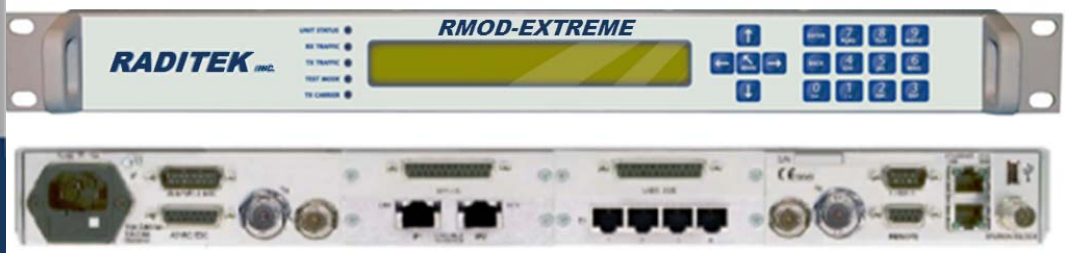
SATCOM SCPC Extreme Modem

SCPC-EXTREME Satellite Modem to 256QAM, with data rate:

18K-200 Mbps & dual IF: 70/140M and L band

RoHS COMPLIANT



RADITEK's new *software-defined modem, the* SCPC Extreme modem has a multiband IF: 70MHz, 140MHz and L band. The *hardware platform* has a powerful processor that makes it ideal for handling high speed IP traffic. The modem can be fitted with virtually any standard type of terrestrial interface and *software activated options* will allow it to operate at data rates up to 200Mbps.
Low cost software activated options allow you to enable only the features you need at the time, and you can upgrading as needed. Upgrades requiring hardware additions include: the Quad RAD Mux and LDPC+.

Advanced Bandwidth-Efficient Features

This **RMOD-EXTREME** has the most powerful SCPC, bandwidth-saving features, such as:
Simu-Carrier, which shares the same transmit and receive frequency reducing satellite bandwidth by up to (in some cases) a full 50% at the expense of some Transmit power. NOTE: Using our LDPC+ will save around 2 dB excess Eb/No. Using our **AUPC** (Uplink Power Control), several more dBs can be saved too. This can allow perfect transponder loading and significant cost savings, especially in the case where there is no excess satellite Tx power penalty/cost (such as operating own satellite).

- **Low-latency LDPC+** has been designed for Eb/No extending applications (1 to 2 dB better than TPC)
- **DVB-S2** option is also available.
- Advanced bandwidth-saving IP features include acceleration and header and payload compression.

Optional features:

- Multi IF band support: (70M/140MHz and L-band)
- Data rates 18Kbps to 200Mbps
- DVB-S2-/ACM to 256QAM LDPC/BCH, TPC FEC options
- Terrestrial interface options including Ethernet: EIA-530, G.703 (balanced & unbalanced), OC-3, STM-1, Serial LVDS, ASI, HSSI, Quad E1,
- Modulation up to 256QAM
- Simu-Carrier™ option (reusing uplink frequencies)
- Uplink Power control (AUPC)
- Signal-under-carrier real time interferer detection tool
- Built-in spectrum and constellation monitors tool
- IPv6 compliant
- Drop and insert: T1-D4, T1-ESF, E1-G.732
- Interoperable with other Raditek SCPC modems
- Feature-based pricing and corresponding Software upgradeable features, for many options.
- Advanced ESC: High rate Async and low rate IBS.
- DVB-S2x Receive Adaptive equalizer (standard)
- DVB-S2x Carrier ID

Applications include:

- IP trunking/backhaul
- Mobile backhaul
- SNG
- Maritime communications
- Corporate networking
- Disaster recovery
- Satellite news gathering
- G.703 backhaul
- Advanced IP feature set options, including:
  - TCP acceleration
  - HTTP acceleration,
  - Routing, bridging, encryption
  - ACM (DVB-S2)
  - Header and payload compression
  - Traffic shaping
  - AES 256 encryption (**Extreme E** model)

Part Number example: RMOD-Extreme-10Mb-NxE1-p3
Description: *(High Performance Satellite Modem: Extreme,10Mb data rate,* **SCPC, I x E1 or 4E1MUX or (3E1+IP)MUX**
Options Data Rate SCPC Simu Carrier Modulation n x E1/T1 (N=1 to 4) DVB-S2x LDPC+

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SCPC Satcom Modem (18K-200 Mbps),

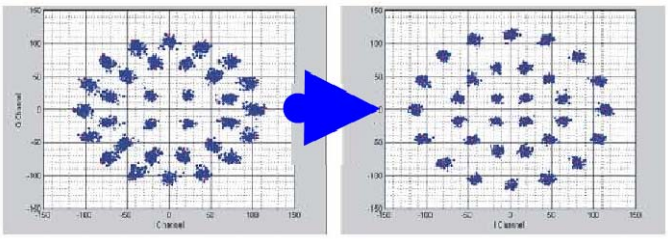
(IFs: 70, 140MHz & L band), BPSK to 256QAM, RMOD-EXTREME-p3

