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(54) **HIGH SPEED DOWNLINK PACKET ACCESS CO-PROCESSOR FOR UPGRADING THE CAPABILITIES OF AN EXISTING MODEM HOST**

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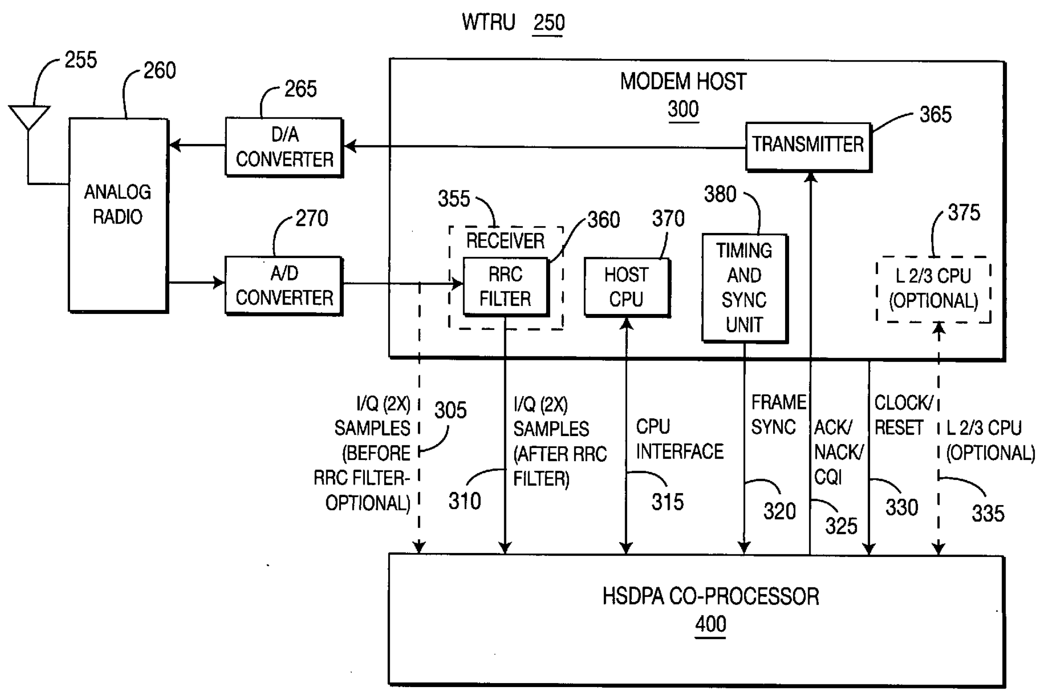
(52) **U.S. Cl.** **370/335**; 370/437

(57) **ABSTRACT**

A wireless transmit/receive unit (WTRU) for processing code division multiple access (CDMA) signals. The WTRU includes a modem host and a high speed downlink packet access (HSDPA) co-processor, which communicate over a plurality of customizable interfaces. The modem host operates in accordance with third generation partnership project (3GPP) Release 4 (R4) standards, and the HSDPA co-processor enhances the wireless communication capabilities of the WTRU as a whole such that the WTRU operates in accordance with 3GPP Release 5 (R5) standards.



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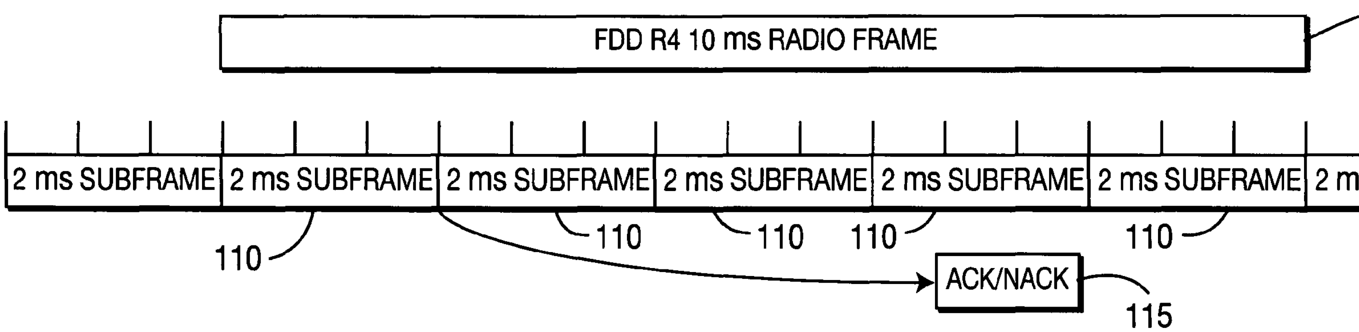

