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(12) **United States Patent**  
**Lefley**

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(54) **NFC DEVICE WITH PLL CONTROLLED ACTIVE LOAD MODULATION**

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WO WO 2009/063214 A1 5/2009

(73) Assignee: **Broadcom Corporation**, Irvine, CA (US)

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(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 238 days.

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(21) Appl. No.: **13/535,874**

*Primary Examiner* — Sonny Trinh

(22) Filed: **Jun. 28, 2012**

(74) *Attorney, Agent, or Firm* — Sterne, Kessler, Goldstein & Fox P.L.L.C.

(65) **Prior Publication Data**

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(51) **Int. Cl.**  
**H04B 7/00** (2006.01)

(52) **U.S. Cl.**  
USPC ..... **455/41.1**; 455/180.3; 455/41.2; 340/10.4

(58) **Field of Classification Search**  
CPC .... H04B 5/00; H04B 5/0056; H04M 2250/04  
USPC ..... 455/41.1, 41.2, 180.3; 375/256; 178/43; 340/10.1

See application file for complete search history.

(57) **ABSTRACT**

A wireless communication device for communicating in the near-field via active load modulation. The device including an antenna configured to receive a magnetic field, a recovery device configured to recover a clock from the magnetic field, and a multiplexer configured to receive the recovered clock and a reference clock, and to output one of the recovered clock and the reference clock based on a current operational state of the wireless communication device. The wireless communication device further including a shunt regulator configured to produce the active load modulation by modulating an impedance of the wireless communication device, a phase-locked loop (PLL) configured to receive one of the recovered clock and the reference clock and to utilize the recovered clock and the reference clock and to control the active load modulation, and a driver configured to contribute to the active load modulation by adjusting an amplitude of a voltage across the antenna.

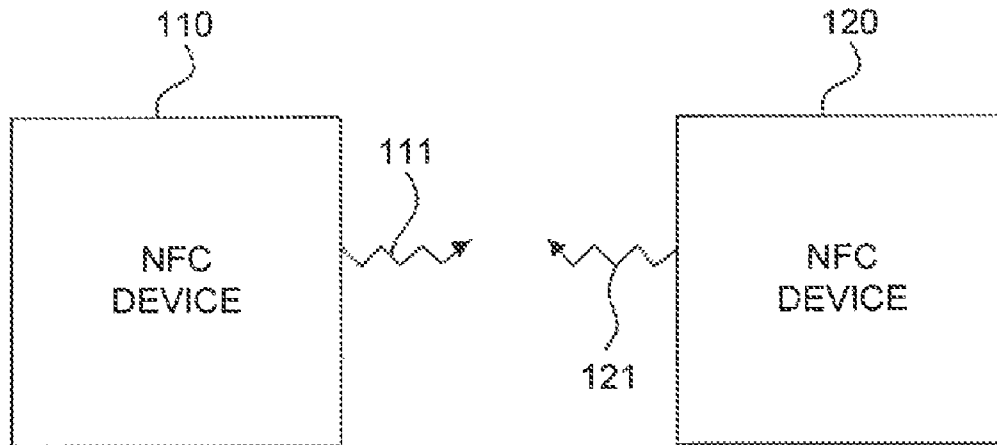
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**20 Claims, 6 Drawing Sheets**

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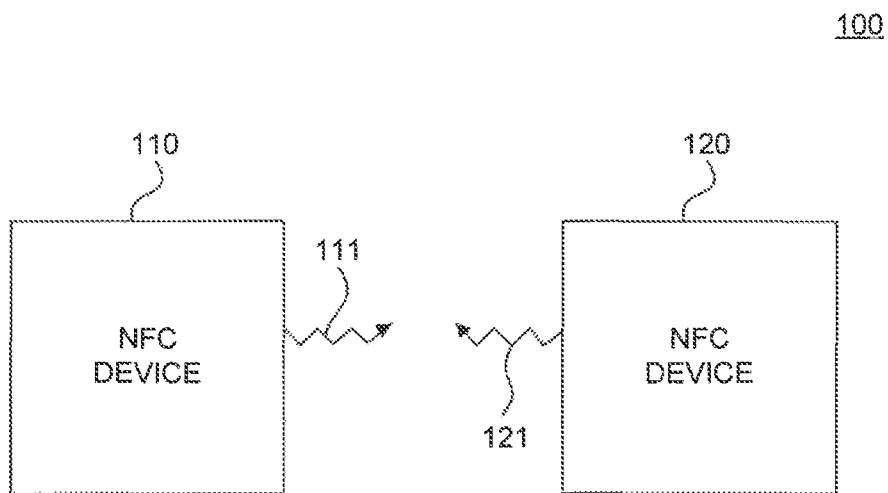


