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**Datasheet for the decision  
of 23 August 2019**

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**Language of the proceedings:** EN

**Title of invention:**

Spatial interference mitigation schemes for wireless communication

**Applicant:**

Qualcomm Incorporated

**Headword:**

Inter-cell feedback II/QUALCOMM

**Relevant legal provisions:**

EPC Art. 56, 84, 123(2)

**Keyword:**

Clarity - main request (no)  
Added subject-matter - auxiliary request 1a (yes)  
Inventive step - auxiliary request 1 (no): re-formulation of objective problem necessary - auxiliary request 1b (yes)

**Decisions cited:**

T 1639/07, T 1009/12



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Case Number: T 1440/16 - 3.5.05

**D E C I S I O N**  
**of Technical Board of Appeal 3.5.05**  
**of 23 August 2019**

**Appellant:** Qualcomm Incorporated  
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**Decision under appeal:** **Decision of the Examining Division of the  
European Patent Office posted on 18 December  
2015 refusing European patent application  
No. 13167293.3 pursuant to Article 97(2) EPC**

**Composition of the Board:**

**Chair** A. Ritzka  
**Members:** K. Bengi-Akyuerek  
F. Blumer

## **Summary of Facts and Submissions**

I. The appeal is against the decision of the examining division to refuse the present European patent application (divided from its parent application EP 09747718.6 underlying appeal case T 1441/16) for lack of clarity (Article 84 EPC) with respect to the claims of a main request and for lack of inventive step (Article 56 EPC) with respect to the claims of first to seventh auxiliary requests, having regard to the disclosure of

**D5:** US-A-2003/0020651.

The following prior-art document was also cited in the course of the examination proceedings:

**D2:** C. Wang and R.D. Murch: "Investigation into MU-MISO transmission with limited feedback", Proceedings of the Wireless Communications and Networking Conference, pp. 2035-2039, April 2006.

II. In its statement setting out the grounds of appeal, the appellant requested that the examining division's decision be set aside and that a patent be granted on the basis of the main request or one of the first to seventh auxiliary requests underlying the appealed decision.

III. In a communication annexed to the summons to oral proceedings pursuant to Article 15(1) RPBA, the board gave its preliminary opinion on the appeal. It introduced the following prior-art document into the appeal proceedings in reaction to the appellant's arguments:

**D10:** US-A-2007/0230373.

In particular, the board indicated that claim 1 of the main request was unclear (Article 84 EPC), while claim 1 of the first to seventh auxiliary requests lacked an inventive step (Article 56 EPC), having regard to prior-art document D2 or D10.

IV. With a letter of reply dated 2 July 2019, the appellant submitted amended claims according to seven further auxiliary requests (auxiliary requests 1a, 1b, 3a, 4a, 5a, 6a and 7a) and provided counter-arguments on the objections raised in the board's communication under Article 15(1) RPBA.

V. Oral proceedings were held on 23 August 2019, during which the appellant filed a further claim set as a new "auxiliary request 1b" replacing the former one on file.

The appellant's final request was that the decision under appeal be set aside and that a patent be granted on the basis of any one of the following claim requests:

- main request filed with the letter of 6 October 2014 during the examination proceedings
- auxiliary request 1 filed with the letter of 20 October 2015 during the examination proceedings
- auxiliary request 1a filed with the letter of 2 July 2019
- auxiliary request 1b filed during the oral proceedings before the board
- auxiliary request 2 filed with the letter of 20 October 2015 during the examination proceedings

- auxiliary request 3 filed with the letter of 20 October 2015 during the examination proceedings
- auxiliary request 3a filed with the letter of 2 July 2019
- auxiliary request 4 filed with the letter of 20 October 2015 during the examination proceedings
- auxiliary request 4a filed with the letter of 2 July 2019
- auxiliary request 5 filed with the letter of 20 October 2015 during the examination proceedings;
- auxiliary request 5a filed with the letter of 2 July 2019
- auxiliary request 6 filed with the letter of 20 October 2015 during the examination proceedings;
- auxiliary request 6a filed with the letter of 2 July 2019
- auxiliary request 7 filed during the oral proceedings before the examining division on 20 November 2015
- auxiliary request 7a filed with the letter of 2 July 2019.

At the end of the oral proceedings, the board's decision was announced.

