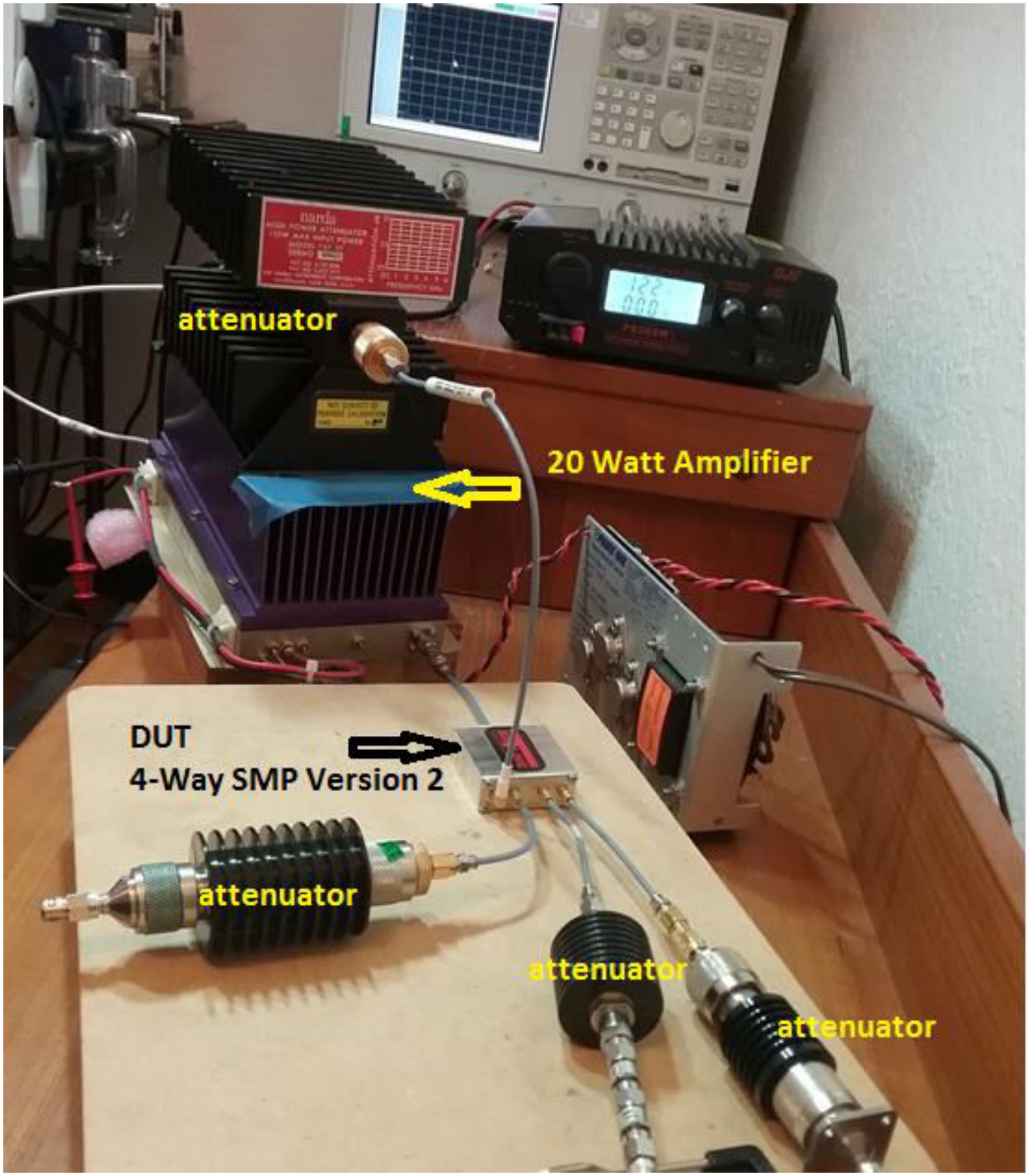
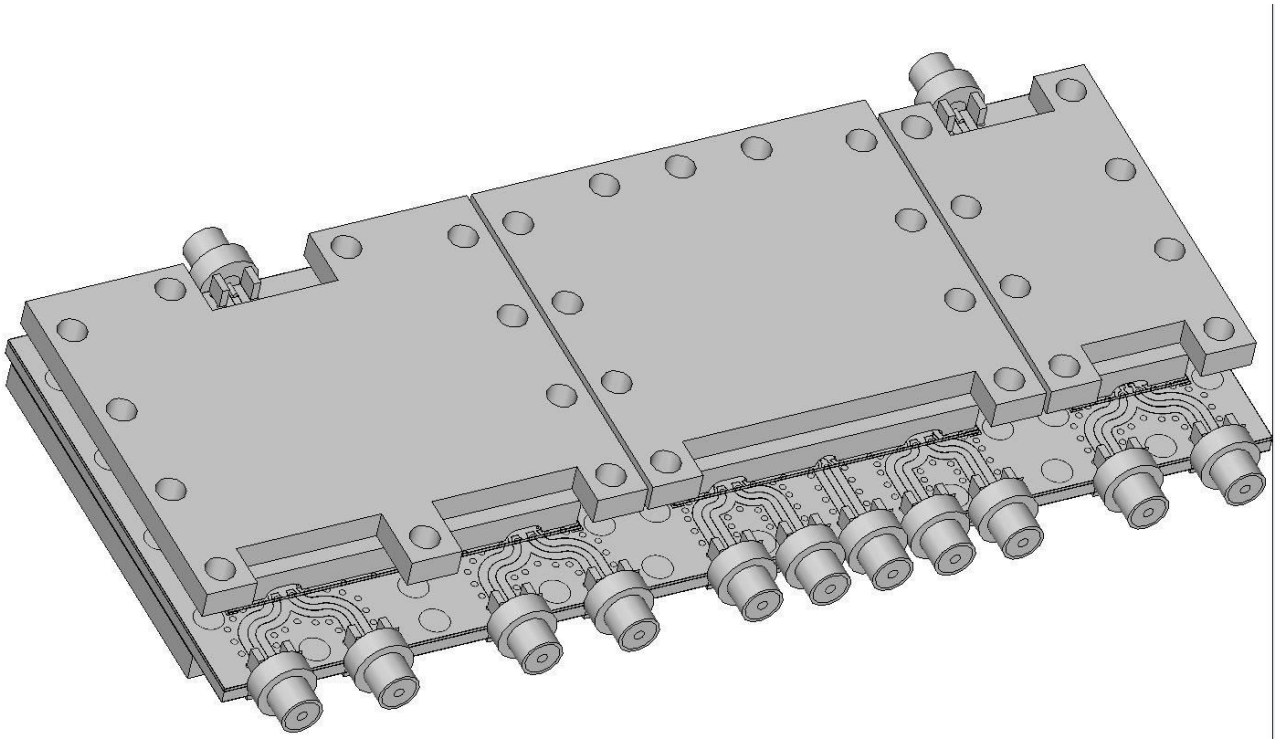
High Power Splitter Testing Conditions

