Appendix D: Specifications

The organization of this section is as follows:

- General Specifications (Table 1)
- Option 38 PDH (Table 2)
- Option 14 Jitter/Wander (Table 3)
- Environmental Specifications (Table 4)
- Physical Specifications (Table 5)
- Certifications and Compliances (Table 6)

CTS850 SDH/PDH Test Set

Table D 1: General CTS850 Specifications

Characteristic	Description
SDH Generator Output	
Electrical Output	
Data Rates	STM-0: 51.84 Mb/s STM-1: 155.52 Mb/s
Data Formats	STM-0E: B3ZS STM-1E: CMI
Signal Level at Transmit Output	STM-0E: ±1.0 Vpk ±10% into 75 STM-0E (6dB) STM 0E output attenuated with 6 dB cable loss (12.7 dB √f characteristic cable) STM-1E : ±0.5 Vpk ±10% into 75 STM-1E (6dB) STM 0E output attentuated with 6 dB cable loss (12.7 dB √f characteristic cable)
Pulse Shape at Transmit Output	Meets ITU-T G.703 Pulse Masks

Table D 1: General CTS850 Specifications (Cont.)

Characteristic	Description
Return Loss	>15 dB
Connectors	Unbalanced BNC, 75 to ground Option 12 1.6/5.6, 75 Ohm to ground
Optical Output	
Data Rates	STM-0: 51.84 Mb/s STM-1: 155.52 Mb/s STM-4: 622.08 Mb/s
Optical Module Options	Opt. 01, Electrical only, STM 0/1E Opt. 03, 1310 nm, IR, STM-0/1 Opt. 04, 1310 nm, IR, STM-0/1/4 Opt. 05, 1550 nm, LR, STM-0/1/4 Opt. 06, 1310/1550 nm, STM 0/1/4
Signal Level & Wavelength	10 dBm, typical, 1310 nm, (Opt. 03, 04, 06) 0 dBm, typical, 1550 nm, (Opt. 05, 06)
Pulse Shape	Meets ITU-T G.957 Eye Pattern Masks
Wavelength	1308 nm, typical (Opt. 03, 04, 06) 1550 nm, typical (Opt. 05, 06)
Spectral Width	≤ 4 nm rms, 1310 nm (Opt. 03, 04, 06) ≤ 1 nm rms, 1550 nm (Opt. 05, 06)
Laser Classification	Class 1 laser, complies with 21 CFR 1040.10 and 1040.11, complies with IEC 825, Section 9.4
Connectors	User selectable when ordering Opt. 31: FC PC; Opt. 32: ST; Opt. 33: SC; Opt. 34: DIN. Other connector types consult factory
SDH Signal Structure	
Payload Channel (AU)	Concatenated VC4 4c signal in STM 4 One active AU 4 in STM-1 One active AU 4 in STM 4 (The other 3 channels are unequipped) One active AU 3 in STM-0
Unequipped Payload	C2 byte is set to 00 Bulk fill set to 00

Table D 1: General CTS850 Specifications (Cont.)

Characteristic	Description
SDH Internal Pattern Generator	
Patterns Bulk Fill in a selected AU channel (AU 3 or AU 4)	PRBS: 2^9 1, 2^{15} 1, 2^{20} 1, 2^{23} 1; All 1s, All 0s, 8-bit programmable word. PRBS patterns may be inverted *Overhead Test Patterns* RSOH Orderwire E1 RSOH User Byte F1 MSOH Orderwire E2 POH User Byte F2 D1 D3 DCC D4 D12 DCC PRBS: 2^{15} 1, 2^{20} 1, 2^{23} 1. PRBS patterns may be inverted.
Error Type and Insert Rates Single or Continuous rate	RS BIP B1 STM0: 1.0e 3 to 1.0e 10 STM1: 1.0e 4 to 1.0e 10 STM4: 1.0e 5 to 1.0e 10 MS BIP B2 STM0: 1.0e 3 to 1.0e 10 STM1/4: 1.0e 4 to 1.0e 10 Path BIP B3 STM0: 1.0e 3 to 1.0e 10 STM1/4: 1.0e 4 to 1.0e 10 HP REI G1 STM0: 1.0e 3 to 1.0e 10 STM1/4: 1.0e 4 to 1.0e 10 Payload (Pattern Bit Error) 1.0e 3 to 1.0e 10
Defects	LOS, LOF, LSS (Pattern Loss), RS TIM, MS AIS, MS RDI, AU LOP, AU AIS, HP RDI, HP TIM, HP PLM, HP UNEQ2, LP RDI, LP RFI, LP TIM, LP UNEQ, LP PLM, TU AIS

Table D 1: General CTS850 Specifications (Cont.)

Characteristic	Description
SDH Transmitter Clock	
Internal Clock	
Accuracy	±4.6 ppm, for instrument calibrated within 36 months
External Clock Reference	
Rates	2.048 Mb/s ± 50 ppm 2.048 MHz ± 50 ppm 1.544 Mb/s ± 50 ppm
Input	Unbalanced, 75 , BNC connector, G.703 signal format
Recovered Clock	
Loop timing	Clock is recovered from received signal
Transmit Line Frequency Offset rate	±100 ppm of nominal line rate, resolution 0.1 ppm
SDH Receiver Input	
Electrical Input	
Data Rates	STM-0: 51.84 Mb/s ±100 ppm STM-1: 155.52 Mb/s ±100 ppm
Data Formats	STM-0E: B3ZS STM-1E: CMI

Table D 1: General CTS850 Specifications (Cont.)

Characteristic	Description
Signal Sensitivity/Equalization	STM-0E: 0.5 Vpk min to 1.2 Vpk max STM-0E 6 dB[1]: 0.25 Vpk min to 0.6 Vpk max STM-0E 12dB[2]: 0.125 Vpk min to 0.35 Vpk max STM-0E Monitor: 20 dB of flat loss below 6 dB STM-1E: 0.35 Vpk min to 0.6 Vpk max STM-1E 6 dB[3]: 0.35 Vpk min to 0.6 Vpk max STM-1E 12dB[4]: 0.07 Vpk min to 0.3 Vpk max STM-1E Monitor: 26 dB of flat loss below STM 1E level
Signal Level Display	Readout for: Electrical signal level in mV
Return Loss	>15 dB
Connectors	Unbalanced BNC, 75 to ground Option 12 1.6//5.6, 75 Ohm to ground
SDH Optical Input	
Data Rates	STM-0: 51.84 Mb/s (±100 ppm) STM-1: 155.52 Mb/s (±100 ppm) STM-4: 622.08 Mb/s (±100 ppm)
Maximum Input Power	7 dBm: Opt. 05 and 06 include a 10 dB attenuator for use at 1550 nm
Operating Wavelength	1310 nm and 1550 nm: 1100 nm to 1570 nm operating range
Signal Sensitivity	28 dBm for BER ≤10^{10}
Optical Power Meter Accuracy	±2 dBm, typical: For input power in a range of 30 dBm to 6 dBm

1 **6 dB cable loss @ 25 MHz (12.7 dB √f characteristic cable)**

2 **12 dB cable loss @ 25 MHz (12.7 dB √f characteristic cable)**

3 **6 dB cable loss @ 78 MHz (12.7 dB √f characteristic cable)**

4 **12 dB cable loss @ 78 MHz (12.7 dB √f characteristic cable)**

Table D 1: General CTS850 Specifications (Cont.)

