

LS-18-R1 Data Sheet



**Lumistar LS-18-R Series
Rack Mount Telemetry Data Simulation
& RF Transmission Test System**

**A Complete
Data Simulation and RF Broadcasting System
In a Rack Mount Configuration**

**The LS-18-R Series is Designed
Specifically to Support
IRIG Flight Test Operations**



LS-18-R Series Features:

- Utilizes Lumistar's LS-68-M & LS-18-M Technology Mated Together To Create a Dynamic "Data Simulation and RF Transmission System"
- Ground, Mobile, Airborne/Shipboard & Remote Operations
- Rack Mount Unit
 - 1U typical for low power, up to 4U for higher power applications
 - Available in Modular (-M) and Lunchbox (-P1) options
- Flexible/Extensible Firmware-Based Personalities
 - Easy Field Upgrades to Add Additional Features
- Data Rates Up To 45 Mbps (with RF Modulation)
 - 50 Mbps Clock/Data TTL/422 Differential
- Internally Derived PCM PRN Patterns or Simulated Framed Data
 - Excellent for Loop Back Tests
 - Supports IRIG 106 Ch 4 Class I and Class II formats
- Accepts Clock and Data for Modulation from External Sources
- Accepts Data for Modulation via UDP Ethernet Connection (*optional*)
- Multi-Mode RF Modulation Formats
 - ARTM Tier 0/1/2 (PCM/FM/SOQPSK-TG/MultiH CPM) are Standard
 - BPSK, QPSK, AQPSK, UQPSK, AUQPSK *also available upon request*
- Bit Synchronizers (Optional)
- Multiple Code Conversion Formats Available
 - Such as NRZ/Biphase, and Randomized Codes
- Configuration File Uploads made over TCP/IP Network Connection
- Data Playback from Internally Stored Configuration
 - Only Need to Power On The Unit to Run Last Op State
- Data Playback from Internally Stored Pre-Recorded Data (*optional*)
 - Playback from internal memory, 64 GB capacity
 - Not included in this proposal
- Decoms 1 or 2 (*Optional*)



Lumistar LS-18-R1 Series Rack Mount Data Simulation & RF Transmission System Specs

- **RF Power Output : +20 dBm (nominally) to less than -90 dBm**
 - Power Level adjustment accuracy of 0.5 dB
 - One RF Output (*Standard*) or Two Outputs (*Optional*)
 - Both RF outputs share same data source
- **Available in up to Five Standard RF Bands in a single unit**
 - S, E, Lower-L, Upper-L, lower and middle C bands
 - Bands in the 900 MHz to 6 GHz range
 - Standard Tuning Resolution 250 KHz
- **Internal Bit Error Rate Reader for Loopback Testing**
- **O-scope Display for Externally Provided Data**
- **Data Recording and Playback (Optional)**
 - 64GB per data channel x two channels (*18 hours at 8 Mbps per channel*)
- **IRIG Time Code Reader / Generator (Optional, not included herein)**
 - Accepts IRIG A/B/G Time Code Inputs
 - Used for Time Stamping of Simulated Data
 - PTP IEEE 1588 (Optional)
- **No OS**
 - Control / Status over Ethernet (or USB/232)
- **Size and Weight**
 - 1U rack mount configuration
 - Approx. 20 pounds
 - 80 watts power dissipation (for +20 dBm RF application)
 - Power: 110-240 VAC, 46-63 Hz
- **Auto-Boot to Last Saved Configuration on Power On Mode**
 - No Operator Intervention Needed in this Mode
 - Enhances Remote Operability
 - Unit “comes up” automatically to desired Op State
- **Setup / Control Using Ethernet Connection and Lumistar Application**
 - Or use your Own Software using our ICD
- **Also Available Modular or Portable Configurations**

Modulator Specifications

- RF Modulation of Internal PRN/Simulated Data
- RF Modulation of External Clock/Data
 - Optional: Playback of Internally recorded/stored data
- Standard RF Frequencies (MHz):
 - 1435-1535 (LL), 1710-1850 (UL), 2200-2395 (S), 2185-2485 (E), 4400-4950 C-low), 5091-5250 (C-mid)
 - Operable between 1400-5250 MHz (optional bands)
- LDPC encoding available (Optional)
- RF Tuning Step Size:
 - 250 kHz step size (typical); *as low as to 10 KHz Hz upon request*
- RF Output: +13 dBm minimum across all frequency bands
 - Adjustable over a > 90 dB dynamic range
- Frequency Accuracy:
 - 0.002 ppm
- RF Output Power SW Controls: Static and dynamic controls; groups of up to 4096 values; groups can be chained
- Doppler Sweep: Three section profile; programmable sweep rate and mode (*future*)
- Noise Injection: Programmable Eb/No (*future*)
- Transmitter Output Impedance:
 - 50 ohms nominal
 - VSWR: 2:0: 1 (max), 1.5:1 typical

