

SLM-5650BD Satellite Demodulator

Satellite Demodulator



Overview

The SLM-5650BD Satellite Demodulator is a receive only version of our latest generation USARSTRAT WGS certified modem product targeted for critical commercial backhaul and government/military applications. It is fully compliant with MIL-STD-188-165A/B and supports FIPS 140-2 certified encryption. The SLM-5650BD leverages the heritage and feature set of our very successful SLM-5650B modem. The SLM-5650BD supports backwards compatibility and inter-operability with existing SLM-5650A networks while providing enhanced performance and new features including:

Embedded:

- Gigabit Ethernet Bridge interface
- LNB reference and voltage
- BUC reference

Increased/Improved:

- Field Programmable Gate Array (FPGA) resource increased by x5 (future proof)
- Maximum spreading factor (512)
- Maximum chip rate (64 Mcps)
- Maximum symbol rate with LDPC (40Msps)

Decreased:

- DSSS acquisition times (x8 faster)
- Power consumption (reduced ~ 25%)
- Chassis length (reduced 1.5 inches)

The SLM-5650BD is compliant with the strict requirements defined in MIL-STD-188-165A, modem types I, II, IV, V and VI for applications on DSCS, WGS and commercial satellites. Data rates from 8 kbps to 155.52 Mbps and symbol rates from 32 kpsps to 64 Msps are supported. The SLM-5650BD is designed to support cost-effective point-to-multipoint Internet protocol (IP) applications in both Layer-2 bridged and Layer-3 routed networks. The SLM-5650BD can be equipped with either a single 10/100/1000Base-T Ethernet interface (standard) or optionally be equipped with a 4-port 10/100/1000Base-T Ethernet Network Processor module that supports switching, routing, and advanced Quality of Service protocols.

The SLM-5650BD can be integrated with the Vipersat Management System (VMS) to provide fully automated network and capacity management (future software upgrade). An AES-256 TRANSEC module, compliant with the FIPS 140-2 standard, is also available as an option. All traffic (including overhead and all VMS control traffic) is encrypted when using the TRANSEC module.

Advanced forward error correction (FEC) capabilities are a Comtech EF Data standard feature. Viterbi, Trellis, Concatenated Reed-Solomon, Sequential, Turbo Product Codes, and three Low Density Parity Check codes (LDPC) families are all supported.

Direct sequence spread spectrum is available to support point-to-multipoint applications as an option in conjunction with LDPC-based FEC and BPSK. Spreading factors up to 512 are supported. Maximum supported chip rate is 64 Mcps. Spread spectrum results in operation with ultra-low power spectral densities. This enables use of small antenna apertures when adjacent satellite interference (ASI) is an important consideration.

The IF interface supports 52 to 88, 104 to 176, and 950 to 2000 MHz frequency ranges.

Features

- MIL-STD-188-165A compliant (Types I, II, IV, V, VI)
- Selectable 70/140 MHz and 950 – 2000 MHz IFs
- AES-256 TRANSEC, FIPS 140-2 certified
- Dynamic bandwidth allocation with Vipersat Management System (future software upgrade)
- Support for bridged point-to-multipoint network architecture
- BPSK, QPSK, OQPSK, 8PSK, 8-QAM, 16-QAM
- Viterbi, Reed Solomon, Trellis, Sequential, Turbo Product Code (TPC), EBEM, & Low Density Parity Check (LDPC) FEC
- FEC rates 1/1, 5/16, 1/2, 2/3, 3/4, 5/6, 7/8, and others
- Direct sequence spread spectrum, integer factors 2,3,4...510, 511, 512
- Direct sequence spread spectrum, chip rates up to 64 Mcps
- 8 kbps to 155.52 Mbps
- Ethernet interface for remote control using HTTP, Telnet and Simple Network Management Protocol (SNMP)
- EIA-485 and EIA-232 interface for remote control

Typical Users

- Government
- Military
- Secure Commercial Networks

Common Applications

- Communications at-the-Pause
- Communications on-the-move
- Rugged Environments
- Secure Networks

Compatibility

The SLM-5650BD is interoperable with the SLM-5650A and the SLM-5650B satellite modems.

Data Interfaces

The modem single Gigabit Ethernet port as standard features. An optional 4-port Gigabit Ethernet interface is also available.

