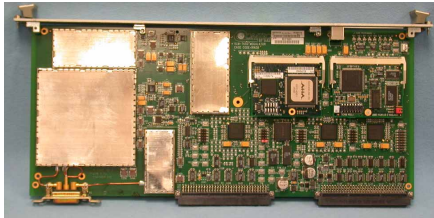
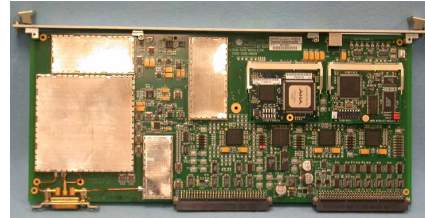


# VLM-7650 VME Satellite Modulator and Demodulator



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 modulator and demodulator 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.

# VLM-7650 VME Satellite Modulator and Demodulator

## 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 ksp/s to 10 Msps
External Reference In	1, 5, or 10 MHz at $\geq 0$ 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 $\Omega$
Spurious	0 to 500 MHz (+5 to -25 dBm) -55 dBc
Output Connector	Blind Insert a D-shell with (3) 50 $\Omega$ connectors

## Demodulation Specifications

Input Power:	
Desired Carrier	-15 to -55 dBm
Maximum Composite	0 dBm or +40 dBc
Input Impedance	50 $\Omega$
Input Connector	Blind Insert D-shell with (3) 50 $\Omega$ connectors
Carrier Acquisition Range	$\pm 35$ 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 $\geq 2T^*$ and N-K=2T
K=50 to 253	
T= 5 to 10	
Interleaver Depth	4, 8, and 16

## 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

## Coding Options

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

## 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 <sup>-6</sup>	6.1	4.1	2.5	3.0
10 <sup>-8</sup>	7.2	4.4	3.1	3.6
10 <sup>-10</sup>	8.2	5.0	3.8	4.2

### QPSK/QPSK/BER Performance

BER	Viterbi									
	1/2			RS			Turbo			
	1/2	3/4	7/8	1/2	3/4	7/8	21/44	3/4	7/8	17/18
10 <sup>-6</sup>	6.1	7.5	8.6	4.1	5.6	6.7	3.3	3.9	4.1	6.8
10 <sup>-8</sup>	7.2	8.8	9.9	4.4	6.0	7.1	3.5	4.3	4.3	7.4
10 <sup>-10</sup>	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	7/8	2/3	5/6	3/4	7/8	17/18	
10 <sup>-6</sup>	8.7	10.8	6.2	8.2	6.5	7.1	10.0		
10 <sup>-8</sup>	10.2	12.3	6.7	8.9	7.2	7.3	11.2		
10 <sup>-10</sup>	12	13.8	7.2	9.7	7.8	7.5	12.4		

### 16-QAM BER Performance

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

## Environmental and Physical Specifications

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