VI. Claim 1 of the **main request** reads as follows:

"A method of transmitting data in a wireless communication network (100), comprising:  
receiving precoding information sent by a first user equipment, UE (120a - 120d) to a cell (110a, 110b);  
receiving spatial feedback information, SFI, sent by a second UE (120a - 120d) to the cell, the second UE (120a - 120d) not communicating with the cell (110a, 110b); and  
sending a data transmission by the cell (110a, 110b)

using at least one of the precoding information from the first UE (120a - 120d) and the SFI from the second UE (120a - 120d), wherein the SFI is sent by the second UE (120a - 120d) to the cell (110a, 110b) in response to an SFI request sent by a second cell (110a, 110b) to the second UE (120a - 120d)."

Claim 1 of **auxiliary request 1** reads as follows (amendments to claim 1 of the main request highlighted by the board):

"A method of transmitting data in a wireless communication network (100), comprising: receiving precoding information sent by a first user equipment, UE (120a - 120d) to a cell (110a, 110b) serving the first UE (120a - 120d); receiving spatial feedback information, SFI, sent by a second UE (120a - 120d) to the cell, the second UE (120a - 120d) ~~not communicating with~~ being served by the cell (110a, 110b); and sending a data transmission by the cell (110a, 110b) using at least one of the precoding information from the first UE (120a - 120d) and the SFI from the second UE (120a - 120d), wherein the SFI is sent by the second UE (120a - 120d) to the cell (110a, 110b) in response to an SFI request sent by a second cell (110a, 110b) to the second UE (120a - 120d)."

Claim 1 of **auxiliary request 1a** reads as follows (amendments to claim 1 of auxiliary request 1 highlighted by the board):

"A method of transmitting data in a wireless communication network (100), comprising:

receiving precoding information sent by a first user equipment, UE (120a - 120d) to a cell (110a, 110b) serving the first UE (120a - 120d);  
receiving spatial feedback information, SFI, sent by a second UE (120a - 120d) to the cell, the second UE (120a - 120d) not being served by the cell (110a, 110b) but by a second cell; and  
sending a data transmission by the cell (110a, 110b) using ~~at least one of~~ the precoding information from the first UE (120a - 120d) and the SFI from the second UE (120a - 120d) for steering the data transmission toward the first user equipment (120a - 120d) and away from the second user equipment (120a - 120d),  
wherein the SFI is sent by the second UE (120a - 120d) to the cell (110a, 110b) in response to an SFI request sent by a second cell (110a, 110b) to the second UE (120a - 120d)."

Claim 1 of **auxiliary request 1b** reads as follows:

"A method of transmitting data in a wireless communication network (100), comprising:  
receiving precoding information sent by a first user equipment, UE (120a - 120d) to a cell (110a, 110b) serving the first UE (120a - 120d);  
receiving spatial feedback information, SFI, sent by a second UE (120a - 120d) to the cell, the second UE (120a - 120d) not being served by the cell (110a, 110b) but by a second cell;  
determining whether to schedule the first user equipment (120a - 120d) based on the precoding information from the first user equipment (120a - 120d) and the spatial feedback information from the second user equipment (120a - 120d); and  
if a decision is made to schedule the first UE, performing the following steps:



selecting a precoding matrix, based on the precoding information from the first user equipment (120a - 120d) and the spatial feedback information from the second user equipment (120a - 120d), for steering the data transmission toward the first user equipment (120a - 120d) and away from the second user equipment (120a - 120d); and

sending a data transmission by the cell (110a, 110b) using the selected precoding matrix,

wherein the SFI is sent by the second UE (120a - 120d) to the cell (110a, 110b) in response to an SFI request sent by a second cell (110a, 110b) to the second UE (120a - 120d)."

Further independent claim 5 of auxiliary request 1b is directed to a corresponding apparatus.

In view of the decision of the board, there is no need to reproduce the claims of the further auxiliary requests on file.

## **Reasons for the Decision**

### 1. *The present invention*

The present application is concerned with spatial interference mitigation in 3GPP-based cellular wireless networks in the presence of a "serving cell" and an "interfering cell", based on using channel feedback information from both a first user (UE1) served by a certain base station BS1 (i.e. by a serving cell) and a second user (UE2) served by another base station BS2 (i.e. by an interfering cell). In this context, mitigation techniques such as "spatial nulling" (using spatial feedback information, SFI, such as channel

direction indicator, CDI, or precoding matrix indicator, PMI) or "receiver spatial processing" may be used.

The application basically describes two embodiments, a first embodiment relating to *downlink* transmissions from the base station to the UE (see paragraphs [0095] to [00102]; Figs. 5 to 8 as filed) and a second embodiment relating to *uplink* transmissions from the UE to the base station (see paragraphs [00103] to [00108]; Figs. 9 to 12 as filed). According to the description, the alleged technical problem to be solved is "to transmit data in a manner to achieve good performance even in the presence of strong non-serving base stations" (see paragraph [0005] as filed).

