

## PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1  
 Stylesheet Version v1.2

EPAS ID: PAT6478922

<b>SUBMISSION TYPE:</b>	NEW ASSIGNMENT	
<b>NATURE OF CONVEYANCE:</b>	AMENDED AND RESTATED INTELLECTUAL PROPERTY SECURITY AGREEMENT	
<b>CONVEYING PARTY DATA</b>		
<b>Name</b>		<b>Execution Date</b>
TQ DELTA LLC		12/31/2020
<b>RECEIVING PARTY DATA</b>		
<b>Name:</b>	ALTER DOMUS (US) LLC	
<b>Street Address:</b>	225 W. WASHINGTON ST., 9TH FLOOR	
<b>City:</b>	CHICAGO	
<b>State/Country:</b>	ILLINOIS	
<b>Postal Code:</b>	60606	
<b>PROPERTY NUMBERS Total: 227</b>		
<b>Property Type</b>	<b>Number</b>	
Patent Number:	5497398	
Patent Number:	5631610	
Patent Number:	5636246	
Patent Number:	5715280	
Patent Number:	5751716	
Patent Number:	5832030	
Patent Number:	6445730	
Patent Number:	6731695	
Patent Number:	6748016	
Patent Number:	6760373	
Patent Number:	6801570	
Patent Number:	6870888	
Patent Number:	6961369	
Patent Number:	7180938	
Patent Number:	7292627	
Patent Number:	7451379	
Patent Number:	7453881	
Patent Number:	7471721	
Patent Number:	7558329	
Patent Number:	7570686	

Property Type	Number
Patent Number:	7636389
Patent Number:	7656976
Patent Number:	7697598
Patent Number:	7769104
Patent Number:	7796705
Patent Number:	7809028
Patent Number:	7831890
Patent Number:	7835430
Patent Number:	7836381
Patent Number:	7844882
Patent Number:	7889784
Patent Number:	7925958
Patent Number:	7978706
Patent Number:	7978753
Patent Number:	7979778
Patent Number:	8073041
Patent Number:	8090008
Patent Number:	8102909
Patent Number:	8218610
Patent Number:	8238412
Patent Number:	8276048
Patent Number:	8335271
Patent Number:	8335956
Patent Number:	8355427
Patent Number:	8374226
Patent Number:	8391191
Patent Number:	8407546
Patent Number:	8422511
Patent Number:	8432956
Patent Number:	8437382
Patent Number:	8462835
Patent Number:	8468411
Patent Number:	8495473
Patent Number:	8516337
Patent Number:	8594162
Patent Number:	8595577
Patent Number:	8607126
Patent Number:	8611404

Property Type	Number
Patent Number:	8625660
Patent Number:	8634449
Patent Number:	8645784
Patent Number:	8649305
Patent Number:	8718158
Patent Number:	8743931
Patent Number:	8743932
Patent Number:	8750352
Patent Number:	8782498
Patent Number:	8792574
Patent Number:	8793553
Patent Number:	8831031
Patent Number:	8837610
Patent Number:	8913649
Patent Number:	8929423
Patent Number:	8929470
Patent Number:	8937988
Patent Number:	8984366
Patent Number:	9014193
Patent Number:	9014243
Patent Number:	9065886
Patent Number:	9069718
Patent Number:	9094268
Patent Number:	9094348
Patent Number:	9154354
Patent Number:	9191039
Patent Number:	9264533
Patent Number:	9276612
Patent Number:	9286251
Patent Number:	9300324
Patent Number:	9300601
Patent Number:	9319512
Patent Number:	9479637
Patent Number:	9485055
Patent Number:	9485128
Patent Number:	9521003
Patent Number:	9547608
Patent Number:	9621198

Property Type	Number
Patent Number:	9749235
Patent Number:	9755876
Patent Number:	9838531
Patent Number:	9893921
Patent Number:	9894014
Patent Number:	9898220
Patent Number:	9973624
Patent Number:	10044473
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Patent Number:	10264119
Patent Number:	10341261
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Patent Number:	10409510
Patent Number:	10419059
Patent Number:	10484140
Patent Number:	10498495
Patent Number:	10567112
Patent Number:	10579291
Patent Number:	10623559
Patent Number:	10708104
Patent Number:	10805040
Patent Number:	10833809
Application Number:	09768275
Application Number:	09836295
Application Number:	09882046
Application Number:	10175815
Application Number:	10202688
Application Number:	10597482
Application Number:	10631745
Application Number:	10743946
Application Number:	10778083
Application Number:	10802867
Application Number:	10834193
Application Number:	11058289
Application Number:	11090183
Application Number:	11140246
Application Number:	11200002



Property Type	Number
Application Number:	11242024
Application Number:	11289516
Application Number:	11430251
Application Number:	11434249
Application Number:	11616630
Application Number:	11748806
Application Number:	11972340
Application Number:	12383056
Application Number:	12478577
Application Number:	12615077
Application Number:	12640838
Application Number:	12783733
Application Number:	12783737
Application Number:	12783744
Application Number:	12783755
Application Number:	12783788
Application Number:	12783796
Application Number:	12783801
Application Number:	12783825
Application Number:	12783839
Application Number:	13330943
Application Number:	13467392
Application Number:	14285911
Application Number:	14485937
Application Number:	14577769
Application Number:	14724345
Application Number:	14757630
Application Number:	14865966
Application Number:	14932599
Application Number:	15054499
Application Number:	15077506
Application Number:	15084788
Application Number:	15180274
Application Number:	15298817
Application Number:	15304920
Application Number:	15479866
Application Number:	16428232
Application Number:	16544003

Property Type	Number
Application Number:	16561835
Application Number:	16569144
Application Number:	16781802
Application Number:	17027196
Application Number:	60072447
Application Number:	60090891
Application Number:	60109876
Application Number:	60144562
Application Number:	60164134
Application Number:	60172343
Application Number:	60174865
Application Number:	60177944
Application Number:	60197727
Application Number:	60212233
Application Number:	60224308
Application Number:	60241468
Application Number:	60241664
Application Number:	60278936
Application Number:	60283467
Application Number:	60287968
Application Number:	60293034
Application Number:	60309631
Application Number:	60327440
Application Number:	60400550
Application Number:	60549804
Application Number:	60555982
Application Number:	60613594
Application Number:	60618269
Application Number:	60619618
Application Number:	60792236
Application Number:	60849650
Application Number:	60989542
Application Number:	61011267
Application Number:	61183845
Application Number:	61985168
PCT Number:	US0019247
PCT Number:	US0030958
PCT Number:	US0100418

Property Type	Number
PCT Number:	US0102341
PCT Number:	US0112555
PCT Number:	US0132503
PCT Number:	US0141015
PCT Number:	US0209411
PCT Number:	US0224326
PCT Number:	US0231649
PCT Number:	US0323965
PCT Number:	US0533922
PCT Number:	US0536015
PCT Number:	US9406713
PCT Number:	US9515115
PCT Number:	US9708209
PCT Number:	US9708222
PCT Number:	US9708549
PCT Number:	US9708756
PCT Number:	US9914467

#### CORRESPONDENCE DATA

Fax Number: (202)887-4288

*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.*

Phone: 2028874000

Email: dlee@akingump.com

Correspondent Name: DAVID C. LEE

Address Line 1: 2001 K STREET N.W.

Address Line 2: AKIN GUMP STRAUSS HAUSER & FELD LLP

Address Line 4: WASHINGTON, D.C. 20006

ATTORNEY DOCKET NUMBER:	697820.0023
NAME OF SUBMITTER:	DAVID C. LEE
SIGNATURE:	/David C. Lee/
DATE SIGNED:	01/04/2021
	This document serves as an Oath/Declaration (37 CFR 1.63).

#### Total Attachments: 25

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AMENDED AND RESTATED INTELLECTUAL PROPERTY SECURITY AGREEMENT

This AMENDED AND RESTATED INTELLECTUAL PROPERTY SECURITY AGREEMENT (as amended, restated, amended and restated, supplemented or otherwise modified from time to time, the “**IP Security Agreement**”), dated as of December 31, 2020, is made by each undersigned grantor (each, a “**Grantor**”, and, collectively, the “**Grantors**”) in favor of ALTER DOMUS (US) LLC, a Delaware limited liability company, as collateral agent for its own benefit and the benefit of the Lenders (as defined in the Credit Agreement defined below) (in such capacity, together with its successor and assigns in such capacity, the “**Collateral Agent**”). Capitalized terms used herein and not otherwise defined herein shall have the meanings assigned to such terms in the Credit Agreement or the Security Agreement (as defined below), as applicable.

WHEREAS, the Borrower, ALTER DOMUS (US) LLC, as Administrative Agent (as defined therein), the Collateral Agent and the Lenders from time party thereto, are each party to that certain Amended and Restated Credit Agreement, dated as of December 31, 2020 (as amended, restated, amended and restated, supplemented or otherwise modified from time to time, the “**Credit Agreement**”), pursuant to which the Lenders have agreed, among other things, to continue the existing term loan and extend further credit to the Borrower in the form of delayed draw term loans upon the terms and subject to the conditions specified therein;

WHEREAS, in connection with the Credit Agreement, each Grantor has entered into the Amended and Restated Security Agreement, dated as of December 31, 2020 (as amended, restated, amended and restated, supplemented or otherwise modified from time to time, the “**Security Agreement**”) in order to induce the Lenders to make and continue to make, as applicable, Loans; and

WHEREAS, under the terms of the Security Agreement, each Grantor has granted to the Collateral Agent, for the ratable benefit of the Credit Parties, a security interest in, among other property, certain intellectual property of such Grantor, and has agreed as a condition thereof to execute this IP Security Agreement for recording with the United States Patent and Trademark Office and the United States Copyright Office, as the case may be.

NOW, THEREFORE, for good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, each Grantor agrees as follows:

(a) Grant of Security Interest. As security for the prompt and complete payment or performance, as the case may be, in full of the Secured Obligations, each Grantor hereby grants to the Collateral Agent for itself and the ratable benefit of the Credit Parties, a security interest in all of its right, title and interest in and to all of the following personal property, whether now owned by or owing to or hereafter acquired by or arising in favor of such Grantor (collectively, the “**IP Collateral**”):

(i) all Trademark registrations and applications for Trademark registration in the United States Patent and Trademark Office listed on Schedule I hereto;

(ii) all issued Patents and pending Patent applications in the United States Patent and Trademark Office listed on Schedule II hereto;

(iii) all Copyright registrations and pending applications for Copyright registration in the United States Copyright Office listed on Schedule III; and

(iv) all Proceeds and products of any and all of the foregoing and all supporting obligations, collateral security and guarantees given by any Person with respect to any of the foregoing;

provided, however, that notwithstanding any of the other provisions herein (and notwithstanding any recording of the Collateral Agent's Lien made in the United States Patent and Trademark Office, United States Copyright Office, or other registry office in any other jurisdiction), this Short-Form IP Security Agreement shall not constitute a grant of a security interest in any Trademark applications filed in the United States Patent and Trademark Office on the basis of such Grantor's "intent-to-use" such trademark, unless and until acceptable evidence of use of the Trademark has been filed with and accepted by the United States Patent and Trademark Office pursuant to Section 1(c) or Section 1(d) of the Lanham Act (15 U.S.C. 1051, et seq.), to the extent that granting a lien in such Trademark application prior to such filing would adversely affect the enforceability or validity of such Trademark application.

(b) Security for Secured Obligations. The grant of a security interest in the IP Collateral by each Grantor under this IP Security Agreement secures the payment of all Secured Obligations of such Grantor now or hereafter existing under or in respect of the Loan Documents, whether direct or indirect, absolute or contingent, and whether for principal, reimbursement obligations, interest, premiums, penalties, fees, indemnifications, contract causes of action, costs, expenses or otherwise, subject to the terms and provisions thereof.

(c) Recordation. This IP Security Agreement has been executed and delivered by each Grantor for the purpose of recording the grant of security interest herein with the United States Patent and Trademark Office and the United States Copyright Office, as the case may be. Each Grantor authorizes and requests that the Register of Copyrights, the Commissioner for Patents and the Commissioner for Trademarks and any other applicable government officer record this IP Security Agreement.

(d) Execution in Counterparts. This IP Security Agreement may be executed in any number of counterparts, each of which when so executed shall be deemed to be an original and all of which taken together shall constitute one and the same agreement.

(e) Grants, Rights and Remedies. This IP Security Agreement has been entered into in conjunction with the provisions of the Security Agreement. The Grantor does hereby acknowledge and confirm that the grant of the security interest hereunder to, and the rights and remedies of, the Collateral Agent with respect to the Collateral are more fully set forth in the Security Agreement, the terms and provisions of which are incorporated herein by reference as if fully set forth herein. In the event of any conflict between the terms of this IP Security Agreement and the terms of the Security Agreement, the terms of the Security Agreement shall govern.

(f) Governing Law. THIS IP SECURITY AGREEMENT SHALL BE GOVERNED BY, AND CONSTRUED IN ACCORDANCE WITH, THE LAW OF THE STATE OF NEW YORK.

(g) General. Sections 10.04, 10.14(b) and 10.15 of the Credit Agreement are hereby incorporated by reference into this IP Security Agreement *mutatis mutandis* and shall apply hereto.

(h) Severability. In case any one or more of the provisions contained in this IP Security Agreement should be held invalid, illegal or unenforceable in any respect, the validity, legality and enforceability of the remaining provisions contained herein and in the Security Agreement shall not in any way be affected or impaired thereby (it being understood that the invalidity of a particular provision in a particular jurisdiction shall not in and of itself affect the validity of such provision in any other jurisdiction). The parties hereto shall endeavor in good-faith negotiations to replace the invalid, illegal or unenforceable provisions with valid provisions the economic effect of which comes as close as possible to that of the invalid, illegal or unenforceable provisions.

(i) Amendment and Restatement. This IP Security Agreement is an amendment and restatement but not a novation of that certain Intellectual Property Security Agreement, dated as of October 5, 2018, in favor of the Collateral Agent (as amended, modified or supplemented prior to the date hereof, the “**Original IP Security Agreement**”). All Liens and security interests securing payment of the Secured Obligations under the Original IP Security Agreement are hereby collectively, renewed, extended, ratified and brought forward as security for the payment and performance of the Secured Obligations. Each Grantor hereby (i) reaffirms each Lien, pledge and security interest granted to the Collateral Agent under or in connection with the Original IP Security Agreement, (ii) agrees that after giving effect to this IP Security Agreement such Liens, pledges and security interests shall continue in full force and effect, and (iii) agrees that such Liens, pledges and security interests continue to secure the full and prompt payment and performance of all of the Secured Obligations.

[Remainder of Page Intentionally Blank]

IN WITNESS WHEREOF, each Grantor has caused this IP Security Agreement to be duly executed and delivered by its officer thereunto duly authorized as of the date first above written.

**TQ DELTA LLC**, as Grantor

By: TQCAP GP, LLC, its manager

By: TECHQUITY CAPITAL MANAGEMENT,  
LLC, its sole member

By:   
Name: Abha Divine  
Title: Managing Director

[Signature Page to A&R IP Security Agreement]



ACCEPTED AND AGREED  
as of the date first above written.

ALTER DOMUS (US) LLC,  
as Collateral Agent

By: T. K.  
Name: Jon Kirschmeier  
Title: Associate Counsel

[Signature Page to A&R IP Security Agreement]

**Schedule I**

Trademarks

UNITED STATES TRADEMARKS:

Registrations / Applications:

OWNER	REGISTRATION/ APPLICATION NUMBER	TRADEMARK
TQ Delta LLC	5110447	TQ DELTA

**Schedule II**

Patents

(see attached)

TQ DELTA, LLC  
Privileged and Confidential / Attorney Client Communication

Reference #	Title	Country ID	Status	Serial #	Filed Date	Publication #	Patent #	Issue Date	Expiration Date
6936-2-CON-2	Systems and Methods for Establishing a Diagnostic Transmission Mode and Communicating Over the Same	US	ISSUED	10/619,691	7/16/03	US 2004-0202237 A1	7,570,686	8/4/09	10/1/22
6936-2-CON-2-1	Multicarrier Modulation Messaging for Frequency Domain Received Idle Channel Noise Information	US	ISSUED	12/477,742	6/3/09	US 2009-0238254 A1	7,835,430	11/16/10	1/8/21
6936-2-CON-2-1-1	Multicarrier Modulation Messaging for Power Level Per Subchannel Information	US	EXPIRED	12/779,660	5/13/10	US 2010-0226418 A1	8,238,412	8/7/12	4/7/20
6936-2-CON-2-1-2	Multicarrier Modulation Messaging for SNR Per Subchannel During Showtime Information	US	ISSUED	12/779,708	5/13/10	US 2010-0220775 A1	7,889,784	2/15/11	1/8/21
6936-2-CON-2-1-3	Systems and Methods for Establishing a Diagnostic Transmission Mode and Communicating Over the Same	US	ISSUED	13/004,254	1/11/11	US 2011-0103443 A1	8,634,449	1/21/14	7/4/21
6936-2-CON-2-1-4	Multicarrier Modulation Messaging for Power Level Per Subchannel Information	US	ISSUED	13/476,310	5/21/12	US 2012-0230476 A1	8,432,956	4/30/13	1/8/21
6936-2-CON-2-1-5	Systems and Methods for a Transceiver to Transmit or Receive Test Information Over a Communication Channel Using Multicarrier Modulation	US	ISSUED	13/873,892	4/30/13	US 2013-0243049 A1	8,743,931	6/3/14	1/8/21
6936-2-CON-2-1-6	Systems and Methods for Establishing a Diagnostic Transmission Mode and Communicating Over the Same	US	ISSUED	14/153,282	1/13/14	US 2014-0126616 A1	8,929,423	1/6/15	1/8/21
8303-2-CON-2-1-7	Systems and Methods for Establishing a Diagnostic Transmission Mode and Communicating Over the Same	US	ISSUED	14/282,254	5/20/14	US 2014-0254645 A1	9,319,512	4/19/16	1/8/21
8303-2-CON-2-1-8	Systems and Methods for Establishing a Diagnostic Transmission Mode and Communicating Over the Same	US	ABANDONED	14/577,769	12/19/14	US 2015-0103936 A1			2/16/16
8303-2-CON-2-1-9	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	US	ISSUED	14/818,731	8/5/15	US 2015-0341488 A1	9,264,533	2/16/16	1/8/21
8303-2-CON-2-1-10	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	US	ISSUED	14/991,431	1/8/16	US 2016-0127537 A1	9,479,637	10/25/16	1/8/21
6936-2-CON-2-1-11	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	US	ISSUED	15/016,432	2/5/16	US 2016-0165042 A1	9,973,624	5/15/18	1/8/21
6936-2-CON-2-1-12	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	US	ISSUED	15/098,932	4/14/16	US 2016-0227026 A1	10,264,119	4/16/19	1/8/21
6936-2-CON-2-1-13	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	US	ISSUED	15/295,602	10/17/16	US 2017-0034343 A1	9,838,531	12/5/17	1/8/21
6936-2-CON-2-1-14	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	US	ISSUED	15/958,878	4/20/18	US 2018-0249001 A1	10,623,559	4/14/20	1/8/21
6936-2-PAU-4-DIV	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	AU	ISSUED	2008203520	1/8/01	AU 2008203520	2008203520	11/5/09	1/8/21
6936-2-PAU-4-DIV-2	Diagnostic Methods and Systems for Multicarrier Modems	AU	ABANDONED	2009222537	1/8/01	AU 2009222537	2009222537	12/22/11	1/4/17
6936-2-PAU-4-DIV-3	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	AU	ABANDONED	2011247879	1/8/01		2011247879	9/18/14	1/4/17
6936-2-PAU-4-DIV-4	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	AU	ABANDONED	2014208320	1/8/01		2014208320	3/12/15	1/4/17
8303-2-PAU-4-DIV-5	DIAGNOSTIC METHODS AND SYSTEMS FOR MULTICARRIER MODEMS	AU	ABANDONED	2015200087	1/8/01				2/28/17
8303-2-PAU-4-DIV-6	DIAGNOSTIC METHODS AND SYSTEMS FOR MULTICARRIER MODEMS	AU	ABANDONED	2017201226	1/8/01		2017201226	9/7/17	12/6/19
8303-2-PAU-4-DIV-7	DIAGNOSTIC METHODS AND SYSTEMS FOR MULTICARRIER MODEMS	AU	ABANDONED	2017210489	1/8/01				12/6/19
6936-2-PCA	Diagnostic Methods and Systems for Multicarrier Modems	CA	ISSUED	2,394,491	1/8/01	CA 2394491	2,394,491	3/29/11	1/8/21
6936-2-PCA-DIV	Diagnostic Methods and Systems for Multicarrier Modems	CA	ABANDONED	2,726,826	1/8/01	CA 2726826	2,726,826	11/20/12	12/23/16
6936-2-PCA-DIV-2	Diagnostic Methods and Systems for Multicarrier Modems	CA	EXPIRED	2,788,662	1/8/01		2,788,662	1/3/17	1/8/20
6936-2-PCA-DIV-3	Diagnostic Methods and Systems for Multicarrier Modems	CA	ISSUED	2,948,960	1/8/01		2,948,960	6/23/20	1/8/21
6936-2-PCT	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	WO	NAT PHASE	PCT/US01/00418	1/8/01	WO 2001/52516			

6936-2-PEP-5	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	EP	ISSUED	06022008.4	1/8/01	1755253	1755253	7/13/11	1/8/21
6936-2-PEP-5-BE	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	BE	ISSUED	06022008.4	1/8/01	N/A	1755253	7/13/11	1/8/21
6936-2-PEP-5-CH	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	CH	ISSUED	06022008.4	1/8/01	N/A	1755253	7/13/11	1/8/21
6936-2-PEP-5-DE	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	DE	ISSUED	06022008.4	1/8/01	N/A	1755253	7/13/11	1/8/21
6936-2-PEP-5-ES	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	ES	ISSUED	06022008.4	1/8/01	N/A	1755253	7/13/11	1/8/21
6936-2-PEP-5-FR	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	FR	ISSUED	06022008.4	1/8/01	N/A	1755253	7/13/11	1/8/21
6936-2-PEP-5-GB	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	GB	ISSUED	06022008.4	1/8/01	N/A	1755253	7/13/11	1/8/21
6936-2-PEP-5-GR	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	GR	ABANDONED	06022008.4	1/8/01	N/A	1755253	7/13/11	12/6/19
6936-2-PEP-5-HK	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	HK	ABANDONED	07108499.2	1/8/01	HK 1100379			8/4/11
6936-2-PEP-5-IE	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	IE	ISSUED	06022008.4	1/8/01	N/A	1755253	7/13/11	1/8/21
6936-2-PEP-5-IT	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	IT	ISSUED	06022008.4	1/8/01	N/A	1755253	7/13/11	1/8/21
6936-2-PEP-5-NL	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	NL	ISSUED	06022008.4	1/8/01	N/A	1755253	7/13/11	1/8/21
6936-2-PEP-5-DIV-1	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	EP	ISSUED	10011985.8	1/8/01	2276182	2276182	2/26/20	1/8/21
6936-2-PEP-5-DIV-1-DE	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	DE	ISSUED	10011985.8	1/8/01	2276182	60151242.1	2/26/20	1/8/21
6936-2-PEP-5-DIV-1-FR	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	FR	ISSUED	10011985.8	1/8/01		2276182	2/26/20	1/8/21
6936-2-PEP-5-DIV-1-GB	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	GB	ISSUED	10011985.8	1/8/01		2276182	2/26/20	1/8/21
6936-2-PEP-5-DIV-1-HK	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	HK	ABANDONED	11101591.8	1/8/01	HK 1147612			12/5/19
6936-2-PEP-5-DIV-2	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	EP	ABANDONED	10011983.3	1/8/01	2293459			12/12/19
6936-2-PEP-5-DIV-2-HK	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	HK	ABANDONED	11103980.3	1/8/01	HK 1149982			12/12/19
6936-2-PEP-5-DIV-3	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	EP	ISSUED	10011984.1	1/8/01	2317684	2317684	2/26/20	1/8/21
6936-2-PEP-5-DIV-3-DE	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	DE	ISSUED	10011984.1	1/8/01	2317684	60151241.3	2/26/20	1/8/21
6936-2-PEP-5-DIV-3-FR	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	FR	ISSUED	10011984.1	1/8/01		2317684	2/26/20	1/8/21
6936-2-PEP-5-DIV-3-GB	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	GB	ISSUED	10011984.1	1/8/01		2317684	2/26/20	1/8/21
6936-2-PEP-5-DIV-3-HK	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	HK	ABANDONED	11106469.6	1/8/01	1152597			11/11/19

6936-2-PEP-5-DIV-3-NL	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	NL	ISSUED	10011984.1	1/8/01		2317684	2/26/20	1/8/21
6936-2-PEP-5-DIV-4	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	EP	ISSUED	10011982.5	1/8/01	2270996	2270996	3/7/18	1/8/21
6936-2-PEP-5-DIV-4-DE	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	DE	ISSUED	10011982.5	1/8/01		2270996	3/7/18	1/8/21
6936-2-PEP-5-DIV-4-FR	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	FR	ISSUED	10011982.5	1/8/01		2270996	3/7/18	1/8/21
6936-2-PEP-5-DIV-4-GB	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	GB	ISSUED	10011982.5	1/8/01		2270996	3/7/18	1/8/21
6936-2-PEP-5-DIV-4-HK	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	HK	ISSUED	11101590.0	1/8/01	HK 1147611	HK 1147611	9/21/18	1/8/21
6936-2-PEP-5-DIV-5	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	EP	ABANDONED	18159847.5	1/8/01	3349386			12/12/19
6936-2-PEP-5-DIV-5-HK	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	HK	ABANDONED	18113502.4	1/8/01	1254420			1/14/20
6936-2-PJP	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	JP	ABANDONED	2001-552611	1/8/01	JP 2003/520504			7/13/11
6936-2-PJP-DIV	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	JP	ISSUED	2008-191051	1/8/01	2009-027721	4722972	4/15/11	1/8/21
6936-2-PJP-DIV-2	SYSTEMS AND METHODS FOR ESTABLISHING A DIAGNOSTIC TRANSMISSION MODE AND COMMUNICATING OVER THE SAME	JP	ABANDONED	2011-012155	1/8/01	2011-151808			6/21/13
6936-2-PROV-1	MULTICARRIER MODULATION SYSTEM WITH REMOTE DIAGNOSTIC TRANSMISSION MODE	US	EXPIRED	60/174,865	1/7/00	N/A			1/7/01
6936-2-PROV-2	CHARACTERIZATION OF TRANSMISSION LINES USING BROADBAND SIGNALS IN A MULTI-CARRIER DSL SYSTEM	US	EXPIRED	60/224,308	8/10/00	N/A			8/10/01
6936-16	SYSTEMS AND METHODS FOR MULTI-PAIR ATM OVER DSL	US	ISSUED	10/264,258	10/4/02	US 2003-0091053 A1	7,453,881	11/18/08	7/24/25
6936-16-CON	SYSTEMS AND METHODS FOR MULTI-PAIR ATM OVER DSL	US	ISSUED	12/247,741	10/8/08	US 2009-0028158 A1	7,809,028	10/5/10	10/4/22
6936-16-CON-2	Combining Multiple DSL Transceivers for a High Data Rate Connection	US	ISSUED	12/769,277	4/28/10	US 2010-0208737 A1	7,978,706	7/12/11	10/4/22
6936-16-CON-3	Systems and Methods for Multi-Pair ATM Over DSL	US	ISSUED	12/783,777	5/20/10	US 2010-0290471 A1	8,422,511	4/16/13	10/4/22
6936-16-CON-4	Systems and Methods for Multi-Pair ATM Over DSL	US	ISSUED	13/863,058	4/15/13	US 2013-0223453	8,831,031	9/9/14	10/4/22
6936-16-CON-5	BONDING DEVICE AND METHOD	US	ISSUED	14/465,502	8/21/14	US 2014-0362863 A1	9,014,193	4/21/15	10/4/22
6936-16-CON-6	BONDING DEVICE AND METHOD	US	ISSUED	14/682,435	4/9/15	US 2015-0215239 A1	9,300,601	3/29/16	10/4/22
6936-16-CON-7	BONDING DEVICE AND METHOD	US	ISSUED	15/057,741	3/1/16	US 2016-0182406 A1	9,894,014	2/13/18	10/4/22
6936-16-CON-8	BONDING DEVICE AND METHOD	US	ISSUED	15/882,619	1/29/18	US 2018-0152395 A1	10,341,261	7/2/19	10/4/22
6936-16-PCA	SYSTEMS AND METHODS FOR MULTI-PAIR ATM OVER DSL	CA	ISSUED	2,461,320	10/4/02	CA 2461320	2,461,320	10/25/11	10/4/22
6936-16-PCT	SYSTEMS AND METHODS FOR MULTI-PAIR ATM OVER DSL	WO	NAT PHASE	PCT/US02/31649	10/4/02	WO 2003/032555			
6936-16-PEP	SYSTEMS AND METHODS FOR MULTI-PAIR ATM OVER DSL	EP	ISSUED	02778433.9	10/4/02	1433277	1433277	7/25/12	10/4/22
6936-16-PEPBE	SYSTEMS AND METHODS FOR MULTI-PAIR ATM OVER DSL	BE	ISSUED	02778433.9	10/4/02		1433277	7/25/12	10/4/22
6936-16-PEPDE	SYSTEMS AND METHODS FOR MULTI-PAIR ATM OVER DSL	DE	ISSUED	02778433.9	10/4/02		1433277	7/25/12	10/4/22
6936-16-PEPFR	SYSTEMS AND METHODS FOR MULTI-PAIR ATM OVER DSL	FR	ISSUED	02778433.9	10/4/02		1433277	7/25/12	10/4/22
6936-16-PEPGB	SYSTEMS AND METHODS FOR MULTI-PAIR ATM OVER DSL	GB	ISSUED	02778433.9	10/4/02		1433277	7/25/12	10/4/22
6936-16-PEP-DIV	SYSTEMS AND METHODS FOR MULTI-PAIR ATM OVER DSL	EP	ISSUED	12002728.9	10/4/02	2506508	2506508	5/2/18	10/4/22
6936-16-PEP-DIV-DE	SYSTEMS AND METHODS FOR MULTI-PAIR ATM OVER DSL	DE	ISSUED	12002728.9	10/4/02		2506508	5/2/18	10/4/22
6936-16-PEP-DIV-FR	SYSTEMS AND METHODS FOR MULTI-PAIR ATM OVER DSL	FR	ISSUED	12002728.9	10/4/02		2506508	5/2/18	10/4/22
6936-16-PEP-DIV-GB	SYSTEMS AND METHODS FOR MULTI-PAIR ATM OVER DSL	GB	ISSUED	12002728.9	10/4/02		2506508	5/2/18	10/4/22
6936-16-PEP-DIV-2	SYSTEMS AND METHODS FOR MULTI-PAIR ATM OVER DSL	EP	ISSUED	18170134.3	10/4/02	3386128	3386128	7/24/19	10/4/22
6936-16-PEP-DIV-2-DE	SYSTEMS AND METHODS FOR MULTI-PAIR ATM OVER DSL	DE	ISSUED	18170134.3	10/4/02	3386128	DE60249960.7	7/24/19	10/4/22
6936-16-PEP-DIV-2-FR	SYSTEMS AND METHODS FOR MULTI-PAIR ATM OVER DSL	FR	ISSUED	18170134.3	10/4/02		3386128	7/24/19	10/4/22
6936-16-PEP-DIV-2-GB	SYSTEMS AND METHODS FOR MULTI-PAIR ATM OVER DSL	GB	ISSUED	18170134.3	10/4/02		3386128	7/24/19	10/4/22

