

## PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1  
 Stylesheet Version v1.2

EPAS ID: PAT4472167

<b>SUBMISSION TYPE:</b>	NEW ASSIGNMENT
<b>NATURE OF CONVEYANCE:</b>	ASSIGNMENT
<b>CONVEYING PARTY DATA</b>	
<b>Name</b>	<b>Execution Date</b>
JAMES AWEYA	11/02/2015
IVAN BOYD	11/12/2015
<b>RECEIVING PARTY DATA</b>	
<b>Name:</b>	KHALIFA UNIVERSITY OF SCIENCE, TECHNOLOGY AND RESEARCH
<b>Street Address:</b>	P.O. BOX 127788
<b>City:</b>	ABU DHABI
<b>State/Country:</b>	UNITED ARAB EMIRATES
<b>Name:</b>	BRITISH TELECOMMUNICATIONS PLC
<b>Street Address:</b>	81 NEWGATE STREET
<b>City:</b>	LONDON
<b>State/Country:</b>	UNITED KINGDOM
<b>Postal Code:</b>	EC1A 7AJ
<b>Name:</b>	EMIRATES TELECOMMUNICATIONS CORPORATION
<b>Street Address:</b>	P.O. BOX 3838
<b>City:</b>	ABU DHABI
<b>State/Country:</b>	UNITED ARAB EMIRATES
<b>PROPERTY NUMBERS Total: 1</b>	
<b>Property Type</b>	<b>Number</b>
<b>Application Number:</b>	15490938
<b>CORRESPONDENCE DATA</b>	
<b>Fax Number:</b>	(216)241-0816
<i>Correspondence will be sent to the e-mail address first; if that is unsuccessful, it will be sent using a fax number, if provided; if that is unsuccessful, it will be sent via US Mail.</i>	
<b>Phone:</b>	2166228844
<b>Email:</b>	ipdocket@calfee.com
<b>Correspondent Name:</b>	SEAN T. MOORHEAD
<b>Address Line 1:</b>	1405 EAST 6TH STREET
<b>Address Line 4:</b>	CLEVELAND, OHIO 44114
<b>ATTORNEY DOCKET NUMBER:</b>	27154/04064

<b>NAME OF SUBMITTER:</b>	SEAN T. MOORHEAD
<b>SIGNATURE:</b>	/Sean T. Moorhead/
<b>DATE SIGNED:</b>	06/22/2017
<b>Total Attachments: 28</b> source=04373859#page1.tif source=04373859#page2.tif source=04373859#page3.tif source=04373859#page4.tif source=04373859#page5.tif source=04373859#page6.tif source=04373859#page7.tif source=04373859#page8.tif source=04373859#page9.tif source=04373859#page10.tif source=04373859#page11.tif source=04373859#page12.tif source=04373859#page13.tif source=04373859#page14.tif source=04373859#page15.tif source=04373859#page16.tif source=04373859#page17.tif source=04373859#page18.tif source=04373859#page19.tif source=04373859#page20.tif source=04373859#page21.tif source=04373859#page22.tif source=04373859#page23.tif source=04373859#page24.tif source=04373859#page25.tif source=04373859#page26.tif source=04373859#page27.tif source=04373859#page28.tif	

**ASSIGNMENT OF INVENTION  
AND ASSOCIATED INTELLECTUAL PROPERTY RIGHTS**

**Parties:**

**1 'The Inventor'**

*James Aweya*

*Etisalat BT Innovation Centre, Khalifa University, Abu Dhabi, United Arab Emirates*

**2 'The Employer'**

*Khalifa University of Science, Technology, and Research  
P.O. Box 127788, Abu Dhabi, United Arab Emirates*

**3 'The Assignee'**

*Khalifa University of Science, Technology, and Research  
P.O. Box 127788, Abu Dhabi, United Arab Emirates*

and

*British Telecommunications plc  
81 Newgate Street, London, EC1A 7AJ, United Kingdom*

and

*Emirates Telecommunications Corporation  
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14/2/16



**PATENT** 77154/04155

**REEL: 042941 FRAME: 0587**

(D) The Inventor, the Employer and the Assignee have agreed that the Inventor and the Employer will each assign to the Assignee for the consideration mentioned below all such present and future rights title and interest as they each may own in to under and arising from the Invention and the Patent Applications, including without limitation any further contributions that the Inventor may make in the future to the development or improvement of the Invention and any matter that shall be contained in any of the Patent Applications.

