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(54) **METHOD AND APPARATUS THAT FACILITATES A TIMING ALIGNMENT IN A MULTICARRIER SYSTEM**

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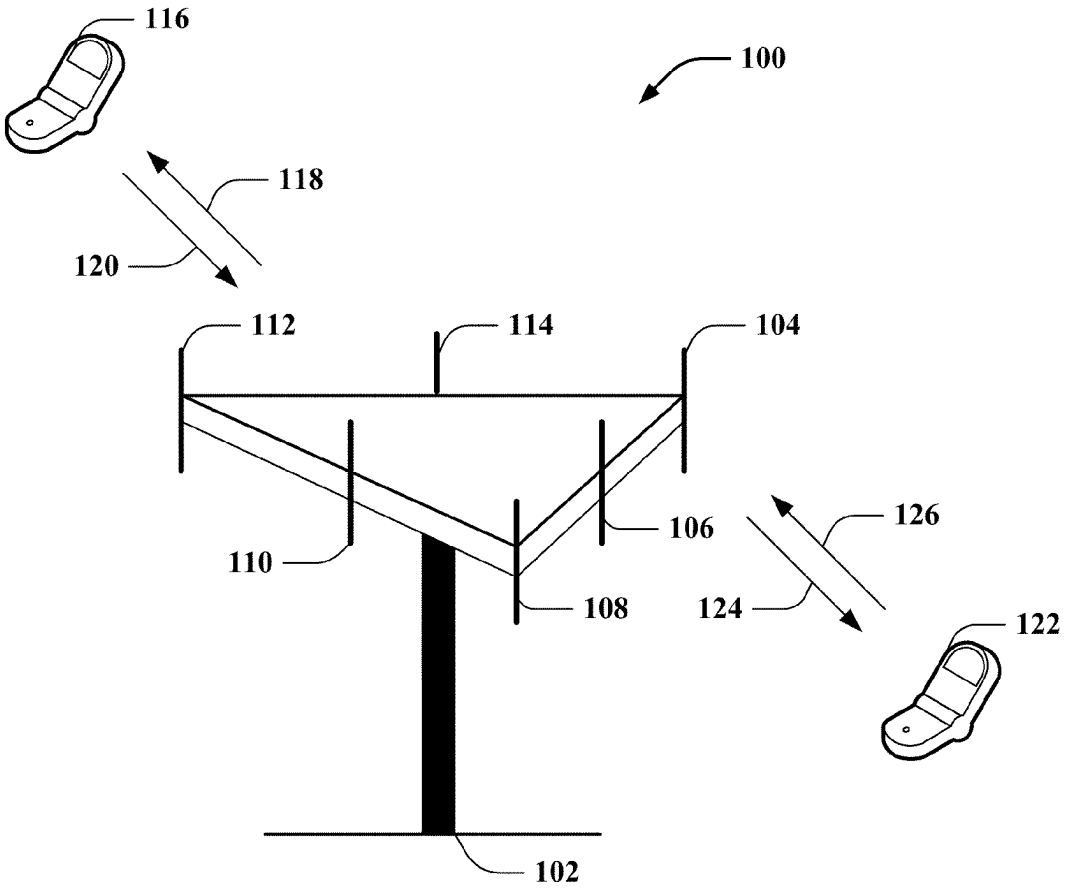
(52) **U.S. Cl.** **370/252**; 370/350; 370/336

(57) **ABSTRACT**

Aspects are disclosed for facilitating a timing alignment in a multicarrier system. In one aspect, at least one downlink timing associated with at least one downlink carrier is determined, and an uplink timing associated with an uplink group of carriers is ascertained based on at least one downlink timing and a timing offset associated with the uplink group of carriers. Each of the uplink group of carriers is then transmitted within a threshold value of the uplink timing. In another aspect, a downlink communication is transmitted to a wireless terminal via at least one downlink carrier. This embodiment further includes assigning a timing offset to an uplink group of carriers, and providing the timing offset to the wireless terminal via the at least one downlink carrier. An uplink communication is then received via the uplink group of carriers according to the timing offset.



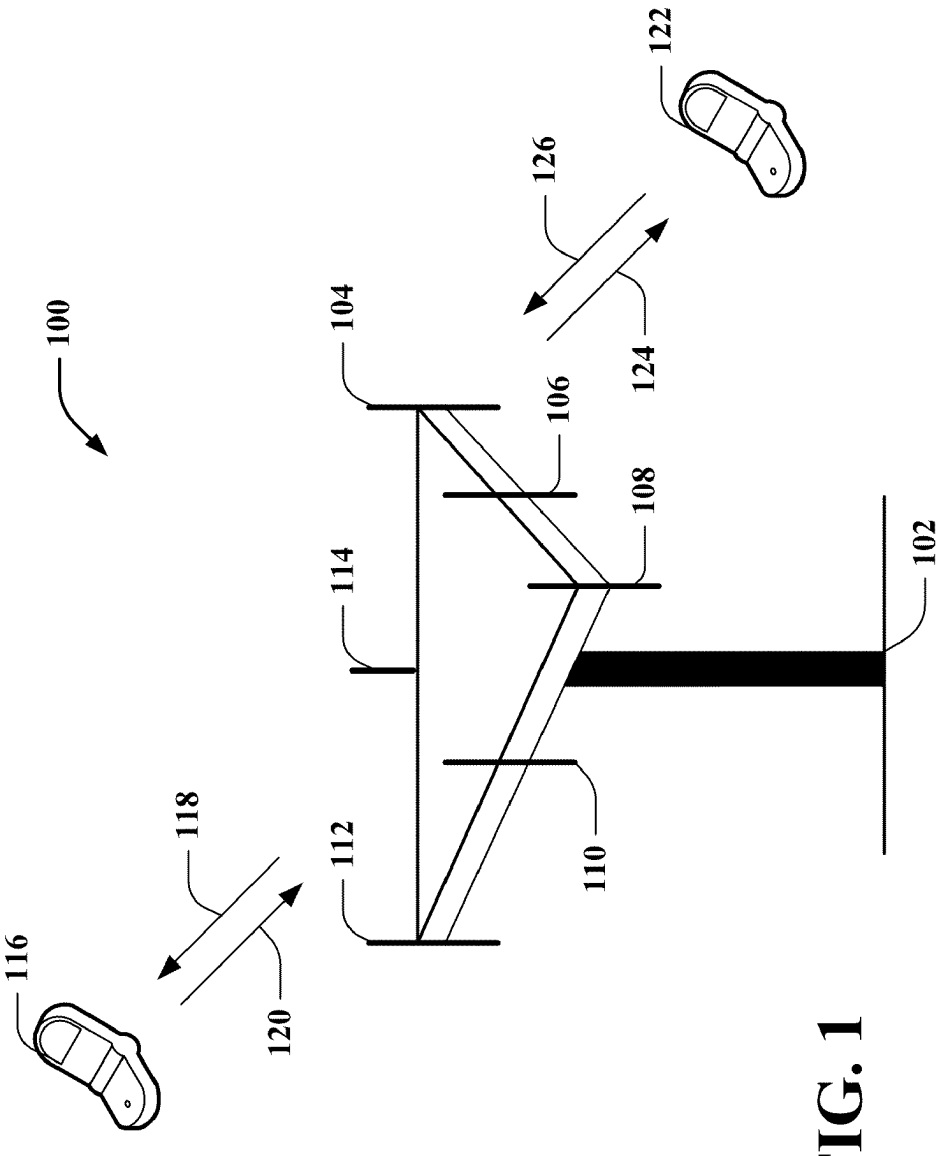


FIG. 1

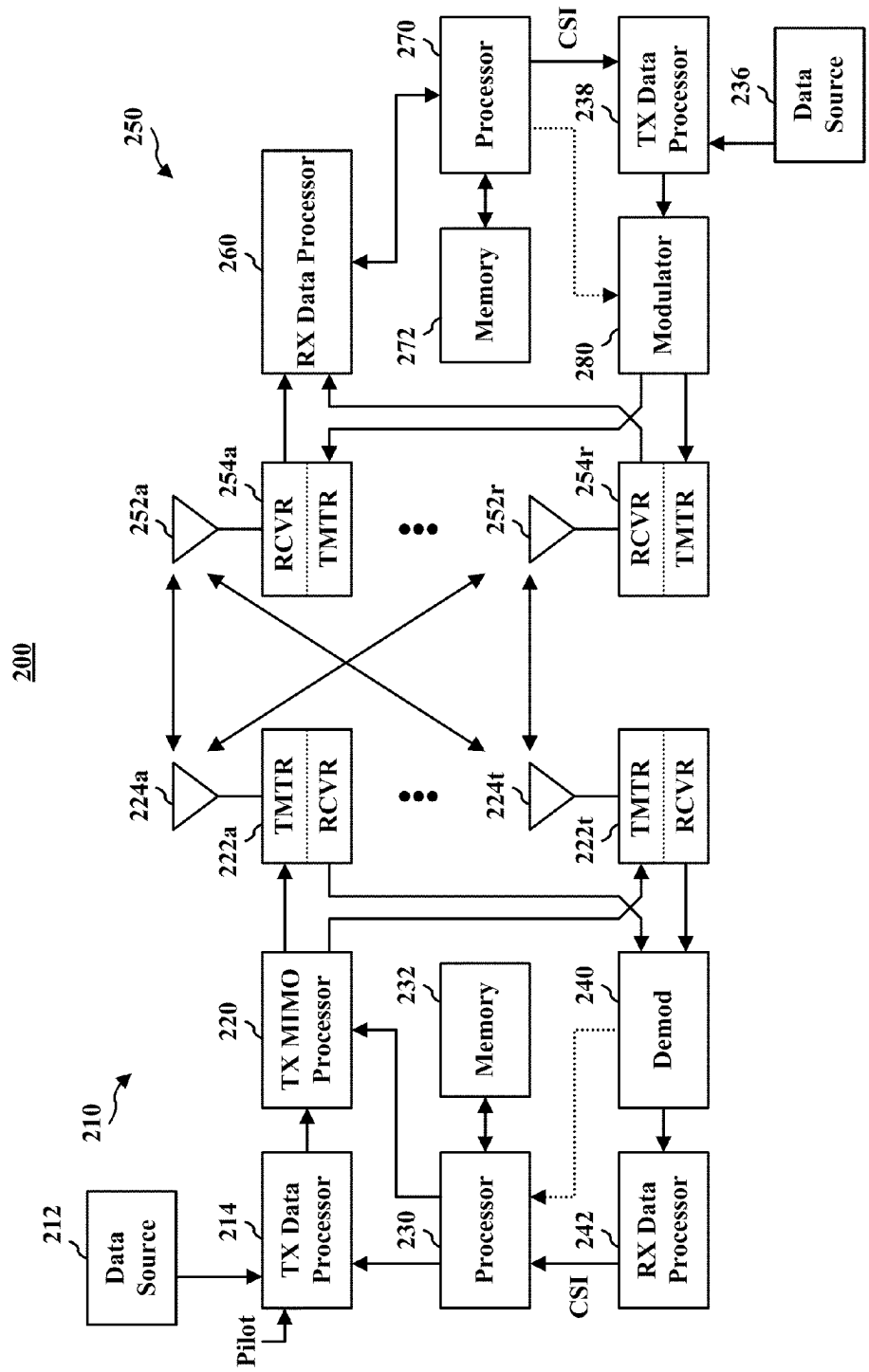

200
210
212
Data Source
214
TX Data Processor
Pilot
220
TX MIMO Processor
222a
TMTR
RCVR
224a
252a
254a
RCVR
TMTR
230
Processor
232
Memory
240
Demod
242
RX Data Processor
CSI
250
260
RX Data Processor
270
Processor
272
Memory
280
Modulator
238
CSI
TX Data Processor
236
Data Source
252r
254r
RCVR
TMTR
224t
222t
TMTR
RCVR

FIG. 2

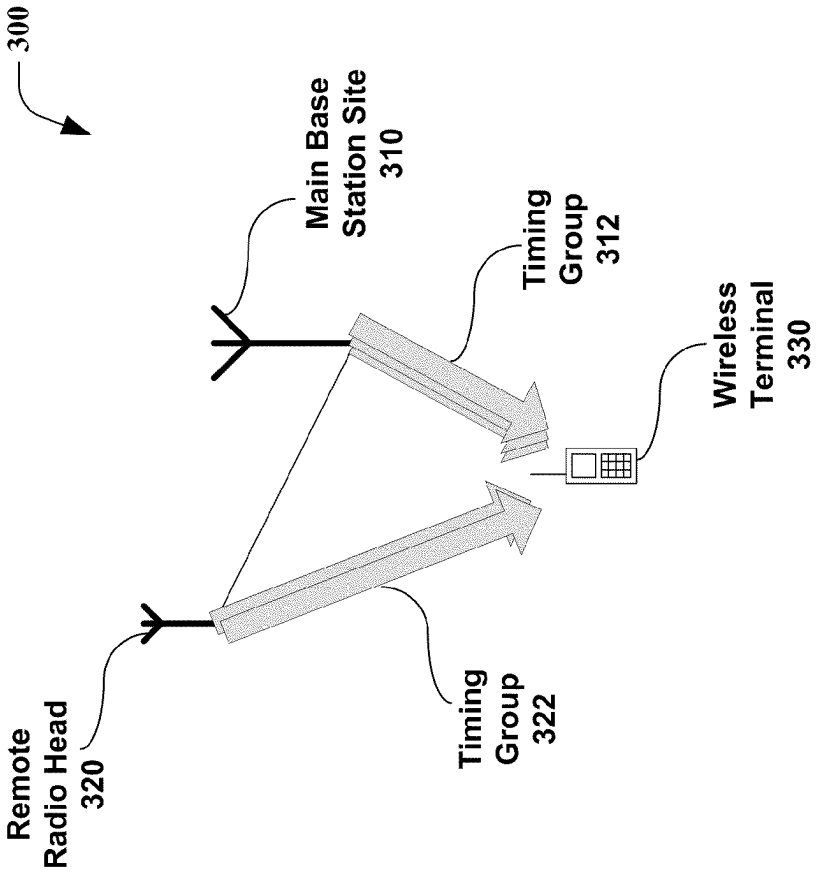

300
Main Base Station Site 310
Timing Group 312
Wireless Terminal 330
Remote Radio Head 320
Timing Group 322

FIG. 3

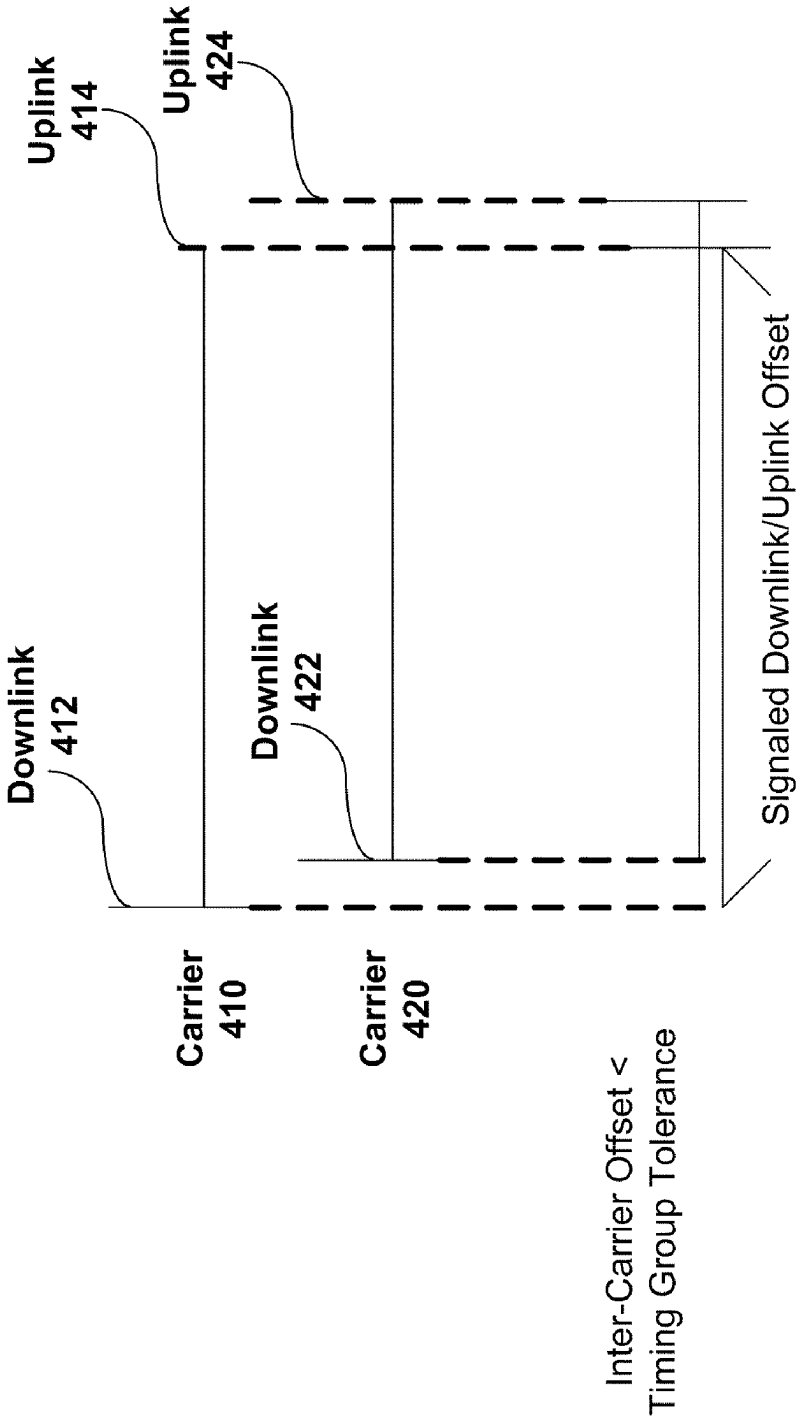

Uplink 414
Uplink 424
Downlink 412
Downlink 422
Signaled Downlink/Uplink Offset
Carrier 410
Carrier 420
Inter-Carrier Offset < Timing Group Tolerance