Characteristic	Description
Connectors	User selectable when ordering Opt. 31: FC PC; Opt. 32: ST; Opt.33: SC; Opt. 34: DIN. Other connector types consult factory.
Through Mode	Monitors a selected channel while passing the signal through unchanged (both electrical and optical)
Section Overhead	
Access	Set overhead bytes to any value from binary 00000000 to 11111111: A1, A2, J0, E1, F1, D1 D3, K1, K2, D4 D12, S1, M1, E2 View all Section Overhead bytes Clear text decode of S1 message byte provided per G.707
Add/Drop	Orderwire Access to E1 byte from RJ 11 jack. Insert data from the Overhead Add/Drop connector into the Section DCC, Line DCC, E1, E2 or F1 user byte. Drops data from the Section DCC, Line DCC, E1, E2, or F1 user byte out to the Overhead Add/Drop connector. PRBS evalution is provided internally for bytes E1, E2, F1, F2, D1 D3, D4 D12.
K1 and K2 (APS)	Set the APS Bytes, K1 and K2, to any code defined in ITU G.783 Annex A and G.841. Selectable by clear text for all Span and Ring messages
Path Overhead	
Access	Set Path Overhead bytes to any value from binary 00000000 to 11111111: C2, G1 (bits 5 7 only), F2, H4 (bits 1 6 only), F3, K3, N1 View all Path Overhead bytes Clear text decode of C2 signal label per ITU G.707

Table D 1: General CTS850 Specifications (Cont.)

Characteristic	Description
Add/Drop	Insert data from the Overhead Add/Drop connector into the F2 user byte PRBS can be used via F2 internally
Trace Bytes J1, J0	J1 HP Trace VC4 Overhead User defined 15 byte with CRC, 64 byte formats per ITU T G.707 J0 RS Trace User defined 15 byte with CRC per ITU T G.707
Pointer Control	
Single	Single pointer justification
Burst	Bursts of two to eight pointer justifications spaced four frames apart. All adjustments within a given burst are in the same direction. Subsequent bursts are in alternating directions
Continuous	Pointer justifications occur continuously at a predetermined rate in an incrementing, decrementing, or alternating direction. Rate between movements: 2 ms to 10 s, with a resolution of 1 ms.
Set to Value	Set to a new location with or without the NDF being set. Range is 0 to 1023 (783 1023 are illegal locations).

Table D 1: General CTS850 Specifications (Cont.)

Characteristic	Description
Pointer Test Sequences AU Pointer sequences available	G.783(a) Single Alternating G.783(b) Regular + Double G.783(c) Regular + Missing G.783(d) Double Alternating G.783(e) Single G.783(f) Burst G.783(g1) Periodic 87 3 G.783(g2) Periodic 87 3 With Add G.783(g3) Periodic 87 3 With Cancel G.783(h1) Periodic G.783(h2) Periodic with Add G.783(h3) Periodic with Cancel Phase Transient Pointer Adjustment Burst
Pointer Direction	Positive or Negative
Initialization Period	On or Off Thirty second burst of 1 pointer per second in the same direction as the selected test, per ITU T G.783
Cool Down Period	On or Off This will last at least 60 seconds, for an integral number of complete sequences, per ITU T G.783.
Combined Jitter	Simultaneous PDH mapping frequency offset with ITU t G.783 Pointer Sequences generation. To enable the measurement of combined mapping and pointer jitter. The range specification for this function is restricted to +/ 50 ppm if the Transmitter is using recovered clock for its reference and Pointer with Mapping Offset" is selected.
SDH Measurements	
SDH Anomalies Error Count, Error Rate, and Errored Seconds for:	B1, B2, B3, Payload, MS-REI, HP-REI, LP REI
Network Defects (Seconds)	LOS, LSS (Pattern Loss), CTS Loss of AC Power
SDH Defects (Seconds)	MS AIS, MS RDI, AU AIS, HP RDI, AU LOP, RS TIM, HP TIM, HP UNEQ, HP PLM, LP RDI, LP RFI, LP TIM, LP UNEQ, LP PLM, TU AIS

Table D 1: General CTS850 Specifications (Cont.)

Characteristic	Description
AU Pointer Measurements	NDF Sec., Illegal Sec., +Ve Just. Count, VE Just. Count, Illegal Count, NDF Count, Pointer Value
G.826 Performance Analysis	
RS B1, MS B2, Path B3, AU LOP, AU AIS, HP REI, HP TIM, HP PLM, HP UNEQ, LP REI, LP TIM, LP UNEQ, TU LOP, TU AIS Seconds and ratio	Errored Blocks, ES, %ES, SES, %SES, UAS, %UAS, CSES Periods, Background Block Errors, %Background Block Error, Path UAS, %Path UAS
G.826 Performance Analysis	
Performance analysis performed as per user settable allocation percentage for SDH and PDH.	Regeneration Section, Multiplex Section, high and low order path layers are individually evaluated. Analysis results: Pass or Fail
G.821 Performance Analysis	
Pattern Bit Seconds and % of total time	Error-Count, ES, DM, SES, UAS, EFS
M.2101.1 Error Analysis	
B1, B2, B2, TU BIP, RS TIM, MS REI, MS RDI, MS AIS, AU AIS, AU LOP, HP REI, HP TIM, HP UNEQ, HP PLM, HP RDI, LP REI, LP TIM, LP UNEQ, LP PLM, LP RDI, LOS, OOF, TU LOM, TU AIS, TU LOP	Errored blocks, ES, %ES, SES, %SES, CSES, UAS, %UAS, Background Block Errors, %Background Block Errors, Path UAS, %Path UAS
M.2101.1 Performance Analysis	
Test Types: BIS (Bring in Service); PAR (Performance After Repair); MAINT (Maintenance); Custom (User controls performance limits)	Automated test types allow Performance Analysis for Regeneration Section, Multiplex Section, high and low order path layers based on user settable allocation percentage. Custom test type allows user to select the performance objective limits. Analysis Results: Acceptable, Provisional/Degraded or Unacceptable.

Table D 1: General CTS850 Specifications (Cont.)

