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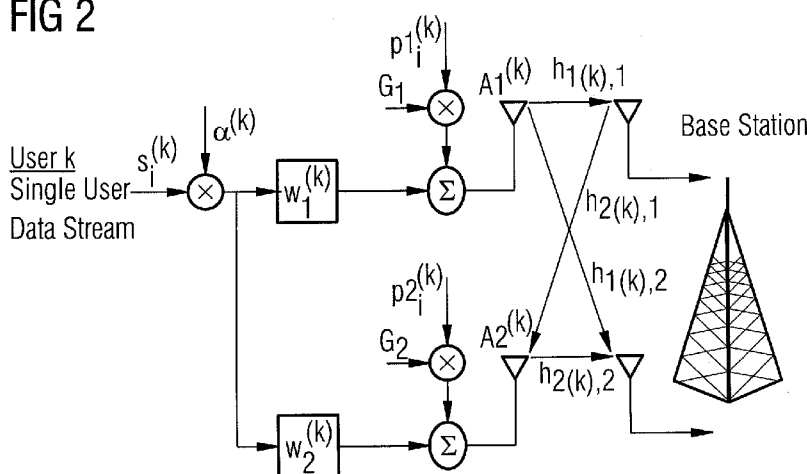
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(54) Title: SOFT HANDOVER (SHO) FOR TRANSMIT ANTENNA ARRAY (TxAA) FOR 3GPP WCDMA UPLINK

FIG 2



(57) Abstract: Soft handover (SHO) for transmit antenna array (TxAA) for 3GPP WCDMA uplink, wherein a user terminal comprises at least two antennas which transmit and receive simultaneously, and a processing unit for processing data from a base station in response to a transmitted pilot signal, and for controlling transmission parameter of the user terminal, wherein the processing unit decides on the weights of which base station should be followed.

Description

Soft handover (SHO) for transmit antenna array (TxAA) for
3GPP WCDMA uplink

5

Technical field of the invention

The invention relates to the technical field of communication
10 networks. In particular the present invention relates to a
user terminal for wireless communication, a method of trans-
mitting data, and to a program element for deciding which
base station should be followed in the next slot, especially
in soft handover.

15

Background of the invention

Spectrum scarcity has resulted in the demand for technologies
which can make more efficient use of allocated bandwidths.

20

Multiple input multiple output (MIMO) technology is reported
to be such a technology, one which attempts to exploit multi-
path propagation effects to provide higher data throughput,
whilst remaining spectrally efficient.

25

The generic term MIMO is sometimes used to refer to a number
of technologies relating to multiple antennas. These include
so-called "Spatial Multiplexing", in which multiple signals
are transmitted over the same resources (Implemented in wide-
30 band code division multiple access (WCDMA) as double transmit
antenna array (D-TxAA)), "Transmit Diversity", in which the
same information is transmitted over multiple channels (WCDMA
example TxAA), and beamforming techniques.

35

By definition, spatial multiplexing MIMO technology works
with multiple signals, the generation of which will lead to
more user and system interference. Receivers working in such
scenarios are likely to be more complex as a consequence.

Current 3GPP WCDMA standards make use of MIMO in the downlink (TxAA itself and D-TxAA for high speed downlink packet access (HSDPA)). Such MIMO schemes can improve throughput in the downlink.

5

The following documents of the 3GPP WCDMA standards can be considered as a basis for the invention.

10 The document TS 25.211 of the 3rd Generation Partnership Project (3GPP); Technical Specification Group Radio Access Network; Physical channels and mapping of transport channels onto physical channels (FDD), v8.2.0, 2008-09, Release 8, may describe the characteristics of the Layer 1 transport channels and physicals channels in the FDD mode of UTRA. The
15 main objectives of the document may be to be a part of the full description of the UTRA Layer 1, and to serve as a basis for the drafting of the actual technical specification.

20 The document TS 25.212 of the 3rd Generation Partnership Project (3GPP); Technical Specification Group Radio Access Network; Multiplexing and channel coding (FDD), v8.3.0, 2008-09, Release 8, may describe the characteristics of the Layer 1 multiplexing and channel coding in the FDD mode of UTRA.