FIG. 4

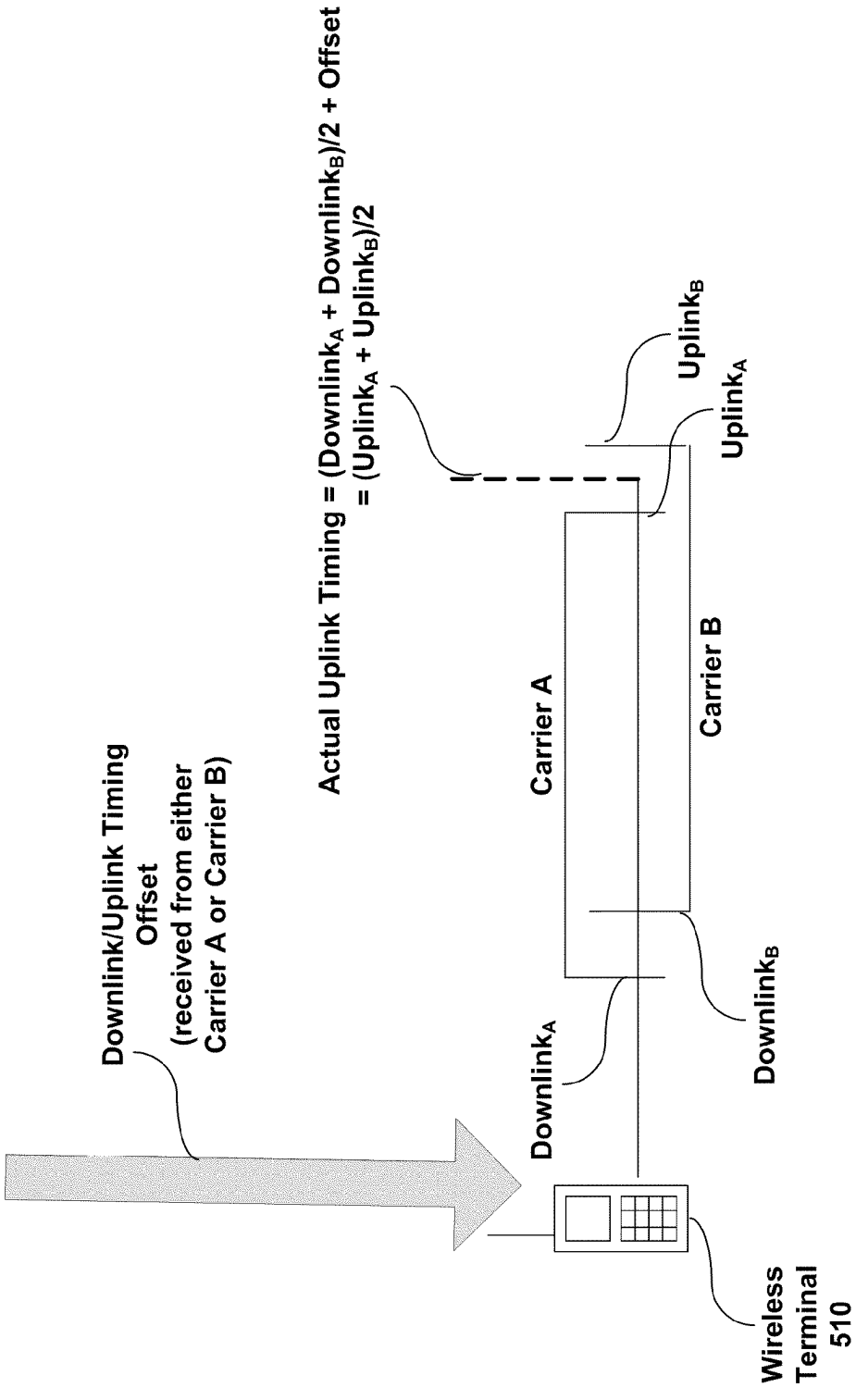
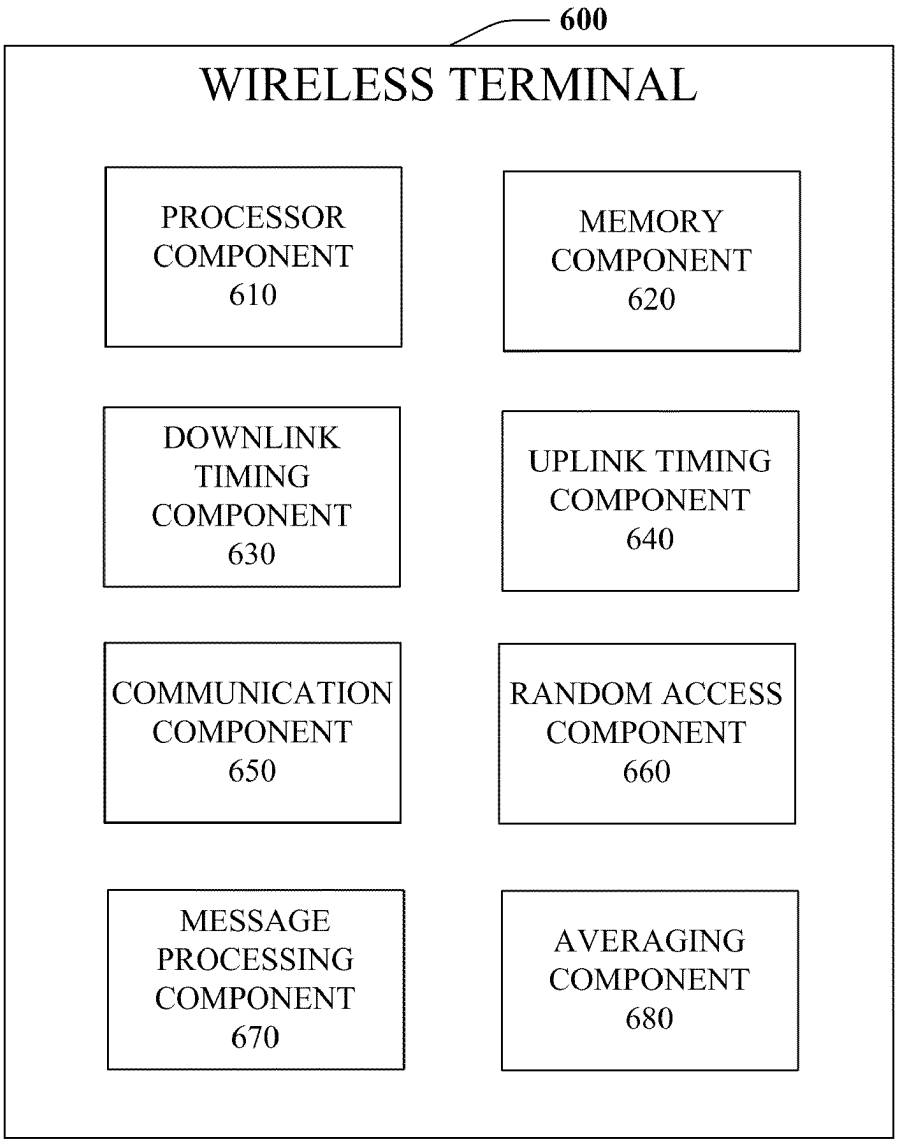

Downlink/Uplink Timing Offset (received from either Carrier A or Carrier B)
Actual Uplink Timing = (Downlink$_A$ + Downlink$_B$)/2 + Offset = (Uplink$_A$ + Uplink$_B$)/2
Carrier A
Carrier B
Downlink$_A$
Downlink$_B$
Uplink$_A$
Uplink$_B$
Wireless Terminal 510

FIG. 5

FIG. 6


600
WIRELESS TERMINAL
PROCESSOR COMPONENT 610
MEMORY COMPONENT 620
DOWNLINK TIMING COMPONENT 630
UPLINK TIMING COMPONENT 640
COMMUNICATION COMPONENT 650
RANDOM ACCESS COMPONENT 660
MESSAGE PROCESSING COMPONENT 670
AVERAGING COMPONENT 680

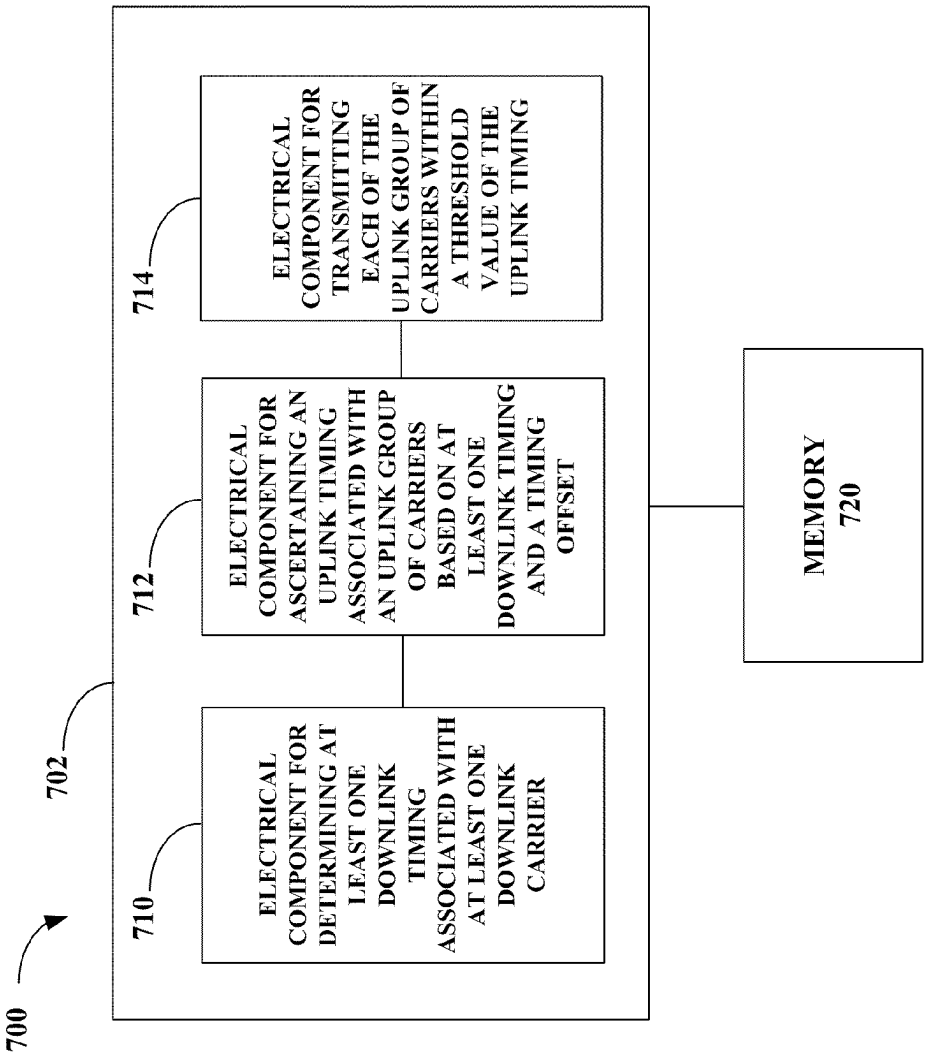

700
702
710
ELECTRICAL COMPONENT FOR DETERMINING AT LEAST ONE DOWNLINK TIMING ASSOCIATED WITH AT LEAST ONE DOWNLINK CARRIER
712
ELECTRICAL COMPONENT FOR ASCERTAINING AN UPLINK TIMING ASSOCIATED WITH AN UPLINK GROUP OF CARRIERS BASED ON AT LEAST ONE DOWNLINK TIMING AND A TIMING OFFSET
714
ELECTRICAL COMPONENT FOR TRANSMITTING EACH OF THE UPLINK GROUP OF CARRIERS WITHIN A THRESHOLD VALUE OF THE UPLINK TIMING
MEMORY 720

FIG. 7

FIG. 8

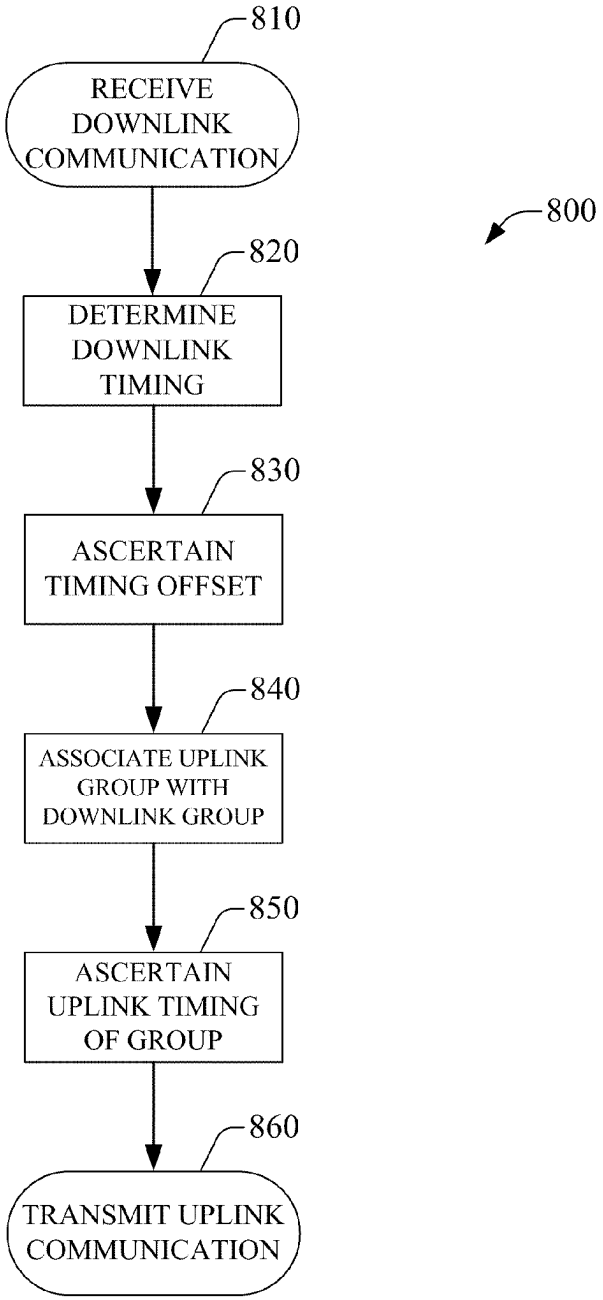
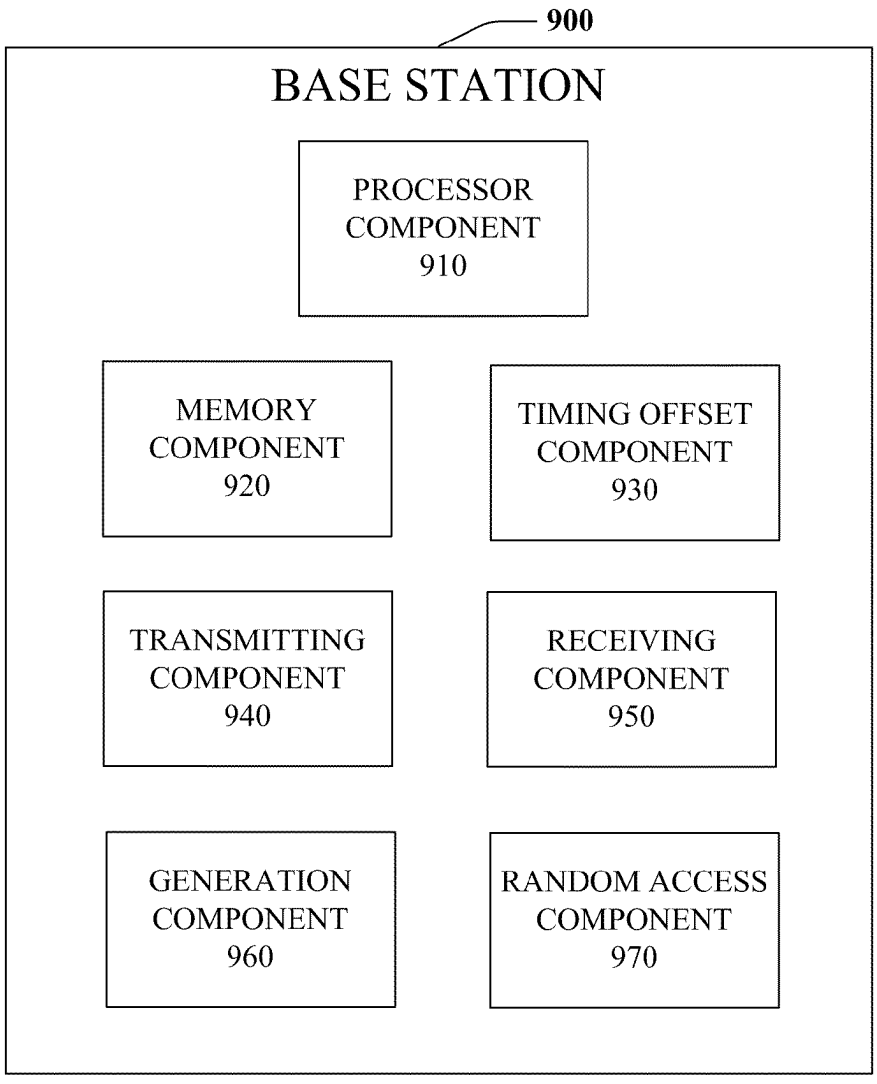