Characteristic	Description
SDH Standards Compliance	
SDH Framing	G.707
SDH Multiplexing	G.707
SDH Optical Interfaces	G.957
SDH Electrical Interfaces	G.703
SDH Jitter Tolerance	G.825 & G.958
SDH Pointer Sequences	G.783
MSP/APS Message	G.841, G.783
SDH Error Analysis	G.826, G.821
SDH Performance Analysis	M.2101.1
SDH Test Patterns	O.181, O.150, O.151
SDH Availability Performance	G.827
LEDs	
SDH Status Indicators	LOS, LOF, OOF, LOP, MS AIS, MS RDI, AU AIS, HP RDI, Signal Present, Pattern Lock, LSS, Error, Pointer Adj
SDH Histograms	
Error Count (General)	B1, B2, B3, MS-REI, HP-REI, Pattern Bit, Pointer Jitter
Defects On/Off	LOS, OOF, LOF, AU-LOP, MS-AIS, HP-RDI, AU-AIS, Pattern Loss, Loss of Power
Pointers	AU Pointer Value, Pointer Justification
Measurement Utilities	
Measurement Control	Manual Start/Stop Timed: 1 s to 99 days with 1 s resolution Continuous

Table D 1: General CTS850 Specifications (Cont.)

Characteristic	Description
Histogram Display Resolution	High: 1 sec (displays 2 hours with 1 sec resolution) Normal: 1 min, 5 min, 15 min, 1 hour (displays 5 days with 1 min resolution) Low: 15 min, 60 min, 4 hrs, 12 hrs (displays 75 days with 15 min resolution)
Result Logging	All measurements are recorded with start, stop time and date. Current results (totalized and graphical) are stored in memory. Both graphical and totalized results can be stored on disk.
LEDs	
PDH and TU Status Indicators	TU AIS, LP RDI, PDH AIS, PDH RAI
Histograms for PDH & TU	
Error Count (General)	E1 Anomalies, TU BIP, LP-REI, Pattern Bit, Pointer Jitter
PDH & TU Defects On/Off	LOS, LOF, PDH AIS, PDH RAI, TU-LOP, TU-AIS, LP-RDI, TU LOM, Pattern Loss, Loss of Power
TU Pointers	TU Pointer Value, Pointer Justification
Histograms for Jitter/Wander	Jitter (UIpp), Frequency Drift Rate (ppm/sec)
Utilities	
TroubleScan	Scans all measurement results for key violations
AutoScan	AutoScan to incoming signal (rate, mapping, framing and pattern). Identifies incoming signal and presents graphical display of AU and TU structure, and PDH mux structure. Identifies TU signal status by showing TU number, equipped vs unequipped, alarms, and pattern.
Stored Setups	5 front panel setups in memory 200 front panel setups per disk

Table D 1: General CTS850 Specifications (Cont.)

Characteristic	Description
Pass/Fail Tests	Predefined Pass/Fail Tests can be created, stored and executed Pass/Fail tests are stored on disk 200 Pass/Fail test setups per disk
Add/Drop Interface for Data Communication Channels and User Channels	A DB-37 female connector provides the interface to an external protocol analyzer. Clock and data signals are differential TTL, conform to RS-422 specifications, and are also compatible with single-ended TTL signals. Add/Drop: D1 D3, D4 D12, F1, F2, E1, E2 Connector: 37 Pin DIN (DTE and DCE) RJ11 style handset jack for analog access to E1/E2 bytes
Triggering	Pulse at start of each frame, (Tx and Rx), Connector: 37 Pin DIN
Error output	B1, B2, B3 bit error selectable
Disk Drive	3.5 inch, 1.44 MB, DOS compatible Measurement Results stored in ASCII Stored Setups and Pass/Fail Tests
Printer	Optional printer DPU 414 (DMAPRN) Printer support: Epson, HP Thinkjet, ASCII text Serial Printer Port: V.24 Print to disk: BMP format, Interleaf format, Encapsulated PostScript, ASCII text
Computer Interface	IEEE-488.2 interface RS-232-C interface (DB9)
Help Mode	Online task-oriented help
Display	7 inch diagonal CRT, green phosphor Resolution: 640 by 480 pixels VGA output: 15 pin connector

Table D 2: CTS 850 Opt. 38 PDH Tributaries Specifications

Characteristic	Description
2 Mb/s, 8 Mb/s, 34 Mb/s, 140 Mb/s Generator	
Option 38 2 Mb/s, 8 Mb/s, 34 Mb/s, 140 Mb/s Tributaries	
Option 55 45 Mb/s map/demap capability only	
The data format can be built upon the pattern generator framed or unframed output at the PDH line/mapping rate, or upon multiple layers of user configurable sub multiplexing. A specific hierarchy or tributaries can be selected and filled with a background pattern.	
Electrical Output	
Data Rates	2 Mb/s (2.048 Mb/s) 8 Mb/s (8.448 Mb/s) 34 Mb/s (34.368 Mb/s) 45 Mb/s (44.736 Mb/s) 140 Mb/s (139.264 Mb/s)
Formats	2 Mb/s, 8 Mb/s, 34 Mb/s: HDB3, AMI 45 Mb/s: HDB3, B3ZS 140 Mb/s: CMI
Signal Level	2 Mb/s: 3 Vpk ±0.3 V into 120 (balanced) 2 Mb/s: 2.37 Vpk ±0.237 V into 75 8 Mb/s: 2.37 Vpk ±0.1 V into 75 34 Mb/s: 1 Vpk ±0.1 V into 75 45 Mb/s DS3 High: 0.9 Vpk ±0.2 V into 75 45 Mb/s DSX: 0.36 Vpk to 0.85 Vpk into 75 140 Mb/s: 1 Vpk pk ±0.1 V into 75
Pulse Shape	Meets ITU-T G.703 Pulse Masks
Connectors	2 Mb/s: 3 pin Siemens 120 2 Mb/s, 8 Mb/s, 34 Mb/s, 45 Mb/s, 140 Mb/s: BNC 75 Option 12: 1.6/5.6 75 Ohm

Table D 2: CTS 850 Opt. 38 PDH Tributaries Specifications (Cont.)

Characteristic	Description
PDH Output Data Source	2 Mb/s: 2 Mb/s Internal Generator Configured from N x 64kbit/s Drop from SDH TU12 Drop from demuxed 8 Mb/s and above From 2 Mb/s input (through mode) 8 Mb/s: Internal Pattern Generator Muxed up from 2 Mb/s From 8 Mb/s input (through mode) 34 Mb/s: Internal Pattern Generator Muxed up from 8 Mb/s Drop from SDH TU3 Drop from demuxed 140 Mb/s From 34 Mb/s input (through mode) 45 Mb/s: Internal Pattern Generator Drop from SDH TU3 From 45 Mb/s input (through mode) 140 Mb/s: Internal Pattern Generator Muxed up from 34 Mb/s Drop from SDH VC4 From 140 Mb/s input (thorugh mode)
2 Mb/s, 8 Mb/s, 34 Mb/s, 140 Mb/s Internal Pattern Generator	
Framing	2 Mb/s: Unframed N x 64kbits/s (with starting TS, range) FAS (31 channel) FAS + CRC4 (31 channel) FAS + MFAS (30 channel) FAS + CRC4 + MFAS (30 channel) (G.704, G.737, G.732) 8 Mb/s: Unframed FAS (G.742) 34 Mb/s: Unframed FAS (G.751) 45 Mb/s: Unframed M13 (bulk filled) C bit Parity (bulk filled) 140 Mb/s: Unframed FAS (G.751)

Table D 2: CTS 850 Opt. 38 PDH Tributaries Specifications (Cont.)

