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CONFIRMATION NO. 1552

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FILING RECEIPT



Date Mailed: 07/26/2011

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Title

Intelligent Point of Interface for Distributed Antenna Systems

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PROVISIONAL APPLICATION FOR PATENT COVER SHEET – Page 1 of 2

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

Express Mail Label No. VIA EFS WEB (Online)

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Additional inventors are being named on the _____ separately numbered sheets attached hereto		
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PTO/SB/16 (12-08)

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SIGNATURE /Jason D. Gardner 58180/

Date July 11, 2011

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(if appropriate)

TELEPHONE 404-815-6500

Docket Number: 62508/809556

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INTELLIGENT POINT OF INTERFACE FOR DISTRIBUTED ANTENNA SYSTEMS

Brief Description of the Drawings

[0001] Figure 1 is a schematic view of a distributed antenna system having an intelligent point of interface (i-POI) according to one embodiment.

[0002] Figure 2 is a block diagram of an i-POI system with an interface section, an output section, and a backplane according to one embodiment.

[0003] Figures 3A and 3B are modeling diagrams of various configurations of an i-POI system providing sectors to coverage zones according to one embodiment.

[0004] Figure 4 is a block diagram of interconnected i-POI systems according to one embodiment.

[0005] Figure 5 is a block diagram of an i-POI system configured to communicate with other i-POI systems according to one embodiment.

Detailed Description

[0006] Certain aspects and embodiments are directed to an intelligent point of interface (“i-POI”) system that can be disposed in a distributed antenna system (DAS) and that can redistribute capacity among coverage zones serviced by the DAS. A DAS can include a unit, such as an i-POI system, in communication with carrier systems, such as base stations of cellular service providers. The i-POI system can provide one or more signals, such as analog RF signals or digitized RF signals, over a serial link to the remote antennas in the coverage zone. An example of an i-POI system is an intelligent base transceiver station (“BTS”) router.

[0007] A coverage zone can include one or more remote antennas that provide signal coverage to an area. The remote antennas in a coverage zone can communicate with the i-POI system over a serial link. The remote antennas can wirelessly communicate the signals from the i-POI system to wireless devices positioned in a coverage zone.

[0008] The i-POI system can redistribute capacity by changing which sectors are provided to which coverage zones. A sector can represent an amount of telecommunication capacity that can be allocated to wireless devices in one or more coverage zones. Increasing the bandwidth associated with a sector can increase the capacity represented by the sector. A sector can include one or more analog RF channels or digital signals representing RF channels, signals in one or more analog or digital RF bands, and/or one or more multiple-input and multiple-output (“MIMO”) data streams.

[0009] The signals of a sector can be provided to a coverage zone via the i-POI system. The signals of a sector can also be divided among two or more coverage zones providing coverage to a physical area. All of the signals of a sector can be radiated by the remote antennas of one or more coverage zones included in a physical area.

[0010] Increasing the number of coverage zones to which a sector is distributed can decrease the capacity density of each coverage zone. The capacity density of a coverage zone can include the number of sectors distributed to the coverage zone. If more wireless devices are concentrated in a first coverage zone than are concentrated in a second coverage zone, the i-POI system can shift capacity from the second coverage zone to the first coverage zone. The i-POI can shift capacity by reducing the number of coverage zones to which a sector is distributed. By distributing the sector to fewer coverage zones (and thus a smaller physical area), the capacity density (i.e., the capacity per physical area) is increased. The number of coverage zones to which an i-POI system distributes sectors can be greater than or equal to the number of sectors distributed by the i-POI system.

[0011] Sectors from base stations associated with different telecommunications system operators can be distributed to one or more common coverage zones. The i-POI system can allocate the respective capacities of different telecommunications system operators among coverage zones such that different capacity densities are associated with different telecommunication system operators within a specific coverage zone. For example, four sectors of a first telecommunication system operator may be distributed among six coverage zones and two sectors of a second telecommunication

system operator may be distributed among the same six coverage zones. The capacity density for the first telecommunication system operator thus exceeds the capacity density for the second telecommunication system operator in the same physical area including the six coverage zones.

[0012] An i-POI system can include donor interface cards, a backplane, and zone interface cards. A donor interface card interfaces with a base station and can provide digital data streams representing the signals of a sector to the backplane. The backplane can route digital signals from donor cards to one or more zone interface cards. The i-POI system can provide signals of a sector via the zone interface card to one or more remote antennas in a coverage zone.

[0013] An i-POI system can also determine the location of a specific wireless device within the environment of the DAS. The i-POI system can communicate with a base station to determine an identifier for the specific wireless device. The i-POI system can then determine a channel over which the specific wireless device is communicating. A channel can include a connection, such as a transmit and receive frequency, over which a wireless device and a base station communicate via the DAS. The i-POI system can determine a coverage zone to which the channel is being provided and which remote antenna in a coverage zone is associated with the wireless device. The i-POI system can determine which remote antenna is associated with the wireless device by determining the received signal strength indicator (RSSI) of an uplink signal from the wireless device at each remote antenna. The remote antenna associated with the wireless device receives the uplink signal at the strongest RSSI. The i-POI system can access a data file that includes the location of each remote

antenna to determine, based on which remote antenna is communicating with the wireless device, the location of the wireless device.