FIG. 1

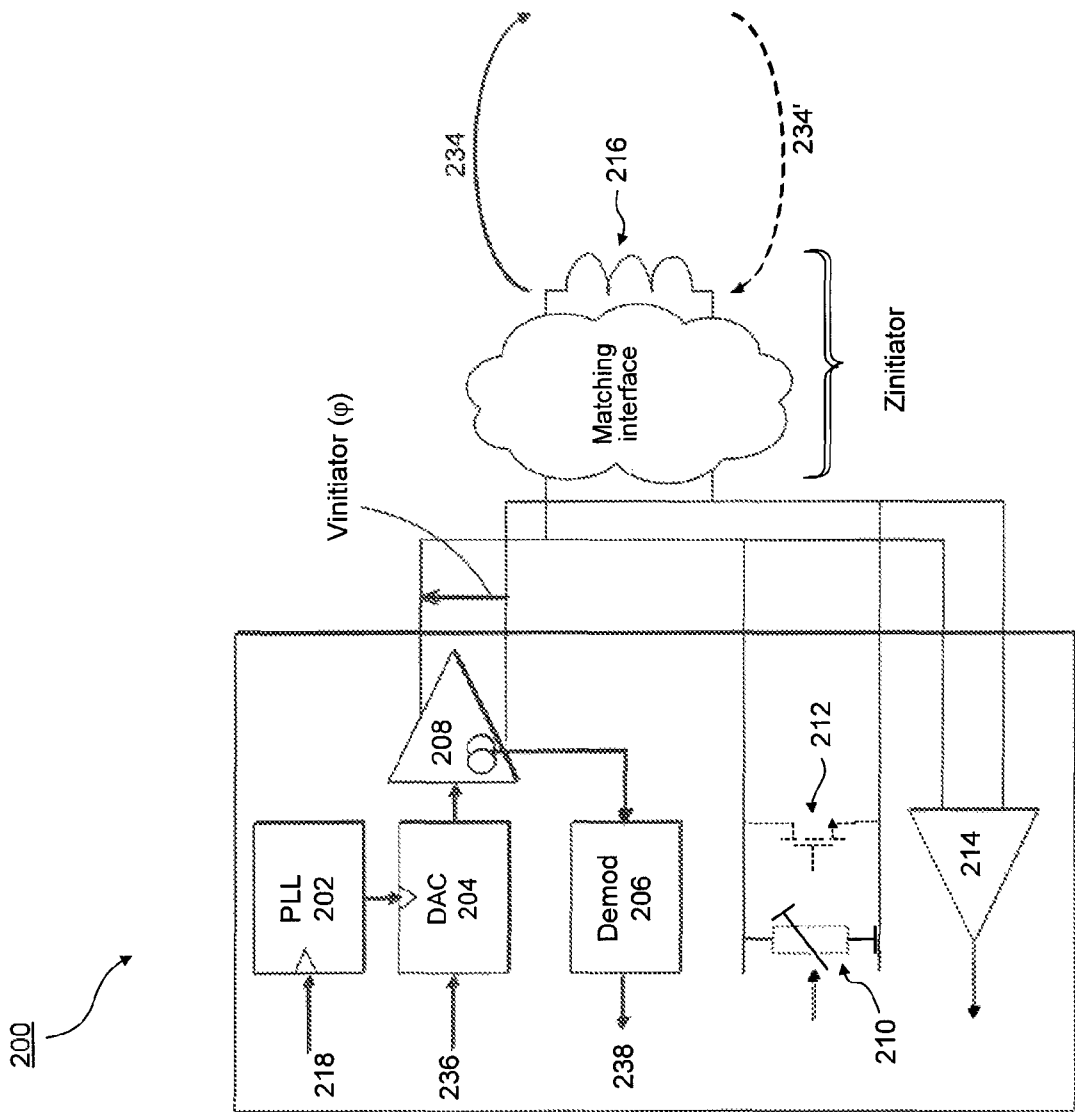


FIG. 2A

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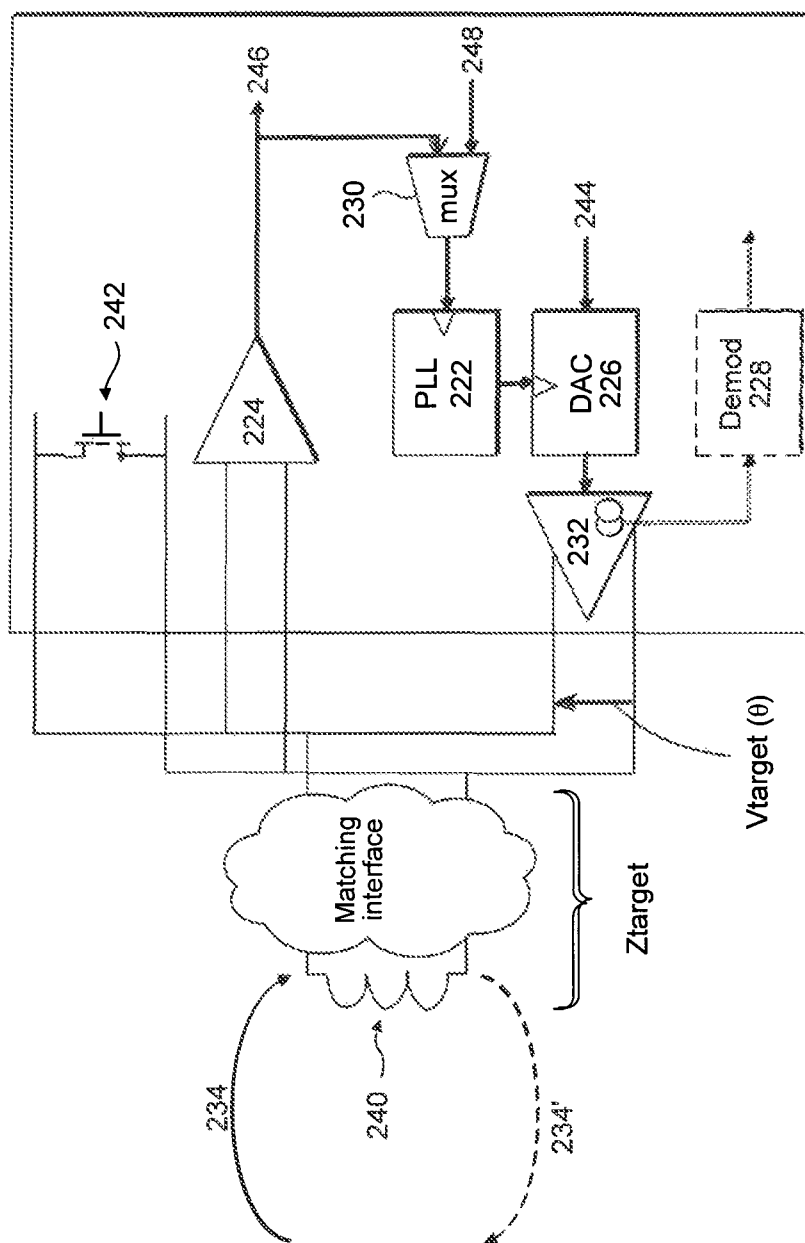