6936-16-PEP-DIV-2-NL	SYSTEMS AND METHODS FOR MULTI-PAIR ATM OVER DSL	NL	ISSUED	18170134.3	10/4/02		3386128	7/24/19	10/4/22
6936-16-PROV	MULTI-PAIR ATM OVER DSL	US	EXPIRED	60/327,440	10/5/01	N/A			10/5/02
6936-54	RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT	US	ISSUED	11/246,163	10/11/05	US 2006-0088054 A1	7,831,890	11/9/10	11/7/28
6936-54-CO N	RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT	US	ISSUED	12/761,586	4/16/10	US 2010-0228924 A1	7,844,882	11/30/10	10/11/25
6936-54-CO N-2	Computer Readable Medium with Instructions for Resource Sharing in a Telecommunications Environment	US	ISSUED	12/853,020	8/9/10	US 2010-0306628 A1	7,836,381	11/16/10	10/11/25
6936-54-CO N-3	RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT	US	ISSUED	12/901,699	10/11/10	US 2011-0029844 A1	8,276,048	9/25/12	10/11/25
6936-54-CO N-4	RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT	US	ISSUED	13/567,261	8/6/12	US 2012-0257148 A1	8,495,473	7/23/13	10/11/25
6936-54-CO N-5	RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT	US	ISSUED	13/942,938	7/16/13	US 2013-0308689 A1	8,607,126	12/10/13	10/11/25
6936-54-CO N-6	RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT	US	ISSUED	14/081,469	11/15/13	US 2014-0075128 A1	9,069,718	6/30/15	10/11/25
6936-54-CO N-7	RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT	US	ISSUED	14/730,874	6/4/15	US 2015-0268863 A1	9,286,251	3/15/16	10/11/25
6936-54-CO N-8	RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT	US	ISSUED	15/046,821	2/18/16	US 2016-0179389 A1	9,547,608	1/17/17	10/11/25
6936-54-CO N-9	RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT	US	ISSUED	15/372,841	12/8/16	US 2017-0090811 A1	9,898,220	2/20/18	10/11/25
6936-54-CO N-10	RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT	US	ISSUED	15/874,277	1/18/18	US 2018-0157436 A1	10,409,510	9/10/19	10/11/25
6936-54-CO N-10-DIV	RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT	US	ISSUED	16/261,109	1/29/19	US 2019-0155530 A1	10,579,291	3/3/20	10/11/25
6936-54-CO N-11	RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT	US	PUBLISHED	16/544,003	8/19/19	US 2019-0369891 A1			10/11/25
6936-54-PAU	Resource Sharing in a Telecommunications Environment	AU	ABANDONED	2005296086	10/11/05	AU 2005296086			4/6/11
6936-54-PAU-DIV	Resource Sharing in a Telecommunications Environment	AU	ABANDONED	2011201250	10/11/05	AU 2011201250			2/25/15
6936-54-PAU-DIV-2	Resource Sharing in a Telecommunications Environment	AU	ISSUED	2015200618	10/11/05		2015200618	11/12/15	10/11/25
6936-54-PCA	Resource Sharing in a Telecommunications Environment	CA	ISSUED	2,580,280	10/11/05	CA 2580280	2,580,280	3/10/15	10/11/25
6936-54-PCA-DIV	Resource Sharing in a Telecommunications Environment	CA	ABANDONED	2,869,452	10/11/05		2,869,452	1/19/16	9/25/17
6936-54-PCA-DIV-2	Resource Sharing in a Telecommunications Environment	CA	ABANDONED	2,909,150	10/11/05		2,909,150	11/7/17	9/4/20
6936-54-PCA-DIV-3	Resource Sharing in a Telecommunications Environment	CA	ISSUED	2,980,607	10/11/05		2,980,607	4/7/20	10/11/25
6936-54-PCN	Resource Sharing in a Telecommunications Environment	CN	ABANDONED	200580032703.1	10/11/05	CN101057438A			7/14/15
6936-54-PCN-DIV	Resource Sharing in a Telecommunications Environment	CN	ISSUED	201510413116.2	10/11/05	104993912	ZL201510413116.2	12/3/19	10/11/25
6936-54-PCT	RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT	WO	NAT PHASE	PCT/US05/36015	10/11/05	WO 2006/044227 A1			
6936-54-PEP	RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT	EP	ISSUED	05807443.6	10/11/05	EP 1832028	1832028	1/31/18	10/11/25
6936-54-PEPDE	RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT	DE	ISSUED	05807443.6	10/11/05		1832028	1/31/18	10/11/25
6936-54-PEPFR	RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT	FR	ISSUED	05807443.6	10/11/05		1832028	1/31/18	10/11/25
6936-54-PEPGB	RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT	GB	ISSUED	05807443.6	10/11/05		1832028	1/31/18	10/11/25
6936-54-PEPHK	RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT	HK	ISSUED	07110121.4	10/11/05	HK 1102043	HK 1102043	7/6/18	10/11/25
6936-54-PEP-DIV	RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT	EP	PUBLISHED	18153945.3	10/11/05	3340511			10/11/25
6936-54-PEP-DIV-HK	RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT	HK	PUBLISHED	18113503.3	10/11/05	1254421			10/11/25
6936-54-PIN	Resource Sharing in a Telecommunications Environment	IN	ABANDONED	1208/KOLNP/2007	10/11/05	IN 1208/KOLNP/2007			10/12/24
6936-54-PIP	Resource Sharing in a Telecommunications Environment	JP	ISSUED	2007-535818	10/11/05	2008-516533	4889646	12/22/11	10/11/25
6936-54-PIP-DIV	Resource Sharing in a Telecommunications Environment	JP	ABANDONED	2008-264540	10/11/05	2009-065692	4976359	4/20/12	2/21/17
6936-54-PKR	Method and System for Allocating Shared Memory in a Transceiver	KR	ISSUED	10-2007-7008270	10/11/05	10-2007-0065369	10-1160717	6/21/12	10/11/25
6936-54-PKR-DIV	Method for Allocating Memory in a Transceiver	KR	ABANDONED	10-2010-7022463	10/11/05	10-2010/0116234	10-1160765	6/21/12	3/10/17
6936-54-PROV	RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT	US	EXPIRED	60/618,269	10/12/04	N/A			10/12/05

6936-47	SYSTEM AND METHOD FOR SCRAMBLING THE PHASE OF THE CARRIERS IN A MULTICARRIER COMMUNICATIONS SYSTEM	US	ISSUED	09/710,310	11/9/00	N/A	6,961,369	11/1/05	7/28/23
6936-47-CDN	SYSTEM AND METHOD FOR SCRAMBLING THE PHASE OF THE CARRIERS IN A MULTICARRIER COMMUNICATIONS SYSTEM	US	EXPIRED	11/211,535	8/26/05	US 2006-0002454 A1	7,292,627	11/6/07	11/9/20
6936-47-CDN-2	System and Method for Scrambling the Phase of the Carriers in a Multicarrier Communications System	US	EXPIRED	11/863,581	9/28/07	US 2008-0069253 A1	7,471,721	12/30/08	11/9/20
6936-47-CDN-3	System and Method for Scrambling the Phase of the Carriers in a Multicarrier Communications System	US	EXPIRED	12/255,713	10/22/08	US 2009-0110105 A1	7,769,104	8/3/10	11/9/20
6936-47-CDN-4	System and Method for Scrambling the Phase of the Carriers in a Multicarrier Communications System	US	EXPIRED	12/783,725	5/20/10	US 2010-0290507 A1	8,090,008	1/3/12	11/9/20
6936-47-CDN-5	System and Method for Scrambling the Phase of the Carriers in a Multicarrier Communications System	US	EXPIRED	13/303,417	11/23/11	US 2012-0069878 A1	8,718,158	5/6/14	11/18/20
6936-47-CDN-6	System and Method for Scrambling the Phase of the Carriers in a Multicarrier Communications System	US	EXPIRED	14/256,677	4/18/14	US 2014-0226737 A1	8,929,470	1/6/15	11/9/20
6936-47-CDN-7	System and Method for Scrambling the Phase of the Carriers in a Multicarrier Communications System	US	EXPIRED	14/540,332	11/13/14	US 2015-0071385 A1	9,755,876	9/5/17	11/9/20
6936-47-CDN-8	System and Method for Scrambling the Phase of the Carriers in a Multicarrier Communications System	US	EXPIRED	15/693,914	9/1/17	US 2018-0013599 A1	10,187,240	1/22/19	11/9/20
6936-47-CDN-DIV	System and Method for Descrambling the Phase of the Carriers in a Multicarrier Communications System	US	ISSUED	11/860,080	9/24/07		8,073,041	12/6/11	11/5/23
6936-47-CDN-DIV-CDN	System and method for descrambling the phase of carriers in a multicarrier communications system	US	EXPIRED	13/284,549	10/28/11	US 2012-0044977 A1	8,218,610	7/10/12	11/9/20
6936-47-CDN-DIV-CDN-2	System and Method for Descrambling the Phase of Carriers in a Multicarrier Communications System	US	EXPIRED	13/439,605	4/4/12	US 2012-0195353 A1	8,355,427	1/15/13	11/9/20
6936-47-CDN-DIV-CDN-3	System and Method for Scrambling Using a Bit Scrambler and a Phase Scrambler	US	EXPIRED	13/718,016	12/18/12	US 2013-0136160-A1	9,014,243	4/21/15	11/9/20
6936-47-CDN-DIV-CDN-4	SYSTEM AND METHOD FOR SCRAMBLING USING A BIT SCRAMBLER AND A PHASE SCRAMBLER	US	EXPIRED	14/684,737	4/13/15	US 2015-0222467 A1	9,485,128	11/1/16	11/9/20
6936-47-CDN-DIV-CDN-5	SYSTEM AND METHOD FOR SCRAMBLING USING A BIT SCRAMBLER AND A PHASE SCRAMBLER	US	PUBLISHED	15/298,817	10/20/16	US 2017-0041173 A1			11/9/20
6936-47-PAU	SYSTEM AND METHOD FOR SCRAMBLING THE PHASE OF THE CARRIERS IN A MULTICARRIER COMMUNICATIONS SYSTEM	AU	ABANDONED	15964/01	11/9/00	AU 1596401			11/9/20
6936-47-PCA	SYSTEM AND METHOD FOR SCRAMBLING THE PHASE OF THE CARRIERS IN A MULTICARRIER COMMUNICATIONS SYSTEM	CA	ABANDONED	2,387,812	11/9/00	CA2387812			11/9/20
6936-47-PCT	SYSTEM AND METHOD FOR SCRAMBLING THE PHASE OF THE CARRIERS IN A MULTICARRIER COMMUNICATIONS SYSTEM	WO	NAT PHASE	PCT/US00/030958	11/9/00	WO 2001/035591			
6936-47-PEP	SYSTEM AND METHOD FOR SCRAMBLING THE PHASE OF THE CARRIERS IN A MULTICARRIER COMMUNICATIONS SYSTEM	EP	ABANDONED	00978507.2	11/9/00	EP 1228615			11/9/20
6936-47-PIP	SYSTEM AND METHOD FOR SCRAMBLING THE PHASE OF THE CARRIERS IN A MULTICARRIER COMMUNICATIONS SYSTEM	JP	ABANDONED	2001-537217	11/9/00	2003-514444A			11/9/20
6936-47-PIP-DIV	System and Method for Scrambling the Phase of the Carriers in a Multicarrier Communications System	JP	ABANDONED	2006-345675	11/9/00	JP 2007/129755			11/9/20
6936-47-PKR	SYSTEM AND METHOD FOR SCRAMBLING THE PHASE OF THE CARRIERS IN A MULTICARRIER COMMUNICATIONS SYSTEM	KR	ABANDONED	2002-7005830	11/9/00	10-2002-0049025			11/9/20
6936-47-PROV	SYSTEM AND METHOD FOR SCRAMBLING THE PHASE OF THE CARRIERS IN A MULTICARRIER COMMUNICATIONS SYSTEM	US	EXPIRED	60/164,134	11/9/99	N/A			11/9/00
6936-53	CRC COUNTER NORMALIZATION	US	ISSUED	11/232,899	9/23/05	US 2006-0069980 A1	7,451,379	11/11/08	3/8/27
6936-53-CDN	CRC COUNTER NORMALIZATION	US	ISSUED	12/236,902	9/24/08	US 2009-0019346	7,925,958	4/12/11	5/4/26
6936-53-CDN-2	CRC COUNTER NORMALIZATION	US	ISSUED	12/783,771	5/20/10	US 2010-0293444 A1	7,979,778	7/12/11	9/23/25
6936-53-CDN-3	CRC COUNTER NORMALIZATION	US	ISSUED	13/156,098	6/8/11	US 2011-0239087 A1	8,516,337	8/20/13	9/23/25
6936-53-CDN-4	CRC COUNTER NORMALIZATION	US	ISSUED	13/968,880	8/16/13	US 2013-0339828 A1	8,793,553	7/29/14	9/23/25
6936-53-CDN-5	CRC COUNTER NORMALIZATION	US	ISSUED	14/338,503	7/23/14	US 2014-0337683 A1	8,984,366	3/17/15	9/23/25
6936-53-CDN-6	CRC COUNTER NORMALIZATION	US	ISSUED	14/638,889	3/4/15	US 2015-0180508 A1	9,300,324	3/29/16	9/23/25
6936-53-CDN-7	CRC COUNTER NORMALIZATION	US	ISSUED	15/062,522	3/7/16	US 2016-0188403 A1	10,049,003	8/14/18	9/23/25
6936-53-CDN-8	CRC COUNTER NORMALIZATION	US	ISSUED	16/037,825	7/17/18	US 2018-0341544 A1	10,346,243	7/9/19	9/23/25
6936-53-CDN-9	CRC COUNTER NORMALIZATION	US	PUBLISHED	16/428,232	5/31/19	US 2019-0286514 A1			9/23/25
6936-53-PAU	CRC COUNTER NORMALIZATION	AU	ISSUED	2005289753	9/23/05	AU 2005289753	2005289753	3/19/09	9/23/25
6936-53-PAU-DIV	CRC COUNTER NORMALIZATION	AU	ABANDONED	2009200784	9/23/05	AU 2009200784			6/27/11
6936-53-PCA	CRC COUNTER NORMALIZATION	CA	ISSUED	2,550,263	9/23/05	CA 2550263	2,550,263	11/2/10	9/23/25



6936-53-PCA-DIV	CRC COUNTER NORMALIZATION	CA	ABANDONED	2,711,718	9/23/05	CA 2711718	2,711,718	3/24/15	7/28/20
6936-53-PCA-DIV-2	CRC COUNTER NORMALIZATION	CA	ABANDONED	2,876,137	9/23/05		2,876,137	9/13/16	9/12/18
6936-53-PCA-DIV-3	CRC COUNTER NORMALIZATION	CA	ABANDONED	2,935,980	9/23/05		2,935,980	1/8/19	7/28/20
6936-53-PCA-DIV-4	CRC COUNTER NORMALIZATION	CA	ABANDONED	3,023,907	9/23/05		3,023,907	6/4/19	7/28/20
6936-53-PCN	CRC COUNTER NORMALIZATION	CN	ISSUED	200580008869.X	9/23/05	CN193481.7A	200580008869.X	5/16/12	9/23/25
6936-53-PCN-DIV	CRC COUNTER NORMALIZATION	CN	ABANDONED	201210063701.0	9/23/05	CN 102624488	201210063701.0	11/25/15	7/25/17
6936-53-PCN-DIV-HK	A Method and a system for Cyclic Redundancy Checksum (CRC) Anomaly Counter Normalization, and a Module Performing the Method.	HK	ABANDONED	13101408.9	9/23/05	HK1174752			3/22/16
6936-53-PCT	CRC COUNTER NORMALIZATION	WO	NAT PHASE	PCT/US05/033922	9/23/05	WO 2006/036723 A1			
6936-53-PEP	CRC COUNTER NORMALIZATION	EP	ISSUED	05799765.2	9/23/05	1792430	1792430	7/20/11	9/23/25
6936-53-PEPBE	CRC COUNTER NORMALIZATION	BE	ABANDONED	05799765.2	9/23/05	N/A	1792430	7/20/11	8/4/20
6936-53-PEPCH	CRC COUNTER NORMALIZATION	CH	ABANDONED	05799765.2	9/23/05	N/A	1792430	7/20/11	8/4/20
6936-53-PEPDE	CRC COUNTER NORMALIZATION	DE	ISSUED	05799765.2	9/23/05	N/A	1792430	7/20/11	9/23/25
6936-53-PEPDK	CRC COUNTER NORMALIZATION	DK	ABANDONED	05799765.2	9/23/05	N/A	1792430	7/20/11	8/4/20
6936-53-PEPFR	CRC COUNTER NORMALIZATION	FR	ISSUED	05799765.2	9/23/05	N/A	1792430	7/20/11	9/23/25
6936-53-PEPGB	CRC COUNTER NORMALIZATION	GB	ABANDONED	05799765.2	9/23/05	N/A	1792430	7/20/11	8/6/19
6936-53-PEPHK	CRC COUNTER NORMALIZATION	HK	ABANDONED	07110654.9	9/23/05	HK 1102488			8/4/11
6936-53-PEPIE	CRC COUNTER NORMALIZATION	IE	ABANDONED	05799765.2	9/23/05	N/A	1792430	7/20/11	8/4/20
6936-53-PEPNL	CRC COUNTER NORMALIZATION	NL	ISSUED	05799765.2	9/23/05	N/A	1792430	7/20/11	9/23/25
6936-53-PEPSE	CRC COUNTER NORMALIZATION	SE	ABANDONED	05799765.2	9/23/05	N/A	1792430	7/20/11	8/4/20
6936-53-PEP-DIV	CRC COUNTER NORMALIZATION	EP	ISSUED	11005906.0	9/23/05	EP2381610A1	2381610	12/21/16	9/23/25
6936-53-PEP-DIV-DE	CRC COUNTER NORMALIZATION	DE	ISSUED	11005906.0	9/23/05		2381610	12/21/16	9/23/25
6936-53-PEP-DIV-FR	CRC COUNTER NORMALIZATION	FR	ISSUED	11005906.0	9/23/05		2381610	12/21/16	9/23/25
6936-53-PEP-DIV-GB	CRC COUNTER NORMALIZATION	GB	ISSUED	11005906.0	9/23/05		2381610	12/21/16	9/23/25
6936-53-PEP-DIV-2	CRC COUNTER NORMALIZATION	EP	ISSUED	16020487.1	9/23/05	3176973	3176973	6/17/20	9/23/25
6936-53-PEP-DIV-2-DE	CRC COUNTER NORMALIZATION	DE	ISSUED	16020487.1	9/23/05		3176973	6/17/20	9/23/25
6936-53-PEP-DIV-2-FR	CRC COUNTER NORMALIZATION	FR	ISSUED	16020487.1	9/23/05		3176973	6/17/20	9/23/25
6936-53-PEP-DIV-2-GB	CRC COUNTER NORMALIZATION	GB	ISSUED	16020487.1	9/23/05		3176973	6/17/20	9/23/25
6936-53-PIN	CRC COUNTER NORMALIZATION	IN	ABANDONED	1601/KOLNP/2006	9/23/05	IN 1601/KOLNP/2006			9/23/25
6936-53-PIP	CRC COUNTER NORMALIZATION	JP	ABANDONED	2006-551651	9/23/05	2007-519382			10/12/11
6936-53-PIP-DIV	CRC COUNTER NORMALIZATION	JP	ABANDONED	2006-345676	9/23/05	JP 2007/151145			10/12/11
6936-53-PIP-DIV-2	CRC COUNTER NORMALIZATION	JP	ISSUED	2010-042193	9/23/05	2010-178353	5237317	4/5/13	9/23/25
6936-53-PIP-DIV-3	CRC COUNTER NORMALIZATION	JP	ISSUED	2012-194723	9/23/05	2013-009417	3823936	10/16/15	9/23/25
6936-53-PIP-DIV-4	CRC COUNTER NORMALIZATION	JP	ISSUED	2015-105633	9/23/05	2015-167401	6215254	9/29/17	9/23/25
6936-53-PIP-DIV-5	CRC COUNTER NORMALIZATION	JP	ISSUED	2016-162059	9/23/05	2016-220241	6335230	5/11/18	9/23/25
6936-53-PKR	CRC COUNTER NORMALIZATION	KR	ISSUED	10-2006-7011697	9/23/05	10-2007-0072425	10-0955190	4/20/10	9/23/25
6936-53-PKR-DIV	CRC COUNTER NORMALIZATION	KR	ABANDONED	10-2010-7005285	9/23/05	10-2010/0035665			9/23/25
6936-53-PKR-DIV-2	CRC COUNTER NORMALIZATION	KR	ABANDONED	10-2010-7024190	9/23/05	10-2010-0120722			9/23/25
6936-53-PROV	CRC COUNTER NORMALIZATION METHOD AND SYSTEM	US	EXPIRE D	60/613,594	9/23/04	N/A			9/25/05
6936-52-PCA	Impulse Noise Management	CA	ISSUED	2,555,757	3/3/05	CA 2555757	2,555,757	1/20/15	3/3/25
6936-52-PCA-REI	Impulse Noise Management	CA	ISSUED	2,555,757R	3/3/05		2,555,757	3/27/18	3/3/25
6936-52-PCN	On-Line Impulse Noise Protection (INP) Adaptation	CN	ABANDONED	200580006738.8	3/3/05	CN1926794A			11/10/11
6936-52-PCT	ON-LINE IMPULSE NOISE PROTECTION (INP) ADAPTATION	WO	NAT PHASE	PCT/US05/06842	3/3/05	WO 2005/086405 A3			
6936-52-PEP	Impulse Noise Management	EP	ABANDONED	05724394.1	3/3/05	EP 1721403			3/3/25
6936-52-PEPHK	ON-LINE IMPULSE NOISE PROTECTION (INP) ADAPTATION	HK	ABANDONED	07105041.1	3/3/05	HK 1097672			8/23/12
6936-52-PEP-DIV	Impulse Noise Management	EP	ABANDONED	10006702.4	3/3/05	2228936			3/7/11
6936-52-PEP-DIV-HK	Impulse Noise Management	HK	ABANDONED	10110020.1	3/3/05	HK 1143672			8/23/12
6936-52-PIN	ON-LINE IMPULSE NOISE PROTECTION (INP) ADAPTATION	IN	ABANDONED	2155/KOLNP/2006	7/31/06	IN 2137/KOLNP/2006			7/31/26
6936-52-PROV	ON-LINE IMPULSE NOISE PROTECTION (INP) ADAPTATION	US	EXPIRE D	60/549,804	3/3/04	N/A			3/3/05
6936-52-PROV-2	IMPULSE NOISE PROTECTION (INP) TRAINING	US	EXPIRE D	60/555,982	3/24/04	N/A			3/24/05
6936-52-PUS	Impulse Noise Management	US	ABANDONED	10/397,482	7/27/06	US 2008-0232444 A1			10/14/11
6936-52-PUS-CON	Impulse Noise Management	US	ISSUED	12/769,193	4/28/10	US 2010-0220771 A1	8,462,835	6/11/13	3/3/25
6936-52-PUS-CON-2	Impulse Noise Management	US	ISSUED	13/914,852	6/11/13	US 2013-0227235 A1	8,594,162	11/26/13	3/3/25
6936-52-PUS-CON-3	Impulse Noise Management	US	ISSUED	14/075,077	11/8/13	US 2014-0064343 A1	8,743,932	6/3/14	3/3/25
6936-52-PUS-CON-4	Impulse Noise Management	US	ABANDONED	14/285,911	5/23/14	US 2014-0254643 A1			2/11/16
6936-52-PUS-CON-5	IMPULSE NOISE MANAGEMENT	US	ABANDONED	14/757,630	12/23/15	US 2016-0127079 A1			9/10/18
6936-52-PUS-CON-6	IMPULSE NOISE MANAGEMENT	US	ISSUED	16/126,027	9/10/18	US 2019-0007164 A1	10,567,112	2/18/20	3/3/25
6936-52-PUS-CON-6-DIV	IMPULSE NOISE MANAGEMENT	US	ISSUED	16/448,939	6/21/19	US 2019-0312667 A1	10,805,040	10/13/20	3/3/25
6936-52-PUS-CON-7	IMPULSE NOISE MANAGEMENT	US	PUBISHED	16/781,802	2/4/20	US 2020-0177304 A1			3/3/25
6936-28	MULTICARRIER TRANSMISSION SYSTEM WITH LOW POWERSLEEP MODE AND RAPID-ON CAPABILITY	US	EXPIRE D	09/581,400	6/13/00	N/A	6,445,730	9/3/02	1/26/19
6936-28-CON	MULTICARRIER TRANSMISSION SYSTEM WITH LOW POWERSLEEP MODE AND RAPID-ON CAPABILITY	US	ABANDONED	10/175,815	6/21/02	US 2002-0150152			5/17/04
6936-28-CON-1	MULTICARRIER TRANSMISSION SYSTEM WITH LOW POWERSLEEP MODE AND RAPID-ON CAPABILITY	US	ABANDONED	10/778,083	2/17/04	US 2004-0160906			5/30/05
6936-28-CON-2	MULTICARRIER TRANSMISSION SYSTEM WITH LOW POWERSLEEP MODE AND RAPID-ON CAPABILITY	US	ABANDONED	11/090,183	3/28/05	US 2005-0185726 A1			3/12/06
6936-28-CON-3	MULTICARRIER TRANSMISSION SYSTEM WITH LOW POWERSLEEP MODE AND RAPID-ON CAPABILITY	US	ABANDONED	11/289,516	11/30/05	US 2006-0078060 A1			

6936-28-CO-N-4	MULTICARRIER TRANSMISSION SYSTEM WITH LOW POWER SLEEP MODE AND RAPID-ON CAPABILITY	US	EXPIRED	11/425,507	6/21/06	US 2006-0233273 A1	7,697,598	4/13/10	1/26/19
6936-28-CO-N-5	Multicarrier Transmission System with Low Power Sleep Mode and Rapid-on Capability	US	ABANDONED	12/615,946	11/10/09	US 2010-0054312 A1	7,978,753	7/12/11	12/12/18
6936-28-CO-N-6	Multicarrier Transmission System with Low Power Sleep Mode and Rapid-On Capability	US	EXPIRED	13/152,538	6/3/11	US 2011-0235691 A1	8,437,382	5/7/13	1/26/19
6936-28-CO-N-7	Multicarrier Transmission System with Low Power Sleep Mode and Rapid-On Capability	US	EXPIRED	13/887,889	5/6/13	US 2013-0243051-A1	8,611,404	12/17/13	1/26/19
6936-28-CO-N-8	Multicarrier Transmission System with Low Power Sleep Mode and Rapid-On Capability	US	EXPIRED	14/092,248	11/27/13	US 2014-0086287 A1	8,750,352	6/10/14	1/26/19
6936-28-CO-N-9	Multicarrier Transmission System with Low Power Sleep Mode and Rapid-On Capability	US	ABANDONED	14/295,981	6/4/14	US 2014-0286379 A1	9,094,268	7/28/15	12/12/18
6936-28-CO-N-10	MULTICARRIER TRANSMISSION SYSTEM WITH LOW POWER SLEEP MODE AND RAPID-ON CAPABILITY	US	EXPIRED	14/798,014	7/13/15	US 2015-0326404 A1	9,521,003	12/13/16	1/26/19
6936-28-CO-N-11	MULTICARRIER TRANSMISSION SYSTEM WITH LOW POWER SLEEP MODE AND RAPID-ON CAPABILITY	US	ABANDONED	15/180,274	6/13/16	US 2016-0286493 A1			11/19/18
6936-28-PAU	MULTICARRIER TRANSMISSION SYSTEM WITH LOW POWER SLEEP MODE AND RAPID-ON CAPABILITY	AU	EXPIRED	23409/99	1/26/99	AU 2340999	764933	12/18/03	1/26/19
6936-28-PAU-2	MULTICARRIER TRANSMISSION SYSTEM WITH LOW POWER SLEEP MODE AND RAPID-ON CAPABILITY	AU	ABANDONED	2003266426	12/4/03	AU 2003266429			3/10/05
6936-28-PCA	MULTICARRIER TRANSMISSION SYSTEM WITH LOW POWER SLEEP MODE AND RAPID-ON CAPABILITY	CA	EXPIRED	2,357,551	1/26/99	CA 2357551	2,357,551	9/30/08	1/26/19
6936-28-PCA-DIV	Multicarrier Transmission System With Low Power Sleep Mode and Rapid-On Capability	CA	ABANDONED	2,633,064	1/26/99	CA 2633064	2,633,064	4/2/13	12/23/16
6936-28-PCA-DIV-2	Multicarrier Transmission System With Low Power Sleep Mode and Rapid-On Capability	CA	EXPIRED	2,800,005	1/26/99		2,800,005	3/14/17	1/26/19
6936-28-PCT	MULTICARRIER TRANSMISSION SYSTEM WITH LOW POWER SLEEP MODE AND RAPID-ON CAPABILITY	WO	NAT PHASE	PCT/U599/01539	1/26/99	WO 2000/045559			
6936-28-PEP	MULTICARRIER TRANSMISSION SYSTEM WITH LOW POWER SLEEP MODE AND RAPID-ON CAPABILITY	EP	EXPIRED	99903370.7	1/26/99	1145518	1145518	11/24/04	1/26/19
6936-28-PEPGB	MULTICARRIER TRANSMISSION SYSTEM WITH LOW POWER SLEEP MODE AND RAPID-ON CAPABILITY	GB	EXPIRED	99903370.7	1/26/99	N/A	1145518	11/24/04	1/26/19
6936-28-PEP-2	MULTICARRIER TRANSMISSION SYSTEM WITH LOW POWER SLEEP MODE AND RAPID-ON CAPABILITY	EP	EXPIRED	04022871.0	1/26/99	1524812	1524812	10/31/07	1/26/19
6936-28-PEP-2-DE	MULTICARRIER TRANSMISSION SYSTEM WITH LOW POWER SLEEP MODE AND RAPID-ON CAPABILITY	DE	EXPIRED	04022871.0	1/26/99	N/A	1524812	10/31/07	1/26/19
6936-28-PEP-2-FR	MULTICARRIER TRANSMISSION SYSTEM WITH LOW POWER SLEEP MODE AND RAPID-ON CAPABILITY	FR	EXPIRED	04022871.0	1/26/99	N/A	1524812	10/31/07	1/26/19
6936-28-PEP-2-GB	MULTICARRIER TRANSMISSION SYSTEM WITH LOW POWER SLEEP MODE AND RAPID-ON CAPABILITY	GB	EXPIRED	04022871.0	1/26/99	N/A	1524812	10/31/07	1/26/19
6936-28-PEP-3	Multicarrier Transmission System with Low Power Sleep Mode and Rapid-on-Capability	EP	EXPIRED	07021150.3	1/26/99	1901512	1901512	11/23/11	1/26/19
6936-28-PEP-3-DE	Multicarrier Transmission System with Low Power Sleep Mode and Rapid-on-Capability	DE	EXPIRED	07021150.3	1/26/99	N/A	1901512	11/23/11	1/26/19
6936-28-PEP-3-FR	Multicarrier Transmission System with Low Power Sleep Mode and Rapid-on-Capability	FR	EXPIRED	07021150.3	1/26/99	N/A	1901512	11/23/11	1/26/19
6936-28-PEP-3-GB	Multicarrier Transmission System with Low Power Sleep Mode and Rapid-on-Capability	GB	EXPIRED	07021150.3	1/26/99	N/A	1901512	11/23/11	1/26/19
6936-28-PEP-3-HK	Multicarrier Transmission System with Low Power Sleep Mode and Rapid-on-Capability	HK	ABANDONED	08110349.9	1/26/99	HK 1117978			7/28/11
6936-28-PEP-3-DIV-1	Multicarrier Transmission System with Low Power Sleep Mode and Rapid-on-Capability	EP	EXPIRED	10011996.5	1/26/99	2302857	2302857	9/2/15	1/26/19
6936-28-PEP-3-DIV-1-DE	Multicarrier Transmission System with Low Power Sleep Mode and Rapid-on-Capability	DE	EXPIRED	10011996.5	1/26/99		2302857	9/2/15	1/26/19
6936-28-PEP-3-DIV-1-FR	Multicarrier Transmission System with Low Power Sleep Mode and Rapid-on-Capability	FR	EXPIRED	10011996.5	1/26/99		2302857	9/2/15	1/26/19
6936-28-PEP-3-DIV-1-GB	Multicarrier Transmission System with Low Power Sleep Mode and Rapid-on-Capability	GB	EXPIRED	10011996.5	1/26/99		2302857	9/2/15	1/26/19
6936-28-PEP-3-DIV-2	Multicarrier Transmission System with Low Power Sleep Mode and Rapid-on-Capability	EP	EXPIRED	10012013.8	1/26/99	2330749	2330749	4/30/14	1/26/19
6936-28-PEP-3-DIV-2-DE	Multicarrier Transmission System with Low Power Sleep Mode and Rapid-on-Capability	DE	EXPIRED	10012013.8	1/26/99		2330749	4/30/14	1/26/19
6936-28-PEP-3-DIV-2-FR	Multicarrier Transmission System with Low Power Sleep Mode and Rapid-on-Capability	FR	EXPIRED	10012013.8	1/26/99		2330749	4/30/14	1/26/19