25 The document TS 25.213 of the 3rd Generation Partnership Project (3GPP); Technical Specification Group Radio Access Network; Spreading and modulation (FDD), V8.2.0, 2008-09, Release 8 may describe spreading and modulation for UTRA Physical Layer FDD mode.

30

The document TS 25.214 of the 3rd Generation Partnership Project (3GPP); Technical Specification Group Radio Access Network; Physical layer procedures (FDD), V8.3.0, 2008-09, Release 8, may specify and establish the characteristics of
35 the physicals layer procedures in the FDD mode of UTRA.

The document TS 36.211 of the 3rd Generation Partnership Project (3GPP); Technical Specification Group Radio Access

Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Channels and Modulation, V8.4.0, 2008-09, Release 8, may describe the physical channels for evolved UTRA.

5 The document TS 36.212 of the 3rd Generation Partnership Project (3GPP); Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Multiplexing and channel coding, V8.4.0, 2008-09, Release 8, may specify the coding, multiplexing and mapping to physical
10 channels for E-UTRA.

The document TS 36.213 of the 3rd Generation Partnership Project (3GPP); Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA),
15 v8.4.0, 2008-09, Release 8, may specify and establish the characteristics of the physicals layer procedures in the FDD and TDD modes of E-UTRA.

The document TS 36.214 of the 3rd Generation Partnership Project (3GPP); Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer - Measurements, v08.4.2, 2008-09, Release 8; may contain the description and definition of the measurements done at the UE and network in order to support operation
20 tion in idle mode and connected mode.
25

Summary of the invention

It might be an object of the invention to provide improved
30 exchange of data between a user terminal and a base station, especially in soft handover.

This and other objects are achieved by the subject matter of each independent claim. Further embodiments of the invention
35 are described in the respective dependent claims.

In general, a user terminal according to the invention comprises at least two antennas, and a processing unit for

processing data from a base station, and for controlling transmission parameter of the user terminal, wherein the processing unit decides which base station should be followed, wherein the user terminal is adapted to transmit data simultaneously from at least two antennas or to receive data simultaneously with at least two antennas.

Advantageously, such a user terminal is capable of transmitting and receiving an increased throughput of data. That is, two data streams might exist at the same time in the uplink as well as in the downlink, based on different channels. Alternatively, a single stream may be transmitted, but using both antennas. Therewith, the space diversity may be exploited.

Principally, in case of two antennas for the transmission and reception of data, there may be several base stations (defined as a single antenna of a base station) receiving signals from the user terminal. Subsequently, all these base stations will send a control command back to the user terminal. Thus, the user terminal will receive a lot of commands because of its two (or more) antennas. Finally it is critical to select the best transmission to one of the base stations as a basis for the next transmission.

A control command may include the information that the power of the transmission in the last slot was too high, i.e. that the power of the transmission might be in the next slot lower. Such a control command is usually called a 'power down command'. On the other hand, the command which may be send back to the user terminal may include the information that this base station has simply acknowledged the transmission from the user terminal. Otherwise, the control command might include information about the signal to noise ratio (SNR) of the last transmission.

According to an aspect of the invention, the processing unit of the user terminal may decide on weights for the next slot

based on data from a base station indicating a power down command.

Alternatively, the user terminal may decide on weights based
5 on a best signal to noise ratio or a last acknowledgement command coming from a base station.

It should be noted, that the control command from the base station may also include all of the mentioned information or
10 a selection therefrom. Notwithstanding, the user terminal may selected one or a combination of the information for the decision which base station should be followed in the next slot.

Furthermore, the term 'decide on weights' may include comparison of the received control commands, and ranking of the same, to achieve a 'best' command with respect to a special aspect of transmission. The 'decision' may then be to select said 'best' command. Based on said decision, the transmission
15 parameters may be allocated to the transmission of a single slot in the past, and the transmission parameter for the next slot may then be adjusted.
20

According to another aspect of the invention, the user terminal transmits an unique pilot from the its antennas, which is
25 selected in order to indicate which weight vector has been applied.

According to another embodiment of the invention, a method
30 for transmitting data by means of a user terminal comprises the steps of transmitting data from at least two antennas simultaneously, receiving feedback information from at least one base station, processing the feedback information, deciding for the next slot, which base station should be followed,
35 wherein deciding for the next slot might be a decision on weights based on data from a base station indicating a power down command or a best signal to noise ratio, or representing a last acknowledgement command send from a base station.