**Operative provisions:**

In consideration for the payment of One U.S. Dollar by the Assignee to each of the Inventor and the Employer, the receipt and sufficiency of which are hereby acknowledged by the Inventor and by the Employer:-

**1** The Inventor and the Employer HEREBY SELL ASSIGN AND TRANSFER to the Assignee absolutely and free from encumbrances, by way of current assignment of both existing and future rights and property:

**1.1** all such legal and beneficial rights title and interest as they each may own or be entitled to in Canada and the United States and all other countries of the world in to under and arising from the Invention and the Patent Applications and all matter that shall be contained in the Patent Applications, and all national and regional phases and any and all divisions, continuations and continuations-in-part of all of the aforesaid applications, and any and all patents that may be granted pursuant to any of them for the full period thereof, including any re-issues, re-examinations, renewals, extensions and Supplementary Protection Certificates, and including all rights and powers arising or accrued therefrom including the right to sue for damages and other remedies in respect of any infringement of any such rights before on or after the date hereof and to retain any damages obtained as a result of such action;

**1.2** all such rights as they each may have to apply for prosecute and obtain patents and other intellectual property protection anywhere in the world in respect of the Invention and the invention(s) that shall be disclosed in and all matter that shall be contained in the Patent Applications to the intent that any patents or other intellectual property protection for the Invention and for such invention(s) and matter may be applied for and shall be granted in the name of and shall vest in the Assignee or its successors or assigns;

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THIS ASSIGNMENT MAY BE EXECUTED IN COUNTERPARTS



14/2/16



## SCHEDULE

**Identification of some, but not necessarily all, patent applications falling within the scope of clause 1 of this Assignment**

[illegible]

SIGNED by )  
the INVENTOR )  
at: ABU DHABI, UAE )  
on: 2 NOVEMBER 2015 )  
in the presence of: )

Signature: .....

Witness

Signature:

Name:

**Address:**

Witness  
Signature: Al-Rubaie  
Name: Ahmad Al-Rubaie  
Address: Khalifa University  
Abu Dhabi  
U.A.E.

2/1

14/2/16

✓

SIGNED for and on behalf of )  
the EMPLOYER )  
at: Abu Dhabi )  
on: 14/2/16 )  
in the presence of: )

Witness

Signature: N. Azarm  
Name: Nader Azarm  
Address: Khalifa Univ  
Abu Dhabi, UAE

Signature: 

Name: Dr. Mohammed Al Mualla

Position: SVP R&D, KUSTAR

SIGNED for and on behalf of )  
the 1st CO-APPLICANT )  
at: )  
on: )  
in the presence of: )

Witness

Signature: )  
Name: )  
Address: )

Signature: 

Name: Dr. Mohammed Al Mualla

Position: SVP R&D, KUSTAR

SIGNED for and on behalf of )  
the 2nd CO-APPLICANT )  
at: )  
on: )  
in the presence of: )

Witness

Signature: )  
Name: )  
Address: )

Signature: )

Name: )

Position: )



14/2/16



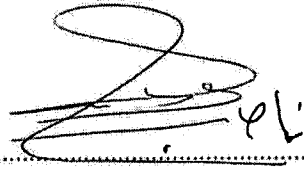
SIGNED for and on behalf of )  
the 3rd CO-APPLICANT )  
at: Abu Dhabi )  
on: 14/2/16 )  
in the presence of: )