6936-28-PEP-3-DIV-2-GB	Multicarrier Transmission System with Low Power Sleep Mode and Rapid-on-Capability	GB	EXPIRED	10012013.8	1/26/99		2330749	4/30/14	1/26/19
6936-28-PIP	MULTICARRIER TRANSMISSION SYSTEM WITH LOW POWERSLEEP MODE AND RAPID-ON CAPABILITY	JP	EXPIRED	2000-396705	1/26/99	2003-518341	4282907	3/27/09	1/26/19
6936-28-PIP-DIV	MULTICARRIER TRANSMISSION SYSTEM WITH LOW POWERSLEEP MODE AND RAPID-ON CAPABILITY	JP	ABANDONED	2008-323651	1/26/99	N/A			1/26/19
6936-28-PKR	MULTICARRIER TRANSMISSION SYSTEM WITH LOW POWERSLEEP MODE AND RAPID-ON CAPABILITY	KR	ABANDONED	7009402/2001	1/26/99	10-2001-0108132			5/15/06
6936-28-PROV	MULTICARRIER TRANSMISSION SYSTEM WITH LOW POWERSLEEP MODE AND RAPID-ON CAPABILITY	US	EXPIRED	60/072,447	1/26/98	N/A			1/26/99
6936-55-PAU	Initialization in the Presence of Impulse Noise	AU	ISSUED	2005295758	10/14/05	AU 2005295758	2005295758	7/9/10	10/14/25
6936-55-PAU-2	Initialization in the Presence of Impulse Noise	AU	ABANDONED	2010202626	10/14/05	AU 2010202626			6/27/11
6936-55-PCA	DMT Symbol Repetition in the Presence of Impulse Noise	CA	ISSUED	2,582,106	10/14/05	2,582,106	2,582,106	4/28/15	10/14/25
6936-55-PCA-DIV	DMT Symbol Repetition in the Presence of Impulse Noise	CA	ABANDONED	2,881,036	10/14/05		2,881,036	12/22/15	9/8/20
6936-55-PCA-DIV-2	DMT Symbol Repetition in the Presence of Impulse Noise	CA	ABANDONED	2,906,478	10/14/05		2,906,478	1/8/19	10/14/25
6936-55-PCN	Initialization in the Presence of Impulse Noise	CN	ISSUED	200580034464.3	10/14/05	CN101040480A	200580034464.3	8/31/11	10/14/25
6936-55-PCN-HK	DMT Symbol Repetition in the Presence of Impulse Noise	HK	ISSUED	08102934.7	10/14/05	HK 1108783	HK1108783	12/16/11	10/14/25
6936-55-PCT	DMT Symbol Repetition in the Presence of Impulse Noise	WO	NAT PHASE	PCT/US05/36815	10/14/05	WO 2006/044533 A1			
6936-55-PEP	DMT SYMBOL REPETITION IN THE PRESENCE OF IMPULSE NOISE	EP	ISSUED	05810124.7	10/14/05	1800427	1800427	6/20/12	10/14/25
6936-55-PEPBE	Initialization in the Presence of Impulse Noise	BE	ISSUED	05810124.7	10/14/05		1800427	6/20/12	10/14/25
6936-55-PEPCH	Initialization in the Presence of Impulse Noise	CH	ABANDONED	05810124.7	10/14/05		1800427	6/20/12	9/8/20
6936-55-PEPDE	Initialization in the Presence of Impulse Noise	DE	ISSUED	05810124.7	10/14/05		1800427	6/20/12	10/14/25
6936-55-PEPDK	Initialization in the Presence of Impulse Noise	DK	ABANDONED	05810124.7	10/14/05		1800427	6/20/12	10/14/25
6936-55-PEPES	Initialization in the Presence of Impulse Noise	ES	ISSUED	05810124.7	10/14/05		1800427	6/20/12	10/14/25
6936-55-PEPFR	Initialization in the Presence of Impulse Noise	FR	ISSUED	05810124.7	10/14/05		1800427	6/20/12	10/14/25
6936-55-PEPGB	Initialization in the Presence of Impulse Noise	GB	ISSUED	05810124.7	10/14/05		1800427	6/20/12	10/14/25
6936-55-PEPHK	Initialization in the Presence of Impulse Noise	HK	ISSUED	07112380.6	10/14/05	HK 1103889	1103889	12/28/12	10/14/25
6936-55-PEPIT	Initialization in the Presence of Impulse Noise	IT	ISSUED	05810124.7	10/14/05		1800427	6/20/12	10/14/25
6936-55-PEPNL	Initialization in the Presence of Impulse Noise	NL	ISSUED	05810124.7	10/14/05		1800427	6/20/12	10/14/25
6936-55-PEPSE	Initialization in the Presence of Impulse Noise	SE	ABANDONED	05810124.7	10/14/05		1800427	6/20/12	10/14/25
6936-55-PEP-DIV	Initialization in the Presence of Impulse Noise	EP	ISSUED	11000980.0	10/14/05	2312784	2312784	2/1/17	10/14/25
6936-55-PEP-DIV-DE	Initialization in the Presence of Impulse Noise	DE	ISSUED	11000980.0	10/14/05		2312784	2/1/17	10/14/25
6936-55-PEP-DIV-FR	Initialization in the Presence of Impulse Noise	FR	ISSUED	11000980.0	10/14/05		2312784	2/1/17	10/14/25
6936-55-PEP-DIV-GB	Initialization in the Presence of Impulse Noise	GB	ISSUED	11000980.0	10/14/05		2312784	2/1/17	10/14/25
6936-55-PEP-DIV-2	Initialization in the Presence of Impulse Noise	EP	PUBLISHED	17020039.8	10/14/05	3220567			10/14/25
6936-55-PEP-DIV-2-HK	Initialization in the Presence of Impulse Noise	HK	PUBLISHED	18100419.3	10/14/15	1241167			10/14/35
6936-55-PIN	Initialization in the Presence of Impulse Noise	IN	ABANDONED	1209/KOLNP/2007	10/14/05	IN 1209/KOLNP/2007			10/15/24
6936-55-PIP	DMT Symbol Repetition in the Presence of Impulse Noise	JP	ABANDONED	2007-536883	10/14/05	2008-517535			4/15/13
6936-55-PIP-DIV	DMT Symbol Repetition in the Presence of Impulse Noise	JP	ABANDONED	2008-264367	10/14/05	2009-081862			4/15/13
6936-55-PKR	DMT SYMBOL REPETITION IN THE PRESENCE OF IMPULSE NOISE	KR	ISSUED	10-2007-7008275	10/14/05	10-2007-0061867	10-1272404	5/31/13	10/14/25
6936-55-PKR-DIV	DMT Symbol Repetition in the Presence of Impulse Noise	KR	ISSUED	10-2010-7022479	10/14/05	10-2010/0121542	10-1314976	9/27/13	10/14/25
6936-55-PKR-DIV-2	DMT Symbol Repetition in the Presence of Impulse Noise	KR	ABANDONED	10-2012-7021605	10/14/05				4/16/13
6936-55-PROV	XDSL INITIALIZATION IN THE PRESENCE OF IMPULSE NOISE	US	EXPIRED	60/619,618	10/15/04	N/A			10/15/05
6936-55-PUS	DMT Symbol Repetition in the Presence of Impulse Noise	US	ISSUED	11/575,598	3/20/07	US 2007-0217491 A1	7,796,705	9/14/10	8/22/27
6936-55-PUS-CON	Impulse Noise Protection During Initialization	US	ISSUED	12/769,747	4/29/10	US 2010-0208842 A1	8,913,649	12/16/14	10/14/25
6936-55-PUS-CON-2	DMT Symbol Repetition in the Presence of Impulse Noise	US	ISSUED	14/559,136	12/3/14	US 2015-0146821 A1	9,621,198	4/11/17	10/14/25
6936-55-PUS-CON-3	DMT SYMBOL REPETITION IN THE PRESENCE OF IMPULSE NOISE	US	ABANDONED	15/479,866	4/5/17	US 2017-0214487 A1			9/12/19
6936-55-PUS-CON-4	DMT SYMBOL REPETITION IN THE PRESENCE OF IMPULSE NOISE	US	PUBLISHED	16/569,144	9/12/19	US 2020-0007268 A1			10/14/25
6936-57-PAU	Packet Retransmission and Memory Sharing	AU	ABANDONED	2007257055	4/12/07	AU 2007257055			4/12/27
6936-57-PBR	Packet Retransmission and Memory Sharing	BR	ISSUED	PI-0709871-5	4/12/07	BR P10709871	PI 0709871-5	10/15/19	10/15/29
6936-57-PCA	Packet Retransmission and Memory Sharing	CA	ISSUED	2,647,589	4/12/07	CA 2647589	2,647,589	8/21/18	4/12/27

6936-57-PCA-DIV	Packet Retransmission and Memory Sharing	CA	PENDING	3,011,163	4/12/07				4/12/27
6936-57-PCN	Packet Retransmission and Memory Sharing	CN	ABANDONED	200780012891.0	4/12/07	CNI01421992A			4/16/13
6936-57-PCN-HK	Packet Retransmission and Memory Sharing	HK	ABANDONED	09109954.6	4/12/07	HK 1133132			4/16/13
6936-57-PCD	Packet Retransmission and Memory Sharing	CO	ABANDONED	08-109.377	4/12/07	08-109.377			4/12/27
6936-57-PCT	Packet Retransmission and Memory Sharing	WO	NAT PHASE	PCT/US07/66522	4/12/07	WO 2007/143277			
6936-57-PEP	Packet Retransmission and Memory Sharing	EP	ISSUED	07811844.5	4/12/07	2005674	2005674	9/28/16	4/12/27
6936-57-PEP-DE	Packet Retransmission and Memory Sharing	DE	ISSUED	07811844.5	4/12/07		2005674	9/28/16	4/12/27
6936-57-PEP-FR	Packet Retransmission and Memory Sharing	FR	ISSUED	07811844.5	4/12/07		2005674	9/28/16	4/12/27
6936-57-PEP-GB	Packet Retransmission and Memory Sharing	GB	ISSUED	07811844.5	4/12/07		2005674	9/28/16	4/12/27
6936-57-PEP-DIV	Packet Retransmission and Memory Sharing	EP	ISSUED	10000017.3	4/12/07	2178254	2178254	2/8/17	4/12/27
6936-57-PEP-DIV-DE	Packet Retransmission and Memory Sharing	DE	ISSUED	10000017.3	4/12/07		2178254	2/8/17	4/12/27
6936-57-PEP-DIV-FR	Packet Retransmission and Memory Sharing	FR	ISSUED	10000017.3	4/12/07		2178254	2/8/17	4/12/27
6936-57-PEP-DIV-GB	Packet Retransmission and Memory Sharing	GB	ISSUED	10000017.3	4/12/07		2178254	2/8/17	4/12/27
6936-57-PEP-DIV-HK	Packet Retransmission and Memory Sharing	HK	ABANDONED	10104429.1	4/12/07	HK 1136723			10/26/16
6936-57-PEP-DIV-2	Packet Retransmission and Memory Sharing	EP	ISSUED	10000016.5	4/12/07	2173071	2173071	6/26/13	4/12/27
6936-57-PEP-DIV-2-BE	Packet Retransmission and Memory Sharing	BE	ABANDONED	10000016.5	4/12/07		2173071	6/26/13	1/13/17
6936-57-PEP-DIV-2-DE	Packet Retransmission and Memory Sharing	DE	ABANDONED	10000016.5	4/12/07		2173071	6/26/13	1/13/17
6936-57-PEP-DIV-2-FR	Packet Retransmission and Memory Sharing	FR	ABANDONED	10000016.5	4/12/07		2173071	6/26/13	1/13/17
6936-57-PEP-DIV-2-GB	Packet Retransmission and Memory Sharing	GB	ABANDONED	10000016.5	4/12/07		2173071	6/26/13	1/13/17
6936-57-PEP-DIV-2-HK	Packet Retransmission and Memory Sharing	HK	ABANDONED	10103698.7	4/12/07	HK 1135537	1135537	11/15/13	1/13/17
6936-57-PEP-DIV-3	Packet Retransmission and Memory Sharing	EP	ISSUED	17020026.5	4/12/07	3190756	3190756	10/31/18	4/12/27
6936-57-PEP-DIV-3-DE	Packet Retransmission and Memory Sharing	DE	ISSUED	17020026.5	4/12/07		3190756	10/31/18	4/12/27
6936-57-PEP-DIV-3-FR	Packet Retransmission and Memory Sharing	FR	ISSUED	17020026.5	4/12/07		3190756	10/31/18	4/12/27
6936-57-PEP-DIV-3-GB	Packet Retransmission and Memory Sharing	GB	ISSUED	17020026.5	4/12/07		3190756	10/31/18	4/12/27
6936-57-PEP-DIV-4	Packet Retransmission and Memory Sharing	EP	PUBLISHED	17020525.6	4/12/07	3301871			4/12/27
6936-57-PEP-DIV-4-HK	Packet Retransmission and Memory Sharing	HK	PENDING	18110134.6	4/12/07				4/12/27
6936-57-PIN	Packet Retransmission and Memory Sharing	IN	ABANDONED	4084/KOLNP/2008	4/12/07	IN 4084/KOLNP/2008			4/12/27
6936-57-PIP	6936and Memory Sharing	JP	ABANDONED	2009-505623	4/12/07	2009-533973			2/27/12
6936-57-PIP-DIV	Packet Retransmission and Memory Sharing	JP	ABANDONED	2010-017356	4/12/07	2010-136427			10/2/12
6936-57-PIP-DIV-2	Packet Retransmission and Memory Sharing	JP	ISSUED	2012-042978	4/12/07	2012-151863	5486621	2/28/14	4/12/27
6936-57-PIP-DIV-3	Packet Retransmission and Memory Sharing	JP	ISSUED	2013-246257	4/12/07	2014-090433	5948307	6/10/16	4/12/27
6936-57-PKR	Packet Retransmission and Memory Sharing	KR	ISSUED	10-2008-7024792	4/12/07	10-2008-0108127	10-1736999	5/11/17	4/12/27
6936-57-PKR-DIV	Packet Retransmission and Memory Sharing	KR	ABANDONED	10-2014-7005299	4/12/07				6/20/16
6936-57-PKR-DIV-2	Packet Retransmission and Memory Sharing	KR	ABANDONED	10-2017-7012757	4/12/07				1/12/18
6936-57-PKR-DIV-3	Packet Retransmission and Memory Sharing	KR	ISSUED	10-2017-7036067	4/12/07		10-1952812	2/21/19	4/12/27
6936-57-PKR-DIV-4	Packet Retransmission and Memory Sharing	KR	ISSUED	10-2019-7005116	4/12/07		10-2151398	8/28/20	4/12/27
6936-57-PMX	Packet Retransmission and Memory Sharing	MX	ISSUED	MX/a/2008/012505	4/12/07	MX 2008012505	301471	7/18/12	4/12/27
6936-57-PMX-DIV	Packet Retransmission and Memory Sharing	MX	ABANDONED	MX/a/2011/005751	4/12/07				4/12/27
6936-57-PROV	XDSL PACKET RETRANSMISSION MECHANISM	US	EXPIRED	60/792,236	4/12/06	N/A			4/12/07
6936-57-PUS	Packet Retransmission and Memory Sharing	US	ISSUED	12/295,828	10/2/08	US 2009-0300450 A1	8,335,956	12/18/12	10/11/25
6936-57-PUS-CON	Packet Retransmission and Memory Sharing	US	ISSUED	12/783,758	5/20/10	US 2011-0002331 A1	8,407,546	3/26/13	7/23/28
6936-57-PUS-CON-2	Packet Retransmission and Memory Sharing	US	ISSUED	13/766,059	2/13/13	US 2013-0163592 A1	8,645,784	2/4/14	4/12/27
6936-57-PUS-CON-3	Packet Retransmission and Memory Sharing	US	ISSUED	14/159,125	1/20/14	US 2014-0133491 A1	9,485,055	11/1/16	4/12/27
6936-57-PUS-CON-4	PACKET RETRANSMISSION AND MEMORY SHARING	US	ISSUED	15/298,526	10/20/16	US 2017-0041224 A1	10,044,473	8/7/18	4/12/27
6936-57-PUS-CON-5	PACKET RETRANSMISSION AND MEMORY SHARING	US	ISSUED	16/046,494	7/26/18	US 2018-0331790 A1	10,484,140	11/19/19	10/11/25
6936-57-PUS-CON-6	PACKET RETRANSMISSION AND MEMORY SHARING	US	PUBLISHED	16/561,835	9/5/19	US 2019-0393991 A1			4/12/27
6936-57-PUS-DIV	Packet Retransmission	US	ISSUED	12/760,728	4/15/10	US 2010-0205501 A1	8,595,577	11/26/13	8/28/27
6936-57-PUS-DIV-CON	Packet Retransmission	US	ISSUED	12/783,765	5/20/10	US 2010-0332935 A1	8,468,411	6/18/13	10/11/25
6936-57-PUS-DIV-CON-2	Packet Retransmission	US	ISSUED	14/075,194	11/8/13	US 2014-0068366 A1	9,094,348	7/28/15	4/12/27
6936-57-PUS-DIV-CON-3	Packet Retransmission	US	ISSUED	14/742,334	6/17/15	US 2015-0312001 A1	9,749,235	8/29/17	4/12/27

6936-57-PUS-DIV-CON-4	Packet Retransmission	US	ISSUED	15/678,870	8/16/17	US 2017-0373971 A1	10,498,495	12/3/19	4/12/27
6936-57-PUS-DIV-CON-5	TECHNIQUES FOR PACKET AND MESSAGE COMMUNICATION IN A MULTICARRIER TRANSCIVER ENVIRONMENT	US	ISSUED	16/701,343	12/3/19	US 2020-0106558 A1	10,833,809	11/10/20	4/12/27
6936-57-PUS-DIV-CON-6	PACKET RETRANSMISSION	US	PENDING	17/027,196	9/21/20				4/12/27
6936-59-PROV	xDSL Packet Retransmission Mechanism With Examples	US	EXPIRED	60/849,650	10/5/06	N/A			10/5/07
6936-26	SYSTEMS AND METHODS FOR A MULTICARRIER MODULATION SYSTEM WITH A VARIABLE MARGIN	US	ABANDONED	09/836,295	4/18/01	US 2002-0009155			10/4/05
6936-26-CON	SYSTEMS AND METHODS FOR A MULTICARRIER MODULATION SYSTEM WITH A VARIABLE MARGIN	US	ABANDONED	11/242,024	10/4/05	US 2006-0018395 A1			4/18/21
6936-26-CON-2	Systems and Methods for a Multicarrier Modulation System with a Variable Margin	US	ABANDONED	11/972,340	1/10/08	US 2008-0107204 A1			7/27/11
6936-26-CON-3	Systems and Methods for a Multicarrier Modulation System with a Variable Margin	US	ISSUED	12/694,143	1/26/10	US 2010-0128810 A1	8,374,226	2/12/13	7/3/21
6936-26-CON-4	Systems and Methods for a Multicarrier Modulation System with a Variable Margin	US	ABANDONED	13/467,392	5/9/12	US 2012-0219047 A1			4/18/21
6936-26-CON-5	Systems and Methods for a Multicarrier Modulation System with a Variable Margin	US	ISSUED	13/764,529	2/11/13	US 2013-0148708 A1	8,625,660	1/7/14	4/18/21
6936-26-CON-6	Systems and Methods for a Multicarrier Modulation System with a Variable Margin	US	ISSUED	14/079,285	11/13/13	US 2014-0072062 A1	8,937,988	1/20/15	4/18/21
6936-26-CON-7	Systems and Methods for a Multicarrier Modulation System with a Variable Margin	US	ISSUED	14/591,612	1/7/15	US 2015-0117557 A1	9,154,354	10/6/15	4/18/21
6936-26-CON-8	SYSTEMS AND METHODS FOR A MULTICARRIER MODULATION SYSTEM WITH A VARIABLE MARGIN	US	ABANDONED	14/865,966	9/25/15	US 2016-0013962 A1			12/13/16
6936-26-CON-9	SYSTEMS AND METHODS FOR A MULTICARRIER MODULATION SYSTEM WITH A VARIABLE MARGIN	US	ISSUED	15/348,372	11/10/16	US 2017-0078129 A1	9,893,921	2/13/18	4/18/21
6936-26-CON-10	SYSTEMS AND METHODS FOR A MULTICARRIER MODULATION SYSTEM WITH A VARIABLE MARGIN	US	ISSUED	15/886,295	2/1/18	US 2018-0159711 A1	10,708,104	7/7/20	4/18/21
6936-26-PAU	MULTICARRIER MODULATION SYSTEM WITH VARIABLE MARGIN TO ACCOUNT FOR TIME VARYING IMPAIRMENTS	AU	ABANDONED	2001257081	4/18/01	N/A			
6936-26-PAU-CON	Data Allocation With Variable SNR Margins	AU	ISSUED	2007200448	4/18/01	AU 2007200448	2007200448	8/6/09	4/18/21
6936-26-PAU-CON-2	Data Allocation With Variable SNR Margins	AU	ABANDONED	2009202880	4/18/05	AU 2009202880			10/18/11
6936-26-PCA	MULTICARRIER MODULATION SYSTEM WITH VARIABLE MARGIN TO ACCOUNT FOR TIME VARYING IMPAIRMENTS	CA	ISSUED	2,406,151	4/18/01	CA 2405151	2,406,151	4/13/10	4/18/21
6936-26-PCA-2	DATA ALLOCATION WITH VARIABLE SNR MARGINS	CA	ABANDONED	2,689,952	4/18/01	CA 689952			2/24/11
6936-26-PCT	MULTICARRIER MODULATION SYSTEM WITH VARIABLE MARGIN TO ACCOUNT FOR TIME VARYING IMPAIRMENTS	WO	NAT PHASE	PCT/US01/12555	4/18/01	WO 2001/080510			
6936-26-PEP	MULTICARRIER MODULATION SYSTEM WITH VARIABLE MARGIN TO ACCOUNT FOR TIME VARYING IMPAIRMENTS	EP	ABANDONED	01930554.9	4/18/01	EP 1275229	1275229	3/21/07	4/18/21
6936-26-PEPBE	Data Allocation With Variable SNR Margins	BE	ABANDONED	01930554.9	4/18/01	N/A	1275229	3/21/07	4/18/21
6936-26-PEPDE	Data Allocation With Variable SNR Margins	DE	ABANDONED	01930554.9	4/18/01	N/A	1275229	3/21/07	4/18/21
6936-26-PEPFR	Data Allocation With Variable SNR Margins	FR	ABANDONED	01930554.9	4/18/01	N/A	1275229	3/21/07	4/18/21
6936-26-PEPGB	Data Allocation With Variable SNR Margins	GB	ABANDONED	01930554.9	4/18/01	N/A	1275229	3/21/07	4/18/21
6936-26-PEP-DIV	Data Allocation With Variable SNR Margins	EP	ISSUED	07005676.7	4/18/01	1830535	1830535	6/15/11	4/18/21
6936-26-PEP-DIV-BE	Data Allocation With Variable SNR Margins	BE	ISSUED	07005676.7	4/18/01	N/A	1830535	9/5/07	4/18/21
6936-26-PEP-DIV-DE	Data Allocation With Variable SNR Margins	DE	ISSUED	07005676.7	4/18/01		1830535	6/15/11	4/18/21
6936-26-PEP-DIV-FR	Data Allocation With Variable SNR Margins	FR	ISSUED	07005676.7	4/18/01	N/A	1830535	9/5/07	4/18/21
6936-26-PEP-DIV-GB	Data Allocation With Variable SNR Margins	GB	ISSUED	07005676.7	4/18/01	N/A	1830535	9/5/07	4/18/21
6936-26-PEP-DIV-2	MULTICARRIER MODULATION SYSTEM WITH VARIABLE MARGIN TO ACCOUNT FOR TIME VARYING IMPAIRMENTS	EP	ABANDONED	10011998.1	4/18/01	2267963			4/18/21
6936-26-PJP	MULTICARRIER MODULATION SYSTEM WITH VARIABLE MARGIN TO ACCOUNT FOR TIME VARYING IMPAIRMENTS	JP	ABANDONED	2001-576639	4/18/01	2004-501535			4/18/21
6936-26-PKR	MULTICARRIER MODULATION SYSTEM WITH VARIABLE MARGIN TO ACCOUNT FOR TIME VARYING IMPAIRMENTS	KR	ABANDONED	2002-7013983	4/18/01	10-2002-087990			4/18/21
6936-26-PROV	MULTICARRIER MODULATION SYSTEM WITH VARIABLE MARGIN TO ACCOUNT FOR TIME VARYING IMPAIRMENTS	US	EXPIRED	60/197,727	4/18/00	N/A			4/18/01

6936-7-CON	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	US	ABANDONED	10/202,688	7/25/02	US 2003-0007509			7/13/06
6936-7-PAU	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	AU	EXPIRED	48339/99	6/25/99	AU 4833999	750898	11/21/02	6/25/19
6936-7-PAU-2	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	AU	EXPIRED	2002301627	6/25/99	AU 2002301627	2002301627	8/6/04	6/25/19
6936-7-PAU-3	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	AU	ABANDONED	2004203322	6/25/99	AU 2004203322	2004203322	10/11/07	5/4/17
6936-7-PAU-4	Multicarrier Communication With Variable Overhead Rate	AU	ABANDONED	2007202930	6/25/99	AU 2007202930			6/25/19
6936-7-PAU-4-DIV	Multicarrier Communication With Variable Overhead Rate	AU	ABANDONED	2010249199	6/25/99	AU 2010249199			6/25/19
6936-7-PCA	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	CA	ABANDONED	2,335,865	6/25/99	CA 2335865	2,335,865	12/16/08	3/10/17
6936-7-PCA-DIV	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	CA	EXPIRED	2,641,978	6/25/99	CA 2641978	2,641,978	1/6/15	6/25/19
6936-7-PCA-DIV-2	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	CA	EXPIRED	2,867,539	6/25/99		2,867,539	3/14/17	6/25/19
6936-7-PCT	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	WO	NAT PHASE	PCT/US99/14467	6/25/99	WO 2000/001127			
6936-7-PEP-2	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	EP	EXPIRED	04012683.1	6/25/99	1453268	1453268	3/8/06	6/25/19
6936-7-PEPAT-2	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	AT	EXPIRED	04012683.1	6/25/99	N/A	1453268	3/8/06	6/25/19
6936-7-PEPBE-2	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	BE	EXPIRED	04012683.1	6/25/99	N/A	1453268	3/8/06	6/25/19
6936-7-PEPCH-2	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	CH	EXPIRED	04012683.1	6/25/99	N/A	1453268	3/8/06	6/25/19
6936-7-PEPDE-2	Multicarrier Communication With Variable Overhead Rate	DE	EXPIRED	04012683.1	6/25/99	N/A	1453268	3/8/06	6/25/19
6936-7-PEPES-2	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	ES	EXPIRED	04012683.1	6/25/99	N/A	1453268	3/8/06	6/25/19
6936-7-PEPFI-2	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	FI	EXPIRED	04012683.1	6/25/99	N/A	1453268	3/8/06	6/25/19
6936-7-PEPFR-2	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	FR	EXPIRED	04012683.1	6/25/99	N/A	1453268	3/8/06	6/25/19
6936-7-PEPGB-2	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	GB	EXPIRED	04012683.1	6/25/99	N/A	1453268	3/8/06	6/25/19
6936-7-PEPGR-2	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	GR	EXPIRED	04012683.1	6/25/99	N/A	1453268	3/8/06	6/25/19
6936-7-PEPHK-2	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	HK	EXPIRED	05101665.7	6/25/99	HK 1068080	HK1068080	5/6/06	6/25/19
6936-7-PEPIE-2	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	IE	EXPIRED	04012683.1	6/25/99	N/A	1453268	3/8/06	6/25/19
6936-7-PEPIT-2	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	IT	EXPIRED	04012683.1	6/25/99	N/A	1453268	3/8/06	6/25/19
6936-7-PEPNL-2	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	NL	EXPIRED	04012683.1	6/25/99	N/A	1453268	3/8/06	6/25/19
6936-7-PEPSE-2	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	SE	EXPIRED	04012683.1	6/25/99	N/A	1453268	3/8/06	6/25/19
6936-7-PEP-3	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	EP	EXPIRED	06004566.3	6/25/99	EP 1667392	1667392	1/10/18	6/25/19
6936-7-PEP-3-DE	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	DE	EXPIRED	06004566.3	6/25/99		1667392	1/10/18	6/25/19
6936-7-PEP-3-FR	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	FR	EXPIRED	06004566.3	6/25/99		1667392	1/10/18	6/25/19
6936-7-PEP-3-GB	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	GB	EXPIRED	06004566.3	6/25/99		1667392	1/10/18	6/25/19
6936-7-PEP-3-HK	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	HK	EXPIRED	06112790.1	6/25/99	1091070	HK1091070	6/22/18	6/25/19
6936-7-PEP-3-DIV-1	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	EP	EXPIRED	10011974.2	6/25/99	2278765	2278765	11/7/18	6/25/19
6936-7-PEP-3-DIV-1-AT	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	AT	EXPIRED	10011974.2	6/25/99		2278765	11/7/18	6/25/19
6936-7-PEP-3-DIV-1-BE	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	BE	EXPIRED	10011974.2	6/25/99		2278765	11/7/18	6/25/19
6936-7-PEP-3-DIV-1-CH	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	CH	EXPIRED	10011974.2	6/25/99		2278765	11/7/18	6/25/19
6936-7-PEP-3-DIV-1-DE	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	DE	EXPIRED	10011974.2	6/25/99	2278765	DE 699 45 900.1	11/7/18	6/25/19
6936-7-PEP-3-DIV-1-ES	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	ES	EXPIRED	10011974.2	6/25/99		2278765	11/7/18	6/25/19
6936-7-PEP-3-DIV-1-FI	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	FI	EXPIRED	10011974.2	6/25/99		2278765	11/7/18	6/25/19
6936-7-PEP-3-DIV-1-FR	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	FR	EXPIRED	10011974.2	6/25/99		2278765	11/7/18	6/25/19
6936-7-PEP-3-DIV-1-GB	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	GB	EXPIRED	10011974.2	6/25/99		2278765	11/7/18	6/25/19
6936-7-PEP-3-DIV-1-GR	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	GR	EXPIRED	10011974.2	6/25/99		2278765	11/7/18	6/25/19
6936-7-PEP-3-DIV-1-IE	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	IE	EXPIRED	10011974.2	6/25/99		2278765	11/7/18	6/25/19
6936-7-PEP-3-DIV-1-IT	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	IT	EXPIRED	10011974.2	6/25/99		2278765	11/7/18	6/25/19
6936-7-PEP-3-DIV-1-NL	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	NL	EXPIRED	10011974.2	6/25/99		2278765	11/7/18	6/25/19
6936-7-PEP-3-DIV-1-SE	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	SE	EXPIRED	10011974.2	6/25/99		2278765	11/7/18	6/25/19
6936-7-PEP-3-DIV-2	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	EP	EXPIRED	10011980.9	6/25/99	2278766	2278766	11/7/18	6/25/19
6936-7-PEP-3-DIV-2-DE	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	DE	EXPIRED	10011980.9	6/25/99	2278766	DE 699 45 902.8	11/7/18	6/25/19
6936-7-PEP-3-DIV-2-FR	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	FR	EXPIRED	10011980.9	6/25/99		2278766	11/7/18	6/25/19
6936-7-PEP-3-DIV-2-GB	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	GB	EXPIRED	10011980.9	6/25/99		2278766	11/7/18	6/25/19

6936-7-PEP-3-DIV-3	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	EP	EXPIRED	10011981.7	6/25/99	2278767	2278767	11/7/18	6/25/19
6936-7-PEP-3-DIV-3-DE	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	DE	EXPIRED	10011981.7	6/25/99	2278767	DE 699 45 903.6	11/7/18	6/25/19
6936-7-PEP-3-DIV-3-FR	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	FR	EXPIRED	10011981.7	6/25/99		2278767	11/7/18	6/25/19
6936-7-PEP-3-DIV-3-GB	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	GB	EXPIRED	10011981.7	6/25/99		2278767	11/7/18	6/25/19
6936-7-PKR	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	KR	ABANDONED	2000-7014830	6/25/99	10-2001-0053220	10-0955169	4/20/10	3/10/17
6936-7-PKR-2	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	KR	EXPIRED	10-2010-7002843	6/25/99	10-2010-0031635	10-1006609	12/30/10	6/25/19
6936-7-PKR-3	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	KR	ABANDONED	10-2010-7021589	6/25/99	10-2010-0121683			6/25/19
6936-7-PROV	MULTICARRIER COMMUNICATION WITH VARIABLE OVERHEAD RATE	US	EXPIRED	60/090,891	6/26/98	N/A			6/26/99
6936-3	SYSTEM AND METHOD FOR THE APPLICATION OF AN LMS METHOD TO UPDATING AN ECHO CANCELLER IN AN ADSL MODEM	US	ABANDONED	09/768,275	1/25/01	US 2001-0040875			8/25/05
6936-3-CON	SYSTEM AND METHOD FOR THE APPLICATION OF AN LMS METHOD TO UPDATING AN ECHO CANCELLER IN AN ADSL MODEM	US	ABANDONED	11/058,289	2/16/05	US 2005-0141441 A1			5/9/06
6936-3-CON-2	SYSTEM AND METHOD FOR THE APPLICATION OF AN LMS METHOD TO UPDATING AN ECHO CANCELLER IN AN ADSL MODEM	US	ABANDONED	11/430,251	5/9/06	US 2006-0215587 A1			12/10/10
6936-3-CON-3	SYSTEM AND METHOD FOR THE APPLICATION OF AN LMS METHOD TO UPDATING AN ECHO CANCELLER IN AN ADSL MODEM	US	ISSUED	12/783,740	5/20/10	US 2010-0296663 A1	8,391,191	3/5/13	1/29/21
6936-3-CON-4	SYSTEM AND METHOD FOR THE APPLICATION OF AN LMS METHOD TO UPDATING AN ECHO CANCELLER IN AN ADSL MODEM	US	ABANDONED	12/783,744	5/20/10	N/A			2/18/11
6936-3-CON-5	SYSTEM AND METHOD FOR THE APPLICATION OF AN LMS METHOD TO UPDATING AN ECHO CANCELLER IN AN ADSL MODEM	US	ISSUED	13/772,516	2/21/13	US 2013-0163749 A1	8,649,305	2/11/14	1/25/21
6936-3-CON-6	System and Method for the Application of an LMS Method to Updating an Echo Canceller in an ADSL Modem	US	ISSUED	14/164,632	1/27/14	US 2014-0140499 A1	9,065,886	6/23/15	1/25/21
6936-3-CON-7	SYSTEM AND METHOD FOR THE APPLICATION OF AN LMS METHOD TO UPDATING AN ECHO CANCELLER IN A MULTICARRIER TRANSMITTER	US	ABANDONED	14/724,345	5/28/15	US 2015-0288808 A1			11/4/16
6936-3-PAU	SYSTEM AND METHOD FOR THE APPLICATION OF AN LMS METHOD TO UPDATING AN ECHO CANCELLER COEFFICIENTS IN AN ADSL MODEM	AU	ABANDONED	32943/01	1/25/01	AU 3294301	783527	2/16/06	1/4/17
6936-3-PCA	System and Method for the Application of an LMS Method to Updating an Echo Canceller in an ADSL Modem	CA	ABANDONED	2,396,162	1/25/01	CA 2396162			4/25/12
6936-3-PCT	APPLICATION OF LMS METHOD TO UPDATING ECHO CANCELLER COEFFICIENTS IN ADSL MODEM	WO	NAT PHASE	PCT/US01/02341	1/25/01	WO 2001/056184			
6936-3-PEP	APPLICATION OF LMS METHOD TO UPDATING ECHO CANCELLER COEFFICIENTS IN ADSL MODEM	EP	ABANDONED	01905022.8	1/25/01	EP 1250766	1250766	9/17/08	12/12/19
6936-3-PEP-BE	APPLICATION OF LMS METHOD TO UPDATING ECHO CANCELLER COEFFICIENTS IN ADSL MODEM	BE	ABANDONED	01905022.8	1/25/01	N/A	1250766	9/17/08	12/12/19
6936-3-PEP-DE	APPLICATION OF LMS METHOD TO UPDATING ECHO CANCELLER COEFFICIENTS IN ADSL MODEM	DE	ABANDONED	01905022.8	1/25/01	N/A	1250766	9/17/08	12/12/19
6936-3-PEP-FR	APPLICATION OF LMS METHOD TO UPDATING ECHO CANCELLER COEFFICIENTS IN ADSL MODEM	FR	ABANDONED	01905022.8	1/25/01	N/A	1250766	9/17/08	12/12/19
6936-3-PEP-GB	APPLICATION OF LMS METHOD TO UPDATING ECHO CANCELLER COEFFICIENTS IN ADSL MODEM	GB	ABANDONED	01905022.8	1/25/01	N/A	1250766	9/17/08	12/12/19
6936-3-PEP-DIV	System and Method for the Application of an LMS Method to Updating an Echo Canceller in an ADSL Modem	EP	ABANDONED	08015818.1	1/25/01	1 995 884			1/25/21
6936-3-PEP-DIV-2	System and Method for the Application of an LMS Method to Updating an Echo Canceller in an ADSL Modem	EP	ABANDONED	10011999.9	1/25/01	226,791.3			1/25/21
6936-3-PIP	APPLICATION OF LMS METHOD TO UPDATING ECHO CANCELLER COEFFICIENTS IN ADSL MODEM	JP	ABANDONED	2001-555226	1/25/01	JP 2003-521194			1/25/21
6936-3-PKR	APPLICATION OF LMS METHOD TO UPDATING ECHO CANCELLER COEFFICIENTS IN ADSL MODEM	KR	ABANDONED	2002-7009465	1/25/01	10-2002-0069265			1/25/21
6936-3-PKR-DIV	APPLICATION OF LMS METHOD TO UPDATING ECHO CANCELLER COEFFICIENTS IN ADSL MODEM	KR	ABANDONED	10-2010-7006184	1/25/01	10-2010-0034063			1/25/21
6936-3-PROV	APPLICATION OF LMS METHOD TO UPDATING ECHO CANCELLER COEFFICIENTS IN ADSL MODEM	US	EXPIRED	60/177,944	1/25/00	N/A			1/25/01

