

RADITEK INC.



SATCOM / TELECOM BROCHURE



2013

Advanced SCPC Satellite Modem

70/140MHz or L-band, 220V AC, IP, E1, T1, Data

RMOD-SCPC-(2-20Mb)* -70/140MHz/L-p3

* 2Mb (optionally expandable to 20Mbps) data rate,

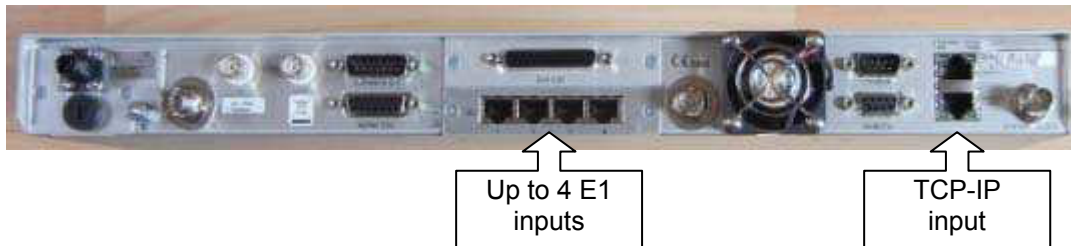


OPTIONS Available:

- Data rate is from 2Mbps to a maximum of 20Mbps,
- 10Msymbol/s maximum for 8PSK (and above) and DVB-S2.
- IBS, IDR, E1/E0 Drop & Insert...
- DVB-S2 FEC and modulation support...
- Ethernet.
- Various traffic/terrestrial interfaces
- AUPC (Automatic Uplink Power control)
- Quad(4) E1 cards allowing up to 4 x E1s to be multiplexed onto a single carrier
- IF interfaces include: 70MHz or 140MHz or L-band, and special IF combinations
- SCPC (Single Channel per carrier)
- DVB-S2 outbound with SCPC return, or SCPC outbound with DVB-S2 return.
- Or SCPC outbound and return.
- Hybrid mode where Tx/Rx SCPC features are combined with DVB-S2 space segment savings.
- All traditional SCPC features are supported including IBS, IDR, ESC, Drop & Insert, AUPC, etc.
- 48 V DC Power Supply

Raditek can also offer other state of the art modems to support SCPC with DAMA, ABOD (automatic bandwidth on demand) with MESH and/or STAR networks-all with sophisticated NMC software support.

The **Multi-E1/IP** option is a very useful way to combine up to 4x E1 (balanced/G.703) inputs or 3XE1 and an IP input, simultaneously, for transmission on one satellite channel. There is no other way to send IP and E1 at the same time on this modem.



Part Number: RMOD-SCPC-(2-20Mb)*-70/140MHz/L-p3

Description: High Performance Satellite Modem: SCPC 70/140MHz or L-band, 220V AC, IP, E1, T1, Data

* 2Mb (optionally expandable to 20Mbps) data rate,

Options **Data Rate** **DVBS2** **Simu Carrier** **Modulation** **SCPC** **LDPC+**

If IP is used, an IP accelerator is recommended, either as an option within the modem or a third party external one. The data rate is limited, otherwise, due to the satellite propagation delay.

The maximum data rate when using the MUX option is limited, at any port to 2Mbps. Without any IP accelerator you may not see data rates above 200Kbps on the IP channel.

All E1 MUX options include: Drop and Insert and full E1 setup. Supports Extended Drop and Insert with 1-31 timeslots Requires IBS/SMS option in 4. the host modem. Modem can easily be 1+1 redundancy protected

Advanced SCPC Satellite Modem

2Mbps (expandable to 20Mbps) data rate, 70 or 140MHz IF, 220V AC.