Internal PCM Simulation and Bit Sync Specifications:

- **Frame Sync Pattern: 7 to 64 bits**
- **Frame Sync Polarity: Normal, Inverted**
- **Frame Sync Data Rate: Up to 50Mbps (NRZ)**
- **Forward Error Correction Encoding (FEC): LDPC (all six codes in accordance with IRIG 106, Convolutional R1/2, Reed-Solomon)**
- **IRIG 106 Support: Class I and II Data**
- **First Bit: MSB or LSB**
- **First Minor Frame Number: 0 or 1**
- **Frame Sync Location: Leads or Trails**
- **Simulator Variable Word Length: 3 to 16 bits**
- **Simulator Minor Frame Length: 3 to 65,536 Words**
- **Simulator Major Frame Length: 1 to 65 536 Minor Frames**
- **Simulator Sub Frame Sync: FCC, FAC, SFID, URC**
- **Time Reader Inputs: External IRIG AM, 1PPS , Internal IRIG Generator, PTP (IEEE-1588)**
- **Time Reader IRIG200 Formats: A, B and G**
- **Time Reader Input Termination: 100 Ohms, >10K Ohms; Software selectable**
- **Time Generator: A, B and G;**
 - **Battery Backed Real-time Clock and Calendar (optional)**
- **PCM Simulator Baseband Outputs: Maximum of 2 Data Streams**
- **Digital Data Outputs: 5V TTL (50 ohm drive capable), High speed RS 422/485 enhanced; simultaneous operation**
- **Bit Sync Input Range (V p-p): 200 mV to 20V**
- **Bit Sync Input Offset Range: +/- 8V**
- **Bit Sync Data Rate: Up to 50Mbps (NRZ); Up to 25 Mbps (Non-NRZ)**
- **Bit Sync Streams Available: Up to 2 (optional item)**
- **Bit Sync Inputs per Stream: Single-Ended 1, Single-Ended 2, Differential, Simulator Loop-back; Software selectable**
- **Bit Sync In put Impedance Selection: 50, 75, 110, and 1K Oh ms for SE channels; 110, 5K Ohms for differential; Software selectable**
- **Bit Sync Input PCM Codes: NRZ-L/M/S, BIO-L/M/S, RZ, DM-M/S , M2-M/S , RNRZ-11/15/17/23**

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INTERNAL DATA SIMULATION SOFTWARE WINDOW

Simulator	Simulator	Simulator
Sim Enabled / Track Decom	ENA <input checked="" type="checkbox"/> TRK <input type="checkbox"/>	ENA <input checked="" type="checkbox"/> TRK <input type="checkbox"/>
Bit Rate (Mbps)	50.000	1.000
FEC Code	No FEC Encoding	No FEC Encoding
Frame Sync Pattern Length	32	32
Frame Sync Pattern (hex)	0xFE6B2840	0xFE6B2840
Common Word Length	16	16
Words per Minor Frame	624	624
Number of Minor Frames	96	96
First Bit of Word	LSB <input type="radio"/> MSB <input checked="" type="radio"/>	LSB <input type="radio"/> MSB <input checked="" type="radio"/>
First Minor Frame Number	0 <input checked="" type="radio"/> 1 <input type="radio"/>	0 <input checked="" type="radio"/> 1 <input type="radio"/>
Frame Sync Location	Leads <input checked="" type="radio"/> Trails <input type="radio"/>	Leads <input checked="" type="radio"/> Trails <input type="radio"/>
Subframe Mode	SFID Count Up	SFID Count Up
FAC Mode Enabled	FAC <input type="checkbox"/>	FAC <input type="checkbox"/>
SFID Word Number	3	3
SFID Msb	6	6
SFID Locator	0000 0000 0111 1111	0000 0000 0111 1111
URC Sync Pattern (hex)	0x123456789ABCDEF	0x123456789ABCDEF