Characteristic	Description
Patterns (for PDH Testing Line/Mapped)	Active Channel Patterns in selected measurement channels. N x 64 Kb/s PRBS 2^9 1per O.153 PRBS 2^{11} 1per O.152 PRBS 2^{15} 1per O.151 PRBS 2^{20} 1per O.153 PRBS 2^{23} 1;per O.151 All the above may be inverted All 1s All 0s TS Idle 1020 Hz audio tone 2,8,34,45,140 Mb/s PRBS 2^9 1per O.153 PRBS 2^{11} 1per O.152 PRBS 2^{15} 1per O.151 PRBS 2^{20} 1per O.153 PRBS 2^{23} 1;per O.151 All the above may be inverted All 1s All 0s Alternating 1/0 1 in 8 8, 16, 24 bit User selectable pattern Fill Patterns in background non measurement channels. N x 64 Kbit/s TS Idle (55 H) 2 Mb/s PRBS 2E15 1 All 1s All 0s Alternating 1/0 8,34,45,140 Mb/s PRBS 2^{15} 1per O.151 PRBS 2^{20} 1per O.153 PRBS 2^{23} 1;per O.151 All the above may be inverted All 1s All 0s Alternating 1/0

Table D 2: CTS 850 Opt. 38 PDH Tributaries Specifications (Cont.)

Characteristic	Description
Errors	Single, Continuous, Burst (all are mutually exclusive and effective on active channels only)
Error Type	CRC (2 Mb/s only) min. 1.0E 8, max 1.0E 4 Parity Bit Error (45 Mb/s only) P bit (M13, C bit); CP bit (C bit); REI (C bit) Frame Burst (available on any ONE enabled multiplexed level) (2,8,34,45,140 Mb/s) N<M<1000 M=frame count N= consecutive FAS Error count *Pattern Bit* first line is Payload Pattern bit at active pattern's rate; Second line is *Line Code* 64 kb/s, min. 1.0E 6, max 1.0E 2, *Line Code: not applicable* 2 Mb/s, min. 1.0E 8, max. 1.5E 2 *Line Code: min. 1.0E 8, max. 1.0E 3* 8 Mb/s, min. 1.0E 9, max. 1.0E 2 *Line Code:* min. 1.0E 10, max. 1.0E 3 34 Mb/s, min. 1.0E 9, max. 1.5E 2 *Line Code:* min. 1.0E 10, max. 1.0E 3 45 Mb/s, min. 1.0E 9, max. 1.5E 2 *Line Code:* min. 1.0E 10, max. 1.0E 3 140 Mb/s, min. 1.0E 9, max. 1.5E 2 *Line Code: not applicable*
Alarm Insertion	2 Mb/s: AIS, RAI NFAS bit 3=1 8 Mb/s: AIS, RAI NFAS bit 11=1 34 Mb/s: AIS, RAI NFAS bit 11=1 45 Mb/s: AIS, RAI NFAS bit 11=1 140 Mb/s: AIS, RAI NFAS bit 13=1
TU12/TU3/VC4 Mapping	
Mapping Signal Source for TU12, , and VC4	Internal Generator: / Received Signal: 2 Mb/s / 2 Mb/s 34 Mb/s / 2, 34 Mb/s 45 Mb/s / 45 Mb/s 140 Mb/s / 2, 34, 140 Mb/s
Mapping mode	Floating Asynchronous per G.707

Table D 2: CTS 850 Opt. 38 PDH Tributaries Specifications (Cont.)

Characteristic	Description
TU12 Active Map Channel Selection	Allows selection of any one or all of 63 TU channels, or all TU 12s simultaneously Remaining 62 TU channels are background
TU3 Active Map Channel Selection	Allows selection of any one or all of 3 TU channels, or all TU 3s simultaneously Remaining 2 TU channels are background
140 Mb/s Active Map Channel Selection	Into selected STM-1 VC4
TU12 Background Channels	
TU Background Channel Content	When internal 2 Mb/s or 34 Mb/s generator is used: PRBS: 2^{15} 1 or Idle pattern (11010101) when external source is used: PRBS: 2^{15} 1
TU Background Channel Framing	All unframed unless All TUs
TU3 Background Channels	
TU Background Channel Content	When internal 34 Mb/s generator is used: VC3 is a Bulk filled pattern, Valid Pointer and BIP Bulk fill data is 01, 02, and 03 for TU3 #1, #2, and #3.
TU Errors (Single or Continuous)	TU12 BIP 2 TU3 BIP 8 LP REI
TU Defects	TU AIS LP RDI TU Loss of Pointer LP UNEQ TU Loss of Multiframe LP PLM LP RFI LP TIM
PDH Transmitter Clock	
Transmit Line Frequency Offset	±100 ppm of nominal line rate. Resolution, 0.1 ppm
2 Mb/s, 8 Mb/s, 34 Mb/s, 140 Mb/s Receiver	
Electrical Input	
Data Rates	2 Mb/s (2.048 Mb/s) ±150 ppm 8 Mbit/s ±150 ppm 34 Mb/s (34.368 Mb/s) ±150 ppm 45 Mb/s (44.736 Mb/s) ±150 ppm 140 Mb/s (139.264 Mb/s) ±150 ppm

Table D 2: CTS 850 Opt. 38 PDH Tributaries Specifications (Cont.)

Characteristic	Description
Formats	2, 8, 34 Mb/s: HDB3, AMI 45 Mb/s: HDB3, B3ZS 140 Mb/s: CMI
Impedance	2 Mb/s: 120 balanced 2 Mb/s Bridged: 1 k balanced 2, 8, 34, 45, 140 Mb/s: 75 unbalanced
PDH Receive Signal Level	ITU TG.703 nominal pulse and signal level Normal: Auto equalization of root fcable loss to ITU TG.703 limits * 2 Mb/s Bridged: Auto equalization of root fcable loss to ITU TG.703 limits ** Protected Monitor Point 20dB: 15to 23dB flat loss Protected Monitor Point 30dB: 23to 31dB flat loss * 2 Mb/s & 8 Mb/s root fcable loss = 6 dB max * 34 Mb/s & 140 Mb/s root fcable loss= 12 dB max ** 2 Mb/s Bridged only specified for 120 Ohm balanced cable
Connectors	2 Mb/s: 3 pin Siemens 120 2 Mb/s, 8 Mb/s, 34 Mb/s, 45 Mb/s, 140 Mb/s: BNC 75
2 Mb/s, 8 Mb/s, 34 Mb/s 140 Mb/s Internal Pattern Receiver	
Pattern Receiver Source	N/Mx64 kbit/s & 2 Mb/s: 2 Mb/s External Drop from SDH TU12 Demuxed 8 Mb/s and above 8 Mb/s: 8 Mb/s External Demuxed 34 Mb/s 34 Mb/s: 34 Mb/s Internal Demuxed 140 Mb/s 45 Mb/s: 45 Mb/s External SDH TU3 Drop 140 Mb/s: 140 Mb/s External SDH VC4 Drop

Table D 2: CTS 850 Opt. 38 PDH Tributaries Specifications (Cont.)

