



OVERVIEW

The Evolution Series PD10 has been designed for cost-critical modem applications and discerning users who demand quality and reliability at an affordable price. This **10Mbps** capable modem offers full compliance with IESS-308, 309, 310, 314 & 315, plus a range of data interfaces including Ethernet. The Evolution Series Satellite Modem design is based on highly programmable logic giving the flexibility of instant feature upgrades and built-in future-proofing.

Advanced Bandwidth-Efficient Features

Evolution Series Modems contain a host of bandwidth-efficient features, which can all be used at the same time.

Paired Carrier™ overlays transmit and receive carriers reducing satellite bandwidth by up to 50%. Paired Carrier™ uses ViaSat's patented PCMA technology.

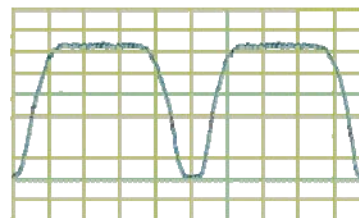
FastLink™ low-latency LDPC has been designed specifically for latency-sensitive applications while giving coding gain that is close to the theoretical limits.

Advanced bandwidth-saving IP features include acceleration and header and payload compression. A sophisticated on-board IP traffic shaping feature allows end-to-end provisioning of quality of service.

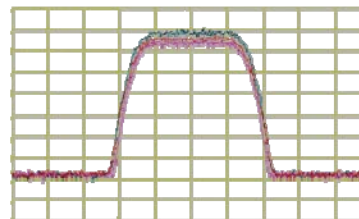
FEATURES

- ▶ Data rate options to 10Mbps, 5Msp
- ▶ Paired Carrier™ option.
- ▶ A wide range of terrestrial interfaces including Ethernet, serial and G.703.
- ▶ Advanced IP feature set including TCP acceleration, compression, routing, bridging, traffic shaping, ACM, VCM and throughput/diagnostic graphs.
- ▶ FastLink Low-Latency LDPC, 2nd Generation Turbo (TPC) and other FEC options.
- ▶ Modulations up to 64QAM.
- ▶ **New!** Patent-pending LinkGuard™ signal-under-carrier interference detection.

Paired Carrier™ Operation



Paired Carrier Disabled



Paired Carrier Enabled
 Can save 50% on space segment

BUY NOW

EVOLUTION Series

PD10 IF Satellite Modem

Main Specifications	
Frequency	50 to 90MHz & 100 to 180MHz (resolution 100Hz) (BNC connector)
Data Rate	4.8kbps to 10Mbps 1bps resolution (Note: Operation to 2,048kbps provided as standard; extension options to 5Mbps, 10Mbps)
Symbol Rate	9.6ksps to 5Mps
Operating Modes	Closed Network (+ESC) (IESS-315) IBS/IDR (IESS-308/309/310/314) options (IDR includes audio channel option and P1348 emulation option)
Scrambling	IBS: Synchronised to framing per IESS-309 IDR with RS coding: Synchronised to RS overhead IDR, no RS coding, non-TPC FEC: V.35 self-synchronising IDR, no RS coding, with TPC FEC: 2 ⁿ 12-1 up to 10 Mbps Closed+ESC: Synchronised to ESC overhead
IF Impedance	50Ω & 75Ω
Return Loss	18dB typical
Frequency Reference	Ageing <1ppm/yr
External Reference	Clocking only: 1 to 10MHz, 1kHz steps Clocking and RF frequency: 10MHz, 0dBm±1dB
Redundancy	Can be operated in standalone, 1:1 or 1:N redundancy configuration

Traffic Interfaces	
Base modem (standard): Ethernet (10/100 BaseT) IP traffic on RJ45	
Traffic options: IP Traffic card 10/100/1000 BaseT on RJ45 (increases performance compared to base modem IP traffic) RS422, X.21, V.35 and RS232 on EIA530 connector (25-pin D-type female) Serial LVDS (25-pin D-type female) G.703 (balanced on EIA530) G.703 (unbalanced on BNC 75Ω female) Quad E1 G.703 (balanced on RJ45) HSSI (50-pin HD SCSI-2 connector) Eurocom (D/1, D, C, G)	
MultiMux option: generates a single carrier from any mixture of G.703, IP and EIA530 traffic	

