Internal distribution code:

(A) [-] Publication in OJ
(B) [-] To Chairmen and Members
(C) [-] To Chairmen
(D) [X] No distribution

Datasheet for the decision of 21 May 2014

Case Number: T 2347/09 - 3.5.05

Application Number: 04007874.3

Publication Number: 1583277

IPC: H04L1/20, H04L1/06, H04L27/26, H04B7/06

Language of the proceedings: EN

Title of invention:
MIMO-OFDM backward-compatible transmission system

Applicant:
Infineon Technologies AG

Headword:
MIMO/OFDM training/INFINEON

Relevant legal provisions:
EPC Art. 56, 84

Keyword:

Decisions cited:

Catchword:

Beschwerdekammern
Boards of Appeal
Chambres de recours

European Patent Office
D-80298 MUNICH
GERMANY
Tel. +49 (0) 89 2399-0
Fax +49 (0) 89 2399-4465

Case Number: T 2347/09 - 3.5.05

D E C I S I O N
of Technical Board of Appeal 3.5.05
of 21 May 2014

Appellant: (Applicant)	Infineon Technologies AG Am Campeon 1-12 85579 Neubiberg (DE)
Representative:	Graf Lambsdorff, Matthias Patentanwälte Lambsdorff & Lange Dingolfinger Strasse 6 81673 München (DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 15 July 2009 refusing European patent application No. 04007874.3 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chair	A. Ritzka
Members:	P. Cretaine
	F. Blumer

Summary of Facts and Submissions

I. The appeal is against the decision of the examining division, posted on 15 July 2009, to refuse European patent application No. 04007874.3 on the grounds of insufficiency of disclosure (Article 83 EPC), lack of clarity (Article 84), and lack of novelty and inventive step (Articles 54 and 56 EPC), having regard to the disclosure of

D1: WO 03/034646,

with respect to a main request and a first to sixth auxiliary request.

II. Notice of appeal was received on 3 September 2009 and the appeal fee was paid on the same day. With the statement setting out the grounds of appeal, received on 13 November 2009, the appellant requested that the decision of the examining division be set aside and that a patent be granted on the basis of the main request or any of the second to sixth auxiliary requests underlying the decision under appeal.

III. A summons to oral proceedings scheduled for 21 May 2014 was issued on 18 February 2014. In an annex to this summons, the board gave its preliminary opinion on the appeal, pursuant to Article 15(1) RPBA. In particular, objections were raised under Article 84 EPC as regards the main request and the second and third auxiliary requests, and under Article 56 EPC with respect to all the requests on file, having regard to the disclosure of D1. The board further established from the file that the appellant had not re-submitted the first auxiliary request refused by the examining division.

IV. With a letter dated 8 April 2014, the appellant informed the board that it would not be attending the scheduled oral proceedings.

V. Oral proceedings were held as scheduled on 21 May 2014 in the absence of the appellant. After due deliberation on the basis of the pending requests and the written submissions, the decision of the board was announced at the end of the oral proceedings.

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

"An OFDM-transmitter in an OFDM transmission system (50) operable to optimise estimates of a quantity at a receiver, said quantity being one of a channel transfer function from a transmitting antenna to a receiving antenna, a frequency offset, a timing offset, a sampling rate offset, or a measure of the spatial position of the transmitter, wherein said transmitter comprises a transmitting means (54) connected to a number of antennas, and a control means (52) connected to said transmitting means (54),
characterized in that
said control means (52) controls said transmitting means (54) to
- initially transmit an initial quantity estimation sequence during an initial quantity estimation phase, and
- subsequently transmit a sequence of data symbols such that the information rate of the data symbols is progressively increased with time."

The main request comprises further independent claims for a corresponding system (claim 3), method (claim 7) and computer program (claim 12) at a receiver.

Claim 1 of the **second auxiliary request** reads as follows:

"An OFDM communication system (100) operable to optimise estimates of a quantity at a receiver, said quantity being one of a channel transfer function from a transmitting antenna to a receiving antenna, a frequency offset, a timing offset, a sampling rate offset, or a measure of the spatial position of the transmitter, wherein said communication system (100) comprises a receiving means (60) connected to a number of receiving antennas, and a control means (110) connected to said receiving means (60),
characterized in that
said control means (110) controls said receiving means (60) to initially receive an initial quantity estimation sequence during an initial quantity estimation phase and subsequently receive a sequence of data symbols such that the information rate of the data symbols is progressively increased with time,
said communication system (100) also comprises a first estimating means (102) operable to make an initial estimate of said quantity, based on the received symbols during an initial quantity estimate phase, an estimate updating means (104) connected to said first estimating means (102) operable to store a current estimate of said quantity, a decoding means (106) connected to said estimate updating means (104) operable to decode the received symbols, wherein said communication system (100) also comprises a remodulating means (108) connected to said decoding means (106) and said estimate updating means (104), which remodulating means (108) is operable to duplicate the modulation function performed at the transmitter to generate estimated transmitted symbols, wherein said communication system (100) also comprises a control

means (110) connected to said decoding means (106) and said remodulating means (108)."

