

about 76° C, about 77° C, about 78° C, about 79° C, about 80° C, about 81° C, about 82° C, about 83° C, about 84° C, about 85° C, about 86° C, about 87° C, about 88° C, about 89° C, about 90° C, about 91° C, about 92° C, about 93° C, about 94° C, about 95° C, about 96° C, about 97° C, about 98° C, about 99° C, about 100° C or greater than 100° C. By heating the reverse transcription solution to a high temperature, the enzymes can be deactivated. In some embodiments, the sample can be heated to about 95 C for about 4 minutes.

[0196] As described above, the flow member is in contact with a heating element 6230, which can be, for example, a printed circuit board (PCB) heater. The heating element 6230 includes connectors 6231 and multiple, segmented portions, and thus can independently produce thermal energy into the holding volume 6211 and the serpentine flow channel 6214. In some embodiments, the heating element 6230 is designed to heat the serpentine portion 6214 of the sample preparation module 6200 while not heating the holding volume 6211, and vice-versa.

[0197] To minimize the heat energy that can inadvertently transfer between the holding volume 6211 and various portions of the serpentine channel 6214, or even between different portions of the serpentine channel 6214, one or more slots 6232 can be cut in the printed circuit board heater 6230 to isolate various portions of the heater 6230. For example, in some embodiments, the heater 6230 can include a series of slots and/or openings as described in U.S. Patent Publication No. 2017/0304829 entitled, entitled “Printed Circuit Board Heater for an Amplification Module,” which is incorporated herein by reference in its entirety. Moreover, in some embodiments, the heating element of the heater 6230 is located on an internal layer so the top copper pour (not shown) can be used as a heat spreader to minimize temperature variation along the serpentine path.

[0198] The reverse transcription solution, after being flowed through the inactivation process, may be flowed via the output port 6215 through the fluid control valve 6300 and into the inlet port 6217 of the mixing assembly 6250. The mixing assembly 6250 mixes the output from the serpentine flow channel 6214 with the reagents (identified as R3) to conduct a successful amplification reaction. Similarly stated, the mixing module 6250 is configured to reconstitute the reagent R3 in a predetermined input volume, while ensuring even local concentrations of reagents R3 in the entirety of the volume. In some embodiments, the mixing assembly 6250 is configured