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**Datasheet for the decision
of 24 April 2014**

Case Number: T 2296/10 - 3.5.05

Application Number: 08253749.9

Publication Number: 2071757

IPC: H04L1/06, H04L27/26

Language of the proceedings: EN

Title of invention:

OFDM-transmitting apparatus and method, and OFDM-receiving apparatus and method

Applicant:

Sony Corporation

Headword:

Alamouti encoding/SONY

Relevant legal provisions:

EPC Art. 56

Keyword:

Inventive step (no) - no technical prejudice

Decisions cited:

Catchword:



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Boards of Appeal
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Case Number: T 2296/10 - 3.5.05

D E C I S I O N
of Technical Board of Appeal 3.5.05
of 24 April 2014

Appellant: Sony Corporation
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted on 30 June 2010 refusing European patent application No. 08253749.9 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chair: A. Ritzka
Members: K. Bengi-Akyuerek
D. Prietzel-Funk

Summary of Facts and Submissions

I. The appeal is against the decision of the examining division, posted on 30 June 2010, to refuse European patent application No. 08253749.9 on the grounds of lack of clarity (Article 84 EPC) with respect to a main request and lack of inventive step (Article 56 EPC) with respect to the main request and a first auxiliary request, having regard to the disclosure of

D1: O. Haffenden: "Pilot patterns for MISO/MIMO",
BBC Research, pp. 1-6, 29 November 2007.

Moreover, a second auxiliary request was not admitted into the examination proceedings under Rules 116(1) and 137(3) EPC on the ground that it was late-filed and *prima facie* not allowable under Article 123(2) EPC.

II. Notice of appeal was received on 17 August 2010. The appeal fee was paid on the same day. With the statement setting out the grounds of appeal, received on 22 October 2010, the appellant filed new claims according to a main request and first to third auxiliary requests. It 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 auxiliary requests. In addition, oral proceedings were requested as an auxiliary measure.

III. A summons to oral proceedings scheduled for 24 April 2014 was issued on 3 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, Article 123(2) EPC as regards the auxiliary requests, and Article 56 EPC with

respect to the main and auxiliary requests, having regard to D1 and the disclosure of

D2: O. Haffenden: "Alamouti in varying channels",
BBC Research, pp. 1-18, 5 October 2007.

The board informed the appellant that D2, cited in the application as filed (cf. page 3, lines 16-19), was introduced into the appeal proceedings due to its relevance for the assessment of novelty and inventive step. Furthermore, the appellant was also informed that the board considered that the auxiliary requests on file could have been presented in the first-instance proceedings and that therefore those requests might possibly not be admitted into the appeal proceedings under Article 12(4) RPBA.

- IV. With a letter dated 24 March 2014, the appellant submitted counter-arguments with regard to the objections raised in the board's communication under Article 15(1) RPBA.
- V. By letter dated 17 April 2014, the appellant submitted a witness statement of the inventor of the present invention ("Declaration of Lothar Stadelmeier") and outlined the arguments which it intended to raise at the scheduled oral proceedings before the board.
- VI. By fax dated 23 April 2014, i.e. one day before the scheduled oral proceedings, the appellant filed another witness statement ("Declaration of Samuel Asangbeng Atungsiri") without providing further arguments.
- VII. Oral proceedings were held as scheduled on 24 April 2014, during which the appellant withdrew the first, second, and third auxiliary requests on file.

The allowability of the main request was discussed.

The appellant's final request was that the decision under appeal be set aside and that a patent be granted on the basis of the main request, submitted with the letter setting out the grounds of appeal dated 22 October 2010. At the end of the oral proceedings, the decision of the board was announced.

