

## PATENT COOPERATION TREATY

## PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 119314-8012.WO01	<b>FOR FURTHER ACTION</b>	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
International application No. PCT/US 18/17090	International filing date ( <i>day/month/year</i> ) 06 February 2018 (06.02.2018)	(Earliest) Priority Date ( <i>day/month/year</i> ) 11 August 2017 (11.08.2017)
Applicant COHERE TECHNOLOGIES		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 4 sheets.

It is also accompanied by a copy of each prior art document cited in this report.

## 1. Basis of the report

a. With regard to the language, the international search was carried out 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)).

b.  This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6bis(a)).

c.  With regard to any nucleotide and/or amino acid sequence disclosed in the international application, see Box No. I.

2.  Certain claims were found unsearchable (see Box No. II).

3.  Unity of invention is lacking (see Box No. III).

4. With regard to the title,

the text is approved as submitted by the applicant.

the text has been established by this Authority to read as follows:

5. With regard to the abstract,

the text is approved as submitted by the applicant.

the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the drawings,

a. the figure of the drawings to be published with the abstract is Figure No. 10

as suggested by the applicant.

as selected by this Authority, because the applicant failed to suggest a figure.

as selected by this Authority, because this figure better characterizes the invention.

b.  none of the figures is to be published with the abstract.

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 18/17090

**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2.  Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
  
3.  Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

**Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:  
Group I: claims 1-6, 14, and 15: drawn to a wireless communication method and system for transmitting orthogonal time frequency space (OTFS) modulated wireless signals from a transmitter.

Group II: claims 7-13 and 16-19: drawn to a wireless communication method and system for receiving a signal comprising multiple symbols.

The inventions listed as Groups I and II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

--See Extra Sheet--

1.  As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2.  As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3.  As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
  
4.  No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:  
1-6, 14,15

**Remark on Protest**

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US 18/17090

A. CLASSIFICATION OF SUBJECT MATTER  
IPC(8) - H04B 15/00 (2018.01)  
CPC - H04B 10/516; H04B 7/0868; H04W 28/0231

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

See Search History Document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

See Search History Document

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

See Search History Document

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2002/0136276 A1 (Franceschini et al.) 26 September 2002 (26.09.2002) entire document, especially: para [0011], [0021]-[0023], [0030], [0033], [0049]	1-6, 14, 15
Y	US 2008/0165873 A1 (Ghosh et al.) 10 July 2008 (10.07.2008) entire document, especially: para [0016], [0017], [0020], [0030] [0041], [0042]	1-6, 14, 15
A	US 2015/0349995 A1 (Marvell Wrold Trade Ltd) 03 December 2015 (03.12.2015) entire document	1-6, 14, 15
A	US 2004/0086027 A1 (Shattil) 06 May 2004 (06.05.2004) entire document	1-6, 14, 15

Further documents are listed in the continuation of Box C.

See patent family annex.

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

31 May 2018

Date of mailing of the international search report

14 JUN 2018

Name and mailing address of the ISA/US

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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 18/17090

Continuation of: Box No. III Observations where Unity of Invention is Lacking

**Special technical features:**

Group I requires transmitting orthogonal time frequency space (OTFS) modulated wireless signals from a transmitter, comprising: receiving information bits for transmission, wherein the information bits include user data and control data; segmenting the information bits into a stream of segments; applying a corresponding forward error correction (FEC) code to each of the stream of segments and combining outputs of the FECs to generate a stream of symbols; processing the stream of symbols to generate a waveform; and transmitting the waveform over a communication medium, not found in the other groups.

Group II requires performing channel equalization on the signal to generate a channel equalized signal; logically dividing the channel equalized signal into a first number of segments; demodulating and symbol de-mapping the channel equalized signal in successive steps such that each step operates to recover one or more bits of one of the number of the segments to generate a demodulated bitstream; wherein an order in which the successive steps are performed depends on a reliability of success of recovering the one or more bits in each of the successive steps; processing the demodulated bitstream to generate information related to the bits from the signal; providing a feedback signal to the channel equalization operation based on the processing of the demodulated bitstream; and logically separating user data and control data from the demodulated bitstream, not found in the other groups.

**Shared Features:**

The only technical features shared by Groups I and II that would otherwise unify the groups are a wireless signal including information bits that include user data and control data.

However, these shared technical features do not represent a contribution over prior art, because the shared technical features are disclosed by US 2016/0095105 A1 to Qualcomm Incorporated (hereinafter 'Qualcomm') 31 March 2016 (31.03.2016), which discloses wireless signal including information bits that include user data and control data (para [0132] -In another example, transmitting the uplink control data at Block 1708 may include transmitting the uplink control data as two or more ACK/NACK bits for each of two or more codewords and/or one or more carriers.).

As the shared technical features were known in the art at the time of the invention, they cannot be considered special technical features that would otherwise unify the groups.

Groups I and II therefore lack unity under PCT Rule 13 because they do not share a same or corresponding special technical feature.