

SLM-7650 Satellite Modem



INTRODUCTION

Comtech EF Data's SLM-7650 satellite modem is designed to comply with the strict requirements of the Defense Satellite Communications System (DSCS) defined in MIL-STD-188-165. The SLM-7650 also operates with most major commercial satellite systems in the world including Intelsat, Eutelsat, SES Americom, Panamsat, Skynet, Newskies, and others.

The modem is capable of high-level modulation techniques such as 8-phase shift keying (8-PSK) and 16-Quaternary Amplitude Modulation (16-QAM).

Advanced forward error correction (FEC) techniques are implemented. Viterbi, Trellis, Concatenated Reed-Solomon, and Turbo Product Code are available. Turbo coding significantly reduces the inherent decoding delay of Reed-Solomon while providing improved performance over Viterbi or trellis coding.

FEATURES

- MIL-STD-188-165 compliant
- BPSK, OQPSK, QPSK, 8-PSK, 16-QAM
- FEC rates 1/1, 1/2, 3/4, 7/8, 2/3, 5/6, and others
- 9.6 kbps to 20.0 Mbps (code rate dependent)
- Flash upgrade capability
- IDR/IBS Framing only
- Open network overhead terminations (optional circuit card)
- Drop and Insert (D&I) (optional circuit card)
- Closed network overhead capability for:
 - Automatic Uplink Power Control (AUPC)
 - Asynchronous Channel Unit
- Reed-Solomon Codec
- Turbo Product Codec (optional circuit card)
- Asymmetrical loop timing
- Clock recovery for input data without an associated transmit clock

APPLICATIONS

The SLM-7650 is the ideal equipment solution when implementing Tri-Band terminals that require both commercial and government communication access.

The modem complies with IESS-310 for 8-PSK over INTELSAT and EUTELSAT satellite networks.

COMPATIBILITY

The SLM-7650 is interoperable with the OM-73, SLM-3650, MD-1352(P)/U (BEM-7650), SLM-8650, and MD-945. The INTELSAT and EUTELSAT open network capabilities provide interoperability with earth stations worldwide.

DATA AND CLOCK

The modem is configured to derive timing from either the data, clock, or a 1, 5, 10 or 20 MHz station clock. The interface type is MIL-STD-188-114 and accepts balanced differential pairs for data and clock. The data and clock also meet the requirements for EIA-422.

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. D&I and access to the ESC overhead signals are available with an optional interface card.

ASYNC/AUPC (SLM-7650-02)

An engineering service channel for station-to-station communications or remote control is available by activating the overhead channel. Asynchronous communications at various protocols and baud rates may be configured for either EIA-232 or EIA-485 communications. Seven percent of the data rate is added as overhead for this application.

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

Uncorrectable burst errors will occur as the threshold BER is approached. The Reed-Solomon FEC can be used to further correct the burst errors 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 improves the viability of satellite communication circuits that were previously troublesome due to poor fade margins or excessively low look angles. The SLM-7650 Turbo coding is compatible with Intelsat IESS-315 and Comtech EF Data's CDM-600.

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SYSTEM

Operating Frequency Range	50 to 90, 100 to 180 MHz, in 1 Hz steps
Modulation Types	BPSK, QPSK, Offset QPSK, 8-PSK, 16-QAM
Digital Data Rate	9.6 kbps to 20.0 Mbps, in 1 bps steps
Symbol Rate	9.6 Ks/s to 10 Ms/s
External Reference In	1, 5, 10, or 20 MHz, selectable
Internal Reference	$\pm 2 \times 10^{-7}$
Stability	
Scrambling	V.35 scrambler variations to meet MIL-STD-188-165 and IESS-308, -309, -310.
IDR/IBS Framing Compatibility	Support for IDR and IBS framing. Allows basic IDR/IBS open network operation.
Built-in Test (BIT)	Fault and status reporting, BER performance monitoring, IF loopback, programmable test modes, Tx/Rx 2047 pattern provides and estimated BER.
Summary Faults	Reported via 15-pin D sub, FORM C relay contacts for Tx, Rx, Common equipment faults, and Tx and Rx Alarms.

MODULATION

Output Power	+5 to -30 dBm, adjustable in 0.1 dB steps
Output Return Loss	17 dB
Output Impedance	50 Ω
Spurious	0 to 500 MHz (-5 to -30 dBm) -55 dBc 0 to 500 MHz (+5 to -20 dBm) -50 dBc >64 kbps 0 to 500 MHz (+5 to -20 dBm) -45 dBc <64 kbps
Tx Clock Source	INT, Tx Terrestrial, and Data Source Sync
Output Connector	TNC

DEMODULATION

Input Power:	
Desired Carrier	-15 to -55 dBm
Maximum Composite	0 dBm or +40 dBc
Input Impedance	50 Ω
Input Connector	TNC
Carrier Acquisition Range	± 35 kHz, selectable
Input Return Loss	17 dB minimum
Buffer Clock	INT, EXTERNAL, Tx Terrestrial, Rx Satellite
Elastic Buffer	32 to 1,048,576 bits, selectable

CODING OPTIONS

Uncoded	1/1
Viterbi	K = 7
Viterbi and Reed-Solomon	Concatenated
Trellis	Per IESS-310
Trellis and Reed-Solomon	Concatenated
TURBO	Turbo Product Code (TPC)

OPEN NETWORK OPTION

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

AVAILABLE OPTIONS

How Enabled	Option
FAST	Variable data rate
FAST	8-PSK, 16-QAM
FAST	IBS, IDR
FAST	Concatenated R/S codec
FAST	ASYNCR, AUPC
FAST + Card	TURBO
Hardware	37 Pin (F) D connector, EIA-449
Hardware	25 Pin (F) D connector, EIA-530

BER PERFORMANCE

E_b/N_0 Performance Viterbi Decoder, QPSK

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

High Order Modulation Option

E_b/N_0 Performance, Viterbi Decoder, Reed-Solomon

BER	8-PSK		16-QAM		Turbo 8-PSK		Turbo 16-QAM	
	2/3	5/6	3/4	7/8	3/4	7/8	3/4	7/8
10^{-6}	6.2	8.2	8.4	9.8	6.5	7.1	7.6	8.2
10^{-7}	6.5	8.5	8.6	10.0	6.9	7.2	7.95	8.35
10^{-8}	6.7	8.9	8.8	10.3	7.2	7.3	8.3	8.5
10^{-9}	6.9	9.3	9.0	10.5	7.5	7.4	8.65	8.65
10^{-10}	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	19" W x 19" D x 1.71" H (1 RU) (48 cm x 48 cm x 4.3 cm)
Weight	< 15 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