Characteristic	Description
Framing	N/Mx64kbit/s & 2 Mb/s: Unframed FAS (31 channel) FAS + CRC4 (31 channel) FAS + MFAS (30 channel) FAS + CRC4 + MFAS (30 channel) (G.704, G.737, G.732) 8 Mb/s: Unframed FAS (G.742) 34 Mb/s: Unframed FAS (G.751) 45 Mb/s: Unframed FAS (G.742) 140 Mb/s: Unframed FAS (G.751) CAS (Signalling in TS 16) Bits displayed: a,b,c,d VFchan. 1 to 30 Value displayed: 1 or 0
TU12/TU3/VC4 Demapping	
Demapping TU12, TU3 and VC4 Signal Drop to	Internal Receiver: / External Signal Output 2 Mb/s / 2 Mb/s 34 Mb/s / 34 Mb/s 45 Mb/s / 45 Mb/s 140 Mb/s / 140 Mb/s
Demapping mode	Floating Asynchronous
TU12 Active Demap Channel Selection	Allows selection of any one of 63 TU channels
TU3 Active Demap Channel Selection	Allows selection of any one of 3 TU channels
140 Mb/s Active Demap Channel from	Selected STM-1 VC4

Table D 2: CTS 850 Opt. 38 PDH Tributaries Specifications (Cont.)

Characteristic	Description
TU Path Overhead	
TU12 Path Overhead Access, bits 5 7 only	V5 control (xxxx) Set Path Overhead bytes to any value from binary 00000000 to 11111111: N2 and K4 View all TU Path Overhead bytes
TU3 Path Overhead Access	Set Path Overhead bytes to any value from binary 00000000 to 11111111: (set G1 bits 5 7 only) C2, F3, K3, N1 (H4 bits 1 6 only) View all TU Path Overhead bytes
TU3 Path Trace Byte J1	Send user-defined 15 bytes & CRC sequence or set to all “space” characters View Path Trace J1
TU12 Path Trace Byte J2	Send user-defined 15-byte & CRC sequence, or set to 00000000 (Null) View Path Trace J2
TU Pointer Measurement	
TU Pointer Interaction	TU12, TU3, or AU4, but not at the same time
Single	Single pointer justification (increment or decrement)
Burst	Bursts of two to eight pointer justifications spaced four multi-frames apart. All adjustments within a given burst are in the same direction. Subsequent bursts are in alternating directions.
Continuous	Pointer justifications occur continuously at a predetermined rate in an incrementing, decrementing, or alternating direction. Rate between movements: 48 ms to 10 s, with a resolution of 1 ms.
Set to Value	Set to a new location with or without the NDF being set. TU12 Range is from 0 to 1023 (140 1023 are illegal locations). TU3 Range is from 0 to 1023 (783 1023 are illegal locations).

Table D 2: CTS 850 Opt. 38 PDH Tributaries Specifications (Cont.)

Characteristic	Description
TU Pointer sequences available	G.783(a) Single Alternating G.783(b) Regular + Double G.783(c) Regular + Missing G.783(d) Double Alternating G.783(e) Single G.783(f) Burst G.783(g1) Periodic 87 3 G.783(g2) Periodic 87 3 With Add G.783(g3) Periodic 87 3 With Cancel G.783(h1) Periodic G.783(h2) Periodic with Add G.783(h3) Periodic with Cancel Phase Transient Pointer Adjustment Burst TU-3 Periodic 85 5 TU-3 Periodic 85 5 With Add TU-3 Periodic 85 5 With Cancel TU-12 Periodic 35 1 TU-12 Periodic 35 1 With Add TU-12 Periodic 35 1 With Cancel
Pointer Direction	Positive or Negative
Initialization Period	On or Off Thirty second burst of 1 pointer per second in the same direction as the selected test, per ITU T G.783
Cool Down Period	On or Off This will last at least 60 seconds, for an integratl number of complete sequences, per ITU T G.783
PDH & TU Measurements	
PDH Error Count, Error Rate and Error seconds for	FAS; CRC-4 (2 Mb/s only); Pattern Bit; Code Violation; 45 Mb/s Frame Bit Error; 45 Mb/s REI
TU Error Count, Error Rate and Error seconds for	TU12 BIP 2 TU3 BIP-8 TU12 REI TU3 REI
PDH Defect Seconds for	AIS; RDI; Loss of Sync Sequence (LSS); Loss of Frame (FAS); Loss of Signal

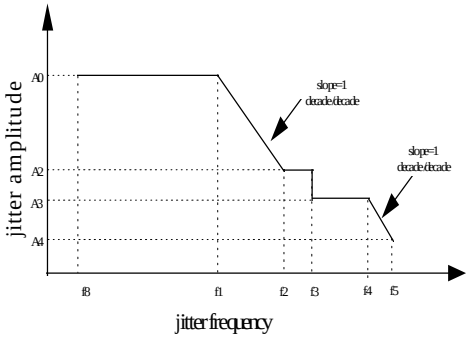
Table D 2: CTS 850 Opt. 38 PDH Tributaries Specifications (Cont.)

Characteristic	Description
TU Defect Seconds for	TU AIS LP RDI LP RFI LP PLM LP TIM LP UNEQ TU Loss of Pointer TU Loss of Multiframe
TU Pointer Measurements	Seconds: LOP Illegal pointers NDF Count: Illegal pointers Positive justifications Negative justifications
G.826 Performance Analysis for TUs	
TU12 BIP-2 & REI Seconds and ratio	Errored Blocks, ES, %ES, SES, %SES, UAS, %UAS, CSES Periods, Background Block Errors, %Background Block Errors, Path UAS, %Path UAS, Verdict Analysis
TU3 BIP-8 & REI Seconds and ratio	Errored Blocks, ES, %ES, SES, %SES, UAS, %UAS, CSES Periods, Background Block Errors, %Background Block Errors, Path UAS, %Path UAS, Verdict Analysis
G.821 Performance Analysis for PDH	
PDH Frame & CRC-4 Errors, Seconds, and % of total time	Errored Blocks, ES, %ES, SES, %SES, UAS, %UAS, CSES Periods, Background Block Errors, %Background Block Errors, Path UAS, %Path UAS, Verdict Analysis
Payload (Pattern Bit Errors), Seconds and % of total time	Error-Count, ES, SES, UAS, EFS, DM
M.2100 Analysis for PDH	
In Service Seconds and % of total time	Error-Count, ES, SES, UAS, EFS
Out of Service Seconds and % of total time	Error-Count, ES, SES, UAS, EFS

Table D 2: CTS 850 Opt. 38 PDH Tributaries Specifications (Cont.)

