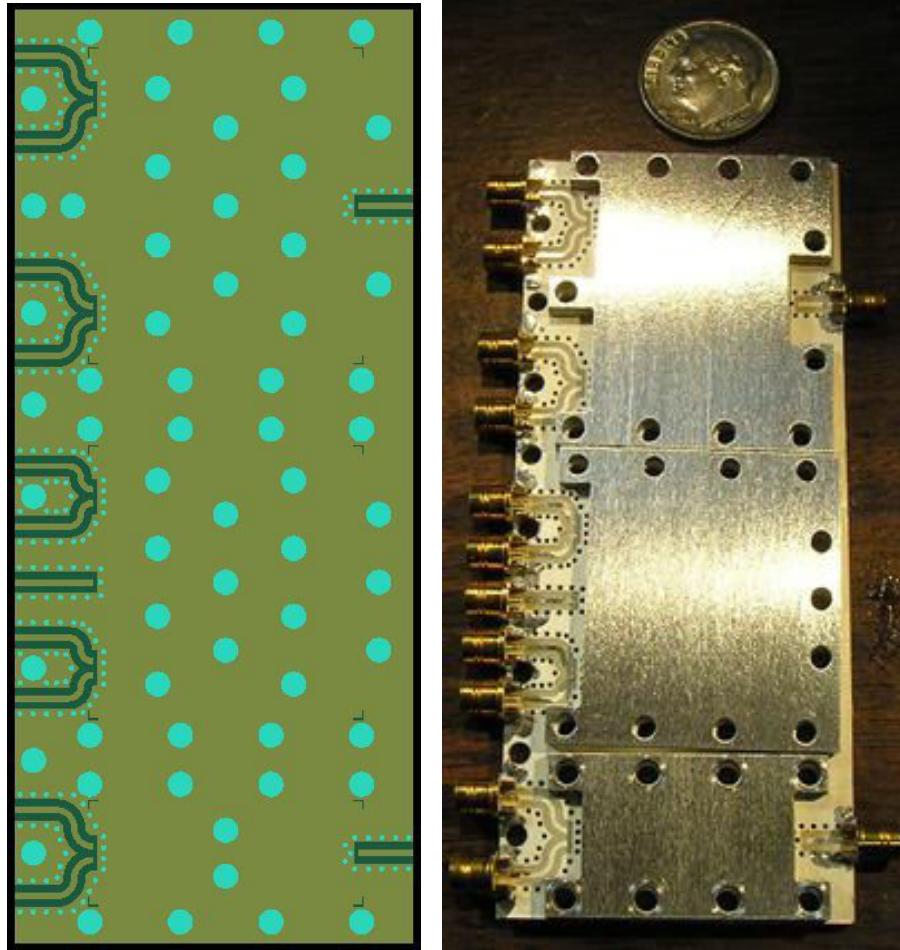




BBTLine Splitter/Combiner Evaluation Board Cautions

Shown below is the “Splitter Evaluation Board” (left image is the bare board, right image is the board with SMP connectors and stiffener “plates”):



CAUTION #1:

If removing and/or installing BBTLine splitter/combiner devices from the evaluation board, only personnel with years of extensive surface mount re-work experience should undertake this effort.

CAUTION #2:

The board material use on this evaluation board is Rogers 3003. **This is a very soft material.** It is very easy to damage the evaluation board RF traces (even with very little pressure from soldering iron tips). When working with the evaluation board (and splitter devices), minimize the contact pressure between soldering irons and board RF traces.

CAUTION #3:

A very “fine” surface-mount soldering iron station and soldering iron tips (along with fine de-soldering braid/wick) should be used during all re-work. An example soldering station from JBC is shown below. Soldering tips should be 0.1 mm in diameter. De-soldering braid (or “wick”) should be 30 mil width (for example, Chem-Wik 2-100L)



CAUTION #4:

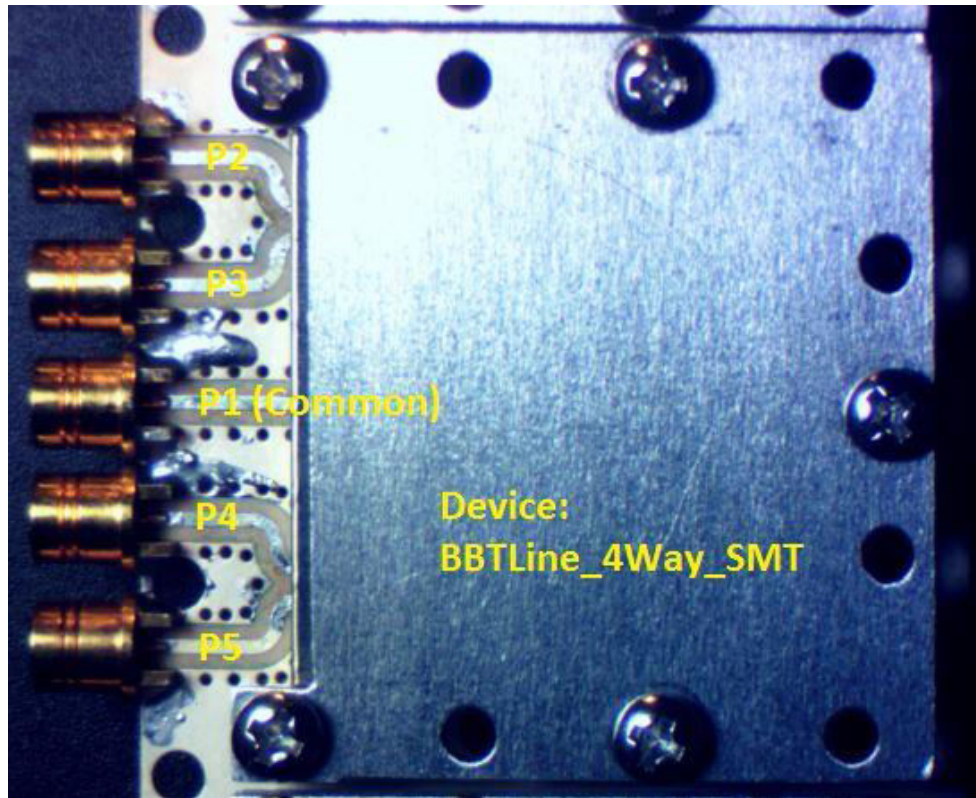
2-56 screws (0.5" long), 2-56 nuts and 100 mil thick aluminum stiffener "plates" provide the intimate contact between the splitter/combiner device ground plane and the evaluation board ground plane as shown in three images below. Not all 2-56 screws have to be populated as shown below.

DO NOT OVERTIGHTEN SCREWS. ENSURE THAT THE TWO PLATES ARE PRESENT ON BOTH THE TOP AND BOTTOM SURFACES (BOTTOM PLATE NOT SHOWN). ONE PLATE IS PLACED ON THE EVALUATION BOARD BOTTOM SURFACE AND THE OTHER PLATE IS PLACED ON THE LID OF THE SPLITTER/COMBINER DEVICE.

Take turns applying even (**but moderate**) pressure slowly to each screw head, in a random fashion, to ensure overall even (**and moderate**) pressure is applied to the overall splitter lid. Use best judgement here, do not overtighten, just a few pound-inches of torque should be sufficient.