FIG. 1

205 210 215 220 225

CATEGORY	CODES	DATA RATE	BITS/SUBFRAME	CODE BLOCKS
CAT 6	5	3.6 Mbps	7298	2
CAT 8	10	7.2 Mbps	14411	3
CAT 9	15	10 Mbps	20251	4
CAT 10	15	14 Mbps	27952	6

FIG. 2

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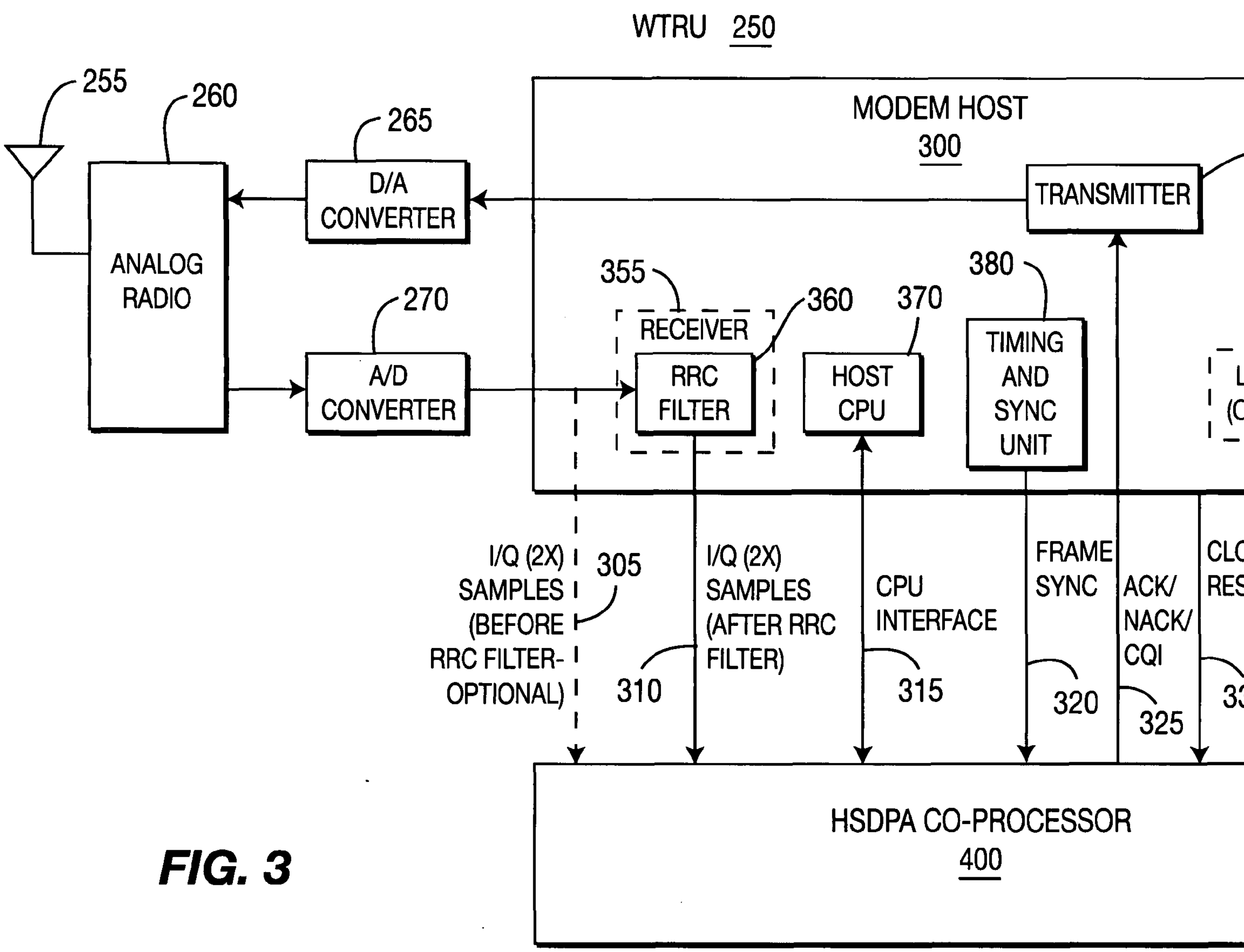