2. MAIN REQUEST

Claim 1 of the main request comprises the following limiting features, as labelled by the board:

A method of transmitting data in a wireless communication network, comprising the steps of:

- A) receiving precoding information sent by a first user equipment (UE) to a cell;
- B) receiving spatial feedback information (SFI) sent by a second UE to the cell,
- C) the second UE not communicating with the cell;
- D) sending a data transmission by the cell using at least one of the precoding information from the first UE and the SFI from the second UE,
- E) wherein the SFI is sent by the second UE to the cell in response to an SFI request sent by a second cell to the second UE.

The above method steps are evidently performed by the base station of a serving cell and relate to downlink transmissions.

2.1 *Clarity (Article 84 EPC)*

2.1.1 The board agrees with the finding of the decision under appeal that feature C) contradicts feature B) and that therefore present claim 1 does not comply with Article 84 EPC.

2.1.2 As to feature C), the appellant argued that its wording had to be understood as meaning ("after a very first glance", as the appellant put it) that the second UE did not communicate with the serving cell apart from sending spatial feedback information to it.

2.1.3 The board is not convinced. Such an interpretation is in no way derivable from the wording of claim 1. Rather, the second UE either communicates with the serving cell or does not communicate with it but cannot perform any combination thereof. The appellant did not provide any further comments on this at the oral proceedings before the board.

2.2 In conclusion, the main request is not allowable under Article 84 EPC.

3. AUXILIARY REQUEST 1

Claim 1 of this auxiliary request differs from claim 1 of the main request essentially in that it no longer includes feature C) and instead specifies that (emphasis added):

C') the cell serves the first UE but not the second UE.

The board is satisfied that new feature C') is supported e.g. by paragraph [0005] and Figure 1 of the present application as originally filed and that it thus complies with Article 123(2) EPC. Furthermore, claim 1 now complies with Article 84 EPC.

3.1 *Novelty and inventive step (Articles 54 and 56 EPC)*

The board judges that the subject-matter of present claim 1 is new but not inventive (Article 56 EPC) having regard to prior-art document D2 or D10, for the reasons set out below.

3.1.1 The board concurs with the appellant that document **D5** does not represent the most suitable starting point for assessing inventive step. Document D5 relates to interference management in wireless routing networks, based on exchanging wireless routing information (such as transmission power levels, antenna pointing directions, transmission peaks/nulls, etc.) between interfering wireless routing devices. However, it is not concerned with the provision of feedback (routing) information by mobile users in a cellular system made up of 3GPP-based base stations and mobile UEs.

Rather, the board finds that prior-art documents D2 and D10 are more suitable starting points since they are concerned with inter-user interference management in wireless multi-user MIMO/MISO systems, based on providing channel state information from different mobile users.

3.1.2 In particular, document **D2** discloses the following limiting features of present claim 1 (emphasis added by the board):

A method of transmitting data in a wireless communication network ("multi-user MISO system"; see abstract), comprising the steps of:

- A) receiving precoding information ("feedback information"; see e.g. page 2036, left-hand column, paragraph above equation (4)), comprising a CDI (e.g. "spatial signature  $v_1$ " of "channel state information") or a PMI ("index  $i$ "), sent by a first UE ("user 1") to a ~~cell~~ region (see e.g. page 2037, left-hand column, second and third paragraphs);
- B) receiving SFI (e.g. "spatial signature  $v_2$ ") sent by a second UE ("user 2") to the ~~cell~~ region (see e.g. page 2037, left-hand column, penultimate paragraph);
- C') wherein the ~~cell~~ region (region of "single base station") serves the first UE (see e.g. page 2035, section II, first paragraph) ~~and not the second UE;~~
- D) sending a data transmission by the ~~cell~~ region using the precoding information (" $i$ "; " $v_1$ ") from the first UE and the SFI (" $j$ "; " $v_2$ ") from the second UE (see e.g. page 2036, right-hand column, last paragraph: "*... let the BS jointly decide what beamforming weights to use for both users based on the feedback from them ...*"; page 2037, left-hand column, second paragraph, last sentence: "*... then the beamforming weight set corresponding to the  $(i, j)^{th}$  entry of the two-dimensional codebook is selected for downlink transmission*"; page 2037, right-hand column, equation (13)),

E) wherein the SFI is sent by the second UE to the cell region ~~in response to an SFI request sent by a second cell to the second UE~~ (see e.g. page 2037, left-hand column, second and third paragraphs).