Witness

Signature: N. AZARM

Name: Nader Azarmi

Address: Khalifa Univ  
Abu Dhabi, UAE

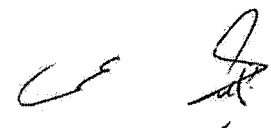
Signature: 

Name: Nasser A. Salim

Position: GM, Etisalat



14/2/16





# **ABSTRACT**

This invention relates to methods and systems for estimating and checking synchronization accuracy, in particular frequency synchronization accuracy. It is particularly applicable to synchronization methods and systems which involve a digital phase-locked loop (DPLL) and embodiments provide methods and systems for estimating and tracking how well the DPLL is frequency synchronized to a source frequency. In one embodiment, frequency synchronization accuracy is used as an additional quality metric for mobile call handover between base stations. Call handover is of major importance within any mobile network; without checking frequency synchronization before handover dropped calls and interrupted communication can result.



11/4/2/16



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*PN*

*23/12/15*

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*RN*

23/12/15

States or any other patent applications which relate to the Invention or to any invention(s) that shall be disclosed in any of the Patent Applications and any and all divisionals, continuations and continuations-in-part of any such applications) as may be reasonably necessary or desirable to secure or to provide further evidence of the vesting in the Assignee or its successors or assigns of all legal and beneficial rights title and interest intended to be assigned to the Assignee hereunder and to confirm the title of the Assignee or its successors or assigns to all such rights title and interest and to assist (in the course of litigation or interference or any other proceedings or otherwise) in the resolution of any question concerning the Invention or invention(s) that shall be disclosed in the Patent Applications or any application for patent or other intellectual property protection for any of the said inventions or any intellectual property protection granted pursuant to any such application.

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AS WITNESS the signatures of the Inventor and of duly authorised officers of the Employer and the Assignee

THIS ASSIGNMENT MAY BE EXECUTED IN COUNTERPARTS

*RN*

23/12/15

## SCHEDULE

**Identification of some, but not necessarily all, patent applications falling within the scope of clause 1 of this Assignment**

[illegible]

SIGNED by \_\_\_\_\_ )  
the INVENTOR \_\_\_\_\_ )  
at: ..... )  
on: ..... )  
in the presence of: \_\_\_\_\_ )

Signature: .....

**Witness**

Signature: .....

Name:

Address:

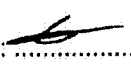
RW  
23/12/15

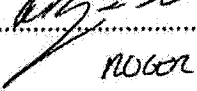
SIGNED for and on behalf of )  
the EMPLOYER )  
at: ..... )  
on: ..... )  
in the presence of: )  
Witness  
Signature: .....  
Name:  
Address:


Signature: .....  
Name:  
Position:

SIGNED for and on behalf of )  
the 1st CO-APPLICANT )  
at: ..... )  
on: ..... )  
in the presence of: )  
Witness  
Signature: .....  
Name:  
Address:

Signature: .....  
Name:  
Position:

X SIGNED for and on behalf of )  
the 2nd CO-APPLICANT )  
at: 81 NEWGATE ST, LONDON )  
on: 23/12/15 )  
in the presence of: )  
Witness  
Signature:  .....  
Name: CHI-FAT LAU  
Address: 81 Newgate St  
London  
EC1A 7AJ

Signature:  .....  
Name: ROGER NASH  
Position: HEAD OF PATENTS

  
23/12/15

SIGNED for and on behalf of )

the 3rd CO-APPLICANT )

at: ..... )

on: ..... )

in the presence of: )

Witness

Signature: .....

Name:

Address:

Signature: .....