FIG. 3

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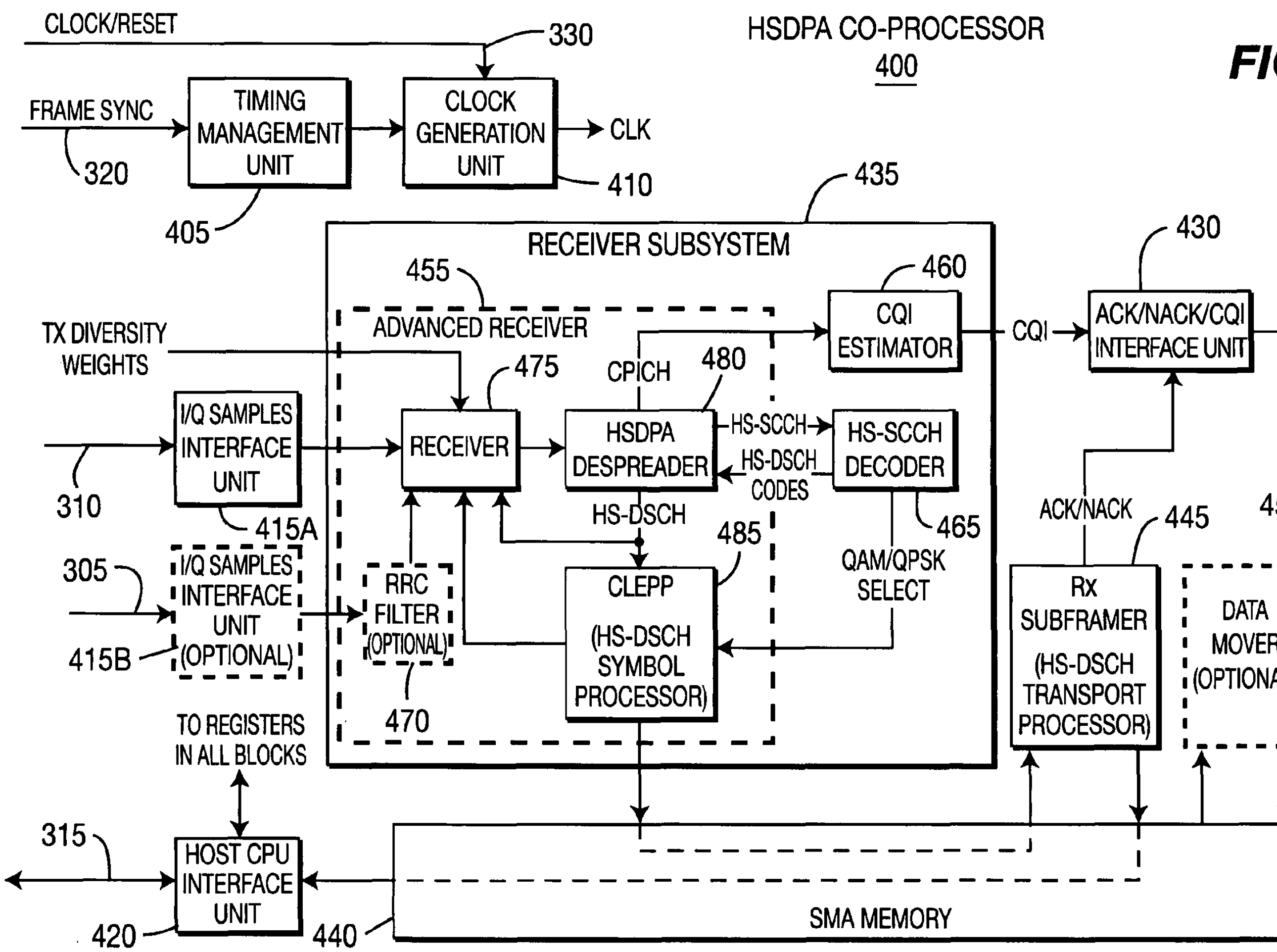

FIG

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HIGH SPEED DOWNLINK PACKET ACCESS CO-PROCESSOR FOR UPGRADING THE CAPABILITIES OF AN EXISTING MODEM HOST

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of U.S. Provisional Application No. 60/591,005 filed Jul. 26, 2004, which is incorporated by reference as if fully set forth.

FIELD OF INVENTION

[0002] The present invention relates to the field of wireless communications. More particularly, the present invention relates to a wireless transmit/receive unit (WTRU) including a high speed downlink packet access (HSDPA) co-processor which operates in conjunction with a host chip, such as a modem host in a universal mobile telecommunication system (UMTS) frequency division duplex (FDD) baseband integrated circuit (IC) chip or a dual mode global system for mobile communications (GSM)/general packet radio service (GPRS)/enhanced data rate for GSM evolution (EDGE)/UMTS or GSM/GPRS/UMTS.