Specifications	
Frequency	IF: 50 to 90MHz & 100 to 180MHz (resolution 100Hz) (BNC f/m connector) L-band: 950 to 2050MHz (resolution 100Hz) (N-type f/m connector)
Data Rate	DVB-S2: 50kbps to 155Mbps LDPC+: 4.8kbps to 100Mbps TPC: 4.8kbps to 60Mbps 1bps resolution Operation to 2.048kbps-standard. Options to 5Mbps, 10Mbps, 25Mbps, 60Mbps, 100Mbps and 200Mbps
Symbol Rate	DVB-S2/S2x: 100ksps to 50Msps TPC: 9ksps to 40Msps LDPC+:18Ksps to 40Msps
Operating Modes	DVB-S2 (EN 302 307-1) option DVB-S2x (EN 302 307-2) option Closed Network (+ ESC) (IESS-315) IBS/IDR (IESS-308/309/310/314) options
Scrambling	DVB-S2/S2x: as per EN 302 307 IBS: per IESS-309 Closed Network + ESC: Sync'd to ESC overhead
Impedance	IF: 50Ω/75Ω, L-band: 50Ω
Return Loss	IF: <-18dB. L-band: <-15dB
Redundancy	Standalone, 1:1 or 1:16 redundancy configuration

Traffic Interfaces

Standard: Gbit Ethernet: IP traffic RJ45.
OPTIONS:
4 port Gbit Ethernet switch: Expands to 4 ports
EIA-530 (RS422, X.21, V.35 and RS232 on 25-pin D-type female) G.703 (balanced on RJ-45; unbalanced 75Ω BNC female)
Quad E1 G.703 (balanced RJ45)
Quad ASI (75Ω BNC)
STM-1/OC-3/Optical Gigabit Ethernet (small form-factor pluggable module)
Serial LVDS (25-pin D-type female),
HSSI 50pin HD SCSI-2 connector
IDR IESS 308 (50 way f/m D connector)

BUC PSU option: 24V or 48V via IFL cable (200W)
BUC Reference: 10MHz via IFL cable, ±0.01ppm, 3dBm ±3dB
FSK control: Allows M&C for L band BUC from Modem via Tx IFL cable
LNB (10MHz ref.):Via IFL cable, 10MHz ±0.01ppm, 0dBm ±3dB
LNB voltage: Selectable: 13, 15, or 24Vdc via IFL cable to 0.5A



Adaptive Transmit predistorter improvement for a 32APSK example.

Modulator	
Output Power	IF: 0 to –25dBm (0.1dB steps) L-band: 0 to –40dBm (0.1dB steps)
Output Power Stability	±1 dB, 0ºC - 50ºC (Acc. ±0.375 dBm)
Transmit Filter Roll-off	5%, 10%, 15%, 20%, 25%, 35%
Phase Accuracy	±2º maximum
Amplitude Accuracy	±0.2dB maximum
Carrier Suppression	-30dBc minimum
Output Phase Noise	To: EN302 307, EN300 421, EN301 210 IESS-308
Harmonics & spurious	Better than –55dBc/ 4kHz in band
Transmit On/Off Ratio	65dB minimum

Demodulator **Outputs: 1 (standard), 4, 8, 12, 16 (options)**	
Input Range	IF min. : -115+10 log (symbol rate) L-band min: -130+10 log (symbol rate) IF/L-band max: -80+10 log (symbol rate)
Maximum Composite Signal	+10dBm
Wanted-to-composite Level	IF: -94+10 log (symbol rate) L-band: -102+10 log (symbol rate)
Frequency Sweep Width	±1kHz to ±250kHz (1kHz steps)
Data rate (1bps res.)	Inbound: 18Kbps to 100Mbps Total for all combined: to 20Mbps
Symbol rate (1sps res,)	Inbound: 18Ksps to 40Msps Total for all combined: to 70Msps
Acquisition Time	Dependent on FEC, data rate and sweep width
Clock Tracking Range	±100ppm minimum
Receive Filter Roll-off	5%, 10%, 15%, 20%, 25%, 35%
Performance Monitoring	Eb/No (range 0-15dB, ±0.2dB) Frequency offset (100Hz resolution) Receive signal level Buffer fill status

Adaptive Rx, 9 tap, Equalizer : Automatically switched on above 10Msps **(standard)**
Options:
Adaptive Tx, 9 tap, Predistorter: Corrects carrier slope/ group delay. **Up to 2dB performance gain.**
DVB Carrier ID (ETSI 103 129): Supports interfering carriers. Allows a carrier with a low power CID waveform to be identified

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SCPC Satcom Modem (18K-200 Mbps),

