

T-Carrier/E-Carrier Module Technical Specifications

DS1/E1

Requirements	Meets the requirements of G.703 (E1)	Alarm Detection	<u>DS1</u> : OOF, pattern sync, LOS, AIS, yellow, LOF, idle, clock, <u>E1</u> : AIS, LOF, LOS, pattern sync, yellow, RM-FAI, CASML
Line Code	<u>DS1</u> : AMI, B8ZS, <u>E1</u> : AMI, HDB3	Alarm Generation	<u>DS1</u> : AIS, yellow, idle, clock, LOS, LOF <u>E1</u> : AIS, LOF, RAI, RMRAI, CASMFL, LOS
Framing	<u>DS1</u> : SF (D4), ESF, SLC 96, unframed; <u>E1</u> : PCM31 (CCS), PCM31CRC (CCS and CRC), PCM30 (CAS), PCM30CRC, (CAS & CRC), unframed	Error Injection	<u>DS1</u> : BPV (code), BIT, frame, CRC, <u>E1</u> : BIT, frame, CRC, FEBE
Line Rates	<u>DS1</u> : 1.544 MHz \pm 4.6 ppm (Tx), Stratum III-compliant, 1.544 MHz \pm 200 ppm (Rx) <u>E1</u> : 2.048 MHz (Tx), 2.048 MHz (Rx), offset capability \pm 100 ppm	Error Injection Rate	<u>DS1</u> : Single, 10^{-7} to 10^{-3} , user-programmable <u>E1</u> : Single, 10^{-7} to 10^{-3} , user-programmable
Impedance	<u>DS1</u> : 100/120 ohm \pm 5% balanced <u>E1</u> : 75 ohm unbalanced, 100/120 ohm balanced	Patterns	<u>DS1</u> : QRSS, 2^{15-1} , 2^{20-1} , 2^{23-1} PRBS, 3 in 24, all 1's, all 0's, 1 in 8, 1010, or 24-bit user-programmable, 55 Daly, T1-2, T1-3, T1-5, 55 octet, ATM (mapping), DDS 1^6 , multi-pattern, bridge tap <u>Fractional T1</u> : QRSS, 2^8-1 , 2^9-1 , 2^{11-1} PRBS <u>E1</u> : 2^8-1 , 2^9-1 inverted, 2^9-1 , 2^9-1 inverted, 2^{11-1} , 2^{11-1} inverted, 2^{15-1} , 2^{15-1} inverted, 2^{20-1} , 2^{20-1} inverted, 2^{23-1} , 2^{23-1} inverted, user patterns <u>Fractional E1</u> : QRSS, 2^8-1 , 2^9-1 , 2^{11-1} PRBS
Level (Tx)	<u>DS1</u> : 0 dBdsx \pm 1 dB, -7.5 dBdsx, \pm 1 dB, -15 dBdsx \pm 1 dB <u>E1</u> : 0 dBdsx, -7.5 dBdsx, -15 dBdsx	Loop Codes Support	<u>DS0/64 Kbps</u> : DDS latching and non-latching <u>DS1</u> : Transmit: in-band, out-of-band, line loopback, payload loopback, 4-bit smart jack, 5-bit smart jack, 16-bit user-programmable; receive: Auto response on/off, display of current loopback status <u>E1</u> : Payload, line, loop-back
Level (Rx)	<u>DS1</u> : Terminated: +6 to -26 dBdsx w/ EQ Monitor: 0 to -26 dBdsx w/ EQ Bridge: 1K ohm, 0 to -26 dBdsx w/ EQ <u>E1</u> : Terminated, 0 to -26 dBdsx w/ EQ Bridge: 1K ohm, 0 to -26 dBdsx w/ EQ	Loop-back	Line and payload loop-back (manual)
Connectors	<u>DS1</u> : Bantam; <u>E1</u> : BNC	DS0/64 Kbps Access	Contiguous/non-contiguous (Fractional T1), Transmit: Individual DS0/64 Kbps channels replaced with idle codes (0x0F) or AIS (0xFF); Received: Monitor individual DS0/64 Kbps channel data, signaling bits, and VF drop to speaker
Synchronization	<u>DS1</u> : Internal, received DS1 signal, BITS (1.544 Mbps); <u>E1</u> : Internal, received E1 signal, SETS (2.048 Mbps)	DS0/64 Kbps Signaling Monitor	AB (SF) and ABCD (ESF) all channels simultaneously
Input Signal Measurement	<u>DS1</u> : Voltage range: \pm 0.1 Vp to \pm 3.6 Vp Frequency measurement range: 1.544 MHz \pm 200 ppm <u>E1</u> : Peak voltage range: +0.1 Vp to +7 Vp; Frequency measurement range: 2.048 MHz, \pm 200 ppm		
Interface	<u>DS3</u> : Complies to ANSI T1.102, <u>E1</u> : Complies with ITU-T G.703, <u>STM-1</u> : Complies with ITU-T G.703		
Error Measurement	<u>DS1</u> : BPV (code), frame, CRC, BIT, excess 0's, <u>E1</u> : BIT, BPV (code), frame, CRC, FEBE (performance measurements per G.826, G.821, M.2100)		