Modulator	
Output Power	0 to -25dBm (0.1dB steps)
Output Power Stability	±0.5dB, 0°C to 50°C
Transmit Filter Roll-off	20%, 25%, 35%
Phase Accuracy	±2° maximum
Amplitude Accuracy	±0.2dB maximum
Carrier Suppression	-30dBc minimum
Output Phase Noise	As IESS-308, nominally 3dB better
Frequency Stability	<1ppm/yr
Harmonics	Better than -55dBc/ 4kHz in band
Spurious	Better than -55dBc/ 4kHz in band
Transmit On/Off Ratio	55dB minimum
Adaptive Signal Predistorter Option	Use with 16QAM to relax HPA back-off by up to 1.6dB. Compensates for HPA non-linearities

Demodulator	
Input Range	-30 to -60dBm wanted signal
Maximum Composite Signal	30dB above level of desired input up to a maximum of 0dBm
Frequency Sweep Width	±1kHz to ±32kHz up to 10 Msps (1kHz steps) ±10kHz to ±250kHz above 10 Msps (10kHz steps)
Acquisition Threshold	<5dB Es/No QPSK
Acquisition Time	Dependent on FEC, data rate and sweep width (e.g. at 9.6kbps, less than 1s at 6dB Es/No QPSK; at 10Mbps, less than 100ms at 6dB Es/No QPSK)
Clock Tracking Range	±100ppm minimum
Receive Filter Roll-off	20%, 25%, 35%
Performance Monitoring	Eb/No (range 0-15dB, ±0.2dB) Frequency offset (100Hz resolution) Receive signal level Buffer fill status
AGC Output	Buffered direct AGC output for antenna tracking, etc.

Forward Error Correction	
Modulation	BPSK, QPSK, OQPSK plus options for: 8PSK, 16QAM, FastLink 8QAM, FastLink 16APSK, FastLink 32APSK, FastLink 64QAM
FEC	Note BPSK and (O)QPSK provided as standard; other modulations are options FastLink Low-Latency LDPC option: BPSK 0.499 (O)QPSK 0.532, 0.639, 0.710, 0.798 8PSK/8QAM: 0.639, 0.710, 0.778 16APSK/16QAM: 0.726, 0.778, 0.828, 0.851 32APSK: 0.778, 0.828, 0.886, 0.938 64QAM: 0.828, 0.886, 0.938, 0.960 TPC option: BPSK 5/16, 21/44, 0.493 (Paradise), 2/3, 3/4, 0.789 (Paradise), 7/8 (Paradise), Rate 7/8 de facto (O)QPSK: 5/16, 21/44, 0.493 (Paradise), 2/3, 3/4, 0.789 (Paradise), 7/8 (Paradise), 7/8 de facto, 0.93 (Paradise) 8PSK: 3/4 de facto, 7/8 de facto, 0.93 (Paradise) 16QAM: 3/4 de facto, 7/8 de facto, 0.93 (Paradise) Viterbi: BPSK/(O)QPSK 1/2, 3/4, 7/8 TCM option: 8PSK 2/3 Sequential option: BPSK/(O)QPSK 1/2, 3/4, 7/8 Reed-Solomon outer codec available with Viterbi and TCM

