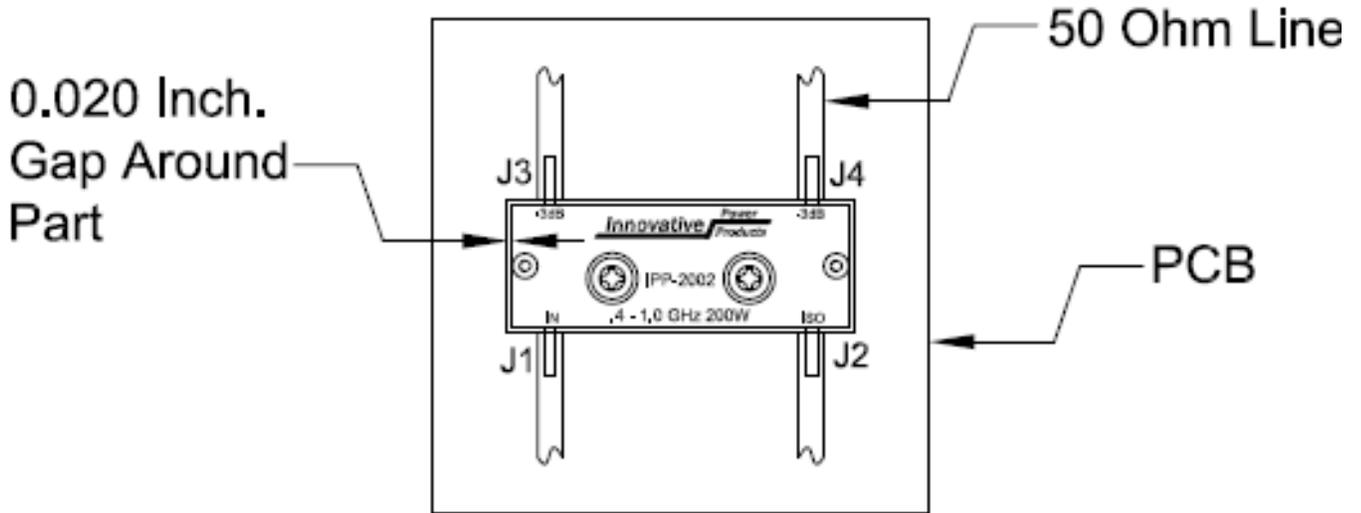# IPP 90 Degree, Drop-In, 3dB Hybrid Application Note

❖ General Notes:
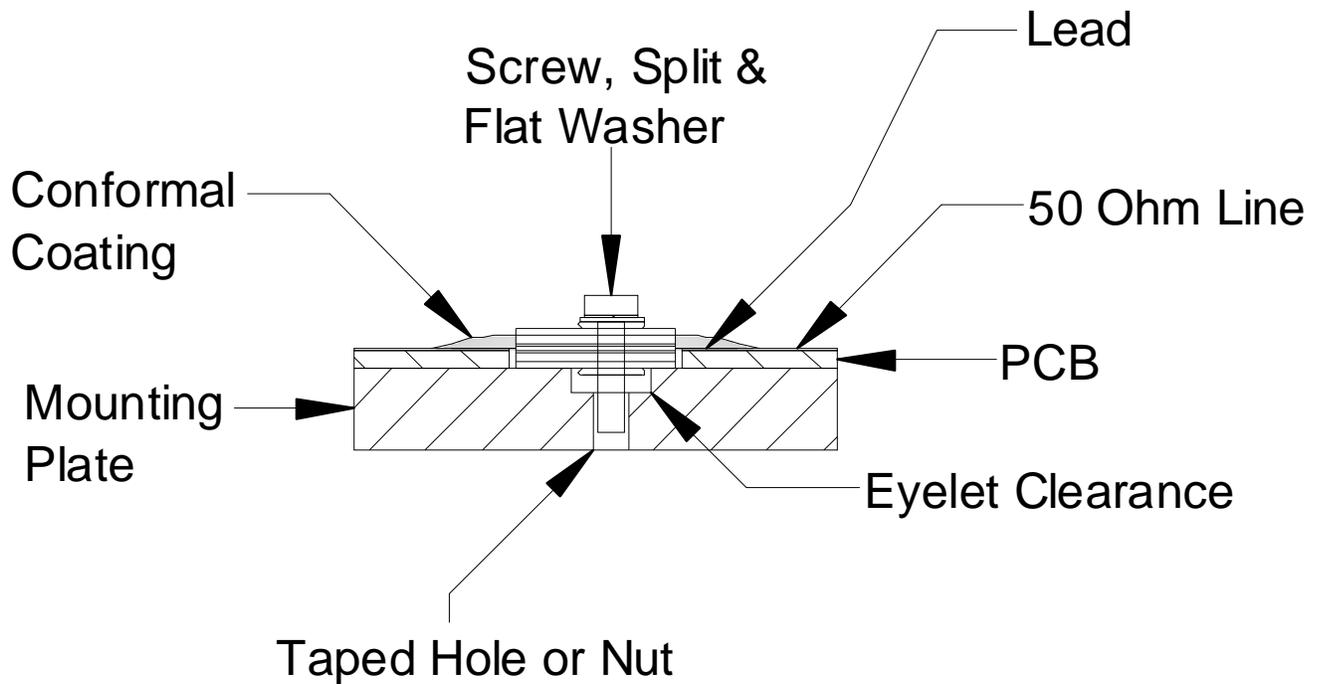 o Data and specifications apply when part is mounted in IPP test fixture and terminated into 50 Ohms with >30dB return loss.
  o Conformal coating is recommended at the lead/50Ω line interface for high power applications to prevent voltage arcing.
  o To insure proper grounding the bottom plate of coupler must lay flat on mounting surface. Please allow clearance for all eyelet projections in base plate.
  o Solder leads to 50 ohm lines using lead free or Sn63 alloy.
  o Torque #2-56 stainless steel machine screw, split and flat washer to 2.5 in-lbs.
  o Operating temperature is -55°C to +85°C base plate, non-condensing.