According to an aspect of the invention, the transmitted data might include a unique pilot.

According to another embodiment of the invention, a program
5 element, which when being executed by a processing unit of
the user terminal, is adapted to carry out the steps according
to the mentioned method, i.e. controlling the transmission
of data, processing received feedback information, deciding
for the next slot, which base station should be followed.
10

The decision for the next slot may be a decision on weights
based on data from a base station indicating a power down
command or a best signal to noise ratio or representing a
15 last base station sending an acknowledgement.

Therefore, the invention relates to a program element for a
processing unit, such that the method according to the invention
might be executed on an appropriate system such as a
20 user terminal. The program element is preferably loaded into
a working memory of a data processor. The data processor is
thus equipped to carry out the method of the invention. Further,
the program code of the program element may be stored
on a computer readable medium, such as a CD-Rom. However, the
25 program element may also be presented over a network like the
worldwide web and can be downloaded into the working memory
of a data processor from such a network.

It has also to be noted that exemplary embodiments of the
30 present invention and aspects of the invention have been described
with reference to different subject-matters. In particular,
some embodiments have been described with reference to
apparatus type claims whereas other embodiments have been
described with reference to method type claims. However, a
35 person skilled in the art will gather from the above and the
following description that unless other notified in addition
to any combination between features belonging to one type of
subject-matter also any combination between features relating

to different subject-matters in particular between features of the apparatus claims and the features of the method claims may be considered to be disclosed with this application.

5 These and other aspects of the present invention will become apparent from and elucidated with reference to the embodiments described hereinafter.

Exemplary embodiments of the present invention will be described in the following with reference to the following drawings.

Brief description of the drawings

15 Figure 1 shows a top level block diagram for transmit antenna array in the downlink.

Figure 2 shows a diagram illustrating a theoretical uplink transmit antenna array for multiple users.

20 Figure 3 shows steps of interaction between a user terminal and a base station in one slot.

Figure 4 shows a flowchart of a method according to the invention, performed by a user terminal.

Detailed description

30 The illustration in the drawings is schematic. In different drawings, similar or identical elements are provided with the same reference numerals.

This invention is related to (1) MIMO and (2) "classical" Wideband Code Division Multiple Access (WCDMA) and the uplink channel design which allows for joint operation of these two technology areas, focusing on the impact that soft handover (SHO) has when considering using transmit adaptive antenna & double transmit adaptive antenna in the uplink.

Since there are less implementation restrictions when considering multiple antennas for base stations, research has mostly focused on MIMO antennas and antenna arrays at the base station of cellular systems. The size of the user equipment or handset limits the number of antennas that can be deployed typically to one or two (when considering typical mobile communications operating frequencies and associated propagation environments). Never-the-less, certain MIMO techniques can still be deployed working within the limitations - one such technique being transmit antenna array.

With current, single antenna, mobiles, space diversity cannot be easily exploited. Emerging technologies allow for multiple antennas, appropriately spaced, and utilizing antenna switching or transmit antenna weighting. The invention focuses in particular on antenna weighting based transmit diversity and spatial multiplexing and shows that the same concept as that which already exists in the downlink of 3GPP WCDMA HSPA R9 can be applied to the uplink, but, that this then generates a problem with soft handover operation. In particular, during soft handover the user terminals signal will be received by multiple base stations across independent transmission paths, and the optimal weighting vectors to be applied to the transmit antennas may differ for each receiving base station. However, the user terminal can only apply one set of antenna weights at the transmitter. The invention thus addresses and solves, beside others, the problem of deciding on the appropriate weights to apply.

Transmit adaptive antenna, as well as double transmit adaptive antenna already exist for 3GPP WCDMA downlink (and are backwards compatible). Transmit adaptive antenna in the downlink works with a single user bit stream. Double transmit adaptive antenna in the downlink works with dual streams for each user (hence the name).

The top level block diagram for transmit adaptive antenna in the downlink is shown in figure 1.