3.1.3 Moreover, document **D10** likewise discloses essentially the same features as D2 since the access point (AP) of a certain "basic service area" serving a first UE sends data ("beamformed data packet 92") to the first UE using the precoding information ("beamforming matrix  $V_1$ ") received from the first UE and the SFI ("beamforming matrix  $V_2$ ") from the second UE sent in response to an SFI request ("feedback request") sent by the access point to the second UE (see e.g. paragraphs [0022] and [0033] to [0035], in conjunction with Fig. 5, blocks 84, 90 and 92).

3.1.4 Thus, the subject-matter of present claim 1 differs from the disclosure of D2 or D10 in that the respective region or service area is a cell that does not serve the second mobile user and that the SFI is sent in response to an SFI request sent by a second cell according to features C') and E).

3.1.5 The appellant submitted that the problem underlying the present invention was "to transmit data in a manner to achieve good performance even in the presence of strong non-serving base stations" or "to provide a more efficient way of communicating data in a coverage area of multiple base stations" (see statement of grounds of appeal, sections III.9 and III.21) or "to reduce interference when transmitting data in densely populated wireless communication systems", as put forward at the oral proceedings before the board.

3.1.6 However, those problems cannot be considered to be valid objective problems. The board recalls that the objective technical problem must be derived from technical effects that are based on objectively established facts and that are directly and causally related to the technical features of the claimed invention (see e.g. T 1639/07, Reasons 2.5).

3.1.7 In the present case, the mere fact that data is sent from a serving cell to a served mobile user on the basis of feedback information obtained from both a serving and an interfering cell - without any details on how this information is actually utilised at the base station of the serving cell - cannot credibly ensure "good performance", a "more efficient way of communicating data" or "reduced interference".

This is even more so since feature D) requires solely that "at least one of" the feedback information from the first UE and the second UE be used such that the feedback data from the second UE may be omitted. Rather, the base station performing the method steps of present claim 1 has no impact at all on the different structural setting, i.e. that the interfering user from which the base station is supposed to receive feedback information is by chance served by another cell. Hence, the board holds that distinguishing feature C') has the mere technical effect that the SFI emanates from an interfering cell and thus relates solely to a different structural scenario in terms of the mobile network in question.

3.1.8 As to distinguishing feature E), it is apparent to the board that no interrelation or coordination between the first cell and the second cell as regards the actual transmission timing of such a SFI request is

discernible in the claimed subject-matter. As a consequence, the wording of present claim 1 encompasses even the case of outdated SFI data being received from the interfering cell so that the base station of the serving cell may use "incorrect" feedback data, most likely leading to severe system performance degradations. Therefore, contrary to the appellant's view, no concrete technical effect or benefit associated with feature E) can be derived.

Thus, the board finds that this feature constitutes an "arbitrary feature" being of no relevance for the matter of inventive step (see e.g. T 1009/12, Reasons 2.7) since it merely relates to the question of which unit is responsible for triggering the transmission of SFI but apparently does not credibly contribute to the solution of the allegedly underlying technical problem ("to transmit data in a manner to achieve good performance even in the presence of strong non-serving base stations"; see e.g. paragraph [0005] of the present application as filed).

- 3.1.9 In view of the above, the objective problem to be solved by claim 1 may be framed - in a less ambitious way - as "how to perform interference management in alternative structural scenarios compared to those of D2 or D10".
  
- 3.1.10 Starting from the teachings of D2 (see e.g. page 2036, left-hand column, paragraphs beneath equation (3) referring to served and non-served users or multiple regions) or D10 (see e.g. paragraph [0045] referring to cellular systems) and contrary to the appellant's view, the person skilled in the field of 3GPP-based wireless networks would have been aware that wireless coverage areas such as "regions" (as in D2) or "service



areas" (as in D10) could readily be mapped to "cells", commonly served by distinct base stations in typical cellular systems.

Consequently, the skilled person would have applied - without any modification - the same interference management schemes as used in D2 or D10, both taking into account channel feedback data originating from a first mobile user and a second interfering user, to a scenario where the second mobile user stems from another cell rather than from a different region or service area. By doing so, the skilled person would have readily arrived at the solution of present claim 1 without the need of inventive skills.

3.2 In view of the above, auxiliary request 1 is not allowable under Article 56 EPC.

4. AUXILIARY REQUEST 1a

Claim 1 of auxiliary request 1a differs from claim 1 of auxiliary request 1 basically in that it further specifies that (emphasis added by the board):

- F) the second UE is served by a second cell;
- G) data transmission is sent by the serving cell using both the precoding information from the first UE and the SFI from the second UE for steering it toward the first UE and away from the second UE.