810
RECEIVE DOWNLINK COMMUNICATION
800
820
DETERMINE DOWNLINK TIMING
830
ASCERTAIN TIMING OFFSET
840
ASSOCIATE UPLINK GROUP WITH DOWNLINK GROUP
850
ASCERTAIN UPLINK TIMING OF GROUP
860
TRANSMIT UPLINK COMMUNICATION

FIG. 9


900
BASE STATION
PROCESSOR COMPONENT 910
MEMORY COMPONENT 920
TIMING OFFSET COMPONENT 930
TRANSMITTING COMPONENT 940
RECEIVING COMPONENT 950
GENERATION COMPONENT 960
RANDOM ACCESS COMPONENT 970

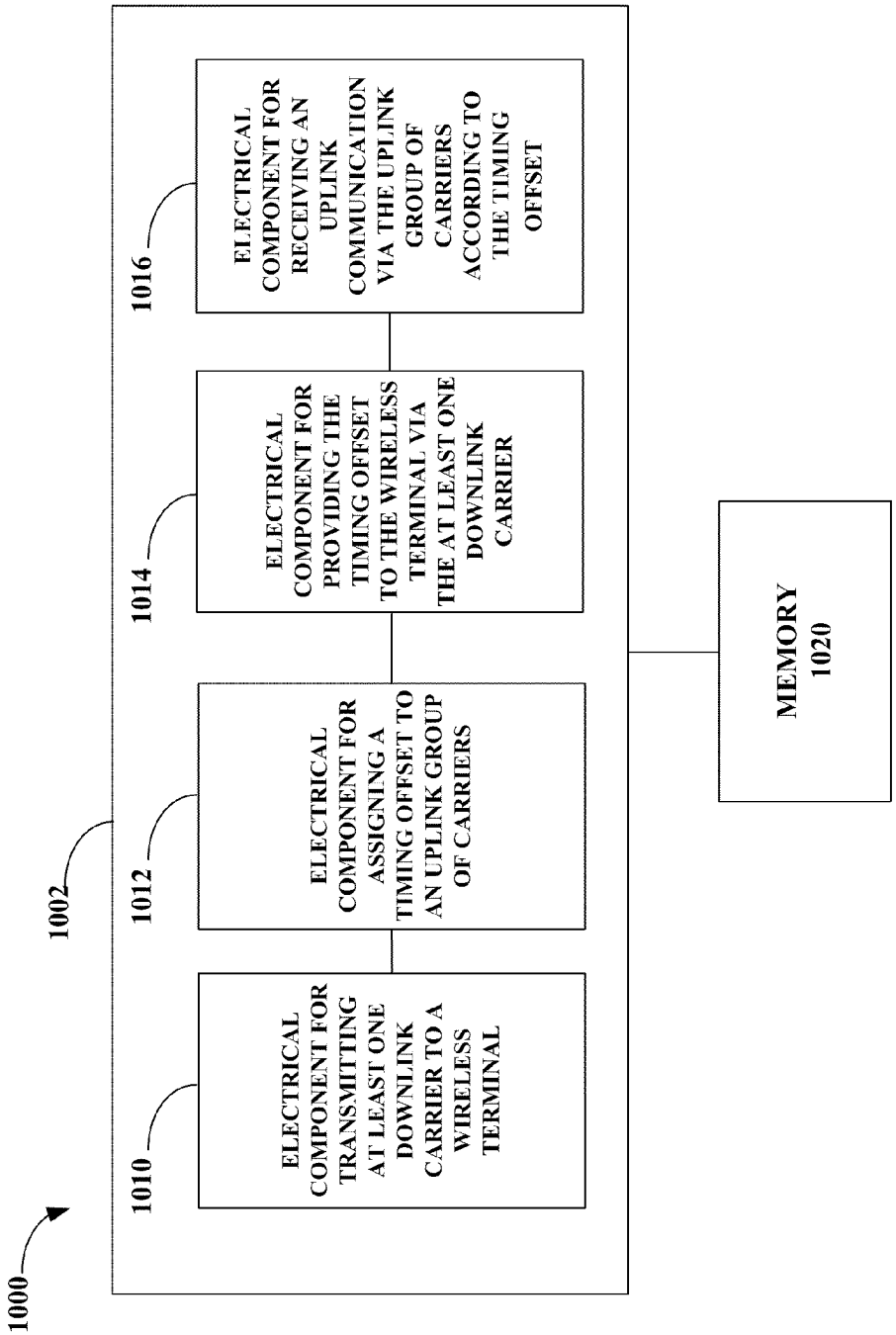
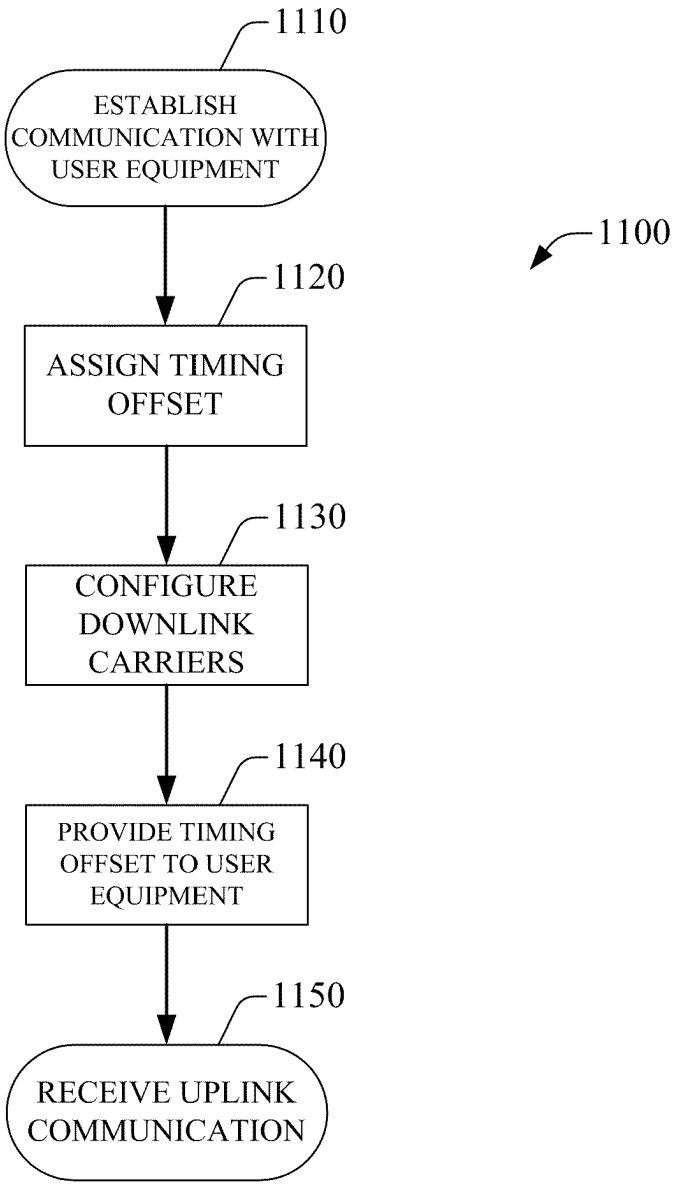

1000
1002
1010
ELECTRICAL COMPONENT FOR TRANSMITTING AT LEAST ONE DOWNLINK CARRIER TO A WIRELESS TERMINAL
1012
ELECTRICAL COMPONENT FOR ASSIGNING A TIMING OFFSET TO AN UPLINK GROUP OF CARRIERS
1014
ELECTRICAL COMPONENT FOR PROVIDING THE TIMING OFFSET TO THE WIRELESS TERMINAL VIA THE AT LEAST ONE DOWNLINK CARRIER
1016
ELECTRICAL COMPONENT FOR RECEIVING AN UPLINK COMMUNICATION VIA THE UPLINK GROUP OF CARRIERS ACCORDING TO THE TIMING OFFSET
MEMORY
1020

FIG. 10

FIG. 11


1110
ESTABLISH COMMUNICATION WITH USER EQUIPMENT
1100
1120
ASSIGN TIMING OFFSET
1130
CONFIGURE DOWNLINK CARRIERS
1140
PROVIDE TIMING OFFSET TO USER EQUIPMENT
1150
RECEIVE UPLINK COMMUNICATION

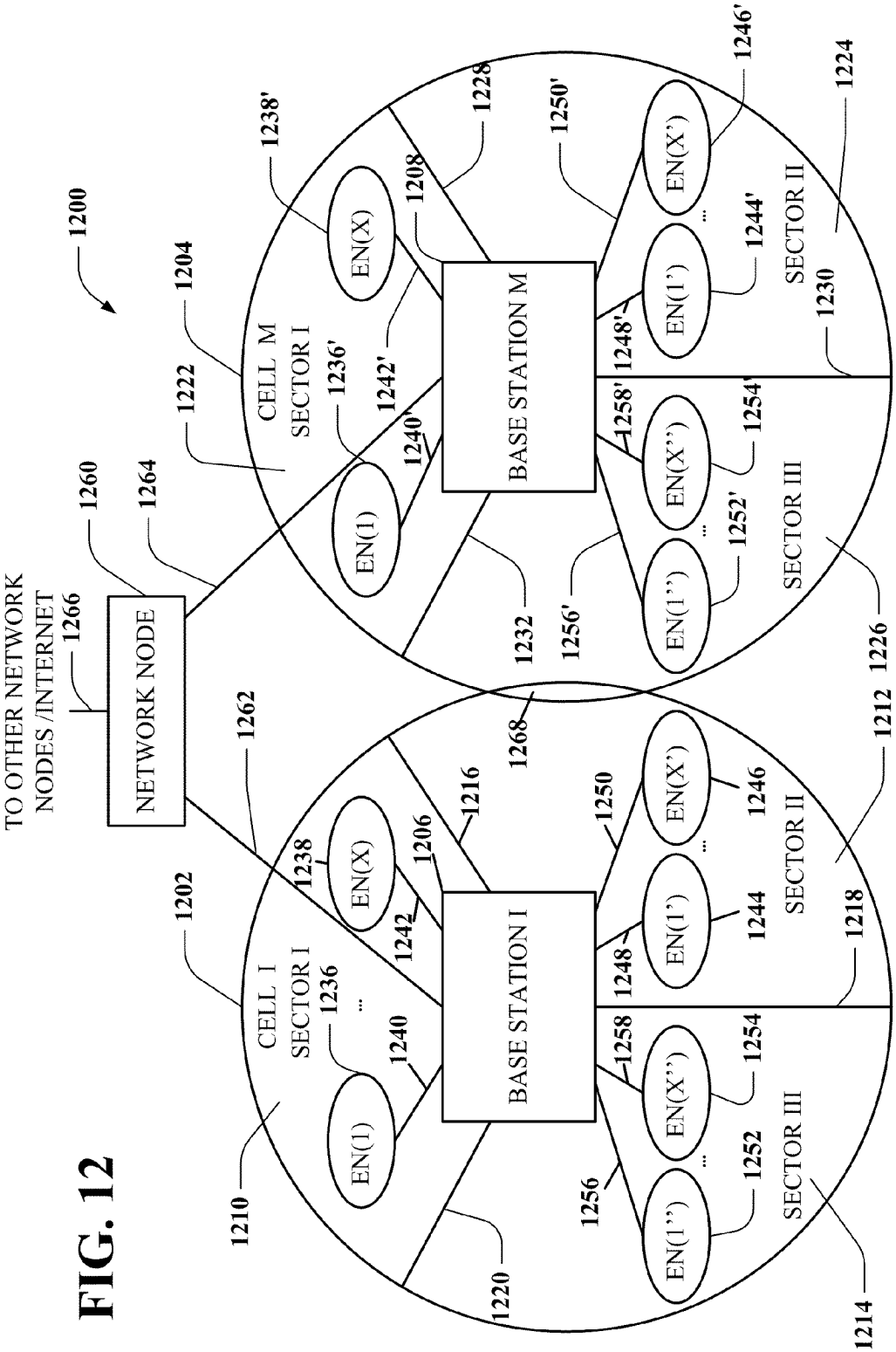

1200
TO OTHER NETWORK NODES /INTERNET
1266
NETWORK NODE
1260
1264
1262
1202
CELL I
SECTOR I
1236
1238
EN(1)
EN(X)
1240
1242
1206
1216
BASE STATION I
1248
1258
1254
1252
1244
1246
1250
EN(1'')
EN(X'')
EN(1')
EN(X')
SECTOR III
SECTOR II
1210
1220
1256
1214
1218
1212
1226
1268
1232
1256'
1222
1204
CELL M
SECTOR I
1236'
1238'
1240'
1242'
1208
1228
BASE STATION M
1248'
1258'
1254'
1252'
1244'
1246'
1250'
SECTOR III
SECTOR II
1230
1224

FIG. 12

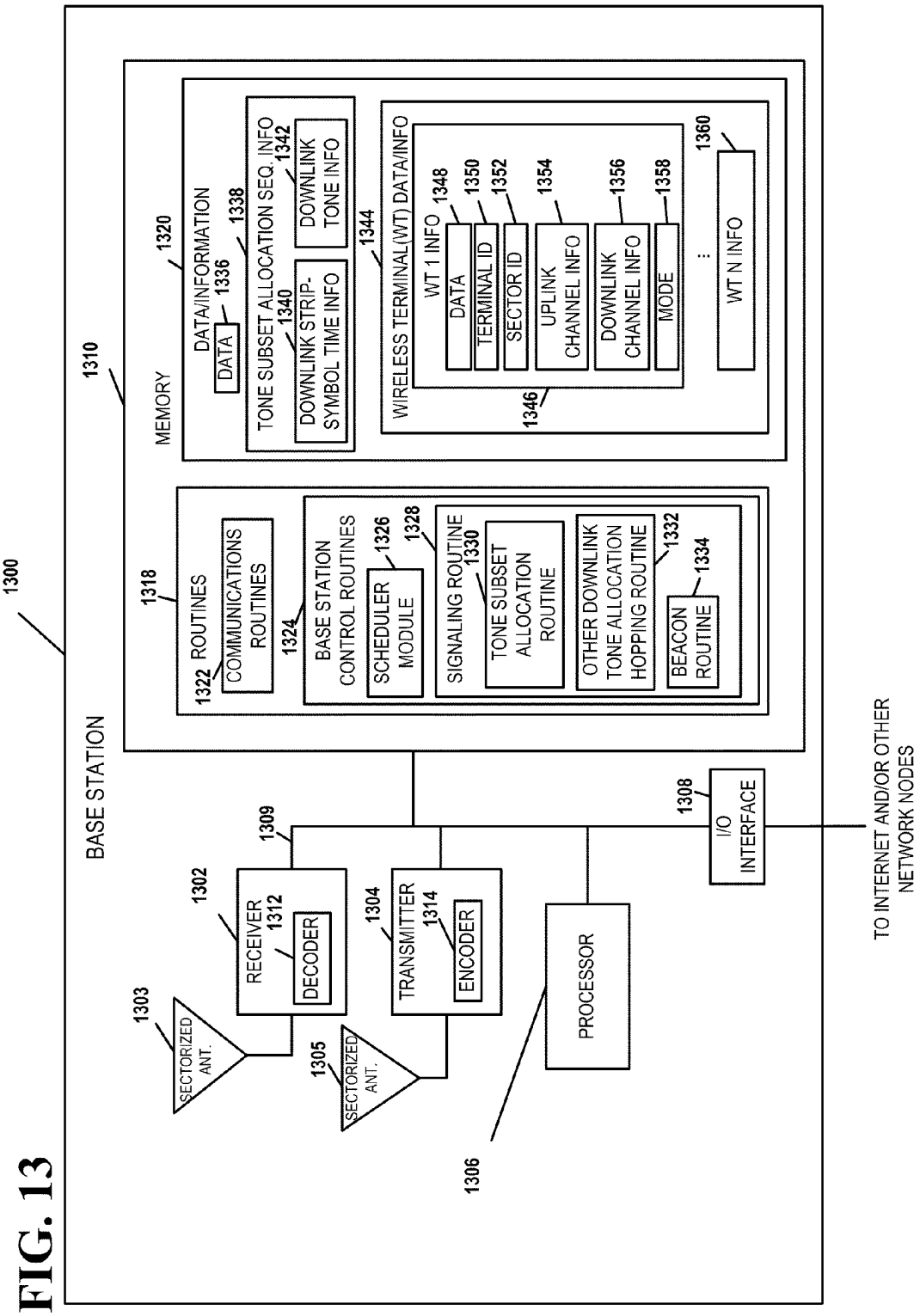
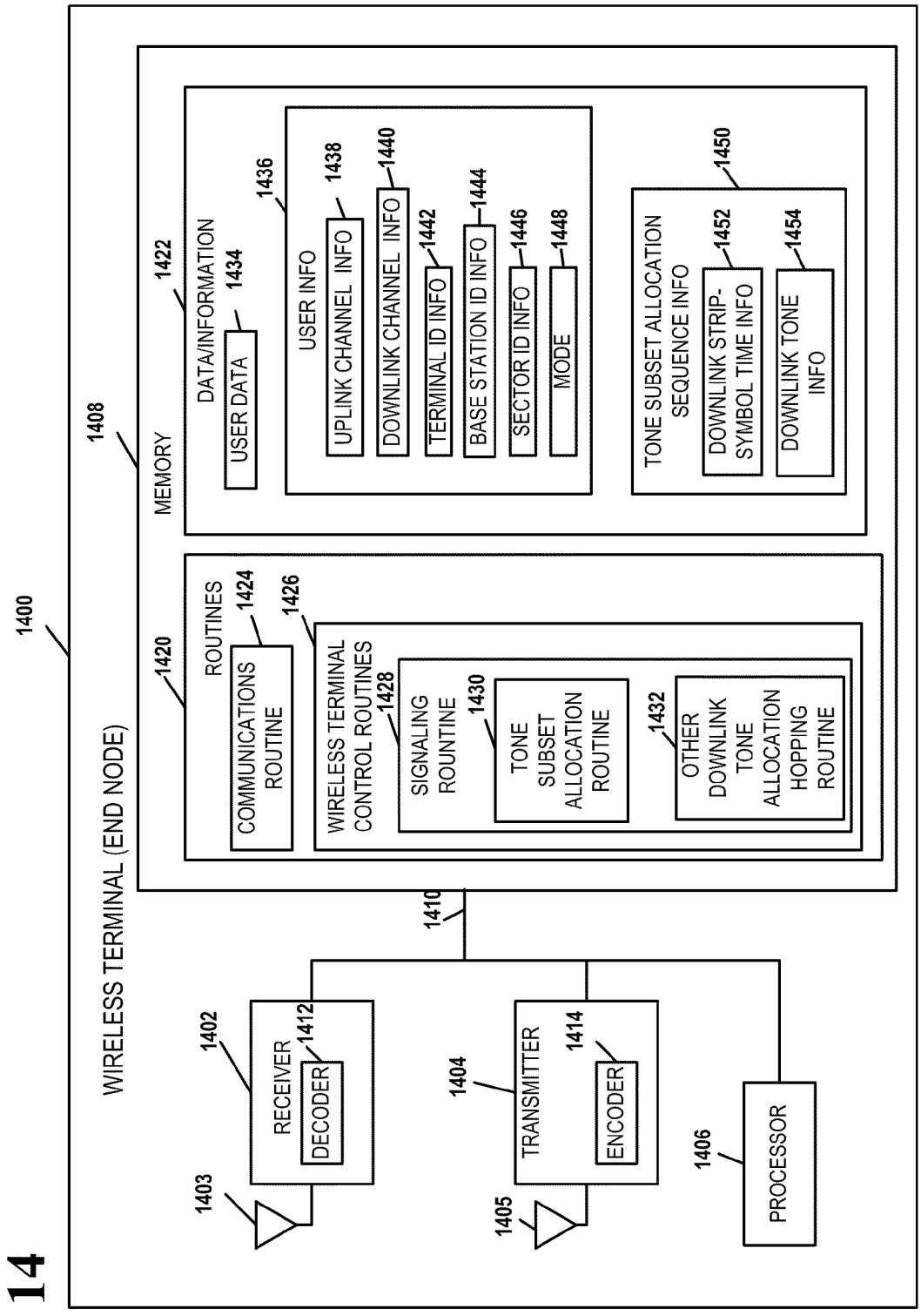

