

# Satellite Delay Simulator

## HSDS-70-MB

Hollis Electronics HSDS-70-MB is a low-cost solution for Earth Station to Satellite Link Simulation.

### Key Features of the HSDS-70-MB

- Up to 2 Independent Channels
- Delay Doppler with Continuous Phase
- Rain Fade
- Frequency Doppler
- Up to 2 Digital Noise Generators



Using digital signal processor (DSP) technology, the HSDS-70-MB provides improved satellite link simulation for more confidence in test results. With its internal digital power meters and built-in noise generator, this single instrument provides accurate and repetitive fading and carrier-to-noise setting ability in one box. The HSDS-70-MB is an ideal instrument for creating realistic scenarios for closed loop testing of satellites, ground equipment and mobile transceivers.

Center frequency	70 MHz
Operating bandwidth	35 MHz
Nominal input level	0 dBm
Input dynamic range	12 Bits
Nominal gain from input to output	0 dB, $\pm 1$ dB
Return Loss	14dB Max, 19dB Typ
Characteristic impedance (input and output)	50 Ohms
Connector type	Type N (female)
Spurious (one full hop or one half hop)	$\leq -40$ dBc
Signal-to-Noise ratio (one full hop or one half hop)	$\geq 35$ dB
Bypass mode delay	$\leq 5$ us

The HSDS-70-MB supports

**Two Configurations :**  
 Either 2 Half Hops to simulate an Up and Down link  
 Or  
 1 Full Hop to simulate a round trip delay to and from the satellite

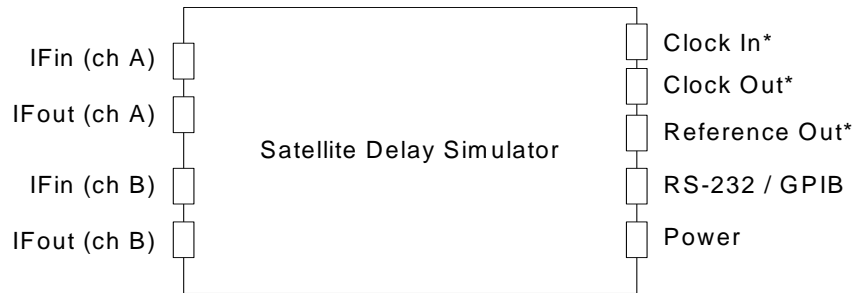
### Highlights:

- Independent channel simulator with internal digital power meter and AWGN noise generator (one per channel) in one instrument
- Fully digital implementation using latest DSP technology resulting in high accuracy and repeatability
- Real-time dynamic step changes are supported with high resolution
- Delay Modes; Bypass, Linear/Limit Profile, Linear/Cyclic Profile and Fixed
- Satellite orbit simulation; delay change & frequency shift
- Maximum inclined orbit simulation with smooth transition delays and no signal distortion
- Satellite movement is simulated with continuous delay changes
- Simulate 2 Half Hops (Up/Down Link) or 1 Full Hop (Round Trip)
- Controlled with a simple set of commands via RS232

### Applications:

Earth Terminal Testing  
 Satellite Payload Testing  
 Satellite Systems Integration  
 Mobile Transceiver Testing

## Satellite Delay Simulator I/O Diagram



\* Options

## Basic Specifications

The minimum specifications of the HSDS-70-MB are:

Doppler Range:	$\pm 12$ Kc (Higher ranges available)
Maximum Rate of Change:	$\pm 1050$ Hz/sec
Maximum Acceleration:	$\pm 1200$ Hz/SecSec
Digital Step Size (nominal)	10Hz or less
Profile Types:	Linear Limit, Linear Cyclical, Sinusoidal
Sweep:	Single or continuous

## Frequency Doppler Specifications

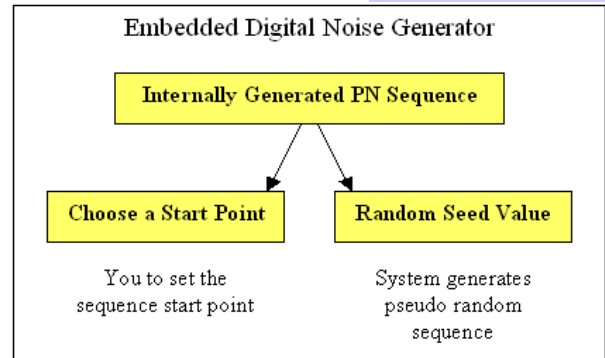
Parameter	C-Band	X-Band	Ku-Band	Ka-Band
Doppler Shift in Hz	$\pm 2,475$	$\pm 3,535$	$\pm 6,045$	$\pm 11,810$
Doppler Rate of Change in Hz/sec	$\pm 226$	$\pm 270$	$\pm 490$	$\pm 1,046$
Doppler Acceleration in Hz/sec <sup>2</sup>	$\pm 243$	$\pm 290$	$\pm 526$	$\pm 1,124$