Figure 1 illustrates a base station having two antennas A1 and A2. Within the dotted rectangle of the base station, there are shown data streams for single user 1 and k, symbolizing a group of single users 1 to k. Each data stream of one user is split into two streams w_1 and w_2 having different antenna weight vectors. All these streams are collected in a respective summarizer Σ , and are sent via one of the antennas to each user terminal. Each user terminal in figure 1 comprises one antenna.

Each user terminal will have to estimate two channels since signals emanate from the base station's two antennas. Based on this estimate, the user terminal recommends one of four antenna weighting vectors to be applied in a subsequent transmission slot.

The antenna weights are determined by the user terminal and are conveyed (recommended) to the base station. The actual weights used are signalled from the base station to the user terminal by means of a dedicated pilot signal.

For transmit diversity, the weighting vector that maximises the receiver signal to noise ratio at the user terminal is selected. For double transmit adaptive antennas, two weighting vectors (two weights per vector, i.e. four weights) are selected which maximise the signal to noise ratio on the two streams. The two vectors of double transmit adaptive antennas are related such that the two streams transmitted to a single user will be received in an orthogonal manner by the user's receiver (aiding data detection).

In order to estimate the different channel conditions, the base station sends a common, un-weighted (unique) pilot p1 and p2 from each of its antennas A1 and A2. The user terminal measures each pilot and then determines which choice of weighting factors, for each pilot, would maximise its estimated signal to noise ratio (SNR) in the next slot. The recommendation of which weight vector/antenna to use is sent by

the user terminal to the base station in the form of an appropriate indicator. The ultimate decision on which weight vector/antenna to use is made by the base station. Using these weights the base station weights the appropriate data (e.g. on the dedicated physical data channel (DPDCH)).

Keeping said aspects of downlink from a base station in mind, the invention considers the uplink of a cellular system such as 3GPP WCDMA when utilizing high speed user packet access (HSUPA).

The invention makes use of transmission from two antennas, at the same time, in the uplink in order to exploit space diversity and thereby increase user throughput.

Theoretically, there is no reason why the downlink concept cannot be applied to the uplink, at least in terms of the appropriate building blocks. If this is done the resulting figure is as shown in figure 2.

The changes required when adopting the downlink concept to the uplink can be seen from figure 2, which shows, on the left side, one exemplary user k with its data stream. This data stream is divided in two streams w_1 and w_2 , which are sent respectively by the antennas A1 and A2 of the user terminal. On the right side of figure 2, there is shown a symbolization of a base station having also two antennas.

When considering transmit adaptive antenna in the downlink there are transmissions from the base stations two antennas which reach all users - each user therefore tracks two channels. In the uplink however, having two antennas per user implies that the base station will have to track two channels per user if it has only one antenna, and four channels per user if it has two antennas itself.

The transmit power on each pilot will have to be controlled separately in order to achieve a constant receive SNR for

each pilot. The enhanced dedicated physical data channel (E-DPDCH) should be transmitted on each antenna with a constant power offset, β_{ed} with respect to the dedicated physical data channel (DPCCH).

5

A further problem occurs in the uplink since soft handover, i.e. the fact that a user will be in communication with multiple base stations at the same time, needs to be considered.

10 The basic transmissions/signalling involved when considering a possible scheme for Uplink WCDMA transmit adaptive antenna is shown in figure 3. Figure 3 shows the steps of a power control loop in one slot, for a transmission from a user terminal 100 to a base station 200, including feedback from the
15 base station to the user terminal and internal processing steps. The numbers in circles are used to allocate each step to the user terminal or to the base station.

Starting at number 1, two, unique, pilot signals are sent, at
20 the same time, from the user terminal's two antennas. Data (mapped onto the E-DPDCH), using actual weights that were signalled by the base station in the previous slot, are also sent (at the same time as the pilot signals) for the current slot. Also actual weights, which will be used for weighting
25 the data in the next slot are sent (during the current slot), alternatively they could be sent on an un-weighted channel, e.g. the DPCCH.

All base stations in the active set (i.e. those which are in
30 soft handover with the user terminal), having been forewarned (during the previous slot and by the user terminal) of the weights to be used for the current slot, will be able to immediately decode the uplink data (E-DPDCH) channel, at number 2.