(IFs: 70, 140MHz & L band), BPSK to 256QAM, RMOD-EXTREME-p3

Forward Error Correction	
DVB-S2 EN 302 307-1	**QPSK** 1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10 **8PSK** 3/5, 2/3, 3/4, 5/6, 8/9, 9/10 **16APSK** 2/3, 3/4, 4/5, 5/6, 8/9, 9/1 **32APSK** 3/4, 4/5, 5/6, 8/9, 9/10
LDPC Low latency	**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	**BPSK** 5/16, 21/44, 3/4, 7/8 **(O)QPSK** 5/16, 21/44, 3/4, 7/8, 0.93 **8PSK** 3/4, 7/8, 0.93 **8QAM** 3/4, 7/8, 0.93 **16QAM** 3/4, 7/8, 0.93
DVB-S2x Low latency	**Very Short Frame:** (Frame size of 5,400 bits, reducing latency to 33% of standard DVB-S2 Short frame) **QPSK** 1/5, 4/15, 1/3, 2/5, 7/15, 8/15, 3/5, 2/3, 11/15, 12/15 **8PSK** 11/15, 12/15 **16APSK** 12/15 **UltraShort Frame:** (Frame size of 3,240 bits, reducing latency to 20% of standard DVB-S2 Short frame) **QPSK** 2/9, 1/3, 4/9, 5/9, 2/3, 7/9 **8PSK** 2/3, 7/9 **16APSK** 2/3, 7/9 **32APSK** 7/9 **64APSK** 7/9
DVB-S2x & **DVB-S2** EN 302 307-2	**Normal Frame:** **QPSK** 13/45, 9/20, 11/20 **8PSK** 23/36, 25/36, 13/18 **8APSK-L** 5/9, 26/45 **16APSK** 26/45, 3/5, 28/45, 23/36, 25/36, 13/18, 7/9, 77/90 **16APSK-L** 5/9, 8/15, 1/2, 3/5, 2/3 **32APSK** 32/45, 11/15, 7/9 **32APSK-L** 2/3 **64APSK** 11/15, 7/9, 4/5, 5/6 **64APSK-L** 32/45 **Short Frame:** **QPSK** 11/45, 4/15, 14/45, 7/15, 8/15, 32/45 **8PSK** 7/15, 8/15, 26/45, 32/45 **16APSK** 7/15, 8/15, 26/45, 3/5, 32/45 **32APSK** 2/3, 32/45
Legacy FEC compatibility	
DVB-S/DSNG	**DVB-S:** QPSK 1/2, 2/3, 3/4, 5/6, 7/8 **DVB-DSNG:** 8PSK 2/3, 5/6, 8/9; 16QAM 3/4, 7/8 (ETSI EN 300421/ 301210 compliant)
Legacy FEC (Optional)	**Viterbi:** BPSK/(O)QPSK 1/2, 3/4, 7/8 **TCM:** 8PSK 2/3 **Sequential:** BPSK/(O)QPSK 1/2, 3/4, 7/8 **Reed-Solomon** outer codec for Viterbi, TCM & Sequential
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.
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. Supports 10,000 concurrent accelerated TCP connections (plus at least 40,000 unaccelerated TCP connections) up to the modem maximum data rate.
Header	Header Compression to RFC 3095.

Compression Option	Reduces Ethernet/IP/UDP/ TCP/RTP header sizes typically by 90%. 1-way packet processing limit: 60,000 pps; 2-way limit: 45,000 pps. (compresses 14-byte Ethernet frame to typically one byte)
HTTP Acceleration	Speeds web page downloads to browsers and DNS caching
Payload Compression Option	Uses Deflate algorithm (RFC 1951) to compress all TCP/IP packets (TCP and UDP), typically resulting in compression of payloads by 50%
Traffic Shaping Option	Reliable throughput levels for IP streams, using committed info. rate and Burst Info. Rate settings. Stream differentiation is by IP address, IEEE 802.1p priority class, Diff serv DSCP class or MPLS EXP field
Encryption (Model E)	Encrypts all IP traffic using AES with 256-bit keys Special modem: Extreme-E
IPv6	Provided as standard. Dual IPV4/ IPV6 TCP/IP stack allowing use of both IPv4 and IPv6 addresses for bridging and routing of traffic
VLAN Support	IEEE 802.1q VLAN support (standard) IEEE 802.1p Quality of Service (packet prioritization) 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)
IP over DVB-S2 Encapsulation Option	Supports encapsulation/ decapsulation of MPE (EN301192), ULE (RFC4326) Or RADITEK's advanced RXE
NAT	NAT firewall to allow all network devices to share a single IP address when viewed from other end of satellite link
IEEE 1588 V2 Precision Time Protocol (PTP)	PTP hardware implementation with nanosecond-resolution timestamping provides sub-microsecond accurate clock synchronization; modem implements a PTP boundary clock, operating in both master & slave modes
sFlow Performance Metrics	sFlow is the industry standard for network monitoring, giving full modem performance visibility to sFlow compatible network management devices
Simu-Carrier™ Option	
Simu-Carrier™	Transmit and receive carriers share/reuse the same bandwidths. Special digital techniques are used in the demodulator to cancel the transmit carrier leaving the receive carrier signal.