## Built-in Digital Noise Generators

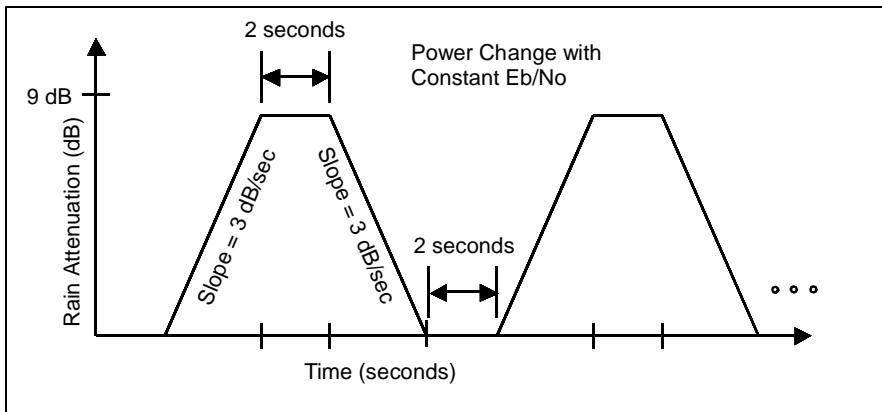
The dual Digital Noise Generators allow generation of various forms of noise impairments to test the robustness of system design.

The advantage of digital noise is that the accuracy of the signal to noise ratio is not affected by the analog discrepancies introduced by RF amplifiers and other components in the RF chain eliminating the need for periodic calibration. The noise and signal are combined digitally where the noise is perfectly flat and the signal power level is measured digitally. This means that any variations in the frequency response in the system after the noise is added to the signal, affects both the signal and the noise equally.

By using the digital output attenuator on the SDS and the digital attenuator of the digital noise source the operator has complete flexibility over setting the  $E_b/N_0$  or SNR. The operator has a choice of setting an SNR or  $E_b/N_0$ . Since the noise is added digitally to the digitized signal accuracy and repeatability are greatly improved.



## Rain Fade Specifications



The minimum specifications of the Rain Fade Simulator are:

Profile Attenuation range	0 to 10 dB
Profile Resolution	$\pm 0.1$ dB
Profile End Point Accuracy	$\pm 0.5$ dB
Maximum Rate of Change	10 dB/second
Digital Step Size (nominal)	0.1 dB or less
Profile Concatenation Limit:	10
Sweeps:	Single or continuous
Step dB change range	0 to 30 dB
Step Change Accuracy	$\pm 1$ dB

## Specifications:

### General

Input Frequency:	70 MHz
RF bandwidth (2 dB):	35 MHz
Number of channels:	1 or 2
Input level:	-20 dBm $\pm$ 1dB
Output level :	-20 dBm $\pm$ 1 dB
Gain:	0 dB typical
VSWR:	1.5 : 1 Max, 1.25 : 1 Typical

### Delay Doppler

Minimum Range:	1 ms to 650 ms
Minimum step size:	Continuous
Accuracy:	Based on 10MHz reference

### Frequency Doppler

Doppler range:	$\pm$ 1 MHz (Higher ranges available)
Maximum rate of change:	$\pm$ 1050 Hz/sec
Maximum acceleration:	$\pm$ 1200 Hz/SecSec
Digital step size:	10 Hz or less
Profile types:	Linear limit, linear cyclical, sinusoidal
Sweep:	Single or continuous
Temperature range:	25° C nominal +/- 5° C
Signal-to-Noise Ratio:	$\geq$ 30 dB
Spurious:	$\leq$ -40 dBc in-band
Bypass mode delay:	$\leq$ 5 $\mu$ s
Connector type:	Type BNC

### Digital Noise Generator (AWGN)

PN sequence	Random (60 hr. repeat intervals)
Crest factor	16.7 dB
C/N	
Max Noise Power Level	-86 dBm/Hz (IF, assuming unity gain)
Resolution:	0.01 dB
Accuracy:	$\pm$ 0.1 dB at baseband $\pm$ 0.25dB at IF

### Rain Fade

Profile attenuation range:	0 dB to 10 dB
Profile resolution:	$\pm$ 0.1 dB
End point accuracy:	$\pm$ 0.5 dB
Maximum rate of change:	10 dB/second
Digital step size:	0.1 dB or less
Profile concatenation limit:	10
Sweeps:	Single or continuous
Step dB change rate:	0 to 30 dB
Step change accuracy:	$\pm$ 1dB

### System Specifications

Power Requirements	
Voltage	100-120 VAC 220-250 VAC, auto sensing
Frequency	47-60 Hz
Operating environment	
Temperature	5° to 40° C
Humidity range	20 to 80% RH
Dimensions	20"D x 17"W x 5.25" H (3U) (508mm D x 432 mm W x 133 mm H)
Weight	30 lbs. (13.6 kg)
Control interfaces	Labview drivers, RS-232 GP-IB (optional)

### Ordering Information

#### HSDS-70-XX-XXXX

Base Model	- Interface Frequency
1 dB Bandwidth:	
NB = 16 MHz	
MB = 35 MHz	
Options:	
	NB and MB Include Options 1-4
1 = Delay Doppler,	
2 = Frequency Doppler	
3 = Noise Generator(s),	
4 = Rain Fade	
5 = Path Loss,	
6 = Phase shift	

### RF Interface Solutions

RF integrated solutions are available;  
contact factory for additional information

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