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(54) **METHOD AND APPARATUS FOR CONTROLLING MIMO SYSTEM USING SINGLE SERIAL PROGRAMMING INTERFACE**

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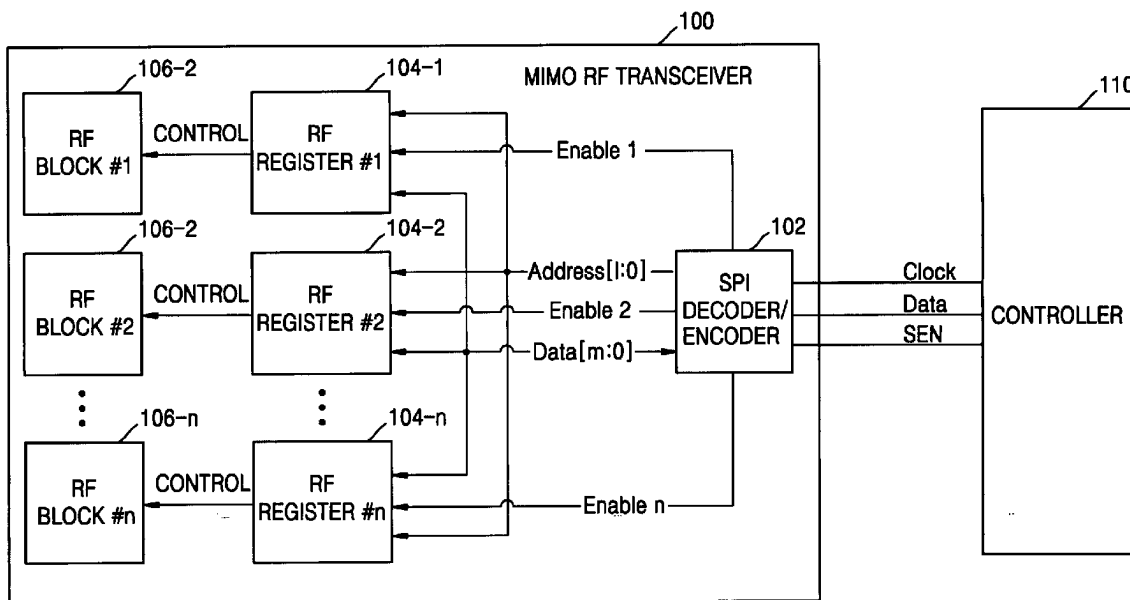Dec. 24, 2004 (KR) 10-2004-0112240

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(57) **ABSTRACT**

A method and apparatus for controlling a multi-input multi-output (MIMO) radio frequency (RF) transceiver having a plurality of RF blocks using a single serial programming interface (SPI) are provided. The MIMO system includes: a MIMO transceiver, having one or more input and output units and a serial interface conversion unit controlling the input and output units; and a controller, which controls the MIMO transceiver. The serial interface conversion unit receives control data from the controller via a serial programming interface (SPI), decodes the received control data to have a format appropriate for controlling the input and output units, and encodes data received from the input and output units to be compatible with the SPI. Accordingly, it is possible to realize a small-sized MIMO system having a simple structure and to reduce the probability of errors occurring in the process of controlling a plurality of RF blocks of the MIMO system.

FIG. 1

FIG. 2

MSB										LSB
D_m	$\cdot \cdot \cdot$	D_0	A_I	$\cdot \cdot \cdot$	A_0	I_n	$\cdot \cdot \cdot$	I_1	R/W

DATA FIELD (210)
ADDRESS FIELD (220)
DEVICE ID FIELD (230)
R/W FLAG (240)

FIG. 3

Data (310)

R/W flag | R/W | Device ID FIELD | I_1 | I_n | Address FIELD | A_0 | A_I | Data FIELD | D_0 | D_m

Clock (320)

SEN (330)