VIII. Claim 1 of the main request (sole request) reads as follows:

"An apparatus for transmitting data symbols via Orthogonal Frequency Division Multiplexed (OFDM) symbols in accordance with a Digital Video Broadcast-Terrestrial standard, the OFDM symbols comprising a plurality of data bearing sub-carriers and one or more continuous pilot sub-carrier symbols, which are located in the same position for each of the OFDM symbols and scattered pilot sub-carrier symbols, which change position between one OFDM symbol and another, in accordance with a predetermined pattern, the apparatus comprising

a modulator (28, 37.1, 37.2, 38.1, 38.2) operable to receive the data symbols for communicating via the OFDM symbols,

to form the data symbols into pairs,

to generate first pairs of modulation symbols for each of the pairs of data symbols, the first pair of modulation symbols forming first and second modulation symbols of an Alamouti cell,

to form a first version of the OFDM symbols by modulating the sub-carriers allocated for carrying the one or more pilot carriers in accordance with the predetermined pattern, and modulating the sub-carriers allocated for carrying the data with the first and

second modulation symbols of the Alamouti cells,

to generate second pairs of modulation symbols for each of the pairs of data symbols, the second pairs of modulation symbols forming third and fourth modulation symbols of the Alamouti cell formed for the pair of data symbols in the first version of the OFDM symbol,

to form a second version of the OFDM symbols by modulating the sub-carriers allocated for carrying the one or more pilot carriers in accordance with the predetermined pattern, and modulating the sub-carriers allocated for carrying the data with the third and fourth modulation symbols of the Alamouti cell,

and

a transmitter (42, 44, 46) for transmitting the first version of the OFDM symbols via a first antenna (112), and the second version of the OFDM symbols via a second antenna (114), wherein the OFDM symbols are formed with the continuous pilot symbol sub-carriers and the scattered pilot symbol sub-carriers at locations within the first and second OFDM symbols with a pattern determined in accordance with the Digital Video Broadcast-Terrestrial standard, without pre-condition on the location of the pilot sub-carrier symbols with respect to a location of the data bearing sub-carrier symbols and for at least one of the pairs of data symbols, the sub-carriers, on which each of the modulation symbols of the first and second modulation symbols and the third and fourth modulation symbols forming the Alamouti cell are modulated, are separated within the first and second versions of the OFDM symbol by at least one other data bearing sub-carrier or one or more of the scattered or continuous pilot symbol sub-carriers."

The further independent claims 8, 14, 15, and 16 of the main request are directed to a corresponding receiving

apparatus and process (claims 8 and 15), to the associated transmission process (claim 14), and to a system comprising corresponding transmission and receiving apparatuses (claim 16).

Reasons for the Decision

1. The appeal is admissible.

2. MAIN REQUEST

Claim 1 of this request differs from claim 1 of the main request underlying the appealed decision basically in that it further specifies that the OFDM symbols are to be transmitted in accordance with a Digital Video Broadcast Terrestrial (DVB-T) standard.

This amendment was made in response to the objections raised in the decision under appeal under Article 84 EPC (cf. Reasons, section 4) and is based on the disclosure of page 14, lines 5-7 of the application as filed.

2.1 Article 52(1) EPC: Novelty and inventive step

In the board's judgment, claim 1 does not meet the requirements of Article 52(1) EPC in conjunction with Article 56 EPC, for the following reasons:

2.1.1 The board concurs with the finding of the decision under appeal that D1 represents the closest prior art for the subject-matter of claim 1, since it is related to the same technical problem as the present invention, namely how to deal with split Alamouti pairs in connection with Alamouti-type encoding/decoding of OFDM

symbols using pilot symbols.

2.1.2 As to the question of novelty, the appellant contended that the following features of claim 1 were not disclosed in D1 (cf. appellant's letter dated 17 April 2014, page 7, penultimate paragraph):

- A) the predetermined pattern of continuous and scattered pilot sub-carrier symbols being in accordance with a DVB-T standard;
- B) generating second pairs of modulation symbols for each of the pairs of data symbols, the second pairs of modulation symbols forming third and fourth modulation symbols of the Alamouti cell formed for the pair of data symbols in the first version of the OFDM symbol;
- C) forming a first version of OFDM symbols with the first and second modulation data symbols of an Alamouti cell and a second version of OFDM symbols with the third and fourth modulation data symbols of a cell by modulating the pilot sub-carriers and the data-bearing sub-carriers;
- D) the pilot symbols being allocated without pre-condition on the location of the pilot symbols with respect to a location of the data symbols;
- E) at least one of the data symbol pairs of an Alamouti cell being separated by either a pilot symbol or a data symbol.