[0014] An i-POI system can also include a separate copper or optical interface card for connecting the i-POI system to another i-POI system in the DAS. Interconnecting multiple i-POI systems can increase the number of coverage zones supported by a sector.

[0015] Detailed descriptions of these embodiments are discussed below. These illustrative examples are given to introduce the reader to the general subject matter discussed here and are not intended to limit the scope of the disclosed concepts. The following sections describe various additional embodiments and examples with reference to the drawings in which like numerals indicate like elements, and directional descriptions are used to describe the illustrative embodiments but, like the illustrative embodiments, should not be used to limit the present invention.

[0016] Figure 1 depicts a DAS 10 having an i-POI system 14 in communication with the base stations 12a-n and with the remote antennas 18a-p of coverage zones 16a-f. The DAS 10 can be positioned in an area, such as a stadium or office building, to extend wireless communication coverage of the base stations 12a-n. Different base stations 12a-n can be associated with different sectors of one telecommunication system operator and/or be associated with different telecommunication system operators.

[0017] In the downlink direction, the DAS 10 can receive signals from the base stations 12a-n via a wired or wireless communication medium. Downlink signals can include signals provided from the base stations 12a-n and radiated into the coverage

zones 16a-f by the remote antennas 18a-p. The downlink signals received by the i-POI system 14 can be associated with one or more sectors from the base stations 12a-n.

[0018] The i-POI system 14 can communicate sectors between the base stations 12a-n and the coverage zones 16a-f. Each of the coverage zones 16a-f can correspond to a physical area within the environment of the DAS 10. The DAS 10 can distribute a sector to a single physical area that includes multiple coverage zones. The remote antennas in the coverage zones of the physical area can radiate the signals of the sector distributed to the physical area.

[0019] The i-POI system 14 can include circuitry for processing the signals communicated between the base stations 12a-n and the coverage zones 16a-f. Processing the signals can include transforming the signals received from the base stations 12a-n into a digital format. Processing the signals can also include filtering downlink signals from the base stations 12a-n.

[0020] The i-POI system 14 can also include circuitry for routing signals from the base stations 12a-n to the remote antennas 16a-f. Routing the signals can include combining the signals of the sectors from one or more base stations 12a-n. In some embodiments, the i-POI system 14 can combine signals from multiple sectors associated with a common telecommunication system operator if the signals are associated with different frequency bands or different non-overlapping segments of the same RF band. Routing the signals can also include transforming the signals into a format used by the remote antennas (e.g., analog RF signals), and providing the combined signals to the remote antennas for specific coverage zones.

[0021] In some embodiments, the i-POI system 14 can communicate with both the base stations 12a-n and the remote antennas 18a-p using analog RF signals. The i-POI system 14 can transform analog RF signals from the base stations 12a-n into digital signals for processing, such as by routing the digital signals and combining the digital signals together. The i-POI system can transform the digital signals into analog RF signals before providing the signals to the remote antennas 18a-p.

[0022] In other embodiments, the i-POI system 14 can communicate digital signals with the base stations 12a-n and communicate analog RF signals with the remote antennas 18a-p. Processing signals from the base stations 12a-n can include converting signals in one digital format used by the base stations 12a-n into a different digital format used by the i-POI system 14. For example, the i-POI system 14 may convert digital signals in different standardized formats, such as Common Public Radio Interface ("CPRI") or Open Radio Equipment Interface ("ORI"), to a common digital format to process the signals.

[0023] In other embodiments, the i-POI system 14 can communicate digital signals with remote antenna units associated with remote antennas 18a-p. Processing signals from the base stations 12a-n can include converting signals in one digital format used by the base stations 12a-n into a different digital format used by the remote antenna units.

[0024] For example, an i-POI system 14 communicating with remote antenna units may receive downlink signals that are digital signals in different standardized formats from the base stations 12a-n. The i-POI system 14 can convert the downlink signals to digital data streams in a common format and combine the digital data streams

into a combined digital data stream. The i-POI system 14 can provide the combined digital data stream to the remote antenna units. Sectors provided as MIMO data streams, for example, can be combined with other digital data streams and provided to a common remote antenna unit. The remote antenna units can de-multiplex the combined digital data stream into digital data streams representing individual downlink signals. The remote antenna units can convert the digital data streams signals to downlink analog RF signals and radiate the downlink analog RF signals to the wireless devices. For each downlink signal, the i-POI system 14 can receive a reference clock signal from the base station at which the downlink signal originated. The i-POI system can use the reference clock signal to synchronize the remote antenna units radiating a downlink signal with the base station providing the downlink signal.

