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PRODUCT SUMMARY

The HL844x Series are ultra-broadband Kelvin bias tees with a maximum insertion loss of 1.75 dB.

A typical bias tee allows for insertion of a DC bias current into a circuit with minimal perturbation of a 50 Ω transmission line, but can suffer measurement errors due to voltage drop across the DC coil.

A Kelvin bias tee is designed for applications where both DC and RF signals are applied to the Device under Test (DUT) and precision DC measurements are required. It eliminates DC biasing errors as the sense coil allows accurate measurement of the DC voltage applied across the DUT.

These devices can be used for biasing amplifiers, lasers, optical modulators, and other devices.

Applications include 112 Gbps PAM4 signaling, optical communication systems, high-speed data systems, and interfacing between devices with incompatible DC operating points.

MODELS & OPTIONS

The following models are available:

- ***HL8444***, 40 GHz
- ***HL8445***, 50 GHz
- ***HL8447***, 67 GHz

The following options are available:

- ***-M***, matched pair
- ***-U***, unmatched part(s)

- ***-11***, 11 V breakdown
- ***-30***, 30 V breakdown

- ***-JJ***, jack AC, AC+DC
- ***-JP***, jack AC, plug AC+DC
- ***-PJ***, plug AC, jack AC+DC
- ***-PP***, plug AC, AC+DC

HL844x Series Kelvin Bias Tees (50 kHz to 67 GHz, 175 mA)

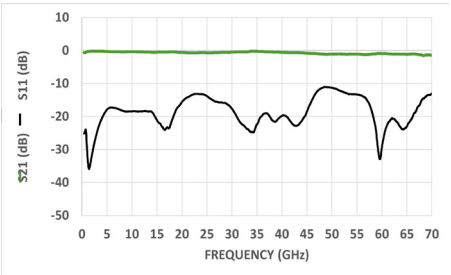
Features and Technical Specifications[1] (HL8447 shown)

Bandwidth	50 kHz to > 67 GHz (opt. -11) 85 kHz to > 67 GHz (opt. -30)
Insertion Loss	1.75 dB, 1 MHz to 67 GHz, (opt. -JJ) See *Fig. 1*
Return Loss	15 dB f ≤ 35 GHz, all options 10 dB f > 35 GHz, all options See *Fig. 3*
Amplitude Match (opt. -M only)	± 0.2 dB, f ≤ 67 GHz, all options See *Fig. 5*
Phase Match (opt. -M only)	± 4°, f = 40 GHz
Breakdown Voltage	11 V, max (opt. -11) 30 V, max (opt. -30)
Maximum Current	175 mA
Group Delay	≈ 115 ps ± 10 ps ripples, all options See *Fig. 4*
Rise Time (10-90%)	5 ps, all options
Connectors (AC / AC+DC)	1.85 mm Standard configuration is jack/plug
DC/Sense ports	SMA jack
Temperature Limits	-40° to +70° C, operating
RoHS Compliant	Yes, assembled with lead-free solder
REACH Compliant	Yes
Warranty	1 year, see website

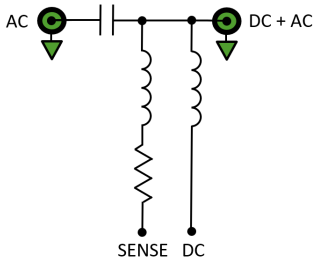
NOTE 1 - Unless otherwise noted, the specifications in this table are typical for Model Number HL8447 using the standard connector configuration (-JP, jack/plug). Full specifications for this and related models are available on Page 2 of this datasheet.



