

PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
Stylesheet Version v1.2

EPAS ID: PAT3196796

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	ASSIGNMENT
CONVEYING PARTY DATA	
Name	Execution Date
DR JAMES AWEYA	12/09/2014
RECEIVING PARTY DATA	
Name:	KHALIFA UNIVERSITY OF SCIENCE, TECHNOLOGY, AND RESEARCH
Street Address:	P.O. BOX 127788
City:	ABU DHABI
State/Country:	UNITED ARAB EMIRATES
Name:	BRITISH TELECOMMUNICATIONS PLC
Street Address:	81 NEWGATE STREET
City:	LONDON
State/Country:	UNITED KINGDOM
Postal Code:	EC1A 7AJ
Name:	EMIRATES TELECOMMUNICATIONS CORPORATION
Street Address:	ETISALAT BUILDING, INTERSECTION OF ZAYED THE 1ST STREET AND SHEIKH RASHID BIN SAEED AL MAKTOUM STREET
Internal Address:	P.O. BOX 3838
City:	ABU DHABI
State/Country:	UNITED ARAB EMIRATES
PROPERTY NUMBERS Total: 1	
Property Type	Number
Application Number:	14566943
CORRESPONDENCE DATA	
Fax Number:	(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>	
Phone:	216-622-8844
Email:	ipupdate@calfee.com
Correspondent Name:	SEAN MOORHEAD
Address Line 1:	1405 EAST SIXTH STREET
Address Line 4:	CLEVELAND, OHIO 44114-1607
NAME OF SUBMITTER:	SEAN MOORHEAD

PATENT

SIGNATURE:	/Sean T. Moorhead/
DATE SIGNED:	01/26/2015
Total Attachments: 14 source=02847244#page1.tif source=02847244#page2.tif source=02847244#page3.tif source=02847244#page4.tif source=02847244#page5.tif source=02847244#page6.tif source=02847244#page7.tif source=02847244#page8.tif source=02847244#page9.tif source=02847244#page10.tif source=02847244#page11.tif source=02847244#page12.tif source=02847244#page13.tif source=02847244#page14.tif	

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

Parties:

1 'The Inventor'

Dr James Aweya

Etisalat BT Innovation Centre, Khalifa University of Science, Technology, and Research, P.O. Box 127788, 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
Etisalat Building, Intersection of Zayed the 1st 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 Devices for Clock Synchronization over Links with Asymmetric Transmission Rates* which is described in the abstract annexed hereto and is the subject of Case No. SXH/FP7062151 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")


10/12/14

(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 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.

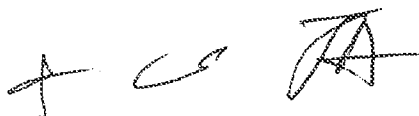
4 The Inventor and the Employer HEREBY REQUEST the US Commissioner of Patents and the relevant authorities in all countries of the world to issue any patents granted for the Invention or the invention(s) that shall be disclosed in the Patent Applications in the name of the Assignee or its successors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



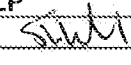
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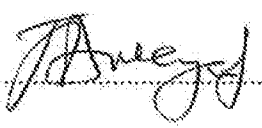
PATENT

REEL: 034808 FRAME: 0195


SCHEDULE

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

Country/region	Application No.	Application Date	Title	Signature for Mewburn Ellis LLP
VZ	4/516463	11 Dec 2014	METHODS & DEVICES FOR LOCAL SYNCHRONIZATION OF DEVICES WITH ASYMMETRIC TRANSMISSION RATES	

SIGNED by)
the INVENTOR)
at: ABU DHABI, UAE)
on: 9 DEC 2014) Signature: 
in the presence of)

Witness
Signature: A. Al-Rubaie
Name: Ahmad Al-Rubaie
Address: P.O. BOX 127788,
Abu Dhabi,
UAE.


10/12/14

SIGNED for and on behalf of)
the EMPLOYER)
at: Abu Dhabi)
on: 10/12/14)
in the presence of:)

Signature: 

Name: Mohammed Al Mualla
Position: SVP R&D, KUSTAR

Witness

Signature: A. Al-Rubai
Name: Ahmed A. Rubaie
Address: P.O. Box 127788
Abu Dhabi
UAE.