[0025] In other embodiments, the i-POI system 14 can receive downlink signals that are analog signals from base stations 12a-n. The analog signals can include MIMO signals as streams, or more than one sector of the same operator in the same band segment of the same RF band. At least one of the signals, which may be a second stream of a MIMO signal or a second sector, can be translated in frequency in the i-POI system 14, and transported over the same communication link as a first signal. A remote antenna may be associated with circuitry that can translate the second stream of the MIMO signal or the second sector back to an original frequency. If the signal is the second MIMO stream, the signal can be radiated with the other streams on the same antenna element. If the signal is the second sector, the signal can be radiated by a separate antenna element. A reference clock signal can be provided by the i-POI

system 14 to the DAS to allow the circuitry associated with the remote antenna to be synchronized in frequency with the first conversion of the signal.

[0026] The coverage zones 16a-f can include the areas to which the DAS 10 extends signal coverage of the base stations 12a-n. For example, if the DAS 10 is positioned in a stadium, the coverage zones 16a-f may correspond to different sections of the stadium and the parking lot surrounding the stadium. In another example, if the DAS 10 is positioned in an office building, each of the coverage zones 16a-f may correspond to a different floor of the building.

[0027] Each of the coverage zones 16a-f can each include one or more remote antennas 18a-p. The remote antennas 18a-p can service a number of different wireless devices, such as cellular phones, operating in the environment of the DAS 10. The remote antennas of a particular coverage zone can receive the same group of signals from the i-POI system 14. The remote antennas in the coverage zone can radiate the group of signals, such as a sector, received from the i-POI system 14 to the coverage zone. The remote antennas 18a-p can communicate with the i-POI system 14 via any communication medium capable of carrying signals between the i-POI system 14 and the remote antennas 18a-p. Examples of a suitable communication medium include copper wire (such as a coaxial cable), optical fiber, and microwave or optical link. The link can transport the signals in analog or in digitized form. As depicted in Figure 1, different coverage zones can include different numbers of remote antennas.

[0028] In some embodiments, the remote antennas 18a-p can receive analog RF signals from the i-POI system 14. In other embodiments, the remote antennas 18a-p can each be associated with remote antenna units. The remote antenna units can be

configured to receive digital signals from the i-POI system 14 and convert the digital signals to analog RF signals prior to radiating the signals to wireless devices in the coverage zone. In a DAS that includes remote antenna units, the i-POI system 14 can also generate control signals to control and configure the remote antenna units. The control signals can be combined with downlink signals provided to the remote antenna units.

[0029] In the uplink direction, the i-POI system can receive uplink signals from remote antennas 18a-p. Uplink signals can include signals received from wireless devices in the coverage zones 16a-f. The i-POI system 14 can process uplink signals received from the remote antennas 18a-p. Processing the uplink signals can include converting the uplink signals to a digital format, filtering the digital uplink signals, adding uplink signals from different zones, and routing. The digital uplink signals can be converted to a proper format, such as analog RF or a standardized digital format, and routed to the base station communicating with the respective wireless devices in a coverage zone.

[0030] Figure 2 depicts an embodiment of the i-POI system 14 having an interface section, an output section, and a backplane 104. The interface section can include donor interface cards 102a-n. The output section can include zone interface cards 106a-n.

[0031] In the downlink direction, the donor interface cards 102a-n can transform signals received from the base stations 12a-n, such as RF signals, into one or more digital data streams. A digital data stream can include a series of digital samples representing a signal. In some embodiments, transforming the signals received from

the base stations 12a-n can include separately converting analog RF signals into digital data streams by separate analog-to-digital converters. In other embodiments, transforming the signals can include converting digital signals in different standardized formats, such as CPRI or ORI data packets, from different base stations into a common digital format for processing at the backplane 104.

[0032] In the uplink direction, the donor interface cards 102a-n can transform digital data streams into uplink signals to be provided to the base stations 12a-n. The donor interface cards 102a-n can also include circuitry, such as band pass filters, for filtering downlink and uplink signals. Filtering the downlink and uplink signals can eliminate undesirable signals. The filters of the donor interface cards 102a-n can pass desired signals within a frequency band and reject or attenuate undesirable signal components.

[0033] In the downlink direction, the digital data streams from the donor interface cards 102a-n can be provided to the backplane 104. The backplane 104 can include configurable digital signal processing circuitry for processing signals from the donor interface cards 102a-n. An example of the configurable digital processing circuitry is a field-programmable Gate Array ("FPGA"). The backplane 104 can combine the digital data streams into serialized data streams via the configurable digital signal processing circuitry. In some embodiments, combining the digital data streams can include multiplexing parallel digital data streams into a digital data stream. In other embodiments, combining the digital data streams can include summing or adding digital data streams.

[0034] The combined data streams from the backplane 104 can be provided to the zone interfaces cards 106a-n. The backplane 104 can also provide combined digital data streams representing the signals of multiple sectors to a single zone interface card. Each of the zone interface cards 106a-n can transform the combined data streams into downlink signals to be provided to the remote antennas of one or more coverage zones. Each of the zone interface cards 106a-n can simultaneously provide the downlink signals to the remote antennas of the respective coverage zones. In some embodiments, the downlink signals can include analog RF signals of sectors provided from base stations to be radiated by the remote antennas of a respective coverage zone. In other embodiments, the downlink signals can include digital signals of sectors provided from base stations to be provided to remote antenna units of a respective coverage zone. The remote antenna units can convert the digital signals to analog RF signals and radiate the RF signals into the coverage zones.