Characteristic	Description
G.826 Analysis for PDH	
Near End & Far End In Service Seconds for selected rate (within channel(s) under test at all enabled MUX levels)	Errored Blocks, ES, %ES, SES, %SES, UAS, %UAS, CSES Periods, Background Block Errors, %Background Block Errors, Path UAS, %Path UAS
For remote selected rate (within channel(s) under test at all enabled MUX levels)	Errored Blocks, ES, %ES, SES, %SES, UAS, %UAS, CSES Periods, Background Block Errors, %Background Block Errors, Path UAS, %Path UAS
PDH Standards Compliance	
PDH Mapping/Demapping	G.707
PDH Line Interfaces	G.703
PDH Jitter Tolerance	G.823, G.824
PDH Error Analysis	G.821, G.826, M.2100
PDH Availability Performance	G.827
PRBS Test Patterns	O.151, O.152, O.153
Monitor Mode Levels	G.772
PDH Framing	G.704, G.727, G.732, G.742, G.751

Table D 3: CTS 850 Opt. 14 Jitter & Wander Specifications

Characteristic	Description
Jitter Generator (requires Option 14) Meets or exceeds the requirements of ITU TG.823, G.824, G.825, O.171. Confirms to new O.172	
Jittered Line Output	Sinusoidal modulation of transmit clock frequency, applicable to any SDH or PDH data rate, except 8 Mbit/s. Jitter is additional to any line frequency offset.
Modulation Range Modulation is selectable up to the following limits, which depend on the rate:	

Amplitude Scale in UI_{p-p}	A_0	$A2$	A_3	A_4
2 Mb/s rate	100000UI	10.0UI	3.0UI	1.00UI
34 Mb/s rate	100000UI	10.0UI	3.0UI	1.00UI
45 Mb/s	100000UI	10.0UI	3.00UI	1.00UI
140 Mb/s rate	100000UI	10.0UI	3.0UI	1.00UI
STM 0 (52 Mb/s rate)	100000UI*	10.0UI	3.0UI	1.00UI
STM 1 (155 Mb/s rate)	100000UI*	10.0UI	3.0UI	1.00UI
STM 4 (622 Mb/s rate)	100000UI*	10.0UI	3.0UI	1.00UI

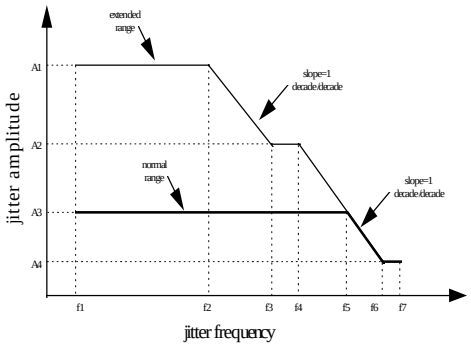
* when equipped with bulk fill payload

Frequency Scale in Hz	f_0	f_1	f_2	f_3	f_4	f_5
2 Mb/s rate	12 Hz	30mHz	300Hz	9kHz	33.3kHz	100kHz
34 Mb/s rate	12 Hz	30mHz	300Hz	10kHz	267kHz	800K
45 Mb/s	12 Hz	30mHz	300Hz	16.7kHz	133kHz	400K
140 Mb/s rate	12 Hz	30mHz	300Hz	20kHz	1.17M	3.5M
STM 0 (52 Mb/s rate)	12 Hz	30mHz	300Hz	10kHz	133kHz	400K
STM 1 (155 Mb/s rate)	12 Hz	30mHz	300Hz	35kHz	433kHz	1.3M
STM 4 (622 Mb/s rate)	12 Hz	30mHz	300Hz	125kHz	1.67M	5.0M

Table D 3: CTS 850 Opt. 14 Jitter & Wander Specifications (Cont.)

Characteristic	Description
Amplitude Accuracy	± 5% ± 0.06 UI at 622 Mb/s rate Line Output ± 5% ± 0.04 UI at 622 Mb/s rate Clock Output ± 5% ± 0.03 UI for all other rates. Line or Clock Output
Amplitude Resolution	0.01 UI
Frequency Accuracy	± 1% below 1.00 KHz ± 5 ppm, above 1.00 KHz
Frequency Resolution	3 decimal places
Jittered Clock Output	Operates in addition to the jittered line output.
Output Level, typical	0.8 V_{p-p} output (for all rates) is AC coupled and terminated with unbalanced 75 2 MHz G.703 output is compliant with G.703 2048 kHz synchronization interface specifications
Nominal Clock Rates	2 MHz, 34 MHz, 45 MHz, 140 MHz, 52 MHz, 155 MHz, or 622 MHz. Can be set independently of transmit line rate
Connector	Rear-panel, unbalanced 75 BNC
Jitter and Wander Analysis for SDH/PDH	Peak-to-peak or RMS jitter measurement of the Clock or Line input. Meets or exceeds the requirements of ITU-T G.783, G.823, G.824, G.825, G.958, O.171. Confirms to new O.172.
Jitter Measurements	Peak-to-peak Jitter (UI), Positive Peak Jitter (UI), Negative Peak Jitter (UI), Jitter Hit Seconds, Jitter Unlocked Seconds, RMS (UI)
Timing Quality (Video Related Jitter/Wander Hit Measurements	Pointer Event Seconds, Current Frequency Drift Rate (ppm/sec), Maximum Frequency Drift Rate (ppm/sec), Current Frequency, Maximum Frequency, Minimum Frequency

Table D 3: CTS 850 Opt. 14 Jitter & Wander Specifications (Cont.)

Characteristic	Description
Normal and Extended Jitter Measurement Resolution and Range Normal Resolution: 0.005UI. Resolution is 0.1UI for Fullband (0.1 Hz Highpass). Resolution for RMS is 0.001 UIrms Extended Resolution: 0.01 UI, except fullband 0.1 Hz, 0.1 UI Range: See graph	

Amplitude Scale in UI_{p-p}	*A_1*	*A_2*	*A3*	*A4*
All rates	200UI	10UI	6 UI	see below

Frequency Scale in Hz	*f1*	*f_2*	*f_3*	*f_4*	*f5*	*f6*
2 Mb/s rate	0.1Hz	15Hz	300Hz	1.9K	3.2K	38.4K
34 Mb/s rate	0.1Hz	15Hz	300Hz	8K	13.3K	160K
45 Mb/s rate	0.1Hz	15Hz	300Hz	16K	26.7K	320K
140 Mb/s rate	0.1Hz	15Hz	300Hz	16K	26.7K	320K
52 Mb/s rate	0.1Hz	15Hz	300Hz	16K	26.7K	320K
155 Mb/s rate	0.1Hz	15Hz	300Hz	16K	26.7K	320K
622 Mb/s rate	0.1Hz	15Hz	300Hz	40K	68K	1.33M

	f7	*A4*
2 Mb/s rate	100K	0.5UI
34 Mb/s rate	800K	0.5UI
45 Mb/s rate	400K	0.5UI
140 Mb/s rate	3.5M	0.5UI
52 Mb/s rate	400K	0.4UI
155 Mb/s rate	1.3M	0.3UI
622 Mb/s rate	5.0M	0.5UI

Table D 3: CTS 850 Opt. 14 Jitter & Wander Specifications (Cont.)