- **PRN Pattern Generation Specifications**

- **Enable via Software Control**
- **Bit Rate values between 1000 and 60 Mbps are available**
- **Data Patterns: Data patterns for the PRN Pattern Generation can be selected via Software Control. The pattern options are**
 - **All 0's, All 1's, Alternating 0's and 1's, PN3, PN4, PN5, PN6, PN7, PN9, PN10, PN11, PN15, PN17, PN18, PN20, PN21, PN22, PN23 and a selectable User Pattern.**
- **User Pattern (Hex): A user defined pattern of up to 31 bits can be entered in hexadecimal for in to the Software GUI. For this pattern to be active, the Data Pattern window must be set to "User Pattern".**
- **Data Invert: The PRN Generator output polarity can be altered via Software Control.**
- **Clock Invert: Output clock polarity can be altered via Software Control to be 0/90/180/270 degrees relative to the data bit period**
- **Error Injection: Random bit errors can be added to the PRN Pattern using Software Control. The user may select between the three TX BERT injection modes: Off, Continuous and Burst.**
- **Burst Errors: The user is able to program bursts of errors to inject in the PRN stream via Software Control. These burst errors are limited to a maximum of 64. Burst errors are injected each time the BURST error button is selected in Software.**

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PRN PATTERN GENERATION SOFTWARE WINDOW

Test Bert

Enable TX BERT

Bit Rate (Mbps)

Tx Pattern Select

User Pattern (Hex)

Data Invert Norm Inv

Clock Invert Norm Inv

FEC Code

Continuous BER

Burst Errors

Error Injection Off Burst Cont.

Enable RX BERT

Rx Pattern Select

PCM Input Decoder

Data Source

- **PRN Pattern Reading Specifications**

- **Enable via Software Control**
- **The Lock State of the PRN Reader indicator provides the present state of the BERT pattern correlator.**
 - **A green indication indicates that the receive correlator is locked to the selected pattern.**
 - **If the indicator is yellow, the correlator is unable to establish lock.**
- **Data Invert State: This LED indicator provides the present status as to whether the data that the RX correlator is receiving is presently polarity inverted or non-inverted. In the inverted state, the LED indicator will be yellow. If the pattern is not inverted, the LED will contain no color.**
- **Lock Loss Count: This status box contains a count of the number of times the RX BERT has lost lock since the last reset.**
- **Inversion Count: This status box contains a count of the number of times the RX BERT has detected a pattern inversion since the last reset. This count includes all inversion counts including one to an inverted state and from an inverted state.**
- **Total Bit Count: This status box contains the total number of bits that the RX BERT has counted since the last reset condition.**
- **Total Error Bits: This status box contains the total number of error bits that the RX BERT has counted since the last reset condition.**
- **BER: This status box contains a calculation of the Bit Error Rate (BER). For this status box, the BER calculation takes the total number of errors counted and divides that number by the total number of bits counted. This calculated value is not a time-averaged value but a long-term trend calculation.**
- **Bit Rate (Mbps): This status box provides the present bit rate being received for the specified stream. Values are provided in Mbps.**

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- **Loopback:** Selection of this check box internally loops the PRN Pattern generator (or TX BERT) to the PRN Pattern Reader (or RX BERT).
- **Sample (Secs):** The lower area of the right pane contains an averaged BER calculation section. Each stream can setup a sample period and calculate the average BER over a given period. To set the averaging period, enter a value in seconds between 2 and 86400 (1 day) in the resulting dialog box.
- **Sample Error Count:** The number of errors counted over the averaged period will be displayed in this status box.
- **Avg BER:** The calculated average BER figure will be displayed in this status box. This will be a calculation of the number of bit errors accumulated in the Sample period divided by the number of bits counted in the averaging period.
- **Progress:** The progress status bar provides a visual feedback of the progress on averaging process. As the process progresses, a bar will fill from the left to the right of the display area.
- **Stop/Start Avg:** This toggle button is used to initiate and halt the averaged BER calculations for a selected RX BERT stream.
- **Reset Stats:** This toggle button is used to clear the bit error and clock counts used for BER calculations on a selected RX BERT stream.
- **Start Avg:** This toggle button is used to initiate and halt the BER calculations for the connected RX BERT stream.
- **Reset Stats:** This toggle button is used to clear the bit error and clock counts used for all BER calculations.