Ethernet Traffic	
Throughput Performance	The maximum modem throughput depends on IP traffic format and the features enabled. Bridged IP/UDP data can be processed up to the modem maximum data rate. Please seek assistance from Paradise Datacom in evaluating your particular requirements.
Routing and Bridging	Bridging (standard). Static routing (standard). Dynamic routing option: RIP V1, V2; OSPF V2, V3; BGP V4
TCP Acceleration Option	Typical throughput level of 90% of link capacity. IP Traffic card option: Supports 5,000 concurrent accelerated TCP connection limit (plus at least 35,000 unaccelerated TCP connections) up to the modem maximum data rate. Base modem TCP acceleration option is restricted to 1000 accelerated TCP connections and 10Mbps. IP Traffic card includes HTTP Acceleration (reduces web page download times)
Header Compression Option	IP Traffic card option. Robust Header Compression to RFC 3095. Reduces Ethernet/IP/UDP/RTP header sizes typically by 90%. 1-way packet processing limit: 29,000 pps; 2-way limit: 22,000 pps. Includes Ethernet header compression (compresses 14-byte Ethernet frame to typically one byte)
Traffic Shaping Option	Provides guaranteed throughput levels for IP streams, using Committed Information Rate and Burst Information Rate settings. Stream differentiation is by IP address, IEEE 802.1p priority class, Diffserv DSCP class or MPLS EXP field
VLAN Support	IEEE 802.1q VLAN support (standard) IEEE 802.1p Quality of Service (packet prioritisation) using strict priority or fair weighting queuing
DHCP, SNMP	DHCP (standard) for automatic allocation of M&C IP address. SNMP (standard) v1, v2c and v3
Web Server	Embedded web server M&C interface (standard)
IP Diagnostic Graphs	Shows Tx, Rx throughput (bps, pps); dropped, errored packet counts (standard)
Operating mode	Can be operated in stand-alone, 1:1 or 1:N redundancy configuration.



Post Office Box 1639
101 Eagle Road - Building #7
Avon, Colorado 81620 USA
970 748-3094 or tollfree 866 SATCOM1
Fax 970 748-3096
www.satcomresources.com

Paired Carrier	
Paired Carrier	Transmit and receive carriers are overlaid on top of each other in the same space segment. Echo cancellation techniques are used in the demodulator to cancel the transmit carrier and extract the wanted receive carrier signal
Paired Carrier data rate options	512kbps, 1024kbps, 2.5Mbps, 5Mbps, and 10Mbps traffic rate
Supported power asymmetry	-10dB to +10dB
Supported symbol rate asymmetry	Up to 12:1
Eb/No degradation	Typically < 0.5dB (0.7dB for 16QAM/16APSK with 10dB power asymmetry)
Mobile Operation	Uses GPS data to continually recalculate position relative to satellite, allowing uninterrupted operation in mobile environments (ships, etc.) anywhere in satellite footprint

Drop & Insert Option	
Bearer Types	T1-D4, T1-ESF, E1-G.732
Timeslot Selection	Independent selection of arbitrary timeslots for both drop and insert.
Bearer Generation	Terrestrial bearer may be looped through modem, or terminated after Drop Mux and a new bearer generated by the insert Mux
Timeslot ID	Maintains the identity of individual Drop/Insert timeslots for N=1,2,3,4,5,6,8,10,12,15,16, 20, 24 and 30. (See extended option below)

Extended Drop & Insert Option	
Timeslot Re-Ordering	Selected timeslots may be independently re-ordered on both Tx and Rx paths
Multi-Destination Working	All or only a subset of the received data may be inserted into the terrestrial bearer on the receive path for multi-destination working
Timeslot ID Maintenance	The framed service is extended to maintain the identity of individual timeslots for all values of N from 1 to 31
Signalling	CAS and RBS are fully supported

Advanced ESC		
ESC/Aux Port	Provides high rate async ESC or Intelsat low rate async IBS ESC	
Electrical Interface	IP, RS232, RS422 or RS485	
Async ESC	Closed Net Plus ESC	Overhead scales to any ESC baud rate from 0.5% to 70% of the main channel rate
	IBS Option	High rate async channel (1/32nd to 2/32nd of the IBS overhead) providing async baud rates from 0.2% to 5.1% of the terrestrial rate
Advanced Aux	Intelsat low-rate async ESC carried in bit 1 of TS32 providing a synchronous channel at 1/480th of the data rate, allowing up to one quarter of this rate for over-sampled async data	