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Simu-Carrier™ Data rate options	256kbps, 512kbps, 1024kbps, 2.5Mbps, 5Mbps, 10Mbps, 15Mbps, 20Mbps, 25Mbps, 30Mbps, 40Mbps, 50Mbps, 60Mbps, 80Mbps, 100Mbps and 200Mbps traffic rate (30kHz to 54MHz occupied bandwidth)
Power asymmetry	-10dB to +10dB
Symbol rate asymmetry	Up to 12:1
Eb/No degradation	Typically 0.1 dB < 0.5dB max. (to 0.7dB for 16QAM/16APSK, To 1dB for 32APSK
Mobile Operation	Uses GPS data to continually update the position allowing uninterrupted operation in mobile environments (ships, etc.) anywhere in the satellite footprints.

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-next)

mating module for the module to match fiber interface etc. We can supply further details including mating modules if required.

Extended Drop & Insert Option	
Multi-Destinational 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	Maintains the identity of individual timeslots for all values of N from 1 to 31
Signaling	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
Async ESC	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	

Extra Specs	
IP Support for MTU	Up to 10KB

TPC Performance (Eb/No dB at 5E-8 BER)	
BPSK, (O)QPSK	Rate ½, 3.0; Rate ¾, 4.2, Rate 7/8, 4.2; Rate 0.93, 6.5
8PSK	Rate ¾, 6.3, Rate 7/8, 6,8; Rate 0.93, 9.6
8QAM	Rate ¾, 6.7 Rate 7/8, 6.8; Rate 0.93, 10.1
16QAM	Rate ¾, 7.8, Rate 7/8, 7.9; Rate 0.93, 10.4
DVB-S/DSNG Performance	
QPSK	Rate ½, 3.9; Rate 2/3. 4.6, Rate ¾, 4.0, Rate 5/6, 4.6, Rate 7/8, 5.3
8PSK	Rate 2/3. 6.9, Rate 5/6, 8.9, Rate 8/9, 9.4
16QAM	Rate 3/4. 9.0, Rate 7/8, 10.7

DVB-S2x (10E-7 BER)
Normal frames, Pilot off

	Spectral Efficiency	Eb/No dB (Es/No dB)
QPSK 13/45	0.567	0.5 (-2.0)
QPSK 9/20	0.889	0.9 (0.4)
QPSK 11/20	1.088	1.1 (1.5)
8APSK-L 5/9	1.647	3.1 (5.3)
8APSK-L 26/45	1.713	3.2 (5.5)
8PSK 23/36	1.896	3.6 (6.4)
8PSK 25/36	2.062	4.1 (7.2)
8PSK 13/18	2.145	4.3 (7.6)
16APSK-L 1/2	1.972	3.4 (6.3)
16APSK-L 8/15	2.104	3.5 (6.7)
16APSK-L 5/9	2.193	3.6 (7.0)
16APSK-L 3/5	2.370	3.9 (7.6)
16APSK-L 2/3	2.635	4.4 (8.6)
16APSK 26/45	2.281	4.2 (7.8)
16APSK 3/5	2.370	4.4 (8.1)
16APSK 28/45	2.458	4.2 (8.1)
16APSK 23/36	2.524	4.6 (8.6)
16APSK 25/36	2.745	5.2 (9.6)
16APSK 13/18	2.856	5.4 (10.0)
16APSK 7/9	3.077	6.0 (10.9)
16APSK 77/90	3.386	7.0 (12.3)
32APSK-L 2/3	3.289	6.5 (11.7)
32APSK 32/45	3.510	6.5 (12.0)
32APSK 11/15	3.620	6.7 (12.3)
32APSK 7/9	3.841	7.5 (13.3)
64APSK-L 32/45	4.206	8.4 (14.6)
64APSK 11/15	4.338	8.9 (15.3)
64APSK 7/9	4.603	9.3 (15.9)
64APSK 4/5	4.735	9.5 (16.3)
64APSK 5/6	4.933	10.3 (17.2)

DVB-S2 (10E-7 BER)
Short frames, Pilot off

	Spectral Efficiency	Eb/No dB (Es/No dB)
QPSK 1/4	0.365	2.2 (-2.2)
QPSK 1/3	0.629	1.3 (-0.7)
QPSK 2/5	0.760	1.1 (-0.1)
QPSK 1/2	0.848	1.6 (0.9)
QPSK 3/5	1.156	2.1 (2.7)
QPSK 2/3	1.288	2.3 (3.4)
QPSK 3/4	1.420	2.9 (4.4)
QPSK 4/5	1.508	3.1 (4.9)
QPSK 5/6	1.596	3.5 (5.5)
QPSK 8/9	1.727	4.0 (6.4)
8PSK 3/5	1.725	4.0 (6.4)
8PSK 2/3	1.922	4.5 (7.3)
8PSK 3/4	2.118	5.1 (8.4)
8PSK 5/6	2.381	6.0 (9.8)
8PSK 8/9	2.577	7.0 (11.1)
16APSK 2/3	2.548	5.6 (9.7)
16APSK 3/4	2.809	6.2 (10.7)
16APSK 4/5	2.983	6.7 (11.4)
16APSK 5/6	3.157	7.1 (12.1)
16APSK 8/9	3.418	8.1 (13.4)
32APSK 3/4	3.493	8.1 (13.5)
32APSK 4/5	3.709	8.7 (14.4)
32APSK 5/6	3.925	9.0 (14.9)
32APSK 8/9	4.249	10.2 (16.5)