Characteristic	Description				
Fixed Error Noise with Clock, typical	For peak to peakmeasurement, in UIp p				
	Highband	*Wideband*	*Fullband (10Hz)*	*Full (1Hz)*	*Full (0.1Hz)*
2 Mb/s rate	± 0.01	± 0.15	± 0.1	± 0.2	± 0.3
34 Mb/s rate	± 0.02	± 0.03	± 0.1	± 0.2	± 0.3
45 Mb/s rate	± 0.02	± 0.03	± 0.1	± 0.2	± 0.3
140 Mb/s rate	± 0.04	± 0.05	± 0.1	± 0.2	± 0.3
52 Mb/s rate	± 0.02	± 0.03	± 0.1	± 0.2	± 0.3
155 Mb/s rate	± 0.02	± 0.03	± 0.1	± 0.2	± 0.3
622 Mb/s rate	± 0.03	± 0.05	± 0.7	± 0.7	± 1.0
	For extended range, fixed error shall be less than or equal to 0.1 UI, plus the value listed above. For RMS measurements, ± 0.01 UIrms at all rates				
Fixed Error with PRBS Data Signal, typical	For peak to peakmeasurement, in UIp p				
	Highband	*Wideband*	*Fullband (10Hz)*	*Full (1Hz)*	*Full (0.1Hz)*
2 Mb/s rate	± 0.025	± 0.035	± 0.1	± 0.2	± 0.3
34 Mb/s rate	± 0.025	± 0.035	± 0.1	± 0.2	± 0.3
45 Mb/s rate	± 0.025	± 0.035	± 0.1	± 0.2	± 0.3
140 Mb/s rate	± 0.025	± 0.035	± 0.1	± 0.2	± 0.3
52 Mb/s rate	± 0.025	± 0.035	± 0.1	± 0.2	± 0.3
155 Mb/s rate	± 0.025	± 0.035	± 0.1	± 0.2	± 0.3
622 Mb/s rate	± 0.050	± 0.070	± 0.75	± 0.7	± 1.0
	* For extended range, fixed error shall be less than or equal to 0.1 UI, plus the value listed above. For RMS measurements fixed error, ± 0.01 UIrms at all rates				

Table D 3: CTS 850 Opt. 14 Jitter & Wander Specifications (Cont.)

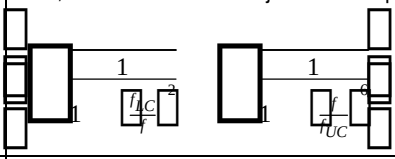
Characteristic	Description
Jitter Measurement Accuracy	Jitter measurement accuracy is a function of the modulation frequency and the highpass filter chosen. Measured jitter frequency response is expressed by the equation below, where f_{LC} is lower cutoff frequency and f_{UC} is high frequency cutoff (defined in table following). Pass band is from f_{LC} to f_{UC}. Uncertainity = ± 5%A ± fixed error, where A is the actual jitter at the input. 
Input Phase Tolerance	Input phase tolerance exceeds 200 UIp p, to accommodate worst case tributary pointerjitter, in conformance with new O.172.
Measurement Frequency Response	Measurement filters meet the requirements of ITU-T G.783, G.823, G.824, G.825, G.958, and O.172. Lower cutoff (high pass) is first order (20 dB/ decade). For 2 Mb/s, 34 Mb/s and 140 Mb/s, this reponse is 20 dB/decade down to 0.1 Hz in wideband mode, in conformance with new 0.172, Upper cutoff (low pass) is third order maximally flat Butterworth (60 dB/decade). Cutoff frequencies are ±10%, except 2 Mb/s is +100%/ 10%.
Fullband Filter Frequency Cutoff Values	2 Mb/s: 0.1, 1 or 10 Hz 34 Mb/s 0.1, 1 or 10 Hz 45 Mb/s 0.1, 1 or 10 Hz 140 Mb/s 0.1, 1 or 10 Hz STM-0: 0.1, 1 or 10 Hz STM-1: 0.1, 1 or 10 Hz STM-1: 0.1, 1 or 10 Hz STM-4: 0.1, 1 or 10 Hz

Table D 3: CTS 850 Opt. 14 Jitter & Wander Specifications (Cont.)

Characteristic	Description
Wideband Filter Frequency Cutoff Values	2 Mb/s: 20 Hz 34 Mb/s 100 kHz 45 Mb/s 10.0 Hz 140 Mb/s 200 Hz STM-0: 100 Hz STM-1: 500 Hz STM-4: 1000 Hz
Highband Filter Frequency Cutoff Values	2 Mb/s: 700 Hz or 18.0 kHz 34 Mb/s 10.0 kHz 45 Mb/s 30.0 kHz 140 Mb/s 10.0 kHz STM-0: 12.0 kHz STM-1: 65.0 kHz STM-4: 250 kHz
RMS Filter Frequency Cutoff Values	2 Mb/s: 12 kHz 34 Mb/s 12 kHz 45 Mb/s 12 kHz 140 Mb/s 12 kHz STM-0: 12 kHz STM-1: 12 kHz STM-4: 12 kHz
f_{uc} Frequency Cutoff Values	2 Mb/s: 100 kHz 34 Mb/s 800 kHz 45 Mb/s 400 kHz 140 Mb/s 3.50 MHz STM-0: 400 kHz STM-1: 1.3 MHz STM-4: 5.0 MHz

Table D 3: CTS 850 Opt. 14 Jitter & Wander Specifications

Characteristic	Description
Jitter Clock Input	Input to measure jitter on a clock signal.
Nominal Clock Rates	Any supported SDH or PDH rate, except 8 Mbit/s. Rate is independent of the receive line rate.
Frequency Tolerance	Nominal rate ±100 ppm
Input Amplitude, typical	0.4 V_{p-p} minimum, 1.5 V_{p-p} maximum amplitude
Connector	Rear-panel, unbalanced 75 BNC
Analog Jitter Output	Demodulated jitter from the receiver. The output is filtered by any measurement filters selected.
Connector	Rear-panel 50 BNC
Sensitivity, typical	Normal measurement range: 100 mV/UI Extended measurement range: 2.65 mV/UI
Output Level, typical	± 1V, centered at 0 V ± 100 mV
Accuracy	± 10%, in addition to measurement inaccuracy
Lock Time	<10 seconds wideband, highband, fullband (10 Hz) highpass filter <30 seconds fullband, 1.0 Hz highpass filter <60 seconds fullband, 0.1 highpass filter
Wander Measurements	According to ITU TG.813, G.812, ETS300 462 n. Conforms to new O.172 Peak-to-Peak Wander, TIE (Time Interval Error), MTIE (Maximum TIE), TDEV (Time Deviation) Current Frequency, Maximum Frequency, Minimum Frequency, Frequency Drift Rate
Peak to Peakand TIE Measurement	Fixed Error $Z_{0\ is\ TIE}$ (τ) is observation period Range: $2.1*10^{17}$ ns Accuracy ±0.5% ± Z_0 (τ) where Z_0 (τ)(nsec) observation interval, (τ)(nsec) 2.5 + 0.0275 (τ) 0.05 ± (τ) ± 1.000 29.0 + 0.010 (τ) (τ) is greater than 1.000 Bandwidth: 10 Hz ±10% Resolution: 0.3 ns or better

Table D 3: CTS 850 Opt. 14 Jitter & Wander Specifications (Cont.)

