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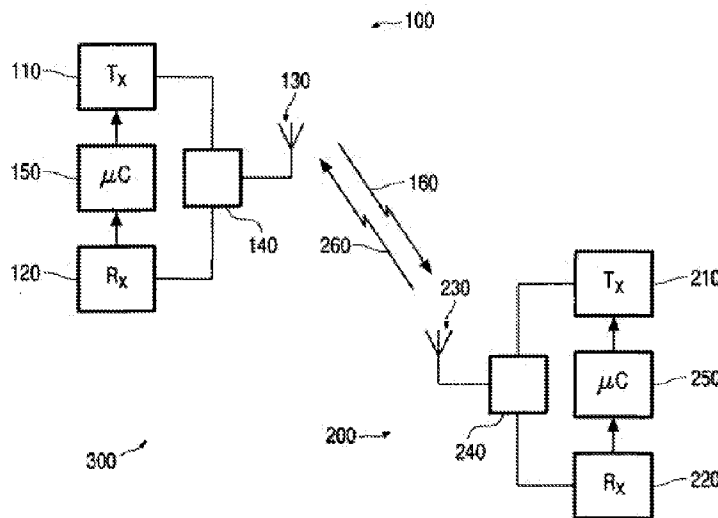


FIG 1

(57) Abstract: According to the invention, signalling is provided to indicate the presence and purpose of at least some sets of a plurality of sets of reference symbols, to enable different mobile terminals with different capabilities to use the provided sets of reference symbols for different purposes.

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A METHOD FOR SIGNALLING OF REFERENCE SYMBOLS

FIELD OF THE INVENTION

This invention relates to a method for signalling of reference symbols, a radio station comprising means for signalling reference symbols. This invention is in an example, more specifically related to a mobile communication network like a UMTS (Universal Mobile Telecommunication Standard) or UMTS LTE (Long Term Evolution) system.

10 BACKGROUND OF THE INVENTION

Reference symbols (a.k.a. pilot symbols) are provided in mobile communication systems such as the UMTS LTE for a number of different purposes. For instance, these include providing a phase reference for decoding of data, estimating channel quality, and estimating suitable precoding to be applied at the transmitter.

Different mobile terminals may have different capabilities – for example, some mobile terminals may be able to process reference symbols from more transmitter antennas (which may be “virtual antennas” – i.e. pluralities of physical antennas excited together), like in MIMO systems where the transmission can be done on a plurality of streams with help of an antenna array. If more sets of reference symbols are to be provided for the terminals which are able to use them, other terminals which are not able to make use of them may still need to be informed of their presence, as other data cannot be received on the symbols that are used for additional sets of reference symbols.

25 In the case of LTE, the current assumptions are as follows:

- The number of antennas used for the Primary Broadcast Channel (PBCH) is discovered by the mobile terminal by a number of blind attempts at decoding the PBCH – i.e. by attempting to decode the PBCH under the assumption of 1, 2 and 4 antennas (and corresponding reference symbols from each antenna), and checking a CRC (Cyclic Redundancy Check) to verify the assumption.
- Control signalling channels are transmitted using the same set of antennas as the PBCH, i.e., if N antennas are used for the PBCH, N antennas are used for the control signaling.

- The reference symbols are embedded in the control signalling on certain time-frequency resource elements.

The corollary of these assumptions is that if the network wishes to use 4 antennas for any mobile terminals for transmission of data or channel quality estimation, all 4 antennas have to have reference symbols embedded into the control channel signalling, and the control signalling would also have to be transmitted from all 4 antennas.

However, this assumption that existence of a certain number of sets of reference symbols (where each set of reference symbols corresponds to an antenna of the transmitter) embedded into a transmission implies that all sets must be used as a phase reference for decoding that transmission (which must therefore be transmitted from the same number of antennas as the number of sets of reference symbols), prevents the possibility of different terminals using different sets of reference symbols for different purposes.

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SUMMARY OF THE INVENTION

An object of the invention is to propose a method for signalling reference signals in a more clever way.

Another object of the invention is to propose a method for enabling different uses of the reference symbols.

Still another object of the invention is to provide a radio station able to transmit multi purpose reference symbols.

According to a first aspect of the invention, a method is proposed for communicating between a first station and a second station, said method comprising at the first station transmitting data and a plurality of sets of reference symbols, and further comprising at the first station transmitting a purpose indicator indicating of a purpose of use by the second station of at least one of the sets of reference symbols.

