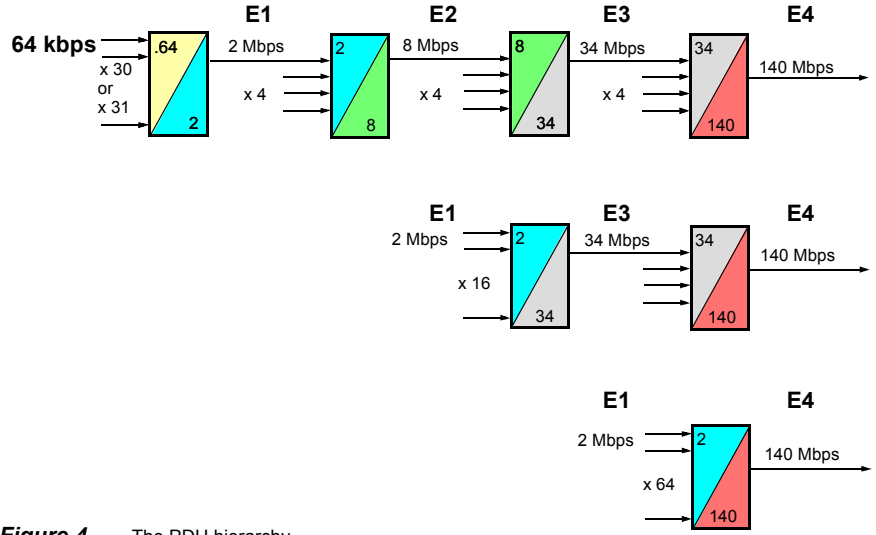


Figure 4 The PDH hierarchy

Standard	Binary Rate	Size	Frame/s	Code	Amplitude	Attenuation
G.704/732	2,048 kbps±50 ppm	256 bits	8,000	HDB3	2.37-3.00V	6 dB
G.742	8,448 kbps±30 ppm	848 bits	9,962.2	HDB3	2.37V	6 dB
G.751	34,368 kbps±20 ppm	1536 bits	22,375.0	HDB3	1.00V	12 dB
G.751	139,264 kbps±15 ppm	2928 bits	47,562.8	CMI	1.00V	12 dB