TRANSEC Module

An optional transmission security (TRANSEC) module provides bulk AES-256 encryption/decryption certified to FIPS 140-2. The TRANSEC module encrypts all traffic sent over the air, including data traffic, overhead channel and Vipersat Management System messages (if present). The TRANSEC module supports Static Key mode using AES-256 CBC mode.

Advanced Iterative Forward Error Correction

High performance LDPC and Turbo coding (both TPC and EBEM Turbo) provides superior error correction performance over Viterbi, Trellis and Reed-Solomon FEC. The SLM-5650BD TPC is compatible with Intelsat IESS 315,

Network Processor

The Network Processor (NP) module provides a wide variety of advanced Internet Protocol (IP) features including routing, switching, Quality of Service, and Vipersat dynamic bandwidth control.

Networking	With the NP module installed, the modem can be configured as an Ethernet switch or as a high-speed router. Networking options include configuration of a bridged point-to-multipoint network, which enables bridged network connectivity (desired in many satellite networks carrying encrypted traffic) in a hub-spoke network architecture.
Multicast	Multicast traffic forwarding is supported via static multicast addressing, dynamic multicast address learning through IGMP router and IGMP Proxy, and via the bridged point-to-multipoint mode of operation.
Flow Control	Flow Control is supported via Ethernet pause frames (IEEE 801.3).
Proxy ARP	Proxy ARP is supported to enable transparent subnets.
Quality of Service (QoS)	The NP module supports multi-level QoS to reduce jitter and latency for real time traffic, provide priority treatment to mission critical applications and allow non-critical traffic to use the remaining bandwidth. Supported functionality includes differentiated services code point (DSCP) in accordance with RFCs 2474 and 2475, Expedited Forwarding in accordance with RFC 3246, and Per Hop Behavior in accordance with RFC 3247.
VMS Bandwidth Management	The Vipersat Management System (VMS) is the engine that provides dynamic Single Carrier per Channel (dSCPC) bandwidth management of the space segment (future software upgrade).

Expanded Dynamic Range

The modem exceeds the MIL-STD-188-165A input signal dynamic range requirements by extending the low signal input level requirement of -55 dBm to down to -70 dBm for lower baud rate carriers.

Network Management / Remote Control

The modem supports access to network management information via HTTP using a standard web browser. SNMP and Telnet remote control is also supported. The modem includes separate Ethernet and EIA-485/EIA-232 remote control interfaces. Remote control can also be accomplished via the Ethernet ports of the optional Network Processor. Secure network management via Secure Sockets Layer (SSL), Secure Shell (SSH) and SNMPv3 are available as options.

Specifications

Operating Frequency Range	52 to 88 MHz, 104 to 176 MHz, 950 to 2000 MHz in 100 Hz steps
Modulation Types	BPSK, QPSK, OQPSK, 8PSK, 8-QAM, 16APSK, 16-QAM
Spreading Factors	Integer factors 2-512; BPSK LDPC only
Digital Data Rate	Gigabit Ethernet: 8 kbps to 155.52 Mbps
Symbol Rate	32 ksps to 64 Msps
Chip Rate	32 kcps to 64 Mcps
External Reference Input	TNC connector, 1, 5, or 10 MHz, selectable
INT REF Stability	± 0.06 ppm (± 6 x 10 ⁻⁸), 0° to 50°C
Scrambling	V.35, OM-73 and synchronous
Built-in Test (BIT)	Fault and status reporting, BER performance monitoring, built in Fireberd emulation
Summary Faults	Reported via front panel LEDs, 15-pin D sub, FORM C relay contacts for RX, common equipment faults, and RX alarms
Unit Management	EIA-485, EIA-232, 10/100Base-T Ethernet with HTTP, Telnet and SNMP

Demodulation

Input Carrier Power	70/140MHz bands: +10 to -55dBm L-Band: +10 to -55 dBm carrier (SR > 3.2 Msps) +10 to [-55 - 10log ₁₀ (3.2/SR)], (SR ≤ 3.2 Msps)
Maximum Composite Power	+20 dBm or +40 dBc
Input Impedance	50 Ω
Input Connectors	TNC for 52 to 88 MHz, 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, 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	Standard	Per IESS-310
Sequential	Optional	1/2, 3/4, and 7/8 rates
Turbo Product Code (TPC)	Standard	5/16, 21/44, 3/4, and 7/8 TPC per IESS-315
Low Density Parity Check (LDPC)	Optional	1/2, 2/3, 3/4, and 7/8 HP, LL, and ULL modes