SIGNED for and on behalf of)
the 1st CO-APPLICANT)
at: Abu Dhabi)
on: 10/12/14)
in the presence of:)

Signature: 

Name: Mohammed Al Mualla
Position: SVP R&D, KUSTAR

Witness

Signature: A. Al-Rubai
Name: Ahmed Al-Rubaie
Address: P.O. Box 127788
Abu Dhabi
UAE

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

Signature:

Name:

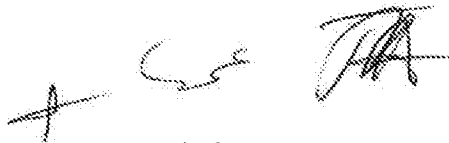
Position:

Witness


Signature:

Name:

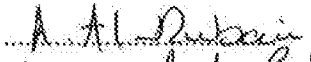
Address:


10/12/14

SIGNED for and on behalf of)
the 3rd CO-APPLICANT)
at: Abu Dhabi)
on: 10/12/14)
in the presence of:)

Signature: 
Name: ABDULAZIZ AL MUTAWA
Position: SVP / Technology Innovations

Witness

Signature: 
Name: Ahmad Al Lubain
Address: p.o. Box 127788
Abu Dhabi
UAE.



10/12/14

ABSTRACT

This invention relates to methods and devices for clock synchronization. The invention has particular application in the alignment of slave clocks to a master clock and in dealing with packet delay variations where the forward and reverse communication paths between the master and slave clocks have asymmetric transmission rates. Such methods and devices have particular application in small cell backhaul solutions for 4G/LTE deployments. In embodiments of the invention, the slave clock uses link rate information to estimate the packet delay variations due to transmission path asymmetry and thus estimate the offset and skew of the slave clock. Embodiments provide a simple linear approximation technique and a Kalman filter-based technique for estimating offset and skew of the slave clock.

4 6 7A

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Parties:

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Dr James Aweya

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2 'The Employer'

*Khalifa University of Science, Technology, and Research
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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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1/9/14

(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.

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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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A.v. 1/9/14

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

no. 1/9/14

SCHEDULE

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

Country/region	Application No.	Application Date	Title	Signature for Mewburn Ellis LLP
US	14/566943	11/06/2014	Methods & Devices For Data Synchronization Over Links With Semi-Full Duplex Links	[Signature]

SIGNED by _____)
 the INVENTOR _____)
 at: _____)
 on: _____) Signature: _____)
 in the presence of: _____)

Witness
 Signature: _____
 Name: _____
 Address: _____

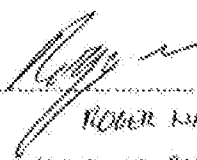
SIGNED for and on behalf of)
the EMPLOYER)
at:)
on:)
in the presence of:)
Witness
Signature:
Name:
Address:

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:

SIGNED for and on behalf of)
the 2nd CO-APPLICANT)
at: 81 NEWGATE ST, LONDON)
on: 1/9/14)
in the presence of:)
Witness
Signature:
Name: CHI-FAN LAU
Address: 81 Newgate St
London
EC1A 7AJ

Signature: 
Name: ROGER WASH
Position: HEAD OF PATENTS

RN. 1/9/14

SIGNED for and on behalf of)
the 3rd CO-APPLICANT)
at:)
on:)
in the presence of:)

Signature:
Name:
Position:

Witness
Signature:
Name:
Address:

P.N. 1/9/14

ABSTRACT

This invention relates to methods and devices for clock synchronization. The invention has particular application in the alignment of slave clocks to a master clock and in dealing with packet delay variations where the forward and reverse communication paths between the master and slave clocks have asymmetric transmission rates. Such methods and devices have particular application in small cell backhaul solutions for 4G/LTE deployments. In embodiments of the invention, the slave clock uses link rate information to estimate the packet delay variations due to transmission path asymmetry and thus estimate the offset and skew of the slave clock. Embodiments provide a simple linear approximation technique and a Kalman filter-based technique for estimating offset and skew of the slave clock.

Rev. 2/9/14