Table 1 *The PDH hierarchy figures*

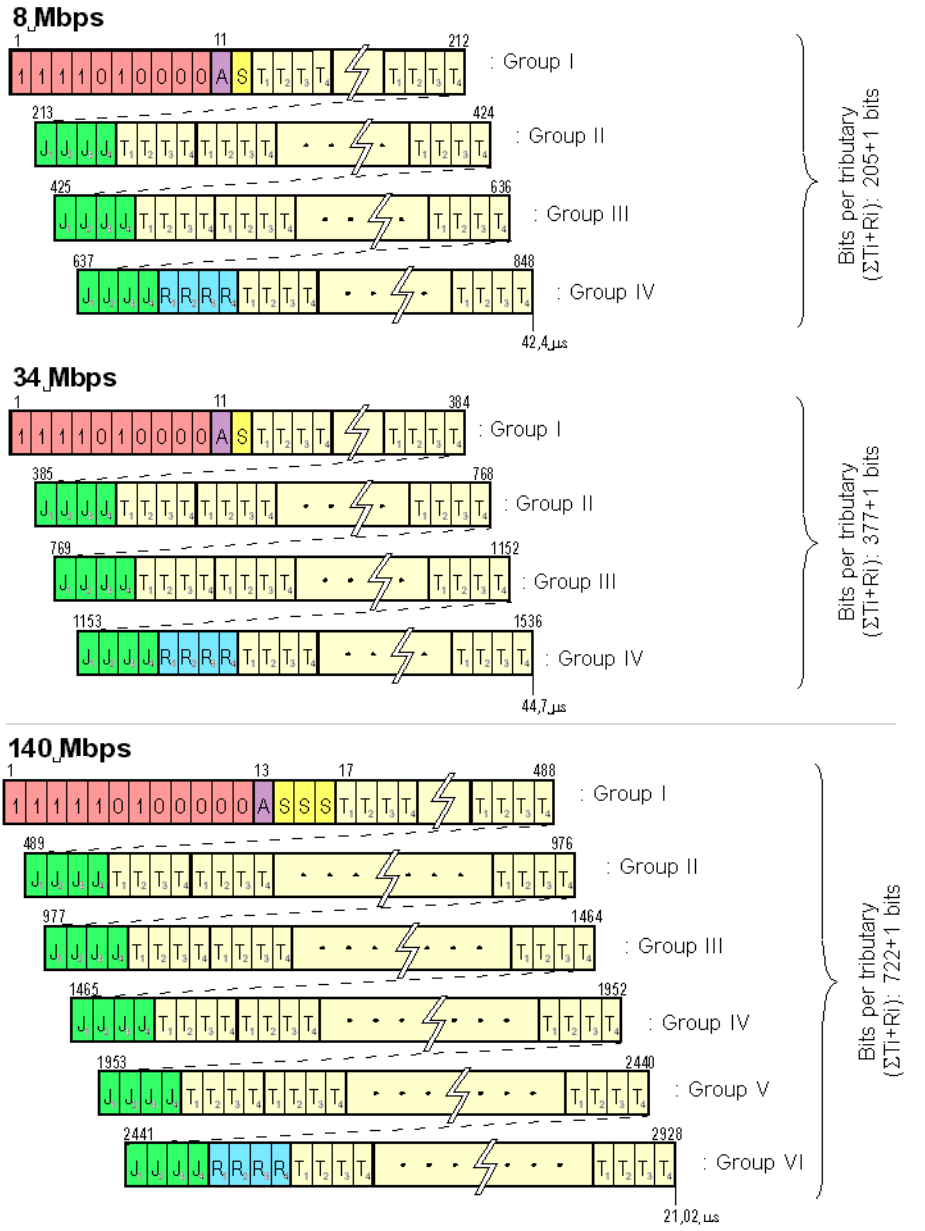


Figure 5 The higher PDH hierarchies. A bit-oriented justification process is used to fit tributaries created with clock impairments.

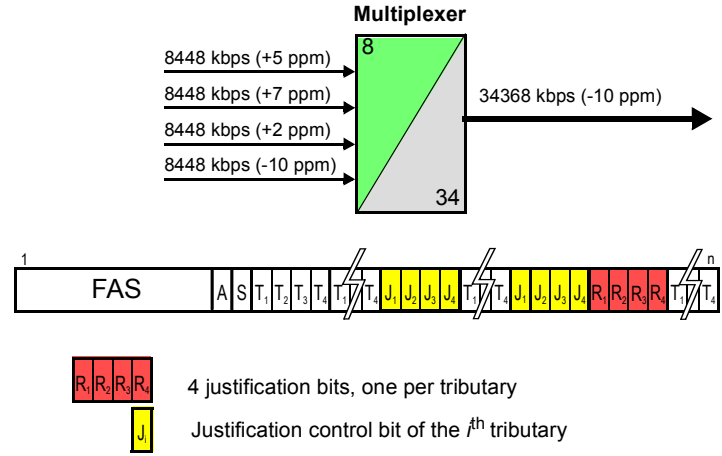
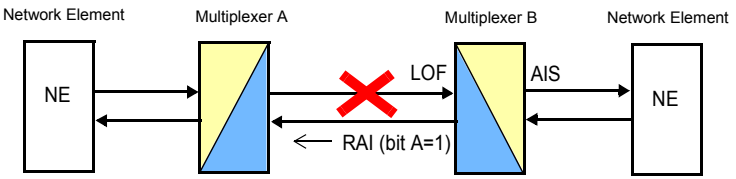
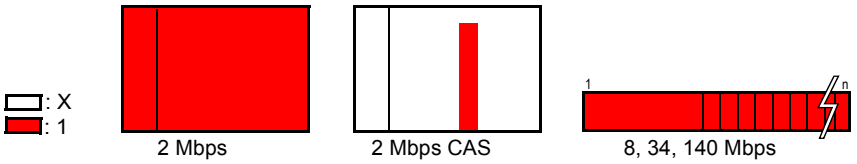


Figure 6 PDH hierarchies are not synchronous, and variations can be expected in the bit rate clock - in this case a justification mechanism is implemented. If all J_i=1, then the R_i bit does not contain information. If all J_i=0, then R_i contains information.