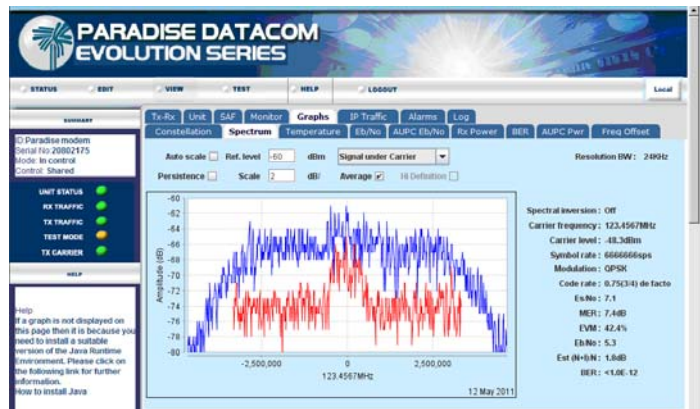
EZ BERT Option	
BER Channel	BERT operates over main traffic, ESC or Aux channels, allowing BER monitoring while on traffic
Test Patterns	PRBS 2 ^N -1: N=6, 7, 9, 11, 15, 19, 20, 23. All 1s, All 0s, alternate patterns, sparse patterns, QRSS, user-defined. Compatible with common BER testers
Other test modes	Transmit CW (pure carrier) Transmit alternate 1-0 pattern

Guaranteed Eb/No BER Performance (dB) (Typical in brackets)						
		Rate 1/2	Rate 3/4	Rate 7/8	Rate 2/3	Rate 0.93
Viterbi QPSK	1E-4	4.7 (4.4)	6.1 (5.8)	7.1 (6.8)		
	1E-8	7.2 (6.9)	8.8 (8.5)	9.5 (9.2)		
Sequential (64kbps)	1E-4	4.3 (4.0)	5.4 (5.1)	6.4 (6.1)		
	1E-8	6.4 (6.1)	7.3 (7.0)	8.6 (8.3)		
Sequential (2048kbps)	1E-4	5.6 (5.3)	6.1 (5.8)	6.9 (6.6)		
	1E-8	7.5 (7.2)	8.1 (7.8)	8.4 (8.1)		
Turbo (TPC) QPSK	1E-4	2.7 (2.4)	3.5 (3.2)	4.1 (3.8)		
	1E-6					6.3 (6.0)
Turbo (TPC) 8PSK	1E-8	3.3 (3.0)	4.5 (4.2)	4.5 (4.2)		6.8 (6.5)
	1E-4		5.6 (5.3)	6.8 (6.5)		
Turbo (TPC) 16QAM	1E-6					9.2 (8.9)
	1E-8		6.8 (6.3)	7.2 (6.8)		9.9 (9.6)
	1E-3		6.5 (6.2)	7.7 (7.4)		
8PSK/TCM	1E-6					10.0 (9.7)
	1E-7		7.8 (7.5)	8.2 (7.8)		
	1E-8					10.7 (10.4)
8PSK/TCM + Reed-Solomon (all rates)	1E-3					6.3 (6.0)
	1E-8					10.4 (10.1)
8PSK/TCM + Reed-Solomon (all rates)	1E-4					6.1 (5.8)
	1E-10					7.3 (7.0)

ODU facilities via IF interface	
FSK Control Option	Allows monitor & control of a compatible Transceiver from the modem via the Tx IFL cable

Data Rate			
Modulation/FEC	FEC Rate de facto	Min Data Rate kbps	Max Data Rate Mbps
BPSK VIT / SEQ	1/2	4.8	2.5 / 2
BPSK VIT / SEQ	3/4	7.2	3.75 / 2
BPSK VIT / SEQ	7/8	8.4	4.375 / 2
BPSK VIT RS	1/2	4.3	2.2
BPSK VIT RS	3/4	6.4	3.3
BPSK VIT RS	7/8	7.5	3.8
O/QPSK VIT / SEQ	1/2	9.6	5 / 2
O/QPSK VIT / SEQ	3/4	14.4	7.5 / 2
O/QPSK VIT / SEQ	7/8	16.8	8.7 / 2
O/QPSK VIT RS	1/2	8.6	4.4
O/QPSK VIT RS	3/4	12.8	6.6
O/QPSK VIT RS	7/8	15	7.7
O/QPSK TPC	1/2	9.6	5
O/QPSK TPC	3/4	14.4	7.5
O/QPSK TPC	7/8	16.8	8.7
O/QPSK TPC	0.93	17.9	9.2
8PSK TCM	2/3	19.2	10
8PSK TCM RS	2/3	17.7	8.8
8PSK TPC	3/4	21.6	10
8PSK TPC	7/8	25.2	10
8PSK TPC	0.93	26.8	10
16QAM TPC	3/4	28.8	10
16QAM TPC	7/8	33.6	10
16QAM TPC	0.93	35.8	10