[0035] In an uplink direction, the zone interface cards 106a-n can receive uplink signals from one or more remote antennas. The uplink signals can be converted to digital data streams and provided to the backplane 104. The backplane 104 can combine the digital data streams into serialized data streams via the configurable digital signal processing circuitry. In some embodiments, combining the digital data streams can include multiplexing parallel digital data streams into a digital data stream. In other embodiments, combining the digital data streams can include summing or adding digital data streams. The backplane 104 can route the appropriate digital data streams representing uplink signals to the appropriate donor interface card.

[0036] The i-POI system 14 can also include a controller 108. The controller 108 can re-configure the configurable digital signal processing circuitry of the backplane 104 to change the routing of signals from the base stations 12a-n to the coverage zone 16a-f. The controller 108 can receive input representing changes to the routing of signals by the i-POI system 14. The input can be received via a graphical user interface or from an automation algorithm for determining the demand on each of the coverage zones. In some embodiments, as depicted in Figure 2, the controller 108 can be disposed in the i-POI system 14. In other embodiments, the controller 108 can be disposed in a separate device external to and in communication with the i-POI system 14.

[0037] The controller 108 may include configuration and report manager functions. In some embodiments, the controller 108 can detect traffic and perform measurements independent of the wireless network standard and protocol. For example, the controller 108 may include a configuration manager that can trigger based on the detection of certain events. Examples of events include a scheduled event of a game, concert, or other type of event, scheduled sequence of events with pre-game, game, and post-game configurations, traffic measurements passing low or high thresholds, base transceiver station failure events, and loss of capacity due to high inter-sector interference. The controller 108 may also include a report manager that can generate reports on traffic, spurious signals, usage, and other types of information. The controller 108 can implement any process for measuring uplink signals for traffic and other types of information, and reporting the information. Certain systems and processes that can be used to do so are described in U.S. Serial No. 12/778,312, filed

May 12, 2010 and titled "System and Method for Detecting and Measuring Uplink Traffic in Signal Repeating Systems," the entirety of which is incorporated herein by reference.

[0038] In some embodiments, an i-POI system 14 can determine a location of a specific wireless device within the environment in which the DAS 10 is deployed. The i-POI system 14 can communicate with one of the base stations 12a-n to determine an identifier for the specific wireless device. An identifier for a wireless device can include any attributes of a communication link between a base station and a wireless device used to identify the wireless device. For example, the identifier can include the transmit and receive frequencies assigned to a wireless device used in frequency division multiple access schemes, a communication time slot assigned to the wireless device used in frequency division multiple access schemes, and/or a spreading code assigned to a wireless device in a code division multiple access scheme.

[0039] The i-POI system 14 can determine a channel over which the specific wireless device is communicating. A channel can include a connection, such as a transmit and receive frequency, over which a wireless device and a base station can communicate via the DAS. A sector of a base station received by a donor card of the i-POI system 14 can include the channel. The i-POI system 14 can determine a coverage zone to which the channel is being provided by determining which sector includes the channel and which coverage zone is receiving the sector.

[0040] In some embodiments, each of the zone interface cards 106a-n can include one or more reference receiver inputs. Each of the zone interface cards 106a-n can communicate via the reference receiver input with a detection device communicatively coupled to each of the remote antennas included in a coverage zone.

In some embodiments, the detection device is a switch matrix that can allow a connection to the signals of individual remote antennas prior to the signals being combined. By communicating via the reference receiver input with a detection device, the i-POI system can detect the location a particular wireless device with greater specificity. The reference receiver input can also provide an output monitoring function for RF or laser pre-distortion. The i-POI system 14 can provide an identifier for a wireless device, such as a timeslot or spreading code, to the detection device via the reference receiver input of the zone interface card associated with the zone to which the channel is being provided.

[0041] The detection device can determine which of the remote antennas receives uplink signals according to the attributes specified in the identifier for the wireless device, such as the time slot or spreading code. The detection device can also determine the received signal strength indicator (RSSI) of an uplink signal from the wireless device at each remote antenna. The i-POI system can communicate with the detection device to identify which remote antenna receives the uplink signal at the strongest RSSI. The i-POI system can determine that the remote antenna receiving the uplink signal at the strongest RSSI is the remote antenna associated with the wireless device. The i-POI system can access a data file that includes the location of each remote antenna to determine, based on which remote antenna is associated with the wireless device, the location of the wireless device.

[0042] In some embodiments, the i-POI system can include one or more spectrum analyzers that can analyze uplink and downlink signals. A spectrum analyzer can be a separate device disposed in the i-POI system or can be disposed in one or

more of the donor interface cards 102a-n, the backplane 104, and/or the zone interface cards 106a-n. The spectrum analyzer can determine the frequencies of the component signals included in the uplink and downlink signals. The spectrum analyzer can store data representing the spectrum of uplink and downlink signals in a memory. The memory can be disposed in the i-POI system or in an external device.