The second auxiliary request comprises further independent claims for a corresponding method (claim 4) and computer program (claim 8).

Claim 1 of the **third auxiliary request** comprises all the features of claim 1 of the second auxiliary request with the additional final phrase "said control means (110) also is operable to compare the received symbols and the estimated transmitted symbols and to calculate an error vector, wherein said estimate updating mean (104) updates said estimate of said quantity based on said error vector."

The third auxiliary request comprises further independent claims for a corresponding method (claim 3) and computer program (claim 6).

Claim 1 of the **fourth auxiliary request** comprises all the features of claim 1 of the second auxiliary request, with the additional final phrase "and wherein it is implemented in a multiple input multiple output transmission system comprising m number of transmitting antennae and n number of receiving antennae, wherein m and n are integers and m, $n \geq 2$, wherein the transmissions on each transmitting antenna during an initial quantity estimation phase are separated in frequency, so that a given transmitting antenna is the only one transmitting on a given subcarrier at a given time."

The fourth auxiliary request comprises further independent claims for a corresponding method (claim 3) and computer program (claim 5).

Claim 1 of the **fifth auxiliary request** comprises all the features of claim 1 of the second auxiliary request, with the additional final phrase "said control means (110) also is operable to compare the received symbols and the estimated transmitted symbols and to calculate an error vector, wherein said estimate updating mean (104) updates said estimate of said quantity based on said error vector, and wherein it is implemented in a multiple input multiple output transmission system comprising m number of transmitting antennae and n number of receiving antennae, wherein m and n are integers and m, n ≥ 2, wherein the transmissions on each transmitting antenna during an initial quantity estimation phase are separated in frequency, so that a given transmitting antenna is the only one transmitting on a given subcarrier at a given time."

The fifth auxiliary request comprises further independent claims for a corresponding method (claim 2) and computer program (claim 4).

Claim 1 of the **sixth auxiliary request** is identical to claim 1 of the fifth auxiliary request.

The sixth auxiliary request comprises further independent claims for a corresponding method (claim 2) and computer program (claim 3).

Reasons for the Decision

1. The appeal is admissible.

2. Non-attendance at oral proceedings

The appellant did not request oral proceedings and decided not to attend those scheduled by the board. Nor did it respond to the objections raised by the board in the communication under Article 15(1) RPBA, annexed to the summons to oral proceedings. Pursuant to Article 15(3) RPBA, the appellant may be treated as relying only on its written case, i.e. in the present case on its arguments submitted with the statement setting out the grounds of appeal. The board maintained the objections to the pending requests which it had raised in its communication under Article 15(1) RPBA, and was in a position to take a decision at the end of oral proceedings.

3. Clarity - Article 84 EPC

Having considered the arguments of the appellant in respect of the objections under Articles 83 and 84 EPC raised by the examining division in the decision under appeal, the board continues to take the view that the lack of a reference to a multiple input multiple output scheme, i.e. MIMO, in independent claims 3 and 7 of the main request, independent claims 1 and 4 of the second auxiliary request and independent claims 1 and 3 of the third auxiliary request contravenes the requirement of Article 84 EPC. It is quite clear from the description as a whole, and not only from the description of the preferred embodiments, that the application is directed specifically to an OFDM/MIMO system in which the transmitter and the receiver **both** comprise a plurality of antennas (see for instance paragraphs [0019], [0021], [0027], [0031], [0035], [0036], [0048], [0050], [0052], [0055], [0060] and [0065], and Figures 1, 5 and 7 of the published application).

The above-mentioned independent claims do not contain this feature and thus are not fully supported by the description, contrary to the requirements of Article 84 EPC.

The following assessment of inventive step has however been established as if this feature were present.

4. Inventive step - Article 56 EPC

4.1 Closest prior art

D1 discloses an OFDM system adapted to function in a MIMO context (see page 5, lines 18 to 29 and from page 23, line 26 to page 24, line 16). A transmitter sends, during a training period, pilot symbols for channel quality measurement at a receiver (see page 7, lines 29 to 32). The receiver sends back to the transmitter a channel quality indicator for applying an appropriate coding rate (page 10, lines 1-5). During the training phase, the antennas may use only disjoint sets of subcarriers (page 11, lines 27-30 and page 29, lines 2-19, Figure 10). At the receiver, the received pilot symbols are decoded and re-encoded and a channel estimate is determined by comparing the received coded symbols with the re-encoded decoded received symbols. Page 28, lines 28-29 shows that the quantity to be estimated may be a frequency offset or a sampling frequency offset.