2.1.3 As regards feature A), contrary to the assumptions of the examining division (cf. appealed decision, page 3, last paragraph) and the appellant (cf. appellant's letter dated 24 March 2014, page 2, penultimate paragraph), the board considers that D1 does indeed teach the use of both continuous pilots, "CPs", and scattered pilots, "SPs" (see e.g. slides entitled "Continual pilots" and "Conclusions"), regardless of

whether they are paired or not. Hence, the types of pilots used cannot distinguish claim 1 from the disclosure of D1. However, the board accepts that the use of a pilot pattern in accordance with a DVB-T standard is neither explicitly nor implicitly disclosed in D1 and thus constitutes a distinguishing feature (see point 2.1.8 below).

- 2.1.4 As to feature B), the appellant argued that this feature implied that the transmitter of the claimed apparatus was configured to transmit Alamouti cells in accordance with a Multiple Input Single Output (MISO) system. However, the title of D1 already demonstrates that its teaching is related to pilot patterns for both MISO and MIMO (Multiple Input Multiple Output) systems (see first slide of D1 entitled "Pilot patterns for MISO/MIMO") and thus clearly teaches the transmission of Alamouti cells in accordance with a MISO system.
- 2.1.5 As regards feature C), the appellant contended that this feature suggested that the transmitter of the claimed apparatus was configured to transmit Alamouti space-frequency (rather than space-time) encoded data symbols. The board considers, however, that all the time/frequency patterns depicted in D1 (see second to fifth slide) unambiguously disclose the use of an Alamouti space-frequency system according to this disclosure, since D1 also supports the transmission of OFDM symbols via multiple transmit antennas (using MISO/MIMO systems) providing *spatial* differentiation and over multiple sub-carriers involving separation in the *frequency* domain.
- 2.1.6 As to feature D), the examining division held that this feature was too broad and was not formulated in positive terms indicating clear limiting features for

the location of the pilot sub-carriers, thus rendering claim 1 unclear under Article 84 EPC (cf. appealed decision, Reasons, section 5). In the board's communication under Article 15(1) RPBA, the board considered that feature D) was in fact related to the technical problem to be solved, i.e. the *result to be achieved* (cf. page 14, lines 19-21 of the application as filed: "The present technique provides a way of allowing Alamouti encoding to be used with mixed pilots and Alamouti pairs. As a result, there is no pre-condition for the placement of the pilot carriers ..."), rather than providing a solution as to how that result is actually achieved according to the alternative Alamouti decoding method (as described in detail at page 14, line 25 to page 25, line 13 of the application as filed). At the oral proceedings before the board, the appellant conceded that feature D) merely implied the use of a pilot pattern according to a DVB-T standard (see also appellant's letter dated 17 April 2014, page 2, third paragraph). Consequently, this feature cannot be regarded as a further limiting feature of claim 1 in addition to the feature given in point 2.1.3 above.

- 2.1.7 As regards feature E), the appellant took the view that it was not anticipated by D1 because that document proposed the pairing of pilot symbols to avoid the separation of Alamouti pairs according to the third to sixth slide. This argument does not convince the board. The board rather holds that feature E) solely describes the situation where some Alamouti pairs are no longer located in neighbouring sub-carriers and thus are separated by some pilot or other data symbols. This, however, merely constitutes an immediate consequence of features A) and D), i.e. that a fixed pilot pattern in accordance with a DVB-T standard is employed, instead

of providing a solution to the underlying problem. According to D1, the above situation is regarded as an undesirable scenario (see the slide entitled "Original proposal (up to 1/8 G.I.)") and thus as a starting point for proposing solutions - such as pairing of pilots - in order to avoid this scenario under the given constraints (see the following slides of D1). Therefore, the board agrees with the finding of the decision under appeal that feature E), i.e. the indication of the overarching problem that some Alamouti pairs are split at least by pilot symbols, is already known from D1 (see e.g. the time/frequency pattern shown in the slide entitled "Original proposal (up to 1/8 G.I.)").