FIG. 4

START

RECEIVE CONTROL SIGNALS VIA SERIAL PROGRAMMING INTERFACE — S410

DECODE RECEIVED CONTROL SIGNALS — S420

TRANSMIT DECODED CONTROL SIGNALS IN MIMO CONTROL SIGNAL FORMAT — S430
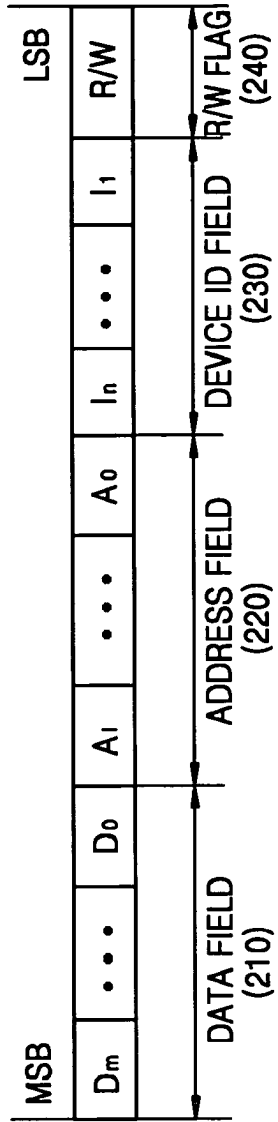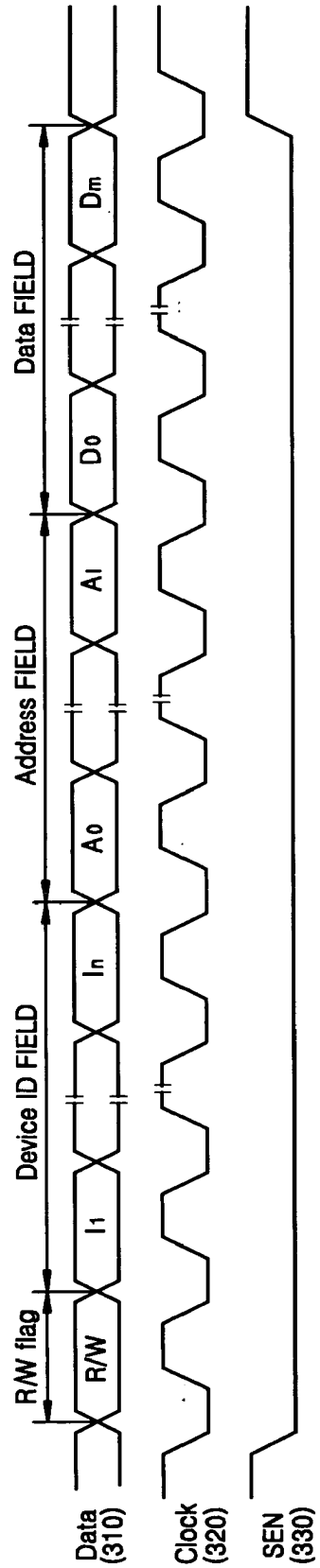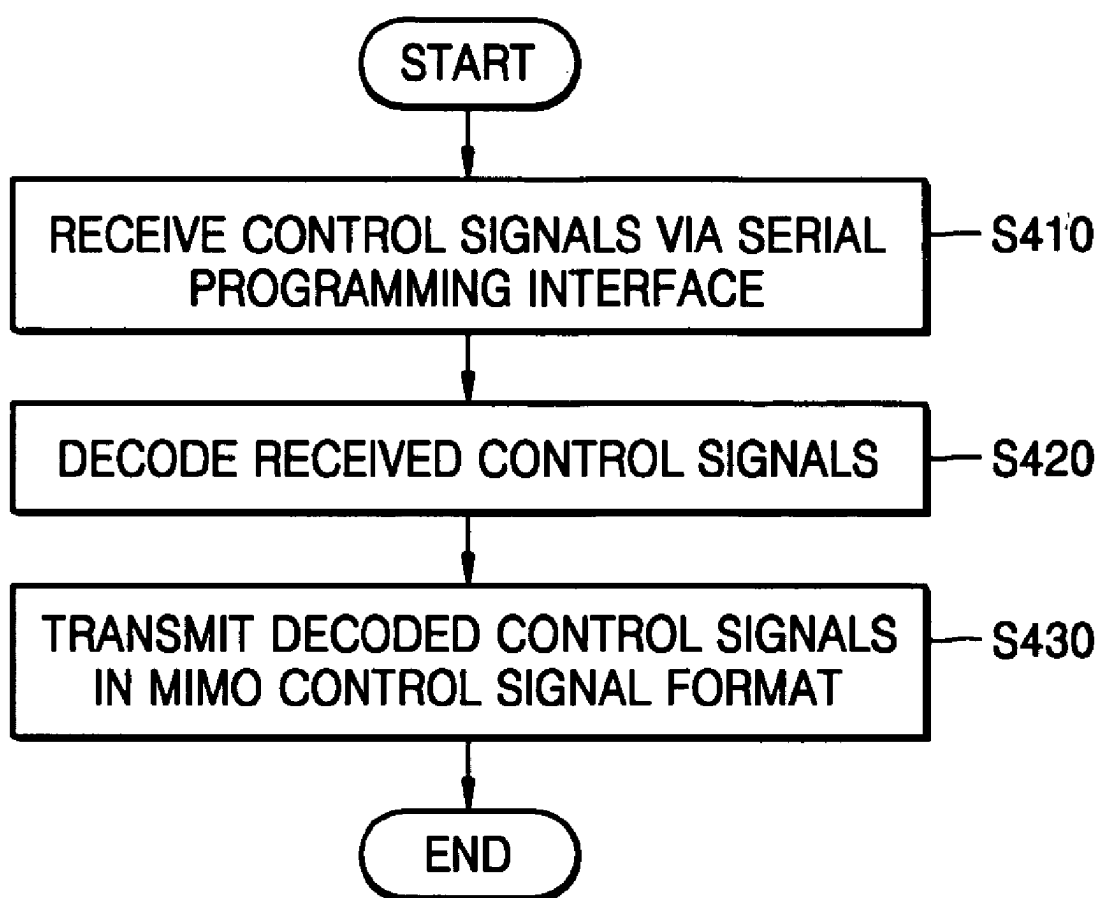
END

METHOD AND APPARATUS FOR CONTROLLING MIMO SYSTEM USING SINGLE SERIAL PROGRAMMING INTERFACE

BACKGROUND OF THE INVENTION

[0001]   This application claims the benefit of Korean Patent Application No. 10-2004-0112240, filed on Dec. 24, 2004, in the Korean Intellectual Property Office, the disclosure of which is incorporated herein in its entirety by reference.