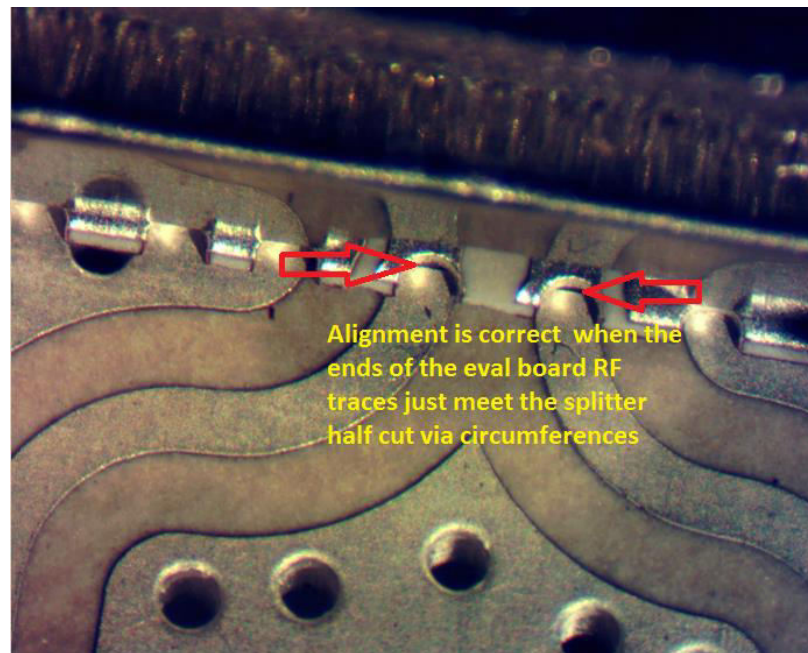
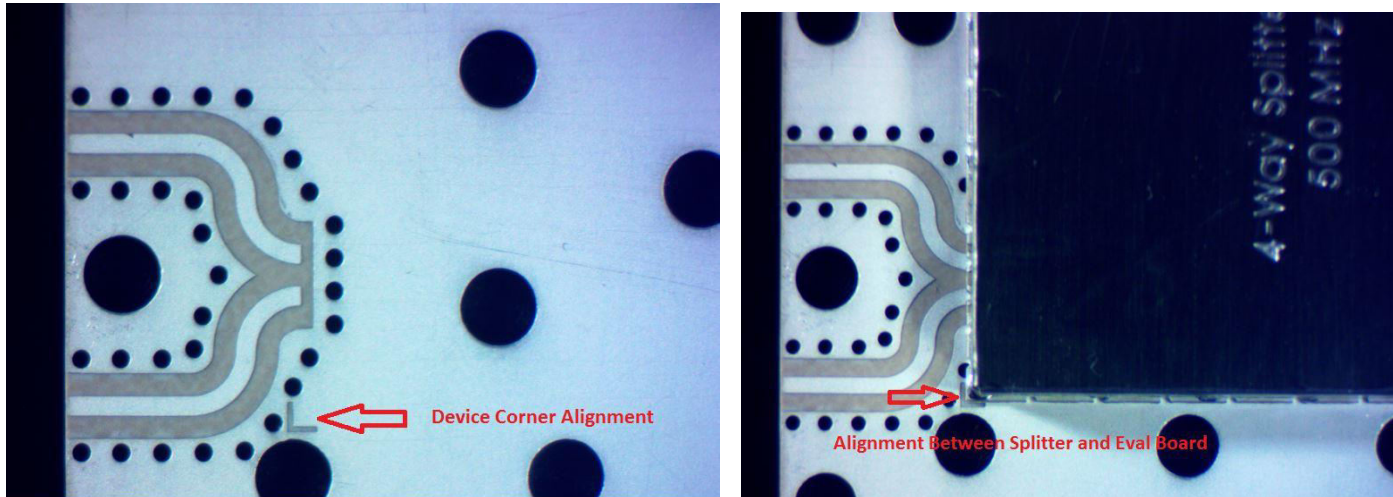
The intent here is to allow the user to apply good contact between the splitter ground plane and the evaluation board ground plane (without the need to solder the entire splitter device ground plane to the evaluation board ground plane).





CAUTION #5:

Precise alignment between the splitter and the evaluation board is required to ensure accurate measurement of the splitter phase and amplitude balance. Notice that there are alignment markers provided on the evaluation board at each corner of the splitter as shown below.



CAUTION #6:

To ensure accurate measurements of phase and amplitude balance, an **absolute minimal amount of solder** is required between the evaluation board RF traces and the splitter half-cut vias. Use 30 mil wide solder-wick (for example, Chem-Wik 2-100L) to remove any excess solder from the RF traces. Excess solder at the evaluation board/splitter device junctions will cause errors in measurements by introducing excess parasitic capacitance.

Use best practices and good judgement here for optimal solder joints. Any parasitic capacitance, due to excess solder at these junctions, will degrade the measurements. Just a slight meniscus of solder should be present between the evaluation board RF traces and the half-cut vias.

Clean up any excess solder wick residue with isopropyl alcohol. **Note that after isopropyl alcohol is applied, a period of one hour should transpire before network analyzer measurements take place, to ensure complete evaporation of the alcohol** (the Rogers 3003 material readily absorbs the alcohol and causes measurement degradation due to the dielectric constant change).

CAUTION #7:

Measuring splitter phase and amplitude balance down to the level that these devices are specified is not trivial.

The connectors on the evaluation board are SMP Smooth-Bore style. The SMP Smooth-Bore style connectors are great from a wear standpoint (that is, they offer minimal wear even after hundreds of mating cycles); however, they pose more of a challenge when measuring splitter phase and amplitude balance. A Smooth-Bore connector does not grasp the SMP cable connector as well as a full détente SMP connector would.