Mechanical/Environmental	
Size	1U chassis – 410mm deep, excluding front panel handles and rear panel connectors and fans
Weight	3.5kg
Power Supply	100-240VAC, +6%, -10%, 1A @100V, 0.5A @ 240V, 47-63Hz Fused IEC connector (live and neutral fused); 48Volts DC option
Safety Standards	EN60950-1
Emission and Immunity	EN55022 Class B (Emissions) EN55024 (Immunity)
Operating Temperature	0 to 50°C
Humidity	95% relative humidity, non-condensing
Compliance	FCC, CE and RoHS compliant
Alarm Relays	4 Independent Form C relays for unit, Tx, Rx and backward alarms



Built-in Spectrum Analyser showing LinkGuard™ Signal-Under-Carrier interference detection.

Fully configurable - only pay for what you need!

Options	Description
Base Modem	<p>✓</p> <p>BPSK/QPSK/OQPSK 4.8kbps to 2,048kbps, 1bps variable rate, closed network modem. Includes: Viterbi FEC, Rates 1/2, 3/4 & 7/8 with k=7 Intelsat Reed-Solomon Outer Codec to IESS 308 Advanced ESC: Variable rate Async channel for Closed Net plus ESC operation, High Rate IBS/SMS ESC - requires IBS option, Async ESC access to IDR 8k sync ESC channel - requires IDR option. AUPC: Automatic Uplink Power Control (operates through ESC channel) Wideband IF: 50-90 MHz & 100-180MHz in 100Hz steps Ethernet 10/100 BaseT Monitor & Control Port: Internal web server; SNMP v1, v2c, v3 Remote web monitoring tools (Spectrum Display, Constellation Monitor and link performance versus time) plus SMTP email client for status notification G.703 E1 via BNC interface - requires EIA 530 for E1 120 ohm balanced or T1 operation EZ BERT Internal Bit Error Rate Tester can run through main data channel, or ESC/Aux channels, or output/input via the terrestrial interface</p>
Adds Data Rates to 5Mbps	Extends base operation to 5Mbps
Adds Data Rates to 10Mbps	Extends 5Mbps operation to 10Mbps - requires 5Mbps option. Also enables G.703 E2 & T2
IP Traffic Interface (on base Modem)	Unaccelerated Ethernet 10/100 Base T on RJ45 via traffic or overhead (Ethernet Bridging). Static Routing max 64 routes. IEEE 802.1p QoS supporting choice of strict priority queuing or fair weighting queuing, IEEE 802.1q VLAN support. Ethernet Header Compression at data rates up to 2Mbps.
Dynamic Routing	Adds Dynamic Routing, supports RIP, OSPF and BGP, plus 64 static routes - requires base IP Traffic Interface to be activated or IP Traffic card fitted.
TCP Acceleration (on base Modem)	TCP Acceleration to 10Mbps on the base Ethernet port, subject to prevailing data rate limits - overcomes performance problems associated with TCP over satellite - requires IP Traffic Interface to be activated.
Ethernet Bridging	Ethernet Bridging for Point-to-Multipoint operation when there is a non-satellite return path - requires IP Traffic Interface to be activated or IP Traffic card fitted.
IP Traffic Shaping	Supports allocation of Committed Information Rate and Burst Information Rate plus priority for IP Streams identified by IP Address, Diffserv Class, IEEE 802.1p priority tag or MPLS EXP field. Requires the base IP Traffic Interface to be activated or IP Traffic card fitted.