Available Options

How Enabled	Option
FAST	Data rates to 5, 10, 20, 52 or 155 Mbps
FAST	8PSK/8-QAM and 16-QAM
FAST	TPC to 5, 10, 20, 52 or 155 Mbps
FAST	LDPC
FAST	Vipersat Management System (future)
FAST	Diff-Serv QoS

FAST	Secure Network Management (SSL/SSH/SNMPv3)
FAST	Sequential FEC
FAST	Bridged point- to-multipoint
FAST	Spread Spectrum (DSSS and/or DSSS-MA)
Hardware	TRANSEC module
Hardware	Gigabit Ethernet Bridge or Network Processor
Hardware	24 VDC power supply

Environmental And Physical

Prime Power	90 to 264 VAC, 47 to 63 Hz 110 W (max), 80 W typical 24 VDC optional
Mounting	1RU
Dimensions (height x width x depth)	1.71" x 19" x 17.5" (4.3 x 48 x 48 cm)
Weight	≤ 12 lbs (5.5 kg)
Temperature, Operating	0 to 50°C (32 to 122°F)
Extended Temp Option:	-32° to 50°C (-25 to 122°F)
Temperature, Storage (Non-operational)	-40 to +70°C (-40 to 158°F)
Humidity	0 to 95%, non-condensing