RMOD-SCPC-2-20Mb-70/140MHz/L-band-p3

Main Specifications

Modulation Scheme	SCPC: BPSK, QPSK, OQPSK, 8PSK (Optionally: 8APSK, 16QAM) Or DVB-S2 (Option): QPSK, 8PSK, 16APSK
IF Frequency Range	50 - 90MHz (70MHz) & 100 - 180MHz (140MHz)
L-band Frequency Range	950 to 2,050MHz
IF Frequency Resolution	100Hz
Traffic Interface - Electrical	Ethernet (10/100 BaseT) IP Traffic on RJ45 with link and traffic indicators. Electronically selectable with other interfaces fitted.
Traffic Interface - Options	RS422 including X.21 DCE and DTE emulation, V.35 and RS232 on EIA530 connector 25 pin female D-type (Option), EIA530 maximum 10Mbps, RS232 max 100kbps Serial LVDS 25 pin female D-type (Option) HSSI 50 pin HD SCSI-2 connector (Option) G.703 balanced on EIA530 G.703 unbalanced on BNC female 75Ω Quad E1 G.703 balanced on RJ45 IP Traffic card 10/100/1000 BaseT on RJ45 Mux option allows a mix of multiple G.703 interfaces plus IP and/or EIA530 traffic with a limit of 2,048kbps per MUX traffic to 4 ports max.
User Traffic Data Rate	SCPC: 4.8kbps – 2,048kbps in base Modem DVB-S2 50kbps – 2,048kbps in base Modem, subject to minimum symbol rate of 100ksymbol/s Extension of base operation to 5Mbps (Optionally to 10 and 20Mps)
User Traffic Data Rate Resolution	1bps Note: The combination of FEC Rate, Modulation scheme and Satellite Overhead limits the Traffic Data Rate Range in all modes.
User Data Rate Range – Closed Network	4.8kbps to 20Mbps no Satellite Overhead (with high Data Rate options)
User Data Rate Range – Minimum Overhead (Closed Network plus ESC)	As Closed Network above except limits inclusive of overhead of approximately 1.4 times the ESC baud rate. Resolution of 1bps. Supports ESC rate from 110 baud to >38.4kbaud.
Outer Forward Error Correction	Concatenated Intelsat Reed-Solomon Outer Codec to IESS308/310 with Custom Option offering variable code rate. Maximum traffic rate 10Mbps.
Scrambling – SCPC Closed Network Plus ESC	32kbps or above: synchronized to ESC overhead. Less than 32kbps: as per closed network. V.35 Scrambler has CCITT, Intelsat, “FDC” and “Linkabit” modes up to 20Mbps (with high Data Rate options)
IF Connector type	BNC female
IF Impedance	50Ω & 75Ω, electronically selectable
Return Loss	18dB typical
Internal Frequency Reference - Ageing	<1ppm/yr
External Reference	Clocking Only: 1-10MHz in 1kHz steps. Clocking and RF Frequency: 10MHz, 0dBm±1dB

RMOD-SCPC-(2-20Mb)-70-140M-L-p3

Specifications may be subject to change

07/09/13

WORLD HQ: 1702L Meridian Ave. Suite 127, San Jose, Ca 95125, U.S.A.

Tel: (408) 266-7404

FAX: (408) 266-4483

WEB: www.raditek.com

E-mail: sales@raditek.com

Advanced SCPC Satellite Modem

2Mbps (expandable to 20Mbps) data rate, 70 or 140MHz IF, 220V AC.

RMOD-SCPC-2-20Mb-70/140MHz/L-band-p3

BER Performance -Guaranteed dB (Typical)						
SCPC mode		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)
	1E-8	3.3 (3.0)	4.5 (4.2)	4.5 (4.2)		6.8 (6.5)
Turbo (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)		10.7 (10.4)
8PSK/TCM	1E-8				6.3 (6.0)	
	1E-3				10.4 (10.1)	
8PSK/TCM + Reed-Solomon (all rates)	1E-4				6.1 (5.8)	
	1E-10				7.3 (7.0)	

Modulator Specifications	
Output Power Level	0 to -25dBm Continuously Variable in 0.1dB steps
Output Level Stability	±0.5dB, 0°C to 40°C
Transmit Filtering Selectable	Intelsat IESS and DVB-S2
Occupied Bandwidth	compliant $\alpha = 0.35$ $\alpha = 0.25$ $\alpha = 0.20$
Recommended Channel Spacing	1.2 x Symbol Rate 1.13 x SR 1.1 x SR
Phase Accuracy	1.4 x Symbol Rate 1.27 x SR 1.2 x SR
Amplitude Accuracy	±2° maximum
Carrier Suppression	±0.2dB maximum
Output Phase Noise	-30dBc minimum
Output Frequency Stability	As IESS-308, nominally 3dB better.
Harmonics	<1ppm/yr
Spurious	Better than -55dBc/ 4kHz in band
Transmit On/Off Ratio	Better than -55dBc/ 4kHz in band
External Transmit Inhibit	55dB minimum
Adaptive Signal Predistorter	By external contact closure or by TTL signal applied to rear panel Alarms & AGC connector
	Option: Use with 16QAM to reduce HPA backoff to 1.6dB.

Demodulator Specifications	
Input Range	-30 to -60dBm
Maximum Composite Signal	30dB above level to a maximum of 0dBm

RMOD-SCPC-(2-20Mb)-70-140M-L-p3

Specifications may be subject to change

07/09/13

WORLD HQ: 1702L Meridian Ave. Suite 127, San Jose, Ca 95125, U.S.A.

Tel: (408) 266-7404

FAX: (408) 266-4483

WEB: www.raditek.com

E-mail: sales@raditek.com

Advanced SCPC Satellite Modem

2Mbps (expandable to 20Mbps) data rate, 70 or 140MHz IF, 220V AC.