2.1.8 Hence, the only difference between the subject-matter of claim 1 and the disclosure of D1 is considered to be that the continuous and the scattered pilot symbol sub-carriers are located at locations within the first and second OFDM symbols with a pattern determined in accordance with the DVB-T standard, i.e. corresponding to feature A) above. Consequently, the subject-matter of claim 1 is found to be novel over D1 (Article 54 EPC).

2.1.9 In this context, the board holds that the distinguishing feature merely implies that one out of several pilot patterns associated with those DVB-T standards which were published before the application's priority date is to be used. However, choosing a certain pilot pattern from several equally likely pilot patterns is regarded as a straightforward implementation detail for the skilled person in the field of mobile communication systems, depending solely upon practical circumstances such as the content to be distributed, implementation preferences,

standardisation constraints and/or market needs.

2.1.10 With its letter dated 17 April 2014 and during the oral proceedings before the board, the appellant submitted that D1 was published in the name of Oliver Haffenden from BBC Research and that, in referring to the declarations of two employees of the appellant (cf. points V and VI above), the BBC favoured MIMO systems with Alamouti *space-time* coding rather than MISO systems using Alamouti *space-frequency* coding for the purpose of implementing the DVB-T2 standard at the time of its publication. This was essentially due to the fact that using Alamouti *space-frequency* coding implied long guard intervals between OFDM symbols, which was however undesirable to the BBC because of infrastructure cost considerations. Therefore, according to the appellant, using a MISO system involving Alamouti *space-frequency* coding for implementing the DVB-T2 standard was against prejudices or uncertainties prevailing at the time of D1's publication date from the perspective of the BBC.

In this regard, the board notes that, in general, cost considerations and technological preferences of a particular company (like the BBC in this case) cannot impose technical prejudices or uncertainties upon a technically skilled person such that he would be deterred from envisaging a technically sound and feasible solution for that reason alone. Otherwise, when analysing and interpreting the actual teaching of the closest prior art determined for the purpose of assessing inventive step according to the well-established "problem-solution approach", internal experiences, beliefs, and preferences concerning technologies to be applied by the company from which that closest prior art originates would generally have

to be taken into account. This would in turn mean that - to answer the question whether the skilled person starting out from the closest prior art would in fact arrive at the claimed solution - additional internal background information on the respective closest prior art (e.g. derived from witness statements from some employees as provided by the present appellant) would be necessary. In other words, the extent to which the notional skilled person in fact applies his skills in providing a solution to an objective technical problem would be unduly bound by such internal information (e.g. the expected infrastructure costs incurred by the BBC when proposing a change in its applied technology) at the filing date of an application instead of finding an appropriate solution to the objective problem posed. That would, however, definitely be incompatible with the problem-solution approach as generally applied.

Rather, the person skilled in a technical field (i.e. mobile communication networks in the present case) would try to seek a technical solution to an objective technical problem (i.e. choosing a certain pilot symbol pattern) under certain constraints (i.e. digital video distribution), starting with the closest prior art (i.e. document D1). However, based on the reasoning set out in points 2.1.1 to 2.1.9, the board considers that said skilled person would arrive at the solution (i.e. using a DVB-T-based pilot symbol pattern) according to feature A) of claim 1 without exercising inventive skills.

- 2.1.11 In view of the above, the subject-matter of claim 1 does not involve an inventive step having regard to D1 and the skilled person's common general knowledge.

2.2 In conclusion, the main and sole request is not allowable under Article 56 EPC.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chair:



K. Götz

A. Ritzka

Decision electronically authenticated