35

The base stations in the active set then, at number 3, carry out channel estimation using the pilot signals from both antennas. The base stations then calculates which weight vector

would have best compensated for the corresponding channel conditions and what value the SNR would have been.

At number 4, a decision is then made as to what weight selection would have resulted in maximising the SNR (out of all possible weight combinations). The assumption then is that this would be the best combination to use in the next user terminal uplink transmission slot. These weights are then sent as Signalled Weights to the user terminal, at number 5.

The base stations will then switch to the actual weights it received from the user terminal in readiness to immediately decode the data sent from the user terminal in the next slot, or alternatively if the actual weights are sent on an un-weighted channel e.g. the DPCCH it may be possible to alter the scheme to dispense with the one slot delay - provided the weights are extracted first. This is allocated at number 6.

The user terminal will receive signalled weights from all base stations it is in communication with. Hence it will make the ultimate decision at number 7, of which weights to use, but working within the parameters set by the Node B's (and ultimately their associated base stations/RNCs). This decision can be based on one of the following:

(1) Use the weights of the base station which indicates a power down command (on the basis perhaps that this base station is experiencing the worse interference from the user terminal), or has sent the largest amount of power down commands in the last N slots, or

(2) Use the weights sent by the last base station to send an acknowledgement (ACK) command, or

(3) Use the weights sent from the base stations that indicates best signal to noise ratio.

Once the decision of which weights to use for the next slot of data has been made they will be sent in the current slot by the base station. In order to repeat the process in a continuous fashion, the pilots from each antenna are always
5 transmitted un-weighted.

The steps perform especially by the user terminal in one power control loop, are schematically illustrated in figure 4. In step S1, the user terminal transmits one pilot with its
10 two antennas. In step S2, the user terminal receives the feedback information from the base station, including at least one of a power down command, an acknowledgement, and a signal to noise ratio. In step S3, the user terminal, i.e. the processing unit of the user terminal processes the re-
15 ceived information, wherein the processing includes the weighting of the information (multiple feedback from more than one base station). In step S4, the user terminal decides on said weights which base station should be followed, i.e. which transmission may be the best for the continuing trans-
20 mission with a maximized signal to noise ratio. Based on said decision, the user terminal will in step S5 adjust the power level and weights of its transmission for the next slot.

Although the invention has been described for transmit adaptive antenna it applies equally well to double transmit adaptive antenna where there will be four weights to determine
25 per user terminal instead of just two.

As a summary, the invention provides a user terminal which is
30 adapted to modify the uplink to allow for transmit adaptive antenna (extendable to double transmit adaptive antenna) by transmitting two un-weighted pilots and by power controlling the pilots separately. Further, the user terminal is adapted to evaluate which base station weighting vector command to
35 follow in soft handover, based on evaluating received power control commands or ACKs.

The basic principle for uplink transmit adaptive antenna is similar to the downlink, however modifications have had to be made. Through the use of uplink transmit adaptive antenna space diversity is exploited leading, ultimately, to an increase in system throughput.

The two uplink pilot signals would have to be transmitted in a unique way, in order to be able to identify from which antenna each was sent. The advantage of using two unique pilots would be for automatic antenna identification, and for the obvious use of channel estimation/equalisation

Weight application is done on a current/next slot basis, but the concept would also have application to working on a transmission time interval (TTI) basis. The advantage of working on a slot basis would be more immediate control, working at the TTI would not lead to such a fast response, but would reduce complexity.

Transmit power control signals may be calculated by each base station based on the user terminal using the weight vector as proposed by that base station. The calculations could be updated based on what weights the user terminal ultimately selects (whether this be best base station, in an SNR sense, or base station indicating power down, or last base station to send an ACK command).

Alternatively, transmit power control signals may be issued by the base station independently for the two uplink DPCCHs.

The user terminal may transmit an indication of the actual weights used to all of the base stations enabling them to decode the data and perform Macro Diversity if required. This would also give an indication of the impact if using best weights for one base station has on the other base stations in the active set. The advantage of signalling the weights used would be to give all base stations an ability to demodulate the received signal using the correct weighting vector

and also estimate the difference in interference caused by using weights that may not be the optimum for them, thereby assisting radio resource control and management.