RMOD-SCPC-2-20Mb-70/140MHz/L-band-p3

Demodulator Specifications

Frequency Acquisition Range	Selectable from $\pm 1\text{kHz}$ to $\pm 32\text{kHz}$ up to 10 MSPS (in 1kHz steps) $\pm 10\text{kHz}$ to $\pm 250\text{kHz}$ above 10 MSPS (in 10kHz steps)
Acquisition Threshold	<5dB Es/No QPSK
Acquisition Time	At 9.6kbps, less than 1s at 6dB Es/No QPSK At 10 Mbps, less than 100ms at 6dB Es/No QPSK
Clock Tracking Range	$\pm 100\text{ppm}$ minimum
Receive Filtering Selectable	Intelsat IESS compliant $\alpha = 0.35$, $\alpha = 0.25$, $\alpha = 0.20$
Performance Monitoring	Measured Eb/No (range 0-15dB, $\pm 0.2\text{dB}$). Measured Frequency Offset (100Hz resolution). Wanted signal level strength indicator centered on the middle of the Rx Input range.
AGC Output	Buffered direct AGC output for antenna tracking, etc.

Data Rate Specifications

Modulation/FEC	FEC Rate de facto	Min Data Rate (kbps)	Max Data Rate (Mbps)
BPSK VIT / SEQ	1/2	4.8	5 / 2
BPSK VIT / SEQ	3/4	7.2	7.5 / 2
BPSK VIT / SEQ	7/8	8.4	8.7 / 2
BPSK VIT RS	1/2	4.3	4.4
BPSK VIT RS	3/4	6.4	6.6
BPSK VIT RS	7/8	7.5	7.7
O/QPSK VIT / SEQ	1/2	9.6	10 / 2
O/QPSK VIT / SEQ	3/4	14.4	15 / 2
O/QPSK VIT / SEQ	7/8	16.8	17.5 / 2
O/QPSK VIT RS	1/2	8.6	8.8
O/QPSK VIT RS	3/4	12.8	13.3
O/QPSK VIT RS	7/8	15	15.5
O/QPSK TPC	1/2	9.6	10
O/QPSK TPC	3/4	14.4	15
O/QPSK TPC	7/8	16.8	17.5
O/QPSK TPC	0.93	17.9	18.6
8PSK TCM	2/3	19.2	20
8PSK TCM RS	2/3	17.7	18.3
8PSK TPC	3/4	21.6	20
8PSK TPC	7/8	25.2	20
8PSK TPC	0.93	26.8	20
16QAM TPC	3/4	28.8	20
16QAM TPC	7/8	33.6	20
16QAM TPC	0.93	35.8	20

Clocking and Buffering Specifications

Clock Integrity	Frequency Locked Loops give phase-hit immune operation even with poor clock sources such as routers etc.	
Tx Clocking SCPC mode	Internal	Standard ($\pm 1\text{ppm}$)
	External	Tracking range $\pm 100\text{ppm}/\text{min}$
	Rx Clock	Slaves Tx timing from Rx clock. (Includes full asymmetric operation)

RMOD-SCPC-(2-20Mb)-70-140M-L-p3

Specifications may be subject to change

07/09/13

WORLD HQ: 1702L Meridian Ave. Suite 127, San Jose, Ca 95125, U.S.A.

Tel: (408) 266-7404

FAX: (408) 266-4483

WEB: www.raditek.com

E-mail: sales@raditek.com

Advanced SCPC Satellite Modem

2Mbps (expandable to 20Mbps) data rate, 70 or 140MHz IF, 220V AC.

RMOD-SCPC-2-20Mb-70/140MHz/L-band-p3

Clocking and Buffering Specifications

Rx Clocking SCPC mode	Buffer Disable Tx Input clock Internal	Clock from Satellite Plesiochronous. (Includes full asymmetric operation) Standard ± 1 ppm
Station Reference Inputs	External timing clock (DTE interface only) Station Reference (see below)	75Ω BNC female Station Clock Connector, transformer isolated. 1MHz to 10MHz in 1kHz steps (accepts sinusoidal >0dBm or square-wave e.g. G.703 para 10) 120Ω RS422 compatible input, 1MHz to 10MHz in 1kHz steps via Async ESC connector NB: When set to 10MHz, the station reference may replace internal reference to all internal circuitry. Unit automatically switches back to internal reference if station reference fails.
Buffer Size	Selectable in 1ms increments from 0ms to 99ms. Automatically adjusted to slip an integer number of terrestrial multi-frame lengths for framed rates. Buffer storage: Maximum buffer size – 256kbytes.	

