

EXHIBIT 9



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(12) **United States Patent**
Sorrells et al.

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(54) **METHOD AND SYSTEM FOR DOWN-CONVERTING AN ELECTROMAGNETIC SIGNAL**

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See application file for complete search history.

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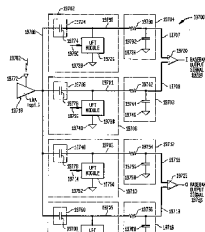
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(57) **ABSTRACT**

Methods, systems, and apparatuses for down converting a modulated carrier signal to a demodulated baseband signal are described herein. A first switch is controlled with a first control signal which comprises a first sampling aperture with a specified frequency, wherein the first switch is on during the first sampling aperture and wherein the first switch is off outside the first sampling aperture. A second switch is controlled with a second control signal which comprises a second sampling aperture and wherein the second switch is off outside the second sampling aperture. The first and second control signals each control a charging and discharging cycle of a respective energy storage element so that for each switch a portion of energy is transferred to the respective energy storage element when the respective switch is on during the charging cycle, and a portion of previously transferred energy is discharged during the discharging cycle for each respective switch when the switch is off. A down-converted in-phase baseband signal portion is derived from energy accumulated at said first energy storage element during both the charging and the discharging cycles for the first energy storage element and a down-converted inverted in-phase baseband signal portion is derived from energy accumulated at said second energy storage element during both the charging and the discharging cycles for the second energy storage element, and the two portions are combined with a first differential amplifier circuit to form a down-converted differential in-phase baseband signal.

28 Claims, 284 Drawing Sheets



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continuation of application No. 13/549,213, filed on Jul. 13, 2012, now Pat. No. 8,660,513, which is a continuation of application No. 12/976,839, filed on Dec. 22, 2010, now Pat. No. 8,340,618, which is a continuation of application No. 12/349,802, filed on Jan. 7, 2009, now Pat. No. 7,865,177, which is a division of application No. 09/550,644, filed on Apr. 14, 2000, now Pat. No. 7,515,896, which is a continuation-in-part of application No. 09/293,342, filed on Apr. 16, 1999, now Pat. No. 6,687,493, which is a continuation-in-part of application No. 09/176,022, filed on Oct. 21, 1998, now Pat. No. 6,061,551.

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