Alarm Management:



AIS Formats:



RAI Formats:

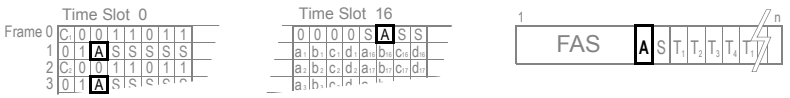


Figure 7 When a multiplexer detects an LOS or LOF, it sends an RAI to its partner multiplexer and forwards an AIS to the next NE.

ID	Detection Criteria
AIS	Alarm Indication Signal. It is detected if there are two or less zeros (ITU-T G.775).
LOF	Loss of Frame alarm. It is raised after three consecutive frames with FAS error or three consecutive signalling bits (ITU-T G.706).
LOS	Loss of Frame Signal alarm.
RAI	Remote Alarm Indication. It is detected after three consecutive frames with the A bit equal to 1 (ITU-T G.732).
FAS error	Frame Alignment Signal error, indicating an incorrect bit in the alignment word.
Bit error	Bit sequence mismatch (when the transmitted pattern is known).
Code error	Violation on coding sequence.
CRC-LOM	Cyclic Redundancy Checksum - Loss of Multiframe. Activated if there is LOF, and deactivated after one correct FAS and two correct CRC-MFAS (ITU-T G.706).
CAS-LOM	Channel-Associated Signalling - Loss of Multiframe. Raised after two consecutive MFAS errors or two multiframes with time slot 16 bits equal to 0 (ITU-T G.732).
CAS-MRAI	Channel-Associated Signalling - Multiframe Remote Alarm Indication. Detected after two consecutive frames with the MRAI bit equal to 1 (ITU-T G.732).
CAS-MAIS	Channel-Associated Signaling - Multiframe Alarm Indication Signal. Detected if there are less than three zeros in the time slot 16 during two consecutive multiframes.
CRC error	Cyclic Redundancy Check error. Raised if one or more bits are erroneous, whenever CRC-LOM is off (ITU-T G.706).
REBE	Remote End Block Error. Raised if the first bit of the frames 14 and 16 is 0 (ITU-T G.706).

Table 1 *2 Mbps events: alarms, errors and event indications*

ID	Explanation
AIS	Alarm Indication Signal. This is detected if less than six zeros in a frame in the case of 140 Mbps, or less than three zeros in 34 Mbps and 8 Mbps.
LOF	Loss of Frame alarm. Raised after four consecutive frames with FAS error
LOS	Loss of Frame Signal alarm
RAI	Remote Alarm Indication. Detected after two consecutive frames with A equals1
FAS error	Frame alignment signal error. One or more incorrect bits in the alignment word.

Table 2 *PDH events: alarms, errors and event indications for all the hierarchies*

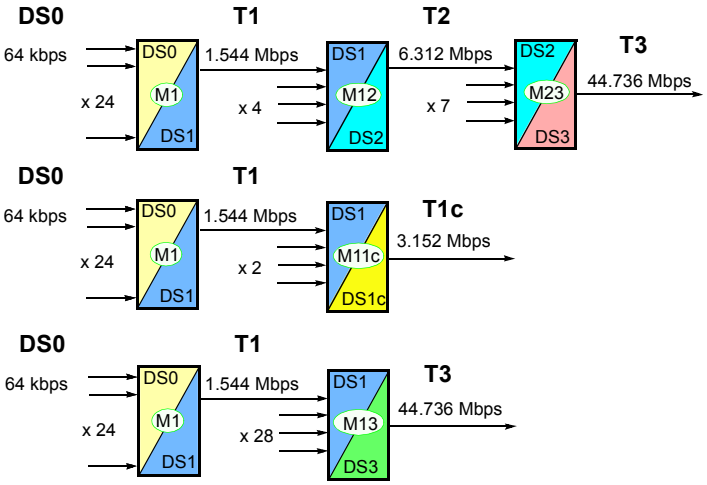


Figure 8 T-Carrier hierarchy (US)