Name:

Position:

*RW*  
23/12/15

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*RW*

23/12/15



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**Parties:**

**1 'The Inventor'**

*Ivan Boyd*

*Ashgreen, Woodlands Road, Raydon, Ipswich IP7 5QA, United Kingdom*

**2 'The Employer'**

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81 Newgate Street, London, EC1A 7AJ, United Kingdom*

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AS WITNESS the signatures of the Inventor and of duly authorised officers of the Employer and the Assignee

THIS ASSIGNMENT MAY BE EXECUTED IN COUNTERPARTS

*RW*

23/12/15

## SCHEDULE

**Identification of some, but not necessarily all, patent applications falling within the scope of clause 1 of this Assignment**

[illegible]

SIGNED by \_\_\_\_\_ )  
the INVENTOR \_\_\_\_\_ )  
at: ..... )  
on: ..... )  
in the presence of: \_\_\_\_\_ )

Signature: .....

**Witness**

Signature: .....

Name:

Address:

22/12/15

X SIGNED for and on behalf of )  
the EMPLOYER )  
at: 81 NEWGATE ST. LONDON )  
on: 23/12/15 )  
in the presence of: )  
Witness  
Signature: \_\_\_\_\_  
Name: CHI-FAI LAN  
Address: 81 Newgate St  
London  
EC1A 7AJ

Signature: \_\_\_\_\_  
Name: ROGER NASH  
Position: HEAD OF PATENTS

SIGNED for and on behalf of )  
the 1st CO-APPLICANT )  
at: \_\_\_\_\_ )  
on: \_\_\_\_\_ )  
in the presence of: )  
Witness  
Signature: \_\_\_\_\_  
Name: \_\_\_\_\_  
Address: \_\_\_\_\_

Signature: \_\_\_\_\_  
Name: \_\_\_\_\_  
Position: \_\_\_\_\_

7 SIGNED for and on behalf of )  
the 2nd CO-APPLICANT )  
at: 81 NEWGATE ST. LONDON )  
on: 23/12/15 )  
in the presence of: )  
Witness  
Signature: \_\_\_\_\_  
Name: CHI-FAI LAN  
Address: 81 Newgate St  
London  
EC1A 7AJ

Signature: \_\_\_\_\_  
Name: ROGER NASH  
Position: HEAD OF PATENTS

LN  
23/12/15

SIGNED for and on behalf of )

the 3rd CO-APPLICANT )

at: ..... )

on: ..... )

in the presence of: )

Witness

Signature: .....

Name:

Address:

Signature: .....

Name:

Position:

*RN*

23/12/15

## ABSTRACT

This invention relates to methods and systems for estimating and checking synchronization accuracy, in particular frequency synchronization accuracy. It is particularly applicable to synchronization methods and systems which involve a digital phase-locked loop (DPLL) and embodiments provide methods and systems for estimating and tracking how well the DPLL is frequency synchronized to a source frequency. In one embodiment, frequency synchronization accuracy is used as an additional quality metric for mobile call handover between base stations.

Call handover is of major importance within any mobile network; without checking frequency synchronization before handover dropped calls and interrupted communication can result.

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**ASSIGNMENT OF INVENTION  
AND ASSOCIATED INTELLECTUAL PROPERTY RIGHTS**

**Parties:**

**1 'The Inventor'**

*Ivan Boyd*

*Ashgreen, Woodlands Road, Raydon, Ipswich IP7 5QA, United Kingdom*

**2 'The Employer'**

*British Telecommunications plc*

*81 Newgate Street, London, EC1A 7AJ, United Kingdom*

**3 'The Assignee'**

*Khalifa University of Science, Technology, and Research  
P.O. Box 127788, Abu Dhabi, United Arab Emirates*

and

*British Telecommunications plc*

*81 Newgate Street, London, EC1A 7AJ, United Kingdom*

and

*Emirates Telecommunications Corporation*

*Etisalat Building, Intersection of Zayed the 1<sup>st</sup> Street and Sheikh Rashid Bin Saeed Al  
Maktoum Street, PO Box 3838, Abu Dhabi, United Arab Emirates*

**Recitals:**

(A) The Inventor is the inventor or is one of the joint inventors of the invention or inventions entitled Methods and Systems for Checking Synchronization Accuracy which is described in the abstract annexed hereto and is the subject of Case No. SXH/FP7132814 of the Assignee's patent attorneys, Mewburn Ellis LLP (such invention or inventions being hereafter called "the Invention").