[0043] The spectrum of the uplink and downlink signals can be used for additional processing of the uplink and downlink signals. Additional processing can include determining the frequencies being used in the respective coverage zone. Determining the frequencies being used in the respective coverage zones can be used to determine whether to redistribute the capacity of the DAS. Additional processing can also include identifying spurious signals, such as noise recovered by the remote antennas that can distort uplink signals, that can be removed using programmable band pass filters disposed in the i-POI system.

[0044] Figures 3A and 3B depict a model of the i-POI system 14 redistributing capacity among coverage zones 16a-f. The i-POI system 14 can receive signals from base stations 12a-n corresponding to sectors 202a-c. The i-POI system 14 can provide the sectors 202a-c to the respective coverage zones 16a-f. Each of the coverage zones 16a-f can include a subset of the remote antennas, depicted as darkened circles in Figures 3A and 3B, of the DAS. Increasing the number of coverage zones to which each of the sectors 202a-c is distributed can decrease the capacity density of the respective coverage zones. The i-POI system 14 can redistribute capacity by changing which sectors 202a-c are provided to which coverage zones 16a-f, respectively.

[0045] Figure 3A depicts the i-POI system 14, according to an initial configuration, providing sectors 202a-c to the coverage zones 16a-f. The i-POI system 14 can be configured to communicate the signals of sector 202a to the coverage zones 16a-d, the signals of sector 202b to the coverage zone 16e, and the signals of sector 202c to the coverage zone 16f. The capacity of sector 202a is divided among the coverage zones 16a-d, while the entire capacity of sector 202b is provided to coverage zone 16e and the entire capacity of sector 202c is provided to coverage zone 16f. Accordingly, the capacity density of each of the coverage zones 16a-d is less than the capacity density of each of the coverage zones 16e-f.

[0046] The signals of a sector can be divided among the coverage zones. For example, a first wireless device in the coverage zone 16a may communicate using a first RF channel of sector 202a and a second wireless device in the coverage zone 16a may communicate using a second RF channel of sector 202a. The first and second RF channels of the sector 202a may be included in a common frequency band but be distributed to different coverage areas.

[0047] For example, a DAS 10 may service a stadium and a parking lot surrounding the stadium, with the coverage zones 16a-d corresponding to different sections of the stadium and the coverage zones 16e-f corresponding to the parking lot. Before an event hosted in the stadium begins, fewer wireless devices will be concentrated in the stadium than in the parking lot. The coverage zones 16a-d may therefore require less capacity than the coverage zones 16e, 16f. Accordingly, the i-POI system can be configured to provide the sector 202a to the coverage zones 16a-d, the sector 202b to coverage zone 16e, and the sector 202c to coverage zone 16f.

Providing a single sector 202a to the coverage zones 16a-d inside the stadium can provide sufficient capacity density for each of the coverage zones 16a-d. Providing the sectors 202b, 202c to the coverage zone 16e inside the stadium can provide sufficient capacity density for each of the coverage zones 16a-d.

[0048] The i-POI system 14 can be re-configured via the controller 108 in response to changes concentration of wireless devices in the respective coverage zones. Figure 3B depicts the i-POI system 14 providing sectors 202a-c to the coverage zones 16a-f according to an subsequent configuration of the i-POI system 14. For example, if the DAS 10 services a stadium and the surrounding parking lot, more wireless devices will be concentrated inside the stadium than in the parking lot after an event begins. The i-POI system 14 can be reconfigured such that the sector 202a is provided to the coverage zone 16a, the sector 202b is provided to the coverage zones 16b, 16c, and the sector 202a is provided to the coverage zones 16d-f. The configuration of i-POI system 14 depicted in Figure 3B thus increases the capacity density of the coverage zones 16a-d as compared to the configuration of i-POI system 14 depicted in Figure 3A.

[0049] Although Figures 3A, 3B depict three sectors provided to six coverage zones, multiple sectors can be provided to a single coverage zone. For example, the signals of a first sector associated with a first telecommunication system operator and the signals of a second sector associated with a second telecommunication system operator can be combined and distributed to the same coverage zone or group of coverage zones. The number of coverage zones to which an i-POI system distributes

sectors can be greater than or equal to the number of sectors distributed by the i-POI system.

[0050] Figure 4 depicts an embodiment of a DAS 10' that includes an i-POI systems 14a in communication with other i-POI systems 14b, 14c. The interconnected i-POI systems can communicate via any suitable communication medium, such as copper cable or optical link. An i-POI system 14a can provide the sectors received by the i-POI system 14a to the i-POI systems 14b, 14c. The sectors can be provided as digital data streams. By providing digital data streams to the i-POI systems 14b, 14c representing the sectors received by the i-POI system 14a, the DAS 10' can be expanded to provide coverage to a larger environment without requiring additional connections between the base stations 12a-n and the i-POI systems 14b, 14c.