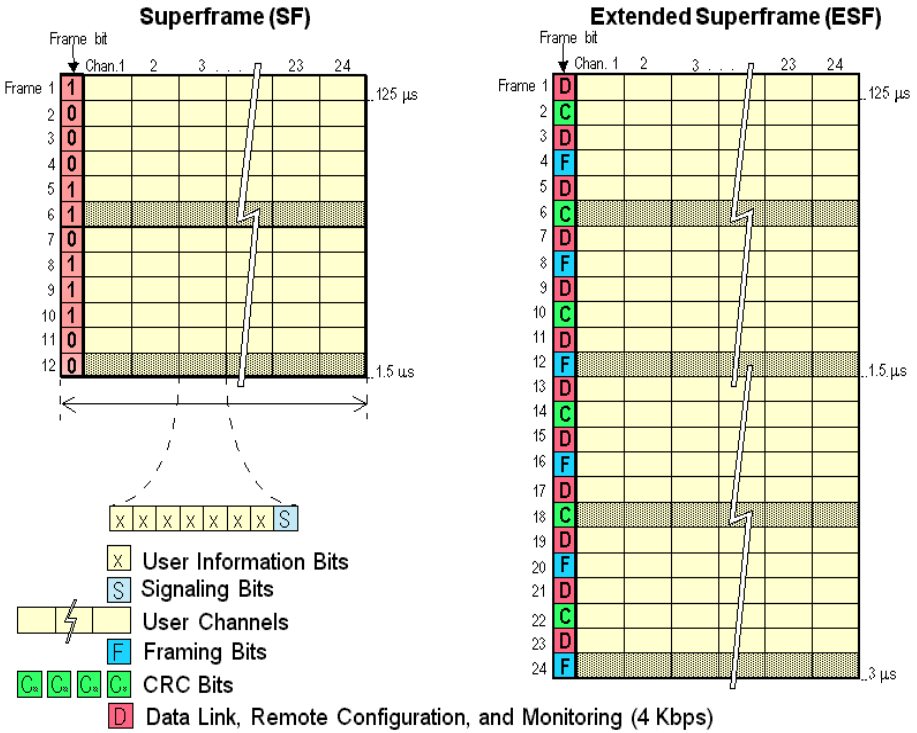


Figure 9 The T1 frame and superframe

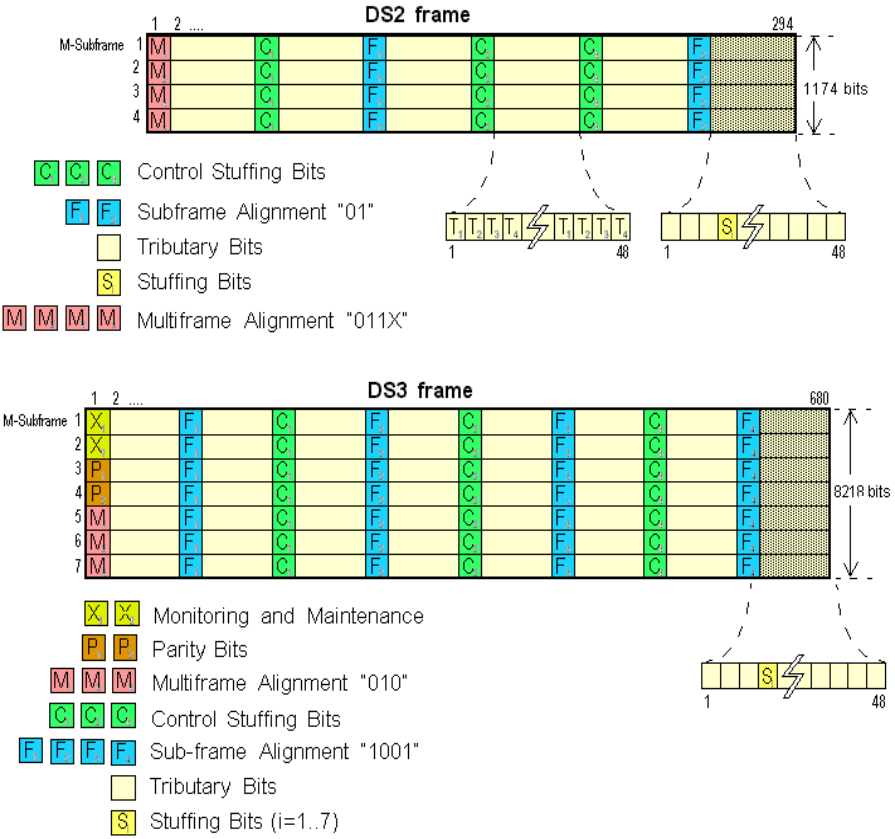


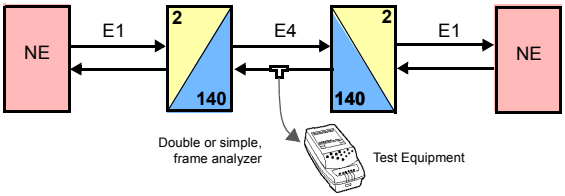
Figure 10 The DS2 frame or M12 multiplexing and DS3 frame.

Code	Event Type	Explanation
00110010 11111111	DS3 equipment failure	Service Affecting (SA), requires quick attention
00011110 11111111	DS3 equipment failure	Non-Service Affecting (NSA)
00000000 11111111	DS1 equipment failure	Service Affecting (SA), requires quick attention
00001010 11111111	DS1 equipment failure	Non-Service Affecting (NSA)
00011100 11111111	DS3 LOS	Loss of Signal
00101010 11111111	Multiple DS1 LOS	Multiple Loss of Signal in the DS1 tributaries
00111100 11111111	Single DS1 LOS	Loss of Signal received from a DS1
