



HL947x Series Resistive Power Dividers (DC to 67 GHz)

Features and Technical Specifications¹ (HL9477 shown)

PRODUCT SUMMARY

The HL947x series are ultra-broadband 6 dB power dividers that provide outstanding amplitude- and phase-symmetrical power division from DC to beyond 67 GHz.

This product is designed using a three-resistor network resulting in outputs that are nominally attenuated to 6 dB, and all ports are impedance-matched to 50 Ohms when the ports are terminated.

They are suitable for use in 112 Gbps PAM4 communications systems, high-speed analog-to-digital conversion, frequency response testing for differential devices, and many other applications.

DEPLOYMENT NOTES

The ports of the HL947x series are symmetrical and the device can be used in any direction.

MODELS & OPTIONS

The following models are available:

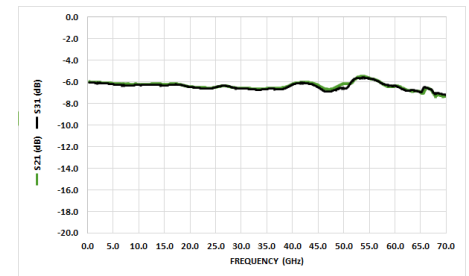
- HL9472, 26.5 GHz
- HL9474, 40 GHz
- HL9475, 50 GHz
- HL9477, 67 GHz

Bandwidth (-1.5 dB)	DC to 67 GHz
Insertion Loss (AC)	6 dB
Amplitude Match	± 0.1 dB See Fig. 1
Phase Match	$\pm 4^\circ$, $f = 20$ GHz $\pm 8^\circ$, $f = 40$ GHz See Fig. 4
Return Loss	> 15 dB, $f \leq 45$ GHz > 10 dB, $f > 45$ GHz See Fig. 2
Rise Time	5 ps
Insertion (Group) Delay	125 ps, all ports See Fig. 3
Max Input Power	+33 dBm
Impedance	50 $\Omega \pm 5\%$
Connectors	1.85 mm, 3x jack/female
Dimensions	0.69" (17.6 mm), center to end of each connector See Fig. 9
Temperature Limits	-40° to +70° C, operating
RoHS Compliant	Yes, assembled with lead-free solder
REACH Compliant	Yes
Warranty	1 year, see website

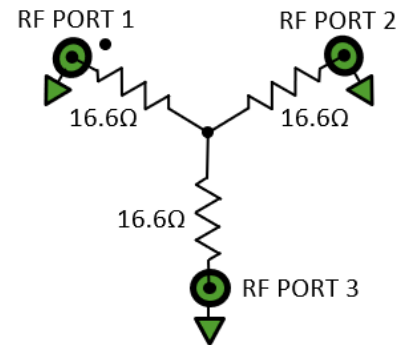
NOTE 1 - Unless otherwise noted, the specifications in this table are typical for Model Number HL9477. Full specifications for this and related models are available on Page 2 of this datasheet.



HL9477, standard configuration shown



Typical HL9477 Insertion Loss



HL947x Schematic and Port Assignments

HL947x Full Specifications

Parameter	HL9472	HL9474	HL9475	HL9477	Comments
Upper Frequency Limit	26.5 GHz	40 GHz	50 GHz	67 GHz	1.5 dB guaranteed, relative to nominal insertion loss
Lower Frequency Limit	DC				
Insertion Loss (DC)	6.02 ± 0.11 dB				
Insertion Loss (AC) <i>See Fig. 1</i>	6 dB				Typical, nominal
Return Loss <i>See Fig. 2</i>	> 24 dB, f = 20 GHz	> 20 dB, f ≤ 30 GHz	> 20 dB, f ≤ 30 GHz > 15 dB, f > 30 GHz	> 15 dB, f ≤ 45 GHz > 10 dB, f > 45 GHz	Typical
Amplitude Match <i>See Fig. 1</i>	± 0.1 dB				Typical, between all ports
Phase Match <i>See Fig. 4</i>	± 4°, f = 20 GHz	± 4°, f = 20 GHz ± 8, f = 40 GHz	± 4°, f = 20 GHz ± 8, f = 40 GHz	± 4°, f = 20 GHz ± 8, f = 40 GHz	Typical, between all ports
Rise Time	17.5 ps	8.75 ps	7 ps	5.2 ps	Typical
Insertion (Group) Delay <i>See Fig. 3</i>	125 ps				Typical, all ports
Max Input Power	+33 dBm				
Impedance	50 Ω ± 5%				All ports
Connectors	SMA, 3x jack/female	2.92 mm, 3x jack/female	2.4 mm, 3x jack/female	1.85 mm, 3x jack/female	Plug/male connectors available upon request
Length and Width	0.69" 17.57 mm				From center to reference plane of each connector
Height	0.535" 13.59 mm				
Weight	14 g (0.49 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				



HL947x Insertion and Return Loss

The HL9477 is matched to 50 Ω on all ports. Port 1 is specified with a dot on the label, and Ports 2 and 3 are matched.