(B) The Inventor was an employee of the Employer when the Invention was made.

(C) The Assignee currently intends to file (in the name of the inventor(s) of the Invention, as required by United States law) one or more United States utility patent application(s) for the Invention and possibly subsequent patent applications in various jurisdictions claiming priority from the said United States utility patent application(s) (the United States utility application(s) together with any subsequent applications for the Invention and/or claiming priority from any of the said United States utility patent applications being hereafter called "the Patent Applications")

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(D) The Inventor, the Employer and the Assignee have agreed that the Inventor and the Employer will each assign to the Assignee for the consideration mentioned below all such present and future rights title and interest as they each may own in to under and arising from the Invention and the Patent Applications, including without limitation any further contributions that the Inventor may make in the future to the development or improvement of the Invention and any matter that shall be contained in any of the Patent Applications.

**Operative provisions:**

In consideration for the payment of One U.S. Dollar by the Assignee to each of the Inventor and the Employer, the receipt and sufficiency of which are hereby acknowledged by the Inventor and by the Employer:-

**1** The Inventor and the Employer HEREBY SELL ASSIGN AND TRANSFER to the Assignee absolutely and free from encumbrances, by way of current assignment of both existing and future rights and property:

**1.1** all such legal and beneficial rights title and interest as they each may own or be entitled to in Canada and the United States and all other countries of the world in to under and arising from the Invention and the Patent Applications and all matter that shall be contained in the Patent Applications, and all national and regional phases and any and all divisions, continuations and continuations-in-part of all of the aforesaid applications, and any and all patents that may be granted pursuant to any of them for the full period thereof, including any re-issues, re-examinations, renewals, extensions and Supplementary Protection Certificates, and including all rights and powers arising or accrued therefrom including the right to sue for damages and other remedies in respect of any infringement of any such rights before on or after the date hereof and to retain any damages obtained as a result of such action;

**1.2** all such rights as they each may have to apply for prosecute and obtain patents and other intellectual property protection anywhere in the world in respect of the Invention and the invention(s) that shall be disclosed in and all matter that shall be contained in the Patent Applications to the intent that any patents or other intellectual property protection for the Invention and for such invention(s) and matter may be applied for and shall be granted in the name of and shall vest in the Assignee or its successors or assigns;

**1.3** all such rights as they each may have to claim priority from any and all of the Patent Applications in any and all applications for patent protection for the Invention and the invention(s) that shall be disclosed in the Patent Applications, such right to be enjoyed by the Assignee as from the date of filing of each patent application from which priority is claimed;

to the intent that the Assignee shall have and hold the rights title and interest hereby assigned as fully and entirely as the same would have been held and enjoyed by the Inventor or by the Employer had this assignment not been made.

**2** The Inventor and the Employer and the Assignee HEREBY GRANT the firm of Mewburn Ellis LLP the power to insert in the Schedule to this Assignment any further identification of any future patent applications in Canada or the United States or any other countries or regions of the world which shall fall within the scope of clause 1 above, as may be necessary or desirable in order to comply with the rules of the United States Patent Office or the Canadian Patent Office or any other patent office for recordation of this document. It is understood and agreed that the Assignee's attorneys Mewburn Ellis LLP have represented only the Assignee and will continue to represent only the Assignee and its successors and assigns with respect to this Assignment.

**3** The Inventor and the Employer each HEREBY UNDERTAKE that at the request and cost of the Assignee or its successors or assigns they will at all times hereafter promptly do all such acts and execute all such documents (including but not limited to documents required to be signed by or on behalf of inventors or assignors in the course of any and all Canadian or United

  
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States or any other patent applications which relate to the Invention or to any invention(s) that shall be disclosed in any of the Patent Applications and any and all divisionals, continuations and continuations-in-part of any such applications) as may be reasonably necessary or desirable to secure or to provide further evidence of the vesting in the Assignee or its successors or assigns of all legal and beneficial rights title and interest intended to be assigned to the Assignee hereunder and to confirm the title of the Assignee or its successors or assigns to all such rights title and interest and to assist (in the course of litigation or interference or any other proceedings or otherwise) in the resolution of any question concerning the Invention or invention(s) that shall be disclosed in the Patent Applications or any application for patent or other intellectual property protection for any of the said inventions or any intellectual property protection granted pursuant to any such application.

