

## HL9403 Drop-in Broadband Balun (20 GHz)

### Features and Technical Specifications

Bandwidth (-3 dB)	5 MHz to 20 GHz
Amplitude Match	$\pm 0.25$ dB to 20 GHz <u>See Fig. 1 below</u>
Phase Match	$\pm 2-4^\circ$ at 20 GHz <u>See Fig. 2 below</u>
Rise time	< 17.5 ps
Insertion Delay	$\approx 278$ ps
Insertion Loss	-6 dB
Return Loss	<u>See Figs. 3-4 below</u>
VSWR	<u>See Fig. 5 below</u>
Max Input Power	+30 dBm
Impedance	50 $\Omega$ In, 2 x 50 $\Omega$ Out
Interface	Drop-in with micro-coax leads
Dimensions	38.1 x 11.43 x 4.6 mm 1.50" x 0.45" x 0.18"
Weight	45.3 g (1.6 oz.)
Temperature Limits	-40° to +100° C, operating
RoHS Compliance	RoHS compliant; made with lead-free solder
Warranty	1 year, see website



#### PRODUCT SUMMARY

The HL9403 is a drop-in (SMT) signal splitter and combiner that offers industry-best amplitude and phase match over a bandwidth of 5 MHz to 20 GHz (-3 dB).

It is suitable for use in high-speed communications systems, high-speed analog-to-digital conversion, frequency response testing for differential devices, and many other applications.

#### DEPLOYMENT NOTES

Although the HL9403 ports are labeled as RF In/Out, this device is bidirectional and can be used either as a signal splitter or combiner.

If the DC voltage of the input or output is not zero, DC block capacitors are required.

#### ADDITIONAL DATA

Higher-resolution versions of the charts on the following pages are available on our website.

### HL9403 Bandwidth

Bandwidth for all HYPERLABS baluns is defined as the range of frequencies where insertion loss is within -3 dB of the reference level (-6 dB).

Figure 1 below shows better than -9 dB insertion loss up to 20 GHz when the device is used as a signal splitter.

### HL9403 Amplitude Match

Amplitude match is a comparison between the signals on the RF Out +/- ports of a balun used as a signal splitter. This specification is derived from the insertion loss (in dB) measured on the output ports of the device.

Figure 1 below shows typical HL9403 insertion loss from 5 MHz to 20 GHz when the device is used as a signal splitter.

The amplitude balance can be seen by comparing the non-inverting output (blue trace), with the inverting output (red trace).

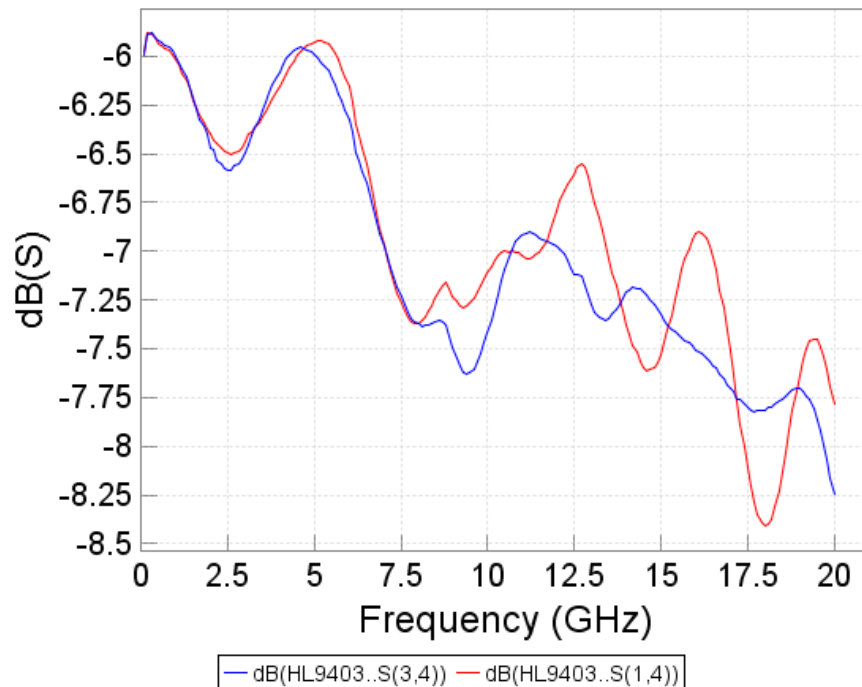


Figure 1: Typical insertion loss measurements of the HL9403 RF Outputs when used as a balun

When the HL9403 is used as a combiner, mixed mode parameters provide additional information on device performance. For more on the HL9403 combiner performance, please see our website for mixed-mode measurement data.