[0002]   1. Field of the Invention

[0003]   The present invention relates to a multi-input multi-output (MIMO) system, and more particularly, to a method and apparatus for controlling each radio frequency (RF) block of a MIMO RF transceiver, which is used in wireless communications, using a single serial programming interface (SPI).

[0004]   2. Description of the Related Art

[0005]   The commercialization of wireless communications has enabled wireless transmissions of multimedia data as well as audio data. Since multimedia data is much larger than audio data, the transmission of multimedia data in real time requires a transceiver to have a sufficiently high effective data throughput. In order to improve effective data throughputs, multi-input multi-output (MIMO) radio frequency (RF) systems have been developed.

[0006]   A conventional MIMO RF system includes a plurality of RF blocks respectively corresponding to pairs of input and output ports. Each of the RF blocks includes a serial programming interface (SPI) and thus is controllable by an external central processing unit (CPU) or a controller using the SPI.

[0007]   In order to control the RF blocks, however, even the same command should be separately transmitted to all of the RF blocks via the respective SPIs. Thus, the conventional MIMO RF system unnecessarily occupies a large area and has a considerable number of signal lines.

SUMMARY OF THE INVENTION

[0008]   The present invention provides a method and apparatus for controlling a multi-input multi-output (MIMO) system using a single serial programming interface (SPI), into which a plurality of SPIs for controlling a plurality of radio frequency (RF) blocks of the MIMO system are integrated. The method and apparatus can control all of the RF blocks at the same time or can separately control the RF blocks from one another using the single SPI.

[0009]   According to an aspect of the present invention, there is provided a multi-input multi-output (MIMO) system. The MIMO system includes: a MIMO transceiver, which comprises one or more input and output units and a serial interface conversion unit controlling the input and output units; and a controller, which controls the MIMO transceiver. The serial interface conversion unit receives control data from the controller via a serial programming interface (SPI), decodes the received control data to have a format appropriate for controlling the input and output units,

[0010]   The format into which the serial interface conversion unit decodes the control data received from the controller, may include: a data field, which contains data necessary for controlling the input and output units; an address field, which contains a plurality of addresses allotted to a plurality of registers for controlling the input and output units; a device identification (ID) field, which identifies the input and output units; and a read or write (R/W) flag, which specifies whether the MIMO transceiver is in a read mode or in a write mode.

[0011]   The device ID field may be comprised of as many bits as there are input and output units in the MIMO transceiver, the bits may respectively correspond to the input and output units of the MIMO transceiver, and thus, if the bits of the device ID field are activated, data may be transmitted to the respective input and output units.

[0012]   According to another aspect of the present invention, there is provided a method of controlling a MIMO system having one or more input and output units. The method includes: receiving control data via a serial programming interface (SPI); and decoding the received control data to have a format appropriate for controlling the input and output units.

[0013]   According to another aspect of the present invention, there is provided a data storage medium storing a format of control data used for controlling a plurality of input and output units of a MIMO system. The control data format includes: a data field, which contains data necessary for controlling the input and output units; an address field, which contains a plurality of addresses allotted to a plurality of registers for controlling the input and output units; a device identification (ID) field, which identifies the input and output units; and a read or write (R/W) flag, which specifies whether the MIMO system is in a read mode or in a write mode.

[0014]   The device ID field may be comprised of as many bits as there are input and output units in the MIMO system, the bits may respectively correspond to the input and output units of the MIMO system, and thus, if the bits of the device ID field are activated, data may be transmitted to the respective input and output units.

[0015]   The input and output units may be radio frequency (RF) blocks, and the MIMO system may be an RF transceiver having a plurality of RF blocks.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016]   The above and other features and advantages of the present invention will become more apparent by describing in detail exemplary embodiments thereof with reference to the attached drawings in which:

[0017]   FIG. 1 is a block diagram of a multi-input multi-output (MIMO) radio frequency (RF) transceiver having a single serial programming interface (SPI) unit, according to an exemplary embodiment of the present invention;

[0018]   FIG. 2 is a diagram illustrating the format of serial data used for controlling a plurality of RF blocks of the MIMO RF transceiver of FIG. 1;

[0019]   FIG. 3 is a timing diagram illustrating serial inter-

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