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PRN PATTERN GENERATION SOFTWARE WINDOW

The screenshot displays a software window with a dark blue background and white text. It contains several status indicators and control elements:

- Lock State:** Indicated by a solid green circle.
- Data Invert State:** Indicated by an empty white circle.
- Lock Loss Count:** 0
- Inversion Count:** 0
- Total Bits Count:** 2.044E+008
- Total Error Bits:** 0
- BER:** 0.000e+0
- Bit Rate (Mbps):** 12.000
- LoopBack:** An unchecked checkbox.
- BER Averaging:** A section containing:
 - Sample (secs):** 5
 - Sample Error Cnt.:** -----
 - Avg BER:** -----
 - Progress:** A horizontal progress bar.
 - Stop Avg:** A button.
 - Reset Stats:** A button.

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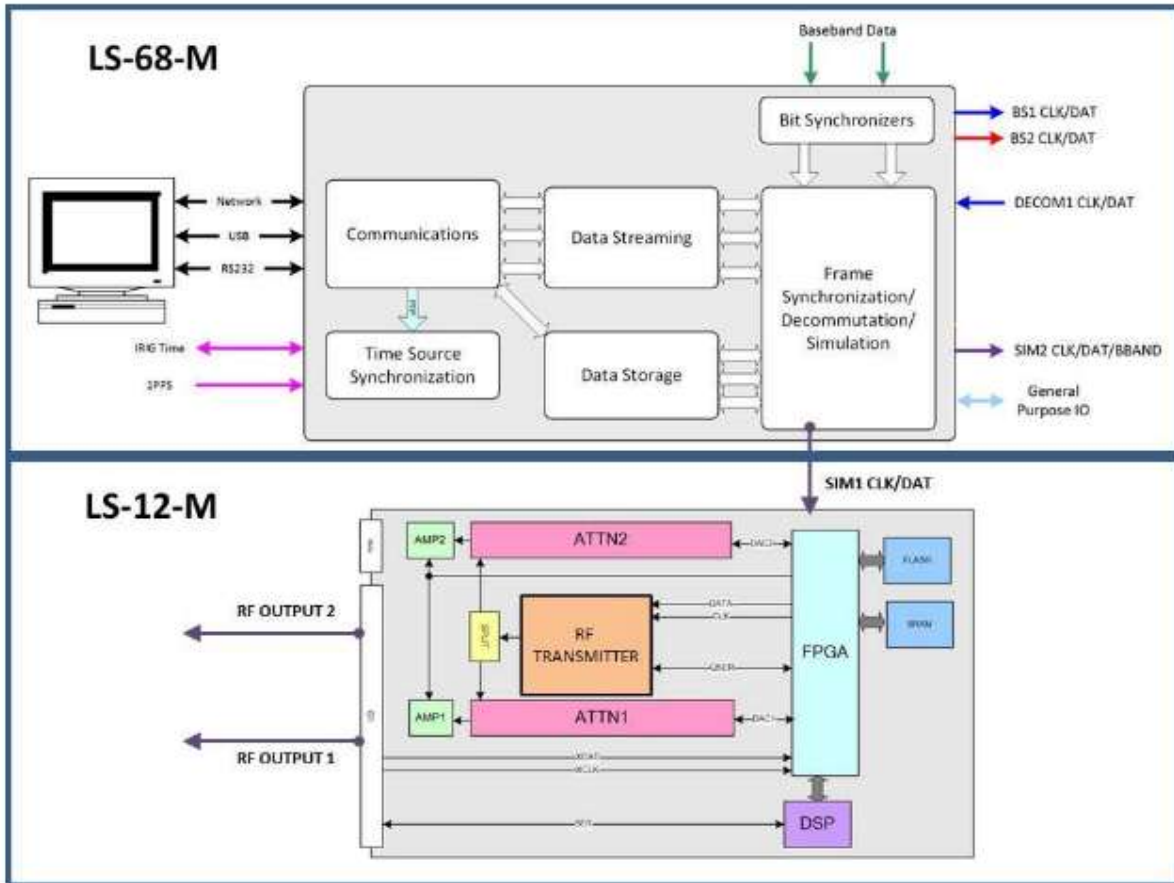


Figure 1

LS-18-M Series Block Diagram

For More Information, please refer to:

User Manual for the LS-68-M

https://lumi-star.com/uploads/MANUALS/LS-68-M/LS-68-M_UserManual.pdf