Input Output Relationships for -3dB, 90° Hybrid Couplers

INPUT	OUTPUT			
	J1	J2	J3	J4
J1	N/A	Isolation Port	-3dB <0°	-3dB <-90°
J2	Isolation Port	N/A	-3dB <-90°	-3dB <0°
J3	-3dB <0°	-3dB <-90°	N/A	Isolation Port
J4	-3dB <-90°	-3dB <0°	Isolation Port	N/A

Mounting, Top View

Conformal Coating

Screw, Split & Flat Washer

Lead

50 Ohm Line

Mounting Plate

PCB

Eyelet Clearance

Taped Hole or Nut

Mounting, Side View

Electrical Specifications

❖ **VSWR (Voltage Standing Wave Ratio)**
  o The voltage standing wave ratio is a measure of how well a load is impedance-matched to a source. The value of VSWR is always expressed as a ratio with 1 in the denominator (2:1, 3:1, 10:1, etc.) It is a scalar measurement only (no angle). A perfect impedance match corresponds to a VSWR 1:1 meaning you will get all the power from source to load.
    ▪ VSWR (σ) = Vmax/Vmin

❖ **Insertion Loss (IL)**
  o The insertion loss is the amount of power (P) lost when transmitted through the coupler from the input port to the other ports.
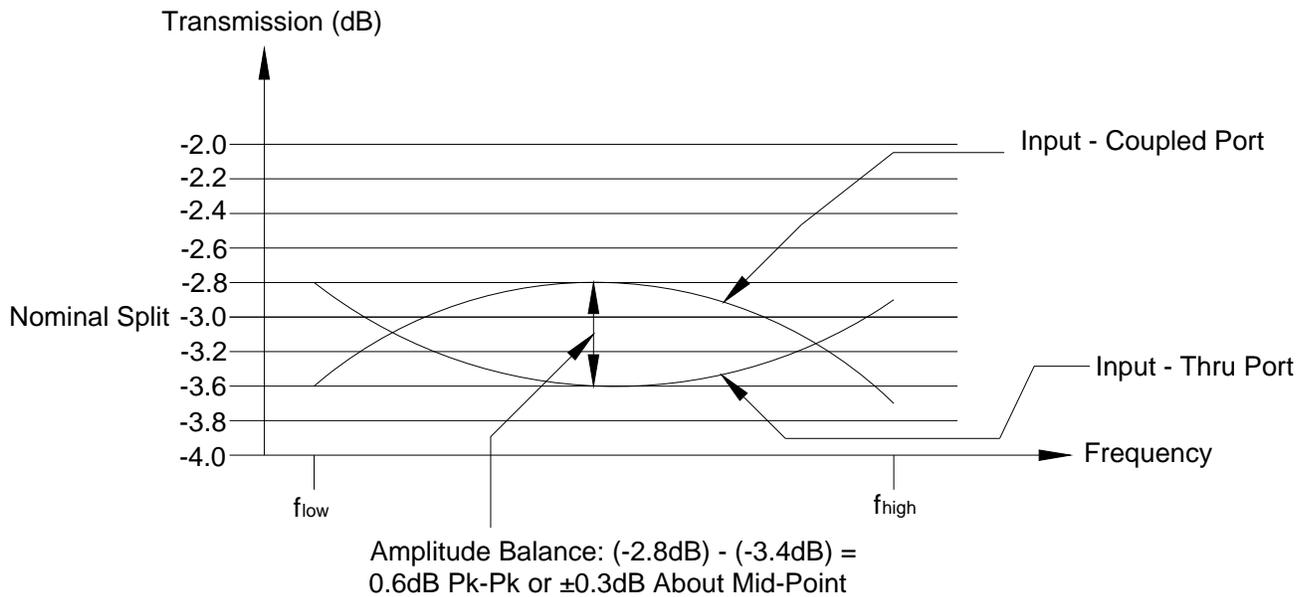   ▪ IL(dB)=10Log(Pin/(Pthru+Pcoupled+Piso))

❖ **Isolation (ISO)**
  o The isolation is the amount of power at the input port
    divided by the amount of power at the isolation port when
    the other two ports are terminated into 50 Ohms.
      ▪ ISO(dB)=10Log(Pin/Piso)

❖ **Amplitude Balance (AB)**
  o The amplitude balance is the difference in the power levels
    at any given frequency for the same input level when
    measured at the coupled and thru ports.
      ▪ AB(dB)=|10Log(Pcoupled/Pthru)|

Transmission (dB)

Input - Coupled Port

-2.0
-2.2
-2.4
-2.6
-2.8
Nominal Split -3.0
-3.2
-3.6
-3.8
-4.0

Input - Thru Port

Frequency

f_{low}

f_{high}

Amplitude Balance: (-2.8dB) - (-3.4dB) =
0.6dB Pk-Pk or ±0.3dB About Mid-Point

Typical Amplitude Balance
Responce for 1-Section Coupler

❖ **Phase Balance (PB)**
  o The phase balance is the difference in phase angle between
    the power at the thru port and the power at the coupled
    port. The nominal difference being 90°.
      ▪ PB(°)= <Pcoupled - <Pthru

❖ **Power (P)**
  o The maximum total CW input power is the sum of the CW input
    power at each port.
      ▪ Ptotal Max= Pin + Pthru + Pcoupled + Piso