

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 1557-403PWO	FOR FURTHER ACTION		See Form PCT/IPEA/416
International application No. PCT/IB2017/056048	International filing date (<i>day/month/year</i>) 30.09.2017	Priority date (<i>day/month/year</i>) 30.09.2016	
International Patent Classification (IPC) or national classification and IPC INV. H04L5/00			
Applicant Telefonaktiebolaget LM Ericsson (Publ)			
1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36. 2. This REPORT consists of a total of <u>6</u> sheets, including this cover sheet. 3. This report is also accompanied by ANNEXES, comprising: a. ☒ (<i>sent to the applicant and to the International Bureau</i>) a total of <u>26</u> sheets, as follows: ☒ sheets of the description, claims and/or drawings which have been amended and/or sheets containing rectifications authorized by this Authority, unless those sheets were superseded or cancelled, and any accompanying letters (see Rules 46.5, 66.8, 70.16, 91.2, and Section 607 of the Administrative Instructions). ☐ sheets containing rectifications, where the decision was made by this Authority not to take them into account because they were not authorized by or notified to this Authority at the time when this Authority began to draw up this report, and any accompanying letters (Rules 66.4bis, 70.2(e), 70.16 and 91.2). ☐ superseded sheets and any accompanying letters, where this Authority either considers that the superseding sheets contain an amendment that goes beyond the disclosure in the international application as filed, or the superseding sheets were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in item 4 of Box No. I and the Supplemental Box (see Rule 70.16(b)). b. ☐ (<i>sent to the International Bureau only</i>) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing, in the form of an Annex C/ST.25 text file, as indicated in the Supplemental Box Relating to Sequence Listing (see paragraph 3ter of Annex C of the Administrative Instructions).			
4. This report contains indications relating to the following items: ☒ Box No. I Basis of the report ☐ Box No. II Priority ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability ☐ Box No. IV Lack of unity of invention ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement ☐ Box No. VI Certain documents cited ☒ Box No. VII Certain defects in the international application ☒ Box No. VIII Certain observations on the international application			
Date of submission of the demand 27.07.2018		Date of completion of this report 17.10.2018	
Name and mailing address of the international preliminary examining authority:  European Patent Office P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Fax: +31 70 340 - 3016		Authorized officer Fonseca dos Santos Telephone No. +31 70 340-2439	



Box No. I Basis of the report

1. With regard to the **language**, this report is based on
- ☒ the international application in the language in which it was filed
 - ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of:
 - ☐ international search (under Rules 12.3(a) and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4(a))
 - ☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a) and (b))
2. With regard to the **elements*** of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

Description, Pages

1-56 as originally filed

Claims, Numbers

1-56 filed in electronic form on 28-08-2018

Drawings, Sheets

1/22-22/22 as originally filed

- ☐ a sequence listing - see Supplemental Box Relating to Sequence Listing.
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since either they are considered to go beyond the disclosure as filed, or they were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in the Supplemental Box (Rules 70.2(c) and (c-bis)):
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
5. ☐ This report has been established:
- ☐ taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rules 66.1(d-bis) and 70.2(e)).
 - ☐ without taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91(Rules 66.4bis and 70.2(e)).

**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/IB2017/056048

6. ☒ With regard to top-up searches (Rules 66.1 *ter* and 70.2(f)):
- ☒ A top-up search was carried out by this Authority on 26.09.2018 (all discovered documents are listed in the Supplemental Box Relating to Top-up Search).
 - ☐ Additional relevant documents have been discovered during the top-up search.
 - ☐ No top-up search was carried out by this Authority because it would serve no useful purpose.
7. ☐ Supplementary international search report(s) from Authority(ies) has/have been received and taken into account in establishing this report (Rule 45bis.8(b) and (c)).

* If item 4 applies, some or all of those sheets may be marked "superseded".

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	<u>1-56</u>
	No: Claims	
Inventive step (IS)	Yes: Claims	<u>1-56</u>
	No: Claims	
Industrial applicability (IA)	Yes: Claims	<u>1-56</u>
	No: Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following document:

D1 ERICSSON: "CSI-RS Design for Class A FD-MIMO",
3GPP DRAFT; R1-157204, 3RD GENERATION PARTNERSHIP
PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650,
ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS
CEDEX ; FRANCE
,
vol. RAN WG1, no. Anaheim, US; 20151116 - 20151120 9
November 2015 (2015-11-09), XP051022786,
Retrieved from the Internet:
URL:[http://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_83/](http://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_83/Docs/)
Docs/
[retrieved on 2015-11-09]

- 1 D1 is regarded as being the prior art closest to the subject-matter of claim 1, and discloses (the references in parentheses applying to this document):

A network node (**Section - 1 Introduction**), comprising:
processing circuitry configured to: select a first set and second set of reference signal resources in a sub frame; and aggregate the first set and second set of reference signal resources in the subframe to form a code division multiplexing, CDM, aggregation configuration (**Options B and C at Figure 1 disclose the combination [i.e aggregation] of 2D CDM-4 for CSI-RS. However, such mapping is disclosed for a CDM-4 aggregation**)

The subject-matter of claim 1 therefore differs from D1 in that:

for a CDM-8 design for at least twenty four CSI-RS, Channel System Information-Reference Signal, antenna ports;

wherein the first set and second set of reference signal resources in the subframe satisfy a temporal criterion such that any two resource elements in the first set and second set of reference signal resources have up to a

maximum time separation of six OFDM symbols; and wherein the first set and second set of reference signal resources in the subframe satisfy a frequency criterion such that any two resource elements in the first set and second set of reference signal resources have up to a maximum frequency separation of six subcarriers.

above, and is therefore new (Article 33(2) PCT).