1300
BASE STATION
1310
MEMORY
1318
ROUTINES
1322
COMMUNICATIONS ROUTINES
1324
BASE STATION CONTROL ROUTINES
1326
SCHEDULER MODULE
1328
SIGNALING ROUTINE
1330
TONE SUBSET ALLOCATION ROUTINE
1332
OTHER DOWNLINK TONE ALLOCATION HOPPING ROUTINE
1334
BEACON ROUTINE
1320
DATA/INFORMATION
1336
DATA
1338
TONE SUBSET ALLOCATION SEQ. INFO
1340
DOWNLINK STRIP-SYMBOL TIME INFO
1342
DOWNLINK TONE INFO
1344
WIRELESS TERMINAL(WT) DATA/INFO
1346
WT 1 INFO
1348
DATA
1350
TERMINAL ID
1352
SECTOR ID
1354
UPLINK CHANNEL INFO
1356
DOWNLINK CHANNEL INFO
1358
MODE
1360
WT N INFO
1309
1302
RECEIVER
1312
DECODER
1304
TRANSMITTER
1314
ENCODER
1303
SECTORIZED ANT.
1305
SECTORIZED ANT.
1306
PROCESSOR
1308
I/O INTERFACE
TO INTERNET AND/OR OTHER NETWORK NODES

FIG. 13

FIG. 14


1400
WIRELESS TERMINAL (END NODE)
1408
MEMORY
1422
DATA/INFORMATION
1434
USER DATA
1436
USER INFO
1438
UPLINK CHANNEL INFO
1440
DOWNLINK CHANNEL INFO
1442
TERMINAL ID INFO
1444
BASE STATION ID INFO
1446
SECTOR ID INFO
1448
MODE
1450
TONE SUBSET ALLOCATION SEQUENCE INFO
1452
DOWNLINK STRIP-SYMBOL TIME INFO
1454
DOWNLINK TONE INFO
1420
ROUTINES
1424
COMMUNICATIONS ROUTINE
1426
WIRELESS TERMINAL CONTROL ROUTINES
1428
SIGNALING ROUNTINE
1430
TONE SUBSET ALLOCATION ROUTINE
1432
OTHER DOWNLINK TONE ALLOCATION HOPPING ROUTINE
1410
1402
RECEIVER
1412
DECODER
1403
1404
TRANSMITTER
1414
ENCODER
1405
1406
PROCESSOR

METHOD AND APPARATUS THAT FACILITATES A TIMING ALIGNMENT IN A MULTICARRIER SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Patent Application Ser. No. 61/218,769 entitled "TIMING ALIGNMENT IN A MULTICARRIER SYSTEM," which was filed Jun. 19, 2009, U.S. Provisional Patent Application Ser. No. 61/294,053 entitled "TIMING ALIGNMENT IN A MULTICARRIER SYSTEM," which was filed Jan. 11, 2010, and U.S. Provisional Patent Application Ser. No. 61/305,014 entitled "TIMING ALIGNMENT IN A MULTICARRIER SYSTEM," which was filed Feb. 16, 2009. The aforementioned applications are herein incorporated by reference in their entirety.

BACKGROUND

[0002] I. Field

[0003] The following description relates generally to wireless communications, and more particularly to methods and apparatuses that facilitate maintaining timing synchronization for user equipment in a multicarrier Long Term Evolution-Advanced (LTE-A) system.

[0004] II. Background

[0005] Wireless communication systems are widely deployed to provide various types of communication content such as voice, data, and so on. These systems may be multiple-access systems capable of supporting communication with multiple users by sharing the available system resources (e.g., bandwidth and transmit power). Examples of such multiple-access systems include code division multiple access (CDMA) systems, time division multiple access (TDMA) systems, frequency division multiple access (FDMA) systems, 3GPP Long Term Evolution (LTE) systems, and orthogonal frequency division multiple access (OFDMA) systems.

[0006] Generally, a wireless multiple-access communication system can simultaneously support communication for multiple wireless terminals. Each terminal communicates with one or more base stations via transmissions on the forward and reverse links. The forward link (or downlink) refers to the communication link from the base stations to the terminals, and the reverse link (or uplink) refers to the communication link from the terminals to the base stations. This communication link may be established via a single-in-single-out, multiple-in-signal-out or a multiple-in-multiple-out (MIMO) system.

[0007] A MIMO system employs multiple (N_T) transmit antennas and multiple (N_R) receive antennas for data transmission. A MIMO channel formed by the N_T transmit and N_R receive antennas may be decomposed into N_S independent channels, which are also referred to as spatial channels, where $N_S \leq \min\{N_T, N_R\}$. Each of the N_S independent channels corresponds to a dimension. The MIMO system can provide improved performance (e.g., higher throughput and/or greater reliability) if the additional dimensionalities created by the multiple transmit and receive antennas are utilized.

[0008] A MIMO system supports a time division duplex (TDD) and frequency division duplex (FDD) systems. In a TDD system, the forward and reverse link transmissions are on the same frequency region so that the reciprocity principle allows the estimation of the forward link channel from the reverse link channel. This enables the access point to extract transmit beamforming gain on the forward link when multiple antennas are available at the access point.

[0009] With respect to timing synchronization in a single-carrier environment, it is noted that the maintenance of such timing synchronization for user equipment (UE) includes having the UE receive an uplink/downlink offset from the network, which occasionally needs to be updated, indicating how it should align its uplink transmissions in relation to the received downlink timing. In a multicarrier environment, however, the synchronization is more complex. Assuming that all carriers serving a single UE are transmitted from the same cell site, it appears that a common offset should be adequate. However, even co-sited carriers could experience some variation in timing for a number of reasons (e.g., cable delays, distance between the base station site and a remote radio head, etc.), which would make separate timing offsets per carrier beneficial or even necessary.

[0010] The above-described deficiencies of current wireless communication systems are merely intended to provide an overview of some of the problems of conventional systems, and are not intended to be exhaustive. Other problems with conventional systems and corresponding benefits of the various non-limiting embodiments described herein may become further apparent upon review of the following description.

SUMMARY

[0011] The following presents a simplified summary of one or more embodiments in order to provide a basic understanding of such embodiments. This summary is not an extensive overview of all contemplated embodiments, and is intended to neither identify key or critical elements of all embodiments nor delineate the scope of any or all embodiments. Its sole purpose is to present some concepts of one or more embodiments in a simplified form as a prelude to the more detailed description that is presented later.

[0012] In accordance with one or more embodiments and corresponding disclosure thereof, various aspects are described in connection with maintaining timing synchronization for user equipment in a LTE-A system. In one aspect, methods and computer program products are disclosed that facilitate a timing alignment in a multicarrier system. These embodiments include determining at least one downlink timing associated with at least one downlink carrier, and ascertaining an uplink timing associated with an uplink group of carriers. For these embodiments, the uplink timing is ascertained based on a processing of at least one downlink timing and a timing offset associated with the uplink group of carriers. Each of the uplink group of carriers is then transmitted within a threshold value of the uplink timing.

[0013] In another aspect, an apparatus configured to facilitate a timing alignment in a multicarrier system is disclosed. Within such embodiment, the apparatus includes a processor configured to execute computer executable components stored in memory. The computer executable components include a downlink timing component, an uplink timing component, and a communication component. The downlink timing component is configured to determine at least one downlink timing associated with at least one downlink carrier, whereas the uplink timing component is configured to ascertain an uplink timing associated with an uplink group of carriers. For this embodiment, the uplink timing is ascer-

tained based on at least one downlink timing and a timing offset associated with the uplink group of carriers. The communication component is then configured to transmit each of the uplink group of carriers within a threshold value of the uplink timing.

[0014] In a further aspect, another apparatus is disclosed. Within such embodiment, the apparatus includes means for determining, means for ascertaining, and means for transmitting. For this embodiment, the means for determining determines at least one downlink timing associated with at least one downlink carrier, whereas the means for ascertaining ascertains an uplink timing associated with an uplink group of carriers. For this embodiment, the uplink timing is ascertained based on at least one downlink timing and a timing offset associated with the uplink group of carriers. The means for transmitting then transmits each of the uplink group of carriers within a threshold value of the uplink timing. In other embodiments, the apparatus further includes a means for performing a random access procedure on at least one random access carrier. For this embodiment, the at least one random access carrier is included in a downlink group of carriers that includes the at least one downlink carrier.

[0015] In another aspect, other methods and computer program products are disclosed for facilitating a timing alignment in a multicarrier system. For these embodiments, various acts are provided, including an act to transmit a downlink communication to a wireless terminal via at least one downlink carrier. These embodiments further include assigning a timing offset to an uplink group of carriers, and providing the timing offset to the wireless terminal via the at least one downlink carrier. An uplink communication is then received via the uplink group of carriers according to the timing offset.

[0016] Another apparatus for facilitating a timing alignment in a multicarrier system is also disclosed. Within such embodiment, the apparatus includes a processor configured to execute computer executable components stored in memory. The computer executable components include a timing offset component, a transmitting component, and a receiving component. The timing offset component is configured to assign a timing offset to an uplink group of carriers, whereas the transmitting component is configured to provide the timing offset to a wireless terminal via at least one downlink carrier. The receiving component is then configured to receive an uplink communication via the uplink group of carriers according to the timing offset.

[0017] In a further aspect, another apparatus is disclosed. Within such embodiment, the apparatus includes means for transmitting, means for assigning, means for providing, and means for receiving. For this embodiment, the means for transmitting transmits at least one downlink carrier to a wireless terminal. The means for assigning then assigns a timing offset to an uplink group of carriers, whereas the means for providing provides the timing offset to the wireless terminal via the at least one downlink carrier. The means for receiving then receives an uplink communication via the uplink group of carriers according to the timing offset. In another embodiment, the apparatus further includes a means for generating a timing message. For this embodiment, the timing message includes a set of uplink timing instructions which are provided to the wireless terminal.

[0018] To the accomplishment of the foregoing and related ends, the one or more embodiments comprise the features hereinafter fully described and particularly pointed out in the claims. The following description and the annexed drawings set forth in detail certain illustrative aspects of the one or more embodiments. These aspects are indicative, however, of but a few of the various ways in which the principles of various embodiments can be employed and the described embodiments are intended to include all such aspects and their equivalents.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] FIG. **1** is an illustration of a wireless communication system in accordance with various aspects set forth herein.

[0020] FIG. **2** is an illustration of an exemplary wireless network environment that can be employed in conjunction with the various systems and methods described herein.

[0021] FIG. **3** is an illustration of an exemplary system where two timing groups are associated with a single eNodeB according to an embodiment.

[0022] FIG. **4** is an illustration of an exemplary ambiguous uplink timing.

[0023] FIG. **5** is an illustration of an exemplary averaging of uplink timings according to an embodiment.

[0024] FIG. **6** illustrates a block diagram of an exemplary wireless terminal that facilitates a timing alignment in a multicarrier system in accordance with an aspect of the subject specification.

[0025] FIG. **7** is an illustration of an exemplary coupling of electrical components that effectuate a timing alignment in a multicarrier system.

[0026] FIG. **8** is a flow chart illustrating an exemplary methodology for facilitating a timing alignment in a multicarrier system in accordance with an aspect of the subject specification.

[0027] FIG. **9** illustrates a block diagram of an exemplary base station that facilitates a timing alignment in a multicarrier system in accordance with an aspect of the subject specification.

[0028] FIG. **10** is an illustration of an exemplary coupling of electrical components that effectuate a timing alignment in a multicarrier system.

[0029] FIG. **11** is flow chart illustrating an exemplary methodology for facilitating a timing alignment in a multicarrier system in accordance with an aspect of the subject specification.

[0030] FIG. **12** is an illustration of an exemplary communication system implemented in accordance with various aspects including multiple cells.

[0031] FIG. **13** is an illustration of an exemplary base station in accordance with various aspects described herein.

[0032] FIG. **14** is an illustration of an exemplary wireless terminal implemented in accordance with various aspects described herein.

DETAILED DESCRIPTION

[0033] Various embodiments are now described with reference to the drawings, wherein like reference numerals are used to refer to like elements throughout. In the following description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of one or more embodiments. It may be evident, however, that such embodiment(s) may be practiced without these specific details. In other instances, well-known structures and devices are shown in block diagram form in order to facilitate describing one or more embodiments.

[0034] The subject specification is directed towards facilitating a timing alignment for user equipment in systems with multiple carriers whose timing may be different. Exemplary embodiments are disclosed in which carriers are grouped into "timing groups" with the similar timing information (within a tolerance), wherein signaling behavior for timing synchronization takes place on a per-group basis rather than a per-carrier basis.

[0035] To this end, it is noted that the techniques described herein can be used for various wireless communication systems such as code division multiple access (CDMA), time division multiple access (TDMA), frequency division multiple access (FDMA), orthogonal frequency division multiple access (OFDMA), single carrier-frequency division multiple access (SC-FDMA), High Speed Packet Access (HSPA), and other systems. The terms "system" and "network" are often used interchangeably. A CDMA system can implement a radio technology such as Universal Terrestrial Radio Access (UTRA), CDMA2000, etc. UTRA includes Wideband-CDMA (W-CDMA) and other variants of CDMA. CDMA2000 covers IS-2000, IS-95 and IS-856 standards. A TDMA system can implement a radio technology such as Global System for Mobile Communications (GSM). An OFDMA system can implement a radio technology such as Evolved UTRA (E-UTRA), Ultra Mobile Broadband (UMB), IEEE 802.11 (Wi-Fi), IEEE 802.16 (WiMAX), IEEE 802.20, Flash-OFDM, etc. UTRA and E-UTRA are part of Universal Mobile Telecommunication System (UMTS). 3GPP Long Term Evolution (LTE) is a release of UMTS that uses E-UTRA, which employs OFDMA on the downlink and SC-FDMA on the uplink.

[0036] Single carrier frequency division multiple access (SC-FDMA) utilizes single carrier modulation and frequency domain equalization. SC-FDMA has similar performance and essentially the same overall complexity as those of an OFDMA system. A SC-FDMA signal has lower peak-to-average power ratio (PAPR) because of its inherent single carrier structure. SC-FDMA can be used, for instance, in uplink communications where lower PAPR greatly benefits access terminals in terms of transmit power efficiency. Accordingly, SC-FDMA can be implemented as an uplink multiple access scheme in 3GPP Long Term Evolution (LTE) or Evolved UTRA.

