

# LUMISTAR

## LS-18-R4 Multipath/Doppler Telemetry Simulator Data Sheet

### Description:

The LS-18 Multi-Path Telemetry Simulator produces two channels of correlated RF signals and allows the user to modulate the output levels and RF frequency to create the deep fades, rapid attenuation and Doppler shifts seen in real world flight test signals. The Multi-path Telemetry Simulator uses an LS-70-S PCI card to generate a custom dynamic PCM format that can be changed in real time, as well as multiple PRN patterns (with/without errors). The unit provides the playback of archived telemetry and the PCM data stream can be modified real time during playback.

The LS-18 has an FM, SOQPSK, Multi-h CPM transmitter that allow for rapid changes in frequency that is split and feeds two Gallium Arsenide FET attenuators for rapid change in signal level to create two output RF signals. Attenuation fade rates of .01 Hz up to 35 kHz can be made with fades of up to 90 dB. The attenuation can be shaped as a Sine, Triangle, Square, Ramp and Step function to create the unique environments seen on ranges. The unit can also be used to test and evaluate range receivers.

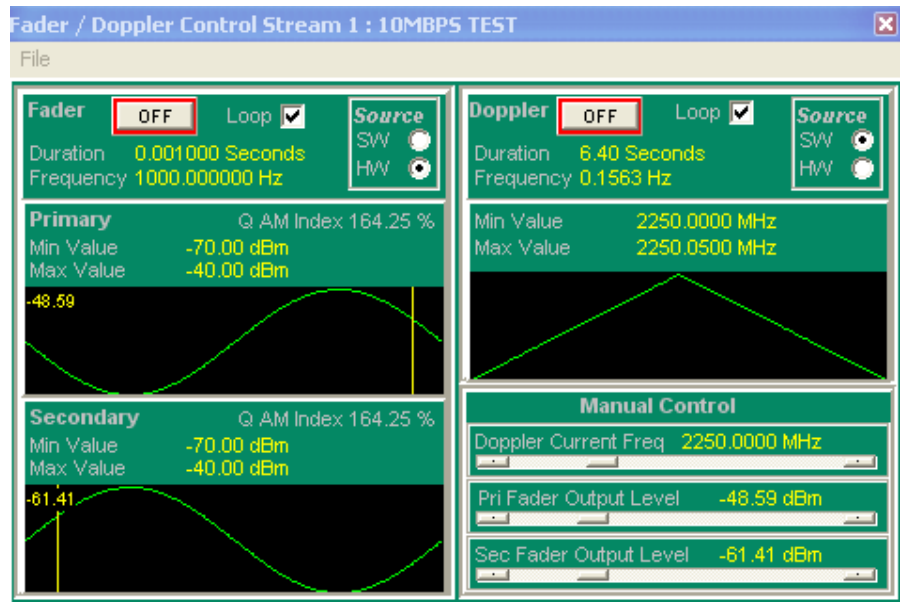


Figure 1  
1 KHz Sin & -Sin Outputs with 30 dB fade & 50 kHz Doppler Shift

### Key Features:

- Simulator & ARTM Digital Transmitter in a 4U Chassis
- ARTM Tier 0 (PCM/FM), ARTM Tier 1 (SOQPSK), or ARTM Tier II (Multi-h CPM)
- Available Bands (X) are S: (2200-2400 MHz); L: (1435-1540MHz) and U: (1710-1850 MHz)
- Programmable for PCM format, transmitter frequency/shift, and output power/fade
- Dual Ported memory with 128K of 32-bit words
- Major Frame Lengths to 65,535 words per minor frame
- Simulator allows common, unique and 64 waveform words
- Each word may be changed dynamically while data is flowing
- Allows playback and re-transmission of archived files with dynamic changing of words
- Simulator contains pseudo-random generator that provides BERT of a receiver
- Programmable output level through software
- Can be used to create secure data link with external encryption device
- Archived information can be played back; reconstructed PCM data can be transmitted
- Other standard Lumistar PCI cards can be added for additional capability