According to a second aspect of the invention, a radio station is proposed said secondary station comprising means for receiving a signal including data and a plurality of sets of reference symbols, and determination means for determining from a purpose indicator included in the signal whether to use said sets of reference symbols for which a purpose is indicated depending on a capability of the secondary station.

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According to a third aspect of the invention, a primary station is proposed, said primary station comprising means for transmitting to a secondary station data, a plurality of sets of reference symbols, and a purpose indicator indicating of a purpose of use by the second station of at least one of the sets of reference symbols.

5 As a consequence, in the system in accordance with the invention, signalling is provided to indicate the presence and purpose of at least some sets of a plurality of sets of reference symbols, to enable different mobile terminals with different capabilities to use the provided sets of reference symbols for different purposes. This permits to obtain more flexibility of use of the reference signals without causing too much
10 overhead by using efficient signalling in some of the embodiments of the invention. Moreover, it permits to avoid a misuse of the pilot signals, for instance the use of the pilot signals for phase synchronisation instead of the estimation of the channel quality.

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

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BRIEF DESCRIPTION OF THE DRAWING

The present invention will now be described in more detail, by way of example, with reference to the accompanying drawing, wherein:

- Fig. 1 is a block diagram of a system in which is implemented the invention.

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DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to a system of communication 300 as depicted on Figure 1, comprising a primary station 100, like a base station, and at least one secondary station 200 like a mobile station.

25 The radio system 300 may comprise a plurality of the primary stations 100 and/or a plurality of secondary stations 200. The primary station 100 comprises a transmitter means 110 and a receiving means 120. An output of the transmitter means 110 and an input of the receiving means 120 are coupled to an antenna 130 or an antenna array comprising a plurality of antennas, by a coupling means 140, which may
30 be for example a circulator or a changeover switch. Coupled to the transmitter means 110 and receiving means 120 is a control means 150, which may be for example a processor. The secondary station 200 comprises a transmitter means 210 and a receiving means 220. An output of the transmitter means 210 and an input of the

receiving means 220 are coupled to an antenna 230 or an antenna array comprising a plurality of antennas, by a coupling means 240, which may be for example a circulator or a changeover switch. Coupled to the transmitter means 210 and receiving means 220 is a control means 250, which may be for example a processor. Transmission from the primary radio station 100 to the secondary station 200 takes place on a downlink channel 160 and transmission from the secondary radio station 200 to the first radio station 100 takes place on an uplink channel 260.

In accordance with an embodiment of the invention, the primary station transmits a plurality of sets of reference symbols, or pilot signals. According to the invention, we propose that the transmitting station, for instance the primary station, signals to the receiving station for instance the secondary station, an indicator of the purpose of reference symbols as well as their presence. Here, the primary station may be a base station or a Node B. Similarly, the secondary station may be a mobile station or a User Equipment.

This would enable the network to indicate to the mobile terminals for example that additional sets of reference symbols are present but that they are not to be used as a phase reference for the signal in which they are embedded. Other purposes for these additional sets of reference symbols could be indicated to specific sets of mobile terminals which had suitable capabilities to process them in the desired way.

In a specific embodiment, a single-bit indicator could be transmitted on a broadcast channel, indicating that M more sets of reference symbols are embedded into a control signalling channel than the number of sets of reference symbols used as a phase reference for the control signalling channel, where M could be predetermined or indicated by different signalling with a slower update rate. Such different signalling could be higher layer signalling for instance.

As an alternative to using a broadcast channel for this indication, the same information could be included in a transmitted indicator of format of the control signalling channel.

In more advanced embodiments, additional signalling could be provided to indicate which sets of reference symbols are to be used for different purposes, including for example:

- phase reference for control signalling
- phase reference for data

- channel quality estimation
- precoding estimation

This would enable some mobile terminals which were capable of processing more sets of reference symbols to use them as a phase reference for data transmissions to those terminals, while other mobile terminals which did not possess this capability would be able to ignore the extra sets of reference symbols even though they were embedded into the control signalling intended for both types of terminal. Thus, a mobile station does not blindly try to decode reference signals on different streams.

This invention and its embodiments could be implemented in communication systems using reference symbols, especially using orthogonal transmission schemes such as OFDMA, where reference symbols are embedded into data transmissions, like UMTS LTE.