Position 1 (must choose 1 option) hardware option	<p>EIA 530 D25 DCE providing selectable RS422 / X.21 / V.35 / RS232, also balanced G.703</p> <p>IDR operation to IESS 308; 2 audio ESC channels, synchronous 8kbps ESC, four form 'C' backward alarms & Async access to 8k sync channel; EZ Audio test tone generator</p> <p>Sat-Abis Interface card (DOUBLE HEIGHT CARD - negates fitting any option in position 2) One E1/fractional E1 port on RJ45 enabled - maximum aggregate traffic rate 2048kbps in all cases</p> <p>Blank Panel</p>
Position 1 Sat-Abis card options - can only be used with the Sat-Abis Interface card	<p>Adds Port 2, E1/fractional E1 on RJ45, requires Sat-Abis Interface in position 1</p> <p>Adds Port 3, E1/fractional E1 on RJ45, requires Sat-Abis Interface in position 1 plus Port 2 activated</p> <p>Adds Port 4, E1/fractional E1 on RJ45, requires Sat-Abis Interface in position 1 plus Ports 2 and 3 activated</p>
Position 2 (must choose 1 option, unless Sat-Abis card fitted in Position 1) hardware option	<p>EIA 530 D25 DCE providing selectable RS422 / X.21 / V.35 / RS232, also balanced G.703</p> <p>IP Traffic card providing TCP acceleration to 10Mbps, subject to prevailing data rate limits, also provides HTTP Acceleration by prefetching webpage inline objects to reduce webpage download time - requires either Blank Panel or EIA 530 in position 1</p> <p>Quad E1 Multiplexer with 1 x RJ45 port enabled plus integral G.703 and Drop & Insert included - includes IBS/SMS satellite framing</p> <p>Blank Panel</p>
Position 2 Quad E1 Mux options - can only be used with Quad E1 Mux card	<p>Adds Port 2 with Drop & Insert to Quad E1 card - requires Quad E1 Mux in Position 2 plus data rate option to 5Mbps</p> <p>Adds Port 3 with Drop & Insert to Quad E1 card - requires Quad E1 Mux in Position 2 and Port 2 option plus 5Mbps and 10Mbps data rate options</p> <p>Adds Port 4 with Drop & Insert to Quad E1 card - requires Quad E1 Mux in Position 2 with Port 2 option & Port 3 option plus 5Mbps and 10Mbps data rate options</p> <p>MultiMux - Allows base IP traffic and/or EIA530 traffic, if EIA530 interface fitted, to be used in place of 1 or 2 Quad E1 ports, each MultiMux port limited to 2,048kbps traffic rate, and aggregate traffic rate limited to prevailing data rate limit</p>
Position 2 IP Traffic option	Adds Robust Header Compression to RFC 3059 (IP/UDP/RTP) - requires IP Traffic card in Position 2
2nd Generation Turbo 10Mbps maximum subject to prevailing data rate limits	<p>Rates 5/16, 21/44, 0.493, 2/3, 3/4, 0.789, 7/8 Paradise (low latency) in BPSK, QPSK, OQPSK</p> <p>Rate 7/8 in QPSK, OQPSK</p> <p>Rate 0.93 Paradise in QPSK, OQPSK</p> <p>Rates 3/4, 7/8, 0.93 Paradise in 8PSK - requires 8PSK option</p> <p>Rates 3/4, 7/8, 0.93 Paradise in 16QAM - requires 16QAM option</p>
FastLink LDPC subject to prevailing data rate limits Must select hardware plus data rate limits	<p>FastLink LDPC ready (hardware option) - requires additional FastLink LDPC software options below to set the max feature traffic rate</p> <p>FastLink LDPC up to 1Mbps, supports BPSK and QPSK, also supports 8PSK - requires 8PSK option, FastLink 8QAM - requires 8QAM option, 16QAM - requires 16QAM option, FastLink 16APSK - requires FastLink16APSK option, FastLink 32APSK - requires FastLink 32APSK option, FastLink 64QAM - requires FastLink 64QAM option</p> <p>FastLink LDPC extension to 2.5Mbps - requires FastLink LDPC to 1Mbps</p> <p>FastLink LDPC extension to 5Mbps - requires FastLink LDPC to 1Mbps and extension to 2.5Mbps</p> <p>FastLink LDPC extension to 10Mbps - requires FastLink LDPC to 1Mbps plus extension to 2.5Mbps and extension to 5Mbps</p>