## ***DYNAMIC PCM SIMULATOR:***

Number of data channels	1
Modes	Independent or Slaved
Outputs	NRZ-L PCM Data, Code Selectable PCM Data, 0 degree clock, Minor frame strobes
Output Levels	Single Ended - TTL, or RS-422 on PCM Data and Clock outputs
Base-band Output	400 mV to 8 V p-p adjustable
Base-band Pre-mod Filter	8 selectable; 5 pole Butterworth
Differential Outputs	Capable of driving RS-422 or TTL compatible inputs
Output Data Rates	64 bps to 30 Mbps (NRZ), 64 bps to 15 Mbps (others)
PCM Codes	NRZ-L/M/S; Bi-Phase-L/M/S, DM- M/S, M <sup>2</sup> , RNRZ-L-11/15, k=7 Convolutional Encoding Rate 1/2, 1/3
Word Length	3 to 16 bits programmable on a word- by-word basis
CRC Generation	CRC16/CCITT
Major Frame Length	Up to 65,535 words per major frame
Major Frame Depth	Up to 1024 Minor Frames per Major Frame
Bit Order	MSB or LSB first, word by word
Frame Sync Pattern	Fully programmable
Major Frame Sync	Fully programmable
Common Words	Data may be changed (word-by-word) while operating
Waveform Words	64 (including SFID, FCC) May be programmed to appear in every frame at the same location Data may be changed while operating.
Baseband Output Level	+/- 2 Volts p-p open circuit +/- 1 Volt p-p into 75 Ohms

## ***IRIG A/B/G READER/GENERATOR:***

Time Reader Input Format	IRIG A, B, or G
Time Reader Rate	½, 1, or 2 times normal rate
Input signal level	1V p-p nominal
Latency	2µsec (maximum)
Data Outputs	Automatic time tags for PCM data blocks (time accessible in register space)
Time Generator Output	IRIG A, B, or G
Time Generator Rate	½, 1, or 2 times normal rate

## ***PSEUDO-RANDOM GENERATOR***

Pseudo-random patterns	11, 15, 17, 19, 21, 23, and 25 bit
Forced Error Modes	Continuous Forced Error Single Forced Error
Fixed Patterns	1 in 2, 1 in 4, 1 in 8, 1 in 16, 2 in 4, 4 in 8, 8 in 16

## ***RF TRANSMITTER:***

Bands	Lower-L (1435-1535 MHz) Upper-L (1750-1855 MHz) S-Band (2200-2395 MHz)
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Others – consult factory

Modulations

IRIG Tier 0 (PCM/FM)  
IRIG Tier I (SOQPSK)  
IRIG Tier II (ARTM CPM)  
Others – consult factory

## ***RF ATTENUATOR:***

Number of channels	1 or 2
Range	-10 to -90 dBm
Modes	Function & AM Modulation Depth
Functions	Sine, Cosine, Tan, Square, Triangle Ramp, all with inversion
Fade Rate (Hz)	.01- 100 SW; 100 – 35,000 HW
Number of Steps:	Up to 10,000

## ***DOPPLER SHIFTER:***

Range	Full Frequency Band
Functions	Sine, Cosine, Tan, Square, Triangle Ramp, all with inversion
Doppler Rate (Hz)	.01- 100 SW; 100 to 35,000 HW
Number of Steps:	Up to 10,000

## ***MECHANICAL:***

4U 20" deep



Chassis has Duo-Core Pentium processor, 200 GB Hard Drive  
2 GB Memory, USB, CD-DVD-RW, Window XP, Rack Slides

## ***MODEL NUMBERS:***

### ***LS-18-R4-AXXX#P***

A= Modulation - F = Tier 0; M = Multi-mode: Tier 0/1/2  
XXX = Frequency Bands; Up to three allowed  
L=1435-1540  
U=1710-1850  
S=2200-2400

# is Number of outputs: 1 = single; 2 = dual  
P for optional Relative Phase Control, output 1 vs. output 2  
Example: LS-18-R4-FS2 is an S-band simulator with two outputs  
and FM modulation, no phase control  
LS-18-R4-MLUS1 is a Tri-Band simulator with one output and FM,  
SOQPSK, and Multi-h CPM modulations (Tier 0, I, II)