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US008436757B2

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

(10) **Patent No.:** **US 8,436,757 B2**

(45) **Date of Patent:** **May 7, 2013**

(54) **COMPLEX BANDPASS  $\Delta\Sigma$ AD MODULATOR AND DIGITAL RADIO RECEIVER**

(75) Inventors: **Hao San, Kiryu (JP); Haruo Kobayashi, Kiryu (JP)**

(73) Assignee: **National University Corporation Gunma University, Maebashi-shi (JP)**

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 59 days.

(21) Appl. No.: **13/254,333**

(22) PCT Filed: **Feb. 24, 2010**

(86) PCT No.: **PCT/JP2010/052873**

§ 371 (c)(1),  
(2), (4) Date: **Sep. 1, 2011**

(87) PCT Pub. No.: **WO2010/101058**

PCT Pub. Date: **Sep. 10, 2010**

(65) **Prior Publication Data**

US 2011/0316729 A1 Dec. 29, 2011

(30) **Foreign Application Priority Data**

Mar. 4, 2009 (JP) ..... 2009-050714

(51) **Int. Cl.**  
**H03M 3/00** (2006.01)

(52) **U.S. Cl.**  
USPC ..... **341/143; 341/155; 375/316; 375/324; 375/327; 375/332**

(58) **Field of Classification Search** ..... **341/143, 341/155; 375/324, 344, 247, 269, 316, 332, 375/345, 346**

See application file for complete search history.

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*Primary Examiner* — Linh Nguyen

(74) *Attorney, Agent, or Firm* — Oblon, Spivak, McClelland, Maier & Neustadt, L.L.P.

(57) **ABSTRACT**

To provide a complex bandpass  $\Delta\Sigma$ AD modulator capable of suppressing the influence of an image component caused by a mismatch between I- and Q-channels on a signal component with low power consumption.

A complex bandpass  $\Delta\Sigma$ AD modulator 10 is configured by a subtraction unit 20, a complex bandpass filter 30, an addition unit 40, a noise extraction circuit unit 50, an ADC unit 60, and a DAC unit 70. The noise extraction circuit unit 50 extracts a quantized noise signal of the ADC unit 60 based on an input signal of the ADC unit 60 and an output signal of the DAC unit 70, delays the extracted quantized noise signal by one sample time, phase-rotates the delayed signal by a predetermined angle, and feeds back the rotated signal to the input side of the ADC unit 60. Thus, a complex bandpass  $\Delta\Sigma$ AD modulator capable of suppressing the influence of the image component caused by a mismatch between I- and Q-channels on the signal component with low power consumption is provided.

**5 Claims, 14 Drawing Sheets**