1) 20 Watt testing of BBTLine's Splitter devices occurrs at a CW frequency of 3.55 GHz using a narrow-band amplifier with maximum 20 watt output power as shown below:



2) All devices tested to-date show no damage and/or S-parameter deviation from original room-temperature S-parameters.
3) High power testing occurrs with high power attenuators as loads. These high power attenuators have good return loss characteristics. So, virtually no reflected load power is returned to the splitter.
4) High power testing of the SMT devices occurred using the splitter evaluation board with "stiffener" plates as shown below:



The "stiffener" plates do offer some level of heat-sinking since they are 100 mil thick Aluminum plates (one plate is placed in direct contact with the lid of the SMT splitter and the other plates is placed on the backside of the evaluation board…secured top to bottom with 2-56 screws). See ".sat" file "TB_with_SMP_splitters_plates.sat" for Mechanical details. See also documents "Evaluation_Board_Cautions_5_14_2017.pdf" and "BBTLine_Splitter_Evaluation_Board_Preliminary_5_14_2017.pdf" for details/images of the Evaluation board and its "stiffener" plates.

5) Because the splitters are internally constructed using 0201 (20 mil by 10 mil) isolation resistors, there is a significant difference between maximum splitter power (> 20 watts) and maximum combiner power. Maximum combiner power is limited by the power rating of an 0201 resistor (50 mW's at Room Temperature) and would occur under the worst-case condition of combining two same-frequency perfectly anti-phase (0 degrees/180 degrees) signals.
6) Because there is a large difference between maximum splitting power and maximum combining power, care must be taken to understand the splitter load return loss levels (in order to avoid damaging the splitter with reflected power from the loads). For example, with the 4-Way "Version 1" splitter, if 20 watts is injected at the common port, the device is roughly 80% efficient at 3.55 GHz. Therefore, roughly sixteen watts of output power, spread across four ports (four watts per port) will be output from the splitter. The splitter itself will consume roughly four watts. If the return loss of the splitter leg loads is poor (e.g., on the order of 10 dB), this means that 400 mW's of power would be reflected back into the splitter. This would clearly exceed the 50 mW's of the 0201 resistors and could damage the device (if the reflected signal from the other "near" splitter leg load is also of a similar level and 180 degrees out of phase). If the return loss of the splitter leg loads is much better (e.g., 20 dB), then only 40 mW's of RF power will be reflected back into the splitter (and the 50 mW 0201 resistor rating is not exceeded). These are the issues that must be carefully thought out. Other frequencies (and

the associated different splitter losses) will also have to be considered. Heat-sinking equivalent to the Evaluation Board may also need to be considered at these higher power levels.

7) The high power test procedure involves the following steps: 1) gather baseline splitter S-parameters at room temperature, 2) adjust splitter common port RF input power to 1 watt, let unit sit for one hour and then gather S-parameters, 3) adjust RF input power to 2 watts, let unit sit for one hour and then gather S-parameters, 4) adjust RF input power to 4 watts, let unit sit for one hour and then gather S-parameters, 5) adjust RF input power to 10 watts, let unit sit for one hour and then gather S-parameters, 6) adjust RF input power to 20 watts, let unit sit for one hour and then gather S-parameters. Compare all S-parameters to original room-temperature S-parameters. No noticeable shift of any S-parameters has been noticed to-date.
8) It is the responsibility of the consumer to test under any test conditions deviating from the above (e.g., different temperatures, frequencies, heat-sinking etc.) to ensure that BBTLine's devices will meet specific consumer requirements.

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