The problem to be solved by the present invention may be regarded as:

how to reduce the performance losses due to channel variations?

The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step (Article 33(3) PCT) for the following reasons: by employing the solution given by the distinguishing features above, it is required that the channel is invariable by only the duration of six symbols and the width of six subcarriers. There can be multiple CSI-RS aggregations and CDM mapping for CDM-8 design for 24 CSI-RS antenna ports. However, none of the prior art teaches the particular conditions given by the distinguishing features and their advantages. Furthermore, this step does not belong to the common general knowledge of the skilled person. Therefore, the subject-matter of claim 1 is new and inventive.

- 2 Since the subject-matter of independent claims 7, 13, 19, 25, 26, 29, 35, 41, 47, 53 and 54 corresponds to the subject-matter of claim 1, claims 7, 13, 19, 25, 26, 29, 35, 41, 47, 53 and 54 meet the requirements of the PCT with respect to novelty and inventive step.
- 3 The dependent claims 2-6, 8-12, 14-18, 20-24, 27-28, 30-34, 36-40, 42-46, 48-52, and 55-56 also meet the requirements of the PCT with respect to novelty and inventive step.

Re Item VII

Certain defects in the international application

1 The independent claims are not in the two-part form in accordance with Rule 6.3(b) PCT.

2 The features of the independent claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

3 Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in D1 is not mentioned in the description, nor is identified therein.

4 The use of parentheses in a claim is reserved for placing reference signs relating to technical features included in the drawings of the PCT Application (see Rule 6.2 (b) PCT and Guidelines 5.11). The parentheses should be replaced, for example, by commas.

Re Item VIII

Certain observations on the international application

- 4 The application does not meet the requirements of Article 6 PCT, because claims 1, 7, 13, 19, 25, 26, 29, 35, 41, 47, 53 and 54 are not clear.
- 5 Claim 1 is not clear for the following reasons:
- 5.1 The term "reference signal resources" is ambiguous and therefore unclear. For example, it is not clear whether it refers to:
- i. the location (i.e. pattern) in the time-frequency resource grid where the reference signal is allocated; or
 - ii. the sequences that form the reference signals;
 - iii. the sequences and their pattern on the frame.
- 5.2 Furthermore, claim 1 initially refers to reference signal resources and resource element. It is not clear whether they refer to the same resources.
- 6 The objections raised in section 5 apply, mutatis-mutandis, to the corresponding claims 7, 13, 19, 25, 26, 29, 35, 41, 47, 53 and 54, which therefore also lack clarity (Article 6 PCT).
- 7 Although claims 1, 2-6, 8-12, 14-18, 20-24, 27-28, 30-34, 36-40, 42-46, 48-52, and 55-56 have been drafted as separate independent claims, they appear to relate effectively to the same subject-matter and to differ from each other only with regard to the definition of the subject-matter for which protection is sought and/or in respect of the terminology used for the features of that subject-matter. The aforementioned claims therefore lack conciseness and as such do not meet the requirements of Article 6 PCT.

IN THE EUROPEAN PATENT OFFICE

AS

INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

International Application Serial No: PCT/IB2017/056048

International Filing Date: 30 September 2017

Applicant: TELEFONAKTIEBOLAGET LM ERICSSON (PUBL)

Title: CDM8 BASED CSI-RS DESIGNS FOR MIMO

Our File No.: 1557-403PWO (P51311 WO1)

VIA FACSIMILE ONLY to: 011-31-70-340-3016

Fonseca dos Santos
The European Patent Office
P.B. 5818
Patentlaan 2
NL-2280 HV Rijswijk

LETTER ACCOMPANYING AMENDMENT UNDER ARTICLE 34

Dear Fonseca dos Santos:

This letter is responsive to the Written Opinion dated 25 January 2018. A Demand for International Preliminary Examination with a one-month Extension of Time was filed via facsimile on 27 July 2018 thereby extending the time limit to 30 August 2018 to file Amendments Under Article 34 in connection with the subject Application. The corresponding fee for the Demand has been paid.