In order to minimize measurement errors, ensure that any cable connectors entering the evaluation board SMP connectors are seated flush with the evaluation board connectors.

The cable connectors entering the evaluation board SMP connectors should enter in a very straight manner (i.e., no angular offset should be noticed between the cable SMP connector and the evaluation board connector). This is not an easy task since the rigidity of the particular cable used will tend to make the cable connector wander to some undesired angle.

Use of **Huber-Suhner “MiniBend” LSR style cables** has proven very beneficial, since the cable can be hand-formed to ensure straight cable entry.

Some kind of restraint, by way of tape, vise and/or a mechanical fixture, may also need to be considered to ensure that the cable connectors are maintained straight and flush with the evaluation board connectors.

Any incorrect seating of the cable connectors and/or cable angular misalignment will translate directly into amplitude and/or phase balance measurement error.

Ensure that all SMP-style 50 ohm Terminations (on unmeasured ports) are also seated flush with the evaluation board SMP connectors.

A “fresh” network analyzer calibration prior to measurement is necessary. Since the cables used during the measurement are likely not going to be extremely phase-stable high-end network analyzer cables, minimize the cable motion/movement between the time of the calibration conditions and the measurement conditions.

The best-case scenario is to have access to an SMP Calibration Kit, so that the network analyzer calibration plane can be extended to the ends of the SMP cable connectors.

If an SMP Calibration Kit is unavailable, some other custom network analyzer standards will have to be used in order to ensure sufficient measurement accuracy. Alternately, very accurate characterization of any cables used during measurements can be employed and used for de-embedding the S-parameter data.

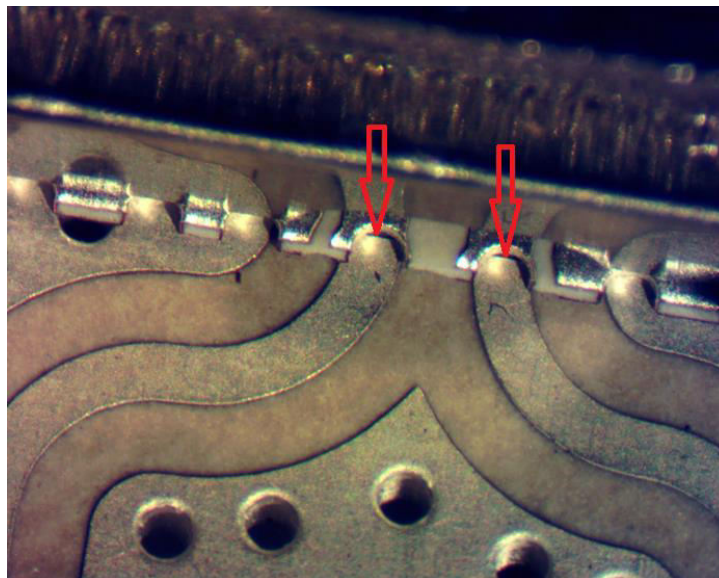
CAUTION #8:

If removing a splitter from the evaluation board, use very fine solder wick (for example, 30 mil wide Chem-Wik 2-100L). First, wick away as much solder as possible from the RF trace/half-cut via junctions (**while applying minimum pressure to the soft board material and RF traces**).

Note that the wicking away of the solder will not guarantee that the device is free from the board. **Be very cautious here**, it is very easy to rip up the evaluation board RF traces and/or damage the splitter half-cut vias.

The recommendation here is to gently apply tweezer-style soldering tips simultaneously to both locations shown in image below, while simultaneously very **gently** working an exacto-blade underneath the splitter device. Very carefully and gently prying the part up (**while also realizing that the other junctions are still soldered down and can be damaged if too much prying is applied**). Pry up just enough to see that these junctions are free from the board...then, repeat for the other junctions. **Again, years of surface mount re-work experience is required here.**

Repeat, again...be very gentle with all of the prying and de-soldering steps here as this board material is very soft and the traces/vias can be easily damaged.



Note: a hot plate and/or hot air re-work station could also be used instead of (or in conjunction with) the tweezer/exacto-blade method outlined above. Realize that the splitters were constructed with low temperature/lead-free solder so that a hot plate high temperature should not exceed 160 C.