### HL9403 Phase Match

The HL9403 is a 180° balun, so the phase match of the RF Out+ and RF Out- ports is specified to degrees from 180°.

Match is dependent on the delay of the output ports. For example, a 2° mismatch at 10 GHz requires the delay of each side of the balun to be within ≈ 0.5 ps of each other. Phase mismatch increases at higher frequencies.

Figure 2 below shows phase mismatch between the RF Outputs from 5 MHz to 20 GHz.

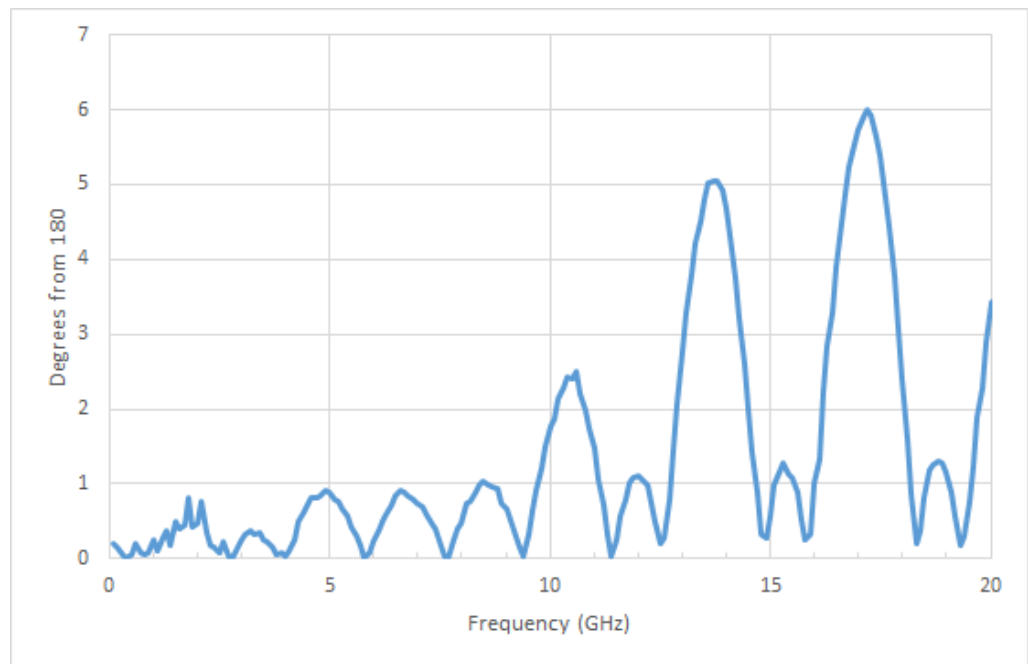


Figure 2: HL9403 phase match, represented as degrees from 180°

### HL9403 Return Loss

Figure 3 shows the return loss on the HL9403 RF Input of a device used as a signal splitter. Figure 4 shows the return loss on the RF Output+ port of a device used as a signal combiner. In both cases, bandwidth is from 5 MHz to 20 GHz.