The appellant essentially provided paragraph [0007] of the original application as a basis for new feature G).

4.1 *Added subject-matter (Article 123(2) EPC)*

- 4.1.1 As to new feature F), the board is satisfied that it is supported e.g. by paragraph [0005] and Figure 1 of the present application as originally filed and that it thus complies with Article 123(2) EPC.
- 4.1.2 However, as to added feature G), the application as originally filed teaches that it is the use of a precoding matrix that may indeed "steer a transmission toward the first UE and away from the second UE" (see paragraph [0007]). Accordingly, the mere use of the precoding information from the first UE and the SFI from the second UE is not sufficient to actually steer the data transmission within the meaning of feature F) of claim 1.

The further basis provided by the appellant at the oral proceedings, namely paragraph [0031] of the application as filed, cannot resolve this problem either, since that basis merely states that "spatial nulling information" or "precoding information" may be used by an interfering cell (rather than a serving cell as implied by present claim 1) to "steer its transmission away from a UE". As a result, feature G) amounts to an unallowable extension of the present application's original content.

- 4.2 In conclusion, auxiliary request 1a is not allowable under Article 123(2) EPC.
5. AUXILIARY REQUEST 1b

Claim 1 of auxiliary request 1b differs from claim 1 of auxiliary request 1a substantially in that it further specifies that (emphasis added by the board):

- H) it is determined whether to schedule the first UE based on the precoding information from the first UE and the SFI from the second UE;
- I) if a decision is made to schedule the first UE, a precoding matrix is selected, based on the precoding information from the first UE and the SFI from the second UE, for steering the data transmission toward the first UE and away from the second UE;
- J) a data transmission is sent by the cell using the selected precoding matrix.

Added features H) to J) are supported e.g. by the first, second and last sentences of paragraph [0096] and by Figure 5, block 516 of the present application as originally filed (Article 123(2) EPC).

#### 5.1 *Inventive step (Article 56 EPC)*

5.1.1 Additional features H) to J) of claim 1 are not known from documents D2 and D10. As a consequence, the subject-matter of present claim 1 now differs in features C'), E), F) and H) to J) from those prior-art documents.

5.1.2 The board accepts that the above distinguishing features yield the synergistic technical effect that an appropriate precoding matrix is only then selected and used for downlink data transmissions if, based on the received feedback from the users of both the serving and the interfering cell, data transmission is actually scheduled, thereby in fact avoiding a wastage of available bandwidth. The objective problem to be solved by present claim 1 may thus be formulated as "how to ensure optimised inter-cell interference management

while maintaining bandwidth efficiency".

- 5.1.3 Starting from the teachings of D2 or D10, the skilled person would have noticed that there are no discernible incentives to further optimise the bandwidth usage of the underlying interference management schemes. On the contrary, the skilled person would, when confronted with the above objective problem, have envisaged the application of the so-called "cooperative approach" where two users are supposed to cooperate such that they jointly feedback their experienced downlink channel state information with the aim of reaching an upper bound of the achievable performance of the underlying system (see e.g. D2, page 2036, section III.A), rather than applying a conditional selection of a precoding matrix (i.e. beamforming matrix) as claimed.

Thus, the board holds that the skilled person would in fact have been deterred from applying in particular the measures of features H) to J) as claimed, since he or she would have been aware that bandwidth wastage as such is no concern at all in the relevant prior art. Therefore, the skilled person would not have been prompted, starting from D2, D5 or D10, to come up with the claimed solution that credibly provides a synergistic technical effect going beyond the sum of the individual effects of its distinguishing features.

Given that the structural features of the further independent apparatus claim 5 correspond to the method steps of present claim 1, the same reasoning applies equally to that independent claim.

- 5.2 Hence, in the light of the available prior art, the subject-matter of the present independent claims of

auxiliary request 1b is held to involve an inventive step within the meaning of Article 56 EPC.

6. Since all the other requirements of the EPC are also found to be fulfilled, the board decides that a patent is to be granted on the basis of claims 1 to 8 according to **auxiliary request 1b**. This auxiliary request being allowable, the remaining auxiliary requests need not be considered further.

## Order

### **For these reasons it is decided that:**

1. The decision under appeal is set aside.
2. The case is remitted to the examining division with the order to grant a patent on the basis of the claims of auxiliary request 1b as filed during the oral proceedings before the board and a description and drawings to be adapted.

The Registrar:

The Chair:



K. Götz-Wein

A. Ritzka

Decision electronically authenticated