Figure 1 shows the HL9477 insertion loss and amplitude match on Ports 2-3 to 70 GHz. Figure 2 shows return loss on all three ports of the same device to 70 GHz. Other models show similar performance within their respective specified bandwidths.

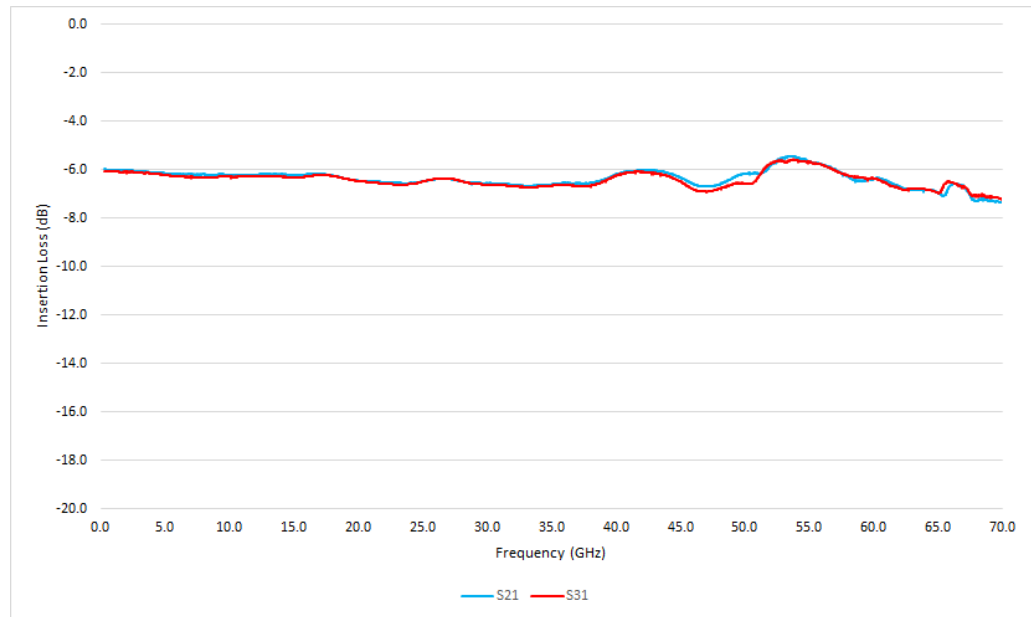


Figure 1: HL9477 Insertion Loss

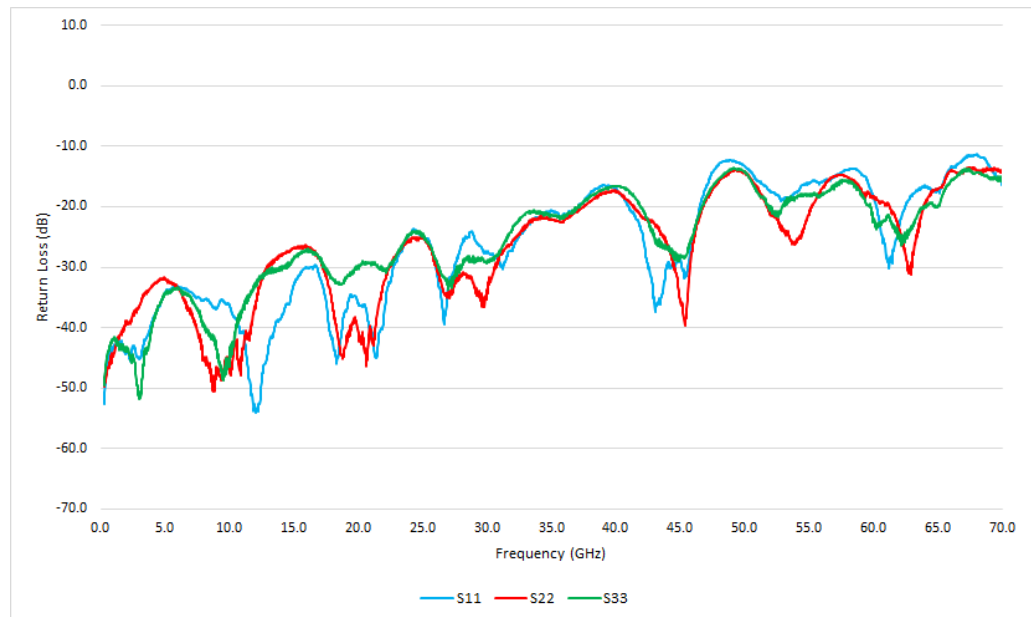


Figure 2: HL9477 Return Loss



HL947x Group Delay and Phase Match

Figure 3 shows the typical group delay of an HL9477. The average slope of the phase mismatch, shown in Figure 4, is equal to the group delay mismatch. Other models show similar performance within respective specified bandwidths.