BER Performance

Example Modes and Performance

Mod / FEC	Code Rate	Eb/No Guaranteed (Typical)				Data Rate Range (kbps)
		10 ⁻⁵	10 ⁻⁶	10 ⁻⁷	10 ⁻⁸	
Legacy Modes						
QPSK/OQPSK VIT	1/2	5.5 (5.1)	6.1 (5.7)	6.7 (6.2)	7.2 (6.6)	64 - 51,840
QPSK/OQPSK VIT	3/4	6.8 (6.3)	7.5 (6.9)	8.2 (7.6)	8.8 (8.3)	64 - 51,840
QPSK/OQPSK VIT	7/8	7.9 (7.2)	8.6 (7.9)	9.2 (8.5)	10.2 (9.4)	64 - 51,840
QPSK/OQPSK VIT R-S	1/2	3.8 (3.4)	4.1 (3.6)	4.2 (3.8)	4.4 (4.0)	64 - 51,840
QPSK/OQPSK VIT R-S	3/4	5.4 (4.7)	5.6 (4.9)	5.8 (5.1)	6.0 (5.3)	64 - 51,840
QPSK SEQ	1/2	4.8 (4.4)	5.0 (4.5)	5.4 (4.9)	5.8 (5.3)	64 - 2,500
QPSK SEQ	3/4	5.7 (5.2)	5.9 (5.4)	6.4 (5.9)	6.8 (6.3)	64 - 3,750
QPSK SEQ	7/8	7.1 (6.6)	7.3 (6.8)	7.8 (7.3)	8.4 (7.9)	64 - 4,375
8PSK TRE	2/3	7.1 (6.6)	7.3 (6.8)	8.1 (7.6)	8.8 (8.3)	256 - 51,840
8PSK TRE R-S	2/3	6.0 (5.5)	6.2 (5.7)	6.5 (6.0)	6.7 (6.2)	256 - 51,840
TPC Modes						
BPSK TPC	5/16	2.4 (1.9)	2.5 (2.0)	2.8 (2.3)	3.1 (2.6)	64 - 20,000
BPSK TPC	21/44	3.2 (2.7)	3.3 (2.8)	3.4 (2.9)	3.5 (3.0)	64 - 30,545
QPSK TPC	21/44	3.2 (2.7)	3.3 (2.8)	3.4 (2.9)	3.5 (3.0)	64 - 61,091
QPSK TPC	3/4	4.0 (3.5)	4.1 (3.6)	4.3 (3.8)	4.6 (4.1)	64 - 96,000
QPSK TPC	7/8	4.4 (3.9)	4.5 (4.0)	4.6 (4.1)	4.7 (4.2)	64 - 112,000
8PSK TPC	3/4	6.4 (5.7)	6.5 (5.8)	6.9 (6.0)	7.2 (6.3)	64 - 144,000
8PSK TPC	7/8	7.0 (6.5)	7.1 (6.6)	7.2 (6.7)	7.3 (6.8)	64 - 155,000
16-QAM TPC	3/4	7.5 (6.9)	7.6 (7.0)	7.95(7.3)	8.3(7.7)	64 - 155,000
16-QAM TPC	7/8	8.1 (7.6)	8.2 (7.7)	8.35(7.8)	8.5(7.9)	64 - 155,000
LPDC Modes						
High Performance						
BPSK LDPC	1/3	1.8 (1.6)	1.9 (1.7)	2.0 (1.8)	2.1 (1.9)	8 - 13,333
BPSK LDPC	1/2	2.0 (1.7)	2.1 (1.8)	2.2 (1.9)	2.3 (2.0)	8 - 20,000
QPSK LDPC	1/2	2.0 (1.7)	2.1 (1.8)	2.2 (1.9)	2.3 (2.0)	32 - 40,000
QPSK LDPC	2/3	2.3 (2.0)	2.4 (2.1)	2.5 (2.2)	2.6 (2.3)	42.7 - 53,333
QPSK LDPC	3/4	3.0 (2.6)	3.1 (2.7)	3.2 (2.8)	3.3 (3.0)	48 - 60,000
8-QAM LDPC	2/3	4.6 (4.2)	4.7 (4.3)	4.8 (4.4)	4.9 (4.5)	256 - 60,000
8-QAM LDPC	3/4	5.6 (5.2)	5.7 (5.3)	5.8 (5.4)	5.9 (5.5)	256 - 60,000
16-QAM LDPC	3/4	6.8 (6.2)	6.9 (6.4)	7.0 (6.6)	7.1 (6.8)	256 - 60,000
Low Latency						
BPSK LL	0.378	1.9 (1.6)	2.0 (1.7)	2.1 (1.8)	2.2 (1.9)	8 - 5,000
BPSK LL	0.451	2.1 (1.8)	2.2 (1.8)	2.3 (2.0)	2.4 (2.1)	8 - 5,000
BPSK LL	0.541	2.2 (1.9)	2.3 (2.0)	2.4 (2.1)	2.5 (2.2)	8 - 5,000
QPSK LL	1/2	2.3 (2.0)	2.4 (2.1)	2.5 (2.2)	2.6 (2.3)	32 - 5,000
QPSK LL	2/3	3.1 (2.8)	3.2 (2.9)	3.3 (3.0)	3.4 (3.1)	42.5 - 5,000
QPSK LL	3/4	3.8 (3.5)	3.9 (3.6)	4.0 (3.7)	4.1 (3.8)	47.7 - 5,000
QPSK LL	7/8	4.6 (4.3)	4.7 (4.4)	4.8 (4.5)	4.9 (4.6)	55.8 - 5,000
8-QAM LL	2/3	5.5 (5.2)	5.6 (5.3)	5.7 (5.4)	5.8 (5.5)	256 - 5,000
8-QAM LL	3/4	6.3 (6.0)	6.4 (6.1)	6.5 (6.2)	6.6 (6.3)	256 - 5,000
16-QAM LL	2/3	6.6 (6.3)	6.7 (6.4)	6.8 (6.5)	6.9 (6.6)	256 - 5,000
16-QAM LL	3/4	7.4 (7.1)	7.5 (7.2)	7.6 (7.3)	7.7 (7.4)	256 - 5,000
Ultra Low Latency						
BPSK ULL	1/2	3.1 (2.8)	3.4 (3.1)	3.7 (3.4)	3.8 (3.5)	8 - 2,000
QPSK ULL	1/2	3.1 (2.8)	3.4 (3.1)	3.7 (3.4)	3.8 (3.5)	32 - 2,000
QPSK ULL	2/3	3.6 (3.3)	3.9 (3.6)	4.2 (3.9)	4.3 (4.0)	41.8 - 2,000
QPSK ULL	3/4	4.1 (3.8)	4.2 (3.9)	4.7 (4.4)	4.8 (4.5)	47.0 - 2,000



2114 West 7th Street, Tempe, Arizona 85281 USA
 Voice: +1.480.333.2200 • Fax: +1.480.333.2540 • Email: sales@comtechedata.com

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