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(54) **LOW NOISE AMPLIFIERS FOR CARRIER AGGREGATION**

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CPC **H04L 27/2647** (2013.01); **H03F 1/223** (2013.01); **H03F 3/193** (2013.01); **H03F 3/68** (2013.01); **H03F 3/72** (2013.01); **H03G 3/20** (2013.01)

(58) **Field of Classification Search**

CPC . H04L 27/2647; H04L 27/2649; H04L 27/38; H03H 7/40; H03G 3/20
USPC 375/316, 317, 318, 345, 349, 340; 455/130, 132, 136, 234.1; 370/542

See application file for complete search history.

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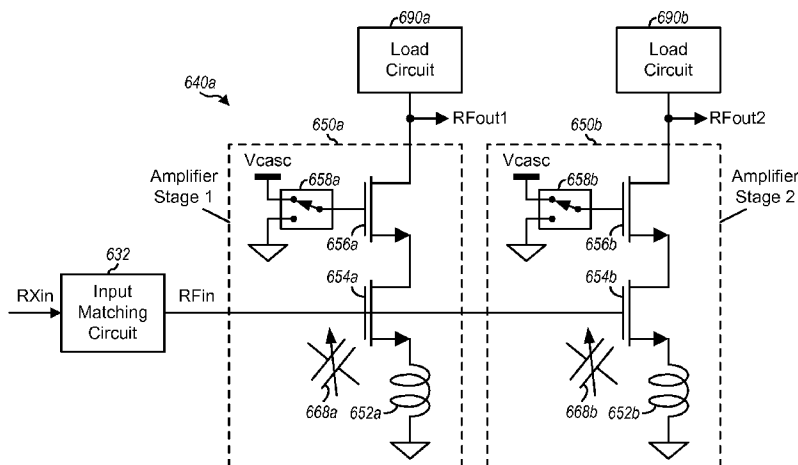
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(57) **ABSTRACT**

Low noise amplifiers (LNAs) supporting carrier aggregation are disclosed. In an exemplary design, an apparatus includes first and second amplifier stages, e.g., for a carrier aggregation (CA) LNA or a multiple-input multiple-output (MIMO) LNA. The first amplifier stage receives and amplifies an input radio frequency (RF) signal and provides a first output RF signal to a first load circuit when the first amplifier stage is enabled. The input RF signal includes transmissions sent on multiple carriers at different frequencies to a wireless device. The second amplifier stage receives and amplifies the input RF signal and provides a second output RF signal to a second load circuit when the second amplifier stage is enabled. Each amplifier stage may include a gain transistor coupled to a cascode transistor.

20 Claims, 17 Drawing Sheets



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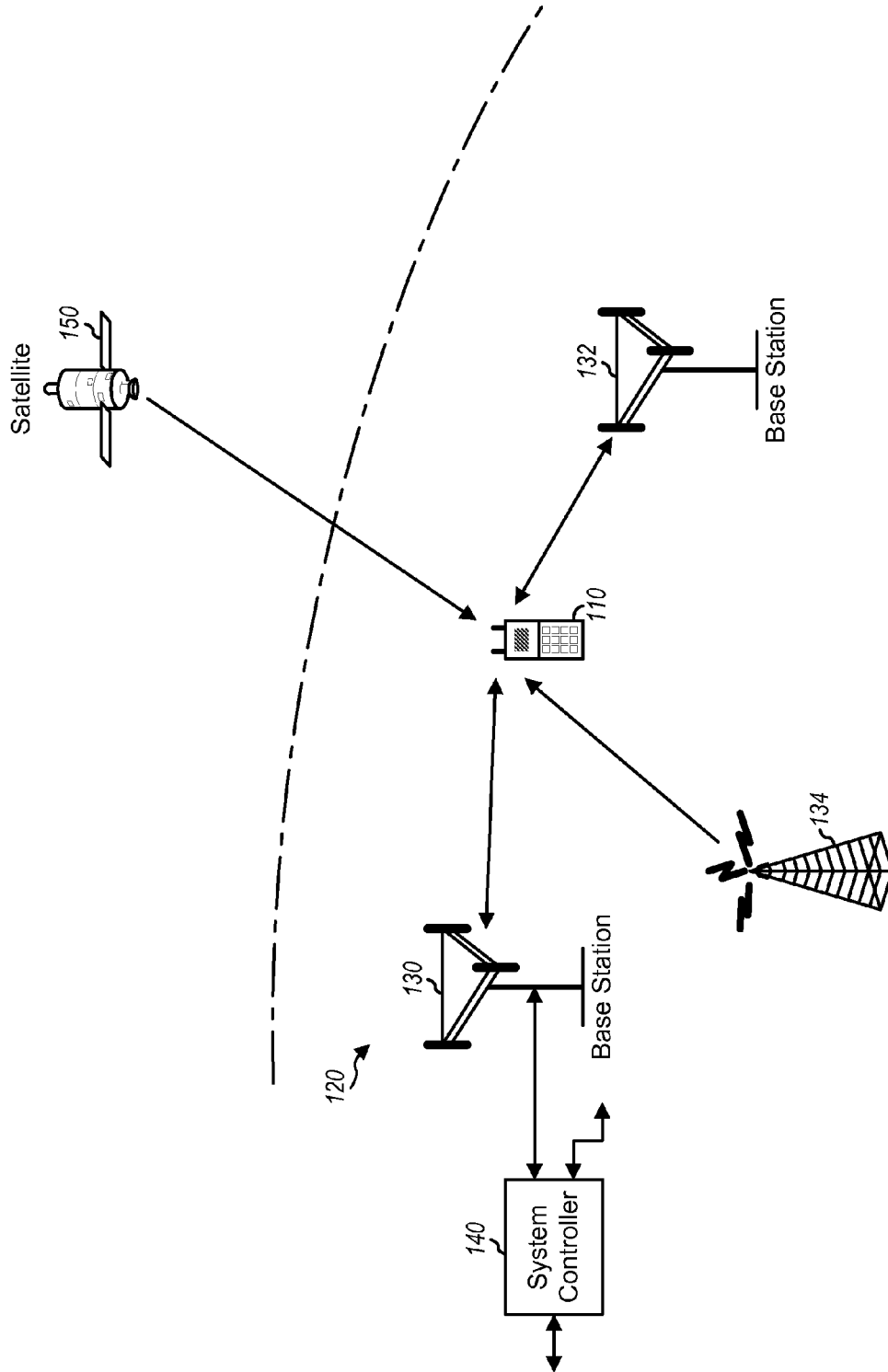


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