Drop & Insert Option Specifications

Bearer Types	T1-D4, T1-ESF and E1-G.732
Timeslot Selection	Independent selection of arbitrary timeslots for both Drop and Insert.
Bearer Generation	The terrestrial bearer may be looped through the Drop Mux then Insert Mux, or terminated after the drop Mux and a new blank bearer generated by the insert Mux. The bearer generated within Insert Mux provides full multi-frame and CRC support and may be generated from the Tx clock, station reference, satellite clock or internal reference.
Bearer Backup	In the event that Insert Mux bearer clock is lost, or AIS is supplied, then Insert Mux will switch temporarily to bearer generation mode in order to preserve receive traffic. The backup bearer may be generated from the station reference, satellite clock or internal reference.
Terrestrial CRC	Fully supported, with front panel display of terrestrial error rate based on CRC (T1-ESF and G.732) or Frame Alignment Word errors (all bearer types).
Timeslot ID	The IBS/SMS or Closed Net Plus ESC overhead 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 Specifications

Timeslot Re-Ordering	Selected timeslots may be independently re-ordered on both Tx and Rx paths.
Multi-Destination	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 IBS/SMS or Closed Net Plus ESC is extended to maintain the identity of individual timeslots for all values of N from 1 to 31.
Signaling	Both Channel Associated Signaling (CAS) and Robbed Bit Signaling (RBS) are fully supported. For G.732 Drop/Insert, CAS signaling is extracted from terrestrial TS16 and carried over the satellite in IBS/SMS TS16 and TS48 before re-inserting into the distant terrestrial TS16. For RBS, the IBS or Closed Net Plus ESC overheads maintain the identity of the in-band signaling and it is re-inserted into the terrestrial multi-frame in the correct positions to maintain the RBS.

Ethernet Traffic

Parameter	
Standard (unaccelerated)	Base modem will pass UDP to at least 5Mbps (subject to prevailing data rate limits enabled in the modem) and unaccelerated TCP to typically 128kbps per connection, subject to an overall packet

RMOD-SCPC-(2-20Mb)-70-140M-L-p3

Specifications may be subject to change

07/09/13

WORLD HQ: 1702L Meridian Ave. Suite 127, San Jose, Ca 95125, U.S.A.

Tel: (408) 266-7404

FAX: (408) 266-4483

WEB: www.raditek.com

E-mail: sales@raditek.com

Advanced SCPC Satellite Modem

2Mbps (expandable to 20Mbps) data rate, 70 or 140MHz IF, 220V AC.

RMOD-SCPC-2-20Mb-70/140MHz/L-band-p3

Ethernet Traffic	
Parameter	
PEP (TCP/IP acceleration) Option Traffic mode	handling limit of 10,000 packets per second. Performance Enhancing Protocol (acceleration) for TCP/IP traffic - overcomes performance problems associated with TCP over satellite. Maximum throughput on the base Modem 10Mbps. Bridging (standard) for point-to-point operation Brouting (Option) for point-to-multipoint and satellite outbound plus non--satellite return. Mesh network support. User selectable bridge between Ethernet traffic and Ethernet M&C port.
DHCP	Dynamic Host Control Protocol allows modem IP address to be allocated dynamically from an external DHCP network server.
Ethernet Header Compression	Compression of Ethernet frame headers at data rates up to 2Mbps. Typically reduces 14 byte Ethernet header to 1 byte.
IEEE 802.1p/q	IEEE 802.1p Quality of Service supporting the choice of strict priority queuing or fair weighting queuing. IEEE 802.1q VLAN support

Aux Port	IDR	Synchronous access to 8kbps IDR ESC. With the Async ESC option, async ESC access to the 8kbps IDR ESC is provided giving up to a 9600 baud async channel
	Others	IBS and Closed Net Plus ESC facilities as before installation of IDR option, but now on ESC port on IDR card not shared ESC/Aux port of base unit.
	RS232 or RS422	(user selectable). Provides clock and data lines.
	IDR	Provides 32 or 64kbps access in place of one or both audio ESC channels.

AUPC Specifications	
Parameter	
Modes of Operation	Monitor of distant Eb/No and BER only, full distant Eb/No maintenance. Unidirectional or Bi-directional operation.
Communication Link	Utilizes asynchronous ESC channel on IBS/SMS, IDR and Closed Network plus ESC carriers (ESC from 300 baud, i.e., overheads down to less than 1%). Maximum data rate 10 Mbps
User Parameters	Target Eb/No, positive power offset, negative power offset

Advanced SCPC Satellite Modem

2Mbps (expandable to 20Mbps) data rate, 70 or 140MHz IF, 220V AC.

RMOD-SCPC-2-20Mb-70/140MHz/L-band-p3

BERT Tester Option Specifications

BER Channel	The BERT may operate through main traffic, ESC or Aux data channels, or outputted via the terrestrial interface. Use of ESC & Aux data channels allows continuous real traffic BER performance monitoring whilst the modem carries traffic.
Test Patterns	PRBS 2 ^N -1: N=6, 7, 9, 11, 15, 19, 20, 23. All 1s, All 0s, Alternate Patterns, Sparce Patterns, QRSS, User. Compatible with common stand-alone BER testers.
Results	Display of error count and average BER.
Autolog	Automatic logging of average BER and other parameters at regular intervals.