[0037] High speed packet access (HSPA) can include high speed downlink packet access (HSDPA) technology and high speed uplink packet access (HSUPA) or enhanced uplink (EUL) technology and can also include HSPA+ technology. HSDPA, HSUPA and HSPA+ are part of the Third Generation Partnership Project (3GPP) specifications Release 5, Release 6, and Release 7, respectively.

[0038] High speed downlink packet access (HSDPA) optimizes data transmission from the network to the user equipment (UE). As used herein, transmission from the network to the user equipment UE can be referred to as the "downlink" (DL). Transmission methods can allow data rates of several Mbits/s. High speed downlink packet access (HSDPA) can increase the capacity of mobile radio networks. High speed uplink packet access (HSUPA) can optimize data transmission from the terminal to the network. As used herein, transmissions from the terminal to the network can be referred to as the "uplink" (UL). Uplink data transmission methods can allow data rates of several Mbit/s. HSPA+ provides even further improvements both in the uplink and downlink as specified in Release 7 of the 3GPP specification. High speed packet access (HSPA) methods typically allow for faster interactions between the downlink and the uplink in data services transmitting large volumes of data, for instance Voice over IP (VoIP), videoconferencing and mobile office applications

[0039] Fast data transmission protocols such as hybrid automatic repeat request, (HARQ) can be used on the uplink and downlink. Such protocols, such as hybrid automatic repeat request (HARQ), allow a recipient to automatically request retransmission of a packet that might have been received in error.

[0040] Various embodiments are described herein in connection with an access terminal. An access terminal can also be called a system, subscriber unit, subscriber station, mobile station, mobile, remote station, remote terminal, mobile device, user terminal, terminal, wireless communication device, user agent, user device, or user equipment (UE). An access terminal can be a cellular telephone, a cordless telephone, a Session Initiation Protocol (SIP) phone, a wireless local loop (WLL) station, a personal digital assistant (PDA), a handheld device having wireless connection capability, computing device, or other processing device connected to a wireless modem. Moreover, various embodiments are described herein in connection with a base station. A base station can be utilized for communicating with access terminal(s) and can also be referred to as an access point, Node B, Evolved Node B (eNodeB), access point base station, or some other terminology.

[0041] Referring now to FIG. **1**, a wireless communication system **100** is illustrated in accordance with various embodiments presented herein. System **100** comprises a base station **102** that can include multiple antenna groups. For example, one antenna group can include antennas **104** and **106**, another group can comprise antennas **108** and **110**, and an additional group can include antennas **112** and **114**. Two antennas are illustrated for each antenna group; however, more or fewer antennas can be utilized for each group. Base station **102** can additionally include a transmitter chain and a receiver chain, each of which can in turn comprise a plurality of components associated with signal transmission and reception (e.g., processors, modulators, multiplexers, demodulators, demultiplexers, antennas, etc.), as will be appreciated by one skilled in the art.

[0042] Base station **102** can communicate with one or more access terminals such as access terminal **116** and access terminal **122**; however, it is to be appreciated that base station **102** can communicate with substantially any number of access terminals similar to access terminals **116** and **122**. Access terminals **116** and **122** can be, for example, cellular phones, smart phones, laptops, handheld communication devices, handheld computing devices, satellite radios, global positioning systems, PDAs, and/or any other suitable device for communicating over wireless communication system **100**. As depicted, access terminal **116** is in communication with antennas **112** and **114**, where antennas **112** and **114** transmit information to access terminal **116** over a forward link **118** and receive information from access terminal **116** over a reverse link **120**. Moreover, access terminal **122** is in communication with antennas **104** and **106**, where antennas **104** and **106** transmit information to access terminal **122** over a forward link **124** and receive information from access terminal **122** over a reverse link **126**. In a frequency division duplex (FDD) system, forward link **118** can utilize a different frequency band than that used by reverse link **120**, and for-

ward link **124** can employ a different frequency band than that employed by reverse link **126**, for example. Further, in a time division duplex (TDD) system, forward link **118** and reverse link **120** can utilize a common frequency band and forward link **124** and reverse link **126** can utilize a common frequency band.

[0043] Each group of antennas and/or the area in which they are designated to communicate can be referred to as a sector of base station **102**. For example, antenna groups can be designed to communicate to access terminals in a sector of the areas covered by base station **102**. In communication over forward links **118** and **124**, the transmitting antennas of base station **102** can utilize beamforming to improve signal-to-noise ratio of forward links **118** and **124** for access terminals **116** and **122**. Also, while base station **102** utilizes beamforming to transmit to access terminals **116** and **122** scattered randomly through an associated coverage, access terminals in neighboring cells can be subject to less interference as compared to a base station transmitting through a single antenna to all its access terminals.

[0044] FIG. **2** shows an example wireless communication system **200**. The wireless communication system **200** depicts one base station **210** and one access terminal **250** for sake of brevity. However, it is to be appreciated that system **200** can include more than one base station and/or more than one access terminal, wherein additional base stations and/or access terminals can be substantially similar or different from example base station **210** and access terminal **250** described below. In addition, it is to be appreciated that base station **210** and/or access terminal **250** can employ the systems and/or methods described herein to facilitate wireless communication there between.

[0045] At base station **210**, traffic data for a number of data streams is provided from a data source **212** to a transmit (TX) data processor **214**. According to an example, each data stream can be transmitted over a respective antenna. TX data processor **214** formats, codes, and interleaves the traffic data stream based on a particular coding scheme selected for that data stream to provide coded data.

[0046] The coded data for each data stream can be multiplexed with pilot data using orthogonal frequency division multiplexing (OFDM) techniques. Additionally or alternatively, the pilot symbols can be frequency division multiplexed (FDM), time division multiplexed (TDM), or code division multiplexed (CDM). The pilot data is typically a known data pattern that is processed in a known manner and can be used at access terminal **250** to estimate channel response. The multiplexed pilot and coded data for each data stream can be modulated (e.g., symbol mapped) based on a particular modulation scheme (e.g., binary phase-shift keying (BPSK), quadrature phase-shift keying (QPSK), M-phase-shift keying (M-PSK), M-quadrature amplitude modulation (M-QAM), etc.) selected for that data stream to provide modulation symbols. The data rate, coding, and modulation for each data stream can be determined by instructions performed or provided by processor **230**.

[0047] The modulation symbols for the data streams can be provided to a TX MIMO processor **220**, which can further process the modulation symbols (e.g., for OFDM). TX MIMO processor **220** then provides N_T modulation symbol streams to N_T transmitters (TMTR) **222***a* through **222***t*. In various embodiments, TX MIMO processor **220** applies beamforming weights to the symbols of the data streams and to the antenna from which the symbol is being transmitted.

[0048] Each transmitter **222** receives and processes a respective symbol stream to provide one or more analog signals, and further conditions (e.g., amplifies, filters, and upconverts) the analog signals to provide a modulated signal suitable for transmission over the MIMO channel. Further, N_T modulated signals from transmitters **222***a* through **222***t* are transmitted from N_T antennas **224***a* through **224***t*, respectively.

[0049] At access terminal **250**, the transmitted modulated signals are received by N_R antennas **252***a* through **252***r* and the received signal from each antenna **252** is provided to a respective receiver (RCVR) **254***a* through **254***r*. Each receiver **254** conditions (e.g., filters, amplifies, and downconverts) a respective signal, digitizes the conditioned signal to provide samples, and further processes the samples to provide a corresponding "received" symbol stream.

[0050] An RX data processor **260** can receive and process the N_R received symbol streams from N_R receivers **254** based on a particular receiver processing technique to provide N_T "detected" symbol streams. RX data processor **260** can demodulate, deinterleave, and decode each detected symbol stream to recover the traffic data for the data stream. The processing by RX data processor **260** is complementary to that performed by TX MIMO processor **220** and TX data processor **214** at base station **210**.

[0051] A processor **270** can periodically determine which available technology to utilize as discussed above. Further, processor **270** can formulate a reverse link message comprising a matrix index portion and a rank value portion.

[0052] The reverse link message can comprise various types of information regarding the communication link and/or the received data stream. The reverse link message can be processed by a TX data processor **238**, which also receives traffic data for a number of data streams from a data source **236**, modulated by a modulator **280**, conditioned by transmitters **254***a* through **254***r*, and transmitted back to base station **210**.

[0053] At base station **210**, the modulated signals from access terminal **250** are received by antennas **224**, conditioned by receivers **222**, demodulated by a demodulator **240**, and processed by a RX data processor **242** to extract the reverse link message transmitted by access terminal **250**. Further, processor **230** can process the extracted message to determine which precoding matrix to use for determining the beamforming weights.

[0054] Processors **230** and **270** can direct (e.g., control, coordinate, manage, etc.) operation at base station **210** and access terminal **250**, respectively. Respective processors **230** and **270** can be associated with memory **232** and **272** that store program codes and data. Processors **230** and **270** can also perform computations to derive frequency and impulse response estimates for the uplink and downlink, respectively.

[0055] As a general framework, aspects disclosed herein are directed towards assigning a UE to at least one "timing group", which hereinafter refers to a group of carriers with uplink timings that are the same to within some tolerance. Depending on the tolerance, a timing group might include carriers that share a common controlling site (but may still have fine differences in timing), or only of carriers whose antennae are collocated. For some embodiments, different carriers with synchronized downlinks, but significant differences in uplink timing for a given UE (e.g., from different cell sites in a synchronous network), would thus not normally belong to the same timing group.

[0056] In an aspect, it is contemplated that a UE may be assigned carriers from multiple timing groups. In principle, a UE with enough reception and decoding capabilities could listen to several sets of carriers with independent timing. Such a situation may, for example, arise if a UE were assigned to carriers from different cell sites. However, with the current LTE design (with no soft handover), and the complexities that arise when attempting to design such a system, a multiple-site assignment seems unlikely.

[0057] Even so, if the tolerances defining a timing group are adequate, it is possible that a UE could be assigned carriers from multiple timing groups originating from the same cell site. For instance, in FIG. **3**, an exemplary system illustrates how two timing groups may originate from a single eNode B. As illustrated, system **300** includes a remote radio head **320** belonging to main base station site **310**, wherein carriers from remote radio head **320** are associated with timing group **322**, whereas carriers from main base station site **310** are associated with timing group **312**. Accordingly, wireless terminal **330** receives carriers having different timings from a single eNodeB, wherein carriers within a timing difference tolerance are grouped together. In such a case, since wireless terminal **330** could be assigned to carriers in both timing group **312** and timing group **322**, it is contemplated that wireless terminal **330** will maintain timing separately for each group. For some embodiments, this might require separate timing advance procedures for each group, or enhanced signaling allowing timing maintenance to take place for all groups in parallel.

[0058] In an aspect, embodiments directed towards selecting carriers for performing a random access procedure are also contemplated. Indeed, within each timing group, a UE may occasionally perform random access to update its timing (e.g., if timing is maintained through a separate procedure for each timing group). Here, although this update only needs to be performed with one carrier of each timing group, the issue arises of how the UE should decide which carrier this is. In an aspect, the UE is configured to avoid performing unnecessary timing updates (i.e., to select a single carrier from the timing group to use for its timing control).

[0059] In principle, it is noted that performing random access on any carrier in a timing group should work. However, it is desirable to avoid situations in which a large number of UEs concentrate their random access attempts on a particular carrier, to minimize contention on the random access channel. To this end, it is contemplated that the system could adopt either a UE-based or a network-based solution.

[0060] In an exemplary network-based solution, the UE is assigned to carriers in a particular timing group, wherein the network provides the UE with instructions regarding which carrier in that group to use for random access. Within such embodiment, the instructions could be absolute (e.g., "always use this carrier") or subject to relaxation based on conditions at the UE (e.g., "use this carrier preferentially, unless radio conditions on that carrier are worse than indicated by a threshold").

[0061] In an exemplary UE-based approach, each UE selects a single carrier for random access for timing updates autonomously. Here, similar to the exemplary network-based solution, the determination of the carrier could be absolute or subject to modification. In a particular embodiment, carrier selection is based on a function that tends to distribute UEs more or less evenly across the timing group. A hash function may be utilized, for example, in which a UE associated with a timing group of n carriers provides some input to a hash function with n possible values, wherein the function's output is the index of the carrier of the group that the UE will (prefer to) use for random access. Here, it is noted that there are many options for an appropriate hash function including, for example, using a UE identifier as an input, as well as other values such as an eNode B identifier. It is further noted that the inputs could be static or time-varying. If they are static (depending on characteristics of the UE and/or the serving eNode B), the UE may tend to use the same carrier for random access throughout its assignment to a particular group whereas, if the inputs vary with time (e.g., through the use of an input value derived from a time measurement, a counter, etc.), the UE may tend to "cycle" through the available carriers. For some embodiments, the latter approach may be preferable, since coincidental "spikes" in concentration (e.g., when a particular site is serving a large number of UEs whose identities result in the same output from the hash function) will tend to correct themselves over time.

[0062] Other UE-based distribution mechanisms are also contemplated. For instance, instead of a fixed hash function, the UE could use a pseudorandom function to choose the carrier. In such a case, the determination could be made only at the time of carrier assignment (so that a given UE consistently uses the same carrier for timing) or at each request for a timing update (so that each UE tends to balance its requests across the available carriers).

[0063] Issues pertaining to timing alignment granularity are now discussed. To this end, it is noted that, if all carriers within a timing group are precisely aligned in both downlink and uplink timing, there is no ambiguity about what the "correct" timing alignment for a given UE should be. However, in the case of small differences between carrier transmission timing (e.g., due to cable delays), carriers with the same timing offset may nevertheless have different absolute timings.

[0064] An exemplary timing diagram illustrating such ambiguous uplink timing is provided in FIG. **4**. As illustrated, carrier **410** is associated with downlink **412** and uplink **414**, whereas carrier **420** is associated with downlink **422** and uplink **424**. Here, it is noted that a UE in such environment could receive its timing information from either carrier **410** or carrier **420**. In an aspect, the timings of carrier **410** and carrier **420** may differ, but by less than the tolerance that the deployment requires for a timing group. It thus follows that, depending on which carrier the UE received its last update from, a UE connected to carrier **410** and carrier **420** could consider the correct uplink timing to be at either uplink **414** or uplink **424**.

[0065] In a particular embodiment, the UE applies the timing offset to the carrier on which it received the timing offset, and assumes that the timing of other carriers in the group is "close enough". With respect to FIG. **4**, this would mean that the system considered uplink **414** and uplink **424** to be the same for purposes of uplink timing accuracy.

[0066] As an alternative, however, the UE could apply the timing offset, not to the received downlink timing from the carrier that transmitted the offset, but to the average timing of the carriers in the timing group. In such a case, although the UE received its timing information from a particular carrier, it tracks the (downlink) timing of each carrier in the group separately, so that when a single downlink/uplink offset is received, the UE can apply the offset separately to each carrier and take an average of the results to provide an "adequate" uplink timing for use with all carriers in the group.

Such an averaging behavior could be either a specified UE behavior (to allow greater downlink tolerances within a timing group while still keeping the variation in uplink timing acceptable) or left to UE implementation.

[0067] In FIG. **5**, an illustration of an exemplary averaging procedure is provided. As illustrated, wireless terminal **510** receives a downlink/uplink offset via either of Carrier A or Carrier B. For this particular example, Carrier A is associated with Downlink_A and Uplink_A, whereas Carrier B is associated with Downlink_B and Uplink_B. The actual uplink timing may then be ascertained by adding the timing offset to the average of Downlink_A and Downlink_B, which is equal to the average of Uplink_A and Uplink_B.

[0068] For some embodiments, in the event that a UE is assigned to several timing groups that are controlled from a common site, the UE may receive timing adjustments for all groups with a single interaction with the base station. Indeed, such a procedure is essentially a signaling optimization since the UE could, in principle, receive the same information by performing a separate timing adjustment for each group. Sending the adjustments as a vector, however, reduces over-the-air activity, and in particular random access procedures, which are expensive in terms of radio resources and UE battery life.

[0069] To implement such a command, the network may need to be aware of the timing groups in which the UE is assigned to at least one carrier. This knowledge could be maintained autonomously in the network, so that upon determining the need to signal a timing advance to a particular UE, the network automatically includes timing advance commands for all appropriate timing groups. Alternatively, the UE could request timing advance values for a particular set of timing groups (e.g., the groups for which the UE's time-alignment timers are within some range of expiring). However, the request for particular groups would represent a new medium access control (MAC) element, which may need to be transmitted over the air at random access with a potentially significant cost in radio resources. For some embodiments, it may therefore be desirable for the network to maintain knowledge of what timing groups require timing advance commands towards a particular UE.

[0070] In another aspect of this vector approach, the network could opt to send only a single timing advance command per MAC element, but indicate which timing group the value is associated with. Such approach would minimize the specification impact to the concerned MAC control element, since the existing information only needs to be augmented by a group identifier. It is presumed that such an identifier could be sent with a small number of bits (e.g., as an index into the set of timing groups with which the UE was configured). Such a mapping could be established by explicit signaling (in higher layers such as the Radio Resource Control) at the time the UE is configured with particular carriers.

[0071] Referring next to FIG. **6**, a block diagram of an exemplary wireless terminal that facilitates a timing alignment in a multicarrier system according to an embodiment is provided. As shown, wireless terminal **600** may include processor component **610**, memory component **620**, downlink timing component **630**, uplink timing component **640**, communication component **650**, random access component **660**, message processing component **670**, and averaging component **680**.