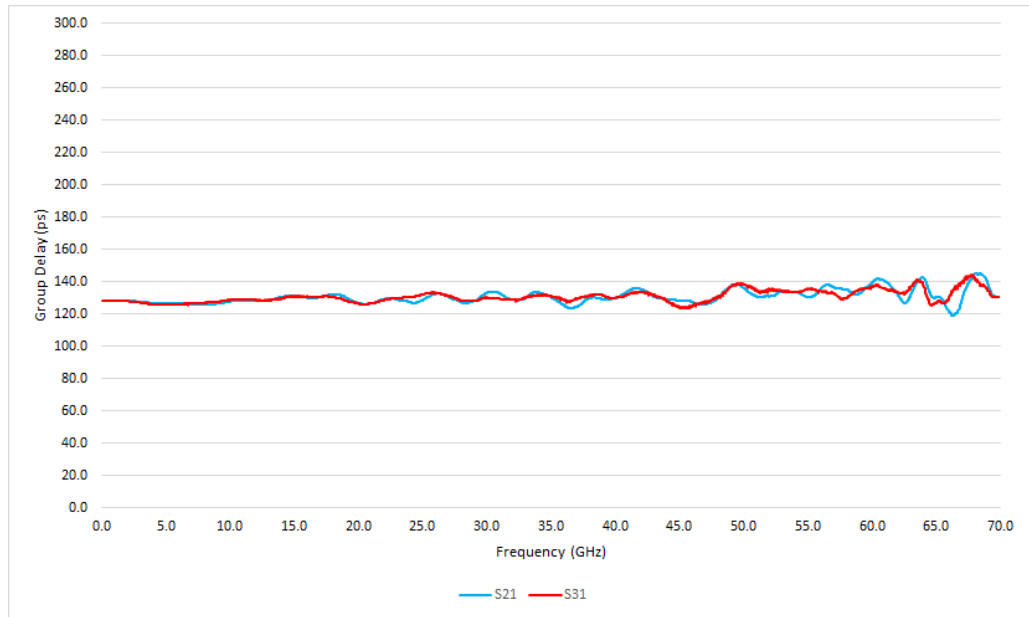


Figure 3: HL9477 Group Delay

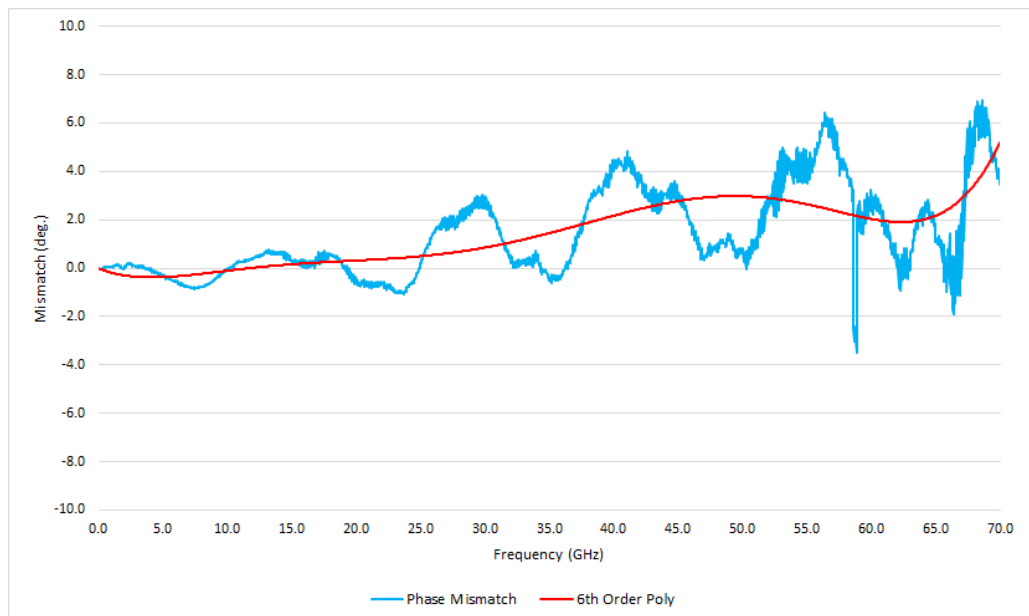


Figure 4: HL9477 Phase Mismatch



HL947x Eye Diagrams

The eye diagrams in *Figures 5-1* show a 56 Gbps PRBS11 pattern passed through an HL9477.