6936-14	SYSTEMS AND METHODS FOR MULTICARRIER MODULATION USING MULTI-TAP FREQUENCY-DOMAIN EQUALIZER AND DECISION FEEDBACK	US	ISSUED	10/211,425	8/2/02	US 2003-0067865	6,760,373	7/6/04	8/2/22
6936-14-CDN	SYSTEMS AND METHODS FOR MULTICARRIER MODULATION USING MULTI-TAP FREQUENCY-DOMAIN EQUALIZER AND DECISION FEEDBACK	US	ABANDONED	10/834,193	4/29/04	US 2004-0202259			8/2/22
6936-14-CDN-2	Systems and Methods for Multicarrier Modulation Using Multi-Tap Frequency-Domain Equalizer and Decision Feedback	US	ISSUED	11/964,409	12/26/07	US 2008-0101452 A1	7,656,976	2/2/10	8/2/22
6936-14-CDN-3	SYSTEMS AND METHODS FOR MULTICARRIER MODULATION USING MULTI-TAP FREQUENCY-DOMAIN EQUALIZER AND DECISION FEEDBACK	US	ABANDONED	12/640,838	12/17/09	US 2010-0098149 A1			9/23/11
6936-14-CDN-4	SYSTEMS AND METHODS FOR MULTICARRIER MODULATION USING MULTI-TAP FREQUENCY-DOMAIN EQUALIZER AND DECISION FEEDBACK	US	ABANDONED	12/783,796	5/20/10	US 2010-0296570 A1			3/2/11
6936-14-CDN-5	SYSTEMS AND METHODS FOR MULTICARRIER MODULATION USING MULTI-TAP FREQUENCY-DOMAIN EQUALIZER AND DECISION FEEDBACK	US	ABANDONED	12/783,801	5/20/10	N/A			2/18/11
6936-14-PCT	SYSTEMS AND METHOD FOR MULTICARRIER MODULATION USING MULTI-TAP FREQUENCY-DOMAIN EQUALIZER AND DECISION FEEDBACK	WO	NAT PHASE	PCT/US02/24326	8/2/02	WO 2003/012990			
6936-14-PROV	MULTICARRIER MODULATION METHOD USING MULTI-TAP FREQUENCY-DOMAIN EQUALIZATION AND DECISION FEEDBACK	US	EXPIRED	60/309,631	8/2/01	N/A			8/2/02
6936-19	MULTI-CARRIER TRANSMITTER	US	EXPIRED	08/105,796	8/12/93	N/A	5,497,398	3/5/96	8/12/13
6936-19-PCT	MULTI-CARRIER TRANSMITTER	WO	NAT PHASE	PCT/US94/06713	6/13/94	WO 1995/005711			
6936-21	SYSTEMS AND METHODS FOR IMPLEMENTING RECEIVER TRANSPARENT Q-MODE	US	ISSUED	10/106,329	3/27/02	US 2002/0196861	6,731,695	5/4/04	3/27/21
6936-21-CDN	SYSTEMS AND METHODS FOR IMPLEMENTING RECEIVER TRANSPARENT Q-MODE	US	ABANDONED	10/802,867	3/18/04	US 2004-0184552 A1			11/10/05
6936-21-CDN-2	SYSTEMS AND METHODS FOR IMPLEMENTING RECEIVER TRANSPARENT Q-MODE	US	ABANDONED	11/200,002	8/10/05	US 2006-0039490 A1			8/7/06
6936-21-CDN-3	SYSTEMS AND METHODS FOR IMPLEMENTING RECEIVER TRANSPARENT Q-MODE	US	ABANDONED	11/434,249	5/16/06	US 2006-0203927 A1			3/27/22
6936-21-CDN-4	SYSTEMS AND METHODS FOR IMPLEMENTING RECEIVER TRANSPARENT Q-MODE	US	ISSUED	11/674,871	2/14/07	US 2007-0147540 A1	7,558,329	7/7/09	3/27/22
6936-21-CDN-5	Systems and Methods for Implementing Receiver Transparent Q-Mode	US	ABANDONED	12/478,577	6/4/09	US 2009-0290620 A1			7/25/11
6936-21-CDN-6	Systems and Methods for Implementing Receiver Transparent Q-Mode	US	ISSUED	12/783,749	5/20/10	US 2010-0290598 A1	8,335,271	12/18/12	3/27/22
6936-21-CDN-7	Systems and Methods for Implementing Receiver Transparent Q-Mode	US	ABANDONED	12/783,755	5/20/10	US 2010-0296604 A1			3/27/22
6936-21-CDN-8	Systems and Methods for Implementing Receiver Transparent Q-Mode	US	ISSUED	13/693,394	12/4/12	US 2013-0094609 A1	8,792,574	7/29/14	3/27/22
6936-21-CDN-9	RANDOMIZATION USING AN XOR SCRAMBLER IN MULTICARRIER COMMUNICATIONS	US	ISSUED	14/308,934	6/19/14	US 2014-0294116 A1	9,191,039	11/17/15	3/27/22
6936-21-CDN-10	SYSTEMS AND METHODS FOR IMPLEMENTING RECEIVER TRANSPARENT Q-MODE	US	ABANDONED	14/932,599	11/4/15	US 2016-0056857 A1			11/14/17
6936-21-CDN-11	SYSTEMS AND METHODS FOR IMPLEMENTING RECEIVER TRANSPARENT Q-MODE	US	ISSUED	15/812,705	11/14/17	US 2018-0069590 A1	10,419,059	9/17/19	3/27/22
6936-21-PAU	RECEIVER TRANSPARENT Q-MODE	AU	ABANDONED	2002248711	3/27/02	AU 2002248711			1/4/05
6936-21-PCA	RECEIVER TRANSPARENT Q-MODE	CA	ABANDONED	2,439,804	3/27/02	CA 2439804			
6936-21-PCT	RECEIVER TRANSPARENT Q-MODE	WO	NAT PHASE	PCT/US02/09411	3/27/02	WO02/078244			
6936-21-PEP	RECEIVER TRANSPARENT Q-MODE	EP	ABANDONED	02717728.6	3/27/02	EP 1374469			11/2/04
6936-21-PIP	RECEIVER TRANSPARENT Q-MODE	JP	ABANDONED	2002-576356	3/27/02	JP 2004-538676			3/10/05
6936-21-PKR	RECEIVER TRANSPARENT Q-MODE	KR	ABANDONED	2003-7012442	3/27/02	10-2004-0004562			3/27/02
6936-21-PROV-1	RECEIVER TRANSPARENT Q-MODE	US	EXPIRED	60/278,936	3/27/01	N/A			
6936-21-PROV-2	RECEIVER TRANSPARENT Q-MODE WITH ON-LINE RECONFIGURATION	US	EXPIRED	60/283,467	4/12/01	N/A			4/12/02
6936-21-PROV-3	RECEIVER TRANSPARENT Q-MODE WITH ON-LINE RECONFIGURATION AND SCRAMBLING	US	EXPIRED	60/287,968	5/1/01	N/A			5/1/02
6936-21-PROV-4	RECEIVER TRANSPARENT Q-MODE WITH ON-LINE RECONFIGURATION, SCRAMBLING AND Q-MODE SYMBOL DISTORTION	US	EXPIRED	60/293,034	5/23/01	N/A			5/23/02
6936-22	MULTI-CARRIER TRANSMISSION SYSTEM ADAPTED FOR PACKET DATA TRANSFER	US	EXPIRED	08/670,245	6/19/96	N/A	5,751,716	5/12/98	6/19/16
6936-22-PCT	MULTI-CARRIER TRANSMISSION SYSTEM ADAPTED FOR PACKET DATA TRANSFER	WO	NAT PHASE	PCT/US97/08756	5/17/97	WO 1997/049208			
6936-22-PEP	MULTI-CARRIER TRANSMISSION SYSTEM ADAPTED FOR PACKET DATA TRANSFER	EP	ABANDONED	97925713.6	5/17/97	N/A			9/5/00



6936-23	SYSTEMS AND METHODS THAT PROVIDE FREQUENCY DOMAIN SUPPLEMENTAL TRAINING OF THE TIME DOMAIN EQUALIZER FOR DMT	US	ISSUED	09/982,065	10/19/01	US 2002-0057734	7,180,938	2/20/07	10/14/23
6936-23-CON	Systems and Methods That Provide Frequency Domain Supplemental Training of the Time Domain Equalizer for DMT	US	ABANDONED	11/616,630	12/27/06	US 2007-0104262			10/19/21
6936-23-CON-2	Systems and Methods That Provide Frequency Domain Supplemental Training of the Time Domain Equalizer for DMT	US	ABANDONED	12/013,874	1/14/08	US 2008-0107164 A1	7,636,389	12/22/09	3/14/17
6936-23-CON-3	Systems and Methods That Provide Frequency Domain Supplemental Training of the Time Domain Equalizer for DMT	US	ABANDONED	12/615,077	11/9/09	US 2010-0054321 A1			2/28/11
6936-23-CON-4	Systems and Methods That Provide Frequency Domain Supplemental Training of the Time Domain Equalizer for DMT	US	ISSUED	12/783,783	5/20/10	US 2010-0290514 A1	8,102,909	1/24/12	10/19/21
6936-23-CON-5	Systems and Methods That Provide Frequency Domain Supplemental Training of the Time Domain Equalizer for DMT	US	ABANDONED	12/783,788	5/20/10	N/A			2/17/11
6936-23-CON-6	Systems and Methods That Provide Frequency Domain Supplemental Training of the Time Domain Equalizer for DMT	US	ABANDONED	13/330,943	12/20/11	US 2012-0087399 A1			9/19/13
6936-23-PCT	SYSTEMS AND METHODS THAT PROVIDE FREQUENCY DOMAIN SUPPLEMENTAL TRAINING OF THE TIME DOMAIN EQUALIZER FOR DMT	WO	NAT PHASE	PCT/US01/32503	10/19/01	WO 2002/033926			
6936-23-PROV	FREQUENCY DOMAIN SUPPLEMENTAL TRAINING OF THE TIME DOMAIN EQUALIZER FOR DMT	US	EXPIRED	60/241,664	10/19/00	N/A			10/19/01
6936-24	MULTICARRIER TRANSMISSION SYSTEM	US	EXPIRED	08/340,747	11/16/94	N/A	5,636,246	6/3/97	11/16/14
6936-24-PAU	MULTICARRIER TRANSMISSION SYSTEM	AU	EXPIRED	41666/96	11/17/95	AU 4166696	708,318	11/11/99	11/17/15
6936-24-PCT	MULTICARRIER TRANSMISSION SYSTEM	WO	NAT PHASE	PCT/US95/15115	11/17/95	WO 1997/026711			
6936-24-PGB	MULTICARRIER TRANSMISSION SYSTEM	GB	EXPIRED	9709849.5	11/17/95	GB 2320401	2320401	4/12/00	11/17/15
6936-25	BIT ALLOCATION AMONG CARRIERS IN MULTICARRIER COMMUNICATIONS	US	EXPIRED	09/600,971	7/20/00	N/A	6,870,888	3/22/05	11/23/19
6936-25-PAU	ALLOCATION OF COMMUNICATION BITS AMONG CARRIERS IN MULTICARRIER COMMUNICATIONS	AU	ABANDONED	18292/00	11/23/99	AU 1829200	754597	3/6/03	11/22/16
6936-25-PAU-2	ALLOCATION OF COMMUNICATION BITS AMONG CARRIERS IN MULTICARRIER COMMUNICATIONS	AU	ABANDONED	2002302029	11/18/02	AU 2002302029			11/19/03
6936-25-PCA	ALLOCATION OF COMMUNICATION BITS AMONG CARRIERS IN MULTICARRIER COMMUNICATIONS	CA	ABANDONED	2,350,916	11/23/99	CA 2350916	2,350,916	11/20/07	9/25/17
6936-25-PCA-DIV	Bit Allocation Among Carriers in Multicarrier Communications	CA	EXPIRED	2,599,805	11/23/99	CA 2599805	2,599,805	9/29/09	11/23/19
6936-25-PCT	ALLOCATION OF COMMUNICATION BITS AMONG CARRIERS IN MULTICARRIER COMMUNICATIONS	WO	NAT PHASE	PCT/US99/27798	11/23/99	WO 2000/031940			
6936-25-PEP	ALLOCATION OF COMMUNICATION BITS AMONG CARRIERS IN MULTICARRIER COMMUNICATIONS	EP	EXPIRED	99961782.2	11/23/99	1133858	1133858	6/30/04	11/23/19
6936-25-PEPGB	ALLOCATION OF COMMUNICATION BITS AMONG CARRIERS IN MULTICARRIER COMMUNICATIONS	GB	EXPIRED	99961782.2	11/23/99	N/A	1133858	6/30/04	11/23/19
6936-25-PEP-2	ALLOCATION OF COMMUNICATION BITS AMONG CARRIERS IN MULTICARRIER COMMUNICATIONS	EP	ABANDONED	04012682.3	11/23/99	1453267			11/23/19
6936-25-PEP-2-DIV-1	ALLOCATION OF COMMUNICATION BITS AMONG CARRIERS IN MULTICARRIER COMMUNICATIONS	EP	ABANDONED	10011993.2	11/23/99	2264932			11/23/19
6936-25-PJP	ALLOCATION OF COMMUNICATION BITS AMONG CARRIERS IN MULTICARRIER COMMUNICATIONS	JP	ABANDONED	2000-584658	11/23/99	2002-531010			11/23/19
6936-25-PJP-DIV	ALLOCATION OF COMMUNICATION BITS AMONG CARRIERS IN MULTICARRIER COMMUNICATIONS	JP	ABANDONED	2010-56580	11/23/99	2010-141931			11/23/19
6936-25-PKR	ALLOCATION OF COMMUNICATION BITS AMONG CARRIERS IN MULTICARRIER COMMUNICATIONS	KR	ABANDONED	2001-7006580	11/23/99	10-2001-0101081			11/23/19
6936-25-PROV	ALLOCATION OF COMMUNICATION BITS AMONG CARRIERS IN MULTICARRIER COMMUNICATIONS	US	EXPIRED	60/109,876	11/25/98	N/A			11/25/99
6936-30	MULTI-TAP FREQUENCY DOMAIN EQUALIZATION WITH DECISION FEEDBACK AND TRELLIS DECODING	US	ABANDONED	10/631,745	8/1/03	US 2004-0096008 A1			8/1/23
6936-30-DIV	MULTI-TAP FREQUENCY DOMAIN EQUALIZATION WITH DECISION FEEDBACK AND TRELLIS DECODING	US	ABANDONED	11/748,806	5/15/07	US 2007-0211812			6/20/11
6936-30-DIV-CON	MULTI-TAP FREQUENCY DOMAIN EQUALIZATION WITH DECISION FEEDBACK AND TRELLIS DECODING	US	ABANDONED	12/783,733	5/20/10	US 2010-0293442 A1			2/25/13
6936-30-DIV-CON-2	MULTI-TAP FREQUENCY DOMAIN EQUALIZATION WITH DECISION FEEDBACK AND TRELLIS DECODING	US	ABANDONED	12/783,737	5/20/10	US 2010-0299582 A1			2/25/13

6936-30-PCT	COMBINED MULTI-TAP FREQUENCY DOMAIN EQUALIZATION WITH DECISION FEEDBACK AND TRELLIS DECODING	WO	NAT PHASE	PCT/US03/23965	8/1/03	WO 2004/014032 A3			
6936-30-PROV	COMBINED MULTI-TAP FREQUENCY DOMAIN EQUALIZATION WITH DECISION FEEDBACK AND TRELLIS DECODING	US	EXPIRED	60/400,550	8/1/02	N/A			8/1/03
6936-36	A SYSTEM AND METHOD FOR TRANSMITTING MESSAGES BETWEEN TRANSCEIVERS USING ELECTROMAGNETICALLY COUPLED SIGNALS	US	ISSUED	09/616,954	7/14/00	N/A	6,748,016	6/8/04	7/5/22
6936-36-CON	SYSTEM AND METHOD FOR TRANSMITTING MESSAGES BETWEEN TRANSCEIVERS USING ELECTROMAGNETICALLY COUPLED SIGNALS	US	ABANDONED	10/743,946	12/24/03	US 2004-0136463 A1			8/27/04
6936-36-PAU	A SYSTEM AND METHOD FOR TRANSMITTING MESSAGES BETWEEN TRANSCEIVERS USING ELECTROMAGNETICALLY COUPLED SIGNALS	AU	ABANDONED	59347/00	7/14/00				1/13/05
6936-36-PCA	A SYSTEM AND METHOD FOR TRANSMITTING MESSAGES BETWEEN TRANSCEIVERS USING ELECTROMAGNETICALLY COUPLED SIGNALS	CA	ABANDONED	2378046	7/14/00				1/13/05
6936-36-PCT	A SYSTEM AND METHOD FOR TRANSMITTING MESSAGES BETWEEN TRANSCEIVERS USING ELECTROMAGNETICALLY COUPLED SIGNALS	WO	NAT PHASE	PCT/US00/19247	7/14/00				
6936-36-PEP	A SYSTEM AND METHOD FOR TRANSMITTING MESSAGES BETWEEN TRANSCEIVERS USING ELECTROMAGNETICALLY COUPLED SIGNALS	EP	ABANDONED	00945396.0	7/14/00				1/13/05
6936-36-PJP	A SYSTEM AND METHOD FOR TRANSMITTING MESSAGES BETWEEN TRANSCEIVERS USING ELECTROMAGNETICALLY COUPLED SIGNALS	JP	ABANDONED	2001-511007	7/14/00				1/13/05
6936-36-PKR	A SYSTEM AND METHOD FOR TRANSMITTING MESSAGES BETWEEN TRANSCEIVERS USING ELECTROMAGNETICALLY COUPLED SIGNALS	KR	ABANDONED	7000562/2002	7/14/00				1/13/05
6936-36-PROV	A SYSTEM AND METHOD FOR TRANSMITTING MESSAGES BETWEEN TRANSCEIVERS USING ELECTROMAGNETICALLY COUPLED SIGNALS	US	EXPIRED	60/144,562	7/16/99	N/A			7/16/00
6936-41	MULTI-CARRIER TRANSMISSION SYSTEM UTILIZING CHANNELS WITH DIFFERENT ERROR RATES	US	EXPIRED	08/661,974	6/12/96	N/A	5,832,030	11/3/98	6/12/16
6936-41-PCT	MULTI-CARRIER TRANSMISSION SYSTEM UTILIZING CHANNELS WITH DIFFERENT ERROR RATES	WO	NAT PHASE	PCT/US97/08222	5/17/97	WO 1997/48204			
6936-45	SINGLE SIDE-BAND MODULATION SYSTEM FOR USE IN DIGITALLY IMPLEMENTED MULTICARRIER TRANSMISSION SYSTEMS	US	EXPIRED	08/591,831	1/25/96	N/A	5,631,610	5/20/97	1/25/16
6936-45-PAU	SINGLE SIDE-BAND MODULATION SYSTEM FOR USE IN DIGITALLY IMPLEMENTED MULTICARRIER TRANSMISSION SYSTEMS	AU	EXPIRED	31342/97	5/17/97	AU 3134297	738201	1/3/02	5/17/17
6936-45-PCA	SINGLE SIDE-BAND MODULATION SYSTEM FOR USE IN DIGITALLY IMPLEMENTED MULTICARRIER TRANSMISSION SYSTEMS	CA	ABANDONED	2289537	5/17/97				7/12/04
6936-45-PCT	SINGLE SIDE-BAND MODULATION SYSTEM FOR USE IN DIGITALLY IMPLEMENTED MULTICARRIER TRANSMISSION SYSTEMS	WO	NAT PHASE	PCT/US97/08549	5/17/97	WO 1998/053552			
6936-45-PEP	SINGLE SIDE-BAND MODULATION SYSTEM FOR USE IN DIGITALLY IMPLEMENTED MULTICARRIER TRANSMISSION SYSTEMS	EP	ABANDONED	97926623.6	5/17/97				3/27/03
6936-45-PJP	SINGLE SIDE-BAND MODULATION SYSTEM FOR USE IN DIGITALLY IMPLEMENTED MULTICARRIER TRANSMISSION SYSTEMS	JP	ABANDONED	10-550313	5/17/97				5/6/04
6936-46	METHOD FOR PARTIALLY MODULATING AND DEMODULATING DATA IN A MULTICARRIER TRANSMISSION SYSTEM	US	EXPIRED	08/668,575	6/20/96	N/A	5,715,280	2/3/98	6/20/16
6936-46-PAU	METHOD FOR PARTIALLY MODULATING AND DEMODULATING DATA IN A MULTICARRIER TRANSMISSION SYSTEM	AU	EXPIRED	30673/97	5/17/97	AU 3067397	743020	5/2/02	5/17/17
6936-46-PCA	METHOD FOR PARTIALLY MODULATING AND DEMODULATING DATA IN A MULTICARRIER TRANSMISSION SYSTEM	CA	ABANDONED	2289529	5/17/97				6/17/03

6936-46-PCT	METHOD FOR PARTIALLY MODULATING AND DEMODULATING DATA IN A MULTICARRIER TRANSMISSION SYSTEM	WO	NAT PHASE	PCT/US97/08209	5/17/97	WO 1998/053572			
6936-46-PEP	METHOD FOR PARTIALLY MODULATING AND DEMODULATING DATA IN A MULTICARRIER TRANSMISSION SYSTEM	EP	ABANDONED	97925573.4	5/17/97				4/16/03
6936-46-PJP	METHOD FOR PARTIALLY MODULATING AND DEMODULATING DATA IN A MULTICARRIER TRANSMISSION SYSTEM	JP	ABANDONED	10-550306	5/17/97				5/13/04
6936-48	INTELLIGENT RATE OPTION DETERMINATION METHOD APPLIED TO ADSL TRANSCIVER	US	ISSUED	09/738,785	12/15/00	US 2001-003098 A1	6,801,570	10/5/04	12/15/20
6936-48-PROV	INTELLIGENT RATE OPTION DETERMINATION METHOD APPLIED TO ADSL TRANSCIVER	US	EXPIRED	60/172,343	12/16/99	N/A			12/16/00
6936-50	SYSTEMS AND METHODS FOR LDPC CODED MODULATION	US	ABANDONED	09/882,046	6/18/01	US 2002-0042899			5/31/05
6936-50-DIV	SYSTEMS AND METHODS FOR LDPC CODED MODULATION	US	ABANDONED	11/140,246	5/31/05	US 2005-0229088 A1			6/18/21
6936-50-DIV-2	SYSTEMS AND METHODS FOR LDPC CODED MODULATION	US	ABANDONED	12/383,056	3/19/09	US 2009-0183048 A1			4/20/16
6936-50-DIV-2-CON	SYSTEMS AND METHODS FOR LDPC CODED MODULATION	US	ABANDONED	12/783,825	5/20/10	US 2010-029573 A1			5/30/11
6936-50-DIV-2-CON-2	Systems and Methods for LDPC Coded Modulation	US	ABANDONED	12/783,839	5/20/10	US 2010-029574 A1			6/1/11
6936-50-DIV-3	SYSTEMS AND METHODS FOR LDPC CODED MODULATION	US	ABANDONED	15/077,506	3/22/16	US 2016-0204901 A1			1/13/17
6936-50-PAU	SYSTEMS AND METHODS FOR LDPC CODED MODULATION	AU	ABANDONED	2001267096	6/18/01	AU 2001267096			3/28/06
6936-50-PCA	SYSTEMS AND METHODS FOR LDPC CODED MODULATION	CA	ABANDONED	2,409,179	6/18/01	CA 2409179			2/24/11
6936-50-PCT	SYSTEMS AND METHODS FOR LDPC CODED MODULATION	WO	NAT PHASE	PCT/US01/41015	6/18/01	WO 2001/097387			
6936-50-PEP	SYSTEMS AND METHODS FOR LDPC CODED MODULATION	EP	ABANDONED	01944712.7	6/18/01	EP 1290802			
6936-50-PJP	SYSTEMS AND METHODS FOR LDPC CODED MODULATION	JP	ABANDONED	2002-511477	6/18/01	2004-503979			10/27/11
6936-50-PKR	SYSTEMS AND METHODS FOR LDPC CODED MODULATION	KR	ABANDONED	2002-7017148	6/18/01	10-2003-0036227			6/18/21
6936-50-PKR-DIV	SYSTEMS AND METHODS FOR LDPC CODED MODULATION	KR	ABANDONED	10-2010-7006498	6/18/01	10-2010-00469063			6/18/21
6936-50-PROV	LDPC CODED MODULATION	US	EXPIRED	60/212,233	6/16/00	N/A			6/16/01
6936-50-PROV-2	LOW DENSITY PARITY CHECK (LDPC) CODED MODULATION FOR ADSL	US	EXPIRED	60/241,468	10/18/00	N/A			10/18/01
6936-60-PCA	Stable Low Power Mode for Multicarrier Transceivers	CA	ABANDONED	2,706,362	11/21/08	CA 2706362			12/21/16
6936-60-PCN	Stable Low Power Mode for Multicarrier Transceivers	CN	ABANDONED	200880117277.5	11/21/08	CN101868551A	ZL200880117277.5	9/7/16	9/20/17
6936-60-PCN-DIV	Stable Low Power Mode for Multicarrier Transceivers	CN	ABANDONED	201310088357.5	11/21/08	CN103227767	ZL201310088357.5	4/12/17	9/20/17
6936-60-PCN-HK	Stable Low Power Mode for Multicarrier Transceivers	HK	ABANDONED	10110838.3	11/21/08	HK1144345			12/12/16
6936-60-PCT	Stable Low Power Mode for Multicarrier Transceivers	WO	NAT PHASE	PCT/US08/84322	11/21/08	WO 2009/067653			
6936-60-PEP	Stable Low Power Mode for Multicarrier Transceivers	EP	ABANDONED	08852660.3	11/21/08	EP 2223489	2223489	4/20/16	7/6/17
6936-60-PEP-DE	Stable Low Power Mode for Multicarrier Transceivers	DE	ABANDONED	08852660.3	11/21/08		2223489	4/20/16	7/6/17
6936-60-PEP-FR	Stable Low Power Mode for Multicarrier Transceivers	FR	ABANDONED	08852660.3	11/21/08		2223489	4/20/16	7/6/17
6936-60-PEP-GB	Stable Low Power Mode for Multicarrier Transceivers	GB	ABANDONED	08852660.3	11/21/08		2223489	4/20/16	7/6/17
6936-60-PEPHK	Stable Low Power Mode for Multicarrier Transceivers	HK	ABANDONED	10109672.4	11/21/08	HK 1143261			2/11/16
6936-60-PIN	Stable Low Power Mode for Multicarrier Transceivers	IN	ABANDONED	1800/KOLNP/2010	11/21/08				11/21/28
6936-60-PJP	Stable Low Power Mode for Multicarrier Transceivers	JP	ABANDONED	2010-535086	11/21/08	2011-504709			11/21/28
6936-60-PROV	Stable Low Power Mode for Multicarrier Transceivers	US	EXPIRED	60/989,542	11/21/07	N/A			11/21/08
6936-60-PLUS	Stable Low Power Mode for Multicarrier Transceivers	US	ISSUED	12/739,330	8/12/10	US 2010-0296555 A1	8,837,610	9/16/14	6/24/29
6936-60-PLUS-CON	Stable Low Power Mode for Multicarrier Transceivers	US	ABANDONED	14/485,937	9/15/14	US 2015-0003504 A1			5/10/16
6936-60-PLUS-CON-2	STABLE LOW POWER MODE FOR MULTICARRIER TRANSCIVERS	US	ABANDONED	15/084,788	3/30/16	US 2016-0212275 A1			6/7/17
6936-61-PROV	Stable Low Power Mode for Multicarrier Transceivers (Second Edition)	US	EXPIRED	61/011,267	1/16/08	N/A			1/16/09
6936-84-PCT	Reed-Solomon Erasure Decoding with Error Detection for Retransmission	WO	NAT PHASE	PCT/US10/37195	6/3/10	WO 2010/141677			
6936-84-PROV	Reed-Solomon Erasure Decoding with Error Detection for Retransmission	US	EXPIRED	61/183,845	6/3/09	N/A			6/3/10
6936-84-PLUS	Reed-Solomon Erasure Decoding with Error Detection for Retransmission	US	ISSUED	13/322,170	2/8/12	US 2012-0144259 A1	8,782,498	7/15/14	11/15/30
6936-84-PLUS-CON	Reed-Solomon Erasure Decoding with Error Detection for Retransmission	US	ISSUED	14/328,237	7/10/14	US 2014-0325306 A1	9,276,612	3/1/16	6/3/30
6936-84-PLUS-CON-2	REED-SOLOMON ERASURE DECODING WITH ERROR DETECTION FOR RETRANSMISSION	US	ABANDONED	15/054,495	2/26/16	US 2016-0182089 A1			5/9/18
6936-85-PCA	Low Power Mode with Legacy Compatibility	CA	PENDING	2,944,006	4/28/15				4/28/35
6936-85-PCT	Low Power Mode with Legacy Compatibility	WO	NAT PHASE	PCT/US15/27983	4/28/15	WO 2015/168117			

6936-85-PEP	Low Power Mode with Legacy Compatibility	EP	ISSUED	15721495.8	4/28/15	3138206	3138206	6/10/20	4/28/35
6936-85-PEPDE	Low Power Mode with Legacy Compatibility	DE	ISSUED	15721495.8	4/28/15		3138206	6/10/20	4/28/35
6936-85-PEPFR	Low Power Mode with Legacy Compatibility	FR	ISSUED	15721495.8	4/28/15		3138206	6/10/20	4/28/35
6936-85-PEPGB	Low Power Mode with Legacy Compatibility	GB	ISSUED	15721495.8	4/28/15		3138206	6/10/20	4/28/35
6936-85-PEPNL	Low Power Mode with Legacy Compatibility	NL	ISSUED	15721495.8	4/28/15		3138206	6/10/20	4/28/35
6936-85-PEP-DIV	Low Power Mode with Legacy Compatibility	EP	ABANDONED	20178740.5	4/28/15				9/30/20
6936-85-PJP	Low Power Mode with Legacy Compatibility	JP	ISSUED	2016-563176	4/28/15	2017-516391	6392006	9/27/19	4/28/35
6936-85-PKR	Low Power Mode with Legacy Compatibility	KR	PENDING	10-2016-7029583	4/28/15				4/28/35
6936-85-PROV	Low Power Mode with Legacy Compatibility	US	EXPIRED	61/985,168	4/28/14				4/28/15
6936-85-PLUS	LOW POWER MODE WITH LEGACY COMPATIBILITY	US	PUBUSHED	15/304920	10/18/16	US 2017-0187512 A1			4/28/35

**Schedule III**

Copyrights

None

AO 120 (Rev. 08/10)

<b>TO:</b> <b>Mail Stop 8</b> <b>Director of the U.S. Patent and Trademark Office</b> <b>P.O. Box 1450</b> <b>Alexandria, VA 22313-1450</b>	<b>REPORT ON THE</b> <b>FILING OR DETERMINATION OF AN</b> <b>ACTION REGARDING A PATENT OR</b> <b>TRADEMARK</b>
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In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been  
filed in the U.S. District Court Transferred to Delaware from Alabama on the following

☐ Trademarks or ☒ Patents. ( ☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO. 15-cv-121-RGA	DATE FILED 7/17/2014	U.S. DISTRICT COURT Transferred to Delaware from Alabama
PLAINTIFF ADTRAN, Inc.		DEFENDANT TQ Delta, LLC
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 See Attachment #1		
2		
3		
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In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED 3/13/2015	INCLUDED BY <input type="checkbox"/> Amendment <input checked="" type="checkbox"/> Answer <input type="checkbox"/> Cross Bill <input type="checkbox"/> Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 See Attachment #2		
2		
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In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT
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CLERK	(BY) DEPUTY CLERK	DATE
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Copy 1—Upon initiation of action, mail this copy to Director    Copy 3—Upon termination of action, mail this copy to Director  
Copy 2—Upon filing document adding patent(s), mail this copy to Director    Copy 4—Case file copy

Patent or Trademark No.	Date of Patent or Trademark	Holder of Patent or Trademark
1.U.S. 7,453,881 B2	11/18/2008	TQ Delta, LLC
2.U.S. 7,809,028 B2	10/05/2010	TQ Delta, LLC
3.U.S. 7,978,706 B2	7/12/2011	TQ Delta, LLC
4.U.S. 8,422,511 B2	4/16/2013	TQ Delta, LLC
5.U.S. 6,445,730 B1	9/03/2002	TQ Delta, LLC
6.U.S. 7,292,627 B2	11/6/2007	TQ Delta, LLC
7.U.S. 7,451,379 B2	11/11/2008	TQ Delta, LLC
8.U.S. 7,471,721 B2	12/30/2008	TQ Delta, LLC
9.U.S. 7,570,686 B2	8/4/2009	TQ Delta, LLC
10. U.S. 7,831,890 B2	11/09/2010	TQ Delta, LLC
11. U.S. 7,835,430 B2	11/16/2010	TQ Delta, LLC
12. U.S. 7,836,381 B1	11/16/2010	TQ Delta, LLC
13. U.S. 7,844,882 B2	11/30/2010	TQ Delta, LLC
14. U.S. 7,889,784 B2	2/15/2011	TQ Delta, LLC
15. U.S. 7,925,958 B2	04/12/2011	TQ Delta, LLC
16. U.S. 7,978,753 B2	07/12/2011	TQ Delta, LLC
17. U.S. 7,979,778 B2	07/12/2011	TQ Delta, LLC
18. U.S. 8,073,041 B1	12/6/2011	TQ Delta, LLC
19. U.S. 8,090,008 B2	1/3/2012	TQ Delta, LLC
20. U.S. 8,218,610 B2	7/10/2012	TQ Delta, LLC
21. U.S. 8,238,412 B2	08/07/2012	TQ Delta, LLC
22. U.S. 8,276,048 B2	09/25/2012	TQ Delta, LLC
23. U.S. 8,355,427 B2	1/15/2013	TQ Delta, LLC

24. U.S. 8,432,956 B2	4/30/2013	TQ Delta, LLC
25. U.S. 8,437,382 B2	5/7/2013	TQ Delta, LLC
26. U.S. 8,462,835 B2	6/11/2013	TQ Delta, LLC
27. U.S. 8,495,473 B2	7/23/2013	TQ Delta, LLC
28. U.S. 8,516,337 B2	08/20/2013	TQ Delta, LLC



	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	US 7,796,705 B2	9/14/2010	TQ Delta, LLC
2	US 8,335,956 B2	12/18/2012	TQ Delta, LLC
3	US 8,407,546 B2	3/26/2013	TQ Delta, LLC
4	US 8,468,411 B2	6/18/2013	TQ Delta, LLC
5	US 8,645,784 B2	2/4/2014	TQ Delta, LLC
6	US 8,595,577 B2	11/26/2013	TQ Delta, LLC

AO 120 (Rev. 08/10)

<b>TO:</b> <b>Mail Stop 8</b> <b>Director of the U.S. Patent and Trademark Office</b> <b>P.O. Box 1450</b> <b>Alexandria, VA 22313-1450</b>	<b>REPORT ON THE</b> <b>FILING OR DETERMINATION OF AN</b> <b>ACTION REGARDING A PATENT OR</b> <b>TRADEMARK</b>
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In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court District of Delaware on the following

☐ Trademarks or ☒ Patents. ( ☐ the patent action involves 35 U.S.C. § 292.);

DOCKET NO.	DATE FILED 7/18/2014	U.S. DISTRICT COURT District of Delaware
PLAINTIFF TQ Delta, LLC		DEFENDANT ADTRAN, Inc.
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 See Attached		
2 32 Pts		
3		
4		
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In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY <input type="checkbox"/> Amendment <input type="checkbox"/> Answer <input type="checkbox"/> Cross Bill <input type="checkbox"/> Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
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In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT
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CLERK	(BY) DEPUTY CLERK	DATE
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Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director  
 Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 US 8,090,008 B2	1/3/2012	TQ Delta, LLC
2 US 8,073,041 B1	12/6/2011	TQ Delta, LLC
3 US 7,292,627 B2	11/6/2007	TQ Delta, LLC
4 US 7,471,721 B2	12/30/2008	TQ Delta, LLC
5 US 8,218,610 B2	7/10/2012	TQ Delta, LLC
6 US 8,355,427 B2	1/15/2013	TQ Delta, LLC
7 US 7,453,881 B2	11/18/2008	TQ Delta, LLC
8 US 7,809,028 B2	10/5/2010	TQ Delta, LLC
9 US 7,978,706 B2	7/12/2011	TQ Delta, LLC
10 US 8,422,511 B2	4/16/2013	TQ Delta, LLC
11 US 7,889,784 B2	2/15/2011	TQ Delta, LLC
12 US 7,835,430 B2	11/16/2010	TQ Delta, LLC
13 US 7,570,686 B2	8/4/2009	TQ Delta, LLC
14 US 8,238,412 B2	8/7/2012	TQ Delta, LLC
15 US 8,432,956 B2	4/30/2013	TQ Delta, LLC
16 US 7,451,379 B2	11/11/2008	TQ Delta, LLC
17 US 8,516,337 B2	8/20/2013	TQ Delta, LLC
18 US 7,979,778 B2	7/12/2011	TQ Delta, LLC
19 US 7,925,958 B2	4/12/2011	TQ Delta, LLC
20 US 8,462,835 B2	6/11/2013	TQ Delta, LLC
21 US 8,594,162 B2	11/26/2013	TQ Delta, LLC
22 US 7,978,753 B2	7/12/2011	TQ Delta, LLC
23 US 6,445,730 B1	9/3/2002	TQ Delta, LLC
24 US 8,611,404 B2	12/17/2013	TQ Delta, LLC
25 US 8,437,382 B2	5/7/2013	TQ Delta, LLC
26 US 7,836,381 B1	11/16/2010	TQ Delta, LLC
27 US 7,844,882 B2	11/30/2010	TQ Delta, LLC
28 US 8,276,048 B2	9/25/2012	TQ Delta, LLC
29 US 8,495,473 B2	7/23/2013	TQ Delta, LLC
30 US 8,607,126 B1	12/10/2013	TQ Delta, LLC
31 US 7,831,890 B2	11/9/2010	TQ Delta, LLC
32 US 8,625,660 B2	1/7/2014	TQ Delta, LLC

**Birch, Melvin (Akima)**

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**From:** ded\_nefreply@ded.uscourts.gov  
**Sent:** Wednesday, November 20, 2013 4:56 PM  
**To:** ded\_ecf@ded.uscourts.gov  
**Subject:** Activity in Case 1:13-cv-01835-RGA TQ Delta LLC v. Pace Americas Inc.  
Patent/Trademark Report to Commissioner

This is an automatic e-mail message generated by the CM/ECF system. Please **DO NOT RESPOND** to this e-mail because the mail box is unattended.

