

# SLM-5650C & SLM-5650C ODU CyberLynx™ Software Defined Modems

Satellite Modems



SLM-5650C



SLM-5650C ODU

## Overview

The SLM-5650C & SLM-5650C ODU CyberLynx™ Software Defined Modems are our latest generation modem solutions for government and military applications and small commercial SatCom terminals. Featuring extremely compact form factors and an extensive list of software options, the SLM-5650C & SLM-5650C ODU CyberLynx can be integrated with a variety of platforms and provide an upgrade path to support your future requirements.

The modems are designed to comply with the widest possible range of U.S. Government and commercial standards, and are compatible with the largest number of satellite modems in the industry. MIL-STD-188-165A/B certification at data rates up to 155 Mbps, symbol rates up to 64 Msps and Chip Rates to 64 Mcps is anticipated in early 2020.

The modems feature AES-256 TRANSEC that is fully compatible with our legacy SLM-5650A and new SLM-5650B Satellite Modems.

The SLM-5650C & SLM-5650C ODU CyberLynx offer unparalleled protection of your critical network traffic using advanced physical layer waveforms and proven TRANSEC protection to meet your Assured Communication requirements.

There are two packaging options. The SLM-5650C CyberLynx is an indoor product that operates from -10°C to +55°C using conductive cooling. The heat is transferred from the electronics to the housing and then out of the housing to an external mounting surface such as a trailer wall. The SLM-5650C ODU CyberLynx is a true IP67 rated Outdoor Unit (ODU) that is designed to meet MIL-STD-810G that operates from -32°C to +65°C.

Building on our expertise with the installed and proven SLM-5650A and new SLM-5650B Satellite Modems, we reduced the form factor sizes of the SLM-5650C & SLM-5650C ODU CyberLynx by nearly 90%, doubled the processing resources, reduced the maximum power consumption by 80% and increased the functionality.

	SLM-5650C	SLM-5650C ODU	SLM-5650A
Dimensions	5.7" x 5.2" x 1.5"	7.7" x 5.9" x 2.8"	20" x 19" x 1.7"
Volume	44.6 cubic inches	127 cubic inches	646 cubic inches
Maximum Power Consumption	27W	30W	130W
Cooling	Conduction	Convection/Conduction	Convection
Weight	2.7 lbs. (1.2 kg)	5.5 lbs. (2.5 kg)	≤ 12 lbs. (5.5 kg)

The SLM-5650C & SLM-5650C ODU CyberLynx have been designed to support many standard features. The following sections also address capabilities beyond this current feature set that could be supported with the existing hardware.

## Typical Users

- Governments/Militaries
- Small Commercial SatCom terminals

## Common Applications

- Communications at-the-Pause
- Communications on-the-Move
- Flyaway Communications
- Integrated Satellite Terminal Communications

## Features

- Fully interoperable with the SLM-5650A and SLM-5650B
- 950 to 2000 MHz L-Band TX/RX
- 8 kbps to 155.52 Mbps
- 32 kbps to 64 Msps
- BPSK, O/QPSK, 8PSK, 8-QAM, 16-QAM Modulation
- BPSK, QPSK, OQPSK, 8PSK, 8QAM, 16QAM
- Uncoded, Viterbi, Viterbi+Reed Solomon, Sequential coding
- High performance Turbo Product Code (TPC) & Low Density Parity Check (LDPC) FEC FEC rates 1/1, 5/16, 1/3, 21/44, 1/2, 2/3, 3/4, 5/6, 7/8, 17/18
- Direct sequence spread spectrum, integer factors 2,3,4...512
- Direct sequence spread spectrum, chip rates up to 64 Mcps
- TRANSEC Encryption (AES-256)
- 10 MHz BUC and LNB Reference
- LNB Voltage (+18V on indoor unit, +13V or +18V on ODU)
- External Carrier Mute (ODU only)
- Summary Fault Relay (ODU only)
- Analog antenna pointing signaling
- Field replaceable IP67 rated Fan (ODU only)
- M&C options include SNMP v1, v2, v3, Web browser (HTTP or HTTPS), Telnet and RS-232 terminal port