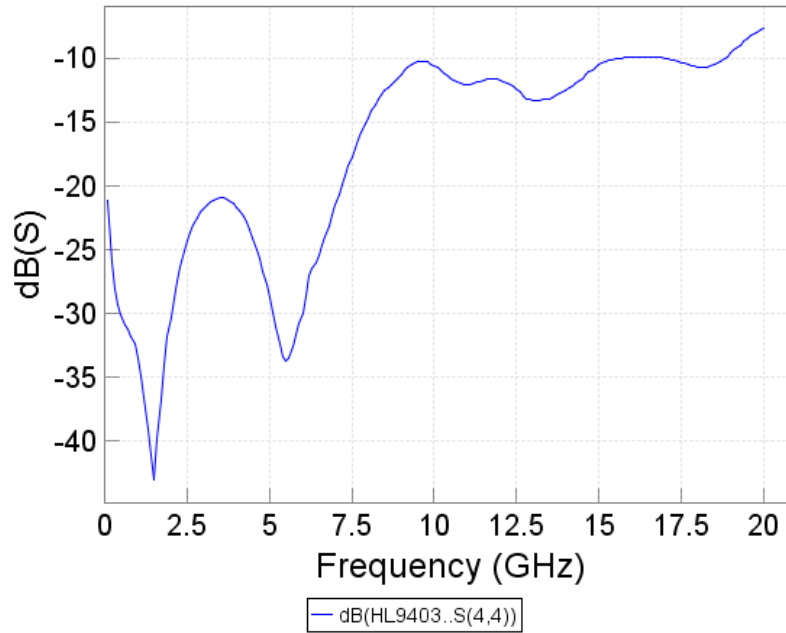


Figure 3: Typical return loss (S11) on the HL9403 RF Input

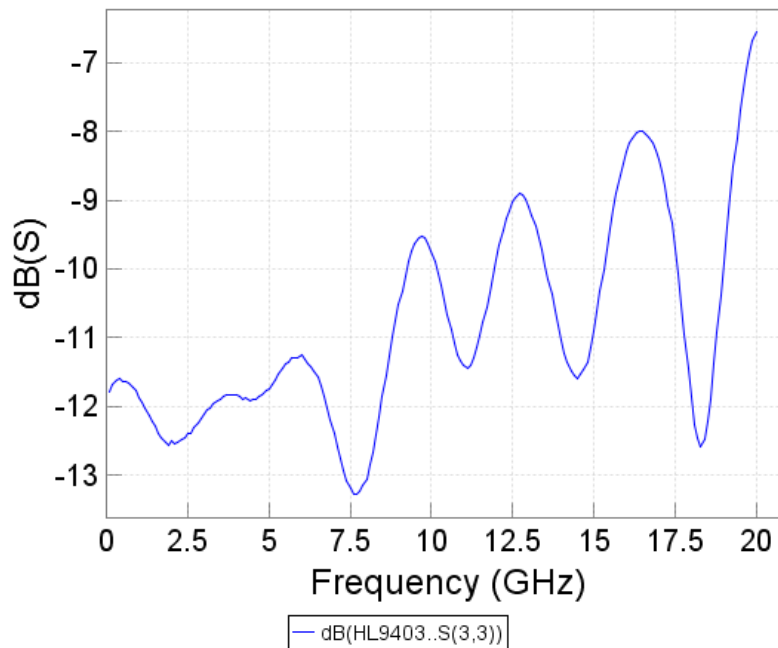
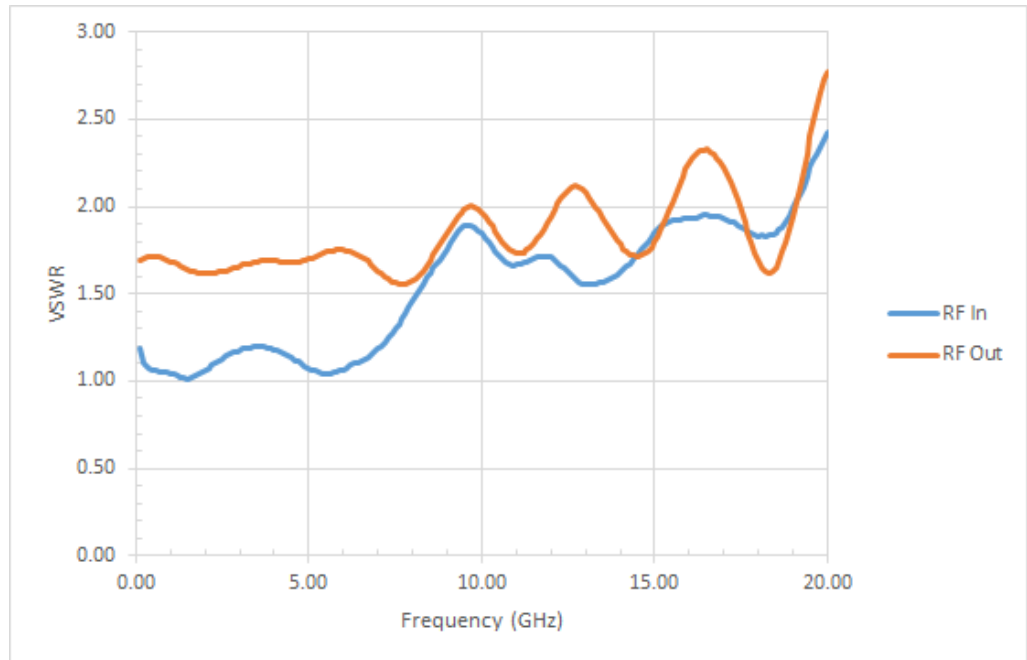


Figure 4: Typical return loss (S11) on the HL9403 RF Output+ port

### HL9403 VSWR

The typical Voltage Standing Wave Ratio (VSWR) of the HL9403 is shown in *Figure 5* below. The blue and orange traces show typical VSWR on the RF In and RF Out+ ports, respectively.



*Figure 5: Typical VSWR on the HL9403 RF Input and RF Output*