Characteristic	Description
MTIE Measurement	Z_1 error due to MTIE algorithm $Z_0 + Z_1 = Z_3$ Range: Limited only by disk space on the PC Calculation Accuracy ±1.0%.05 ± Z_3 (τ) where Z_1 (τ)(nsec) observation interval, (τ)(nsec) 2.0 + 0.0330 (τ) 0.05 ± (τ) ± 1.000 35.0 + 0.012 (τ) (τ) is greater than 1.000 Bandwidth: 10 Hz ±10% Resolution: 0.3 ns or better
TDEV Measurement	Z_2 is TDEV algorithm error $Z_0 + Z_2 = Z_4$ Range: 0.02 s to 167.700 s Calculation Accuracy ±1.0% ± Z_4 (τ) where Z_2 (τ)(nsec) observation interval, (τ)(nsec) 3.0 + 0.0330 (τ) 0.05 ± (τ) ± 1.000 35.0 + 0.012 (τ) (τ) is greater than 1.000 Bandwidth: 10 Hz ±10% Resolution: 0.3 ns or better
Frequency Measurement	Resolution: 1 Hz absolute (0.01 ppm relative) Accuracy: ±0.1 ppm (with respect to source clock)
Frequency Drift Rate	Range: 10,000 ppm/sec Accuracy: <1% ± 0.01 ppm/sec Bandwidth 0 Hz to 0.5 Hz Resolution: 0.001 ppm/sec
	Sample Rate: 50 Hz Anti alias filter: 10 Hz first order roll off, in conformance with new O.172

Table D 3: CTS 850 Opt. 14 Jitter & Wander Specifications (Cont.)

Characteristic	Description
Real Time Wander Analyst software for TDEV/MTIE parameter analysis included with Option 14.	Wander Analyst software works in conjunction with the Tektronix CTS 850 or SJ300E test sets. The software provides full wander TIE, MTIE, and TDEV analysis according to the most recent ITU T, ETSI, ANSI and Bellcore standards. The Windows compatible PC software uploads TIE wander measurement data from the test set at a sampling rate of 50 Hz, stores the data at a rate of 50, 1 or 0.1 Hz (selectable) and simultaneously calculates MTIE and TDEV using efficient algorithms. In addition to the ITU T and European ETSI specifications, Wander Analyst also includes a full suite of North American SONET and ANSI specifications limits. The software provices a hi/lo envelope TIE plot to show transients, full zoom control via cursors and calculates frequency offset and drift rate in accordance with ANSI approved methodology.

Table D 4: Environmental Specifications

Characteristic	Description
Temperature	Operating: 0_ C to +40_ C Nonoperating: 40_ C to +70_ C
Altitude	Operating: 4,572 m (15,000 ft) Nonoperating: 12,192 m (40,000 ft)

Table D 4: Environmental Specifications

Characteristic	Description
Humidity	Operating: To 95%, relative humidity at or below +40_ C for 2 hours or less To 90% relative humidity at or below 30_ C, continuous
Transportation Handling	Qualifies under National Safe Transit Association 1s Pre-shipment Test; 1A-B-1.

Table D–5: Physical Characteristics

Characteristic	Description
Dimensions	Height: 165 mm (6.5 in) 191 mm (7.5 in) with accessory pouch Width: 362 mm (14.25 in) Depth: 490 mm (19.25 in) with front cover 564 mm (22.2 in) with handle extended
Weight	Net: Approximately 8.7 kg (19.3 lb) Shipping: Approximately 14.1 kg (31 lb)
Power Requirements	
Source Voltage and Frequency	100 to 240 VAC ±10% CAT II, continuous range, for 50 Hz/60 Hz
Power Consumption	≤300 Watts

Table D–6: Certifications and compliances

Characteristic	Description
EC Declaration of Conformity – EMC	Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities: EN 61326 — EMC requirements for Class A electrical equipment for measurement, control, and laboratory use [1] IEC 61000-4-2 — Electrostatic Discharge Immunity (Performance Criterion B) IEC 61000-4-3 — RF Electromagnetic Field Immunity (Performance Criterion A)[2] IEC 61000-4-4 — Electrical Fast Transient/Burst Immunity (Performance Criterion B) IEC 61000-4-5 — Power Line Surge Immunity (Performance Criterion B) IEC 61000-4-6 — Conducted RF Immunity (Performance Criterion A) IEC 61000-4-11 — Voltage dips and interruptions immunity (Performance Criterion B) EN 61000-3-2 — AC Power line harmonic emissions
Australia/New Zealand Declaration of Conformity – EMC	Complies with EMC provision of Radiocommunications Act per the following standard(s): AS/NZS 2064.1/2 — Industrial, Scientific, and Medical Equipment:1992
FCC Compliance	Emissions comply with FCC Code of Federal Regulations 47, Part 15, Subpart B, Class A Limits

1 Emissions which exceed the levels required by this standard may occur when this equipment is connected to a test object

2 Bit Error Rate remains $\leq 1E^{-10}$ when the instrument is subjected to a 3 V/m field.

Table D–6: Certifications and compliances (cont.)

Characteristic	Description
EC Declaration of Conformity – Low Voltage	Compliance was demonstrated to the following specification as listed in the Official Journal of the European Communities: Low Voltage Directive 73/23/EEC, amended by 93/69/EEC EN 61010-1/A2:1995 Safety requirements for electrical equipment for measurement, control, and laboratory use
U.S. Nationally Recognized Testing Laboratory Listing	UL3111-1 Standard for Electrical Measuring and Test Equipment
Canadian Certification	CAN/CSA-22.2 No. 231 – CSA Safety requirements for Electrical and Electronic Measuring and testing Equipment
Additional Compliance	ISA-S82.02.01-1999 Safety standard for electrical and electronic test, measuring, controlling, and related equipment. IEC61010-1/A2:1995 Safety requirements for electrical equipment for measurement, control, and laboratory use.
Installation Category Descriptions	Terminals on this product may have different installation category designations. The installation categories are: CAT III Distribution-level mains (usually permanently connected). Equipment at this level is typically in a fixed industrial location. CAT II Local-level mains (wall sockets). Equipment at this level includes appliances, portable tools, and similar products. Equipment is usually cord-connected CAT I Secondary (signal level) or battery operated circuits of electronic equipment

Table D–6: Certifications and compliances (cont.)

Characteristic	Description
Pollution Degree	A measure of the contaminates that could occur in the environment around and within a produce. Typically the internal environment inside a product is considered to be the same as the external. Products should be used only in the environment for which they are rated. Pollution Degree 2 — Normally only dry, nonconductive pollution occurs. Occassionally a temporary conductivity that is caused by condensation must be expected. This location is a typical office/home environment. Temporary condensation occurs only when the product is out of service.
Safety Class	Class 1 (as defined in IEC 1010-1, Annex H) – grounded product