

TURBO



Modulator



Demodulator

INTRODUCTION

Comtech EF Data's VLM-7650M and VLM-7650D Defense Satellite Communications Systems (DSCS) satellite modulators and demodulators have an extended range of microprocessor-controlled functions allowing the modem to communicate with all major satellite systems in the world. The units implement advanced high-level coding techniques, such as Reed-Solomon FEC or Turbo Codec, for superior performance.

FEATURES

- Fully Accessible System Topology (FAST)
- MIL-STD-188-165 compliant (Type B) BPSK, OQPSK, QPSK, 8-PSK, or 16-QAM
- 9.6 kbps to 20 Mbps
- IDR/IBS Framing
- Automatic Uplink Power Control (AUPC)
- Asynchronous Channel Unit (ACU) Overhead
- Reed-Solomon Codec
- Reed-Solomon N, K, T & I values are programmable via the VME or EIA-485 controller
- Turbo Codec
- Built-In Self Test (Requires both Mod and Demod)

APPLICATIONS

The VLM-7650M/D can be used on DSCS, SKYNET, NATO, PANAMSAT, and all U.S. domestic satellites. Options extend the modem range to include EUTELSAT and INTELSAT satellite networks. The VLM-7650M/D are the ideal equipment solution when implementing Tri-band terminals such as the Tri-Band Tactical Terminal (T3) (STAR-T) that require both commercial and government communication access.

COMPATIBILITY

The VLM-7650M/D is compatible within the data rate limitations specified for the following modems:

CDM-600	MD-1002	SLM-3650
LM-46/40446	OM-73	SLM-4650
MD-945	SDM-300A	SLM-6650
		SLM-8650

The INTELSAT/EUTELSAT option provides compatibility with PTT earth stations worldwide.

The fully operational VLM-7650M/D can be configured to operate with many existing commercial and proprietary modems. This is achieved through the selection of specific parameters via the VME or EIA-485 controller.

OPERATING MODES

DSCS Mode

In DSCS mode, the VLM-7650M/D can derive timing from a 1, 5, or 10 MHz station reference oscillator. A built-in plesiochronous elastic buffer can be used to remove Doppler from the data. MIL-STD-188 digital interface is the customary DSCS interface compatible with SLM-8650-00

Open Network Mode

The VLM-7650M/D is equipped with the necessary framing processors to operate with Intermediate Data Rate (IDR), INTELSAT Business Specifications (IBS), or Satellite Multiservice System (SMS) earth stations worldwide.

Custom Mode

The custom mode provides total control of available modem resources. When the proper filter mask, modulation, FEC, and vector rotation are selected, the VLM-7650M/D can be programmed to emulate most other proprietary modems. The custom mode can also be used to modify the DSCS mode for enhancing performance or overcoming unexpected network impairment.

ACU/AUPC

The VLM-7650M/D can be equipped with an ACU/AUPC. Operation in the VLM-7650M/D mode will add overhead bits to the data stream for an over-the-satellite communications link compatible with SLM-8650-02. This link can be used to monitor and control the equipment at a remote site. For the AUPC mode, some of the overhead bits of the frame are utilized to establish a modem-to-modem control link. Thresholds and limits can then be set to automatically compensate for fades.

Turbo FEC Assembly

Encodes data with turbo coding if installed in a modulator or decodes turbo coded data if installed in a demodulator.



