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 A, B, D, E, and F.

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. Other advanced FEC types low density parity codes (LDPC) can be supported by inserting an optional FEC card.

The IF frequency range is easily selected from the front panel or the remote control interfaces. They include 52-88, 100-180, 950-2000 MHz.

FEATURES

- MIL-STD-188-165A compliant (Types A, B, D, E, F)
  - Selectable 70/140 MHz and 950-2000 MHz IF
- BPSK, QPSK, OQPSK, 8-PSK, 16-QAM
- 8-QAM and 64-QAM with a software upgrade
- Adaptive Equalizer
- FEC rates 1/1, 1/2, 2/3, 3/4, 5/6, 7/8, and others
- 64 kbps to >200 Mbps (Modulation, code rate and interface dependent)
- Flash upgrade capability
- IESS-308, -309, -310, -315
- Distant End Monitor and Distant End Monitor Control (DEM and DEMC) supported with a software upgrade
- Viterbi and Reed-Solomon Codec
- Turbo Product Codec (optional SIMM circuit card)
- 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.

OPEN NETWORK FRAMING

The modem provides overhead framing that is compatible with Intelsat specifications IESS-308, IESS-309, IESS-310, and IESS–315, for open network operation. The INTELSAT and EUTELSAT open network standards provide interoperability with earth stations worldwide.

DEMC OVERHEAD

Distant End Monitor and Control (DEMC) is available to monitor and control the far end modem. It can maintain a desired E_b/N_o at the demodulator despite link fades due to excessive rain or other power level variations.

DEMC also supports an engineering service channel for station-to-station communications. Synchronous communications at various data rates may be configured for either EIA-422, EIA-232, or EIA-485 communications.

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).

The modem provides an additional FEC card interface slot to support advances in FEC technology.

Modems

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SLM-5650 Satellite Modem

SYSTEM

Operating Frequency Range	52 to 88, 100 to 180 MHz, 950 to 2000 MHz in 100 Hz steps
Modulation Types	BPSK, QPSK, Offset QPSK, 8-PSK, 16-QAM, (8-QAM, 64-QAM) upgradeable
Digital Data Rate	64 kbps to 20 Mbps, in 1 bps steps (EIA-530) 64 kbps to 52 Mbps, in 1 bps steps (EIA-613) 64 kbps to >200 Mbps, (Interface definable for optional interface plug in card)
Symbol Rate	32 Ks/s to 64 Ms/s
External Reference Input	TNC connector, 1, 5, 10, or 20 MHz, selectable
INT REF Stability	1 x 10^{-7}
Scrambling	V.35, OM-73 and Synchronous.
IDR/IBS Framing	Support for IDR and IBS framing. Allows basic
Compatibility	IDR/IBS open network compatible operation.
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.
Monitor and Control	EIA-485, EIA-232, 10/100 Base-T Ethernet with HTTP, Telnet and SNMP

MODULATION

Output Power	+10 to –45 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 + RS to 500 MHz -51 dBc
Harmonics	From Carrier (CW) to 4000 MHz -60 dBc
Tx Clock Source	EXT, INT, Tx Terrestrial, and Data Source Sync
Output Connectors	TNC for 52 to 88, 100 to 180 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, 100 to 180 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, EXT, Tx Terrestrial, Rx Satellite
Doppler Buffer	32 to 16,777,216 bits, selectable

CODING OPTIONS

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

OPEN NETWORK OPTION

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

AVAILABLE OPTIONS

How Enabled	Option
FAST	Variable data rate > 52 Mb
FAST	8-PSK, 8-QAM, 16-QAM, 64-QAM
FAST	IBS, IDR
FAST	Concatenated R/S codec
FAST	DEMC / Overhead Data channel Framing
FAST + SIMM Card	TURBO

BER PERFORMANCE

E_b/N_0 Performance Viterbi Decoder, QPSK/OQPSK

	Viterbi			Reed-Solomon		TURBO	
BER	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	4.6	4.7
10^{-10}				5.0	6.3	5.5	4.8

High Order Modulation E_b/N_0 Performance

	Viterbi + Reed-Solomon						Turbo			
	8-PSK		16-QAM		8-PSK		16-QAM		64-QAM	
BER	2/3	5/6	3/4	7/8	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		
					(5.8)	(6.6)	(7.0)	(7.7)		
10^{-7}	6.5	8.5	8.6	10.0	6.9	7.2	7.95	8.35		
					(6.0)	(6.7)	(7.3)	(7.8)		
10^{-8}	6.7	8.9	8.8	10.3	7.2	7.3	8.3	8.5	12.3	12.9
					(6.3)	(6.8)	(7.7)	(7.9)		
10^{-9}	6.9	9.3	9.0	10.5	7.5	7.4	8.65	8.65	12.4	13.1
10^{-10}	7.2	9.7	9.2	10.8	7.8	7.5	9.0	8.8	12.5	13.3

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