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DVB-S2 Performance at BER 10E-7
Guaranteed Es/No (dB) for Normal (64k) Frames, pilot off

Eb/No dB (Es/No)	Rate 1/4	Rate 1/3	Rate 2/5	Rate 1/2	Rate 3/5	Rate 2/3	Rate 3/4	Rate 4/5	Rate 5/6	Rate 8/9	Rate 9/10
QPSK	-1.1 (-2.0)	-0.7 (-1.1)	0.7 (-0.3)	1.1 (1.1)	1.7 (2.4)	2.0 (3.2)	2.4 (4.1)	2.6 (4.6)	3.0 (5,2)	3.7 (6.2)	3.9 (6.4)
Spectral efficiency	0.4902	0.6565	0.7894	0.9889	1.1883	1.3223	1.4875	1.5871	1.6547	1.7665	1.7886
8PSK					3.6 (6.0)	4.0 (7.0)	4.6 (8.1)		5.6 (9.5)	6.6 (10.8)	6.9 (11.7)
Spectral efficiency					1.7800	1.9806	2.2281		2.4786	2.6460	2.6792
16APSK						5.2(9.4)	5.8(10.5)	6.2 (11.2)	6.6 (11.8)	7.5 (13.0)	7.8 (13.3)
Spectral efficiency						2.6792	2.9667	3.1656	3.3002	3.5231	3..5673
32APSK								7.8 (13.8)	8.4 (14.5)	9.4 (15.8)	9.6 (16.1)
Spectral efficiency								3.9516	4.1195	4.3979	4.4530

DVB-S2x Eb/No Performance at BER 1E-7

	Rate 1/4	Rate 1/3	Rate 2/5	Rate 1/2	Rate 3/5	Rate 2/3	Rate 3/4	Rate 4/5	Rate 5/6	Rate 8/9	Rate 9/10
QPSK	-1.3	-0.4	0.5	1.9	3.0	3.5	4.4	5.2	5.6	6.7	
8PSK					6.5	7.3	8.6		9.9	11.2	11.3
16APSK						9.8	11.1	11.7	12.3	13.5	

Guaranteed Eb/No BER Performance (dB)
(Typical in parentheses)

		Rate 1/2	Rate 3/4	Rate 7/8	Rate 2/3	Rate 0.93
Viterbi QPSK	1E-4	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)
	1E-8	3.3 (3.0)	4.5 (4.2)	4.5 (4.2)		6.8 (6.5)
2Turbo (TPC) 8PSK	1E-4		5.6 (5.3)	6.8 (6.5)		
	1E-6					9.2 (8.9)
	1E-8		6.8 (6.3)	7.2 (6.8)		9.9 (9.6)
Turbo (TPC) 16QAM	1E-3		6.5 (6.2)	7.7 (7.4)		
	1E-6					10.0 (9.7)
	1E-7		7.8 (7.5)	8.2 (7.8)		
	1E-8					10.7 (10.4)
8PSK/TCM	1E-3				6.3 (6.0)	
	1E-6				10.4 (10.1)	
8PSK/TCM + Reed-Solomon (all rates)	1E-4				6.1 (5.8)	
	1E-10				7.3 (7.0)	

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SCPC Satcom Modem (18K-200 Mbps),

(IFs: 70, 140MHz & L band), BPSK to 256QAM, RMOD-EXTREME-p3

DVB-S2x (10E-7 BER)
Short frames, Pilot off

		Eb/No (dB) & Es/No (dB)
QPSK 11/45	0.453	1.4 (-2.0)
QPSK 4/15	0.497	1.3 (-1.7)
QPSK 14/45	0.585	1.1 (-1.2)
QPSK 7/15	0.892	1.4 (0.9)
QPSK 8/15	1.024	1.7 (1.8)
QPSK 32/45	1.376	2.6 (4.0)
8PSK 7/15	1.331	3.1 (4.3)
8PSK 8/15	1.528	3.4 (5.2)
8PSK 26/45	1.659	3.8 (6.0)
8PSK 32/45	2.053	4.8 (7.9)
16APSK 7/15	1.766	4.0 (6.5)
16APSK 8/15	2.027	4.4 (7.5)
16APSK 26/45	2.200	4.8 (8.2)
16APSK 3/5	2.287	5.0 (8.6)
16APSK 32/45	2.722	5.8 (10.2)
32APSK 2/3	3.168	6.8 (11.8)
32APSK 32/45	3.384	7.3 (12.6)