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System Specifications

Frequency Range	52 to 88, 104 to 176 MHz, in 1 Hz steps
Modulation Types	BPSK, QPSK, Offset QPSK 8-PSK, or 16-QAM
Digital Data Rate	9.6 kbps to 20.0 Mbps, in 1 bps steps
Symbol Rate	19.2 ks/s to 10 Ms/s
External Reference In	1, 5, or 10 MHz at ≥ 0 dBm external reference, selectable
Energy Dispersal	CCITT, V.35, and others

Modulation Specifications

Output Power	+5 to -25 dBm, adjustable in 0.1 dB steps
Output Return Loss	20 dB typical
Output Impedance	50 Ω
Spurious	0 to 500 MHz (+5 to -25 dBm) -55 dBc
Output Connector	Blind Insert a D-shell with (3) 50 Ω connectors

Demodulation Specifications

Input Power:	
Desired Carrier	-15 to -55 dBm
Maximum Composite	0 dBm or +40 dBc
Input Impedance	50 Ω
Input Connector	Blind Insert D-shell with (3) 50 Ω connectors
Carrier Acquisition Range	± 35 kHz, selectable
Input Return Loss	20 dB typical
Elastic Buffer	32 to 1,045,756 bits, selectable

Uplink Power Control Option

Nominal BER	Programmable
Upper Limit	Programmable
Lower Limit	Programmable
Step Size	0.5 dB
Orderwire	Async EIA-485 up to 1.875% of data rate

Coding

Inner Code	Viterbi or Uncoded
Outer Code	Reed-Solomon - Intelsat Compliant
N=60 to 255	K $\geq 2T^*T$ and N-K=2T
K=50 to 253	
T= 5 to 10	
Interleaver Depth	4 to 16 (steps of 4)

Coding Options

Viterbi	K = 7
Uncoded	1/1
Viterbi and Reed-Solomon	Concatenated
Turbo	5/16, 21/44, 3/4, 7/8, 17/18

Open Network Options

IDR	INTELSAT IESS-308 (Framing)
Interface	MIL-188-114
IBS/SMS	INTELSAT IESS-309/EUTALSAT BS7-40 (Framing)
Interface	EIA-422, MIL-188-114

Closed Network Options

DSCS	EIA-422, MIL 188-114
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BER Performance

BPSK BER Performance

BER	Viterbi 1/2			
	Viterbi 1/2 Rate	Reed-Solomon 225/205	Turbo 5/16	Turbo 21/44
10 ⁻⁶	6.1	4.1	2.5	3.0
10 ⁻⁸	7.2	4.4	3.1	3.6
10 ⁻¹⁰	8.2	5.0	3.8	4.2

QPSK/OQPSK/BER Performance

BER	Viterbi			Turbo						
	1/2	3/4	7/8	RS 1/2	RS 3/4	RS 7/8	21/44	3/4	7/8	17/18
10 ⁻⁶	6.1	7.5	8.6	4.1	5.6	6.7	3.3	3.9	4.1	6.8
10 ⁻⁸	7.2	8.8	9.9	4.4	6.0	7.1	3.5	4.3	4.3	7.4
10 ⁻¹⁰	8.2	10.1	11.2	5.0	6.3	7.5	3.7	5.2	4.5	7.9

8-PSK BER Performance

BER	Trellis Decoder		Trellis RS		Turbo		
	2/3	5/6	2/3	5/6	3/4	7/8	17/18
10 ⁻⁶	8.7	10.8	6.2	8.2	6.5	7.1	10.0
10 ⁻⁸	10.2	12.3	6.7	8.9	7.2	7.3	11.2
10 ⁻¹⁰	12	13.8	7.2	9.7	7.8	7.5	12.4

16-QAM BER Performance

BER	Trellis			
	RS 3/4	RS 7/8	Turbo 3/4	Turbo 7/8
10 ⁻⁶	8.4	9.8	7.6	8.2
10 ⁻⁸	8.8	10.3	8.3	8.5
10 ⁻¹⁰	9.2	10.8	9.0	8.8

Environmental and Physical Specifications

Prime Power	D.C. Call Factory
Mounting	9U X 160 mm VME Chassis
Size	9U X 160mm circuit card Assy. 1 VME Slot each
Weight	< 2 lbs. (0.90 kg)
Temperature, Operating	0 to 50°C (32 to 122°F)
Humidity	0 to 95%, non-condensing
Temperature, Storage (Non-operational)	-40 to +70°C (-40 to 158°F)



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