**\*\*\*NOTE TO PUBLIC ACCESS USERS\*\*\*** Judicial Conference of the United States policy permits attorneys of record and parties in a case (including pro se litigants) to receive one free electronic copy of all documents filed electronically, if receipt is required by law or directed by the filer. PACER access fees apply to all other users. To avoid later charges, download a copy of each document during this first viewing. However, if the referenced document is a transcript, the free copy and 30 page limit do not apply.

**U.S. District Court**

**District of Delaware**

**Notice of Electronic Filing**

The following transaction was entered by Farnan, Brian on 11/20/2013 at 4:56 PM EST and filed on 11/20/2013

**Case Name:** TQ Delta LLC v. Pace Americas Inc.

**Case Number:** 1:13-cv-01835-RGA

**Filer:**

**Document Number:** 7

**Docket Text:**

**Report to the Commissioner of Patents and Trademarks for Patent/Trademark Number(s) US 8,090,008 B2; US 8,073,041 B1; US 7,292,627 B2; US 7,471,721 B2; US 8,218,610 B2; US 8,355,427 B2; US 7,453,881 B2; US 7,978,706 B2; US 8,422,511 B2; US 7,889,784 B2; US 7,835,430 B2; US 7,570,686 B2; US 8,238,412 B2; US 8,432,956 B2; US 7,451,379 B2; US 8,516,337 B2; US 7,979,778 B2; US 7,925,958 B2; US 8,462,835 B2; US 7,836,381 B1; US 7,844,882 B2; US 8,276,048 B2; US 8,495,473 B2; US 7,831,890 B2; . (Farnan, Brian)**

**1:13-cv-01835-RGA Notice has been electronically mailed to:**

Brian E. Farnan [bfarnan@farnanlaw.com](mailto:bfarnan@farnanlaw.com), [tfarnan@farnanlaw.com](mailto:tfarnan@farnanlaw.com)

Michael J. Farnan [mfarnan@farnanlaw.com](mailto:mfarnan@farnanlaw.com), [tfarnan@farnanlaw.com](mailto:tfarnan@farnanlaw.com)

**1:13-cv-01835-RGA Filer will deliver document by other means to:**

The following document(s) are associated with this transaction:

AO 120 (Rev. 08/10)

<b>TO: Mail Stop 8</b> <b>Director of the U.S. Patent and Trademark Office</b> <b>P.O. Box 1450</b> <b>Alexandria, VA 22313-1450</b>	<b>REPORT ON THE</b> <b>FILING OR DETERMINATION OF AN</b> <b>ACTION REGARDING A PATENT OR</b> <b>TRADEMARK</b>
---	---

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court District of Delaware on the following  
☐ Trademarks or ☒ Patents. ( ☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED 12/9/2013	U.S. DISTRICT COURT District of Delaware
PLAINTIFF TQ Delta, LLC		DEFENDANT ZyXEL Communications Corporation and ZyXEL Communications, Inc.
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 See Attached		
2		
3		
4		
5		

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY <input type="checkbox"/> Amendment <input type="checkbox"/> Answer <input type="checkbox"/> Cross Bill <input type="checkbox"/> Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT		
CLERK	(BY) DEPUTY CLERK	DATE

Copy 1—Upon initiation of action, mail this copy to Director    Copy 3—Upon termination of action, mail this copy to Director  
Copy 2—Upon filing document adding patent(s), mail this copy to Director    Copy 4—Case file copy

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 US 8,090,008 B2	1/3/2012	TQ Delta, LLC
2 US 8,073,041 B1	12/6/2011	TQ Delta, LLC
3 US 7,292,627 B2	11/6/2007	TQ Delta, LLC
4 US 7,471,721 B2	12/30/2008	TQ Delta, LLC
5 US 8,218,610 B2	7/10/2012	TQ Delta, LLC
6 US 8,355,427 B2	1/15/2013	TQ Delta, LLC
7 US 7,453,881 B2	11/18/2008	TQ Delta, LLC
8 US 7,809,028 B2	10/5/2010	TQ Delta, LLC
9 US 7,978,706 B2	7/12/2011	TQ Delta, LLC
10 US 8,422,511 B2	4/16/2013	TQ Delta, LLC
11 US 7,796,705 B2	9/14/2010	TQ Delta, LLC
12 US 7,889,784 B2	2/15/2011	TQ Delta, LLC
13 US 7,835,430 B2	11/16/2010	TQ Delta, LLC
14 US 7,570,686 B2	8/4/2009	TQ Delta, LLC
15 US 8,238,412 B2	8/7/2012	TQ Delta, LLC
16 US 8,432,956 B2	4/30/2013	TQ Delta, LLC
17 US 7,451,379 B2	11/11/2008	TQ Delta, LLC
18 US 8,516,337 B2	8/20/2013	TQ Delta, LLC
19 US 7,979,778 B2	7/12/2011	TQ Delta, LLC
20 US 7,925,958 B2	4/12/2011	TQ Delta, LLC
21 US 8,462,835 B2	6/11/2013	TQ Delta, LLC
22 US 7,978,753 B2	7/12/2011	TQ Delta, LLC
23 US 6,445,730 B1	9/3/2002	TQ Delta, LLC
24 US 8,437,382 B2	5/7/2013	TQ Delta, LLC
25 US 7,836,381 B1	11/16/2010	TQ Delta, LLC
26 US 7,844,882 B2	11/30/2010	TQ Delta, LLC
27 US 8,276,048 B2	9/25/2012	TQ Delta, LLC
28 US 8,495,473 B2	7/23/2013	TQ Delta, LLC
29 US 7,831,890 B2	11/9/2010	TQ Delta, LLC
30 US 8,335,956 B2	12/18/2012	TQ Delta, LLC
31 US 8,468,411 B2	6/18/2013	TQ Delta, LLC
32 US 8,407,546 B2	3/26/2013	TQ Delta, LLC

<b>TO: Mail Stop 8</b> <b>Director of the U.S. Patent and Trademark Office</b> <b>P.O. Box 1450</b> <b>Alexandria, VA 22313-1450</b>	<b>REPORT ON THE</b> <b>FILING OR DETERMINATION OF AN</b> <b>ACTION REGARDING A PATENT OR</b> <b>TRADEMARK</b>
---	---

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Northern District of Texas, Dallas Division on the following

☒ Trademarks or ☐ Patents. ( ☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO. 3:12-cv-1462-L	DATE FILED 5/10/2012	U.S. DISTRICT COURT Northern District of Texas, Dallas Division	
PLAINTIFF Boulle Ltd		DEFENDANT De Boulle Diamond & Jewelry Inc	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK	
1 4,086,050	1/17/2012	Boulle Ltd	
2			
3			
4			
5			

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED 12/9/2013	INCLUDED BY <input checked="" type="checkbox"/> Amendment <input type="checkbox"/> Answer <input type="checkbox"/> Cross Bill <input type="checkbox"/> Other Pleading		
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK	
1 3,078,625	4/11/2006	De Boulle Diamond & Jewelry Inc	
2 3,078,627	4/11/2006	De Boulle Diamond & Jewelry Inc	
3			
4			
5			

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT
--------------------

CLERK Karen Mitchell	(BY) DEPUTY CLERK s/A. Lowe-Monserrate	DATE 12/10/2013
-------------------------	---	--------------------

Copy 1—Upon initiation of action, mail this copy to Director    Copy 3—Upon termination of action, mail this copy to Director  
 Copy 2—Upon filing document adding patent(s), mail this copy to Director    Copy 4—Case file copy

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

## POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(c).

I hereby appoint:

☒ Practitioners associated with Customer Number:

62574

OR

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number

Name	Registration Number

As attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignments documents attached to this form in accordance with 37 CFR 3.73(c).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(c) to:

☒ The address associated with Customer Number:

62574

OR

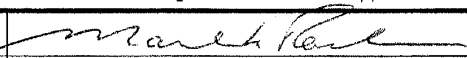
<input type="checkbox"/> Firm or Individual Name			
Address			
City	State	Zip	
Country			
Telephone			Email

Assignee Name and Address: TQ DELTA, LLC  
805 Las Cimas Parkway, Suite 240  
Austin, Texas 78746

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of The practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.

### SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature		Date	10/4/12
Name	Mark K. Roche	Telephone	512-609-1810
Title	Managing Director		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.



Electronic Acknowledgement Receipt	
EFS ID:	14185976
Application Number:	12853020
International Application Number:	
Confirmation Number:	5009
Title of Invention:	COMPUTER READABLE MEDIUM WITH INSTRUCTIONS FOR RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT
First Named Inventor/Applicant Name:	Marcos C. Tzannes
Customer Number:	62574
Filer:	Jason Vick/Joanne Vos
Filer Authorized By:	Jason Vick
Attorney Docket Number:	6936-54-CON-2
Receipt Date:	08-NOV-2012
Filing Date:	09-AUG-2010
Time Stamp:	18:09:42
Application Type:	Utility under 35 USC 111(a)

### Payment information:

Submitted with Payment	no				
<b>File Listing:</b>					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		EntityStatus_373c_w_POA.pdf	422839 1b463807e595de46759adc7f468a8f5560d47843	yes	4

	Multipart Description/PDF files in .zip description		
	Document Description	Start	End
	Miscellaneous Incoming Letter	1	1
	Assignee showing of ownership per 37 CFR 3.73.	2	3
	Power of Attorney	4	4
Warnings:			
Information:			
Total Files Size (in bytes):		422839	
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>			

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re the Application of: Marcos C. Tzannes	) Issued Patent No.: 7,836,381
Application No.: 12/853,020	) Issued Date: November 16, 2010
Filed: August 9, 2010	) Examiner: PFIZENMAYER, Mark C.
Atty. File No.: 6936-54-CON-2	) Confirmation No.: 5009

For: COMPUTER READABLE MEDIUM WITH INSTRUCTIONS FOR RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT

**ASSERTION OF ENTITLEMENT TO SMALL ENTITY STATUS**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Madam:

In accordance with MPEP §§ 509.02 and 509.03 and 37 CFR 1.27, this document is being filed to inform the U.S. Patent Office of the change of status for the above-identified patent from large entity status to small entity status. All fees paid to date have been paid as large entity status. No fees have yet been paid as small entity status. Due to the sale of the referenced patent, the Applicant is now entitled to small entity status.

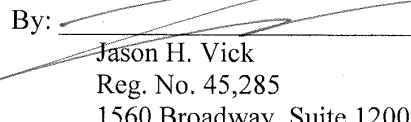
We respectfully request that small entity status be granted for the above-referenced patent.

Please contact the undersigned if there are any questions regarding this notification.

Respectfully submitted,

SHERIDAN ROSS P.C.

Date: 8 Nov '12

By:   
Jason H. Vick  
Reg. No. 45,285  
1560 Broadway, Suite 1200  
Denver, Colorado 80202  
Telephone: 303-863-9700

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

**STATEMENT UNDER 37 CFR 3.73(c)**

Applicant/Patent Owner: TQ DELTA, LLC

Application No./Patent No.: 7,836,381

Filed/Issue Date: November 16, 2010

Titled: COMPUTER READABLE MEDIUM WITH INSTRUCTIONS FOR RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT

TQ DELTA, LLC, a Corporation

(Name of Assignee)

(Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☒ The assignee of the entire right, title, and interest.
2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):
- ☐ The extent (by percentage) of its ownership interest is \_\_\_\_%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.
- ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (e.g., bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

- A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel \_\_\_\_\_, Frame \_\_\_\_\_, or for which a copy thereof is attached.
- B. ☒ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: Marcos C. Tzannes, Michael Lund To: AWARE, INC.

The document was recorded in the United States Patent and Trademark Office at  
Reel 017438, Frame 0094, or for which a copy thereof is attached.

2. From: AWARE, INC. To: TQ DELTA, LLC

The document was recorded in the United States Patent and Trademark Office at  
Reel 029154, Frame 0937, or for which a copy thereof is attached.

[Page 1 of 2]

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

**STATEMENT UNDER 37 CFR 3.73(c)**

3. From: \_\_\_\_\_ To: \_\_\_\_\_

The document was recorded in the United States Patent and Trademark Office at  
Reel \_\_\_\_\_, Frame \_\_\_\_\_, or for which a copy thereof is attached.

4. From: \_\_\_\_\_ To: \_\_\_\_\_

The document was recorded in the United States Patent and Trademark Office at  
Reel \_\_\_\_\_, Frame \_\_\_\_\_, or for which a copy thereof is attached.

5. From: \_\_\_\_\_ To: \_\_\_\_\_

The document was recorded in the United States Patent and Trademark Office at  
Reel \_\_\_\_\_, Frame \_\_\_\_\_, or for which a copy thereof is attached.

6. From: \_\_\_\_\_ To: \_\_\_\_\_

The document was recorded in the United States Patent and Trademark Office at  
Reel \_\_\_\_\_, Frame \_\_\_\_\_, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☒ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

Signature

Jason H. Vick

Printed or Typed Name

Date

45,285

Title or Registration Number

[Page 2 of 2]

UNITED STATES PATENT AND TRADEMARK OFFICE  
**CERTIFICATE OF CORRECTION**

PATENT NO. : 7,836,381 B1  
APPLICATION NO. : 12/853020  
DATED : November 16, 2010  
INVENTOR(S) : Marcos C. Tzannes et al.

Page 1 of 1

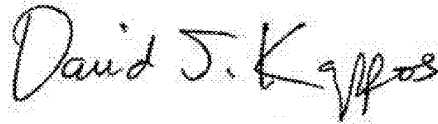
It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In column 12, claim 5, line 2, delete "transmission" and insert -- reception --

In column 12, claim 5, line 7, delete "received" and insert -- transmitted --

In column 12, claim 5, line 12, delete "shred" and insert -- shared --

Signed and Sealed this  
Eighth Day of February, 2011

A handwritten signature in black ink, reading "David J. Kappos". The signature is written in a cursive, flowing style with a large, stylized "D" and "K".

David J. Kappos  
*Director of the United States Patent and Trademark Office*

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re the Application of: Marcos C. Tzannes

Application No.: 12/853,020

Patent No.: 7,836,381

Issued: November 16, 2010

Confirmation No.: 5009

Atty. File No.: 5550-54-CON-2

For: COMPUTER READABLE MEDIUM WITH INSTRUCTIONS FOR RESOURCE  
SHARING IN A TELECOMMUNICATIONS ENVIRONMENT

**REQUEST FOR CERTIFICATE OF CORRECTION OF PATENT FOR**  
**APPLICANT'S MISTAKE (37 C.F.R §1.323)**

Attn: Certificate of Corrections Branch  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

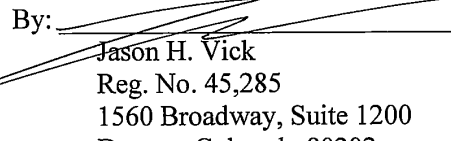
This is a request for a Certificate of Correction under 37 C.F.R. 1.323 for the above-identified patent. Attached is form PTO/SB/44. Applicants have determined that there were typographic errors in claim 5 which were the mistake of the Applicant. The corrections do not introduce new matter, do not require re-examination, and do not materially affect the scope or meaning of the patent.

Payment in the amount of \$100.00, as required by 37 C.F.R. § 1.20(a) is being submitted herewith. Although no additional fees are believed due in connection with the filing of this paper, please charge any additional fees deemed necessary or credit any overpayment to Deposit Account No. 19-1970.

Respectfully submitted,

SHERIDAN ROSS P.C.

Date: 5 Jan 2011

By:   
Jason H. Vick  
Reg. No. 45,285  
1560 Broadway, Suite 1200  
Denver, Colorado 80202  
Telephone: 303-863-9700



**UNITED STATES PATENT AND TRADEMARK OFFICE  
CERTIFICATE OF CORRECTION**

Page 1 of 1

PATENT NO. : 7,836,381  
APPLICATION NO.: 12/853,020  
ISSUE DATE : November 16, 2010  
INVENTOR(S) : Marcos C. Tzannes et al.

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In column 12, claim 5, line 2, delete "transmission" and insert -- reception --

In column 12, claim 5, line 7, delete "received" and insert -- transmitted --

In column 12, claim 5, line 12, delete "shred" and insert -- shared --

**MAILING ADDRESS OF SENDER (Please do not use customer number below):**

Jason H. Vick c/o Sheridan Ross, PC  
1560 Broadway, Suite 1200  
Denver, CO 80202

This collection of information is required by 37 CFR 1.322, 1.323, and 1.324. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1.0 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Attention Certificate of Corrections Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

Electronic Patent Application Fee Transmittal				
<b>Application Number:</b>		12853020		
<b>Filing Date:</b>		09-Aug-2010		
<b>Title of Invention:</b>		COMPUTER READABLE MEDIUM WITH INSTRUCTIONS FOR RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT		
<b>First Named Inventor/Applicant Name:</b>		Marcos C. Tzannes		
<b>Filer:</b>		Jason Vick/Joanne Vos		
<b>Attorney Docket Number:</b>		5550-54-CON-2		
Filed as Large Entity				
<b>Utility under 35 USC 111(a) Filing Fees</b>				
<b>Description</b>	<b>Fee Code</b>	<b>Quantity</b>	<b>Amount</b>	<b>Sub-Total in USD(\$)</b>
<b>Basic Filing:</b>				
<b>Pages:</b>				
<b>Claims:</b>				
<b>Miscellaneous-Filing:</b>				
<b>Petition:</b>				
<b>Patent-Appeals-and-Interference:</b>				
<b>Post-Allowance-and-Post-Issuance:</b>				
Certificate of correction	1811	1	100	100
<b>Extension-of-Time:</b>				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
<b>Miscellaneous:</b>				
<b>Total in USD (\$)</b>				<b>100</b>

<b>Electronic Acknowledgement Receipt</b>	
<b>EFS ID:</b>	9172930
<b>Application Number:</b>	12853020
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	5009
<b>Title of Invention:</b>	COMPUTER READABLE MEDIUM WITH INSTRUCTIONS FOR RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT
<b>First Named Inventor/Applicant Name:</b>	Marcos C. Tzannes
<b>Customer Number:</b>	62574
<b>Filer:</b>	Jason Vick/Joanne Vos
<b>Filer Authorized By:</b>	Jason Vick
<b>Attorney Docket Number:</b>	5550-54-CON-2
<b>Receipt Date:</b>	05-JAN-2011
<b>Filing Date:</b>	09-AUG-2010
<b>Time Stamp:</b>	18:23:43
<b>Application Type:</b>	Utility under 35 USC 111(a)

### **Payment information:**

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$ 100
RAM confirmation Number	7995
Deposit Account	191970
Authorized User	
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File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Certificate of Correction	Request_For_Certificate_of_Correction.pdf	74859 64e279e06af1388275cd8319c653406f248874d1	no	3
Warnings:					
Information:					
2	Fee Worksheet (PTO-875)	fee-info.pdf	30207 0004aeacd21f11727e104e264fd7fb0e4e558a77	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			105066		
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b>            If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b>            If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b>            If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>					



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[www.uspto.gov](http://www.uspto.gov)

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/853,020	08/09/2010	Marcos C. Tzannes	5550-54-CON-2

**CONFIRMATION NO. 5009**

## PUBLICATION NOTICE



\*OC000000044768290\*

62574  
Jason H. Vick  
Sheridan Ross, PC  
Suite # 1200  
1560 Broadway  
Denver, CO 80202

**Title:**COMPUTER READABLE MEDIUM WITH INSTRUCTIONS FOR RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT

**Publication No.**US-2010-0306628-A1

**Publication Date:**12/02/2010

## NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publicly available Searchable Databases via the Internet at [www.uspto.gov](http://www.uspto.gov). The direct link to access the publication is currently <http://www.uspto.gov/patft/>.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at [www.uspto.gov](http://www.uspto.gov) using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently <http://pair.uspto.gov/>. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

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Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101



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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/853,020	11/16/2010	7836381	5550-54-CON-2	5009

62574 7590 10/27/2010  
Jason H. Vick  
Sheridan Ross, PC  
Suite # 1200  
1560 Broadway  
Denver, CO 80202

## ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

### **Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)** (application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

Marcos C. Tzannes, Orinda, CA;  
Michael Lund, West Newton, MA;

# PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: **Mail** **Mail Stop ISSUE FEE**  
**Commissioner for Patents**  
**P.O. Box 1450**  
**Alexandria, Virginia 22313-1450**  
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62574 7590 10/06/2010

Jason H. Vick  
Sheridan Ross, PC  
Suite # 1200  
1560 Broadway  
Denver, CO 80202

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I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/853,020	08/09/2010	Marcos C. Tzannes	5550-54-CON-2	5009

TITLE OF INVENTION: COMPUTER READABLE MEDIUM WITH INSTRUCTIONS FOR RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1510	\$300	\$0	\$1810	01/06/2011

EXAMINER	ART UNIT	CLASS-SUBCLASS
PFIZENMAYER, MARK C	2447	714-774000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).  
☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.  
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list  
(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,  
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Jason H. Vick  
2 Sheridan Ross, P.C.  
3 \_\_\_\_\_

## 3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

Aware, Inc.

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Bedford, MA

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government

## 4a. The following fee(s) are submitted:

☒ Issue Fee  
☒ Publication Fee (No small entity discount permitted)  
☐ Advance Order - # of Copies \_\_\_\_\_

## 4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

☐ A check is enclosed.  
☐ Payment by credit card. Form PTO-2038 is attached.  
☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 19-1970 (enclose an extra copy of this form).

## 5. Change in Entity Status (from status indicated above)

☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27. ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature \_\_\_\_\_

Date 11 Oct '10

Typed or printed name Jason H. Vick

Registration No. 45,285

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re the Application of: Marcos C. Tzannes	)	Group Art Unit: 2447
	)	
Application No.: 12/853,020	)	Examiner: Pfizenmayer, Mark C.
	)	
Filed: August 9, 2010	)	Confirmation No.: 5009
	)	
Atty. File No.: 5550-54-CON-2	)	
	)	

For: A COMPUTER READABLE MEDIUM WITH INSTRUCTIONS FOR RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT

**COMMENTS ON STATEMENT OF REASONS FOR ALLOWANCE**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313

Sir:

Applicant submits this Comments on Statement of Reasons for Allowance to address further the Notice of Allowability ("Notice") having a mailing date of October 6, 2010.

In the Notice, the Examiner's stated reasons for allowance were that:

Claims 46-53 are allowed.

Claim 46 identifies the distinct features of specifying a maximum number of bytes available to be allocated to an interleaver in a transmitted or received message, determining the amount of memory required by the interleaver, and then allocating the bytes of a shared memory to the interleaver wherein the bytes allocated do not exceed the maximum number of available bytes specified in the message.

The closest prior art, Fadavi-Ardekani et al (U.S. Pat. No. 6,707,822) discloses sharing a memory between the interleavers and deinterleavers of multiple ADSL sessions, fails to suggest the claimed limitations as mentioned above in combination with other claimed elements. The above features in conjunction with all other limitations of the dependent and independent claims 46-49 are hereby allowed.

Claim 50 identifies the distinct features of specifying a maximum number of bytes available to be allocated to a deinterleaver in a transmitted or received message, determining the amount of memory required by the deinterleaver, and then allocating the bytes of a shared memory to the deinterleaver wherein the bytes

allocated do not exceed the maximum number of available bytes specified in the message.

The closest prior art, Fadavi-Ardekani et al (U.S. Pat. No. 6,707,822) discloses sharing a memory between the interleavers and deinterleavers of multiple ADSL sessions, fails to suggest the claimed limitations as mentioned above in combination with other claimed elements. The above features in conjunction with all other limitations of the dependent and independent claims 50-53 are hereby allowed.

Based on the Notice, the patentability of all other independent and dependent claims is assumed to be based upon the elements as set forth in such claims and that such claims meet all criteria for patentability under §101, §102, §103 and §112.

As is clear from MPEP 1302.14,

“The statement [of reasons for allowance] is not intended to necessarily state all the reasons for allowance or all the details why claims are allowed and should not be written to specifically or impliedly state that all the reasons for allowance are set forth.”

While the stated Reasons for Allowance may be a stated reason for allowing some independent claims, Applicant submits that some independent claims have a different reason for allowance and that some independent claims have other reasons for allowance.

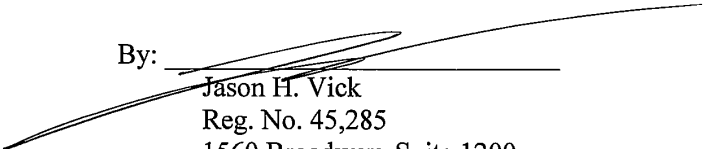
Specifically, the prior art fails to teach the specific combination of features as recited in the independent claims 46 and 50.

Although the Applicant believes that no fees are due for filing this Comments on Statement of Reasons for Allowance, please charge any fees deemed necessary to Deposit Account No. 19-1970.

Respectfully submitted,

SHERIDAN ROSS P.C.

Date: 11 Oct '06

By:   
Jason H. Vick  
Reg. No. 45,285  
1560 Broadway, Suite 1200  
Denver, Colorado 80202  
Telephone: 303-863-9700

Electronic Patent Application Fee Transmittal				
<b>Application Number:</b>		12853020		
<b>Filing Date:</b>		09-Aug-2010		
<b>Title of Invention:</b>		COMPUTER READABLE MEDIUM WITH INSTRUCTIONS FOR RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT		
<b>First Named Inventor/Applicant Name:</b>		Marcos C. Tzannes		
<b>Filer:</b>		Jason Vick/Joanne Vos		
<b>Attorney Docket Number:</b>		5550-54-CON-2		
Filed as Large Entity				
<b>Utility under 35 USC 111(a) Filing Fees</b>				
<b>Description</b>	<b>Fee Code</b>	<b>Quantity</b>	<b>Amount</b>	<b>Sub-Total in USD(\$)</b>
<b>Basic Filing:</b>				
<b>Pages:</b>				
<b>Claims:</b>				
<b>Miscellaneous-Filing:</b>				
<b>Petition:</b>				
<b>Patent-Appeals-and-Interference:</b>				
<b>Post-Allowance-and-Post-Issuance:</b>				
Utility Appl issue fee	1501	1	1510	1510
Publ. Fee- early, voluntary, or normal	1504	1	300	300

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				1810

Electronic Acknowledgement Receipt	
<b>EFS ID:</b>	8597292
<b>Application Number:</b>	12853020
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	5009
<b>Title of Invention:</b>	COMPUTER READABLE MEDIUM WITH INSTRUCTIONS FOR RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT
<b>First Named Inventor/Applicant Name:</b>	Marcos C. Tzannes
<b>Customer Number:</b>	62574
<b>Filer:</b>	Jason Vick/Joanne Vos
<b>Filer Authorized By:</b>	Jason Vick
<b>Attorney Docket Number:</b>	5550-54-CON-2
<b>Receipt Date:</b>	11-OCT-2010
<b>Filing Date:</b>	09-AUG-2010
<b>Time Stamp:</b>	12:15:43
<b>Application Type:</b>	Utility under 35 USC 111(a)

### Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$ 1810
RAM confirmation Number	8316
Deposit Account	191970
Authorized User	
<p>The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:</p> <p>Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)</p> <p>Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)</p>	

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Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)					
<b>File Listing:</b>					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		Issue_Fee_Payment.pdf	345572 81d8c34993a0bf2b2a40d917c5eda3dca067a10d	yes	3
<b>Multipart Description/PDF files in .zip description</b>					
	<b>Document Description</b>	<b>Start</b>	<b>End</b>		
	Issue Fee Payment (PTO-85B)	1	1		
	Post Allowance Communication - Incoming	2	3		
<b>Warnings:</b>					
<b>Information:</b>					
2	Fee Worksheet (PTO-875)	fee-info.pdf	32203 8372f40f2a3eb5d2e38f31edbf1c651dee1bd5fc	no	2
<b>Warnings:</b>					
<b>Information:</b>					
<b>Total Files Size (in bytes):</b>			377775		
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b>          If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b>          If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b>          If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>					



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## NOTICE OF ALLOWANCE AND FEE(S) DUE

62574 7590 10/06/2010

Jason H. Vick  
Sheridan Ross, PC  
Suite # 1200  
1560 Broadway  
Denver, CO 80202

EXAMINER

PFIZENMAYER, MARK C

ART UNIT PAPER NUMBER

2447

DATE MAILED: 10/06/2010

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/853,020	08/09/2010	Marcos C. Tzannes	5550-54-CON-2	5009

TITLE OF INVENTION: COMPUTER READABLE MEDIUM WITH INSTRUCTIONS FOR RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1510	\$300	\$0	\$1810	01/06/2011

**THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.**

**THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.**

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B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

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62574 7590 10/06/2010

Jason H. Vick  
Sheridan Ross, PC  
Suite # 1200  
1560 Broadway  
Denver, CO 80202

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I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/853,020	08/09/2010	Marcos C. Tzannes	5550-54-CON-2	5009

TITLE OF INVENTION: COMPUTER READABLE MEDIUM WITH INSTRUCTIONS FOR RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1510	\$300	\$0	\$1810	01/06/2011

EXAMINER	ART UNIT	CLASS-SUBCLASS
PFIZENMAYER, MARK C	2447	714-774000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

- (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, 1 \_\_\_\_\_
- (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2 \_\_\_\_\_
- 3 \_\_\_\_\_

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

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- ☐ Publication Fee (No small entity discount permitted)
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- ☐ A check is enclosed.
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- ☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number \_\_\_\_\_ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

- ☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27. ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

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Date \_\_\_\_\_

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This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/853,020	08/09/2010	Marcos C. Tzannes	5550-54-CON-2	5009
62574	7590	10/06/2010	EXAMINER	
Jason H. Vick Sheridan Ross, PC Suite # 1200 1560 Broadway Denver, CO 80202			PFIZENMAYER, MARK C	
			ART UNIT	PAPER NUMBER
			2447	
			DATE MAILED: 10/06/2010	

## Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)

(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 0 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 0 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

<b>Notice of Allowability</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	12/853,020	TZANNES ET AL.	
	<b>Examiner</b>	<b>Art Unit</b>	
	MARK PFIZENMAYER	2447	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--**

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to a telephone conversation with Jason Vick (Reg. No. 45,285) on 9/24/2010.

