

ABSTRACT

A radio frequency (RF) device may include a radio frequency integrated circuit (RFIC) chip and an antenna module on an upper surface of the RFIC chip. The antenna module may include a first patch parallel to the RFIC chip and having an upper surface configured to emit radiation in a vertical direction opposite the first patch from the RFIC chip, a ground plate parallel to the first patch, and between the first patch and the RFIC chip, and a first plurality of feed lines connected to a lower surface of the first patch and configured to supply at least one first differential signal to the first patch from the RFIC chip.

FIG. 3A