4.2 Main request

D1 discloses all the features of independent claims 1, 3, 7 and 12, with the following exceptions:

a) the quantity may further be a timing offset or a measure of the spatial position of the transmitter;

b) the sequence of data symbols which is transmitted by the transmitter and received by the receiver after the initial quantity estimation sequence has an information rate which is **progressively increased with time**.

Feature a) defines the information represented by the quantity which is to be estimated at the receiver based on the training sequence. There is nothing in the description to show that the information conveyed by the quantity has an influence on the other technical features of the claimed system and method. Therefore feature a) is merely an obvious option for the skilled person, with no inventive merit in itself.

Feature b) provides the technical effect that the amount of information conveyed by the data symbols increases with time. The objective technical problem can thus be defined as how to improve the throughput of the OFDM system of D1. It is however already known from D1 that the coding rate, and thus the information rate, can be controlled and modified after the training phase (see D1, page 10, lines 1 to 5 and page 23, lines 26 to 28). Since increasing the information rate is a constant aim of every designer of communication systems, it is obvious that the skilled person would adapt the coding in D1 in order to steadily increase this rate, as far as this is possible under the channel conditions. The board notes in that respect that the appellant has acknowledged in the statement setting out the grounds of appeal (page 2, last sentence) that coding is a common measure that the skilled person would apply in order to increase the data rate. Moreover, the term "progressively" does not, in the

board's judgement, add anything to the technical meaning of "increased with time".

For these reasons, the subject-matter of independent claims 1, 3, 7 and 12 does not involve an inventive step (Article 56 EPC).

4.3 Second auxiliary request

Claim 1 adds in substance to independent claim 3 of the main request the features of the receiver structure as illustrated on Figure 9 of the description.

D1 however teaches (see page 12, lines 9 to 19; from page 24, line 25 to page 25, line 15; Figure 2) to decode the received pilot symbols, to re-encode them, and to compare the received pilot symbols with the re-encoded symbols in order to estimate the channel response. Therefore, the first estimating means 102, the updating means 104 and the decoding means 106 of claim 1 can be read together into the decoder 238 of D1; the remodulating means 108 of claim 1 can be read into the encoder 240 of D1. The added features of claim 1 are thus already disclosed in D1.

Therefore, claim 1 according to the second auxiliary request and the corresponding method claim 4 and computer program claim 8 do not meet the requirements of Article 56 EPC, having regard to the disclosure of D1.

4.4 Third auxiliary request

Claim 1 adds in substance to claim 1 according to the second auxiliary request the feature that the receiver calculates an error vector based on the comparison of

the received symbols with the estimated transmitted symbols.

This feature is however already disclosed in D1 (see the comparator 251 in Figure 2).

Therefore, claim 1 according to the third auxiliary request and the corresponding method claim 3 and computer program claim 6 do not meet the requirements of Article 56 EPC, having regard to the disclosure of D1.

4.5 Fourth auxiliary request

Claim 1 adds in substance to claim 1 according to the second auxiliary request the feature that the transmissions on each transmitting antenna during the initial quantity estimation phase are separated in frequency, so that a given transmitting antenna is the only one transmitting on a given subcarrier at a given time. This feature is however already disclosed in D1 (see page 11, lines 28 to 30; page 29, lines 2 to 19; Figure 10), which teaches to allocate disjoint groups of subcarriers to the transmitting antennas for transmitting pilot symbols in a training phase.

Thus, claim 1 according to the fourth auxiliary request and the corresponding method claim 3 and computer program claim 5 do not meet the requirements of Article 56 EPC, having regard to the disclosure of D1.

4.6 Fifth auxiliary request

Claim 1 adds in substance to claim 1 according to the second auxiliary request the additional features mentioned with respect to the third and fourth auxiliary requests in paragraphs 4.4 and 4.5 above.

These features being, as discussed in these paragraphs, already disclosed in D1, claim 1 according to the fifth auxiliary request and the corresponding method claim 2 and computer program claim 4 do not meet the requirements of Article 56 EPC, having regard to the disclosure of D1.

4.7 Sixth auxiliary request

Independent claims 1, 2 and 3 of this request are identical to independent claims 1, 2 and 4, respectively, of the fifth auxiliary request.

Thus the claims according to the sixth auxiliary request do not meet the requirements of Article 56 EPC, having regard to the disclosure of D1.

5. In conclusion, none of the pending requests is allowable under Article 56 EPC. Moreover, the main request and the second and third auxiliary requests are also not allowable under Article 84 EPC.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chair:

G. Nachtigall A. Ritzka

Decision electronically authenticated