HL8447, Option -M-JP shown



Typical HL8447 Insertion and Return Loss



HL844x Schematic and Port Assignments

HL844x Full Specifications

Parameter	HL8444	HL8445	HL8447	Comments
Upper Frequency Limit	> 40 GHz	> 50 GHz	> 67 GHz	3 dB roll-off point, relative to nominal insertion loss
Lower Frequency Limit See *Fig. 2*	50 kHz (opt. -11) 85 kHz (opt. -30)			3 dB roll-off point
Maximum Current	175 mA			
Breakdown Voltage	11 V, max (opt. -11) 30 V, max (opt. -30)			
Insertion Loss See *Fig. 1*	1.75 dB, 1 MHz ≤ f ≤ 40 GHz	1.75 dB, 1 MHz ≤ f ≤ 50 GHz	1.75 dB, 1 MHz ≤ f ≤ 67 GHz	Typical
Return Loss See *Fig. 3*	15 dB, f ≤ 35 GHz 10 dB, f > 35 GHz			Typical, within specified operating frequency
Amplitude Match See *Fig. 5*	± 0.2 dB, (opt. -M)			Typical, opt. -M
Phase Match	± 4°, f = 40 GHz (opt. -M)			Typical, opt. -M
Rise Time	8.75 ps	7 ps	5 ps	Typical
Group Delay See *Fig. 4*	105 ps ± 10 ps ripple	115 ps ± 10 ps ripple	110 ps ± 10 ps ripple	All options
Impedance	50 Ω			Input and Output
DC Resistance	2 Ω			DC to AC+DC
Connector Type	2.92 mm	2.4 mm	1.85 mm	
Connector Configurations (specify when ordering)	Port 1 (AC): jack (J) or plug (P) Port 2 (AC+DC): jack (J) or plug (P)			*Standard configuration is -JP*
Sense Port Connector DC Bias Port Connector	SMA jack SMA jack			
Dimensions (W x D x H)	2.10” x 1.30” x 0.425” 53.3 x 33.02 x 10.8 mm			Package including connectors
Weight	28 g (0.99 oz.)			
Operating Temperature	-40° to +70° C			Case temperature
RoHS Compliant	Yes, assembled with lead-free solder			
REACH Compliant	Yes			
Warranty	1 year, repair or replacement; see website for details			

Note: All specifications are based on test results using the standard connector configuration (-JP). Specifications may vary slightly for other configurations.

HL8447 Plot Diagrams

Figures 1-5 show the typical S-parameter characteristics of an HL8447. Other models show similar performance within their respective specified bandwidths.

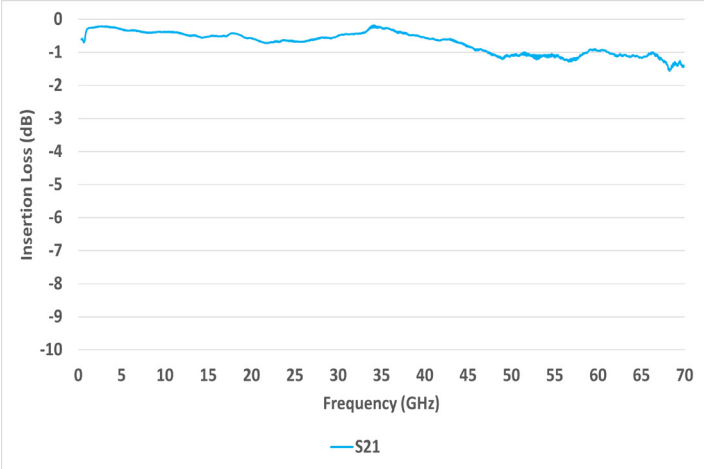


Figure 1: HL8447 Insertion Loss

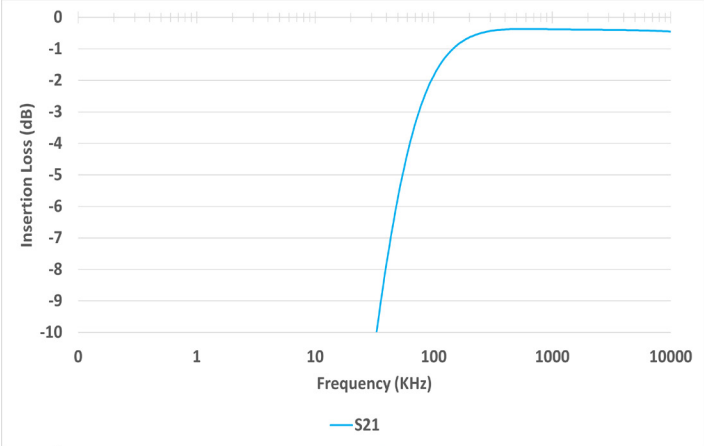


Figure 2: HL8447 Low-frequency Performance (opt. -30)