General Specifications

Loop-backs	Interface Loop (Local and Remote) Framer Loop (Local) RS Loop (Local) FEC Loop (Local) Deframer/Framer Loop (Remote) Internal IF loopback (local, automatically matching Rx IF frequency to Tx)
Test Modes	Transmit CW (Pure Carrier) Transmit Alternate 1-0 Pattern Wideband spectrum analyzer display EZ Audio: 1kHz test tone on audio channels in IDR and P1348 emulation modes
Alarm Relays	4 Independent Change-Over Contacts: Unit Fault, Rx Traffic Fault, Tx Traffic Fault, Deferred Alarm (backward alarm, BER or Eb/No below user set threshold)
Controller	Motorola PowerPC
Embedded Software	Revised embedded software may be downloaded into FLASH memory via Ethernet port with modem remaining in equipment rack.
Configuration Memories	>20 configurations can be stored and recalled from the front panel or remote M&C. Memories can be labeled with text string to aid identification.
User Interface	Clear and intuitive operator interface with plain English dialogue (other languages supported). Graphic display, backlit, high contrast, wide angle LCD. 17 key tactile full keyboard.
Remote Monitor And Control	For multi-drop applications, RS485 interface. For direct to PC applications, RS232 interface (front panel selectable). M&C port may be directly internally linked to ESC port for "over-the-satellite" M&C without cabling. Ethernet (10/100 Base T) via RJ45, embedded Web server, SNMP agent V1, V2c and V3
Redundancy Features	1:1 redundancy controller built in. "Y" cables passively split data maintaining impedances. IF inputs/outputs are passively split/ combined outside the units. Off-line unit tri-states data outputs and mutes Tx carrier.
Monitor	0-10V analogue output (Signal level, Eb/No, or Rx offset frequency) on Alarms & AGC connector.
Mechanical	1U chassis – 410mm deep, excluding front panel handles and rear panel connectors and fans.
Weight	3.5 kg
Power Supply	100-240VAC, +6%, -10%, 1A @100V, 0.5A @ 240V, 47-63Hz.
Safety	Fused IEC connector (live and neutral fused). 48 Volts DC option EN60950-1
EMC	EN55022 Class B (Emissions) EN55082 Part 1 (Immunity)
Environmental	Operating Temperature Range 0-50°C

Advanced SCPC Satellite Modem

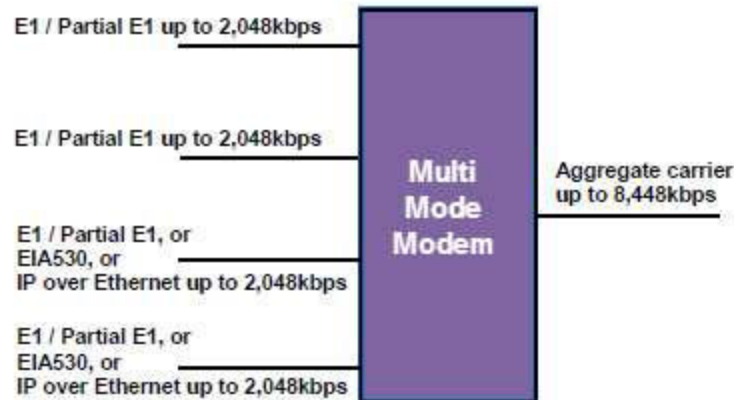
2Mbps (expandable to 20Mbps) data rate, 70 or 140MHz IF, 220V AC.

RMOD-SCPC-2-20Mb-70/140MHz/L-band-p3

ODU facilities via IF interface	
Parameter	
FSK Control Option	Allows monitor & control of a compatible Transceiver from the Modem, via the Tx IFL.

A single composite datastream carrying diverse traffic and traffic formats requires just one modem at each site for a point-to-point link — reducing modem count with no reduction in flexibility.

- An RF power amplifier carrying a single carrier may be operated closer to saturation than an amplifier carrying multiple carriers — e.g. an SSPA with 2 x carriers must be backed off by 2.5dB more than a single carrier SSPA system (TWTAs require even more back-off!). An SSPA with 3 x carriers requires 3.5dB back-off. The single carrier benefit results in more useable power from a given RF amplifier, therefore requires a smaller RF amplifier than multi-carrier solutions.
- As a result of the above, both hub and remote costs are reduced — results in more cost effective solutions for complex systems.
- 1:1 Redundancy protection is available on the combined Modem offers improved reliability for both the modem and multiplexer functions and the 1:1 redundancy controller is included free of charge in the modems.
- More services can be carried simultaneously with no increase in system complexity expandable through software activated feature codes.
- Less hardware means smaller equipment size and less weight — makes the Modem ideal for transportable and mobile systems.
- Suitable for both Military and Commercial applications - has uses in GSM over Satellite (particularly during migration to IP traffic), Distance Learning, Outside Broadcast Co-ordination, Disaster Recovery and more.
- Offers more services to the user at minimal extra cost - multiple traffic links are concentrated into a single carrier.