BACKGROUND

[0003] HSDPA is a packet-based data service in the UMTS wideband code division multiple access (WCDMA) downlink with a data transmission rate of up to 14 Mbps, over a 5 MHz bandwidth. HSDPA implementations include adaptive modulation and coding (AMC), hybrid automatic repeat request (H-ARQ) and advanced receiver design.

[0004] Third Generation Partnership Project (3GPP) specifications are continually being enhanced with new features, designated with parallel "releases." Release 5 (R5) specifications add HSDPA to provide data rates up to approximately 14 Mbps to support packet-based services, (e.g., multimedia, web-browsing, or the like).

[0005] HSDPA is part of FDD R5 and adds some new procedures and physical channels. There are some functions that are normally in the layer 2/3 (L 2/3) protocol stack that have to move down to the physical layer because of latency and timing concerns. There are some stringent timing requirements. For example, there is a positive acknowledgement (ACK)/negative acknowledgement (NACK) signal with a specific transmit time relative to the received data that requires a low latency design.

[0006] FDD R5 demands a significant increase in memory requirements primarily because of the volume of data that is being moved around. There are increased signal processing requirements to support quadrature phase shift keying (QPSK), 16 quadrature amplitude modulation (QAM) signaling, and increased bandwidth of the interfaces. Most R4 implementations have been configured to work at approximately 384 Kilobits per second or less. Therefore, to support HSDPA more memory, increased signal processing, and faster interfaces are required. Further, most R4 implementations use a Rake-type receiver. The performance of a Rake receiver (i.e., bit error rate, symbol error rate, and/or net data throughput) can be poor for HSDPA, particularly for the higher categories and higher peak data rates. Hence an improved or advanced receiver is desirable.

SUMMARY

[0007] The present invention is a WTRU (or IC) for processing code division multiple access (CDMA) signals. The WTRU includes a modem host and an HSDPA co-processor, which communicate over a plurality of customizable interfaces. The modem host operates in accordance with 3GPP R4 standards, and the HSDPA co-processor enhances the wireless communication capabilities of the WTRU such that the WTRU operates in accordance with 3GPP R5 standards.

[0008] The HSDPA co-processor operates in conjunction with a host chip, such as a modem host in a UMTS FDD baseband IC chip or a dual mode GSM/GPRS/EDGE/UMTS or GSM/GPRS/UMTS IC.

BRIEF DESCRIPTION OF THE DRAWING

[0009] A more detailed understanding of the invention may be had from the following description of a preferred embodiment, given by way of example and to be understood in conjunction with the accompanying drawing wherein:

[0010] **FIG. 1** illustrates the difference between 3GPP R4 and R5 from a radio frame perspective;

[0011] **FIG. 2** illustrates a few of the different categories that are defined within the standards;

[0012] **FIG. 3** is a high level block diagram of a WTRU including an R4 modem host and an HSDPA co-processor that enhances the WTRU such that it exhibits R5 capabilities in accordance with the present invention; and

[0013] **FIG. 4** is a detailed block diagram of the HSDPA co-processor used in the WTRU of **FIG. 3**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0014] Hereafter, the terminology "WTRU" includes but is not limited to a user equipment (UE), a mobile station, a fixed or mobile subscriber unit, a pager, or any other type of device capable of operating in a wireless environment. When referred to hereafter, the terminology "Node-B" includes but is not limited to a base station, a site controller, an access point or any other type of interfacing device in a wireless environment.

[0015] The features of the present invention may be incorporated into at least one IC or be configured in a circuit comprising a multitude of interconnecting components.

[0016] **FIG. 1** illustrates the difference between R4 and R5 from a radio frame perspective used for communication between a base station and a WTRU. The FDD R4 traditionally has a ten millisecond (10 ms) radio frame **105**. For HSDPA, the radio frame is broken down into five two-millisecond (2 ms) subframes **110**. Each subframe **110** is essentially its own little HSDPA transaction. In HSDPA, every time the base station sends a subframe **110** to a WTRU, it expects a response in the form of an ACK/NACK **115** and some CQI information that must be transmitted seven and one-half (7.5) timeslots after the data has arrived at the WTRU.

[0017] During each 2 ms subframe **110** in which a WTRU is scheduled to receive data, the data must be received, decoded, checked for integrity, and an ACK/NACK sent back to the base station in the substantially short period of 7.5 timeslots.

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