[0051] Figure 5 depicts an embodiment of an i-POI system 14' with an output section of iPOI system 14' that includes one or more i-POI interface cards 302a-n. The i-POI system 14' can communicate with other i-POI systems via the i-POI interface cards 302a-n. The i-POI system 14' can either provide sectors to coverage zones via the zone interface cards 106a-n or provide sectors to other i-POI systems via one or more i-POI interface cards 302a-n. Examples of the i-POI interface cards 302a-n can include copper or optical interface cards.

[0052] The foregoing description of the embodiments, including illustrated embodiments, of the invention has been presented only for the purpose of illustration and description and is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Numerous modifications, adaptations, and uses thereof will be apparent to those skilled in the art without departing from the scope of this invention.

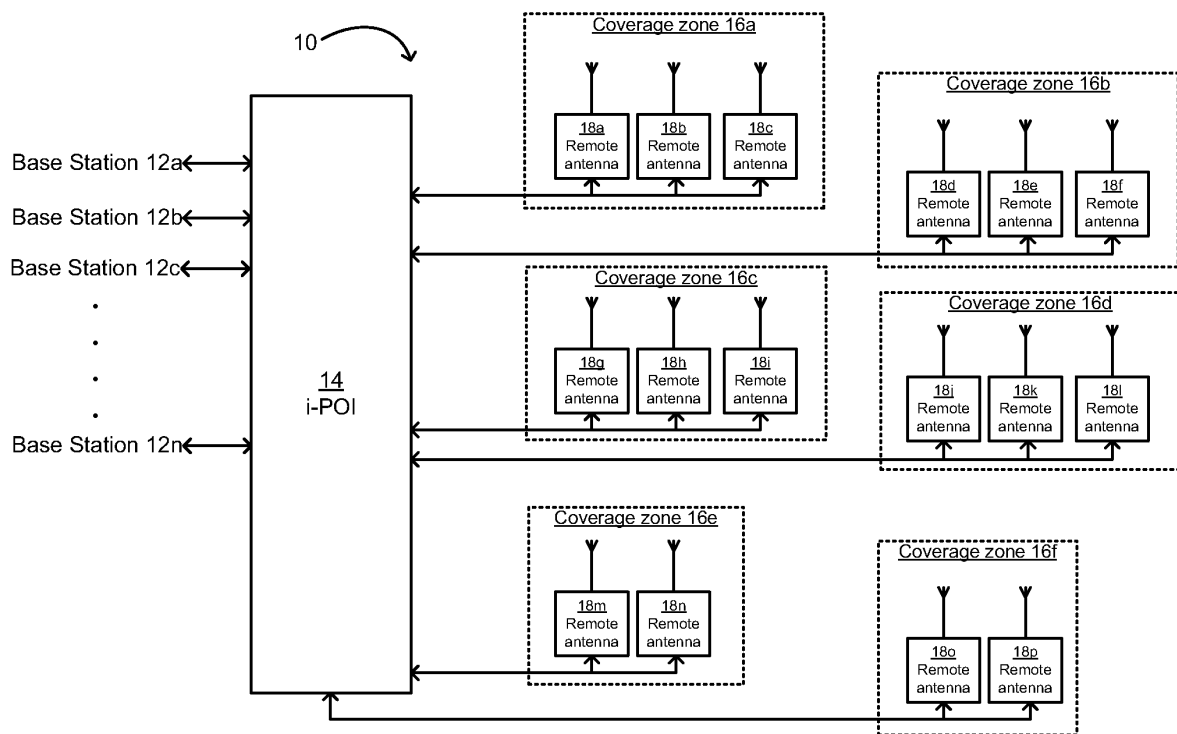


FIG. 1

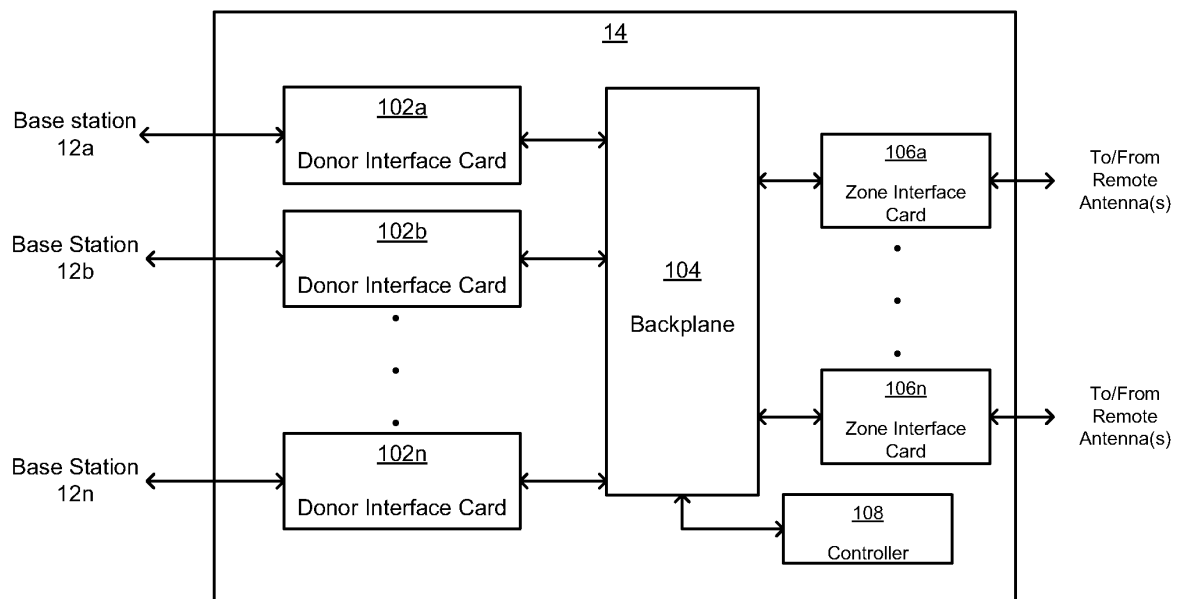


FIG. 2

FIG. 3A

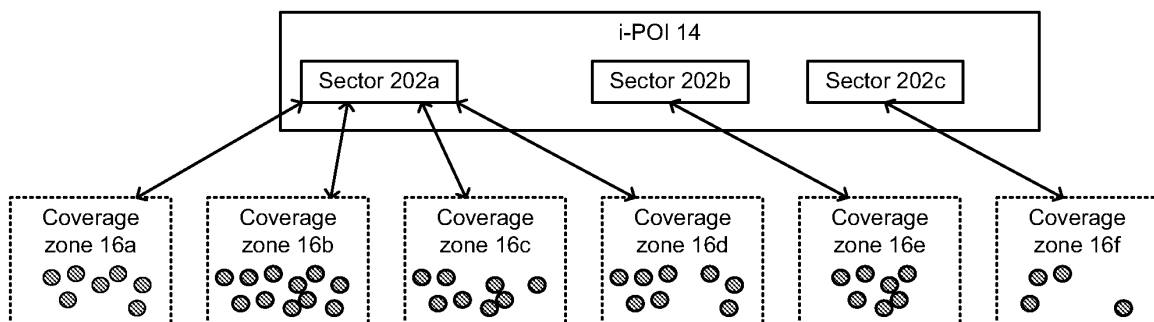
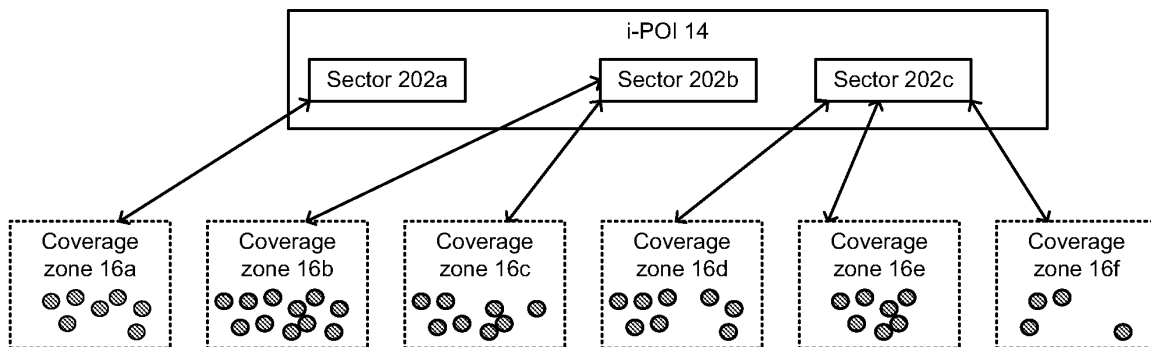