## Specifications

Operating Frequency Range	950 to 2000 MHz in 100 Hz steps
Modulation Types	BPSK, QPSK, OQPSK, 8PSK, 8QAM, 16QAM
Spreading Factors	Integer factors 2-512; BPSK LDPC only
Digital Data Rate	Gigabit Ethernet: 8 kbps to 155.52 Mbps
Symbol Rate	32 kbps to 64 Msps
Chip Rate	32 kbps to 64 Mcps
Spread Spectrum	DSSS with S.F. 2 to 512 integer steps
INT REF Stability	± 0.06 ppm (± 6 x 10 <sup>-8</sup> )
Scrambling	V.35, OM-73 and synchronous
Built-in Test (BIT)	Fault and status reporting, BER performance monitoring, IF loopback, programmable test modes, built in Fireberd emulation
Summary Fault	Reported via LEDs, 9-pin D sub, FORM A relay (ODU only)
Unit Management	EIA-232, 10/100Base-T Ethernet with HTTP, Telnet and SNMP

### Modulation

Output Power	+10 to -40 dBm, adjustable in 0.1 dB steps
Output Return Loss	13 dB minimum
Output Impedance	50 Ω
Output Accuracy	±1.0 dB over frequency and temperature
On/Off Power Ratio	>60 dB
Data Clock Source	Internal, RX recovered
Output Spectrum	Selectable, Meets MIL-188-165A and Intelsat IESS-308, 309, 310 and 315 compliant
Spurious	From Carrier ± Tx SR to 500 MHz -51 dBc (measured in a 10kHz bandwidth).
Harmonics	From carrier (CW) to 4000 MHz -60 dBc
Output Connectors	Indoor unit, SMA female ODU, Type "N" female
BUC Internal Reference	10 MHz, 0 dBm ± 3 dB

### Demodulation

Input Carrier Power	+10 to -55 dBm carrier (SR > 3.2 Msps) +10 to [-55 - 10log <sub>10</sub> (3.2/SR)], (SR ≤ 3.2 Msps)
Maximum Composite Power	+20 dBm or +40 dBc
Input Impedance	50 Ω
Input Connectors	Indoor unit, SMA female ODU, Type "N" female
Carrier Acquisition Range	Programmable ± 1 kHz to ± 255 kHz
Input Return Loss	13 dB minimum
Doppler Buffer	32 to 16,777,216 bits, selectable
LNB DC Current	500 mA maximum
LNB Internal Reference	10 MHz, 0 dBm ± 3 dB

### Terrestrial Traffic Interfaces

Gigabit Ethernet	1 Port Ethernet switch/bridge
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### 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)	Optional	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
EBEM Turbo (fall 2019)	Optional	1/2, 2/3, 3/4, 7/8 and 19/20 (CCM or ITA)
Network Processor	Optional	Layer-2 and Layer-3 IP packet processor

### 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	TPC and LDPC
FAST	AES-256 TRANSEC encryption
FAST	Secure Network Management (SSL/SSH/SNMPv3)
FAST	ASYNCRS-485/232 overhead channel /AUPC
FAST	Sequential FEC
FAST	Spread Spectrum (DSSS and/or DSSS-MA)
FAST	EBEM (STANAG 4486) fall 2019
Hardware	Layer 2/3 Network Processor Spring 2020

### Environmental And Physical – Indoor Unit

Prime Power	5 VDC, 27W (max)
Mounting	Side or bottom attach
Dimensions (height x width x depth)	5.7" x 5.2" x 1.5" (14.7 x 13.2 x 3.8 cm)
Weight	≤ 2.7 lbs. (1.2 kg)
Cooling Method	Conduction
Temperature, Operating	-10 to 50°C (14 to 122°F)
Temperature, Storage (Non-operational)	-40 to +70°C (-40 to 158°F)
Humidity	0 to 95%, non-condensing