[0072] In one aspect, processor component **610** is configured to execute computer-readable instructions related to performing any of a plurality of functions. Processor component **610** can be a single processor or a plurality of processors dedicated to analyzing information to be communicated from wireless terminal **600** and/or generating information that can be utilized by memory component **620**, downlink timing component **630**, uplink timing component **640**, communication component **650**, random access component **660**, message processing component **670**, and/or averaging component **680**. Additionally or alternatively, processor component **610** may be configured to control one or more components of wireless terminal **600**.

[0073] In another aspect, memory component **620** is coupled to processor component **610** and configured to store computer-readable instructions executed by processor component **610**. Memory component **620** may also be configured to store any of a plurality of other types of data including generated by any of downlink timing component **630**, uplink timing component **640**, communication component **650**, random access component **660**, message processing component **670**, and/or averaging component **680**. Memory component **620** can be configured in a number of different configurations, including as random access memory, battery-backed memory, hard disk, magnetic tape, etc. Various features can also be implemented upon memory component **620**, such as compression and automatic back up (e.g., use of a Redundant Array of Independent Drives configuration).

[0074] As illustrated, wireless terminal **600** may also include downlink timing component **630** and uplink timing component **640**. Within such embodiment, downlink timing component **630** is configured to determine at least one downlink timing associated with at least one downlink carrier, whereas uplink timing component **640** is configured to ascertain an uplink timing associated with an uplink group of carriers based on at least one downlink timing and a timing offset associated with the uplink group of carriers. In an aspect, uplink timing component **640** is configured to determine the uplink timing by utilizing a different timing offset for each of a plurality of uplink group of carriers. Uplink timing component **640** may also be configured to determine the uplink timing by utilizing a different downlink timing for each of a plurality of uplink group of carriers.

[0075] In other aspects, the at least one downlink carrier is included in one of a plurality of downlink groups. Within such embodiment, uplink timing component **640** may be configured to determine the uplink timing by associating the uplink group of carriers with the one of the plurality of downlink groups. In a particular aspect, uplink timing component **640** is configured to determine a plurality of uplink timings respectively associated with a plurality of uplink groups. Here, uplink timing component **640** ascertains the plurality of uplink timings by identifying a subset of downlink groups that include an assigned carrier, wherein the plurality of uplink groups are respectively associated with the subset of downlink groups that include the assigned carrier.

[0076] In yet another aspect, wireless terminal **600** includes communication component **650**, which is coupled to processor component **610** and configured to interface wireless terminal **600** with external entities. For instance, communication component **650** may be configured to transmit uplink carriers of a common uplink group according to the uplink timing ascertained by uplink timing component **640**. In a particular embodiment, each of the uplink group of carriers is transmitted within a threshold value of the corresponding uplink timing.

[0077] As illustrated, wireless terminal **600** may also include message processing component **670**. Within such embodiment, message processing component **670** is configured to process a received timing message encoded with a set of uplink timing instructions respectively corresponding to an uplink group subset of the uplink group of carriers. In a particular aspect, message processing component **670** is configured to associate the uplink group of carriers with one of a plurality of downlink groups, wherein the timing message is encoded with a set of uplink timing instructions respectively corresponding to a downlink group subset of the plurality of downlink groups. Here, it should be noted that the received timing message may be a timing advance command, and/or may comprise a vector encoded with timing adjustment values associated with the uplink group subset.

[0078] Particular embodiments are also contemplated wherein the uplink group subset includes assigned carriers. For instance, in one embodiment, each uplink group within the uplink group subset includes at least one carrier with an assigned radio resource. In another embodiment, the uplink group of carriers comprises a set of uplink groups in which each uplink group includes at least one carrier with an assigned radio resource, wherein the uplink group subset is a subset of the set of uplink groups.

[0079] For some embodiments, it is contemplated that the uplink group subset is determined by a network entity. For instance, message processing component **670** may be configured to submit a request requesting the network entity to provide the uplink group subset, wherein the uplink group subset is determined by the network entity in response to the request. Indeed, it should be noted that the received timing message itself may include an indication of which of the uplink group of carriers are included in the uplink group subset. For such embodiments, message processing component **670** may be configured to decode the indication according to a mapping of group identities shared with the network. In an aspect, the mapping of group identities is configured in association with an assignment of dedicated radio resources on uplink carriers within at least one uplink group of the uplink group subset.

[0080] Timing messages which include inter-group uplink timings are also contemplated. For instance, message processing component **670** may be configured to decode a timing message received via a timing message carrier included in a messenger downlink group, wherein the timing message is encoded with at least one inter-group uplink timing. Here, the inter-group uplink timing is an uplink timing corresponding to a target downlink group, wherein the target downlink group is different than the messenger downlink group. For these embodiments, the timing message may include an indication of the target downlink group, message processing component **670** may again be configured to decode the indication according to a mapping of group identities shared with the network. For instance, the mapping of group identities may be configured in association with an assignment of dedicated radio resources on downlink carriers included in the target downlink group.

[0081] In another aspect, rather than using any particular downlink timing, the subject innovation contemplates utilizing a plurality of downlink timings. To this end, wireless terminal **600** may further include averaging component **680**, which is configured to compute an average downlink timing from a plurality of downlink timings. Within such embodiment, the plurality of downlink timings respectively correspond to a set of downlink carriers within a particular downlink group that includes the at least one downlink carrier. Here, uplink timing component **640** is then configured to determine the uplink timing by applying the timing offset to the average downlink timing. With respect to the particular downlink group utilized by averaging component **680**, it is contemplated that such downlink group may be a particular downlink group that comprises at least one carrier associated with an assigned radio resource. Alternatively, the particular downlink group comprises a set of carriers identified by the network.

[0082] Wireless terminal **600** may also include random access component **660**, which is configured to perform a random access procedure. Within such embodiment, random access component **660** is configured to perform the random access procedure on at least one random access carrier included in a downlink group of carriers that includes the at least one downlink carrier received from the network. In a particular aspect, the random access procedure is performed on a single carrier, wherein the single carrier is an assigned carrier provided by a network prior to the performing of the random access procedure. Alternatively, the random access procedure may include receiving the single carrier as part of a dedicated radio resource configuration.

[0083] In another embodiment, a criterion for selecting the appropriate carrier is utilized. For instance, the random access procedure may include receiving a criterion associated with a usage of the single carrier, wherein the criterion is received with an assignment of the single carrier. Within such embodiment, the criterion may be a minimum signal quality threshold associated with the single carrier. Here, it is also contemplated that random access component **660** may be configured to perform the random access procedure on an alternative carrier in response to the criterion not being met by the single carrier. For such embodiment, random access component **660** may be configured to receive an indication of the alternative carrier from the network. Alternatively, the alternative carrier is independently selected by random access component **660**.

[0084] In addition to selecting the alternative carrier, it is also contemplated that the single carrier is independently selected by random access component **660**. Within such embodiment, the selecting may comprise applying a determination function across a set of available carriers in the downlink group of carriers. Here, it is contemplated that any of a plurality of determination functions may be utilized including, for example, a pseudorandom function and/or a hash function. For instance, if a hash function is implemented, the random access procedure may include inputting an identifier into the hash function, wherein the identifier can be associated with the wireless terminal and/or a network node (wherein the downlink group of carriers is controlled by the network node). Embodiments are also contemplated in which the procedure includes inputting a time-varying value into the hash function. For such embodiments, the procedure may further include determining the time-varying value via a time measurement taken from within wireless terminal **600**. The procedure may also include modifying the time-varying value by an arithmetic operation each time the time-varying value is used.

[0085] In another aspect, random access component **660** is configured to select the random access carrier at a particular time. For instance, the selecting procedure may be performed at a time when radio resources are assigned to wireless ter-

minal **600** on any of the downlink group of carriers. Alternatively, the selecting is performed in response to a triggering of the random access procedure.

[0086] Turning to FIG. **7**, illustrated is a system **700** that facilitates a timing alignment in a multicarrier system according to an embodiment. System **700** and/or instructions for implementing system **700** can reside within user equipment (e.g., wireless terminal **600**) or a computer-readable storage medium, for instance. As depicted, system **700** includes functional blocks that can represent functions implemented by a processor, software, or combination thereof (e.g., firmware). System **700** includes a logical grouping **702** of electrical components that can act in conjunction. As illustrated, logical grouping **702** can include an electrical component for determining at least one downlink timing associated with at least one downlink carrier **710**. Logical grouping **702** can also include an electrical component for ascertaining an uplink timing associated with an uplink group of carriers based on at least one downlink timing and a timing offset **712**. Further, logical grouping **702** can include an electrical component for transmitting each of the uplink group of carriers within a threshold value of the uplink timing **714**. Additionally, system **700** can include a memory **720** that retains instructions for executing functions associated with electrical components **710**, **712**, and **714**, wherein any of electrical components **710**, **712**, and **714** can exist either within or outside memory **720**.

[0087] Referring next to FIG. **8**, a flow chart illustrating an exemplary method for facilitating a timing alignment in a multicarrier system is provided. As illustrated, process **800** includes a series of acts that may be performed by various components of user equipment (e.g., wireless terminal **600**) according to an aspect of the subject specification. Process **800** may be implemented by employing at least one processor to execute computer executable instructions stored on a computer readable storage medium to implement the series of acts. In another embodiment, a computer-readable storage medium comprising code for causing at least one computer to implement the acts of process **800** is contemplated.

[0088] In an aspect, process **800** begins with a downlink communication being received at act **810**. Here, the downlink communication is a multicarrier communication, wherein at least one downlink carrier is associated with a downlink group. Process **800** then proceeds to act **820** where a downlink timing of the downlink carrier is determined, followed by act **830** where a timing offset of the downlink carrier's timing group is ascertained.

[0089] Next, at act **840**, an uplink group of carriers is associated with the downlink group of carriers. An uplink timing for the uplink group is then ascertained based on the downlink timing and timing offset, at act **850**. Process **800** then concludes at act **860** where an uplink communication is transmitted via the uplink group of carriers according to the particular uplink timing of the uplink group. Moreover, for this particular example, each of the uplink carriers of an uplink group are transmitted within a threshold tolerance of the uplink timing associated with the group.

[0090] Referring next to FIG. **9**, a block diagram illustrates an exemplary base station that facilitates a timing alignment in a multicarrier system in accordance with various aspects. As illustrated, base station **900** may include processor component **910**, memory component **920**, timing offset component **930**, transmitting component **940**, receiving component **950**, generation component **960**, and random access component **970**.

[0091] Similar to processor component **610** in wireless terminal **600**, processor component **910** is configured to execute computer-readable instructions related to performing any of a plurality of functions. Processor component **910** can be a single processor or a plurality of processors dedicated to analyzing information to be communicated from base station **900** and/or generating information that can be utilized by memory component **920**, timing offset component **930**, transmitting component **940**, receiving component **950**, generation component **960**, and/or random access component **970**. Additionally or alternatively, processor component **910** may be configured to control one or more components of base station **900**.

[0092] In another aspect, memory component **920** is coupled to processor component **910** and configured to store computer-readable instructions executed by processor component **910**. Memory component **920** may also be configured to store any of a plurality of other types of data including data generated by any of timing offset component **930**, transmitting component **940**, receiving component **950**, generation component **960**, and/or random access component **970**. Here, it should be noted that memory component **1220** is analogous to memory component **620** in wireless terminal **600**. Accordingly, it should be appreciated that any of the aforementioned features/configurations of memory component **620** are also applicable to memory component **920**.

[0093] As illustrated, base station **900** may also include timing offset component **930**. Within such embodiment, timing offset component **930** is configured to assign a timing offset to an uplink group of carriers. For instance, in a particular embodiment, timing offset component **930** is configured to assign a different timing offset to each of a plurality of uplink groups.

[0094] In another aspect, base station **900** includes transmitting component **940** and receiving component **950**, which are coupled to processor component **910** and configured to interface base station **900** with external entities. For instance, transmitting component **940** may be configured to provide the timing offset ascertained by timing offset component **930** to a wireless terminal via at least one downlink carrier, whereas receiving component **950** may be configured to receive an uplink communication via the uplink group of carriers according to the timing offset. In a particular embodiment, transmitting component **940** is configured to transmit a downlink group of carriers from antennas located at a common site. In another embodiment, transmitting component **940** is configured to identify a set of carriers respectively corresponding to a plurality of downlink timings to facilitate an averaging of the plurality of downlink timings performed by the wireless terminal.

[0095] As illustrated, base station **900** may also include generation component **960**. Within such embodiment, generation component **960** is configured to generate a timing message encoded with a set of uplink timing instructions. For instance, such instructions may include uplink timing instructions respectively corresponding to an uplink group subset of the plurality of uplink groups, wherein transmitting component **940** is configured to transmit the timing message to a wireless terminal. Here, it should be noted that the timing message may be a timing advance command, and/or may comprise a vector encoded with timing adjustment values associated with the uplink group subset.

[0096] Particular embodiments are also contemplated wherein the uplink group subset includes assigned carriers.

For instance, in one embodiment, each uplink group within the uplink group subset includes at least one carrier with a radio resource assigned to the wireless terminal. In another embodiment, the plurality of uplink groups comprise a set of uplink groups in which each uplink group within the set of uplink groups includes at least one carrier with a radio resource assigned to the wireless terminal, wherein the uplink group subset is a subset of the set of uplink groups.

[0097] In another aspect, it should be noted that base station **900** may include components to facilitate determining the uplink group subset. Such embodiment may, for example, include receiving a request from the wireless terminal to provide the uplink group subset, wherein the determining is performed in response to the request. Generation component **960** may also be configured to generate timing messages encoded with an indication of which of the plurality of uplink groups are included in the uplink group subset. In an exemplary embodiment, the indication is encoded according to a mapping of group identities shared with the wireless terminal. For this embodiment, the mapping of group identities may be configured in association with an assignment of dedicated radio resources on uplink carriers within at least one uplink group of the uplink group subset.

[0098] In another aspect, timing messages encoded with inter-group uplink timings are contemplated. For instance, generation component **960** may be configured to generate a timing message encoded with at least one inter-group uplink timing corresponding to a target downlink group. Within such embodiment, transmitting component **940** is configured to transmit the timing message to the wireless terminal via a timing message carrier included in a messenger downlink group, wherein the target downlink group is different than the messenger downlink group. Here, it should be noted that the timing message can be encoded with an indication of the target downlink group. Similar to the intra-group embodiment discussed previously, such indication can be encoded according to a mapping of group identities shared with the wireless terminal. For example, the mapping of group identities can be configured in association with an assignment of dedicated radio resources on downlink carriers included in the target downlink group.

[0099] As illustrated, base station **900** may also include random access component **970**. Within such embodiment, random access component **970** is configured to identify a random access carrier to facilitate a random access procedure, wherein the random access carrier is a carrier assigned to the wireless terminal. In an aspect, transmitting component **940** may be configured to transmit the random access carrier as part of a dedicated radio resource configuration. In another aspect, random access component **970** may be configured to ascertain a criterion associated with a usage of the random access carrier, wherein the criterion is provided to the wireless terminal with an assignment of the random access carrier. For example, the criterion can be a minimum signal quality threshold associated with the random access carrier. In yet another aspect, random access component **970** is configured to identify an alternative carrier to facilitate a performing of the random access procedure by the wireless terminal on the alternative carrier in response to the criterion not being met by the random access carrier.

[0100] Referring next to FIG. **10**, illustrated is a system **1000** that facilitates a timing alignment in a multicarrier system according to an embodiment. System **1000** and/or instructions for implementing system **1000** can reside within a network entity (e.g., base station **900**) or a computer-readable storage medium, for instance, wherein system **1000** includes functional blocks that can represent functions implemented by a processor, software, or combination thereof (e.g., firmware). Moreover, system **1000** includes a logical grouping **1002** of electrical components that can act in conjunction similar to logical grouping **702** in system **700**. As illustrated, logical grouping **1002** can include an electrical component for transmitting at least one downlink carrier to a wireless terminal **1010**, as well as an electrical component for assigning a timing offset to an uplink group of carriers **1012**. Furthermore, logical grouping **1002** can include an electrical component for providing the timing offset to the wireless terminal via the at least one downlink carrier **1014**. Logical grouping **1002** can also include an electrical component for receiving an uplink communication via the uplink group of carriers according to the timing offset **1016**. Additionally, system **1000** can include a memory **1020** that retains instructions for executing functions associated with electrical components **1010**, **1012**, **1014**, and **1016**. While shown as being external to memory **1020**, it is to be understood that electrical components **1010**, **1012**, **1014**, and **1016** can exist within memory **1020**.

[0101] Referring next to FIG. **11**, a flow chart illustrating an exemplary method that facilitates a timing alignment in a multicarrier system is provided. As illustrated, process **1100** includes a series of acts that may be performed by various components of a network entity (e.g., base station **900**) according to an aspect of the subject specification. Process **1100** may be implemented by employing at least one processor to execute computer executable instructions stored on a computer readable storage medium to implement the series of acts. In another embodiment, a computer-readable storage medium comprising code which causes at least one computer to implement the acts of process **1100** is contemplated.

[0102] In an aspect, process **1100** begins with a multicarrier communication being established with a user equipment at act **1110**. Next, at act **1120**, a timing offset is assigned to an uplink group of carriers, wherein a different timing offset may be assigned to each of a plurality of uplink groups. Once the timing offsets have been assigned, process **1100** proceeds to act **1130** where particular downlink carriers are configured to facilitate a downlink communication with the user equipment. At act **1140**, the timing offset is then provided to the user equipment via at least one of the downlink carriers configured at act **1130**. Process **1100** then concludes at act **1150** where an uplink communication is received from the user equipment according to the timing offset assigned at act **1120**.

