

**PATENT COOPERATION TREATY**

**PCT**

**INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY**

(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44bis)

Applicant's or agent's file reference <b>PC-18465</b>	<b>FOR FURTHER ACTION</b>		See item 4 below
International application No. <b>PCT/JP2014/063701</b>	International filing date ( <i>day/month/year</i> ) <b>23 May 2014 (23.05.2014)</b>	Priority date ( <i>day/month/year</i> ) <b>24 May 2013 (24.05.2013)</b>	
International Patent Classification (8th edition unless older edition indicated) <b>See relevant information in Form PCT/ISA/237</b>			
Applicant <b>NIPPON TELEGRAPH AND TELEPHONE CORPORATION</b>			

<p>1. This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 bis.1(a).</p> <p>2. This REPORT consists of a total of 7 sheets, including this cover sheet.</p> <p>In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.</p>																								
<p>3. This report contains indications relating to the following items:</p> <table> <tr> <td><input checked="" type="checkbox"/></td> <td>Box No. I</td> <td>Basis of the report</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. II</td> <td>Priority</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. III</td> <td>Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. IV</td> <td>Lack of unity of invention</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>Box No. V</td> <td>Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. VI</td> <td>Certain documents cited</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. VII</td> <td>Certain defects in the international application</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. VIII</td> <td>Certain observations on the international application</td> </tr> </table> <p>4. The International Bureau will communicate this report to designated Offices in accordance with Rules 44bis.3(c) and 93bis.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44bis .2).</p>	<input checked="" type="checkbox"/>	Box No. I	Basis of the report	<input type="checkbox"/>	Box No. II	Priority	<input type="checkbox"/>	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability	<input type="checkbox"/>	Box No. IV	Lack of unity of invention	<input checked="" type="checkbox"/>	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement	<input type="checkbox"/>	Box No. VI	Certain documents cited	<input type="checkbox"/>	Box No. VII	Certain defects in the international application	<input type="checkbox"/>	Box No. VIII	Certain observations on the international application
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	Date of issuance of this report <b>24 November 2015 (24.11.2015)</b>
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**PATENT COOPERATION TREATY**

**TRANSLATION**

From the  
INTERNATIONAL SEARCHING AUTHORITY

**PCT**

WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

To:

Date of mailing (day/month/year)	<b>12.08.2014</b>
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Applicant's or agent's file reference <b>PC-18465</b>	<b>FOR FURTHER ACTION</b> See paragraph 2 below
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International application No. <b>PCT/JP2014/063701</b>	International filing date (day/month/year) <b>23.05.2014</b>	Priority date (day/month/year) <b>24.05.2013</b>
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International Patent Classification (IPC) or both national classification and IPC  
**H04J99/00 (2009.01) i, H04J11/00 (2006.01) i, H04W16/28 (2009.01) i**

Applicant  
**NIPPON TELEGRAPH AND TELEPHONE CORPORATION**

1. This opinion contains indications relating to the following items:

- Box No. I Basis of the opinion
- 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 Rule 43bis.1(a)(i) 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

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/JP	Date of completion of this opinion	Authorized officer
Facsimile No.		Telephone No.

WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY

International application No.

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Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:
  - 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 (Rules 12.3(a) and 23.1(b)).
2.  This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))
3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing filed or furnished:
  - a. (means)
    - on paper
    - in electronic form
  - b. (time)
    - in the international application as filed
    - together with the international application in electronic form
    - subsequently to this Authority for the purposes of search
4.  In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

**WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY**

International application No. PCT/JP2014/063701
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<b>Box No. V</b>	<b>Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</b>		
1. Statement			
Novelty (N)	Claims	1-28	YES
	Claims		NO
Inventive step (IS)	Claims	4, 5, 9-13, 16, 17, 20, 21, 24, 26	YES
	Claims	1-3, 6-8, 14, 15, 18, 19, 22, 23, 25, 27, 28	NO
Industrial applicability (IA)	Claims	1-28	YES
	Claims		NO
2. Citations and explanations:			
<p>Document 1: QUALCOMM EUROPE, "Calibration Procedures for TDD Beamforming", 3GPP R1-080494, 18 January 2008</p> <p>Document 2: JP 2007-517440 A (TELEFONAKTIEBOLAGET LM ERICSON (PUBL)) 28 June 2007, claims 1, 5, fig. 3-7, 9, paragraphs [0027]-[0043]</p> <p>Document 3: JP 2007-523570 A (QUALCOMM INCORPORATED) 16 August 2007, claims 1-3, paragraphs [0036]-[0129]</p> <p>Document 4: JP 2010-28599 A (SONY CORPORATION) 04 February 2010, claims 1-5</p> <p>Document 5: JP 2012-525084 A (QUALCOMM INCORPORATED) 18 October 2012, claims 1-12</p> <p>Document 6: MURAKAMI, Tomoki et al., "Study for Implicit Beamforming in Massive MU-MIMO Systems-Part 1", 2013 Nen The Institute of Electronics, Information and Communication Engineers Sogo Taikai Koen Ronbunshu 1, 05 March 2013, p. 625, B-5-215</p>			

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INTERNATIONAL SEARCHING AUTHORITY

International application No.

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**Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

The invention as in claims 1 and 8 does not involve an inventive step in the light of document 1 cited in the ISR. Document 1 (especially, section 4) discloses a wireless communication apparatus in a multi-user multiple-input multiple-output (MU-MIMO) wireless communication system, said wireless communication apparatus transmitting a signal to designate other wireless communication apparatuses to perform transmission/reception for the purpose of calibration, receiving signals transmitted from said other wireless communication apparatuses, obtaining a downlink channel estimation value and an uplink channel estimation value on the basis of the received signal so as to compute the calibration factors required for the calibration, and performing beamforming for the downlink data transmission on the basis of the calibration factors and the uplink channel estimation value.

Although document 1 does not explicitly mention that packet transmission is carried out, it is merely common practice to carry out packet transmission in a wireless communication system.

Therefore, a person skilled in the art could easily apply the common practice to the invention described in document 1 in order to arrive at the configuration as the invention as in claims 1 and 8.

The invention as in claims 2, 3, 6 and 7 does not involve an inventive step in the light of documents 1-3 cited in the ISR.

Document 1 further indicates that an uplink sounding reference signal (SRS) is transmitted so as to estimate the uplink channel during the calibration mode.

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**Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

Furthermore, when a known signal to be used for channel estimation is transmitted, specifically which communication resource to be used and what type of transmission/reception antennas to be associated with for transmission are design matters that could have been selected, as appropriate, by a person skilled in the art according to the required transmission efficiency, transmission quality and the like (see, as reference, claims 1 and 5, and fig. 3-7 and 9 of document 2, and paragraphs [0036]-[0129] of document 3).

The invention as in claims 14, 15 and 18 does not involve an inventive step in the light of documents 1 and 3 cited in the ISR.

Document 3 (in particular, paragraphs [0112]-[0129]) describes a technical idea of performing a calibration that takes into account the correlation of frequency directions, and therefore a person skilled in the art could easily perform weighting according to the level of the correlation.

The invention as in claims 19 and 22 does not involve an inventive step in the light of documents 1 and 3 cited in the ISR.

As described in document 1 (in particular, section 4.1) and document 3 (in particular, paragraphs [0112]-[0129]), it is a common feature to sequentially update calibration factors using the minimum mean square error (MMSE) algorithm.

The invention as in claims 23, 25, 27 and 28 does not involve an inventive step in the light of documents 1

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**Box No. V** Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

and 4 cited in the ISR.

Document 4 (in particular, claims 1-5) describes a technical idea of performing interpolation processing in cases where calibration factors in a prescribed frequency could not be obtained when carrying out a calibration in the frequency direction. Therefore, a person skilled in the art could easily adopt a configuration wherein the channel estimation values for calculating the calibration factors are interpolated.

The invention as in claims 4, 5, 9-13, 16, 17, 20, 21, 24 and 26 is not disclosed in any of documents 1-6 cited in the ISR, and therefore is novel and involves an inventive step.