### Environmental And Physical – Outdoor Unit (ODU)

Prime Power	11 VDC to 33 VDC, 30W (max)
Mounting	Side or bottom attach
Dimensions (height x width x depth)	7.7" x 5.9" x 2.8" (19.4 x 15.0 x 7.1 cm)
Weight	≤ 5.5 lbs. (2.5 kg)
Cooling Method	Convection
Temperature, Operating	-32 to 65°C (-25 to 149°F)
Temperature, Storage (Non-operational)	-40 to +70°C (-40 to 158°F)
Rating	IP67 rated

**Sample SLM-5650C CyberLynx BER Performance**

Mod / FEC	Code Rate	Eb/No Guaranteed (Typical)				Data Rate Range (kbps)
		10 <sup>-6</sup>	10 <sup>-7</sup>	10 <sup>-8</sup>	10 <sup>-10</sup>	
<b>TPC Modes</b>						
BPSK TPC	5/16	2.5 (2.0)	2.8 (2.3)	3.1 (2.6)	3.5 (3.0)	64 - 20,000
BPSK TPC	21/44	3.3 (2.8)	3.4 (2.9)	3.5 (3.0)	3.6 (3.1)	64 - 30,545
QPSK TPC	21/44	3.3 (2.8)	3.4 (2.9)	3.5 (3.0)	3.6 (3.1)	64 - 61,091
QPSK TPC	3/4	3.9 (3.4)	4.1 (3.6)	4.3 (3.8)	4.8 (4.3)	64 - 96,000
QPSK TPC	7/8	4.3 (3.8)	4.4 (4.0)	4.5 (4.1)	4.7 (4.4)	64 -112,000
8PSK TPC	3/4	6.8 (6.2)	7.1 (6.5)	7.4 (6.7)	7.5 (7.1)	64 -144,000
8PSK TPC	7/8	7.1 (6.6)	7.2 (6.7)	7.5 (6.8)	7.6 (7.2)	64 -155,000
16-QAM TPC	3/4	7.6 (7.0)	8.0(7.3)	8.4 (7.8)	9.0 (8.5)	64 -155,000
16-QAM TPC	7/8	8.2 (7.7)	8.3(7.8)	8.5 (7.9)	8.8 (8.3)	64 -155,000
<b>LPDC Modes</b>						
<b>High Performance</b>						
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
<b>Low Latency</b>						
BPSK LL	0.378	1.8 (1.5)	1.9 (1.6)	2.0 (1.8)	2.1 (1.9)	8 - 5,000
BPSK LL	0.451	2.0 (1.7)	2.1 (1.8)	2.2 (1.9)	2.3 (2.0)	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	2.4 (2.1)	2.5 (2.2)	2.6 (2.3)	2.7 (2.4)	32 - 5,000
QPSK LL	2/3	3.0 (2.7)	3.1 (2.8)	3.2 (2.9)	3.3 (3.0)	42.5 - 5,000
QPSK LL	3/4	3.6 (3.3)	3.7 (3.4)	3.8 (3.5)	3.9 (3.6)	47.7 - 5,000
QPSK LL	7/8	4.4 (4.2)	4.5 (4.3)	4.6 (4.4)	4.7 (4.5)	55.8 - 5,000
8-QAM LL	2/3	5.0 (4.7)	5.1 (4.8)	5.2 (4.9)	5.3 (5.0)	256 - 5,000
8-QAM LL	3/4	5.6 (5.3)	5.7 (5.4)	5.8 (5.5)	5.9 (5.6)	256 - 5,000
8-QAM LL	7/8	6.5 (6.3)	6.6 (6.4)	6.7 (6.5)	6.8 (6.6)	256 - 5,000
16-QAM LL	2/3	6.1 (5.8)	6.2 (5.9)	6.3 (6.0)	6.4 (6.1)	256 - 5,000
16-QAM LL	3/4	6.8 (6.5)	6.9 (6.6)	7.0 (6.7)	7.1 (6.8)	256 - 5,000
16-QAM LL	7/8	8.0 (7.7)	8.1 (7.8)	8.2 (7.9)	8.3 (8.0)	256 - 5,000
<b>Ultra Low Latency</b>						
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

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