Figures 6-7 show a 112 Gbps PAM4 signal passed through the HL9477.

All plots are shown at 100 mV/div.

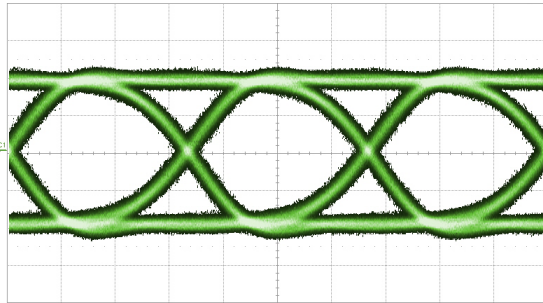


Figure 9: HL9477 56 Gbps PRBS 11, RF Input

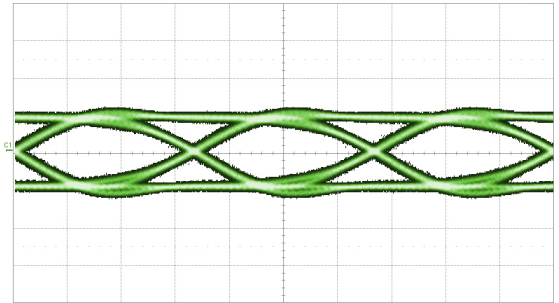


Figure 10: HL9477 56 Gbps PRBS 11, RF Output

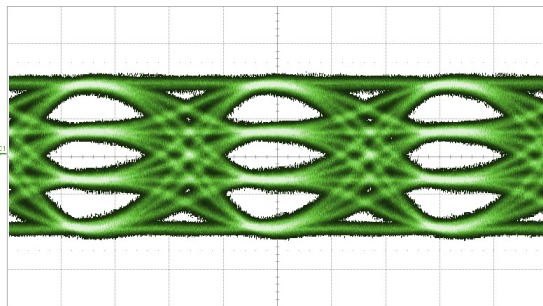


Figure 11: HL9477 112 Gbps PAM4, RF Input

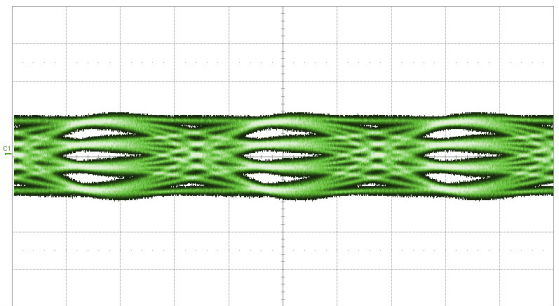


Figure 12: HL9477 112 Gbps PAM4, RF Output



HL947x Dimensional Drawing

Figure 9 shows a mechanical drawing of an HL9477. Unless otherwise noted, all units are shown in inches. Other models vary in length and width based on connectors.

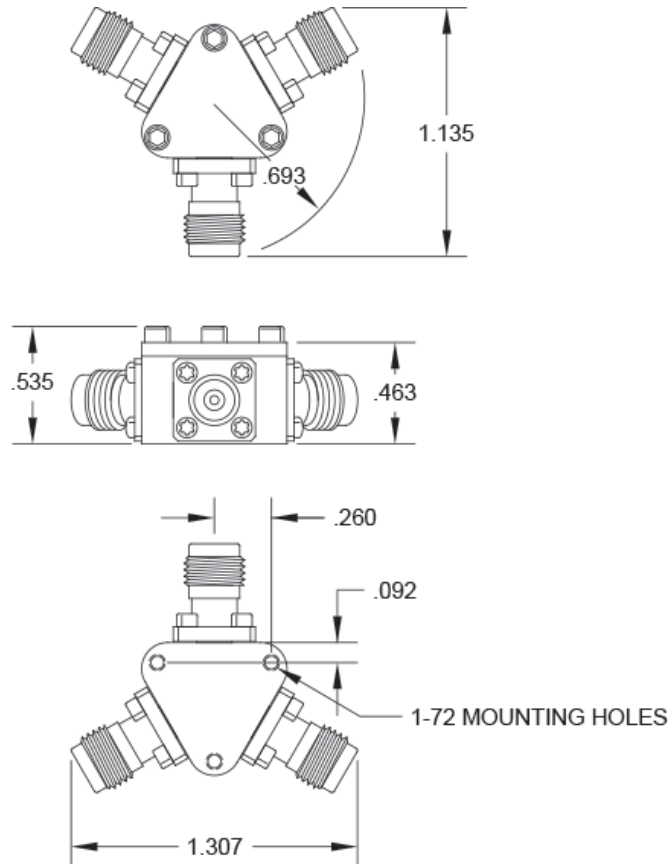


Figure 9: HL9477 Mechanical Drawing