Exemplary Communication System

[0103] Referring next to FIG. **12**, an exemplary communication system **1200** implemented in accordance with various aspects is provided including multiple cells: cell **11202**, cell M **1204**. Here, it should be noted that neighboring cells **1202**, **1204** overlap slightly, as indicated by cell boundary region **1268**, thereby creating potential for signal interference between signals transmitted by base stations in neighboring cells. Each cell **1202**, **1204** of system **1200** includes three sectors. Cells which have not been subdivided into multiple sectors (N=1), cells with two sectors (N=2) and cells with more than 3 sectors (N>3) are also possible in accordance with various aspects. Cell **1202** includes a first sector, sector I **1210**, a second sector, sector II **1212**, and a third sector,

sector III **1214**. Each sector **1210**, **1212**, and **1214** has two sector boundary regions; each boundary region is shared between two adjacent sectors.

[0104] Sector boundary regions provide potential for signal interference between signals transmitted by base stations in neighboring sectors. Line **1216** represents a sector boundary region between sector I **1210** and sector II **1212**; line **1218** represents a sector boundary region between sector II **1212** and sector III **1214**; line **1220** represents a sector boundary region between sector III **1214** and sector I **1210**. Similarly, cell M **1204** includes a first sector, sector I **1222**, a second sector, sector II **1224**, and a third sector, sector III **1226**. Line **1228** represents a sector boundary region between sector I **1222** and sector II **1224**; line **1230** represents a sector boundary region between sector II **1224** and sector III **1226**; line **1232** represents a boundary region between sector III **1226** and sector I **1222**. Cell I **1202** includes a base station (BS), base station I **1206**, and a plurality of end nodes (ENs) in each sector **1210**, **1212**, **1214**. Sector I **1210** includes EN(**1**) **1236** and EN(X) **1238** coupled to BS **1206** via wireless links **1240**, **1242**, respectively; sector II **1212** includes EN(**1'**) **1244** and EN(X') **1246** coupled to BS **1206** via wireless links **1248**, **1250**, respectively; sector III **1214** includes EN(**1"**) **1252** and EN(X") **1254** coupled to BS **1206** via wireless links **1256**, **1258**, respectively. Similarly, cell M **1204** includes base station M **1208**, and a plurality of end nodes (ENs) in each sector **1222**, **1224**, and **1226**. Sector I **1222** includes EN(**1**) **1236'** and EN(X) **1238'** coupled to BS M **1208** via wireless links **1240'**, **1242'**, respectively; sector II **1224** includes EN(**1'**) **1244'** and EN(X') **1246'** coupled to BS M **1208** via wireless links **1248'**, **1250'**, respectively; sector III **1226** includes EN(**1"**) **1252'** and EN(X") **1254'** coupled to BS **1208** via wireless links **1256'**, **1258'**, respectively.

[0105] System **1200** also includes a network node **1260** which is coupled to BS I **1206** and BS M **1208** via network links **1262**, **1264**, respectively. Network node **1260** is also coupled to other network nodes, e.g., other base stations, AAA server nodes, intermediate nodes, routers, etc. and the Internet via network link **1266**. Network links **1262**, **1264**, **1266** may be, e.g., fiber optic cables. Each end node, e.g. EN **1** **1236** may be a wireless terminal including a transmitter as well as a receiver. The wireless terminals, e.g., EN(**1**) **1236** may move through system **1200** and may communicate via wireless links with the base station in the cell in which the EN is currently located. The wireless terminals, (WTs), e.g. EN(**1**) **1236**, may communicate with peer nodes, e.g., other WTs in system **1200** or outside system **1200** via a base station, e.g. BS **1206**, and/or network node **1260**. WTs, e.g., EN(**1**) **1236** may be mobile communications devices such as cell phones, personal data assistants with wireless modems, etc. Respective base stations perform tone subset allocation using a different method for the strip-symbol periods, from the method employed for allocating tones and determining tone hopping in the rest symbol periods, e.g., non strip-symbol periods. The wireless terminals use the tone subset allocation method along with information received from the base station, e.g., base station slope ID, sector ID information, to determine tones that they can employ to receive data and information at specific strip-symbol periods. The tone subset allocation sequence is constructed, in accordance with various aspects to spread inter-sector and inter-cell interference across respective tones. Although the subject system was described primarily within the context of cellular mode, it is to be appreciated that a plurality of modes may be available and employable in accordance with aspects described herein.

Exemplary Base Station

[0106] FIG. **13** illustrates an example base station **1300** in accordance with various aspects. Base station **1300** implements tone subset allocation sequences, with different tone subset allocation sequences generated for respective different sector types of the cell. Base station **1300** may be used as any one of base stations **1206**, **1208** of the system **1200** of FIG. **12**. The base station **1300** includes a receiver **1302**, a transmitter **1304**, a processor **1306**, e.g., CPU, an input/output interface **1308** and memory **1310** coupled together by a bus **1309** over which various elements **1302**, **1304**, **1306**, **1308**, and **1310** may interchange data and information.

[0107] Sectorized antenna **1303** coupled to receiver **1302** is used for receiving data and other signals, e.g., channel reports, from wireless terminals transmissions from each sector within the base station's cell. Sectorized antenna **1305** coupled to transmitter **1304** is used for transmitting data and other signals, e.g., control signals, pilot signal, beacon signals, etc. to wireless terminals **1400** (see FIG. **14**) within each sector of the base station's cell. In various aspects, base station **1300** may employ multiple receivers **1302** and multiple transmitters **1304**, e.g., an individual receivers **1302** for each sector and an individual transmitter **1304** for each sector. Processor **1306**, may be, e.g., a general purpose central processing unit (CPU). Processor **1306** controls operation of base station **1300** under direction of one or more routines **1318** stored in memory **1310** and implements the methods. I/O interface **1308** provides a connection to other network nodes, coupling the BS **1300** to other base stations, access routers, AAA server nodes, etc., other networks, and the Internet. Memory **1310** includes routines **1318** and data/information **1320**.

[0108] Data/information **1320** includes data **1336**, tone subset allocation sequence information **1338** including downlink strip-symbol time information **1340** and downlink tone information **1342**, and wireless terminal (WT) data/info **1344** including a plurality of sets of WT information: WT **1** info **1346** and WT N info **1360**. Each set of WT info, e.g., WT **1** info **1346** includes data **1348**, terminal ID **1350**, sector ID **1352**, uplink channel information **1354**, downlink channel information **1356**, and mode information **1358**.

[0109] Routines **1318** include communications routines **1322** and base station control routines **1324**. Base station control routines **1324** includes a scheduler module **1326** and signaling routines **1328** including a tone subset allocation routine **1330** for strip-symbol periods, other downlink tone allocation hopping routine **1332** for the rest of symbol periods, e.g., non strip-symbol periods, and a beacon routine **1334**.

[0110] Data **1336** includes data to be transmitted that will be sent to encoder **1314** of transmitter **1304** for encoding prior to transmission to WTs, and received data from WTs that has been processed through decoder **1312** of receiver **1302** following reception. Downlink strip-symbol time information **1340** includes the frame synchronization structure information, such as the superslot, beaconslot, and ultraslot structure information and information specifying whether a given symbol period is a strip-symbol period, and if so, the index of the strip-symbol period and whether the strip-symbol is a resetting point to truncate the tone subset allocation sequence used by the base station. Downlink tone information **1342** includes

information including a carrier frequency assigned to the base station **1300**, the number and frequency of tones, and the set of tone subsets to be allocated to the strip-symbol periods, and other cell and sector specific values such as slope, slope index and sector type.

[0111] Data **1348** may include data that WT**1 1400** has received from a peer node, data that WT **1 1400** desires to be transmitted to a peer node, and downlink channel quality report feedback information. Terminal ID **1350** is a base station **1300** assigned ID that identifies WT **1 1400**. Sector ID **1352** includes information identifying the sector in which WT**1 1400** is operating. Sector ID **1352** can be used, for example, to determine the sector type. Uplink channel information **1354** includes information identifying channel segments that have been allocated by scheduler **1326** for WT**1 1400** to use, e.g., uplink traffic channel segments for data, dedicated uplink control channels for requests, power control, timing control, etc. Each uplink channel assigned to WT**1 1400** includes one or more logical tones, each logical tone following an uplink hopping sequence. Downlink channel information **1356** includes information identifying channel segments that have been allocated by scheduler **1326** to carry data and/or information to WT**1 1400**, e.g., downlink traffic channel segments for user data. Each downlink channel assigned to WT**1 1400** includes one or more logical tones, each following a downlink hopping sequence. Mode information **1358** includes information identifying the state of operation of WT**1 1400**, e.g. sleep, hold, on.

[0112] Communications routines **1322** control the base station **1300** to perform various communications operations and implement various communications protocols. Base station control routines **1324** are used to control the base station **1300** to perform basic base station functional tasks, e.g., signal generation and reception, scheduling, and to implement the steps of the method of some aspects including transmitting signals to wireless terminals using the tone subset allocation sequences during the strip-symbol periods.

[0113] Signaling routine **1328** controls the operation of receiver **1302** with its decoder **1312** and transmitter **1304** with its encoder **1314**. The signaling routine **1328** is responsible controlling the generation of transmitted data **1336** and control information. Tone subset allocation routine **1330** constructs the tone subset to be used in a strip-symbol period using the method of the aspect and using data/info **1320** including downlink strip-symbol time info **1340** and sector ID **1352**. The downlink tone subset allocation sequences will be different for each sector type in a cell and different for adjacent cells. The WTs **1400** receive the signals in the strip-symbol periods in accordance with the downlink tone subset allocation sequences; the base station **1300** uses the same downlink tone subset allocation sequences in order to generate the transmitted signals. Other downlink tone allocation hopping routine **1332** constructs downlink tone hopping sequences, using information including downlink tone information **1342**, and downlink channel information **1356**, for the symbol periods other than the strip-symbol periods. The downlink data tone hopping sequences are synchronized across the sectors of a cell. Beacon routine **1334** controls the transmission of a beacon signal, e.g., a signal of relatively high power signal concentrated on one or a few tones, which may be used for synchronization purposes, e.g., to synchronize the frame timing structure of the downlink signal and therefore the tone subset allocation sequence with respect to an ultra-slot boundary.

Exemplary Wireless Terminal

[0114] FIG. **14** illustrates an example wireless terminal (end node) **1400** which can be used as any one of the wireless terminals (end nodes), e.g., EN(**1**) **1236**, of the system **1200** shown in FIG. **12**. Wireless terminal **1400** implements the tone subset allocation sequences. The wireless terminal **1400** includes a receiver **1402** including a decoder **1412**, a transmitter **1404** including an encoder **1414**, a processor **1406**, and memory **1408** which are coupled together by a bus **1410** over which the various elements **1402**, **1404**, **1406**, **1408** can interchange data and information. An antenna **1403** used for receiving signals from a base station (and/or a disparate wireless terminal) is coupled to receiver **1402**. An antenna **1405** used for transmitting signals, e.g., to a base station (and/or a disparate wireless terminal) is coupled to transmitter **1404**.

[0115] The processor **1406**, e.g., a CPU controls the operation of the wireless terminal **1400** and implements methods by executing routines **1420** and using data/information **1422** in memory **1408**.

[0116] Data/information **1422** includes user data **1434**, user information **1436**, and tone subset allocation sequence information **1450**. User data **1434** may include data, intended for a peer node, which will be routed to encoder **1414** for encoding prior to transmission by transmitter **1404** to a base station, and data received from the base station which has been processed by the decoder **1412** in receiver **1402**. User information **1436** includes uplink channel information **1438**, downlink channel information **1440**, terminal ID information **1442**, base station ID information **1444**, sector ID information **1446**, and mode information **1448**. Uplink channel information **1438** includes information identifying uplink channels segments that have been assigned by a base station for wireless terminal **1400** to use when transmitting to the base station. Uplink channels may include uplink traffic channels, dedicated uplink control channels, e.g., request channels, power control channels and timing control channels. Each uplink channel includes one or more logic tones, each logical tone following an uplink tone hopping sequence. The uplink hopping sequences are different between each sector type of a cell and between adjacent cells. Downlink channel information **1440** includes information identifying downlink channel segments that have been assigned by a base station to WT **1400** for use when the base station is transmitting data/information to WT **1400**. Downlink channels may include downlink traffic channels and assignment channels, each downlink channel including one or more logical tone, each logical tone following a downlink hopping sequence, which is synchronized between each sector of the cell.

[0117] User info **1436** also includes terminal ID information **1442**, which is a base station-assigned identification, base station ID information **1444** which identifies the specific base station that WT has established communications with, and sector ID info **1446** which identifies the specific sector of the cell where WT **1400** is presently located. Base station ID **1444** provides a cell slope value and sector ID info **1446** provides a sector index type; the cell slope value and sector index type may be used to derive tone hopping sequences. Mode information **1448** also included in user info **1436** identifies whether the WT **1400** is in sleep mode, hold mode, or on mode.

[0118] Tone subset allocation sequence information **1450** includes downlink strip-symbol time information **1452** and downlink tone information **1454**. Downlink strip-symbol time information **1452** include the frame synchronization structure information, such as the superslot, beaconslot, and ultraslot structure information and information specifying whether a given symbol period is a strip-symbol period, and if so, the index of the strip-symbol period and whether the strip-symbol is a resetting point to truncate the tone subset allocation sequence used by the base station. Downlink tone info **1454** includes information including a carrier frequency assigned to the base station, the number and frequency of tones, and the set of tone subsets to be allocated to the strip-symbol periods, and other cell and sector specific values such as slope, slope index and sector type.

[0119] Routines **1420** include communications routines **1424** and wireless terminal control routines **1426**. Communications routines **1424** control the various communications protocols used by WT **1400**. Wireless terminal control routines **1426** controls basic wireless terminal **1400** functionality including the control of the receiver **1402** and transmitter **1404**. Wireless terminal control routines **1426** include the signaling routine **1428**. The signaling routine **1428** includes a tone subset allocation routine **1430** for the strip-symbol periods and an other downlink tone allocation hopping routine **1432** for the rest of symbol periods, e.g., non strip-symbol periods. Tone subset allocation routine **1430** uses user data/info **1422** including downlink channel information **1440**, base station ID info **1444**, e.g., slope index and sector type, and downlink tone information **1454** in order to generate the downlink tone subset allocation sequences in accordance with some aspects and process received data transmitted from the base station. Other downlink tone allocation hopping routine **1430** constructs downlink tone hopping sequences, using information including downlink tone information **1454**, and downlink channel information **1440**, for the symbol periods other than the strip-symbol periods. Tone subset allocation routine **1430**, when executed by processor **1406**, is used to determine when and on which tones the wireless terminal **1400** is to receive one or more strip-symbol signals from the base station **1300**. The uplink tone allocation hopping routine **1430** uses a tone subset allocation function, along with information received from the base station, to determine the tones in which it should transmit on.

[0120] In one or more exemplary embodiments, the functions described may be implemented in hardware, software, firmware, or any combination thereof. If implemented in software, the functions may be stored on or transmitted over as one or more instructions or code on a computer-readable medium. Computer-readable media includes both computer storage media and communication media including any medium that facilitates transfer of a computer program from one place to another. A storage media may be any available media that can be accessed by a computer. By way of example, and not limitation, such computer-readable media can comprise RAM, ROM, EEPROM, CD-ROM or other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other medium that can be used to carry or store desired program code in the form of instructions or data structures and that can be accessed by a computer. Also, any connection is properly termed a computer-readable medium. For example, if the software is transmitted from a website, server, or other remote source using a coaxial cable, fiber optic cable, twisted pair, digital subscriber line (DSL), or wireless technologies such as infrared, radio, and microwave, then the coaxial cable, fiber optic cable, twisted pair, DSL, or wireless technologies such as infrared, radio, and microwave are included in the definition of medium. Disk and disc, as used herein, includes compact disc (CD), laser disc, optical disc, digital versatile disc (DVD), floppy disk and blu-ray disc where disks usually reproduce data magnetically, while discs reproduce data optically with lasers. Combinations of the above should also be included within the scope of computer-readable media.

[0121] When the embodiments are implemented in program code or code segments, it should be appreciated that a code segment can represent a procedure, a function, a subprogram, a program, a routine, a subroutine, a module, a software package, a class, or any combination of instructions, data structures, or program statements. A code segment can be coupled to another code segment or a hardware circuit by passing and/or receiving information, data, arguments, parameters, or memory contents. Information, arguments, parameters, data, etc. can be passed, forwarded, or transmitted using any suitable means including memory sharing, message passing, token passing, network transmission, etc. Additionally, in some aspects, the steps and/or actions of a method or algorithm can reside as one or any combination or set of codes and/or instructions on a machine readable medium and/or computer readable medium, which can be incorporated into a computer program product.

[0122] For a software implementation, the techniques described herein can be implemented with modules (e.g., procedures, functions, and so on) that perform the functions described herein. The software codes can be stored in memory units and executed by processors. The memory unit can be implemented within the processor or external to the processor, in which case it can be communicatively coupled to the processor via various means as is known in the art.

[0123] For a hardware implementation, the processing units can be implemented within one or more application specific integrated circuits (ASICs), digital signal processors (DSPs), digital signal processing devices (DSPDs), programmable logic devices (PLDs), field programmable gate arrays (FPGAs), processors, controllers, micro-controllers, microprocessors, other electronic units designed to perform the functions described herein, or a combination thereof.