In the present specification and claims the word "a" or "an" preceding an element does not exclude the presence of a plurality of such elements. Further, the word "comprising" does not exclude the presence of other elements or steps than those listed.

The inclusion of reference signs in parentheses in the claims is intended to aid understanding and is not intended to be limiting.

From reading the present disclosure, other modifications will be apparent to persons skilled in the art. Such modifications may involve other features which are already known in the art of radio communication and the art of transmitter power control and which may be used instead of or in addition to features already described herein.

CLAIMS

1. A method of communication between a first station and a second station,
comprising at the first station transmitting data and a plurality of sets of
5 reference symbols,
further comprising at the first station transmitting a purpose indicator indicating
of a purpose of use by the second station of at least one of the sets of reference
symbols.
- 10 2. The method of claim 1, wherein the purpose indicator comprises an indication
that at least one set of reference symbols is transmitted for a purpose being
different from a default purpose.
- 15 3. The method of claim 2, wherein the default purpose is a phase reference for
decoding control signaling.
4. The method of any of claims 1 to 3, wherein the indicator further includes an
indication of the number of sets of reference symbols for which the purpose is
indicated.
- 20 5. The method of claim 1, wherein the indicated purpose is at least one of: a phase
reference for decoding control signaling, a phase reference for decoding data,
performing measurements for channel quality estimation, performing
measurements for precoding estimation.
- 25 6. The method of any preceding claim, wherein the indicator is transmitted on a
broadcast channel.
7. The method of any of claims 1 to 5 wherein the indicator comprises an
30 indication of the format of a control signalling channel.
8. A secondary station comprising means for receiving a signal including data and
a plurality of sets of reference symbols, and determination means for

determining from a purpose indicator included in the signal whether to use said sets of reference symbols for which a purpose is indicated depending on a capability of the secondary station.

- 5 9. A primary station comprising means for transmitting to a secondary station data, a plurality of sets of reference symbols, and a purpose indicator indicating of a purpose of use by the second station of at least one of the sets of reference symbols.

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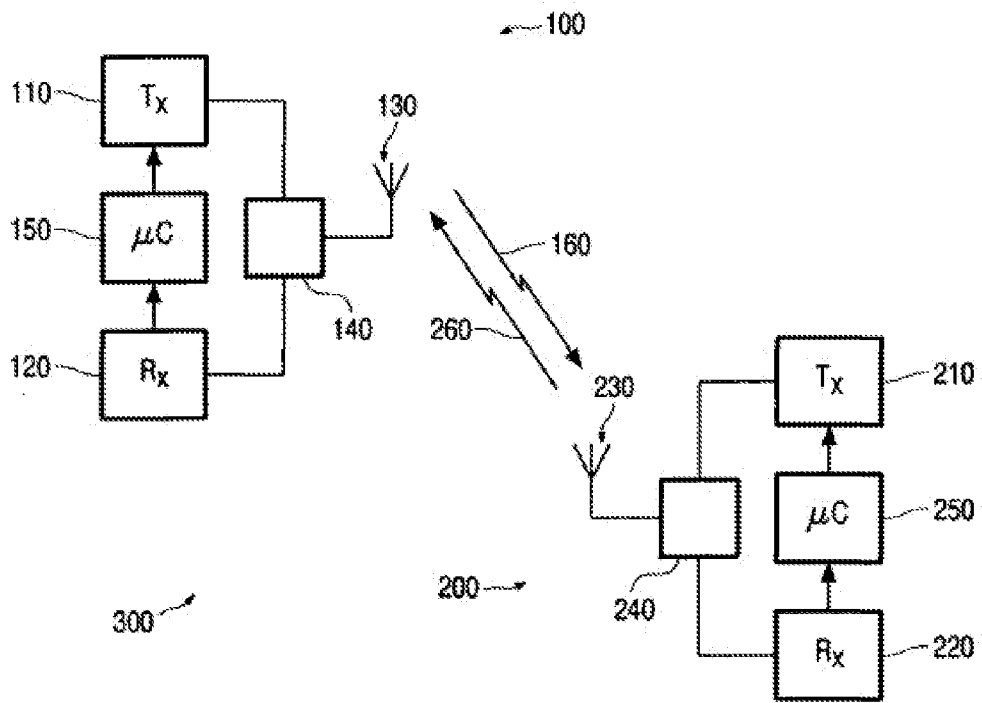


FIG 1