2. ☒ The allowed claim(s) is/are 46-53 (renumbered as 1-8).

3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All   b) ☐ Some\*   c) ☐ None   of the:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\* Certified copies not received: \_\_\_\_\_.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.  
**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS ( as "replacement sheets") must be submitted.  
(a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review ( PTO-948) attached  
1) ☐ hereto or 2) ☐ to Paper No./Mail Date \_\_\_\_\_.  
(b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date \_\_\_\_\_.

**Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).**

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

1. <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) 2. <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) 3. <input checked="" type="checkbox"/> Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date <u>8/12/2010</u> 4. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit of Biological Material	5. <input type="checkbox"/> Notice of Informal Patent Application 6. <input checked="" type="checkbox"/> Interview Summary (PTO-413), Paper No./Mail Date <u>20100924</u> . 7. <input type="checkbox"/> Examiner's Amendment/Comment 8. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance 9. <input type="checkbox"/> Other _____.
--	---

<b><i>Examiner-Initiated Interview Summary</i></b>	<b>Application No.</b> 12/853,020	<b>Applicant(s)</b> TZANNES ET AL.	
	<b>Examiner</b> MARK PFIZENMAYER	<b>Art Unit</b> 2447	

**All Participants:**

(1) MARK PFIZENMAYER.

(2) Jason Vick (Reg. No. 45,285).

**Date of Interview:** 24 September 2010

**Status of Application:** pending

(3) \_\_\_\_\_.

(4) \_\_\_\_\_.

**Time:** 2:00pm

**Type of Interview:**

☒ Telephonic

☐ Video Conference

☐ Personal (Copy given to: ☐ Applicant    ☐ Applicant's representative)

Exhibit Shown or Demonstrated: ☐ Yes    ☒ No

If Yes, provide a brief description: \_\_\_\_\_.

**Part I.**

Rejection(s) discussed:  
*None*

Claims discussed:  
*46-53*

Prior art documents discussed:  
*None*

**Part II.**

**SUBSTANCE OF INTERVIEW DESCRIBING THE GENERAL NATURE OF WHAT WAS DISCUSSED:**

*The examiner and the applicant agreed to the filing of a terminal disclaimer with application 11/246,163 in order to place the application in a condition for allowance.*

**Part III.**

☒ It is not necessary for applicant to provide a separate record of the substance of the interview, since the interview directly resulted in the allowance of the application. The examiner will provide a written summary of the substance of the interview in the Notice of Allowability.

☐ It is not necessary for applicant to provide a separate record of the substance of the interview, since the interview did not result in resolution of all issues. A brief summary by the examiner appears in Part II above.

(Applicant/Applicant's Representative Signature – if appropriate)

**DETAILED ACTION**

1. The applicant cancelled claims 1-45, and added claims 46-53 in the preliminary amendment filed on 8/9/2010. Claims 46-53 are pending.

***Terminal Disclaimer***

2. The terminal disclaimer filed on 9/24/2010 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of any patent granted on application number 11/246,163 has been reviewed and is accepted. The terminal disclaimer has been recorded.

***Allowable Subject Matter***

3. Claims 46-53 are allowed.

Claim 46 identifies the distinct features of specifying a maximum number of bytes available to be allocated to an interleaver in a transmitted or received message, determining the amount of memory required by the interleaver, and then allocating the bytes of a shared memory to the interleaver wherein the bytes allocated do not exceed the maximum number of available bytes specified in the message.

The closest prior art, Fadavi-Ardekani et al (U.S. Pat. No. 6,707,822) discloses sharing a memory between the interleavers and deinterleavers of multiple ADSL sessions, fails to suggest the claimed limitations as mentioned above in combination with other claimed elements. The above features in conjunction with all other limitations of the dependent and independent claims 46-49 are hereby allowed.

Claim 50 identifies the distinct features of specifying a maximum number of bytes available to be allocated to a deinterleaver in a transmitted or received message, determining the amount of memory required by the deinterleaver, and then allocating the bytes of a shared memory to the deinterleaver wherein the bytes allocated do not exceed the maximum number of available bytes specified in the message.

The closest prior art, Fadavi-Ardekani et al (U.S. Pat. No. 6,707,822) discloses sharing a memory between the interleavers and deinterleavers of multiple ADSL sessions, fails to suggest the claimed limitations as mentioned above in combination with other claimed elements. The above features in conjunction with all other limitations of the dependent and independent claims 50-53 are hereby allowed.

### ***Conclusion***

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to MARK PFIZENMAYER whose telephone number is (571)270-7214. The examiner can normally be reached on Monday - Friday 8:00 - 5:30 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, James Hwang can be reached on (571)272-4036. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Mark Pfizenmayer  
Patent Examiner  
24 September 2010

/Joon H. Hwang/  
Supervisory Patent Examiner, Art Unit 2447

<b>Notice of References Cited</b>	Application/Control No. 12/853,020	Applicant(s)/Patent Under Reexamination TZANNES ET AL.	
	Examiner MARK PFIZENMAYER	Art Unit 2447	Page 1 of 1

**U.S. PATENT DOCUMENTS**

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-6,707,822	03-2004	Fadavi-Ardekani et al.	370/395.5
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
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	L	US-			
	M	US-			

**FOREIGN PATENT DOCUMENTS**

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	S					
	T					

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\*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)  
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.



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#### 1 [Hierarchical coarse-grained stream compilation for software defined radio](#)

[Yuan Lin](#), [Manjunath Kudur](#), [Scott Mahike](#), [Trevor Mudge](#)

September 2007 **CASES '07**: Proceedings of the 2007 international conference on Compilers, architecture, and synthesis for embedded systems

**Publisher:** ACM

Full text available: [PDF](#) (464.76 KB)

Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

**Bibliometrics:** Downloads (6 Weeks): 2, Downloads (12 Months): 45, Downloads (Overall): 229, Citation Count: 3

Software Defined Radio (SDR) is an emerging embedded domain where the physical layer of wireless protocols is implemented in software rather than the traditional application specific hardware. The operation throughput requirements of current third-generation ...

**Keywords:** MPSoC compilation, dataflow programming model, modulo scheduling, software defined radio

#### 2 [InfiniteReality: a real-time graphics system](#)

[John S. Montrym](#), [Daniel R. Baum](#), [David L. Dignam](#), [Christopher J. Mical](#)

August 1997 **SI GRAPH '97**: Proceedings of the 24th annual conference on Computer graphics and interactive techniques

**Publisher:** ACM Press/Addison-Wesley Publishing Co. [Request Permissions](#)

Full text available: [PDF](#) (1.00 MB)

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**Bibliometrics:** Downloads (6 Weeks): 6, Downloads (12 Months): 124, Downloads (Overall): 1130, Citation Count: 60

#### 3 [From SODA to scotch: The evolution of a wireless baseband processor](#)

[Mark Woh](#), [Yuan Lin](#), [Sangwon Seo](#), [Scott Mahike](#), [Trevor Mudge](#), [Chaitali Chakrabarti](#), [Richard Bruce](#), [Danny Kershaw](#), [Alastair Reid](#), [Maden Wilder](#), [Krzysztof Flautner](#)

November 2008 **MICRO 41**: Proceedings of the 41st annual IEEE/ACM International Symposium on Microarchitecture

**Publisher:** IEEE Computer Society

Full text available: [PDF](#) (553.71 KB)

Additional Information: [full citation](#), [abstract](#), [references](#), [cited by](#)

**Bibliometrics:** Downloads (6 Weeks): 5, Downloads (12 Months): 97, Downloads (Overall): 160, Citation Count: 4

With the multitude of existing and upcoming wireless standards, it is becoming increasingly difficult for hardware-only baseband processing solutions to adapt to the rapidly changing wireless communication landscape. Software Defined Radio (SDR) promises ...

#### 4 [Low power DSP's for wireless communications \(embedded tutorial session\)](#)

[Ingrid Verbauwhede](#), [Chris Nouri](#)

August 2000 **ISLPED '00**: Proceedings of the 2000 international symposium on Low power electronics and design

**Publisher:** ACM [Request Permissions](#)

Full text available: [PDF](#) (424.32 KB)

Additional Information: [full citation](#), [abstract](#), [references](#), [cited by](#), [index terms](#)

**Bibliometrics:** Downloads (6 Weeks): 6, Downloads (12 Months): 83, Downloads (Overall): 974, Citation Count: 8

Wireless communications and more specifically, the fast growing penetration of cellular phones and cellular infrastructure are the major drivers for the development of new programmable Digital Signal Processors (DSPs). In this tutorial, an overview will ...

**Keywords:** architectures, digital signal processing, programmable processors, wireless communications

#### 5 [SODA: A Low-power Architecture For Software Radio](#)

[Yuan Lin](#), [Hyunseok Lee](#), [Mark Woh](#), [Yeav Harel](#), [Scott Mahike](#), [Trevor Mudge](#), [Chaitali Chakrabarti](#), [Krzysztof Flautner](#)

June 2006 **ISCA '06**: Proceedings of the 33rd annual international symposium on Computer Architecture

**Publisher:** ACM

Full text available: [PDF](#) (443.79 KB)

Additional Information: [full citation](#), [abstract](#), [references](#), [cited by](#), [index terms](#)





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CONFIRMATION NO. 5009

<b>SERIAL NUMBER</b> 12/853,020	<b>FILING or 371(c) DATE</b> 08/09/2010	<b>CLASS</b> 709	<b>GROUP ART UNIT</b> 2447	<b>ATTORNEY DOCKET NO.</b> 5550-54-CON-2		
<b>APPLICANTS</b> Marcos C. Tzannes, Orinda, CA; Michael Lund, West Newton, MA; <b>** CONTINUING DATA *****</b> This application is a CON of 11/246,163 10/11/2005 which claims benefit of 60/618,269 10/12/2004 <b>** FOREIGN APPLICATIONS *****</b> <b>** IF REQUIRED, FOREIGN FILING LICENSE GRANTED **</b> 08/20/2010						
Foreign Priority claimed <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No 35 USC 119(a-d) conditions met <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Verified and /MARK C Acknowledged PFIZENMAYER/ Examiner's Signature		<input type="checkbox"/> Met after Allowance Initials	<b>STATE OR COUNTRY</b> CA	<b>SHEETS DRAWINGS</b> 3	<b>TOTAL CLAIMS</b> 8	<b>INDEPENDENT CLAIMS</b> 2
<b>ADDRESS</b> Jason H. Vick Sheridan Ross, PC Suite # 1200 1560 Broadway Denver, CO 80202 UNITED STATES						
<b>TITLE</b> COMPUTER READABLE MEDIUM WITH INSTRUCTIONS FOR RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT						
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## EAST Search History

## EAST Search History (Prior Art)

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L1	776	379/93.01.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; IBM_TDB	OR	ON	2010/09/24 15:46
L2	3666	375/222.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; IBM_TDB	OR	ON	2010/09/24 15:46
L3	1194	714/774,784.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; IBM_TDB	OR	ON	2010/09/24 15:46
L4	164573	"370"/\$.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; IBM_TDB	OR	ON	2010/09/24 15:46
L5	8150	711/147,153,157,170,173.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; IBM_TDB	OR	ON	2010/09/24 15:46
L6	478	709/215.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; IBM_TDB	OR	ON	2010/09/24 15:47
L7	119	((MARCOS) near2 (TZANNES)).INV.	US-PGPUB; USPAT	OR	ON	2010/09/24 15:47
L8	18	((MICHAEL) near2 (LUND)).INV.	US-PGPUB; USPAT	OR	ON	2010/09/24 15:47
L9	18	reed same shar\$5 near2 (memory buffer) same interleav\$3	US-PGPUB; USPAT; USOCR; EPO; JPO; IBM_TDB	OR	ON	2010/09/24 15:48
L10	190869	(max maximum limit\$5 cap\$4) same (available free total remain\$4) same (memory buffer byte)	US-PGPUB; USPAT; USOCR; EPO; JPO; IBM_TDB	OR	ON	2010/09/24 15:48

L11	519	interleav\$3 and reed and shar\$5 adj2 (memory buffer)	US-PGPUB; USPAT; USOCR; EPO; JPO; IBM_TDB	OR	ON	2010/09/24 15:49
L12	18949	(exchang\$3 transmit\$4 send\$3 trad\$3 configur\$6 set\$1up set adj up initializ\$6 allocat\$3) same (parameter setting) same (available free remain \$3 max maximum total) near6 (memory space buffer byte size)	US-PGPUB; USPAT; USOCR; EPO; JPO; IBM_TDB	OR	ON	2010/09/24 15:49
L13	177016	1 2 3 4 5	US-PGPUB; USPAT; USOCR; EPO; JPO; IBM_TDB	OR	ON	2010/09/24 15:50
L14	6	13 and 9	US-PGPUB; USPAT; USOCR; EPO; JPO; IBM_TDB	OR	ON	2010/09/24 15:50
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L16	17	12 and 3	US-PGPUB; USPAT; USOCR; EPO; JPO; IBM_TDB	OR	ON	2010/09/24 15:50
L17	317573	(interleav\$3 reed shar\$5 adj2 memory)	US-PGPUB; USPAT; USOCR; EPO; JPO; IBM_TDB	OR	ON	2010/09/24 15:51
L18	950	17 and 3	US-PGPUB; USPAT; USOCR; EPO; JPO; IBM_TDB	OR	ON	2010/09/24 15:51
L19	110	18 and 10	US-PGPUB; USPAT; USOCR; EPO; JPO; IBM_TDB	OR	ON	2010/09/24 15:51
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L24	10	("20030067877"   "20040114536"   "20050180323"   "20060088054"   "20090300450"   "6337877"   "6707822"   "6775320"   "6778589"   "6778596").PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; IBM_TDB	OR	ON	2010/09/24 15:54


L25	14512	10 and 13	US-PGPUB; USPAT; USOCR; EPO; JPO; IBM_TDB	OR	ON	2010/09/24 15:54
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**EAST Search History (Interference)**

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L21	183	(maximum) same (memory bytes) same (interleaver deinterleaver)	USPAT; UPAD	OR	ON	2010/09/24 15:52
L22	13	(maximum) same (memory bytes) same (interleaver deinterleaver). clm.	USPAT; UPAD	OR	ON	2010/09/24 15:52
L23	5	(available free) near6 (memory bytes) same (interleaver deinterleaver).clm.	USPAT; UPAD	OR	ON	2010/09/24 15:52

**9/ 24/ 2010 3:57:41 PM**


**C:\ Documents and Settings\ mpfizenmayer\ My Documents\ EAST\ Workspaces  
 \ 163\_Resource\_Share\_telecom\_part2.wsp**

<b>Issue Classification</b> 	<b>Application/Control No.</b> 12853020	<b>Applicant(s)/Patent Under Reexamination</b> TZANNES ET AL.
	<b>Examiner</b> MARK PFIZENMAYER	<b>Art Unit</b> 2447

ORIGINAL						INTERNATIONAL CLASSIFICATION												
CLASS		SUBCLASS				CLAIMED					NON-CLAIMED							
714		774				H	0	3	M	13 / 00 (2006.0)								
CROSS REFERENCE(S)																		
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)																	
714	784																	
375	222																	


<input type="checkbox"/> Claims renumbered in the same order as presented by applicant <input type="checkbox"/> CPA <input type="checkbox"/> T.D. <input type="checkbox"/> R.1.47															
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	14		30	1	46										
	15		31	2	47										
	16		32	3	48										

/MARK PFIZENMAYER/ Examiner.Art Unit 2447  (Assistant Examiner)	9/24/2010  (Date)	<b>Total Claims Allowed:</b> 8	
/Joon H Hwang/ Supervisory Patent Examiner.Art Unit 2447  (Primary Examiner)	09/30/2010  (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 1

<p align="center"><b>Index of Claims</b></p> 	<b>Application/Control No.</b> 12853020	<b>Applicant(s)/Patent Under Reexamination</b> TZANNES ET AL.
	<b>Examiner</b> MARK PFIZENMAYER	<b>Art Unit</b> 2447


✓	<b>Rejected</b>	-	<b>Cancelled</b>	N	<b>Non-Elected</b>	A	<b>Appeal</b>
=	<b>Allowed</b>	÷	<b>Restricted</b>	I	<b>Interference</b>	O	<b>Objected</b>

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<p align="center"><b>Index of Claims</b></p> 	<b>Application/Control No.</b> 12853020	<b>Applicant(s)/Patent Under Reexamination</b> TZANNES ET AL.
	<b>Examiner</b> MARK PFIZENMAYER	<b>Art Unit</b> 2447

✓	<b>Rejected</b>	-	<b>Cancelled</b>	N	<b>Non-Elected</b>	A	<b>Appeal</b>
=	<b>Allowed</b>	÷	<b>Restricted</b>	I	<b>Interference</b>	O	<b>Objected</b>

<input type="checkbox"/> Claims renumbered in the same order as presented by applicant <input type="checkbox"/> CPA <input type="checkbox"/> T.D. <input type="checkbox"/> R.1.47									
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Final	Original	09/24/2010							
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<b>Search Notes</b>  	<b>Application/Control No.</b>  12853020	<b>Applicant(s)/Patent Under Reexamination</b>  TZANNES ET AL.
	<b>Examiner</b>  MARK PFIZENMAYER	<b>Art Unit</b>  2447

SEARCHED			
Class	Subclass	Date	Examiner
709	215	9/24/2010	MCP
375	222	9/24/2010	MCP
714	774,784	9/24/2010	MCP
711	147,153,157,170,173	9/24/2010	MCP
379	93.01	9/24/2010	MCP

SEARCH NOTES		
Search Notes	Date	Examiner
See search history printout	9/24/2010	MCP
709/215; 379/93.01;375/222;714/774,784;711/147,153,157,170,173; and 370 with text	9/24/2010	MCP
Google/IEEE/ACM search	9/24/2010	MCP
Consulted with Primary Bill Thomson regarding search, patentability, and classification	July 2010	MCP
Consulted with Primaries Chaudry, Bonzo, and Torres regarding search and classification	July 2010	MCP
Consulted with Primary Dustin Nguyen regarding search	July 2010	MCP
Inventor Name Search	9/24/2010	MCP
STIC search	July 2010	MCP

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner
	USPAT and PGPUB text search – See search history printout	9/24/2010	MCP

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Substitute for form 1449A/PTO  <b>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</b>				<b>Complete if Known</b>	
				Application Number	12/853,020
				Filing Date	August 9, 2010
				First Named Inventor	Marcos C. Tzannes
				Art Unit	Not Yet Assigned
				Examiner Name	Not Yet Assigned
Sheet	1	of	2	Attorney Docket Number	5550-54-CON-2

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No. <sup>1</sup>	Document Number Number-kind Code <sup>2 (if known)</sup>	Publication Date MM-DD-YYYY	Name of Patentee of Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	1	6337877	01/08/02	Cole et al.	
	2	6707822	03/16/04	Fadavi-Ardekani et al.	
	3	6775320	08/10/04	Tzannes et al.	
	4	6778589	08/17/04	Ishii	
	5	6778596	08/17/04	Tzannes	
	6	2004/0114536	06/17/04	O'Rourke	
	7	2005/0180323	08/18/05	Beightol et al.	
	8	2003/0067877	04/10/03	Sivakumar et al.	
	9	2006/0088054	04/27/06	Tzannes et al.	
	10	2009/0300450	12/03/09	Tzannes (10-02-2008)	
	11	12/783758		Tzannes (05-20-2010)	
	12	12/760728		Tzannes (04-15-2010)	
	13	12/783765		Tzannes (05-20-2010)	
	14	12/761586		Lund et al. (4-16-2010)	

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No. <sup>1</sup>	Foreign Patent Document Country Code <sup>3</sup> ; Number <sup>4</sup> ; Kind Code <sup>5</sup> (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T <sup>6</sup>
	15	EP 1225735	07/24/02	Matsushita Electronic Ind Co Ltd		
	16	EP 1246409	10/02/02	Mitsubishi Electric Corp		
	17	WO 2003/063060	07/31/03	Broadcom Corp.		
	18	WO 2006/044227	04/27/06	Aware Inc.		

Examiner Signature	/Mark Pfizenmayer/	Date Considered	09/24/2010
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\*EXAMINER: Initial if reference is considered, whether or not citation is in conformance and not considered. Include copy of this form with next communication to applicant.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.P./

Substitute for form 1449A/PTO  <b>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</b>				<b>Complete if Known</b>	
				Application Number	12/853,020
				Filing Date	August 9, 2010
				First Named Inventor	Marcos C. Tzannes
				Art Unit	Not Yet Assigned
				Examiner Name	Not Yet Assigned
Sheet	2	of	2	Attorney Docket Number	5550-54-CON-2

OTHER ART (Including Author, Title, Date, Pertinent Pages, etc.)		
Examiner Initials*	Cite No. <sup>1</sup>	
	19	Shoji, T. et al: "Wireless Access Method to Ensure Each Users QOS in Unpredictable and Various QOS Requirements Wireless Personal Communications," Springer, Dordrecht, NL, Vol. 22, No. 2, Aug. 2002, pp. 139-151
	20	"ITU-T Recommendation G.992.5 - Series G: Transmission Systems and Media, Digital Systems and Networks", International Telecommunication Union, ADSL2, May 2003, 92 pages
	21	"ITU-T Recommendation G.992.3," International Telecommunication Union, ADSL2, Jan. 2005, 436 pages
	22	"VDSL2 ITU-T Recommendation G.993.2," International Telecommunication Union, Feb. 2006, 252 pages
	23	"Sunset xDSL: Prequalification of ADSL Circuits with ATU-C Emulation," Sunrise Telecom Inc., Application Series, 2001, San Jose, USA, page 3, available at <a href="http://www.sunrisetelecom.com/technotes/APP-xDSL-8B.pdf">http://www.sunrisetelecom.com/technotes/APP-xDSL-8B.pdf</a>
	24	International Search Report for International (PCT) Patent Application No. PCT/US2005/036015, mailed February 8, 2006
	25	Written Opinion for International (PCT) Patent Application No. PCT/US2005/036015, mailed February 8, 2006
	26	International Preliminary Report on Patentability for International (PCT) Patent Application No. PCT/US2005/036015, mailed April 26, 2007
	27	Examiner's First Report for Australian Patent Application No. 2005296086, mailed June 24, 2009 (Attorney's Ref. No. 5550-54)
	28	Notification of the First Office Action (including translation) for Chinese Patent Application No. 200580032703, mailed September 25, 2009 (Attorney's Ref. No. 5550-54-PCN)
	29	Official Action for U.S. Patent Application No. 11/246,163, mailed February 24, 2009 (Attorney's Ref. No. 5550-54)
	30	Official Action for U.S. Patent Application No. 11/246,163, mailed December 9, 2009 (Attorney's Ref. No. 5550-54)

Examiner Signature	/Mark Pfizenmayer/	Date Considered	09/24/2010
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\*EXAMINER: Initial if reference is considered, whether or not citation is in conformance and not considered. Include copy of this form with next communication to applicant.

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maximum memory available interleaver

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Articles and patents

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Results 1 - 10 of about 73,300. (0.17 sec)

[PDF] [The Cydra 5 stride-insensitive memory system](#)

[psu.edu](#) [PDF]

BR Rau, MS Schlansker, DWL Yen - Proc. Int. Conf. on Parallel ..., 1989 - Citeseer

... When the request rate approaches the **maximum** bandwidth that the **memory** system is designed for, the randomness of ... In the Cydra 5, 8-, 16- and 32-way **interleaving** are **available** in addition to the full 64 ... Also, the presence of four **memory** banks is similar to 4-way **interleaving**. ...

Cited by 85 - [Related articles](#) - [All 4 versions](#)

On **maximum** contention-free **interleavers** and permutation polynomials over integer rings

[arxiv.org](#) [PDF]
OY Takeshita - IEEE Transactions on Information Theory, 2006 - [ieeexplore.ieee.org](#)

... as a point of reference because many good constructions attempt a **max**-imization of ... of an iterative decoder split into 16 parallel sections without causing **memory** access contention ... the current 3GPP standard curves are plotted. 7 Additional reference curves are **available** in [2]. ...

Cited by 49 - [Related articles](#) - [Full Direct](#) - [All 12 versions](#)

... determining sizes of 1: 1 and 2: 1 **memory interleaving** in a computer system, configuring to the **maximum** size, and informing the user if **memory** is incorrectly installed

US Hobson - US Patent 5,809,555, 1998 - [Google Patents](#)

... 1 AND 2:1 **MEMORY INTERLEAVING** IN A COMPUTER SYSTEM, CONFIGURING TO THE **MAXIMUM** SIZE, AND ... result in the loss of some **memory** in a system configured for 2:1 **interleaving**. ... may not yield optimal performance if the total amount of **available memory** is thereby ...

Cited by 6 - [Related articles](#)

[PDF] [A NUMA API for Linux](#)

[andikleen.de](#) [PDF]
A Kleen - Novel Inc., 2005 - [andikleen.de](#)

... The program can allocate node **memory** somewhere between the free **memory** (which is normally low because Linux uses free **memory** for caches) and the **maximum memory** size. This function gives a hint for how much **memory** is **available** for allocation on each node, but it ...

Cited by 25 - [Related articles](#) - [View as HTML](#) - [Full Direct](#) - [All 3 versions](#)

[PDF] [High-performance programmable SISO decoder VLSI implementation for decoding turbo codes](#)

[caltech.edu](#) [PDF]
... T Yokokawa, M Kan, Y Mizutani, ... - GLOBECOM ..., 2001 - [gladstone.systems.caltech.edu](#)

... Some of them have already been **available** on products [6], [7]. However, in order to ... chip **interleavers/deinterleavers** (**maximum** 16K) • capable of 1–3 symbol-wise **interleave** • arbitrary **interleaver** patterns • adapt ... **Maximum memory** lengths of the codes are different for each type. ...

Cited by 24 - [Related articles](#) - [View as HTML](#) - [Full Direct](#) - [All 3 versions](#)

Method for **interleaving** computer disk data input-out transfers with permuted buffer addressing

TJ Parks - US Patent 5,404,454, 1995 - [Google Patents](#)

... Data from the disk drives may be simultaneously loaded into two different **memory** buffers utilizing the **maximum available** I/O ... 5,404,454 METHOD FOR **INTERLEAVING** COMPUTER DISK DATA INPUT-OUT TRANSFERS WITH PERMUTED BUFFER ADDRESSING ...

Cited by 17 - [Related articles](#)

**Memory bank** customization and assignment in behavioral synthesis

[york.ac.uk](#) [PDF]
PR Panda - Proceedings of the 1999 IEEE/ACM international ..., 1999 - [portal.acm.org](#)

... **Memory** packing techniques for realizing the required **memory** for an application in terms of **available** components were ... Note that there is no simple way to **interleave** ai and ci. ... can also be used to solve a variant of the problem stated as: given a **maximum memory** size 478 ...

Cited by 45 - [Related articles](#) - [Full Direct](#) - [All 3 versions](#)

Dynamic **memory** mapper which supports **interleaving** across 2, sup. N+1, 2, sup. N, sup. N-1 number of banks for reducing contention during nonunit stride accesses

JH Mirza, SW White - US Patent 5,247,645, 1993 - [Google Patents](#)

... processor cycle. Multiple ports or pipes in a vector design increase the **interleave** requirements. In ... **memory**. This 60 results in reducing the number of BSMs by a factor of two which, in turn, halves the **available memory**. An alternative ...

Cited by 12 - [Related articles](#)

Low-power mapping of behavioral arrays to multiple memories

[psu.edu](#) [PDF]
P Panda, N Dutt - Proceedings of the 1996 international symposium ..., 1996 - [portal.acm.org](#)

... tion is common in performance-critical systems where the required data access rate exceeds the **maximum** access ... 4). In Figure 2, logical array partitions K1 and K3 are merged into logical **memory** L1. Finally, we map the logical memories into the **available** physical memories ...

Cited by 15 - [Related articles](#) - [All 3 versions](#)

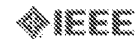
[PDF] [BLAST implementation on BEE2](#)

[berkeley.edu](#) [PDF]
C Chang - ... Engineering and Computer Science University of ..., 2005 - [cs.berkeley.edu](#)

... Due to the large number of I/O pins required to simultaneously accommodate both four independent banks of DRAMs and the high bandwidth inter-FPGA connections, we use the largest FPGA package **available** for the ... Block RAM (Kbits) 5,904 7,992 ... **Max** User I/Os 996 1,040 ...

Cited by 15 - [Related articles](#) - [View as HTML](#)

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## SEARCH RESULTS

You searched for: maximum memory available interleave

Results per Page: 25

Showing 1 - 25 of 10,661 results

**Quantum Memory Hierarchies: Efficient Designs to Match Available Parallelism in Quantum Computing**

Thaker, D.D.; Metodi, T.S.; Cross, A.W.; Chuang, I.L.; Chong, F.T.;

Computer Architecture, 2006. ISCA '06. 33rd International Symposium on

Digital Object Identifier: 10.1109/ISCA.2006.32

Publication Year: 2006 , Page(s): 378 - 390

IEEE CONFERENCES

**Determining Maximum Stack Usage in Preemptive Shared Stack Systems**

Kaj Hanninen; Jukka Maki-Turja; Markus Bohlin; Jan Carlsson; Mikael Nolin,

Real-Time Systems Symposium, 2006. RTSS '06. 27th IEEE International

Digital Object Identifier: 10.1109/RTSS.2006.18

Publication Year: 2006 , Page(s): 445 - 453

IEEE CONFERENCES

**Design and implementation of a turbo decoder for 3G W-CDMA systems**

Xiao-Jun Zeng, Zhi-Liang Hong;

Consumer Electronics, IEEE Transactions on Volume: 48 , Issue: 2

Digital Object Identifier: 10.1109/TCO.2002.1010133

Publication Year: 2002 , Page(s): 284 - 291

IEEE JOURNALS

**Configurable and scalable high throughput turbo decoder architecture for multiple 4G wireless standards**

Yang Sun; Yuming Zhu; Goel, M.; Cavallaro, J.R.;

Application-Specific Systems, Architectures and Processors, 2008. ASAP 2008. International Conference on

Digital Object Identifier: 10.1109/ASAP.2008.4580180

Publication Year: 2008 , Page(s): 209 - 214

IEEE CONFERENCES

**Blind nonlinear channel equalization based on efficient sub-space algorithms**

Dayong Zhou; GeBrunner, V.;

Global Telecommunications Conference, 2005. GLOBECOM '05.

