

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**
(PCT Rule 43*bis*.1)

To:

see form PCT/ISA/220

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.
PCT/US2018/012164

International filing date (day/month/year)
03.01.2018

Priority date (day/month/year)
05.01.2017

International Patent Classification (IPC) or both national classification and IPC
INV. H03M7/30 H04N19/132 H04N19/172 H04N19/146 H04N19/154 H04N19/94 H04N19/124

Applicant
ALCATEL-LUCENT USA INC

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 43*bis*.1(a)(i) with regard to novelty, inventive step and 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 usually 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 66.1*bis*(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:



European Patent Office
D-80298 Munich
Tel. +49 89 2399 - 0
Fax: +49 89 2399 - 4465


Date of completion of this opinion

see form PCT/ISA/210

Authorized Officer

Cyranka, Oliver

Telephone No. +49 89 2399-0



Box No. I Basis of the 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 43bis.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:
 - a. forming part of the international application as filed:
 - in the form of an Annex C/ST.25 text file.
 - on paper or in the form of an image file.
 - b. furnished together with the international application under PCT Rule 13ter.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.
 - c. furnished subsequent to the international filing date for the purposes of international search only:
 - in the form of an Annex C/ST.25 text file (Rule 13ter.1(a)).
 - on paper or in the form of an image file (Rule 13ter.1(b) and Administrative Instructions, Section 713).
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 forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

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

1. Statement

| | | |
|-------------------------------|-------------|-------------|
| Novelty (N) | Yes: Claims | |
| | No: Claims | <u>1-10</u> |
| Inventive step (IS) | Yes: Claims | |
| | No: Claims | <u>1-10</u> |
| Industrial applicability (IA) | Yes: Claims | <u>1-10</u> |
| | No: Claims | |

2. Citations and explanations

see separate sheet

Reference is made to the following documents:

- D1 ARCES MAURO MANGIA ET AL: "Rakeness and beyond in zero-complexity digital compressed sensing: A down-to-bits case study", 2016 IEEE BIOMEDICAL CIRCUITS AND SYSTEMS CONFERENCE (BIOCAS), IEEE, 17 October 2016 (2016-10-17), pages 356-359, XP033051085
- D2 US 2015/370931 A1 (HAIMI-COHEN RAZIEL [US]) 24 December 2015 (2015-12-24)
- D3 ASHOK AMIT ET AL: "Information optimal compressive imaging: design and implementation", VISUAL COMMUNICATIONS AND IMAGE PROCESSING; 20-1-2004 - 20-1-2004; SAN JOSE, vol. 9186, 20 October 2014 (2014-10-20), pages 91860K-91860K, XP060045295

Re Item V

- 1 The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claims 1-10 is not new in the sense of Article 33(2) PCT.
- 1.1 Independent Claims 1, 7
- 1.1.1 Concerning the method of claim 1, document D1 discloses an encoder comprising:
- a) a receiver to receive at least one of a media signal or compressive sensing measurements representative of the media signal; and
(cf. D1, figure 1: " x_k ", *corresponding to a received media signal*, and figure 1: " y_j ", *corresponding to a compressive sensing measurement, in the meaning of the claim*)
 - b) a processor to determine a compression ratio for compressive sensing of the media signal and a quantization level used to quantize the compressive sensing measurements based on a target indicator, and
(cf. D1, section "III. GENERAL ARCHITECTURE AND CONSTRAINTS", particularly equation (2), *discloses determining a compression ratio "CR" based on the target indicator "target quality", in the meaning of the claim*)
 - c) wherein the processor is to quantize the compressive sensing measurements based on the quantization level.
(cf. D1, section "III. GENERAL ARCHITECTURE AND CONSTRAINTS",

discloses that "of these L bits, L_r are the LSBs of the accumulation register discarded to decrease the resolution", corresponding to a quantization of the sensing measurement)

The subject-matter of claim 1 is therefore not new (Article 33(2) PCT).

- 1.1.2 The same reasoning applies to the subject-matter of the corresponding decoder of claim 7, which is also considered to be not new (Article 33(2) PCT).
- 1.1.3 For completeness, it is pointed out that the subject-matter of claims 1 and 12 is also not new (Article 33(2) PCT) over the disclosure of document D2 (cf. D2, paragraph [0018], [0039], *discloses to "acquire a set of compressive sensing measurements of the signal using a structured sensing matrix" and to "determine a signal specific coding scheme for the set of compressive sensing measurements", and further discloses that "the goal of quantization and channel coding is to minimize the data rate, i.e. the number of bits required for the transmission of each measurement, while keeping the distortion at a certain level or equivalently, to minimize the distortion while keeping the data rate at a certain level", corresponding to receiving a compressive measurement and corresponding to determining a compression ratio and a quantization level based on a target indicator, in the meaning of the claims*), as well as over the disclosure of document D3 (cf. D3, section "3. MEASUREMENT QUANTIZATION AND RATE ALLOCATION", *discloses that the "quantizer design uses a set of training images for a measurement size M , measurement signal to noise ratio (SNR) and projection design (i.e. random and information-optimal)", and discloses that "to quantify the image reconstruction performance of a particular projection design and measurement quantizer we employ a set of test images that are representative but distinct from the training images", corresponding to determining a compression ratio for compressive sensing and a quantization level based on a target indicator, in the meaning of the claims*).

2 Dependent Claims 2-6, 8-10

The additional features introduced by the dependent claims 2-6 and 8-10 do not contribute to any subject-matter that might be relevant to overcome an objection with respect to a lack of novelty (Article 33(2) PCT), since all the additional features are either disclosed in document D1, or D2, as follows:

- 2.1 Claim 2: cf. D1, section "III. GENERAL ARCHITECTURE AND CONSTRAINTS", particularly equation (2), discloses determining a compression ratio "CR" based on a target reconstruction quality "target quality", or quantization " L_r, L_s ", in the meaning of the claim.
- 2.2 Claims 3, 8: cf. D1, section "III. GENERAL ARCHITECTURE AND CONSTRAINTS", particularly equation (2), discloses determining a compression ratio "CR" based on a functional relationship between a quantization " L_r, L_s ", and a number of sensing measurements " b_x ", in the meaning of the claims.
- 2.3 Claims 4, 9: cf. D1, section "III. GENERAL ARCHITECTURE AND CONSTRAINTS", particularly equation (2), discloses that the product of quantization level and compression ratio is constant, in the meaning of the claims. Furthermore, it is disclosed to "maximize compression for the same bitloss configuration".
- 2.4 Claim 5: cf. D1, figure 2: "reconstruction quality as a function of the number of measurements", and section "III. GENERAL ARCHITECTURE AND CONSTRAINTS", discloses "given any of the quality targets average curves like those in figure 2 may be used to compute [...] the corresponding compression ratio", and that "for each of the encoding options we may scan the whole design space looking for the maximum possible CR", corresponding to determining a functional relationship based on measured qualities of decompressed test signals formed based on a plurality of test signals generated by compressed sensing based on a plurality of compression ratios, in the meaning of the claim.
- 2.5 Claims 6, 10: cf. D2, figure 1: "Channel Encoder", "Channel decoder", figure 3: "Chanel encode quantized codewords", corresponding to applying channel decoding to the quantized signal, in the meaning of the claims.