RADITEK

SATCOM
SCPC Modem

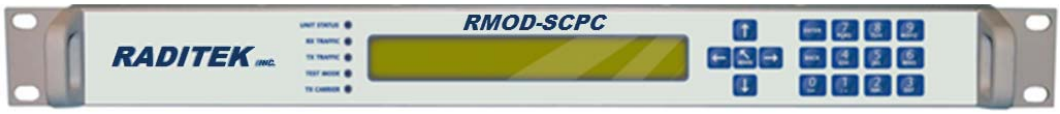
Advanced SCPC Satellite Modem

RoHS COMPLIANT

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,

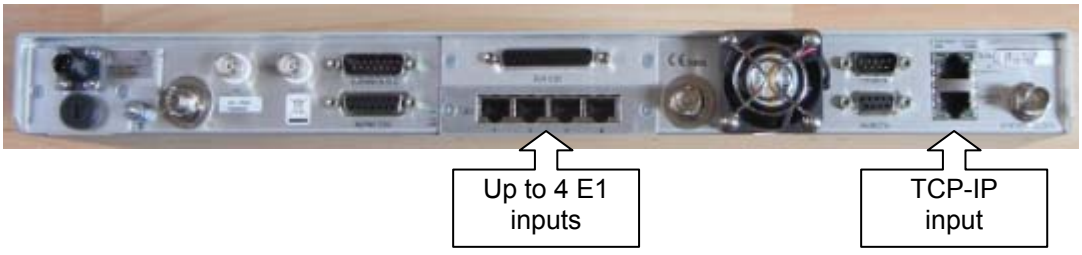


OPTIONS Available:

- **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

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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

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Main Specifications	
Internal Frequency Reference - Ageing	<1ppm/yr
External Reference	Clocking Only: 1-10MHz in 1kHz steps. Clocking and RF Frequency: 10MHz, 0dBm±1dB

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)		
	1E-8					10.7 (10.4)
8PSK/TCM	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)	

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

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Demodulator Specifications	
Input Range	-30 to –60dBm
Maximum Composite Signal	30dB above level to a maximum of 0dBm
Frequency Acquisition Range	Selectable from ±1kHz to ±32kHz up to 10 MSPS (in 1kHz steps) ±10kHz to ±250kHz 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	±100ppm minimum
Receive Filtering Selectable	Intelsat IESS compliant α = 0.35, α = 0.25, α = 0.20
Performance Monitoring	Measured Eb/No (range 0-15dB, ±0.2dB). 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

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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 (±1ppm)
	External	Tracking range ±100ppm/min
	Rx Clock	Slaves Tx timing from Rx clock. (Includes full asymmetric operation)
Rx Clocking **SCPC mode**	Buffer Disable	Clock from Satellite
	Tx Input clock	Plesiochronous. (Includes full asymmetric operation)
	Internal	Standard ±1ppm
	External timing clock (DTE interface only) Station Reference (see below)	
Station Reference Inputs	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.

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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 handling limit of 10,000 packets per second.
PEP (TCP/IP acceleration) Option	Performance Enhancing Protocol (acceleration) for TCP/IP traffic - overcomes performance problems associated with TCP over satellite. Maximum throughput on the base Modem10Mbps.
Traffic mode	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
	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.
Aux Port	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

BUC/LNB Facilities	
LNB Power (included in modem)	+15/24V 0.5A DC to LNB via Rx IFL
FSK Option	Allows monitor and control of a compatible BUC from the modem via the Tx IFL
10MHz Reference (via IFL to BUC/LNB)	10MHz output level to BUC: +3dBm (+/-1dBm) 10MHz output level to LNB: 0dBm (+/-1dBm)
BUC PSU is optional	**BUC PSU Options**
	AC input, 24V 100W DC to Tx BUC (hardware option)
	AC input, 48V 100W DC to Tx BUC (hardware option)
	AC input, 24V 200W DC to Tx BUC (hardware option)
	AC input, 48V 200W DC to Tx BUC (hardware option)

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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.
	Fused IEC connector (live and neutral fused). 48 Volts DC option
Safety	EN60950-1
EMC	EN55022 Class B (Emissions) EN55082 Part 1 (Immunity)
Environmental	Operating Temperature Range 0-50ºC

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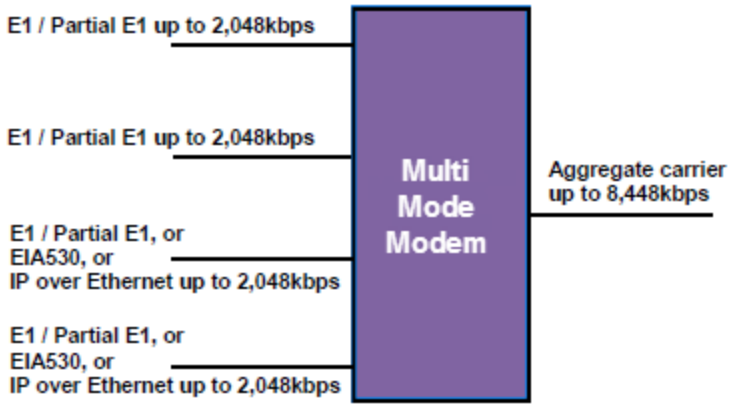
ODU facilities via IF interface	
Parameter	
FSK Control Option	Allows monitor & control of a compatible Transceiver from the Modem, via the Tx IFL.

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.



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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

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