Advanced SCPC Satellite Modem

2Mbps (expandable to 20Mbps) data rate, 70 or 140MHz IF, 220V AC.

RMOD-SCPC-2-20Mb-70/140MHz/L-band-p3

E1 DATA-MUX option for RMOD-SCPC-5-20Mbps-70MHz-p3 Example

The E1 MUX DATA option is a feature, which is available with 70/140MHz IF or L-band interfaces, and the entire Modem family includes free monitoring tools such as a Spectrum Analyzer, Constellation Monitor, performance graphing versus time up to 1 month in duration, plus full Monitor & Control via Internet Explorer and offers unique features which are both cost effective and easy to use.

Application Examples - GSM, Hybrid Services, Cost/Carrier-Reduction

- GSM over satellite migration from G.703 telephony to IP traffic
- GSM over satellite mixed G.703 plus IP data services
- Mixed G.703 and VoIP telephony streams



E1MUX Data Option

SCPC-EXTREME Satellite Modem to 64QAM, with data rate: 18K-155 Mbps & dual IF: 70/140M and L band



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 155Mbps.

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 155Mbps
- DVB-S2-/ACM, to 16APSK. 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 64QAM
- 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.

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 (limited availability)

Part Number: RMOD-Extreme-p3

Description: (High Performance Satellite Modem: EXTREME)

Options	Data Rate	DVBS2	Simu Carrier	Modulation	SCPC	LDPC+
---------	-----------	-------	--------------	------------	------	-------

RMOD-EXTREME-p3

Specifications may be subject to change

07/08/13

WORLD HQ: 1702L Meridian Ave. Suite 127, San Jose, Ca 95125, U.S.A.

Tel: (408) 266-7404

FAX: (408) 266-4483

WEB: www.raditek.com

E-mail: sales@raditek.com

SCPC Satcom Modem (18K-155 Mbps), (IFs: 70, 140MHz & L band), BPSK to 64QAM, 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 155Mbps
Symbol Rate	DVB-S2: 100ksps to 45Msps Non-DVB-S2: 9.6ksps to 40Msps
Operating Modes	DVB-S2 (EN 302 307) option Closed Network (+ ESC) (IESS-315) IBS/IDR (IESS-308/309/310/314) options
Scrambling	DVB-S2: as per EN 302 307 IBS: Synchronized to framing per IESS-309 Closed Network + ESC: Synchronized to ESC overhead
Impedance	IF: 50Ω/75Ω L-band: 50Ω
Return Loss	IF: 18dB typical L-band: 14dB typical
Frequency Reference Stability	Ageing <4E-8/yr
External Reference	Clocking only: 1 to 10MHz, 1kHz steps Clocking and RF frequency: 10MHz, 0dBm±1dB
Redundancy	Standalone, 1:1 or 1:N redundancy configuration
Traffic Interfaces	
Base modem (standard): Ethernet (10/100/1000 BaseT) IP traffic on RJ45. Processing capability: 100,000 packets per second Traffic options: 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 (50-pin f/m D connector)	
RadMux (4 port Mux) option: Combines from: G.703, IP and EIA-530 traffic (requires Quad E1 option)	

Modulator	
Output Power	IF: 0 to -25dBm (0.1dB steps) L-band: 0 to -30dBm (0.1dB steps)
Output Power Stability	±0.5dB, 0°C to 50°C
Transmit Filter Roll-off	5, 10, 15, 20%, 25%, 35%
Phase Accuracy	±2° maximum
Amplitude Accuracy	±0.2dB maximum
Carrier Suppression	-30dBc minimum
Output Phase Noise	To IESS-316, typ. 3dB better
Harmonics	Better than -55dBc/ 4kHz in band
Spurious	Better than -55dBc/ 4kHz in band
Transmit On/Off Ratio	55dB minimum
Demodulator	
Input Range	IF minimum: -115+10 log (symbol rate) L-band minimum: -130+10 log (symbol rate) IF/L-band maximum: -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 ±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 (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	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
AGC Output	Buffered direct AGC output for antenna tracking, etc.