[0124] What has been described above includes examples of one or more embodiments. It is, of course, not possible to describe every conceivable combination of components or methodologies for purposes of describing the aforementioned embodiments, but one of ordinary skill in the art may recognize that many further combinations and permutations of various embodiments are possible. Accordingly, the described embodiments are intended to embrace all such alterations, modifications and variations that fall within the spirit and scope of the appended claims. Furthermore, to the extent that the term "includes" is used in either the detailed description or the claims, such term is intended to be inclusive in a manner similar to the term "comprising" as "comprising" is interpreted when employed as a transitional word in a claim.

[0125] As used herein, the term to "infer" or "inference" refers generally to the process of reasoning about or inferring states of the system, environment, and/or user from a set of observations as captured via events and/or data. Inference can be employed to identify a specific context or action, or can generate a probability distribution over states, for example.

The inference can be probabilistic—that is, the computation of a probability distribution over states of interest based on a consideration of data and events. Inference can also refer to techniques employed for composing higher-level events from a set of events and/or data. Such inference results in the construction of new events or actions from a set of observed events and/or stored event data, whether or not the events are correlated in close temporal proximity, and whether the events and data come from one or several event and data sources.

[0126] Furthermore, as used in this application, the terms "component," "module," "system," and the like are intended to refer to a computer-related entity, either hardware, firmware, a combination of hardware and software, software, or software in execution. For example, a component can be, but is not limited to being, a process running on a processor, a processor, an object, an executable, a thread of execution, a program, and/or a computer. By way of illustration, both an application running on a computing device and the computing device can be a component. One or more components can reside within a process and/or thread of execution and a component can be localized on one computer and/or distributed between two or more computers. In addition, these components can execute from various computer readable media having various data structures stored thereon. The components can communicate by way of local and/or remote processes such as in accordance with a signal having one or more data packets (e.g., data from one component interacting with another component in a local system, distributed system, and/or across a network such as the Internet with other systems by way of the signal).

What is claimed is:

1. A method that facilitates a timing alignment in a multicarrier system, the method comprising:

determining at least one downlink timing associated with at least one downlink carrier;

ascertaining an uplink timing associated with an uplink group of carriers, wherein the uplink timing is ascertained based on a processing of at least one downlink timing and a timing offset associated with the uplink group of carriers; and

transmitting each of the uplink group of carriers within a threshold value of the uplink timing.

2. The method of claim **1**, further comprising performing a random access procedure on at least one random access carrier, wherein the at least one random access carrier is included in a downlink group of carriers that includes the at least one downlink carrier.

3. The method of claim **2**, wherein the performing comprises performing the random access procedure on a single carrier.

4. The method of claim **3**, wherein the single carrier is an assigned carrier provided by a network prior to the performing of the random access procedure.

5. The method of claim **4**, further comprising receiving the single carrier as part of a dedicated radio resource configuration.

6. The method of claim **4**, further comprising receiving a criterion associated with a usage of the single carrier, wherein the criterion is received with an assignment of the single carrier.

7. The method of claim **6**, wherein the criterion is a minimum signal quality threshold associated with the single carrier.

8. The method of claim **6**, wherein the performing comprises performing the random access procedure on an alternative carrier in response to the criterion not being met by the single carrier, and wherein the receiving further comprises receiving an indication of the alternative carrier from the network.

9. The method of claim **6**, wherein the performing comprises performing the random access procedure on an alternative carrier in response to the criterion not being met by the single carrier, and wherein the alternative carrier is independently selected by a wireless terminal.

10. The method of claim **3**, further comprising selecting the single carrier, wherein the single carrier is independently selected by a wireless terminal.

11. The method of claim **10**, wherein the selecting comprises applying a determination function across a set of available carriers in the downlink group of carriers.

12. The method of claim **11**, wherein the determination function is a pseudorandom function.

13. The method of claim **11**, wherein the determination function is a hash function.

14. The method of claim **13**, further comprising inputting an identifier associated with the wireless terminal into the hash function.

15. The method of claim **13**, further comprising inputting an identifier associated with a network node into the hash function, wherein the downlink group of carriers is controlled by the network node.

16. The method of claim **13**, further comprising inputting a time-varying value into the hash function.

17. The method of claim **16**, further comprising determining the time-varying value via a time measurement taken from within the wireless terminal.

18. The method of claim **16**, further comprising modifying the time-varying value by an arithmetic operation each time the time-varying value is used.

19. The method of claim **10**, wherein the selecting is performed at a time when radio resources are assigned to the wireless terminal on any of the downlink group of carriers.

20. The method of claim **10**, wherein the selecting is performed in response to a triggering of the random access procedure.

21. An apparatus configured to facilitate a timing alignment in a multicarrier system, the apparatus comprising:

a processor configured to execute computer executable components stored in memory, the components including:

a downlink timing component configured to determine at least one downlink timing associated with at least one downlink carrier;

an uplink timing component configured to ascertain an uplink timing associated with an uplink group of carriers, wherein the uplink timing is ascertained based on at least one downlink timing and a timing offset associated with the uplink group of carriers; and

a communication component configured to transmit each of the uplink group of carriers within a threshold value of the uplink timing.

22. The apparatus of claim **21**, wherein the uplink timing component is configured to determine the uplink timing by utilizing a different timing offset for each of a plurality of uplink group of carriers.

23. The apparatus of claim **21**, wherein the uplink timing component is configured to determine the uplink timing by utilizing a different downlink timing for each of a plurality of uplink group of carriers.

24. The apparatus of claim **21**, wherein the at least one downlink carrier is included in one of a plurality of downlink groups, and wherein the uplink timing component is configured to determine the uplink timing by associating the uplink group of carriers with the one of the plurality of downlink groups.

25. The apparatus of claim **24**, wherein the uplink timing component is configured to determine a plurality of uplink timings respectively associated with a plurality of uplink groups by identifying a subset of downlink groups that include an assigned carrier, and wherein the plurality of uplink groups are respectively associated with the subset of downlink groups that include the assigned carrier.

26. The apparatus of claim **24**, further comprising a message processing component configured to process a received timing message encoded with a set of uplink timing instructions respectively corresponding to an uplink group subset of the uplink group of carriers.

27. The apparatus of claim **26**, wherein the received timing message is a timing advance command.

28. The apparatus of claim **26**, wherein the received timing message comprises a vector encoded with timing adjustment values associated with the uplink group subset.

29. The apparatus of claim **26**, wherein each uplink group within the uplink group subset includes at least one carrier with an assigned radio resource.

30. The apparatus of claim **26**, wherein the uplink group of carriers comprise a set of uplink groups in which each uplink group within the set of uplink groups includes at least one carrier with an assigned radio resource, and wherein the uplink group subset is a subset of the set of uplink groups.

31. The apparatus of claim **30**, wherein the uplink group subset is determined by a network entity.

32. The apparatus of claim **31**, wherein the message processing component is configured to submit a request requesting the network entity to provide the uplink group subset, and wherein the uplink group subset is determined by the network entity in response to the request.

33. The apparatus of claim **30**, wherein the received timing message includes an indication of which of the uplink group of carriers are included in the uplink group subset.

34. The apparatus of claim **33**, wherein the message processing component is configured to decode the indication according to a mapping of group identities shared with a network.

35. The apparatus of claim **34**, wherein the mapping of group identities is configured in association with an assignment of dedicated radio resources on uplink carriers within at least one uplink group of the uplink group subset.

36. The apparatus of claim **24**, further comprising a message processing component configured to decode a timing message received via a timing message carrier included in a messenger downlink group, wherein the timing message is encoded with at least one inter-group uplink timing corresponding to a target downlink group, and wherein the target downlink group is different than the messenger downlink group.

37. The apparatus of claim **36**, wherein the timing message includes an indication of the target downlink group.

38. The apparatus of claim **37**, wherein the message processing component configured to decode the indication according to a mapping of group identities shared with a network.

39. The apparatus of claim **38**, wherein the mapping of group identities is configured in association with an assignment of dedicated radio resources on downlink carriers included in the target downlink group.

40. The apparatus of claim **21**, further comprising an averaging component configured to compute an average downlink timing from a plurality of downlink timings respectively corresponding to a set of downlink carriers within a particular downlink group that includes the at least one downlink carrier, wherein the uplink timing component is configured to determine the uplink timing by applying the timing offset to the average downlink timing.

41. The apparatus of claim **40**, wherein the particular downlink group comprises at least one carrier associated with an assigned radio resource.

42. The apparatus of claim **40**, wherein the particular downlink group comprises a set of carriers identified by a network.

43. A computer program product that facilitates a timing alignment in a multicarrier system, comprising:

a computer-readable storage medium comprising code for causing at least one computer to:

determine at least one downlink timing associated with at least one downlink carrier;

ascertain an uplink timing associated with an uplink group of carriers, wherein the uplink timing is ascertained based on at least one downlink timing and a timing offset associated with the uplink group of carriers; and

transmit each of the uplink group of carriers within a threshold value of the uplink timing.

44. The computer program product of claim **43**, wherein the code causes the at least one computer to associate the uplink group of carriers with one of a plurality of downlink groups, and wherein the code further causes the at least one computer to receive a timing message encoded with a set of uplink timing instructions respectively corresponding to a downlink group subset of the plurality of downlink groups.

45. The computer program product of claim **43**, wherein the code causes the at least one computer to decode a timing message received via a timing message carrier included in a messenger downlink group, and wherein the timing message is encoded with at least one inter-group uplink timing corresponding to a target downlink group different than the messenger downlink group.

46. The computer program product of claim **43**, wherein the code causes the at least one computer to compute an average downlink timing from a plurality of downlink timings respectively corresponding to a set of downlink carriers within a particular downlink group that includes the at least one downlink carrier, and wherein the code further causes the at least one computer to determine the uplink timing by applying the timing offset to the average downlink timing.

47. The computer program product of claim **43**, wherein the code causes the at least one computer to perform a random access procedure on at least one random access carrier, and wherein the at least one random access carrier is included in a downlink group of carriers that includes the at least one downlink carrier.

48. An apparatus configured to facilitate a timing alignment in a multicarrier system, the apparatus comprising:

means for determining at least one downlink timing associated with at least one downlink carrier;

means for ascertaining an uplink timing associated with an uplink group of carriers, wherein the uplink timing is ascertained based on at least one downlink timing and a timing offset associated with the uplink group of carriers; and

means for transmitting each of the uplink group of carriers within a threshold value of the uplink timing.

49. The apparatus of claim **48**, wherein the means for ascertaining is configured to utilize a different timing offset for each of a plurality of uplink group of carriers.

50. The apparatus of claim **48**, wherein the means for ascertaining is configured to utilize a different downlink timing for each of a plurality of uplink group of carriers.

51. The apparatus of claim **48**, wherein the at least one downlink carrier is included in one of a plurality of downlink groups, and wherein the means for ascertaining is configured to associate the uplink group of carriers with the one of the plurality of downlink groups.

52. The apparatus of claim **48**, further comprising means for performing a random access procedure on at least one random access carrier, wherein the at least one random access carrier is included in a downlink group of carriers that includes the at least one downlink carrier.

53. A method that facilitates a timing alignment in a multicarrier system, the method comprising:

transmitting a downlink communication to a wireless terminal via at least one downlink carrier;

assigning a timing offset to an uplink group of carriers;

providing the timing offset to the wireless terminal via the at least one downlink carrier; and

receiving an uplink communication via the uplink group of carriers, wherein the uplink group of carriers are received according to the timing offset.

54. The method of claim **53**, wherein the assigning comprises assigning a different timing offset to each of a plurality of uplink groups.

55. The method of claim **54**, further comprising generating a timing message encoded with a set of uplink timing instructions respectively corresponding to an uplink group subset of the plurality of uplink groups, wherein the transmitting comprises transmitting the timing message to the wireless terminal.

56. The method of claim **55**, wherein the timing message is a timing advance command.

57. The method of claim **55**, wherein the timing message comprises a vector encoded with timing adjustment values associated with the uplink group subset.

58. The method of claim **55**, wherein each uplink group within the uplink group subset includes at least one carrier with a radio resource assigned to the wireless terminal.

59. The method of claim **55**, wherein the plurality of uplink groups comprise a set of uplink groups in which each uplink group within the set of uplink groups includes at least one carrier with a radio resource assigned to the wireless terminal, and wherein the uplink group subset is a subset of the set of uplink groups.

60. The method of claim **59**, further comprising determining the uplink group subset.

61. The method of claim **60**, further comprising receiving a request from the wireless terminal to provide the uplink group subset, wherein the determining is performed in response to the request.

62. The method of claim **59**, wherein the timing message is encoded with an indication of which of the plurality of uplink groups are included in the uplink group subset.

63. The method of claim **62**, wherein the indication is encoded according to a mapping of group identities shared with the wireless terminal.

64. The method of claim **63**, wherein the mapping of group identities is configured in association with an assignment of dedicated radio resources on uplink carriers within at least one uplink group of the uplink group subset.

65. The method of claim **54**, further comprising generating a timing message encoded with at least one inter-group uplink timing corresponding to a target downlink group, wherein the transmitting comprises transmitting the timing message to the wireless terminal via a timing message carrier included in a messenger downlink group, and wherein the target downlink group is different than the messenger downlink group.

66. The method of claim **65**, wherein the timing message is encoded with an indication of the target downlink group.

67. The method of claim **66**, wherein the indication is encoded according to a mapping of group identities shared with the wireless terminal.

68. The method of claim **67**, wherein the mapping of group identities is configured in association with an assignment of dedicated radio resources on downlink carriers included in the target downlink group.

69. An apparatus configured to facilitate a timing alignment in a multicarrier system, the apparatus comprising:

a processor configured to execute computer executable components stored in memory, the components including:

a timing offset component configured to assign a timing offset to an uplink group of carriers;

a transmitting component configured to provide the timing offset to a wireless terminal via at least one downlink carrier; and

a receiving component configured to receive an uplink communication via the uplink group of carriers, wherein the uplink group of carriers are received according to the timing offset.

70. The apparatus of claim **69**, wherein the transmitting component is configured to transmit a downlink group of carriers from antennas located at a common site.

71. The apparatus of claim **69**, wherein the transmitting component is configured to identify a set of carriers respectively corresponding to a plurality of downlink timings to facilitate an averaging of the plurality of downlink timings performed by the wireless terminal.

72. The apparatus of claim **69**, further comprising a random access component configured to identify a random access carrier to facilitate a random access procedure, wherein the random access carrier is a carrier assigned to the wireless terminal.

73. The apparatus of claim **72**, wherein the transmitting component is configured to transmit the random access carrier as part of a dedicated radio resource configuration.

74. The apparatus of claim **72**, wherein the random access component is configured to ascertain a criterion associated with a usage of the random access carrier, and wherein the

criterion is provided to the wireless terminal with an assignment of the random access carrier.

75. The apparatus of claim **74**, wherein the criterion is a minimum signal quality threshold associated with the random access carrier.

76. The apparatus of claim **74**, wherein the random access component is configured to identify an alternative carrier to facilitate a performing of the random access procedure by the wireless terminal on the alternative carrier in response to the criterion not being met by the random access carrier.

77. A computer program product that facilitates a timing alignment in a multicarrier system, comprising:

a computer-readable storage medium comprising code for causing at least one computer to:

transmit at least one downlink carrier to a wireless terminal;

assign a timing offset to an uplink group of carriers;

provide the timing offset to the wireless terminal via the at least one downlink carrier; and

receive an uplink communication via the uplink group of carriers, wherein the uplink group of carriers are received according to the timing offset.

78. The computer program product of claim **77**, wherein the code causes the at least one computer to transmit a downlink group of carriers from antennas located at a common site.

79. The computer program product of claim **77**, wherein the code causes the at least one computer to assign a different timing offset to each of a plurality of uplink groups.

80. The computer program product of claim **79**, wherein the code causes the at least one computer to generate a timing message encoded with a set of uplink timing instructions respectively corresponding to an uplink group subset of the plurality of uplink groups, and wherein the code further causes the at least one computer to transmit the timing message to the wireless terminal.

81. The computer program product of claim **77**, wherein the code causes the at least one computer to identify a set of carriers respectively corresponding to a plurality of downlink timings to facilitate an averaging of the plurality of downlink timings performed by the wireless terminal.

82. The computer program product of claim **77**, wherein the code causes the at least one computer to identify a random access carrier to facilitate a random access procedure, and wherein the random access carrier is a carrier assigned to the wireless terminal.

83. An apparatus configured to facilitate a timing alignment in a multicarrier system, the apparatus comprising:

means for transmitting at least one downlink carrier to a wireless terminal;

means for assigning a timing offset to an uplink group of carriers;

means for providing the timing offset to the wireless terminal via the at least one downlink carrier; and

means for receiving an uplink communication via the uplink group of carriers, wherein the uplink group of carriers are received according to the timing offset.

84. The apparatus of claim **83**, wherein the means for transmitting is configured to transmit a downlink group of carriers from antennas located at a common site.

85. The apparatus of claim **83**, wherein the means for assigning is configured to assign a different timing offset to each of a plurality of uplink groups.

86. The apparatus of claim **85**, further comprising a means for generating a timing message encoded with at least one inter-group uplink timing corresponding to a target downlink group, wherein the means for transmitting is configured to transmit the timing message to the wireless terminal via a timing message carrier included in a messenger downlink group, and wherein the target downlink group is different than the messenger downlink group.

87. The apparatus of claim **83**, wherein the means for transmitting is configured to identify a set of carriers respectively corresponding to a plurality of downlink timings to facilitate an averaging of the plurality of downlink timings performed by the wireless terminal.

88. The apparatus of claim **83**, wherein the means for transmitting is configured to identify a random access carrier to facilitate a random access procedure, and wherein the random access carrier is a carrier assigned to the wireless terminal.

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