

beginning of a time slot. Fast decision algorithm 430 may continue to search for a stronger burst from a second mobile station 15 arriving at smart antenna apparatus 16 via a second uplink beam later in the time slot. If the burst identified in the second beam station is sufficiently stronger than the burst identified in the first beam, fast decision beam selection module 408 may switch fast decision beam selection 440 from the first beam to the second beam.

[0176] As buffer 480 continues to update the average power 484 of each uplink beam 130, fast decision algorithm 430 may determine whether the average power 484 of the current strongest uplink beam 130 exceeds that of the current fast decision beam selection 440 by an amount greater than improvement threshold 434. If fast decision algorithm 430 determines that current strongest uplink beam 130 does exceed that of the current fast decision beam selection 440 by an amount greater than improvement threshold 434, fast decision beam selection module 408 may switch fast decision beam selection 440 to the current strongest uplink beam 130. If fast decision algorithm 430 determines that current strongest uplink beam 130 does not exceed that of the current fast decision beam selection 440 by an amount greater than improvement threshold 434, fast decision beam selection module 408 may maintain the most recently selected fast decision beam selection 440.

[0177] Fast decision algorithm 430 may continue to determine whether the average power 484 of the current strongest uplink beam 130 exceeds that of the currently current fast decision beam selection 440 by an amount greater than the improvement threshold 434, and fast decision beam selection module 408 may continue to switch the selected fast decision beam selection 440 accordingly. In some embodiments, fast decision beam selection module 408 continues switching or updating fast decision beam selection 440 as described above until a certain time is reached. For example, in a GSM environment, fast decision beam selection module 408 may continue switching fast decision beam selection 440 until the last point in the time slot in which a random access channel (RACH) signal could be received by smart antenna apparatus 16. In particular, fast decision beam selection module 408 continues switching fast decision beam selection 440 until the approximate middle of the time slot is reached. In one embodiment, fast decision beam selection module 408 continues switching until the 61st GSM bit in the time slot is reached.

[0178] In another embodiment, fast decision beam selection module 408 continues switching or updating fast decision beam selection 440 as described above until the same uplink beam 130 remains the selected uplink beam 130 for a defined time period. When the same uplink beam 130 remains selected as fast decision beam selection 440 for a defined time period, that uplink beam 130 may be locked in and fast decision beam selection module 408 may refuse to switch to any other uplink beam 130, regardless of whether the average power 484 of the current strongest uplink beam 130 exceeds the locked-in uplink beam 130 by the improvement threshold 434. For example, in one embodiment, fast decision beam selection module 408 continues switching fast decision beam selection 440 until the same uplink beam 130 is selected as fast decision beam selection 440 for a period of time equal to approximately three GSM bits. In this embodiment, when the same uplink beam 130 remains the fast decision beam selection 440 for approximately three

GSM bits, that uplink beam 130 is locked in and fast decision beam selection module 408 will not switch to any other uplink beam 130.

[0179] Fast decision beam selection module 408 may be operable to determine, or switch, fast decision beam selection 440 substantially in real time. For example, average power calculator 436 may determine the average power 484 of each uplink beam 130 during based on signals received via each uplink beam 130 in a first portion of a first time slot of a first frame. Fast decision algorithm 430 may then select the uplink beam 130 based at least in part on the average power 484 of each uplink beam 130. Receiving beam switch 127 may then switch to the selected uplink beam 130 such that signals received via the selected uplink beam 130 in a second portion of the first time slot of the first frame may be communicated to the base station transceiver in real time.

[0180] In some embodiments, fast decision beam selection module 408 is operable to determine, or switch, fast decision beam selection 440 to the appropriate uplink beam 130 each time average power calculator 436 calculates or updates the average power 484 of each uplink beam 130. To provide further illustration, suppose mobile station 15 communicates a RACH burst, such as a call initiation request or an access request, which is received by processing system 102 via a particular uplink beam 130. Fast decision beam selection module 408 may identify the RACH burst and select the uplink beam 130 as fast decision beam selection 440 before the end of the pre-message, tail, or guard portion of the burst. In one embodiment in a GSM environment, beam selection module 408 is operable to select fast decision beam selection 440 during the 3 GSM bit tail portion at the beginning of a burst.

[0181] Fast decision beam selection module 408 may be used in variety of circumstances. For example, beam selection decisions made by fast decision beam selection module 408 may be used during the initiation of a call by a mobile station 15 or in some situations in which the location of a mobile station 15 is unknown by smart antenna system 14. In particular, fast decision beam selection module 408 may be used to make beam selection determinations regarding a communication initiation signal, such as a random access channel (RACH) signal, received from a mobile station 15, as described above. In addition, in some embodiments, beam selection determinations made by fast decision beam selection module 408 are used initially after mobile station 15 has switched to a particular traffic channel according to base station control signals.

[0182] Fast decision beam selection module 408 provides the ability to switch beams in real time for communications about which smart antenna apparatus 16 has little or no previous information. In particular, fast decision beam selection module 408 may be operable to select and switch beams for call initiation signals received from mobile stations 15. Thus, since beam selection generally decreases interference and increases the coverage or range of an antenna system, smart antenna system 14 has an increased range for identifying initial signals, such as access requests or call initiation signals, from mobile stations 15 as compared with traditional sector antennas or antennas that use beam selection techniques only after a call has been established.

[0183] FIG. 13 illustrates a method of fast decision beam selection in accordance with an embodiment of the present