International Application Serial No: PCT/IB2017/056048

International Filing Date: 30 September 2017

Applicant: Telefonaktiebolaget LM Ericsson (Publ)

Attorney Docket No: 1557-403PWO (P51311_WO1)

Differences Between the Previously Presented Claims and the Claims as Amended

The claims have been amended to include “a code division multiplexing, CDM, aggregation configuration for a CDM-8 design for at least twenty four CSI-RS, Channel System Information-Reference Signal, antenna ports.” Support for this amendment can be found at least on pages 30, 34, 37, 39 and 40 of Applicant’s Specification. Applicant has also amended Claims 7, 19, 35 and 47 to move reference designators within the claim. Applicant has amended Claims 13, 19, 26, 41, 47 and 54 to recite “code division multiplexing, CDM.” Marked-up claims showing the amendments are provided in Appendix A, filed herewith.

As an initial matter, Applicant notes that the claim amendments are only made herein to expedite prosecution of the replacement claims. The amendments should not be interpreted as an admission by Applicant regarding lack of novelty and/or inventiveness of the previously presented claims.

STATEMENT CONCERNING THE CLAIMS**Item V**

The Written Opinion of the International Searching Authority, Item V, states that Claims 1-56 are allegedly not new and allegedly lack an inventive step under Article 33(3) PCT in view of common knowledge in the art and the following reference:

D1 Ericsson: “CSI-RS Design for Class A FD-MIMO”, 3GPP Draft; R1-157204

Independent Claims 1, 7, 13, 19, 25, 26, 29, 35, 41, 47, 53 and 54

Independent Claims 1, 7, 13, 19, 25, 26, 29, 35, 41, 47, 53 and 54 have been amended to recite, in part, “a code division multiplexing, CDM, aggregation configuration for a CDM-8 design for at least twenty four CSI-RS, Channel System Information-Reference Signal, antenna ports.” D1 fails to disclose or suggest these features.

D1 only discusses CDM-2 and CDM-4 designs. The subject matter of the amended claims pertains to a CDM-8 design for at least 24 CSI-RS antenna ports. Therefore, the amended claims are new over D1, at least in view of this feature.

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Further, Claims 1, 7, 13, 19, 25, 26, 29, 35, 41, 47, 53 and 54 have an inventive step in view of D1 and common knowledge in the art. For example, various CSI-RS aggregation and CDM mapping features have different attributes and perform differently. Performance aspects to be addressed are different for each CDM Type and for each number of antenna ports. Extensive studies are required to consider various performance aspects for each combination. Thus, claiming based on a particular design type, e.g., CDM-8 in this case, and CSI-RS antenna ports, is not obvious in view of other design types. For example, there can be multiple CSI-RS aggregations and CDM mapping for CDM-8 design for at least 24 CSI-RS antenna ports, as illustrated by extensive discussion on this topic in the 3GPP fora, a few of which are [1] R1-166341, "CSI-RS design for {20,24,28,32} ports", CATT, 3GPP TSG RAN WG1 Meeting #86, August 22-26, 2016, Gothenburg, Sweden and [2] R1-167996, "WF on CDM aggregation for NP CSI-RS", Samsung, Xinwei, Ericsson, 3GPP TSG RAN WG1, Meeting #86, August 22-26, 2016, Gothenburg, Sweden, noted in the priority documents. Applicant submits that it would not be obvious for a person skilled in the art to arrive the subject matter of the amended independent claims based on D1 and common knowledge in the art.

Accordingly, amended independent Claims 1, 7, 13, 19, 25, 26, 29, 35, 41, 47, 53 and 54 are novel and have an inventive step in view of D1 and common knowledge in the art.

Dependent Claims 2-6, 8-12, 14-18, 20-24, 27, 28, 30-34, 36-40, 42-46, 48-52 and 54-56

Claims 2-6, 8-12, 14-18, 20-24, 27, 28, 30-34, 36-40, 42-46, 48-52 and 54-56 are each dependent either directly or indirectly from one or another of independent Claims 1, 7, 13, 19, 29, 35, 41 and 47 discussed above. Claims 2-6, 8-12, 14-18, 20-24, 27, 28, 30-34, 36-40, 42-46, 48-52 and 54-56 are believed patentable at least by virtue of their dependency from an independent claim believed allowable. These claims recite additional limitations which, in conformity with the features of their corresponding independent claim, are not disclosed or suggested by the art of record. However, the individual reconsideration of the patentability of each claim on its own merits is respectfully requested.

Item VII

The Written Opinion objects to various alleged defects in the international application. As different jurisdictions have different rules, Applicant will address any alleged defects at the national stage level.

International Application Serial No: PCT/IB2017/056048

International Filing Date: 30 September 2017

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Item VIII

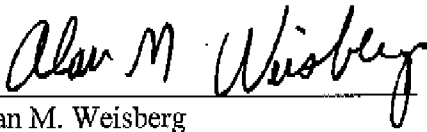
The Written Opinion object to various alleged clarity issues with the claims. As different jurisdictions have different rules, Applicant will address any alleged defects at the national stage level.

For the above reasons, Applicant respectfully asserts that all claims are in proper form, are novel and possess inventive step.

Respectfully submitted,

Date: August 28, 2018

By:



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