LDPC+ options versus Eb/No performance comparisons for 5E-8 BER (* shows for 5E-12)

	FEC Rate	Low BER Eb/No & Es/No	Balanced Eb/No & Es/No	Low Latency Eb/No & Es/No
BPSK	0.499	2.1 (-0.9)	2.9 (-0.1)	3.4 (0.4)
(O)QPSK	0.532	2.1 (2.4)	2.6 (2.9)	2.9 (3.2)
(O)QPSK	0.639	2.4 (3.5)	2.8 (3.8)	3.2 (4.3)
(O)QPSK	0.710	2.7 (4.2)	3.2 (4.7)	3.7 (5.2)
(O)QPSK	0.798	3.1 (5.1)	3.9 (6.0)	4.2 (6.2)
8PSK	0.639	5.4* (8.2)	5.9* (8.7)	6.3* (9.1)
8PSK	0.710	5.6* (8.9)	5.5 (8.8)	5.8 (9.1)
8PSK	0.778	5.6 (9.3)	6.1 (9.7)	6.4 (10.1)
8QAM	0.639	4.4 (7.2)	4.8 (7.6)	5.0 (7.8)
8QAM	0.710	5.0 (8.3)	5.3 (8.6)	5.5 (8.8)
8QAM	0.778	5.5 (9.2)	5.9 (9.6)	6.1 (9.8)
16APSK	0.726	7.6* (12.2)	7.5* (12.1)	7.5 (12.1)
16APSK	0.778	7.8* (12.7)	7.1 (12.0)	7.5 (12.4)
16APSK	0.828	7.4 (12.6)	8.1 (13.3)	8.4 (13.6)
16APSK	0.851	7.9 (13.2)	8.3 (13.6)	8.8 (14.1)
16QAM	0.726	7.2* (11.8)	6.6 (11.2)	6.8 (11.4)
16QAM	0.778	6.7 (11.6)	7.1 (12.0)	7.4 (12.3)
16QAM	0.828	7.2 (12.4)	7.7 (12.9)	8.0 (13.2)
16QAM	0.851	7.5 (12.8)	8.0 (13.3)	8.4 (13.7)
32APSK	0.778	9.8* (15.7)	9.6 (15.5)	10.0 (15.9)
32APSK	0.828	9.8 (16.0)	10.6 (16.8)	10.9 (17.1)
32APSK	0.886	10.8 (17.3)	11.4 (17.9)	11.9 (18.4)
32APSK	0.938	12.6 (19.3)	13.2 (19.9)	13.9 (20.6)

ROUTING mechanisms:

RADITEK Extreme modems supports, in general, both a Layer 2 bridge and a Layer 3 router. At lower rates, the decision depends entirely on the user's network: The user decides whether to pass Ethernet frames through the modem (Layer 2) or just IP packets (dropping the Ethernet frames, i.e. Layer 3). At Layer 3, packets are forwarded, based on IP address; at Layer 2, packets are forwarded, based on MAC address.. Although you can choose to bridge or route over a satellite to correspond to what you do terrestrially, you can, in fact, do the opposite – i.e. bridge over satellite even though you may route the rest of the network. There is no right or wrong or better or worse way of doing things here.

However, with higher data rates (DS3 included), it is better to use the Extreme's 'trunk' mode, which bypasses the processor and handles much higher packets rates, and guarantees no measurable jitter on the output. This is implemented using a Layer 2 bridge,

Raditek Extreme also supports an optical Ethernet interface. The optical Ethernet card uses a small form factor module, which is an open (SMF) standard and will support any type of fiber (regardless of wavelength, connector type, etc.). The user needs to supply the right cable and the right processor and handles much higher packets rates, and guarantees no measurable jitter on the output. This is implemented using a Layer 2 bridge,

Raditek Extreme also supports an optical Ethernet interface. The optical Ethernet card uses a small form factor module, which is an open (SMF) standard and will support any type of fiber (regardless of wavelength, connector type, etc.). The user needs to supply the right cable and the right mating module for the module to match fiber interface etc. We can supply further details including

mating modules if required.