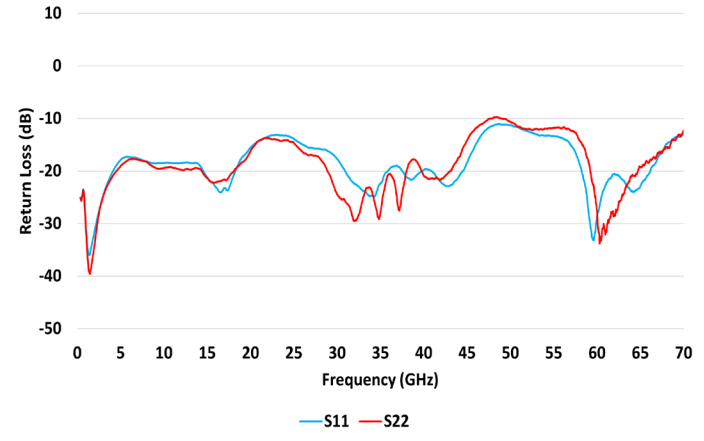


Figure 3: HL8447 Return Loss

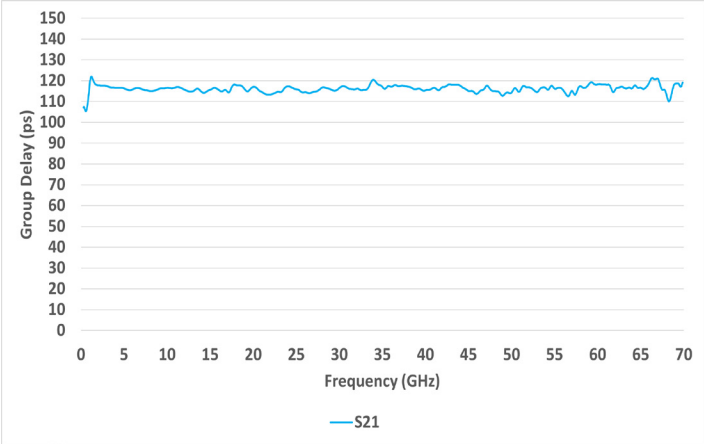


Figure 4: HL8447 Group Delay

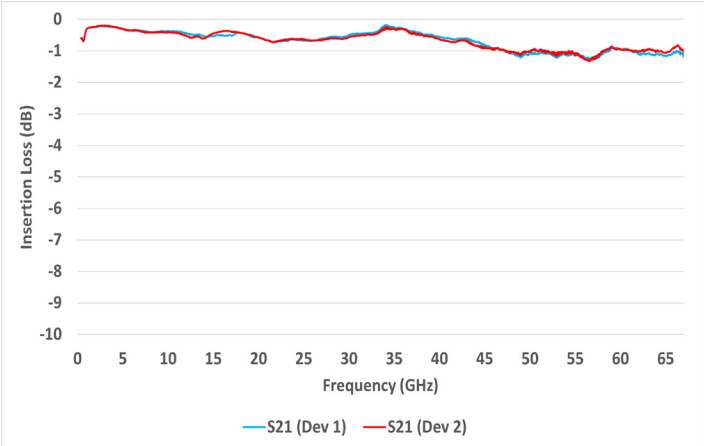


Figure 5: HL8447 Amplitude Matching (opt. -M)

HL8447 Eye Diagrams

The eye diagrams in Figures 6-7 show a 56 Gbps PRBS11 pattern passed through an HL8447 (opt. -30). Figures 8-9 show a 112 Gbps PAM4 signal passed through an HL8447 (opt. -30). All plots have an input signal amplitude of 395 mV and are shown at 89 mV/div. Other models show similar performance within their respective specified bandwidths.