SCPC Satcom Modem (18K-155 Mbps), (IFs: 70, 140MHz & L band), BPSK to 64QAM, RMOD-EXTREME-p3

Forward Error Correction	
Modulation	1. DVB-S2 (Option): QPSK, 8PSK, 16APSK 2a. Non-DVB-S2: BPSK, QPSK, OQPSK 2b. Plus options for: 8PSK, 16QAM, 2c. Low Latency LDPC+: 8QAM, 16APSK, 32APSK, 64QAM
FEC	1. DVB-S2 (LDPC/BCH) option: 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, 9/10 2. Non-DVB-S2: Note <u>BPSK and (O)QPSK provided as standard</u> ; other modulations are optional: 3. 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 4. TPC option: BPSK: 5/16, 21/44, 2/3, 3/4, 0.493, 7/8, Rate 7/8 de facto, 0.789, (O)QPSK: 5/16, 21/44, 2/3, 3/4, 0.493 7/8, 7/8 de facto, 0.789, 0.93 8PSK: 3/4 de facto, 7/8 de facto, 0.93 16QAM: 3/4 de facto, 7/8 de facto, 0.93 5. Viterbi: BPSK/(O)QPSK 1/2, 3/4, 7/8 6. TCM option: 8PSK rate:2/3 7. Sequential option: BPSK/(O)QPSK 1/2, 3/4, 7/8 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 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	Typical throughput level of 90% of link

Option	capacity. Supports 5,000 concurrent accelerated TCP connections (plus at least 35,000 unaccelerated TCP connections) up to the modem maximum data rate.
Header Compression Option	Header Compression to RFC 3095. 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. Includes Ethernet header compression (compresses 14-byte Ethernet frame to typically one byte)
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 Option	Encrypts all IP traffic using AES with 256-bit keys
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
DVB-S2 ACM (option)	Dynamically varies mod/cod with varying link conditions, maximizing throughput at all times by converting unused link margin into additional throughput

SCPC Satcom Modem (18K-155 Mbps), (IFs: 70, 140MHz & L band), BPSK to 64QAM, RMOD-EXTREME-p3

ODU facilities via IF interface	
FSK Control	Allows monitor & control of a compatible L-band BUC or IF Transceiver from the modem via the Tx IFL cable
Simu-Carrier	
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.
Simu-Carrier data rate options	256kbps, 512kbps, 1024kbps, 2.5Mbps, 5Mbps, 10Mbps, 15Mbps, 20Mbps, 25Mbps, 30Mbps, 40Mbps, 50Mbps, 60Mbps, 80Mbps, 100Mbps and 155Mbps traffic rate (30kHz to 54MHz occupied bandwidth)
Power asymmetry	-10dB to +10dB
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 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)

Extended Drop & Insert Option	
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	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	

SCPC Satcom Modem (18K-155 Mbps), (IFs: 70, 140MHz & L band), BPSK to 64QAM, RMOD-EXTREME-p3

DVB-S2 Performance at BER 1E-6 Guaranteed Es/No (dB) for Normal (64k) Frames											
	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	-1.6	-0.7	0.3	1.5	2.8	3.4	4.3	5.0	5.5	6.5	6.7
8PSK					6.4	7.2	8.5		9.8	11.0	11.3
16APSK						9.7	10.8	11.6	12.2	13.4	13.7

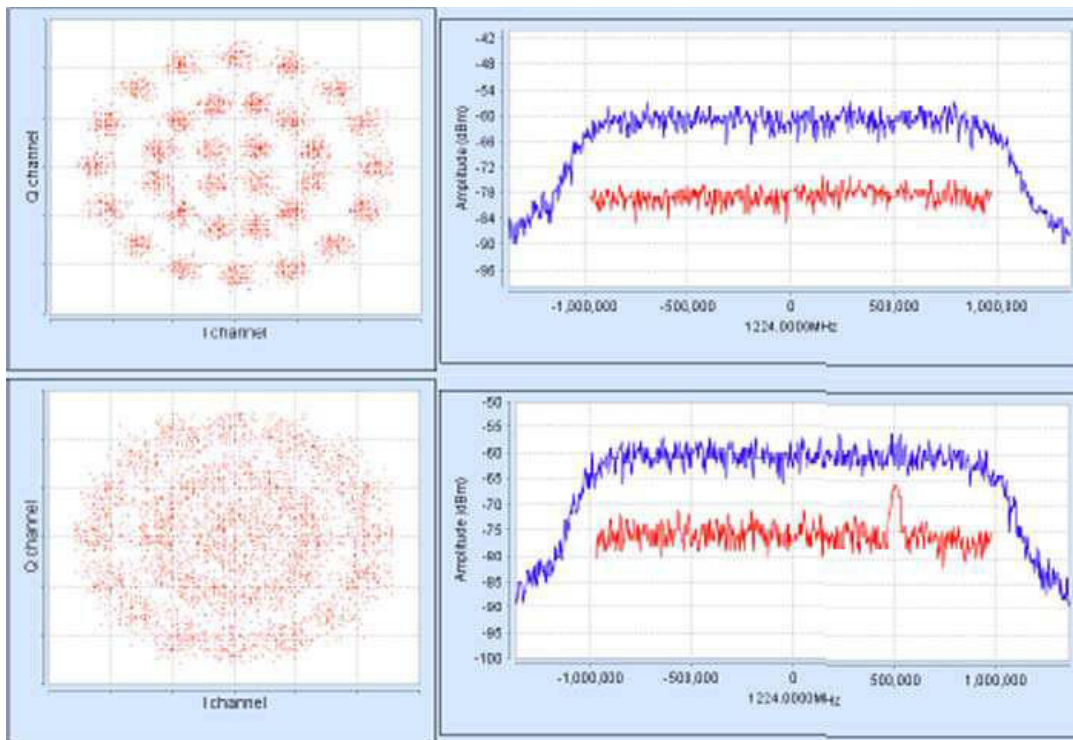
DVB-S2 Performance at BER 1E-6 Guaranteed Es/No (dB) for Short (16k) Frames											
	Rate 1/4	Rate 1/3	Rate 2/5	Rate 1/2	Rate 3/5	Rate 2/3	Rate 3/4	Rate 4/5	Rate 5/6	Rate 8/9	Rate 9/10
QPSK	-1.3	-0.4	0.5	1.9	3.0	3.5	4.4	5.2	5.6	6.7	
8PSK					6.5	7.3	8.6		9.9	11.2	11.3
16APSK						9.8	11.1	11.7	12.3	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	4.7 (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)	