FIG. 3B



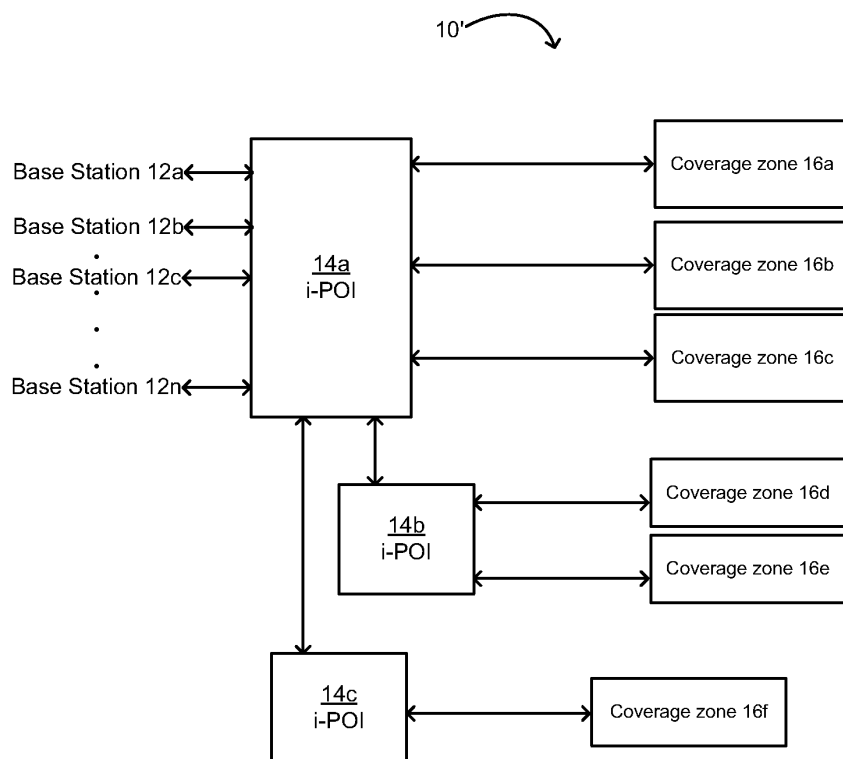


FIG. 4

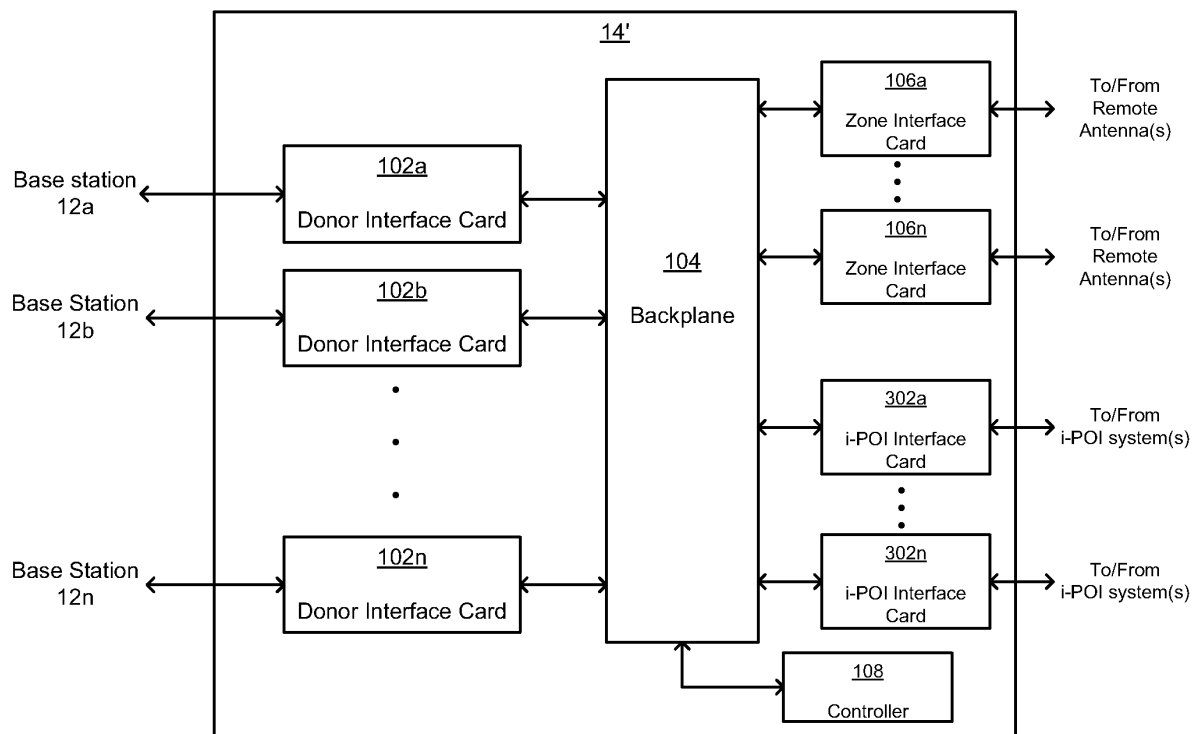


FIG. 5

Electronic Patent Application Fee Transmittal				
Application Number:				
Filing Date:				
Title of Invention:		Intelligent Point of Interface for Distributed Antenna Systems		
First Named Inventor/Applicant Name:		Thomas Kummetz		
Filer:		Eugene B. Joswick/Andrea Cummings		
Attorney Docket Number:		62508-809556		
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Provisional Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
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Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
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Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
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1	Transmittal of New Application	809556_transmittal.pdf	155355 577d1fc616a26e4c173838bd1639cd87ab0a164	no	3
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Information:					
2	Specification	809556_application.pdf	89545 5c943f2a12774ccd86730bc9c52c62ebdf8cda0	no	19
Warnings:					
Information:					
3	Drawings-other than black and white line drawings	809556_drawings.pdf	26626 a30335cb5674fc9ae09391129001acb9d6f181d	no	5
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4	Fee Worksheet (SB06)	fee-info.pdf	29571 03b63d206ff6b878edaba15555063d2a9932ec1e	no	2
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Total Files Size (in bytes):			301097		
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Application Number: 61506363

Document Date: 7/11/2011

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