00000000 11111111	DS3 OOF	Out of Frame in the DS3 signal
00101100 11111111	DS2 AIS	Alarm Indication Signal received from a DS2

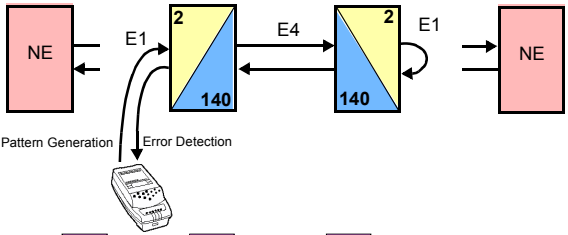
Table 3 *C-bit parity: alarm and status signal codes*

Test and Measurement

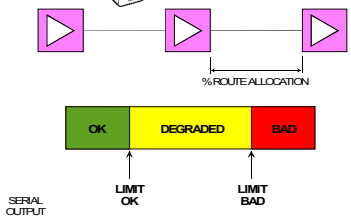
In-Service-Measurement (ISM)



Out-of-Service-Measurement (OOSM)



Performance Measurement



Acronyms

AIS	Alarm Indication Signal	LOS	Loss of Signal
CAS	Channel-Associated Signalling	NE	Network Element
CCS	Common Channel Signalling	PDH	Plesiochronous Digital Hierarchy
CRC	Cyclic Redundancy Check	RAI	Remote Alarm Indication

More information in:
Installation and Maintenance of SDH/SONET, ATM, XDSL, and Synchronization Networks.

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