4 The Inventor and the Employer HEREBY REQUEST the US Commissioner of Patents and the relevant authorities in all countries of the world to issue any patents granted for the Invention or the invention(s) that shall be disclosed in the Patent Applications in the name of the Assignee or its successors or assigns in accordance with this Assignment.

5 This assignment and undertaking shall be binding upon the heirs, executors, administrators, successors and/or assigns of the Inventor and of the Employer and shall enure to the benefit of any heirs, executors, administrators, successors and/or assigns of the Assignee.

6 This agreement shall be governed by and interpreted in accordance with the laws of England, and the courts of England shall have exclusive jurisdiction to settle any disputes which may arise in connection with this agreement.

AS WITNESS the signatures of the Inventor and of duly authorised officers of the Employer and the Assignee

THIS ASSIGNMENT MAY BE EXECUTED IN COUNTERPARTS

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CS

14/2/16

## SCHEDULE

**Identification of some, but not necessarily all, patent applications falling within the scope of clause 1 of this Assignment**

[illegible]

SIGNED by \_\_\_\_\_ )  
the INVENTOR \_\_\_\_\_ )  
at: ABU DHABI \_\_\_\_\_ )  
on: 12<sup>th</sup> NOVEMBER 2015 \_\_\_\_\_ )  
in the presence of: \_\_\_\_\_ )

Signature: Don V. S. ...

**Witness**

Signature: K. H. Jones

Name: RASOOL ASAL

Address: Abu Dhabi



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U ZB

SIGNED for and on behalf of )  
the EMPLOYER )  
at: ..... )  
on: ..... )  
in the presence of: )

Signature: .....

Name:

Position:

Witness

Signature: .....

Name:

Address:

SIGNED for and on behalf of )  
the 1st CO-APPLICANT )  
at: Abu Dhabi ..... )  
on: 14/2/16 ..... )  
in the presence of: )

Signature: .....

Name: Dr. Mohammed Al Mualla

Position: SVP R&D , KUSTAR

Witness

Signature: N. AZARMI .....

Name: Nader Azarmi

Address: Khalifa Univ, Abu Dhabi, UAE

SIGNED for and on behalf of )  
the 2nd CO-APPLICANT )  
at: ..... )  
on: ..... )  
in the presence of: )

Signature: .....

Name:

Position:

Witness

Signature: .....

Name:

Address:

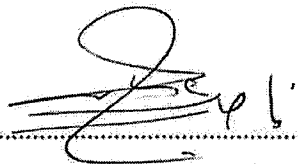
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SIGNED for and on behalf of )  
the 3rd CO-APPLICANT )  
at: Abu Dhabi )  
on: 14/2/16 )  
in the presence of: )

Witness

Signature: N. AZARM  
Name: Nader Azarmi  
Address: Khalifa Univ, Abu Dhabi, UAE

Signature:   
Name: Nasser A. Salim  
Position: General Manager, Etisalat

14/2/16

# **ABSTRACT**

This invention relates to methods and systems for estimating and checking synchronization accuracy, in particular frequency synchronization accuracy. It is particularly applicable to synchronization methods and systems which involve a digital phase-locked loop (DPLL) and embodiments provide methods and systems for estimating and tracking how well the DPLL is frequency synchronized to a source frequency. In one embodiment, frequency synchronization accuracy is used as an additional quality metric for mobile call handover between base stations. Call handover is of major importance within any mobile network; without checking frequency synchronization before handover dropped calls and interrupted communication can result.

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