FIG. 2B

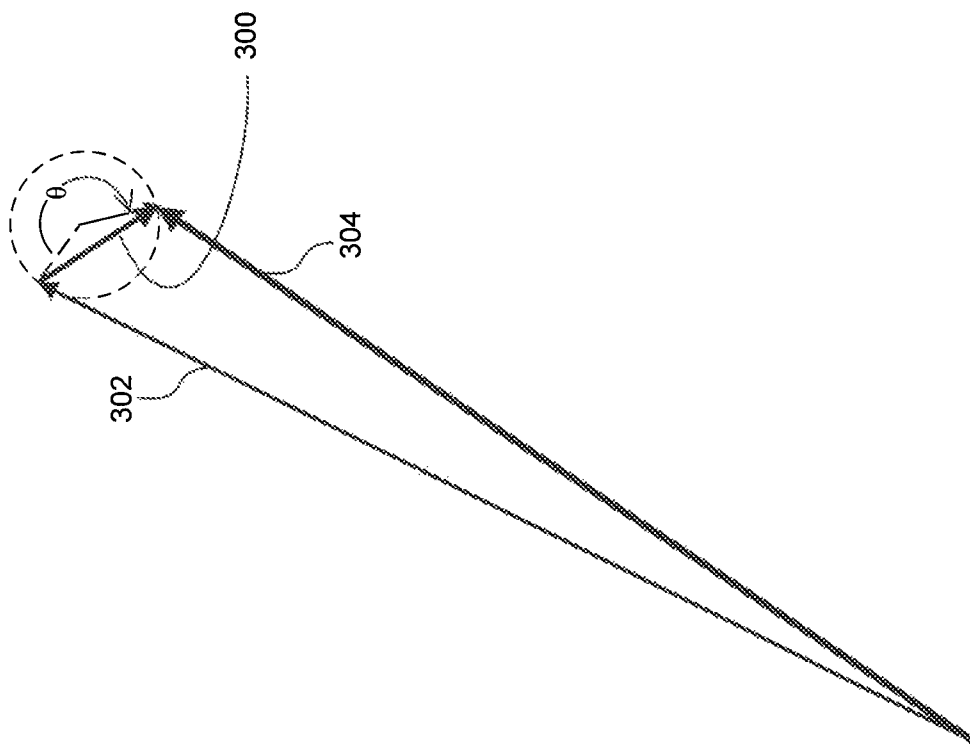


FIG. 3

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