SCPC Satcom Modem (18K-155 Mbps), (IFs: 70, 140MHz & L band), BPSK to 64QAM, RMOD-EXTREME-p3

Mechanical Environmental	
Size	1U chassis, 410mm deep excluding front panel handles and rear panel connectors and fans
Weight	3.5kg
Power Supply	90-250VAC, 1A @100V, 0.5A @ 240V, 47-63Hz Fused IEC connector (live and neutral fused); 48V DC optional
Safety Standards	EN60950-1 2006
Emission and Immunity	EN55022 2006 Class B (Emissions) EN55024 1998 A1 + A2 (Immunity)
Operating Temperature	0 to 50°C
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

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
IF cable power (and reference) summary	
LNB reference	10M ±0.001ppm, 0dBm ±3 dB
LNB power	15V or 24V 0.5A
BUC power	24 or 48V, 200W



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?

RMOD-EXTREME-p3

Specifications may be subject to change

07/08/13

WORLD HQ: 1702L Meridian Ave. Suite 127, San Jose, Ca 95125, U.S.A.

Tel: (408) 266-7404

FAX: (408) 266-4483

WEB: www.raditek.com

E-mail: sales@raditek.com

SCPC Satcom Modem (18K-155 Mbps), (IFs: 70, 140MHz & L band), BPSK to 64QAM, RMOD-EXTREME-p3

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 155Mbps).
- Modulations from BPSK to 16QAM (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).
- We have no direct equivalent of Comtech's CnC-APC, but do 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 155Mbps 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	√	x	x	x	Have SIMU-Carrier and AUPC instead
5% spectral roll-off factor	x	x	√	√	
Low-latency LDPC	√	x	√	√	
Low-latency ACM	√	x	x	x	Under development
Header compression	√	x	√	√	
Payload compression	√	√	√	√	
Encryption	√	x	x	√	
Acceleration	x	x	√	√	
Traffic shaping	√	x	√	√	
Dual IF/L-band	√	√	x	√	
Maximum data rate	25Mbps	169Mbps	100Mbps	155Mbps	
Maximum symbol rate	12.5Msps	63Msps	40Msps	45Msps	
					RADITEK Comments:

RIModel: Comtech Comtech Paradise RADITEK 07/08/13

Specifications may be subject to change

WORLD HQ: 1702L Meridian Ave. Suite 127, San Jose, Ca 95125, U.S.A.

Tel: (408) 266-7404

FAX: (408) 266-4483

WEB: www.raditek.com

E-mail: sales@raditek.com

SCPC Satcom Modem (18K-155 Mbps), (IFs: 70, 140MHz & L band), BPSK to 64QAM, RMOD-EXTREME-p3

	CDM625	CDM750	PD60	Extreme	
Highest order modulation	16QAM	32APSK	64QAM	64QAM	
DVB-S2	x	√	√	√	
DVB-S2 ACM	x	√	√	√	
ASI	√	x	x	√	Note: Will be available soon (high speed serial Video)
SNMP	√	√	√	√	
AUPC	√	x	√	√	
L-band services	√	√	√	√	
IPv6	x	x	√	√	
Web diagnostic tools	x	x	√	√	
Redundancy switch	√	x	√	√	
VLAN	√	x	√	√	
TPC	√	x	√	√	
4-port ethernet switch	√	x	x	x	Easier to use external switch
4 port MUX	√	x	√	√	
Legacy features (see Note 1)	√	x	√	√	
MPE encapsulation	x	x	√	√	~10% overhead
ULE encapsulation	x	x	√	√	~7% overhead
GSE encapsulation	x	√	x	x	~2% over head
RXE encapsulation (proprietary)	x	x	√	√	~2% over head (Raditek's own encapsulation)
Tx predistorter	x	x	√	x	
Rx adaptive equalizer	x	?	√	√	
Optical Ethernet/STM-1/OC-3	x	√	x	√	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