METHOD AND APPARATUS FOR VARYING APPARENT CELL SIZE IN A CELLULAR COMMUNICATION SYSTEM

FIELD OF THE INVENTION

The present invention relates generally to communication systems that divide an area within which communications are to take place into cells and allocates spectral resources among subscriber units in the cells. The present invention more specifically pertains to communication systems having multiple satellites moving relative to each other that project cells onto the surface of the Earth.

BACKGROUND OF THE INVENTION

Satellites are important links for communication between stations at different locations throughout the world, particularly for mobile communication stations. For a satellite system to give worldwide coverage, a network or constellation of satellites is desirable.

Each satellite within such a satellite constellation has one or more directional antennas producing a coverage pattern on Earth referred to as the "footprint" of the satellite antenna. When multiple polar orbiting satellites are used, the satellites converge towards the poles and antenna footprints begin to overlap.

Where the antenna footprint is made up of separate "cells" in which individual communication is to take place, certain cells overlap. When cells from one satellite overlap cells from another satellite, the cells may be turned off as part of a cell management plan to prevent interference between cells of the same channels.

Individual cells generally have limited capacity for communication traffic. A cell's capacity is generally based on the amount of traffic channels available for communication. In satellite communication systems where the satellites move with respect to the surface of the Earth, individual cells may pass over high population density areas having a high demand for communication services. There may be situations where the demand for communication services within an individual cell may exceed the cell's capacity. When this occurs, ongoing communications may unfortunately, be terminated (i.e., calls may be dropped) and/or new subscriber units requesting access to the communication system may be denied access and unable to make a call.

Thus what is needed is a method and apparatus for managing loading in a cellular communication system that reduces or prevents cell traffic overload. What is also needed is a method and apparatus of encouraging subscriber units within overloaded cells to seek service from other overlapping cells that are not overloaded.

SUMMARY OF THE INVENTION

Accordingly, it is an advantage of the present invention that a communication system is provided which distributes loading among cells of the system.

Another advantage of the present invention is that system resources dedicated to one cell are minimized.

Another advantage of the present invention is that communication traffic is shared among adjacent cells.

Another advantage of the present invention is that high demand times are predicted and the traffic load is distributed among adjacent cells based on the predicted demand.

Another advantage is that the present invention, in a preferred embodiment, dynamically compensates in real-time for the traffic demand in a particular cell.

The above and other advantages of the present invention are carried out in one form by a method of controlling cell loading in a cellular communication system. The method comprises the step of communicating within a cell on a traffic channel with a subscriber unit. The subscriber unit monitors a signal level of a broadcast channel associated with the cell. The method also comprises the steps of measuring a demand for communication services within the cell, and changing the signal level in response to the measuring step. The subscriber unit is responsive to the signal level of the broadcast channel.

The present invention also provides a method of controlling cell loading in a cellular communication system comprising the steps of measuring real-time demand for communication services within each cell of the system, and dynamically adjusting, for each of the cells, a signal level of a broadcast channel associated with each cell in response to the real-time demand. The adjusting step causes subscriber units monitoring the signal level to request a handoff to transfer to an adjacent cell.

The present invention also provides a method of controlling cell loading in a cellular communication system having a plurality of cells that move relative to the surface of the Earth. The method comprises the step of determining which cells are planned to be turned off when cells from different satellite nodes overlap. The method also comprises the step of reducing a signal level of a broadcast channel associated with the cells causing subscriber units located in the cells to initiate a handoff to transfer to adjacent cells. The method also comprises the step of turning off the cells after the subscriber units transfer to the adjacent cells.

The present invention also provides a method of encouraging a subscriber unit to seek service from a neighboring cell in a cellular communication system. The method comprises the step of monitoring, by the subscriber unit, a signal level of a broadcast channel associated with a cell in which the subscriber unit is located. The signal level is controlled by the communication system which predicts a demand for communication services within the cell and changes the signal level in response to the predicted demand. The method also includes the step of initiating a handoff request to an adjacent cell when the signal level at the subscriber unit falls below a predetermined value.

The present invention also provides a cellular communication system having a plurality of cells, each cell having a broadcast channel associated therewith. The system comprises an antenna for transmitting the broadcast channel, a multi-channel transceiver coupled to the antenna, and a processor coupled to the transceiver. The processor is configured for measuring a demand for communication services within one of the cells and instructing the transceiver to change a signal level of the broadcast channel in response to the measuring step.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows a layout diagram of an environment which supports a communications system within which the present invention may be practiced;

FIG. **2** illustrates a portion of a cellular pattern formed on the surface of the Earth by satellites for the communication system of FIG. **1**;