Sequential FEC	Rates 1/2, 3/4 & 7/8 in BPSK, QPSK, OQPSK (limited to 2,048kbps max)
FastLink 8QAM	FastLink 8QAM - requires FastLink LDPC
FastLink 16APSK	FastLink 16APSK - requires FastLink LDPC
FastLink 32APSK	FastLink 32APSK - requires FastLink LDPC
FastLink 64QAM	FastLink 64QAM - requires FastLink LDPC
8PSK	Rate 2/3 8PSK Pragmatic TCM to IESS 310. 8PSK Turbo - requires 2nd Generation Turbo FEC option, 8PSK FastLink - requires FastLink LDPC option
16QAM	16QAM Turbo - requires 2nd Generation Turbo FEC option, 16QAM FastLink - requires FastLink LDPC option
IBS / SMS	Satellite Framing to IESS 309 with low rate Intelsat ESC (to IESS 403) & High Rate IBS/SMS ESC
Audio Channels	P1348 Emulation mode for IBS 64kbps carrier (2xaudio) or 128kbps (2xaudio + 64kbps data) - requires IBS / SMS & IDR options
Drop / Insert	T1/E1 linear order Drop/Insert. Drop/Insert can operate with any interface, although G.703 is typically used
Extended D/I	Independent timeslot re-ordering on Tx & Rx. Signaling (E1 CAS & T1 RBS). Rx Partial Insert for multi-destinational working, Timeslot ID maintenance for N=1 to 31 with IBS / SMS or Closed Net plus ESC - requires Drop / Insert option
G.703 Clock Extension	Provides a stable G.703 E1 or T1 reference clock over satellite when traffic is NOT E1 or T1
Advanced AUX	Variable rate synchronous Aux channel for IBS / SMS - requires IBS / SMS option. IDR 32/64kbps in place of one/both audio ADPCM ESC channels - requires IDR option
Custom	Custom RS Outer Codec values of n, k and interleaver depth. Custom IBS / SMS modes, allocation of overhead between ESC and Aux channels in IBS / SMS, custom backward alarms in IBS / SMS, and Closed Net plus ESC - requires IBS/SMS option. Custom IDR mode - requires IDR option.
48V DC Input	K3002 48V DC Primary power input in place of 100-240V AC input (hardware option)
FSK Control Option on IF	Allows monitor & control of a compatible Transceiver from the Modem, via the Tx IFL.
Adaptive Signal Predistorter	Use with 16QAM to relax HPA backoff by up to 1.6dB. Compensates for HPA non-linearities in ground segment and/or transponder. Requires 16QAM option.
Tx Only operation	Transmit functions only
Rx Only operation	Receive functions only
Paired Carrier (carrier re-use) subject to prevailing data rate limits and a minimum occupied bandwidth of 30kHz	<p>Paired Carrier Ready, allows carriers to be overlapped thereby reducing the required satellite bandwidth. (hardware option) - requires additional cumulative software options below depending upon data rate required</p> <p>Paired Carrier up to 512kbps traffic rate - requires Paired Carrier Ready option</p> <p>Extends Paired Carrier up to 1024kbps traffic rate - requires 512kbps option</p> <p>Extends Paired Carrier up to 2.5Mbps traffic rate - requires 1024kbps option</p> <p>Extends Paired Carrier up to 5Mbps traffic rate - requires 2.5Mbps option</p> <p>Extends Paired Carrier up to 10Mbps traffic rate - requires 5Mbps option</p>
Ruggedisation	Adds extra ruggedisation for hostile environments (extra fans, heatsinks, etc.)

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