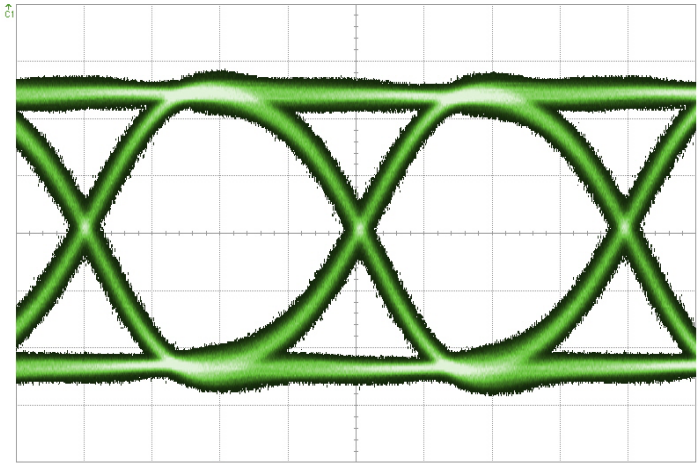


Figure 6: HL8447 56 Gpbs PRBS 11, RF Input

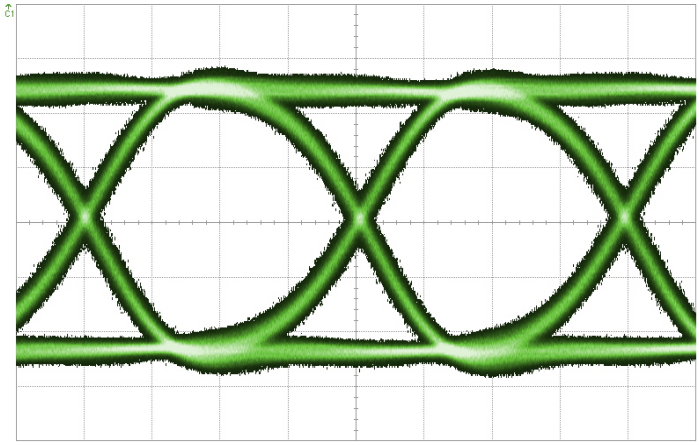


Figure 7: HL8447 56 Gpbs PRBS 11, RF Output

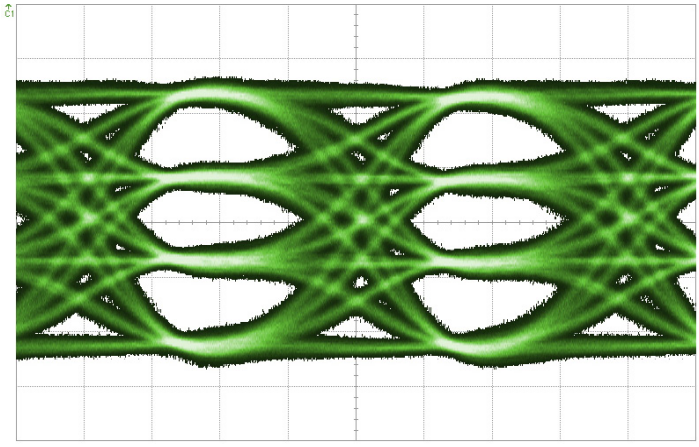


Figure 8: HL8447 112 Gbps PAM4, RF Input

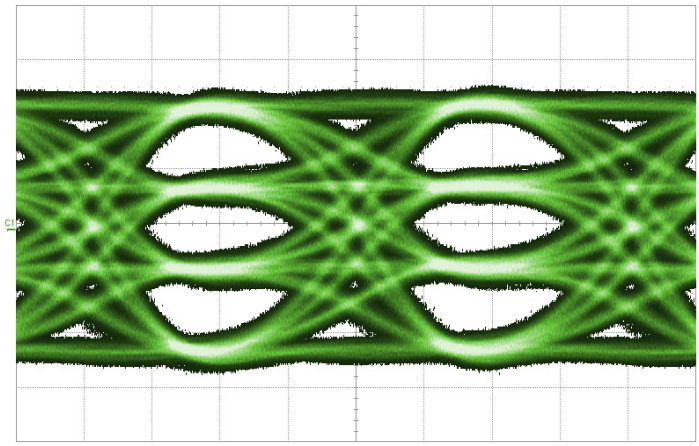


Figure 9: HL8447 112 Gbps PAM4, RF Output

HL844x Dimensional Drawing

Figure 10 shows a mechanical drawing of an HL8447 (opt. -JJ). Unless otherwise noted, all units are in inches. See page 2 for full dimensions.

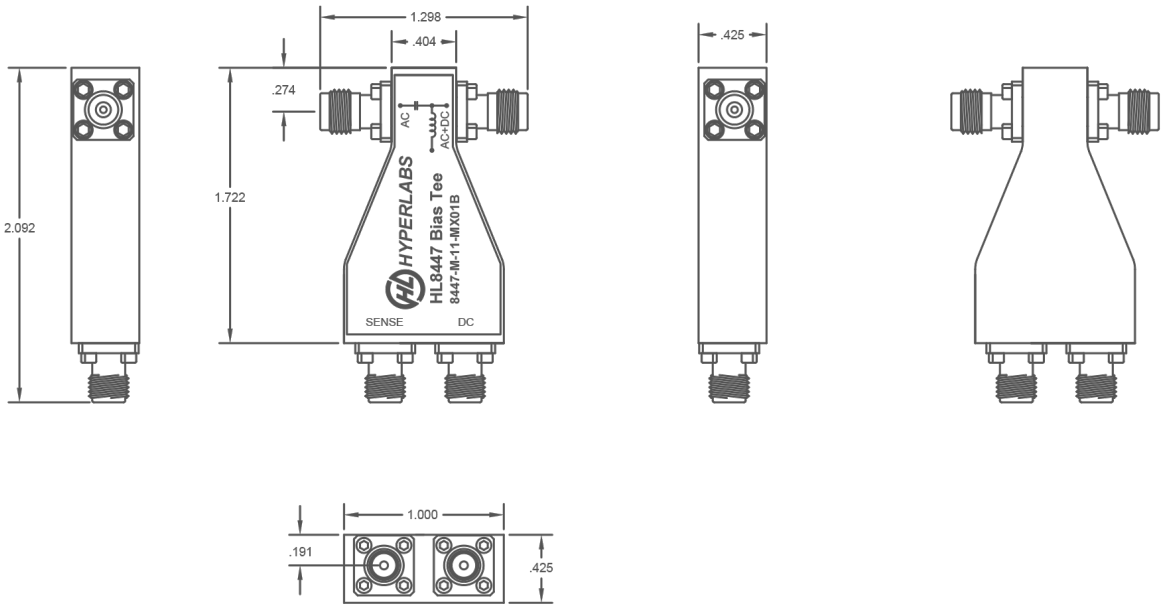


Fig 10: HL8447 Mechanical Drawing