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Mechanical Environmental	
Size	1U chassis, 410mm deep excluding front panel handles and rear panel connectors and fans
Weight	3.5kg
Power Supply	90-264VAC, 1A @100V, 0.5A @ 240V, 47-63Hz Fused IEC connector (live and neutral fused); 24V & 48V DC optional
Safety Standards	EN60950-1 2006
Emission and Immunity	EN55022 2010 Class B (Emissions) EN55024 2010 (Immunity)
Operating Temperature	0 ºC to 50ºC (extended option available) (-40 ºC to 70 ºC storage)
Compliance	FCC, CE and RoHS compliant
Humidity	95% relative humidity, non-condensing
Alarm Relays	4 Independent Form C relays for unit, Tx, Rx and backward alarms
DVB-S2 Ethernet	
ACM	Dynamically varies modcod with varying link conditions, maximizes throughput at all times by converting unused link margin into additional throughput; giving 100% link availability
VCM	Supports transmission/reception of two ASI streams or, one ASI stream with one IP stream, each with its own modcod for optimal throughput
Network Control Web browser user interface support is provided as standard. SNMP and command line interfaces support the development of third-party user interfaces. In addition, the following network control application options are available:	
Extreme Navigator (standard)	Modems and third-party network devices can be fully controlled through a single application..provides an easy-to-navigate site map, with summary status reporting, etc.
Extreme Bandwidth manager	Multi-satellite/transponder carrier planning and high-level system control, monitoring, recording and quality-of-service reporting function.

BER Testing Option	
BER Channel	Bit error rate tester operates over main traffic, ESC or Aux channels, allowing BER monitoring while on traffic. Not available in DVB-S2 mode
Test Patterns	Various test patterns compatible with common BER testers
Other test modes	Transmit CW (pure carrier) Transmit alternate 1-0 pattern Simulated satellite delay for TCP/IP packets
Packet Generator Analyzer	Generates & analyses TCP & UDP packet streams, allowing independent modem-to modem IP testing
Ethernet MTU Size	**Standard:** 10k bytes **Optical Ethernet:** 16k bytes

Basic modem summary, included as standard:

4.8kbps to 2.048Mbps Closed Network (+ ESC) modem with two Gigabit Ethernet RJ45s for M&C and traffic respectively;
Ethernet bridge, static routing and all features described under Ethernet Standard Features
IF operation 50 to 90MHz & 100 to 180MHz L band operation 950 to 2150MHz; with a high stability 10MHz reference;
FSK **TPC:** BPSK, QPSK, OQPSK, 8PSK, 8QAM and 16QAM; to 60Mbps subject to prevailing modem data rate**:** Signal under carrier interference detection on a web spectrum plot showing real time, received spectrum and any interference underneath the received carrier with a traffic; automated alarm when interference rises above user set threshold; supported for all FECs except for basic DVB-S2 option
AUPC: Automatic Uplink Power Control
Web browser monitoring tools: Spectrum display, constellation monitor, TCP/IP throughput
Internal Bit Error Rate Tester (BERT): For non DVB-S2/DVB-S2x operation only
TCP/IP Packet Generator/Analyzer: Generates and analyzes TCP & UDP packet streams, allowing modem to modem IP testing without any other equipment
IEEE 1588 V2 Precision Time Protocol and **Network Time Protocol**

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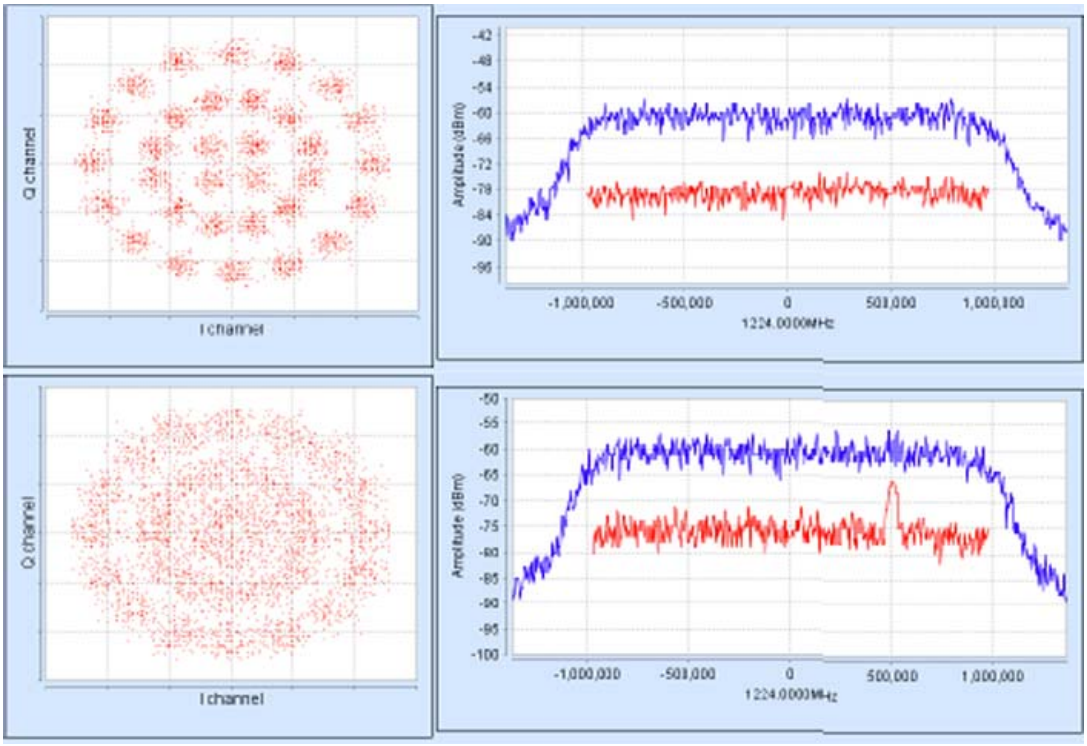

Carrier Under Carrier, interference monitoring plots, showing an interferer, in real time, that is invisible to a regular Spectrum analyzer, when the data traffic is running. Eb/No degradation is optionally programmable, to alarm at a preset level.