- 5 While the invention has been illustrated and described in detail in the drawings and foregoing description, such illustration and description are to be considered illustrative or exemplary and not restrictive; the invention is not limited to the disclosed embodiments.
- 10 Other variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing the claimed invention, from a study of the drawings, the disclosure, and the appended claims. In the claims, the word "comprising" does not exclude other elements or steps, and
- 15 the indefinite article "a" or "an" does not exclude a plurality. A single processor or other unit may fulfill the functions of several items recited in the claims. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these
- 20 measured cannot be used to advantage.

It should also be noted that reference signs in the claims shall not be construed as limiting the scope of the claims.

Acronyms and Terminology

	3GPP	3 rd Generation Project Partnership
	ACK	Acknowledgement
5	DPCCH	Dedicated Physical Control Channel
	DPDCH	Dedicated Physical Data Channel
	E-DPCCH	Enhanced-Dedicated Physical Control Channel
	E-DPDCH	Enhanced-Dedicated Physical Data Channel
	E-DCH	Enhanced-Dedicated Channel
10	HSUPA	High Speed Uplink Packet Access
	OVSF	Orthogonal Variable Spreading Factor
	PHY	Physical
	Rel 7	Release 7 (of 3GPP standards)
	Rx	Receiver
15	SHO	Soft Hand Over
	SNR	Signal to Noise Ratio
	TPC	Transmit Power Control
	TTI	Transmission Time Interval
	Tx	Transmitter
20	TxAA	Transmit Antenna Array
	UMTS	Universal Mobile Telecommunications System
	WCDMA	Wideband Code Division Multiple Access

Patent claims

1. A user terminal comprising
at least two antennas, and
5 a processing unit for processing data from a base station, and for controlling transmission parameter of the user terminal, wherein the processing unit decides which base station should be followed,
wherein the user terminal is adapted to transmit data
10 simultaneously from at least two antennas or to receive data simultaneously with at least two antennas.
2. The user terminal of claim 1, wherein the processing unit decides on weights for the next slot based on data from a
15 base station indicating a power down command.
3. The user terminal of claim 1, wherein the processing unit decides on weights for the next slot based on data representing a last acknowledgement command send from a base station.
20
4. The user terminal of claim 1, wherein the processing unit decides on weights for the next slot based on data from a base station indicating a best signal to noise ratio.
- 25 5. The user terminal of any one of claims 1 to 4, wherein the user terminal transmits an unique pilot from the at least two antennas, which is selected in order to indicate which weight vector has been applied.
- 30 6. A method for transmitting data by means of a user terminal according to any one of claims 1 to 5, the method comprising the steps of:
transmitting data from at least two antennas simultaneously,
35 receiving feedback information from at least one base station,
processing the feedback information,

deciding for the next slot, which base station should be followed.

7. The method of claim 6, wherein deciding for the next slot is a decision on weights based on data from a base station indicating a power down command.

8. The method of claim 6, wherein deciding for the next slot is a decision on weights based on data representing a last acknowledgement command send from a base station.

9. The method of claim 6, wherein deciding for the next slot is a decision on weights based on data from a base station indicating a best signal to noise ratio.

10. The method of any one of claims 6 to 9, wherein the transmitted data include a unique pilot.

11. A program element, which when being executed by a processing unit of the user terminal according to any one of claims 1 to 5, is adapted to carry out:
controlling the transmission of data,
processing received feedback information,
deciding for the next slot, which base station should be followed.

12. The program element of claim 11, wherein deciding for the next slot is a decision on weights based on data from a base station indicating a power down command or a best signal to noise ratio or representing a last base station sending an acknowledgement.

13. The program element of claim 11, being adapted to further generate a unique pilot.

14. The program element of any one of claims 11 to 13, wherein the program element includes a program code which is storable on a computer readable medium.

