

# SLM-5650 Satellite Modem



## INTRODUCTION

Comtech EF Data's SLM-5650 Satellite Modem is designed to comply with the strict requirements of the Defense Satellite Communications System (DSCS) defined in MIL-STD-188-165A, modem types I, II, IV, V and VI.

The modem is designed to support software defined, advanced modulation and signal processing techniques. The selection of these different modes allows the user to maximize performance in a wide variety of environments or to adapt to changing conditions.

Advanced forward error correction (FEC) capabilities are a Comtech EF Data standard feature. Viterbi, Trellis, Concatenated Reed-Solomon, and Turbo Product Codes are all supported.

The IF frequency range is easily selected from the front panel or the remote control interfaces. They include 52-88, 104-176, 950-2000 MHz.

## FEATURES

- MIL-STD-188-165A compliant (Types I, II, IV, V, VI)
  - Selectable 70/140 MHz and 950-2000 MHz IF
- BPSK, QPSK, OQPSK, 8-PSK, 16-QAM
- Adaptive Equalizer
- FEC rates 1/1, 1/2, 2/3, 3/4, 5/6, 7/8, and others
- 64 kbps to 155 Mbps (Modulation, code rate and interface dependent)
- Flash upgrade capability
- IESS-308, -309, -310, -315
- ASYNC/AUPC
- Viterbi and Reed-Solomon Codec
- Optional: Turbo Product Card - FAST
- Asymmetrical loop timing
- Data Source Bit Synchronization (Clock recovery for input data without an associated transmit clock)
- Optional Plug in Data Interface
- Ethernet interface for remote control using HTTP, Telnet, and SNMP
- EIA-485 and EIA-232 interface for remote control
- Full featured, built-in BER test-set

## APPLICATIONS

The SLM-5650 is the ideal equipment solution when implementing Quad-Band terminals that require both commercial and government communication access.

## COMPATIBILITY

The SLM-5650 is interoperable with the OM-73, SLM-3650, MD-1352(P)/U (BEM-7650), SLM-7650, SLM-8650, and MD-945 satellite modems.

## DATA INTERFACES

The modem supports either MIL-STD-188-114 (EIA-422) or HSSI. Connecting an optional interface module can support additional data interfaces. An optional Gigabit Ethernet, 10/100/1000 BaseT card is available.

## OPEN NETWORK FRAMING

The modem provides overhead framing that is compatible with Intelsat specifications IESS-308, IESS-309, and IESS-310, for open network operation. The INTELSAT and EUTELSAT open network standards provide interoperability with earth stations worldwide.

## ASYNC/AUPC

Automatic Uplink Power Control (AUPC) is available to maintain a desired Eb/No at the demodulator despite link fades due to excessive rain or other power level variations.

## REED-SOLOMON CONCATENATED CODING

The Reed-Solomon FEC can be used to further correct burst errors when concatenated with Viterbi or Trellis decoding resulting in greatly improving the satellite link performance. This allows for either extra link margin or the use of smaller antennas.

## TURBO CODING

Turbo coding provides superior error correction performance over Viterbi, Trellis and Reed-Solomon FEC. The SLM-5650 Turbo coding is compatible with Intelsat IESS-315 and Comtech EF Data's CDM-600, SLM-3650, SLM-7650, and the Bandwidth Efficient Modem (BEM).

# SLM-5650 Satellite Modem

## SYSTEM

Operating Frequency Range	52 to 88, 104 to 176 MHz, 950 to 2000 MHz in 100 Hz steps
Modulation Types	BPSK, QPSK, Offset QPSK, 8-PSK, 16-QAM
Digital Data Rate	64 kbps to 20 Mbps, in 1 bps steps (EIA-530), max for Viterbi or Viterbi + R-S 64 kbps to 52 Mbps, in 1 bps steps (EIA-613), requires turbo codec 64 kbps to 155 Mbps, (Interface dependent)
Symbol Rate	32 Ks/s to 64 Ms/s
External Reference Input	TNC connector, 1, 5, or 10 MHz, selectable
INT REF Stability	1 x 10 <sup>-7</sup>
Scrambling	V.35, OM-73 and Synchronous.
IDR/IBS Framing	Support for IDR and IBS framing. Allows basic IDR/IBS open network compatible operation.
Compatibility	
Built-in Test (BIT)	Fault and status reporting, BER performance monitoring, IF loopback, programmable test modes, built in Fireberd emulation allows comprehensive BER measurements.
Summary Faults	Reported via Front Panel LEDs, 15-pin D sub, FORM C relay contacts for Tx, Rx, Common equipment faults, and Tx and Rx Alarms.
Unit Management	EIA-485, EIA-232, 10/100 Base-T Ethernet with HTTP, Telnet and SNMP