How does the RMOD-EXTREME-p3 compare to others?

Regarding the Comtech CDM625, for example, EDMAC is a COMTECH ESC channel proprietary command protocol. RADITEK modems do not support EDMAC, per se, but we do have equivalent ESC command protocols.

Some highlights for the RMOD-EXTREME-p3 include:

- **Data rates from 18kbps to 10Mbps (up to 200Mbps).**
- **Modulations from BPSK to 256QAM (but also 16APSK, 32APSK and 64QAM).**
- **The equivalent ESC channel control to EDMAC/EDMAC 2.**
- **Drop & Insert for Single port E1/T1 and Quad E1 D and I (Ports 2, 3, 4).**
- **The modem hardware itself supports IEEE 1588v2 Precision Time Protocol (PTP) and we are in the process of updating/adding software support for this feature.**

- **Support for jumbo Ethernet frames (2048 byte).**

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- **We have no direct equivalent of Comtech's CnC-APC, but does support AUPC (Adaptive Uplink Power Control) with SIMU-Carrier.**
- **Note: We do not support asynchronous E1 streams because, as stated, G.703 actually requires that clocks are synchronous to within +/-50ppm at 2048kbps so there is no actual market, or significant market, that we are aware of for asynchronous timing support??**

- **SNMP can be used to reboot the modem, if necessary, and can be used for 1:N control.**
- **The modem supports Robbed-bit Signaling.**
- **Quality of Service (QoS) supports Layer 2 and Layer 3.**

The RADITEK modem that matches (and exceeds) the CDM625 is the new 200Mbps Raditek Extreme. . Essentially the CDM625 doesn't even support standard 20% roll-off (managing only 25% minimum) compared to the 5% roll-off for the Extreme.

	Comtech	Comtech	Paradise	RADITEK	RADITEK Comments
Model:	**CDM625**	**CDM750**	**PD60**	**Extreme**	
Carrier overlap	√	√	√	√	
Carrier overlap + power control	√	×	×	×	**Have SIMU-Carrier and AUPC instead**
5% spectral roll-off factor	×	×	√	√	
Low-latency LDPC	√	×	√	√	
Low-latency ACM	√	×	×	×	**Under development**
Header compression	√	×	√	√	
Payload compression	√	√	√	√	
Encryption	√	×	×	√	
Acceleration	×	×	√	√	
Traffic shaping	√	×	√	√	
Dual IF/L-band	√	√	×	√	
Maximum data rate	**25Mbps**	**169Mbps**	**100Mbps**	**155Mbps**	
Maximum symbol rate	**12.5Msps**	**63Msps**	**40Msps**	**45Msps**	
Model:	**Comtech CDM625**	**Comtech CDM750**	**Paradise PD60**	**RADITEK Extreme**	**RADITEK Comments:**
Highest order modulation	**16QAM**	**32APSK**	**64QAM**	**64QAM**	
DVB-S2	×	√	√	√	
DVB-S2 ACM	×	√	√	√	
ASI	√	×	×	√	**Note: Will be available soon (high speed serial Video)**
SNMP	√	√	√	√	
AUPC	√	×	√	√	
L-band services	√	√	√	√	
IPv6	×	×	√	√	
Web diagnostic tools	×	×	√	√	

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	Comtech	Comtech	Paradise	RADITEK	RADITEK Comments
Redundancy switch	√	×	√	√	
VLAN	√	×	√	√	
TPC	√	×	√	√	
4-port ethernet switch	√	×	×	×	**Easier to use external switch**
4 port MUX	√	×	√	√	
Legacy features (see Note 1)	√	×	√	√	
MPE encapsulation	×	×	√	√	**~10% overhead**
ULE encapsulation	×	×	√	√	**~7% overhead**
GSE encapsulation	×	√	×	×	**~2% over head**
RXE encapsulation (proprietary)	×	×	√	√	**~2% over head (Raditek's own encapsulation)**
Tx predistorter	×	×	√	×	
Rx adaptive equalizer	×	?	√	√	
Optical Ethernet/STM-1/OC-3	×	√	×	√	**Coming soon, can use external adapter for now.**
Number of features	**19**	**11**	**27**	**30**	

Note 1: Legacy features cover G.703, Quad E1, HSSI, LVDS, EIA-530, IBS, IDR, TCM, Sequential, Viterbi, Reed-Solomon

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