FIG 1

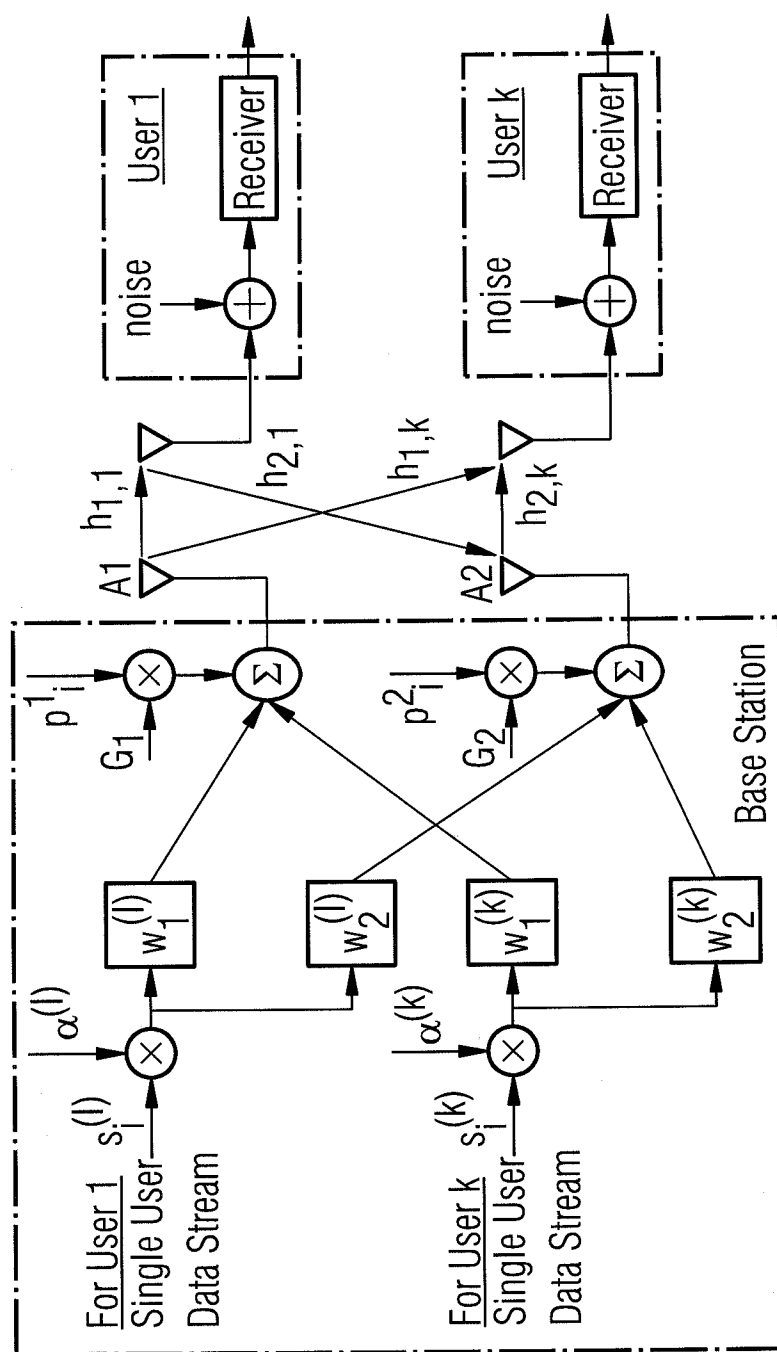


FIG 2

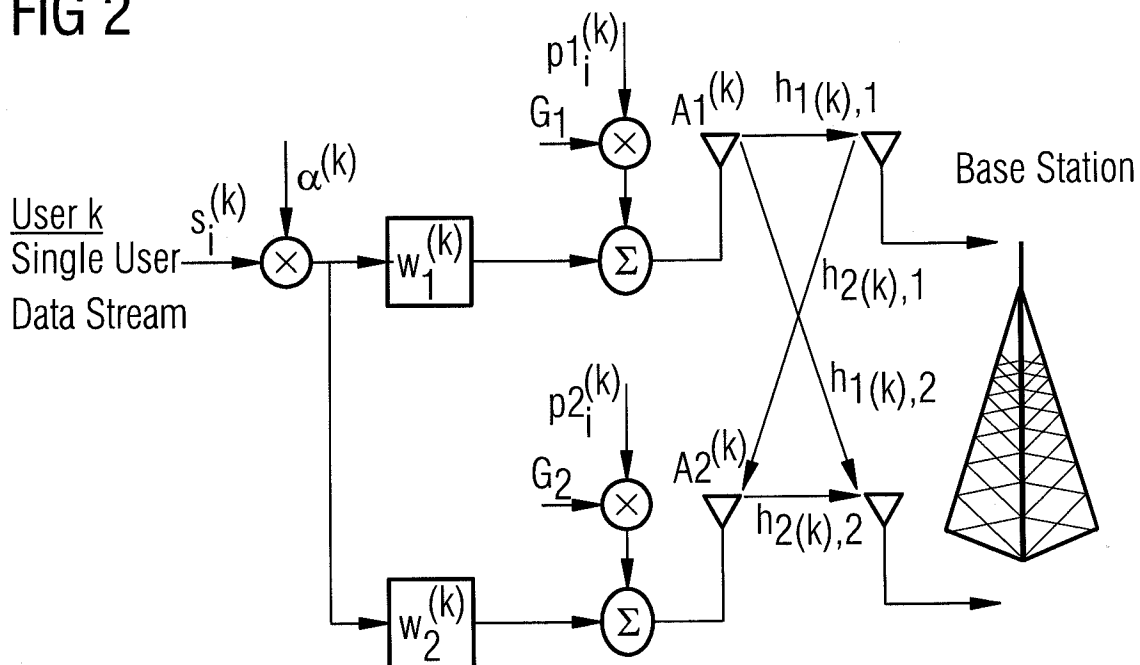


FIG 3

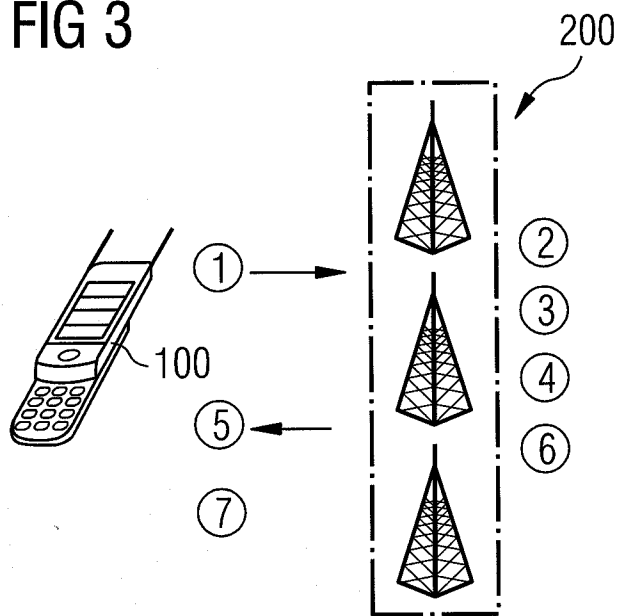
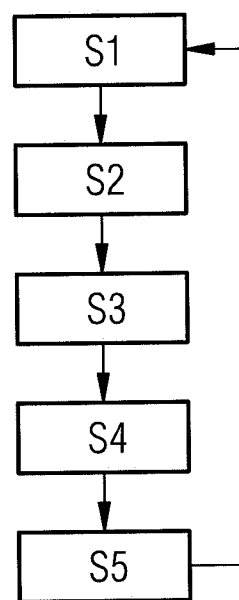


FIG 4



INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2008/068198

A. CLASSIFICATION OF SUBJECT MATTER

INV. H04B7/02 H04B7/06
 ADD. H04W52/40 H04W52/42

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
 H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2008/113031 A (MAGNOLIA BROADBAND INC [US]; HAREL HAIM [US]; KLUDT KENNETH [US] MAGNO) 18 September 2008 (2008-09-18) paragraph [0003] - paragraph [0005] paragraph [0011] - paragraph [0012]; figure 1 paragraph [0019] - paragraph [0024] paragraph [0029] - paragraph [0030] paragraph [0035]; figure 2 paragraph [0038]	1-14
A	WO 2004/114545 A (SIEMENS AG [DE]; BURKERT FRANK [DE]; GERLACH HEINO [DE]) 29 December 2004 (2004-12-29) page 5, line 21 - page 7, line 5; figure 1 page 7, line 34 - page 8, line 31 claim 1 ----- -/--	1-14

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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Date of the actual completion of the international search

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International application No

PCT/EP2008/068198

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Information on patent family members

International application No

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