IEEE

Volume: 4

Digital Object Identifier: 10.1109/GLOCOM.2005.1578096

Publication Year: 2005 , Page(s): 6 pp. - 2419

IEEE CONFERENCES

**Low-cost scalable switching solutions for broadband networking: the ATLANTA architecture and chipset**

Chrissi, F.M.; Kneuer, J.G.; Kumar, V.P.;

Communications Magazine, IEEE

Volume: 35 , Issue: 12

Digital Object Identifier: 10.1109/MCOM.1997.642833

Publication Year: 1997 , Page(s): 44 - 53

File 347:JAPIO Dec 1976-2010/Apr(Updated 100726)  
(c) 2010 JPO & JAPIO  
File 350:Derwent WPIX 1963-2010/UD=201049  
(c) 2010 Thomson Reuters

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Set	Items	Description
S1	52734	(MAX OR MAXIMUM OR CEILING OR LIMIT OR THRESHOLD OR BOUNDARY OR UPPERMOST OR TOPMOST) (5N) (MEMORY OR CAPACITY OR SPACE OR ROOM)
S2	288	(MOST OR HIGHEST OR GREATEST OR LARGEST) (3W) (AMOUNT OR QUANTITY OR NUMBER OR VOLUME OR DENSITY) (3W) (BYTES OR BITS OR SPACE OR ROOM OR CAPACITY OR MEMORY)
S3	10280	S1:S2(10N) (SEND??? OR SENT OR TRANSMIT? OR TRANSMISSION OR TRANSFER? OR COMMUNICAT? OR DELIVER? OR CONVEY? OR FORWARD? OR PROVIDE OR PROVIDES OR PROVIDED OR PROVIDING OR RELAY? OR RECEIV? OR RECEPTION OR UPLOAD? OR DOWNLOAD?)
S4	3613	INTERLEAVER? ? OR DEINTERLEAVER? ? OR INTER()LEAVER? ? OR LATENCY(1W) (PATH? ? OR PATHWAY? ?)
S5	641	S4(15N) (CONFIGUR? OR ALLOCAT? OR ASSIGN? OR RESERV? OR MODIF? OR MANIPULAT? OR ALTER? OR CHANG? OR INCREAS? OR DECREAS? OR LOWER? OR RAIS?)
S6	3	S3 AND S5
S7	12	S3 AND S4
S8	9	S7 NOT S6
S9	3	S8 AND PY=1963:2004
S10	5	S8 AND AY=1963:2004 AND AC=US
S11	6	S9:S10
S12	1	PN=US 20060088054
S13	0	S12 AND S3
S14	7786	(MAX OR MAXIMUM OR CEILING OR LIMIT OR THRESHOLD OR BOUNDARY OR UPPERMOST OR TOPMOST) (5N) DEPTH
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S16	5	S14:S15 AND S4
S17	4	S16 NOT S7
S18	723988	TRANSCEIVER? ? OR RECEIVER? ? OR TRANSMITTER? ?
S19	339	S1:S2(7N)S18(7N) (SEND??? OR SENT OR TRANSMIT? ? OR TRANSMITTED OR TRANSMITTING OR TRANSMISSION OR TRANSFER? OR COMMUNICAT? OR DELIVER? OR CONVEY? OR FORWARD? OR PROVIDE OR PROVIDES OR PROVIDED OR PROVIDING OR RELAY? OR RECEIV? OR RECEPTION OR UPLOAD? OR DOWNLOAD?)
S20	17	(S1:S2 OR S14:S15) (10N) ADVERTIS???
S21	1	S20 AND (S4 OR S18)
S22	68677	(TRANSCEIVER? ? OR RECEIVER(N) TRANSMITTER) (5N) (SEND??? OR SENT OR TRANSMIT? ? OR TRANSMITTED OR TRANSMITTING OR TRANSMISSION OR TRANSFER? OR COMMUNICAT? OR DELIVER? OR CONVEY? OR FORWARD? OR PROVIDE OR PROVIDES OR PROVIDED OR PROVIDING OR RELAY? OR RECEIV? OR RECEPTION OR UPLOAD? OR DOWNLOAD? OR ADVERTIS???)
S23	32	S22(10N)S1:S2

S24	32	S23 NOT (S7 OR S17)
S25	25	S24 AND PY=1963:2004
S26	20	S24 AND AY=1963:2004 AND AC=US
S27	28	S25:S26
S28	28	IDPAT (sorted in duplicate/non-duplicate order)

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S3	10970	S1:S2(10N) (SEND??? OR SENT OR TRANSMIT? ? OR TRANSMITTED OR TRANSMITTING OR TRANSMISSION OR TRANSFER? OR COMMUNICAT? OR DELIVER? OR CONVEY? OR FORWARD? OR PROVIDE OR PROVIDES OR PROVIDED OR PROVIDING OR RELAY? OR RECEIV? OR RECEPTION OR UPLOAD? OR DOWNLOAD? OR ADVERTIS???)
S4	56808	(DATA OR COMMUNICATION OR TRANSMISSION) (1W) (PATH? ? OR PATHWAY? ?) OR FCI()BLOCK
S5	9357	S4(15N) (CONFIGUR? OR ALLOCAT? OR ASSIGN? OR RESERV? OR MODIF? OR MANIPULAT? OR ALTER? OR CHANG? OR INCREAS? OR DECREAS? OR LOWER? OR RAIS?)
S6	27	S3 AND S5
S7	15	S6 AND PY=1963:2004
S8	15	S6 AND AY=1963:2004 AND AC=US
S9	17	S7:S8
S10	17	IDPAT (sorted in duplicate/non-duplicate order)

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S1	67716	(MAX OR MAXIMUM OR CEILING OR LIMIT OR THRESHOLD OR BOUNDARY OR UPPERMOST OR TOPMOST) (5N) (MEMORY OR CAPACITY OR SPACE OR ROOM OR DEPTH)
S2	894	(MOST OR HIGHEST OR GREATEST OR LARGEST) (3W) (AMOUNT OR QUANTITY OR NUMBER OR VOLUME OR DENSITY) (3W) (BYTES OR BITS OR SPACE OR ROOM OR CAPACITY OR MEMORY OR DEPTH)
S3	11551	S1:S2(10N) (SEND??? OR SENT OR TRANSMIT? ? OR TRANSMITTED OR TRANSMITTING OR TRANSMISSION OR TRANSFER? OR COMMUNICAT? OR DELIVER? OR CONVEY? OR FORWARD? OR PROVIDE OR PROVIDES OR PROVIDED OR PROVIDING OR RELAY? OR RECEIV? OR RECEPTION OR UPLOAD? OR DOWNLOAD? OR ADVERTIS???)
S4	64674	INTERLEAVER? ? OR DEINTERLEAVER? ? OR INTER()LEAVER? ? OR (LATENCY OR DATA OR COMMUNICATION OR TRANSMISSION) (1W) (PATH? ? OR PATHWAY? ?) OR FCI()BLOCK
S5	13802	S4(15N) (CONFIGUR? OR ALLOCAT? OR ASSIGN? OR RESERV? OR MODIF? OR MANIPULAT? OR ALTER??? OR ALTERATION? ? OR CHANG? OR INCREAS? OR DECREAS? OR LOWER? OR RAIS?)
S6	20	S3(100N)S5
S7	9	S6 AND PY=1978:2004
S8	8	S6 AND (AC=US OR AC=US/PR) AND AY=1978:2004
S9	13	S7:S8
S10	13	IDPAT (sorted in duplicate/non-duplicate order)
S11	109	S1:S2(10N)BROADCAST???
S12	0	S11(100N)S5
S13	286670	(TRANSCIEVER? ? OR RECEIVER? ? OR TRANSMITTER? ?) (5N) (SEND??? OR SENT OR TRANSMIT? ? OR TRANSMITTED OR TRANSMITTING OR TRANSMISSION OR TRANSFER? OR COMMUNICAT? OR DELIVER? OR CONVEY? OR FORWARD? OR PROVIDE OR PROVIDES OR PROVIDED OR PROVIDING OR RELAY? OR RECEIV? OR RECEPTION OR UPLOAD? OR DOWNLOAD? OR ADVERTIS??? OR BROADCAST???)
S14	479	S13(10N)S1:S2
S15	90455	(TRANSCIEVER? ? OR RECEIVER? ?(1N)TRANSMITTER? ?) (5N) (SEND??? OR SENT OR TRANSMIT? ? OR TRANSMITTED OR TRANSMITTING OR TRANSMISSION OR TRANSFER? OR COMMUNICAT? OR DELIVER? OR CONVEY? OR FORWARD? OR PROVIDE OR PROVIDES OR PROVIDED OR PROVIDING OR RELAY? OR RECEIV? OR RECEPTION OR UPLOAD? OR DOWNLOAD? OR ADVERTIS??? OR BROADCAST???)
S16	84	S15(10N)S1:S2
S17	83	S16 NOT S6
S18	42	S17 AND PY=1978:2004
S19	33	S17 AND (AC=US OR AC=US/PR) AND AY=1978:2004
S20	47	S18:S19
S21	47	IDPAT (sorted in duplicate/non-duplicate order)
S22	419	(MAXIMUM OR MOST OR HIGHEST OR GREATEST OR LARGEST) (3W) (AMOUNT OR QUANTITY OR DENSITY) (3W) (STORAGE() (SPACE OR ROOM OR CAPACITY) OR MEMORY OR RAM)



S23	53	S22(7N)(SEND??? OR SENT OR TRANSMIT? ? OR TRANSMITTED OR TRANSMITTING OR TRANSMISSION OR TRANSFER? OR COMMUNICAT? OR DELIVER? OR CONVEY? OR FORWARD? OR PROVIDE OR PROVIDES OR PROVIDED OR PROVIDING OR RELAY? OR RECEIV? OR RECEPTION OR UPLOAD? OR DOWNLOAD? OR ADVERTIS??? OR BROADCAST???)
S24	40	S23 AND PY=1978:2004
S25	23	S23 AND (AC=US OR AC=US/PR) AND AY=1978:2004
S26	41	S24:S25
S27	41	IDPAT (sorted in duplicate/non-duplicate order)

File 347:JAPIO Dec 1976-2010/Apr(Updated 100726)  
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File 350:Derwent WPIX 1963-2010/UD=201050  
(c) 2010 Thomson Reuters

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Set	Items	Description
S1	143	(MAXIMUM OR MOST OR HIGHEST OR GREATEST OR LARGEST) (3W) (AMOUNT OR QUANTITY OR DENSITY) (3W) (STORAGE() (SPACE OR ROOM OR CAPACITY) OR MEMORY OR RAM)
S2	11	S1(10N) (SEND??? OR SENT OR TRANSMIT? ? OR TRANSMITTED OR TRANSMITTING OR TRANSMISSION OR TRANSFER? OR COMMUNICAT? OR DELIVER? OR CONVEY? OR FORWARD? OR RELAY? OR RECEIV? OR RECEPTION OR UPLOAD? OR ADVERTIS??? OR BROADCAST???)
S3	24	S1(30N) (SEND??? OR SENT OR TRANSMIT? ? OR TRANSMITTED OR TRANSMITTING OR TRANSMISSION OR TRANSFER? OR COMMUNICAT? OR DELIVER? OR CONVEY? OR FORWARD? OR RELAY? OR RECEIV? OR RECEPTION OR UPLOAD? OR ADVERTIS??? OR BROADCAST???)
S4	13	S3 NOT S2

File 8: Ei Compendex(R) 1884-2010/Aug W1  
(c) 2010 Elsevier Eng. Info. Inc.

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File 34: SciSearch(R) Cited Ref Sci 1990-2010/Aug W1  
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File 56: Computer and Information Systems Abstracts 1966-2010/May  
(c) 2010 CSA.

File 60: ANTE: Abstracts in New Tech & Engineer 1966-2010/May  
(c) 2010 CSA.

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? ds

Set	Items	Description
S1	142746	(MAX OR MAXIMUM OR CEILING OR LIMIT OR THRESHOLD OR BOUNDARY OR UPPERMOST OR TOPMOST) (5N) (MEMORY OR RAM OR CAPACITY OR SPACE OR ROOM OR DEPTH)
S2	302	(MOST OR HIGHEST OR GREATEST OR LARGEST) (3W) (AMOUNT OR QUANTITY OR NUMBER OR VOLUME OR DENSITY) (3W) (BYTES OR BITS OR SPACE OR ROOM OR CAPACITY OR MEMORY OR RAM OR DEPTH)
S3	9025	S1:S2(10N) (SEND??? OR SENT OR TRANSMIT? ? OR TRANSMITTED OR TRANSMITTING OR TRANSMISSION OR TRANSFER? OR COMMUNICAT? OR DELIVER? OR CONVEY? OR FORWARD? OR PROVIDE OR PROVIDES OR PROVIDED OR PROVIDING OR RELAY? OR RECEIV? OR RECEPTION OR UPLOAD? OR DOWNLOAD? OR ADVERTIS??? OR BROADCAST???)
S4	92870	INTERLEAVER? ? OR DEINTERLEAVER? ? OR INTER()LEAVER? ? OR (LATENCY OR DATA OR COMMUNICATION OR TRANSMISSION) (1W) (PATH? ? OR PATHWAY? ?) OR FCI()BLOCK
S5	4839	S4(15N) (CONFIGUR? OR ALLOCAT? OR ASSIGN? OR RESERV? OR MODIF? OR MANIPULAT? OR ALTER??? OR ALTERATION? ? OR CHANG? OR INCREAS? OR DECREAS? OR LOWER? OR RAIS?)
S6	12	S3 AND S5
S7	9	RD (unique items)
S8	127	S3 AND S4

S9            6596    S1:S2(10N)(SEND??? OR SENT OR TRANSMIT? ? OR TRANSMITTED OR TRANSMITTING  
OR TRANSMISSION OR TRANSFER? OR COMMUNICAT? OR DELIVER? OR CONVEY? OR FORWARD? OR RELAY?  
OR RECEIV? OR RECEPTION OR UPLOAD? OR DOWNLOAD? OR ADVERTIS??? OR BROADCAST???)

S10           118    S9 AND S4

S11           107    RD   (unique items)

S12           51    S11 NOT PY=2005:2010

S13           49    S12 NOT S7

S14           67877   (TRANSCIEVER? ? OR RECEIVER? ?(1N)TRANSMITTER? ?)(5N)(SEND??? OR SENT OR  
TRANSMIT? ? OR TRANSMITTED OR TRANSMITTING OR TRANSMISSION OR TRANSFER? OR COMMUNICAT?  
OR DELIVER? OR CONVEY? OR FORWARD? OR PROVIDE OR PROVIDES OR PROVIDED OR PROVIDING OR  
RELAY? OR RECEIV? OR RECEPTION OR UPLOAD? OR DOWNLOAD? OR ADVERTIS??? OR BROADCAST???)

S15           31    S14(7N)S1:S2


S16           30    RD   (unique items)

S17           19    S16 NOT (S13 OR S7 OR PY=2005:2010)

S18           56    (MAXIMUM OR MOST OR HIGHEST OR GREATEST OR LARGEST)(3W)(AMOUNT OR  
QUANTITY OR DENSITY)(3W)(STORAGE() (SPACE OR ROOM OR CAPACITY) OR MEMORY OR RAM)

S19           4    S18(30N)(SEND??? OR SENT OR TRANSMIT? ? OR TRANSMITTED OR TRANSMITTING OR  
TRANSMISSION OR TRANSFER? OR COMMUNICAT? OR DELIVER? OR CONVEY? OR FORWARD? OR RELAY? OR  
RECEIV? OR RECEPTION OR UPLOAD? OR ADVERTIS??? OR BROADCAST???)

S20           4    RD   (unique items)

<b>Application Number</b> 	<b>Application/Control No.</b> 12/853,020	<b>Applicant(s)/Patent under Reexamination</b> TZANNES ET AL.	
<b>Document Code - DISQ</b>		<b>Internal Document – DO NOT MAIL</b>	

<b>TERMINAL DISCLAIMER</b>	<input checked="" type="checkbox"/> <b>APPROVED</b>	<input type="checkbox"/> <b>DISAPPROVED</b>
Date Filed : 9/24/10	This patent is subject to a Terminal Disclaimer	

<b>Approved/Disapproved by:</b>
ANDRE ROBINSON  NO DBLE PAT REJ CITED

U.S. Patent and Trademark Office

**TERMINAL DISCLAIMER TO OBVIATE A PROVISIONAL DOUBLE PATENTING  
REJECTION OVER A PENDING "REFERENCE" APPLICATION**

Docket Number (Optional)  
5550-54-CON-2

In re Application of: Marcos C. Tzannes

Application No.: 12/853,020

Filed: August 9, 2010

For: Computer Readable Medium with Instructions for Resource Sharing in a Telecommunications Environment

The owner\*, Aware, Inc., of 100 percent interest in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of any patent granted on pending **reference** Application Number 11/246,163, filed on October 11, 2005, as such term is defined in 35 U.S.C. 154 and 173, and as the term of any patent granted on said **reference** application may be shortened by any terminal disclaimer filed prior to the grant of any patent on the pending **reference** application. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and any patent granted on the **reference** application are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the owner does not disclaim the terminal part of any patent granted on the instant application that would extend to the expiration date of the full statutory term as defined in 35 U.S.C. 154 and 173 of any patent granted on said **reference** application, "as the term of any patent granted on said **reference** application may be shortened by any terminal disclaimer filed prior to the grant of any patent on the pending **reference** application," in the event that: any such patent: granted on the pending **reference** application: expires for failure to pay a maintenance fee, is held unenforceable, is found invalid by a court of competent jurisdiction, is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321, has all claims canceled by a reexamination certificate, is reissued, or is in any manner terminated prior to the expiration of its full statutory term as shortened by any terminal disclaimer filed prior to its grant.

Check either box 1 or 2 below, if appropriate.

1. ☐ For submissions on behalf of a business/organization (e.g., corporation, partnership, university, government agency, etc.), the undersigned is empowered to act on behalf of the business/organization.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

2. ☒ The undersigned is an attorney or agent of record. Reg. No. 45,285

/Jason H. Vick/  
Signature

September 24, 2010  
Date

Jason H. Vick  
Typed or printed name

303-863-9700  
Telephone Number

- ☒ Terminal disclaimer fee under 37 CFR 1.20(d) is included.

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\*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).  
Form PTO/SB/96 may be used for making this statement. See MPEP § 324.

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7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt	
EFS ID:	8493456
Application Number:	12853020
International Application Number:	
Confirmation Number:	5009
Title of Invention:	COMPUTER READABLE MEDIUM WITH INSTRUCTIONS FOR RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT
First Named Inventor/Applicant Name:	Marcos C. Tzannes
Customer Number:	62574
Filer:	Jason Vick/Joanne Vos
Filer Authorized By:	Jason Vick
Attorney Docket Number:	5550-54-CON-2
Receipt Date:	24-SEP-2010
Filing Date:	09-AUG-2010
Time Stamp:	14:48:28
Application Type:	Utility under 35 USC 111(a)

### Payment information:

Submitted with Payment	no
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### File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Terminal Disclaimer Filed	Terminal_Disclaimer_01.pdf	78548	no	2
			ba2ed215a401f5c9c0fb3caeb7330f2e5d6b ab75		

### Warnings:

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This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

**National Stage of an International Application under 35 U.S.C. 371**

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

**New International Application Filed with the USPTO as a Receiving Office**

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Electronic Patent Application Fee Transmittal				
Application Number:		12853020		
Filing Date:		09-Aug-2010		
Title of Invention:		COMPUTER READABLE MEDIUM WITH INSTRUCTIONS FOR RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT		
First Named Inventor/Applicant Name:		Marcos C. Tzannes		
Filer:		Jason Vick/joanne vos		
Attorney Docket Number:		5550-54-CON-2		
Filed as Large Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
<b>Miscellaneous:</b>				
Statutory disclaimer	1814	1	140	140
<b>Total in USD (\$)</b>				<b>140</b>

<b>Electronic Acknowledgement Receipt</b>	
<b>EFS ID:</b>	8493481
<b>Application Number:</b>	12853020
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	5009
<b>Title of Invention:</b>	COMPUTER READABLE MEDIUM WITH INSTRUCTIONS FOR RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT
<b>First Named Inventor/Applicant Name:</b>	Marcos C. Tzannes
<b>Customer Number:</b>	62574
<b>Filer:</b>	Jason Vick/joanne vos
<b>Filer Authorized By:</b>	Jason Vick
<b>Attorney Docket Number:</b>	5550-54-CON-2
<b>Receipt Date:</b>	24-SEP-2010
<b>Filing Date:</b>	09-AUG-2010
<b>Time Stamp:</b>	14:49:40
<b>Application Type:</b>	Utility under 35 USC 111(a)

### **Payment information:**

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$ 140
RAM confirmation Number	1135
Deposit Account	191970
Authorized User	
<p>The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:</p> <p>Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)</p> <p>Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)</p>	

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

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### File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Fee Worksheet (PTO-875)	fee-info.pdf	30420	no	2
			7e5d630038820fccc4d8153c4c9c1ee4e74b7db		

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### Information:

Total Files Size (in bytes):	30420
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#### New Applications Under 35 U.S.C. 111

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#### National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

#### New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.



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United States Patent and Trademark Office  
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www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/853,020	08/09/2010	Marcos C. Tzannes	5550-54-CON-2

**CONFIRMATION NO. 5009**

**POA ACCEPTANCE LETTER**



62574  
Jason H. Vick  
Sheridan Ross, PC  
Suite # 1200  
1560 Broadway  
Denver, CO 80202

Date Mailed: 09/03/2010

**NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY**

This is in response to the Power of Attorney filed 08/26/2010.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/ttran/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Under the Paperwork Reduction Act of 1996, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

## POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(b).

I hereby appoint:

☒ Practitioners associated with the Customer Number:

62574

OR

☐ Practitioner(s) named below (If more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

as attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(b).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(b) to:

☒ The address associated with Customer Number:

62574

OR

☐ Firm or Individual Name

Address

City

State

Zip

Country

Telephone

Email

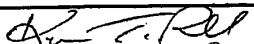
Assignee Name and Address:

AWARE, INC.  
40 Middlesex Turnpike  
Bedford, MA 07130-1423

A copy of this form, together with a statement under 37 CFR 3.73(b) (Form PTO/SB/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(b) may be completed by one of the practitioners appointed in this form if the appointed practitioner is authorized to act on behalf of the assignee, and must identify the application in which this Power of Attorney is to be filed.

### SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature		Date	11/8/09
Name	Kevin E. Russell	Telephone	781-657-0335
Title	VP, General Counsel		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1460, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1460, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Electronic Acknowledgement Receipt	
EFS ID:	8297849
Application Number:	12853020
International Application Number:	
Confirmation Number:	5009
Title of Invention:	COMPUTER READABLE MEDIUM WITH INSTRUCTIONS FOR RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT
First Named Inventor/Applicant Name:	Marcos C. Tzannes
Customer Number:	62574
Filer:	Jason Vick/Joanne Vos
Filer Authorized By:	Jason Vick
Attorney Docket Number:	5550-54-CON-2
Receipt Date:	26-AUG-2010
Filing Date:	09-AUG-2010
Time Stamp:	13:59:43
Application Type:	Utility under 35 USC 111(a)

### Payment information:

Submitted with Payment	no				
<b>File Listing:</b>					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		Statement_Under_373b_w_PO A.pdf	253544 8072eea3edad7610157cb533d30c1d8d78 b8f608	yes	2



	Multipart Description/PDF files in .zip description		
	Document Description	Start	End
	Assignee showing of ownership per 37 CFR 3.73(b).	1	1
	Power of Attorney	2	2
Warnings:			
Information:			
Total Files Size (in bytes):		253544	
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>			

**STATEMENT UNDER 37 CFR 3.73(b)**

Applicant/Patent Owner: AWARE, INC.

Application No./Patent No.: 12/853,020

Filed/Issue Date: August 9, 2010

Titled: **COMPUTER READABLE MEDIUM WITH INSTRUCTIONS FOR RESOURCE SHARING IN A  
TELECOMMUNICATIONS ENVIRONMENT**

AWARE, INC.

, a Corporation

(Name of Assignee)

(Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that it is:

1. ☒ the assignee of the entire right, title, and interest in;
2. ☐ an assignee of less than the entire right, title, and interest in  
(The extent (by percentage) of its ownership interest is \_\_\_\_\_ %); or
3. ☐ the assignee of an undivided interest in the entirety of (a complete assignment from one of the joint inventors was made)  
the patent application/patent identified above, by virtue of either:

A. ☒ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 017438, Frame 0094, or for which a copy therefore is attached.

OR

B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: \_\_\_\_\_ To: \_\_\_\_\_

The document was recorded in the United States Patent and Trademark Office at  
Reel \_\_\_\_\_, Frame \_\_\_\_\_, or for which a copy thereof is attached.

2. From: \_\_\_\_\_ To: \_\_\_\_\_

The document was recorded in the United States Patent and Trademark Office at  
Reel \_\_\_\_\_, Frame \_\_\_\_\_, or for which a copy thereof is attached.

3. From: \_\_\_\_\_ To: \_\_\_\_\_

The document was recorded in the United States Patent and Trademark Office at  
Reel \_\_\_\_\_, Frame \_\_\_\_\_, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☒ As required by 37 CFR 3.73(b)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

Signature

Jason H. Vick

Printed or Typed Name

26 Aug '11

Date

Attorney for Assignee

Title

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.



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UNITED STATES DEPARTMENT OF COMMERCE  
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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
12/853,020	08/09/2010		1090	5550-54-CON-2	8	2

CONFIRMATION NO. 5009

FILING RECEIPT



\*OC000000043156255\*

62574  
Jason H. Vick  
Sheridan Ross, PC  
Suite # 1200  
1560 Broadway  
Denver, CO 80202

Date Mailed: 08/25/2010

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

**Applicant(s)**

Marcos C. Tzannes, Orinda, CA;  
Michael Lund, West Newton, MA;

**Assignment For Published Patent Application**

AWARE, INC., Bedford, MA

**Power of Attorney:** None

**Domestic Priority data as claimed by applicant**

This application is a CON of 11/246,163 10/11/2005  
which claims benefit of 60/618,269 10/12/2004

**Foreign Applications**

**If Required, Foreign Filing License Granted:** 08/20/2010

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/853,020**

**Projected Publication Date:** 12/02/2010

**Non-Publication Request:** No

**Early Publication Request:** No

**Title**

COMPUTER READABLE MEDIUM WITH INSTRUCTIONS FOR RESOURCE SHARING IN A  
TELECOMMUNICATIONS ENVIRONMENT

**Preliminary Class****PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES**

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

**LICENSE FOR FOREIGN FILING UNDER**

**Title 35, United States Code, Section 184**

**Title 37, Code of Federal Regulations, 5.11 & 5.15**

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page 2 of 3

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#### **NOT GRANTED**

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Substitute for form 1449A/PTO				<b>Complete if Known</b>	
<b>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</b>				Application Number	12/853,020
				Filing Date	August 9, 2010
				First Named Inventor	Marcos C. Tzannes
				Art Unit	Not Yet Assigned
				Examiner Name	Not Yet Assigned
Sheet	1	of	2	Attorney Docket Number	5550-54-CON-2

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No. <sup>1</sup>	Document Number Number-kind Code <sup>2</sup> (if known)	Publication Date MM-DD-YYYY	Name of Patentee of Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	1	6337877	01/08/02	Cole et al.	
	2	6707822	03/16/04	Fadavi-Ardekani et al.	
	3	6775320	08/10/04	Tzannes et al.	
	4	6778589	08/17/04	Ishii	
	5	6778596	08/17/04	Tzannes	
	6	2004/0114536	06/17/04	O'Rourke	
	7	2005/0180323	08/18/05	Beightol et al.	
	8	2003/0067877	04/10/03	Sivakumar et al.	
	9	2006/0088054	04/27/06	Tzannes et al.	
	10	2009/0300450	12/03/09	Tzannes (10-02-2008)	
	11	12/783758		Tzannes (05-20-2010)	
	12	12/760728		Tzannes (04-15-2010)	
	13	12/783765		Tzannes (05-20-2010)	
	14	12/761586		Lund et al. (4-16-2010)	

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No. <sup>1</sup>	Foreign Patent Document Country Code <sup>3</sup> ; Number <sup>4</sup> ; Kind Code <sup>5</sup> (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T <sup>6</sup>
	15	EP 1225735	07/24/02	Matsushita Electronic Ind Co Ltd		
	16	EP 1246409	10/02/02	Mitsubishi Electric Corp		
	17	WO 2003/063060	07/31/03	Broadcom Corp.		
	18	WO 2006/044227	04/27/06	Aware Inc.		

Examiner Signature		Date Considered	
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\*EXAMINER: Initial if reference is considered, whether or not citation is in conformance and not considered. Include copy of this form with next communication to applicant.

Substitute for form 1449A/PTO				<b>Complete if Known</b>	
<b>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</b>				Application Number	12/853,020
				Filing Date	August 9, 2010
				First Named Inventor	Marcos C. Tzannes
				Art Unit	Not Yet Assigned
				Examiner Name	Not Yet Assigned
Sheet	2	of	2	Attorney Docket Number	5550-54-CON-2

OTHER ART (Including Author, Title, Date, Pertinent Pages, etc.)		
Examiner Initials*	Cite No. <sup>1</sup>	
	19	Shoji, T. et al: "Wireless Access Method to Ensure Each Users QOS in Unpredictable and Various QOS Requirements Wireless Personal Communications," Springer, Dordrecht, NL, Vol. 22, No. 2, Aug. 2002, pp. 139-151
	20	"ITU-T Recommendation G.992.5 - Series G: Transmission Systems and Media, Digital Systems and Networks", International Telecommunication Union, ADSL2, May 2003, 92 pages
	21	"ITU-T Recommendation G.992.3," International Telecommunication Union, ADSL2, Jan. 2005, 436 pages
	22	"VDSL2 ITU-T Recommendation G.993.2," International Telecommunication Union, Feb. 2006, 252 pages
	23	"Sunset xDSL: Prequalification of ADSL Circuits with ATU-C Emulation," Sunrise Telecom Inc., Application Series, 2001, San Jose, USA, page 3, available at <a href="http://www.sunrisetelecom.com/technotes/APP-xDSL-8B.pdf">http://www.sunrisetelecom.com/technotes/APP-xDSL-8B.pdf</a>
	24	International Search Report for International (PCT) Patent Application No. PCT/US2005/036015, mailed February 8, 2006
	25	Written Opinion for International (PCT) Patent Application No. PCT/US2005/036015, mailed February 8, 2006
	26	International Preliminary Report on Patentability for International (PCT) Patent Application No. PCT/US2005/036015, mailed April 26, 2007
	27	Examiner's First Report for Australian Patent Application No. 2005296086, mailed June 24, 2009 (Attorney's Ref. No. 5550-54)
	28	Notification of the First Office Action (including translation) for Chinese Patent Application No. 200580032703, mailed September 25, 2009 (Attorney's Ref. No. 5550-54-PCN)
	29	Official Action for U.S. Patent Application No. 11/246,163, mailed February 24, 2009 (Attorney's Ref. No. 5550-54)
	30	Official Action for U.S. Patent Application No. 11/246,163, mailed December 9, 2009 (Attorney's Ref. No. 5550-54)

Examiner Signature		Date Considered	
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\*EXAMINER: Initial if reference is considered, whether or not citation is in conformance and not considered. Include copy of this form with next communication to applicant.

Electronic Acknowledgement Receipt	
<b>EFS ID:</b>	8209724
<b>Application Number:</b>	12853020
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	5009
<b>Title of Invention:</b>	A COMPUTER READABLE MEDIUM WITH INSTRUCTIONS FOR RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT
<b>First Named Inventor/Applicant Name:</b>	Marcos C. Tzannes
<b>Customer Number:</b>	62574
<b>Filer:</b>	Jason Vick/Carrie Steward
<b>Filer Authorized By:</b>	Jason Vick
<b>Attorney Docket Number:</b>	5550-54-CON-2
<b>Receipt Date:</b>	12-AUG-2010
<b>Filing Date:</b>	
<b>Time Stamp:</b>	17:03:43
<b>Application Type:</b>	Utility under 35 USC 111(a)

### Payment information:

Submitted with Payment		no			
<b>File Listing:</b>					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		IDS_01.pdf	503122	yes	5
			94eb0259f6d699b5c6dbcac0f33e53ca6d4d6a5d		



	<b>Multipart Description/PDF files in .zip description</b>		
	<b>Document Description</b>	<b>Start</b>	<b>End</b>
	Transmittal Letter	1	3
	Information Disclosure Statement (IDS) Filed (SB/08)	4	5
<b>Warnings:</b>			
<b>Information:</b>			
<b>Total Files Size (in bytes):</b>		503122	
<p><b>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</b></p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b>  If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b>  If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b>  If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>			

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re the Application of:	)	Group Art Unit: Not Yet Assigned
Marcos C. Tzannes	)	Confirmation No.: 5009
Serial No.: 12/853,020	)	Examiner: Not Yet Assigned
Filed: August 9, 2010	)	
Atty. File No.: 5550-54-CON-2	)	<u>INFORMATION DISCLOSURE</u>
Entitled: "A COMPUTER READABLE	)	<u>STATEMENT</u>
MEDIUM WITH INSTRUCTIONS FOR	)	
RESOURCE SHARING IN A	)	Electronically Submitted
TELECOMMUNICATIONS ENVIRONMENT"	)	

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Dear Sir:

The references cited on attached Form PTO-1449 are being called to the attention of the Examiner.

- ☐ Copies of the cited non-patent and/or foreign references are enclosed herewith.
- ☐ Copies of the cited U.S. patents and/or patent applications are enclosed herewith.
- ☐ Copies of the cited U.S. patents/patent application publications are not enclosed in accordance with 37 C.F.R. § 1.98(a).
- ☒ Copies of the cited references are not enclosed, in accordance with 37 C.F.R. § 1.98(d), because the references were cited by or submitted to the U.S. Patent and Trademark Office in prior application Serial No. 11/246,163 filed October 11, 2005, which is relied upon for an earlier filing date under 35 U.S.C. § 120.
- ☐ To the best of applicants' belief, the pertinence of the foreign-language references are believed to be summarized in the attached English abstracts and in the figures, although applicants do not necessarily vouch for the accuracy of the translation.
- ☒ Examiner's attention is drawn to the following related applications:
- Serial No. 11/246,163 filed 10/11/05 (Attorney's Ref. No. 5550-54)
  - Serial No. 12/761,586 filed 04/16/10 (Attorney's Ref. No. 5550-54-CON)
  - Serial No. 12/295,828 filed 10/02/08 (Attorney's Ref. No. 5550-57-PUS)
  - Serial No. 12/760,728 filed 04/15/10 (Attorney's Ref. No. 5550-57-PUS-DIV)

- Serial No. 12/783,758 filed 05/20/10 (Attorney's Ref. No. 5550-57-PUS-CON)
- Serial No. 12/783,765 filed 05/20/10 (Attorney's Ref. No. 5550-57-PUS-DIV-CON)

☐ Other: \_\_\_\_\_

Submission of the above information is not intended as an admission that any item is citable under the statutes or rules to support a rejection, that any item disclosed represents analogous art, or that those skilled in the art would refer to or recognize the pertinence of any reference without the benefit of hindsight, nor should an inference be drawn as to the pertinence of the references based on the order in which they are presented. Submission of this statement should not be taken as an indication that a search has been conducted, or that no better art exists.

It is respectfully requested that the cited information be expressly considered during the prosecution of this application and the references made of record therein.

#### FEES

<input checked="" type="checkbox"/>	<p><b>37 CFR 1.97(b):</b> No fee is believed due in connection with this submission, because the information disclosure statement submitted herewith is satisfied by one of the following conditions ("X" indicates satisfaction):</p> <p><input checked="" type="checkbox"/> Within three months of the filing date of a national application other than a continued prosecution application under 37 CFR 1.53(d), or</p> <p><input type="checkbox"/> Within three months of the date of entry into the national stage of an international application as set forth in 37 CFR 1.491 or</p> <p><input type="checkbox"/> Before the mailing date of a first Office Action on the merits, or</p> <p><input type="checkbox"/> Before the mailing of a first Office action after the filing of a request for continued examination under 37 CFR 1.114.</p> <p>Although no fee is believed due, if any fee is deemed due in connection with this submission, please charge such fee to Deposit Account 19-1970.</p>
<input type="checkbox"/>	<p><b>37 CFR 1.97(e):</b> The information disclosure statement transmitted herewith is being filed after all the above conditions (37 CFR 1.97(b)), but before the mailing date of one of the following conditions:</p> <p>(1) a final action under 37 C.F.R. 1.113 or</p> <p>(2) a notice of allowance under 37 C.F.R. 1.311, or</p> <p>(3) an action that otherwise closes prosecution in the application.</p> <p>This Information Disclosure Statement is accompanied by:</p> <p><input type="checkbox"/> A Certification (below) as specified by 37 C.F.R. 1.97(e). Although no fee is believed due, if any fee is deemed due in connection with this submission, please charge such fee to Deposit Account 19-1970.</p> <p>OR</p> <p><input type="checkbox"/> Please charge Deposit Account 19-1970 in the amount of \$180.00 for the fee set forth in 37 C.F.R. 1.17(p) for submission of an information disclosure statement. Please credit any overpayment or charge any underpayment to Deposit Account 19-1970.</p>
<input type="checkbox"/>	<p><b>37 CFR 1.97(d):</b> This Information Disclosure Statement is being submitted after the period specified in 37 CFR 1.97(c).</p> <p><input type="checkbox"/> This information Disclosure Statement includes a Certification (below) as specified by 37 C.F.R. 1.97(e)</p> <p>AND</p> <p><input type="checkbox"/> Applicants hereby requests consideration of the reference(s) disclosed herein. Please charge Deposit Account 19-1970 in the amount of \$180.00 under 37 C.F.R. 1.17(p). Please credit any overpayment or charge any underpayment to Deposit Account 19-1970. Election to pay the fee should not be taken as an indication that applicant(s) cannot execute a certification.</p>

**Certification (37 C.F.R. 1.97(e))**  
(Applicable only if checked)

- ☐ The undersigned certifies that:
- ☐ Each item of information contained in this information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this statement. 37 C.F.R. 1.97(e)(1).
  - ☐ A copy of the communication from the foreign patent office is enclosed.