## MODULATION

Output Power	+10 to -40 dBm, adjustable in 0.1 dB steps
Output Return Loss	14 dB (70/140 MHz) 9 dB (L-Band)
Output Impedance	50 Ω
Spurious	From Carrier + Symbol Rate to 500 MHz -51 dBc
Harmonics	From Carrier (CW) to 4000 MHz -60 dBc
Tx Clock Source	INT, Tx Terrestrial, and Data Source Sync, Rx Satellite
Output Connectors	TNC for 52 to 88, 104 to 176 MHz Type "N" for 950 to 2000 MHz

## DEMODULATION

Input Power:	
Desired Carrier	+10 to -55 dBm
Maximum Composite	+20 dBm or +40 dBc
Input Impedance	50 Ω
Input Connectors	TNC for 52 to 88, 104 to 176 MHz Type "N" for 950 to 2000 MHz
Carrier Acquisition Range	±30 kHz, selectable
Input Return Loss	14 dB (70/140 MHz) 9 dB (L-Band)
Buffer Clock	INT, Tx Terrestrial, Rx Satellite
Doppler Buffer	32 to 16,777,216 bits, selectable

## CODING OPTIONS

Uncoded	Standard	1/1
Viterbi	Standard	K=7,1/2, 3/4, and 7/8 rates
Viterbi & Reed-Solomon	Standard	Closed Network, per IESS-308 and IESS-309
Trellis	Standard	Per IESS-310
Trellis and Reed-Solomon	Optional	Per IESS-310
Turbo	Optional	TPC Per IESS-315

## OPEN NETWORK FRAMING

IDR	INTELSAT IESS-308 (framing only)
	INTELSAT IESS-310 (framing only)
IBS	INTELSAT IESS-309 (framing only)

## AVAILABLE OPTIONS

How Enabled	Option
FAST	Data Rates to 5, 10, 20, 52 or 155 Mbps
FAST	8-PSK and 16-QAM
FAST + SIMM Card	TURBO (earlier models) to 52 Mbps
FAST	Turbo (later models) to 155 Mbps
FAST	Automatic Uplink Power Control (AUPC)
FAST	Reed-Solomon
Hardware	Gigabit Ethernet

## BER PERFORMANCE

E<sub>b</sub>/N<sub>0</sub> Performance Viterbi Decoder, QPSK/OQPSK

BER	Viterbi			Reed-Solomon		TURBO	
	1/2	3/4	7/8	1/2	3/4	3/4	7/8
10 <sup>-3</sup>	4.2	5.2	6.4				
10 <sup>-4</sup>	4.8	6.0	7.2				
10 <sup>-5</sup>	5.5	6.7	7.9				
10 <sup>-6</sup>	6.1	7.5	8.6	4.1	5.6	4.1	4.5
10 <sup>-7</sup>	6.7	8.2	9.2	4.2	5.8	4.3	4.6
10 <sup>-8</sup>	7.2	8.8	9.9	4.4	6.0	4.6	4.7
10 <sup>-10</sup>				5.0	6.3	5.5	4.8

High Order Modulation E<sub>b</sub>/N<sub>0</sub> Performance  
(Typical values are in parentheses)

BER	Viterbi + Reed-Solomon				Turbo 8-PSK		Turbo 16-QAM	
	2/3	5/6	3/4	7/8	3/4	7/8	3/4	7/8
10 <sup>-6</sup>	6.2	8.2	8.4	9.8	6.5 (5.8)	7.1 (6.6)	7.6 (7.0)	8.2 (7.7)
10 <sup>-7</sup>	6.5	8.5	8.6	10.0	6.9 (6.0)	7.2 (6.7)	7.95 (7.3)	8.35 (7.8)
10 <sup>-8</sup>	6.7	8.9	8.8	10.3	7.2 (6.3)	7.3 (6.8)	8.3 (7.7)	8.5 (7.9)
10 <sup>-9</sup>	6.9	9.3	9.0	10.5	7.5	7.4	8.65	8.65
10 <sup>-10</sup>	7.2	9.7	9.2	10.8	7.8	7.5	9.0	8.8

## ENVIRONMENTAL AND PHYSICAL SPECIFICATIONS

Prime Power	90 to 264 VAC, 47 to 63 Hz, (DC optional)
Mounting	1 RU
Size	19W x 19D x 1.71H inch (48W x 48D x 4.3H cm)
Weight	< 10 lbs. (6.8 kg)
Temperature, Operating	0 to 50°C (32 to 122°F)
Temperature, Storage (Non-operational)	-40 to +70°C (-40 to 158°F)
Humidity	0 to 95%, non-condensing