DS3

Line Code	B3ZS	Input Signal	Voltage range: \pm 0.31 Vp to \pm 1.2 Vp
Mapping/Drop	DS1, E1 (up to 2)	Measurement	Frequency measurement range: 44.736 MHz \pm 200 ppm
Framing	M13, C-Bit parity, unframed	Error Measurement	BPV, BIT, frame, P-Parity, C-Parity, FEBE
Line Rates	44.736 MHz \pm 12 ppm (Tx), 44.736 MHz \pm 200 ppm (Rx)	Alarm Detection	OOF, pattern sync, LOS, AIS, idle, X-Bit, yellow, LOF
Impedance	75 ohm \pm 5% unbalanced	Alarm Generation	AIS, idle, yellow, x-Bit, LOF
Level (Tx)	DS3 High: 0.95 Vp \pm 1.0 dB, DSX3: 0.48 Vp \pm 1.2 dB DS3 Low: 0.35 Vp \pm 1.0 dB	Error Injection	BPV, BIT, frame, P-Parity, C-Parity, FEBE
Level (Rx)	Terminated: 75 ohm, +6 to -12 dB relative to DSX3 w/ EQ, Monitor: 75 ohm, -15 to -26 dB relative to DSX3 w/ EQ	Error Injection Rate	Single, 10^{-7} to 10^{-3} , user-programmable
Connectors	BNC	Patterns	2^{15-1} , 2^{20-1} , 2^{23-1} PRBS*, 1100, 1010, all 1's, all 0's, 8-bit programmable, ATM (mapping)
Synchronization	Internal	FEAC Codes	Alarm/status codes, loop-back codes

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E3

Requirements	Meets the requirements of G.703	Measurement	Frequency measurement range: 34.368 MHz \pm 200 ppm
Line Code	HDB3	Frequency Offset Generation	\pm 100 ppm in units of 0.1 ppm
Mapping/Drop	DS1, E1 (up to 2)	Error Measurement	BPV, BIT, frame (performance measurements per G.821, G.826, M.2100)
Framing	Framed, unframed	Alarm Detection	LOS, LOF, pattern sync, AIS, RDI
Line Rates	34.368 MHz \pm 4.6 ppm (Tx), -2 ppm/yr 34.368 MHz \pm 50 ppm (Rx)	Alarm Generation	LOS, LOF, AIS, RDI
Impedance	75 ohm unbalanced	Error Injection	BPV, BIT, frame
Level (Tx)	1.00 Vp \pm 0.1 Vp	Error Injection Rate	Single, 10^{-7} to 10^{-3} , user-programmable
Level (Rx)	Terminated: 330 m of RG-59, Monitor: -26 dBdsx	Patterns	2^9 -1, 2^9 -1 inverted, 2^{11} -1, 2^{11} -1 inverted, 2^{15} -1, 2^{15} -1 inverted, 2^{20} -1, 2^{20} -1 inverted, 2^{23} -1, 2^{23} -1 inverted, any user-defined pattern up to 32 bits, ATM (mapping). Pass through with Drop and Insert: E3 pass through with Drop/Insert of a single E1 for test (per ITU-T 0.151)
Connectors	BNC: 75 ohm		
Synchronization	Internal, recovered, SETS (2.048 Mbps)		
Input Signal	Peak voltage range: \pm 0.31 Vp to \pm 1.2 Vp		

E4

Requirements	Meets the requirements of G.703	Input Signal	Peak voltage range: \pm 0.3 Vp to \pm 0.7 Vp
Line Code	CMI	Measurement	Frequency measurement range: 139.264 MHz \pm 200 ppm
Mapping/Drop	E3, E1 (up to 2)	Frequency Offset Generation	\pm 100 ppm in units of 0.1 ppm
Framing	Framed, unframed	Error Measurement	Bit, frame, LCV (performance measurements per G.826, G.821, M.2100)
Line Rates	139.264 MHz \pm 20 ppm (Tx), -2 ppm/yr 139.264 MHz \pm 50 ppm (Rx)	Alarm Detection	LOS, LOF, pattern sync, AIS, RDI
Impedance	75 ohm unbalanced	Alarm Generation	LOS, LOF, AIS, RDI
Level (Tx)	0.5 Vp \pm 0.1 Vp	Error Injection	Bit, frame, LCV
Level (Rx)	Terminated: 160 m of RG-59; monitor: -26 dBdsx	Error Injection Rate	Single, 10^{-7} to 10^{-3} , user-programmable
Connectors	BNC: 75 ohm unbalanced	Patterns	2^{20} -1, 2^{20} -1 inverted, 2^{23} -1, 2^{23} -1 inverted, any user-defined pattern up to 32 bits (per ITU-T 0.151)
Synchronization	Internal, recovered, BITS (1.544 Mbps), SETS (2.048 Mbps)		



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