OR

- ☐ No item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the undersigned after making reasonable inquiry, no item of information contained in this Information Disclosure Statement was known to any individual designated in 37 C.F.R. 1.56(c) more than three months prior to the filing of this statement. 37 C.F.R. 1.97(e)(2).

Respectfully submitted,

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Date: 12/13/10

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re the Application of: TZANNES et al.	)	Group Art Unit:
Application No.:	)	Examiner:
Filed: Herewith	)	Confirmation No.:
Atty. File No.: 5550-54-CON-2	)	

For: A COMPUTER READABLE MEDIUM WITH INSTRUCTIONS FOR RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT (As Amended)

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313

**PRELIMINARY AMENDMENT**

Dear Sir:

Prior to the initial review of the above-identified patent application by the Examiner, please enter the following Preliminary Amendment. Although Applicants do not believe that any fees are due based upon the filing of this Preliminary Amendment, please charge any such fees to Deposit Account 19-1970.

Please amend the above-identified patent application as follows:

**Amendments to the Specification** begin on page 2 of this paper.

**Amendments to the Claims** are shown in the listing of claims which begin on page 4 of this paper.

**Remarks** begin on page 6 of this paper.

## AMENDMENTS TO THE SPECIFICATION

Please amend the title with:

A Computer Readable Medium with Instructions for Resource Sharing in a Telecommunications Environment

Please replace paragraph [0001] with:

[0001] This application is a Continuation of U.S. Application No. 11/246,163 filed October 11, 2005, which~~This application~~ claims the benefit of and priority under 35 U.S.C. § 119(e) to U.S. Patent Application No. 60/618,269, filed October 12, 2004, entitled “Sharing Memory and Processing Resources in DSL Systems,” each of which are~~is~~ incorporated herein by reference in their~~its~~ entirety.

Please replace paragraph [0003] with:

[0003] U.S. Patent Nos. 6,775,320 and 6,778,589,~~which are both incorporated herein by reference in their entirety,~~ describe DSL systems supporting multiple applications and multiple framer/coder/interleaver FCI blocks (an FCI block is also referred to as a latency path). DSL systems carry applications that have different transmission requirements with regard to, for example, data rate, latency (delay), bit error rate (BER), and the like. For example, video typically requires a low BER ( $<1E-10$ ) but can tolerate higher latency ( $>20$  ms). Voice, on the other hand, typically requires a low latency ( $<1$  ms) but can tolerate BER ( $>1E-3$ ).

Please replace paragraph [0006] with:

[0006] Accordingly, an exemplary aspect of this invention relates to sharing memory between one or more interleavers and/or ~~deinterleavers~~ deinterleavers in a transceiver. More particularly, an exemplary aspect of this invention relates to shared latency path memory in a transceiver.

Please replace paragraph [0048] with:

**[0048]**        Example #1

A first transmitter portion or receiver portion latency path may carry data from a video application, which needs a very low BER but can tolerate higher latency. In this case, the video will be transported using an latency path that has a large amount of interleaving/deinterleaving and coding (also known as Forward Error Correction (FEC) coding). For example, the latency path may be configured with Reed-Solomon coding using a codeword size of 255 bytes ( $N=255$ ) with 16 checkbytes ( $R=16$ ) and interleaving/deinterleaving using an interleaver depth of 64 ( $D=64$ ). This latency path will require  ~~$N \cdot D = 16 \cdot 255 = 16\text{Kbytes}$~~   $N \cdot D = 255 \cdot 64 = 16\text{Kbytes}$  of interleaver memory at the transmitter (or de-interleaver memory at the receiver). This latency path will be able to correct a burst of errors that is less than 512 bytes in duration.

## **AMENDMENTS TO THE CLAIMS**

This listing of claims will replace all prior versions, and listings, of claims in the application.

### **Listing of Claims:**

1-45. (Cancelled)

46. (New) A non-transitory computer-readable information storage media having stored thereon instructions, that if executed by a processor, cause to be performed a method for allocating shared memory in a transceiver comprising:

transmitting or receiving, by the transceiver, a message during initialization specifying a maximum number of bytes of memory that are available to be allocated to an interleaver;

determining, at the transceiver, an amount of memory required by the interleaver to interleave a first plurality of Reed Solomon (RS) coded data bytes within a shared memory;

allocating, in the transceiver, a first number of bytes of the shared memory to the interleaver to interleave the first plurality of Reed Solomon (RS) coded data bytes for transmission at a first data rate, wherein the allocated memory for the interleaver does not exceed the maximum number of bytes specified in the message;

allocating, in the transceiver, a second number of bytes of the shared memory to a deinterleaver to deinterleave a second plurality of RS coded data bytes received at a second data rate; and

interleaving the first plurality of RS coded data bytes within the shared memory allocated to the interleaver and deinterleaving the second plurality of RS coded data bytes within the shared memory allocated to the deinterleaver, wherein the shared memory allocated to the interleaver is used at the same time as the shared memory allocated to the deinterleaver.

47. (New) The media of claim 46, wherein the determining is based on an impulse noise protection requirement.

48. (New) The media of claim 46, wherein the determining is based on a latency requirement.



49. (New) The media of claim 46, wherein the determining is based on a bit error rate requirement.

50. (New) A non-transitory computer-readable information storage media having stored thereon instructions, that if executed by a processor, cause to be performed a method for allocating shared memory in a transceiver comprising:

transmitting or receiving, by the transceiver, a message during initialization specifying a maximum number of bytes of memory that are available to be allocated to a deinterleaver;

determining, at the transceiver, an amount of memory required by the deinterleaver to deinterleave a first plurality of Reed Solomon (RS) coded data bytes within a shared memory;

allocating, in the transceiver, a first number of bytes of the shared memory to the deinterleaver to deinterleave a first plurality of Reed Solomon (RS) coded data bytes for transmission at a first data rate, wherein the allocated memory for the deinterleaver does not exceed the maximum number of bytes specified in the message;

allocating, in the transceiver, a second number of bytes of the shared memory to an interleaver to interleave a second plurality of RS coded data bytes received at a second data rate; and

deinterleaving the first plurality of RS coded data bytes within the shared memory allocated to the deinterleaver and interleaving the second plurality of RS coded data bytes within the shared memory allocated to the interleaver, wherein the shared memory allocated to the deinterleaver is used at the same time as the shared memory allocated to the interleaver.

51. (New) The media of claim 50, wherein the determining is based on an impulse noise protection requirement.

52. (New) The media of claim 50, wherein the determining is based on a latency requirement.

53. (New) The media of claim 50, wherein the determining is based on a bit error rate requirement.

### REMARKS/ARGUMENTS

By this amendment, claims 1-45 are canceled without prejudice or disclaimer in favor of newly presented claims 46-53.

Additionally, the continuity data has been updated and the specification amended in a similar manner as the parent application. Submitted herewith is a marked-up and clean version of the substitute specification. The substitute specification does not contain any new matter.

Applicants request examination on the merits.

Applicants believe that the pending claims are in condition for allowance and such disposition is respectfully requested. In the event that a telephone conversation would further prosecution and/or expedite allowance, the Examiner is invited to contact the undersigned.

The Commissioner is hereby authorized to charge to Deposit Account No. 19-1970 any fees under 37 C.F.R. §§ 1.16 and 1.17 that may be required by this paper and to credit any overpayment to that Account. If any extension of time is required in connection with the filing of this paper and has not been separately requested, such extension is hereby Petitioned.

Respectfully submitted,

SHERIDAN ROSS P.C.

By: \_\_\_\_\_

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Date: 7 Aug '10

## RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT

### RELATED APPLICATION DATA

[0001] This application claims the benefit of and priority under 35 U.S.C. § 119(e) to U.S. Patent Application No. 60/618,269, filed October 12, 2004, entitled “Sharing Memory and Processing Resources in DSL Systems,” which is incorporated herein by reference in its entirety.

### BACKGROUND

#### Field of the Invention

[0002] This invention generally relates to communication systems. More specifically, an exemplary embodiment of this invention relates to memory sharing in communication systems. Another exemplary embodiment relates to processing or coding resource sharing in a communication system.

#### Description of Related Art

[0003] U.S. Patent Nos. 6,775,320 and 6,778,589, which are both incorporated herein by reference in their entirety, describe DSL systems supporting multiple applications and multiple framer/coder/interleaver FCI blocks (an FCI block is also referred to as a latency path). DSL systems carry applications that have different transmission requirements with regard to, for example, data rate, latency (delay), bit error rate (BER), and the like. For example, video typically requires a low BER ( $<1\text{E-}10$ ) but can tolerate higher latency ( $>20$  ms). Voice, on the other hand, typically requires a low latency ( $<1$  ms) but can tolerate BER ( $>1\text{E-}3$ ).

[0004] As described in U.S. Patent No. 6,775,320, different applications can use different latency paths in order to satisfy the different application requirements of the communication system. As a result a transceiver must support multiple latency paths in order to support applications such as video, Internet access and voice telephony. When implemented in a transceiver, each of the latency paths will have a framer, coder, and interleaver block with different capabilities that depend on the application requirements.

#### SUMMARY

[0005] One difficulty with implementing multiple latency paths in a transceiver is the fact that a latency path is a complicated digital circuit that requires a large amount of memory and processing power. An interleaver within a latency path can consume a large amount of memory in order to provide error correcting capability. For example, a typical DSL transceiver will have at least one latency path with approximately 16 kbytes of memory for the interleaver. Likewise, the coding block, for example, a Reed Solomon coder, consumes a large amount of processing power. In general, as the number of latency paths increase, the memory and processing power requirements for a communication system become larger.

[0006] Accordingly, an exemplary aspect of this invention relates to sharing memory between one or more interleavers and/or deinterleavers in a transceiver. More particularly, an exemplary aspect of this invention relates to shared latency path memory in a transceiver.

[0007] Additional aspects of this invention relate to configuring and initializing shared memory in a communication system. More particularly, an exemplary aspect of this invention relates to configuring and initializing interleaver/deinterleaver memory in a communication system.

[0008] Additional aspects of the invention relate to determining the amount of memory that can be allocated to a particular component by a communication system. More specifically, an exemplary aspect of the invention relates to determining the maximum amount of shared memory that can be allocated to one or more interleaves or deinterleavers.

[0009] According to another exemplary aspect of the invention, processing power is shared between a number of transceiver modules. More specifically, and in accordance with an exemplary embodiment of the invention, a coding module is shared between one or more coders and/or decoders.

[0010] Another exemplary embodiment of the invention relates to transitioning from a fixed memory configuration to a shared memory configuration during one or more of initialization and SHOWTIME (user data transmission).

[0011] An additional exemplary aspect of the invention relates to dynamically updating one or more of shared memory and processing resources based on changing communication conditions.

**[0012]** An additional exemplary aspect of the invention relates to updating one or more of shared memory and processing resources based on an updated communication parameter.

**[0013]** An additional exemplary aspect of the invention relates to updating the allocation of one or more of shared memory and processing resources based on an updated communication parameter(s).

**[0014]** Additional aspects of the invention relate to exchanging shared resource allocations between transceivers.

**[0015]** Additional exemplary aspects relate to a method of allocating shared memory in a transceiver comprising allocating the shared memory to a plurality of modules, wherein each of the plurality of modules comprise at least one interleaver, at least one deinterleaver or a combination thereof.

**[0016]** Still further aspects relate to the above method wherein the plurality of modules comprise interleavers.

**[0017]** Still further aspects relate to the above method wherein the plurality of modules comprise deinterleavers.

**[0018]** Still further aspects relate to the above method wherein the plurality of modules comprise at least one interleaver and at least one deinterleaver.

**[0019]** Additional exemplary aspects relate to a transceiver comprising a plurality of modules each including at least one interleaver, at least one deinterleaver or a

combination thereof and a shared memory designed to be allocated to a plurality of the modules.

[0020] Still further aspects relate to the above transceiver wherein the plurality of modules comprise interleavers.

[0021] Still further aspects relate to the above transceiver wherein the plurality of modules comprise deinterleavers.

[0022] Still further aspects relate to the above transceiver wherein the plurality of modules comprise at least one interleaver and at least one deinterleaver.

[0023] These and other features and advantages of this invention are described in, or are apparent from, the following description of the embodiments.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0024] The embodiments of the invention will be described in detail, with reference to the following figures, wherein:

[0025] Fig. 1 is a functional block diagram illustrating an exemplary transceiver according to this invention;

[0026] Fig. 2 is a flowchart outlining an exemplary method of sharing resources according to this invention;

[0027] Fig. 3 is a flowchart outlining an exemplary method of determining a maximum amount of shared memory according to this invention; and

[0028] Fig. 4 is a flowchart outlining an exemplary resource sharing methodology according to this invention.

DETAILED DESCRIPTION

**[0029]** The exemplary embodiments of this invention will be described in relation to sharing resources in a wired and/or wireless communications environment. However, it should be appreciated, that in general, the systems and methods of this invention will work equally well for any type of communication system in any environment.

**[0030]** The exemplary systems and methods of this invention will also be described in relation to multicarrier modems, such as DSL modems and VDSL modems, and associated communication hardware, software and communication channels. However, to avoid unnecessarily obscuring the present invention, the following description omits well-known structures and devices that may be shown in block diagram form or otherwise summarized.

**[0031]** For purposes of explanation, numerous details are set forth in order to provide a thorough understanding of the present invention. It should be appreciated however that the present invention may be practiced in a variety of ways beyond the specific details set forth herein.

**[0032]** Furthermore, while the exemplary embodiments illustrated herein show the various components of the system collocated, it is to be appreciated that the various components of the system can be located at distant portions of a distributed



network, such as a telecommunications network and/or the Internet, or within a dedicated secure, unsecured and/or encrypted system. Thus, it should be appreciated that the components of the system can be combined into one or more devices, such as a modem, or collocated on a particular node of a distributed network, such as a telecommunications network. As will be appreciated from the following description, and for reasons of computational efficiency, the components of the system can be arranged at any location within a distributed network without affecting the operation of the system. For example, the various components can be located in a Central Office modem (CO, ATU-C, VTU-O), a Customer Premises modem (CPE, ATU-R, VTU-R), a DSL management device, or some combination thereof. Similarly, one or more functional portions of the system could be distributed between a modem and an associated computing device.

**[0033]** Furthermore, it should be appreciated that the various links, including communications channel 5, connecting the elements can be wired or wireless links, or any combination thereof, or any other known or later developed element(s) that is capable of supplying and/or communicating data to and from the connected elements. The term module as used herein can refer to any known or later developed hardware, software, firmware, or combination thereof that is capable of performing the functionality associated with that element. The terms determine, calculate and compute, and variations thereof, as used herein are used interchangeably and include any type of methodology, process, mathematical operation or technique. FCI block and latency path are used interchangeably herein as well as transmitting modem and transmitting transceiver. Receiving modem and receiving transceiver are also used

interchangeably.

**[0034]** Fig. 1 illustrates an exemplary embodiment of a transceiver 100 that utilizes shared resources. It should be appreciated that numerous functional components of the transceiver have been omitted for clarity. However, the transceiver 100 can also include the standard components found in typical communications device(s) in which the technology of the subject invention is implemented into.

**[0035]** According to an exemplary embodiment of the invention, memory and processing power can be shared among a plurality of transmitter and/or receiver latency paths, in a communications transceiver that carries or supports multiple applications. For example, the transmitter and/or receiver latency paths of the transceiver can share an interleaver/deinterleaver memory and the shared memory can be allocated to the interleaver and/or deinterleaver of each latency path. This allocation can be done based on the data rate, latency, BER, impulse noise protection requirements of the application, data or information being transported over each latency path, or in general any parameter associated with the communications system.

**[0036]** Likewise, for example, the transmitter and/or receiver latency paths can share a Reed-Solomon coder/decoder processing module and the processing power of this module can be allocated to each encoder and/or decoder. This allocation can be done based on the data rate/latency, BER, impulse noise protection requirements of the application data or information being transported over each latency path, or in general based on any parameter associated with the communication system.

**[0037]** In accordance with an exemplary operational embodiment, a first transceiver and a second transceiver transmit to one another messages during, for example, initialization which contain information on the total and/or shared memory capabilities of each transceiver and optionally information about the one or more latency paths. This information can be transmitted prior to determining how to configure the latency paths to support the application requirements. Based on this information, one of the modems can select an FCI configuration parameter(s) that meets the transmission requirements of each application being transported over each latency paths. While an exemplary of the embodiment of the invention will be described in relation to the operation of the invention and characteristics thereof being established during initialization, it should be appreciated that the sharing of resources can be modified and messages transmitted between a two transceivers at any time during initialization and/or user data transmission, i.e., SHOWTIME.

**[0038]** Fig. 1 illustrates an exemplary embodiment of a transceiver 100. The transceiver 100 includes a transmitter portion 200 and a receiver portion 300. The transmitter portion 200 includes one or more latency paths 210, 220, .... Similarly, the receiver portion 300 includes one or more latency paths 310, 320, .... Each of the latency paths in the transmitter portion 200 includes a framer, coder, and interleaver designated as 212, 214, 216 and 222, 224 and 226, respectively. Each of the latency paths in the receiver portion includes a deframer, decoder, and deinterleaver designated as 312, 314, 316 and 322, 324, and 326, respectively. The transceiver 100 further includes a shared processing module 110, a shared memory 120, a parameter

determination module 130, a path module 140, an allocation module 150, and a shared resource management module 160, all interconnected by one or more links (not shown).

**[0039]** In this exemplary embodiment, the transceiver 100 is illustrated with four total transmitter portion and receiver portion latency paths, i.e., 210, 220, 310, and 320. The shared memory 120 is shared amongst the two transmitter portion interleavers 216 and 226 and two receiver portion deinterleavers 316 and 326. The shared processing module 110, such as a shared coding module, is shared between the two transmitter portion coders 214 and 224 and the two receiver portion decoders 314 and 324.

**[0040]** While the exemplary embodiment of the invention will be described in relation to a transceiver having a number of transmitter portion latency paths and receiver portion latency paths, it should be appreciated that this invention can be applied to any transceiver having any number of latency paths. Moreover, it should be appreciated that the sharing of resources can be allocated such that one or more of the transmitter portion latency paths are sharing a shared resource, one or more of the receiver portion latency paths are sharing a shared resource, or a portion of the transmitter portion latency paths and a portion of the receiver portion latency paths are sharing shared resources. Moreover, any one or more of the latency paths, or portions thereof, could also be assigned to a fixed resource while, for example, another portion of the latency path(s) assigned to a shared resource. For example, in latency path 210, the interleaver 216 could be allocated a portion of the shared

memory 120, while the coder 214 could be allocated to a dedicated processing module, vice versa, or the like.

**[0041]** In accordance with the exemplary embodiment, a plurality of transmitter portion or receiver portion latency paths share an interleaver/deinterleaver memory, such as shared memory 120, and a coding module, such as shared processing module 110. For example, the interleaver/deinterleaver memory can be allocated to different interleavers and/or deinterleavers. This allocation can be based on parameters associated with the communication systems such as data rate, latency, BER, impulse noise protection, and the like, of the applications being transported. Similarly, a coding module, which can be a portion of the shared processing module 110, can be shared between any one or more of the latency paths. This sharing can be based on requirements such as data rate, latency, BER, impulse noise protection, and the like, of the applications being transported.

**[0042]** For example, an exemplary transceiver could comprise a shared interleaver/deinterleaver memory and could be designed to allocate a first portion of the shared memory 120 to an interleaver, such as interleaver 216 in the transmitter portion of the transceiver and allocate a second portion of the shared memory 120 to a deinterleaver, such as 316, in the receiver portion of the transceiver.

**[0043]** Alternatively, for example, an exemplary transceiver can comprise a shared interleaver/deinterleaver memory, such as shared memory 120, and be designed to allocate a first portion of shared memory 120 to a first interleaver, e.g.,

216, in the transmitter portion of the transceiver and allocate a second portion of the shared memory to a second interleaver, e.g., 226, in the transmitter portion of the transceiver.

**[0044]** Alternatively, for example, an exemplary transceiver can comprise a shared interleaver/deinterleaver memory and be designed to allocate a first portion of the shared memory 120 to a first deinterleaver, e.g., 316, in the receiver portion of the transceiver and allocate a second portion of the shared memory to a second deinterleaver, e.g., 326, in the receiver portion of the transceiver. Regardless of the configuration, in general any interleaver or deinterleaver, or grouping thereof, be it in a transmitter portion or receiver portion of the transceiver, can be associated with a portion of the shared memory 120.

**[0045]** Establishment, configuration and usage of shared resources is performed in the following exemplary manner. First, and in cooperation with the path module 140, the number of transmitter and receiver latency paths (N) is determined. The parameter determination module 130 then analyses one or more parameters such as data rate, transmitter data rate, receiver data rate, impulse noise protection, bit error rate, latency, or the like. Based on one or more of these parameters, the allocation module 150 allocates a portion of the shared memory 120 to one or more of the interleaver and/or deinterleavers, or groupings thereof. This process continues until the memory allocation has been determined and assigned to each of the N latency paths.

[0046] Having determined the memory allocation for each of the latency paths, and in conjunction with the shared resource management 160, the transceiver 100 transmits to a second transceiver one or more of the number of latency paths (N), the maximum interleaver memory for any one or more of the latency paths and/or the maximum total and/or shared memory for all of the latency paths.

[0047] Three examples of sharing interleaver/deinterleaver memory and coding processing in a transceiver are described below. The latency paths in these examples can be in the transmitter portion of the transceiver or the receiver portion of the transceiver.

[0048] Example #1

A first transmitter portion or receiver portion latency path may carry data from a video application, which needs a very low BER but can tolerate higher latency. In this case, the video will be transported using an latency path that has a large amount of interleaving/deinterleaving and coding (also known as Forward Error Correction (FEC) coding). For example, the latency path may be configured with Reed-Solomon coding using a codeword size of 255 bytes ( $N=255$ ) with 16 checkbytes ( $R=16$ ) and interleaving/deinterleaving using an interleaver depth of 64 ( $D=64$ ). This latency path will require  $N*D=16*255=16\text{Kbytes}$  of interleaver memory at the transmitter (or de-interleaver memory at the receiver). This latency path will be able to correct a burst of errors that is less than 512 bytes in duration.

[0049] A second transmitter portion or receiver portion latency path may carry an

internet access application that requires a medium BER and a medium amount of latency. In this case, the internet access application will be transported using a latency path that has a medium amount of interleaving and coding. For example, the latency path may be configured with Reed-Solomon coding using a codeword size of 128 bytes ( $N=128$ ) with 8 checkbytes ( $R=8$ ) and interleaving using an interleaver depth of 16 ( $D=32$ ). This latency path will require  $N*D=128*32=4\text{Kbytes}$  of interleaver memory and the same amount of deinterleaver memory. This latency path will be able to correct a burst of errors that is less than 128 bytes in duration.

**[0050]** A third transmitter portion or receiver portion latency path may carry a voice telephony application, which needs a very low latency but can tolerate BER. In this case, the video will be transported using an latency path that has a large amount of interleaving and coding. For example, the third transmitter portion or receiver portion latency path may be configured with no interleaving or coding which will result in the lowest possible latency through the latency path but will provide no error correction capability.

**[0051]** According to the principles of this invention, a system carrying the three applications described above in Example #1, would have three latency paths that share one memory space containing at least  $(16+4)=20\text{ Kbytes}$ . The three latency paths also share a common coding block that is able to simultaneously encode (in the transmitter portion) or decode (in a receiver portion) two codewords with  $N=255/R=16$  and  $N=128/R=8$ .



**[0052]** According to an exemplary embodiment of this invention, the latency paths can be reconfigured at initialization or during data transmission mode (also known as SHOWTIME in ADSL and VDSL transceivers). This would occur if, for example, the applications or application requirements were to change.

**[0053]** Example #2

If instead of 1 video application, 1 internet application and 1 voice application, there were 3 internet access applications then the transmitter portion and/or receiver portion latency paths would be reconfigured to utilize the shared memory and coding module in a different way. For example, the system could be reconfigured to have 3 transmitter portion or receiver portion latency paths, with each latency path being configured with Reed-Solomon coding using a codeword size of 128 bytes ( $N=128$ ) with 8 checkbytes ( $R=8$ ) and interleaving using an interleaver depth of 16 ( $D=32$ ). Each latency path will require  $N*D=128*32=4\text{Kbytes}$  of interleaver memory and each block will be able to correct a burst of errors that is less than 128 bytes in duration. Based on the example of carrying the three internet access applications described, the three latency path share one memory space containing at least  $3*4=12\text{ Kbytes}$ . Also the three latency paths share a common coding block that is able to simultaneously encode (on the transmitter side) or decode (on the receiver side) three codewords with  $N=128/R=16$ ,  $N=128/R=8$  and  $N=128/R=8$ .

**[0054]** Example #3

The system could be configured to carry yet another set of applications. For example, the latency paths could be configured to carry 2 video applications. In this case only

2 transmitter portion or receiver portion latency paths are needed, which means that the third latency path could be simply disabled. Also, assuming that the memory is constrained based on the first example above, then the maximum shared memory for these 2 latency paths is 20 kBytes. In this case, the system could be reconfigured to have 2 latency paths, with each block being configured with Reed-Solomon coding using a codeword size of 200 bytes ( $N=200$ ) with 10 checkbytes ( $R=10$ ) and interleaving/deinterleaving using an interleaver depth of 50 ( $D=50$ ). Each latency path will require  $N*D=200*50=10\text{Kbytes}$  of interleaver memory and each block will be able to correct a burst of errors that is less than 250 bytes in duration. This configuration results in 20K of shared memory for both latency paths, which is the same as in the first example. In order to stay within the memory constraints of the latency paths, the error correction capability for each latency path is decreased to 250 bytes from 512 bytes in Example #1.

**[0055]** Another aspect of this invention is the how FCI configuration information is transmitted between a first modem and a second modem. FCI configuration information will depend on the requirements of the applications being transported over the DSL connection. This information may need to be forwarded during initialization in order to initially configure the DSL connection. This information may also need to be forwarded during SHOWTIME in order to reconfigure the DSL connection based on a change in applications or the application requirements.

**[0056]** According to one embodiment, a first modem determines the specific FCI configuration parameters, e.g.,  $N$ ,  $D$ ,  $R$  as defined above, needed to meet specific

application requirements, such as latency, burst error correction capability, etc. In order to determine the FCI configuration parameters, the first modem must know what are the capabilities of a second modem. For example, the first modem must know how many latency paths (FCI blocks) the second modem can support. Also the first modem must know the maximum amount of interleaver memory for each transmitter latency path. In addition, since the transmitter latency paths may share a common memory space the first modem must know the total shared memory for all transmitter latency paths. This way the first modem will be able to choose a configuration that can meet application requirements and also meet the transmitter portion latency path capabilities of the second modem.

**[0057]** For example, using values from examples above, a first transceiver could send a message to a second transceiver during initialization or during SHOWTIME containing the following information:

- Number of supported transmitter and receiver latency paths = 3
- Max Interleaver Memory for latency path #1= 16 Kbytes
- Max Interleaver Memory for latency path #2= 16 Kbytes
- Max Interleaver Memory for latency path #3= 16 Kbytes
- Maximum total/shared memory for all latency paths = 20 kBytes

Based on this information, and the application requirements, the first transceiver would select latency path settings. For example, if the applications are 1 video, 1 internet access and 1 voice application, the first transceiver could configure 3 latency paths as follows:

latency path #1 – Video: N=255, R=16, D=64

latency path #2 – Video:  $N=128$ ,  $R=8$ ,  $D=32$

latency path #3 – Video:  $N=0$ ,  $R=0$ ,  $D=1$  (no coding or interleaving)

**[0058]** This would result in a total interleaver memory of 20 kbytes.

**[0059]** Alternatively, if for example, there are only 2 video applications, the first transceiver could configure 2 latency paths as follows:

latency path #1 – Video:  $N=200$ ,  $R=10$ ,  $D=50$

latency path #2 – Video:  $N=200$ ,  $R=10$ ,  $D=50$

latency path #3 – Video:  $N=0$ ,  $R=0$ ,  $D=1$  (no coding or interleaving)

**[0060]** This would also result in a total interleaver memory of 20 kbytes.

**[0061]** Alternatively, the second transceiver can determine the specific FCI configuration parameters, e.g.,  $N$ ,  $D$ ,  $R$  as defined above, needed to meet specific application requirements, such as latency, burst error correction capability, etc. As described above for the first transceiver, in order to determine the FCI configuration parameters, the second transceiver must first know what are the capabilities of the first transceiver. In this case, the first transceiver would send a message to the second transceiver containing the information described above and based on this information and the application requirements the second transceiver would select latency path settings.

**[0062]** Fig. 2 outlines an exemplary method of allocating shared memory in a

transceiver. More specifically, control begins in step S200 and continues to step S210. In step S210, one or more of shared interleaver/deinterleaver memory and/or shared coder/decoder processing resources are allocated to one or more latency paths, in a transceiver. Control then continues to step S220 where the control sequence ends.

**[0063]** Fig. 3 outlines an exemplary method of exchanging shared resource allocations according to an exemplary embodiment of this invention. In particular, control begins in step S310. In step S310, a maximum amount of shared memory that can be allocated to a specific interleaver or deinterleaver of a plurality of interleavers or deinterleavers in a transceiver is determined. Next, in step S320, the determined maximum amount for one or more of the deinterleavers and/or interleavers is transmitted to another transceiver. Messages containing additional information can also be transmitted to the other transceiver and/or received from the other transceiver. Control then continues to step S330 where the control sequence ends.

**[0064]** Fig. 4 outlines an exemplary procedure for resource sharing according to an exemplary embodiment of this invention. In particular, control begins in step S400 and continues to step S410. In step S410, the number of latency paths are determined. Then, in step S420, the latency path information (FCI block information) is transmitted to another transceiver. Messages containing additional information can also be transmitted to the other transceiver and/or received from the other transceiver. This information can be used to, for example, assist with the determination of memory allocation in the transceiver. Moreover, the messages received from the

other transceiver could specify what the memory allocation is to be based on, for example, the number of latency paths, memory allocation in the remote transceiver and required applications. Control then continues to step S430.

**[0065]** In step S430, and for each latency path, the steps in step 440 are performed.

**[0066]** In step S440, and while monitoring of allocation of resources is being performed, steps 450 and 460 are performed. More specifically, in step S450, one or more parameters associated with the communication system are determined. Then, in step S460, shared resources are allocated based on one or more of the communication parameters. Control then continues to step S470.

**[0067]** In step S470, the allocation of shared resources is communicated to another transceiver. Next, in step S480, a determination is made as to whether there is a change in communications that would require the adjustment of the shared resource allocation. Examples of changes in communications conditions include a change in applications being transported over the system and/or changes in the channel condition, etc. If adjustments are required, control jumps back to step S410. Otherwise, control jumps to step S490 where the control sequence ends.

**[0068]** The above-described system can be implemented on wired and/or wireless telecommunications devices, such a modem, a multicarrier modem, a DSL modem, an ADSL modem, an XDSL modem, a VDSL modem, a linecard, test equipment, a

multicarrier transceiver, a wired and/or wireless wide/local area network system, a satellite communication system, a modem equipped with diagnostic capabilities, or the like, or on a separate programmed general purpose computer having a communications device or in conjunction with any of the following communications protocols: CDSL, ADSL2, ADSL2+, VDSL1, VDSL2, HDSL, DSL Lite, IDSL, RADSL, SDSL, UDSL or the like.

**[0069]** Additionally, the systems, methods and protocols of this invention can be implemented on a special purpose computer, a programmed microprocessor or microcontroller and peripheral integrated circuit element(s), an ASIC or other integrated circuit, a digital signal processor, a hard-wired electronic or logic circuit such as discrete element circuit, a programmable logic device such as PLD, PLA, FPGA, PAL, a modem, a transmitter/receiver, any comparable means, or the like. In general, any device capable of implementing a state machine that is in turn capable of implementing the methodology illustrated herein can be used to implement the various communication methods, protocols and techniques according to this invention.

**[0070]** Furthermore, the disclosed methods may be readily implemented in software using object or object-oriented software development environments that provide portable source code that can be used on a variety of computer or workstation platforms. Alternatively, the disclosed system may be implemented partially or fully in hardware using standard logic circuits or VLSI design. Whether software or hardware is used to implement the systems in accordance with this invention is

dependent on the speed and/or efficiency requirements of the system, the particular function, and the particular software or hardware systems or microprocessor or microcomputer systems being utilized. The communication systems, methods and protocols illustrated herein can be readily implemented in hardware and/or software using any known or later developed systems or structures, devices and/or software by those of ordinary skill in the applicable art from the functional description provided herein and with a general basic knowledge of the computer and telecommunications arts.

**[0071]** Moreover, the disclosed methods may be readily implemented in software that can be stored on a storage medium, executed on programmed general-purpose computer with the cooperation of a controller and memory, a special purpose computer, a microprocessor, or the like. In these instances, the systems and methods of this invention can be implemented as program embedded on personal computer such as an applet, JAVA® or CGI script, as a resource residing on a server or computer workstation, as a routine embedded in a dedicated communication system or system component, or the like. The system can also be implemented by physically incorporating the system and/or method into a software and/or hardware system, such as the hardware and software systems of a communications transceiver.

**[0072]** It is therefore apparent that there has been provided, in accordance with the present invention, systems and methods for sharing resources. While this invention has been described in conjunction with a number of embodiments, it is evident that many alternatives, modifications and variations would be or are apparent



to those of ordinary skill in the applicable arts. Accordingly, it is intended to embrace all such alternatives, modifications, equivalents and variations that are within the spirit and scope of this invention.

Claims:

1. A method for sharing resources in a transceiver comprising:  
allocating a first portion of shared memory to a first latency path and  
allocating a second portion of the shared memory to a second latency path.
2. The method of claim 1, wherein the first latency path includes an interleaver and the second latency path includes an interleaver.
3. The method of claim 1, wherein the first latency path includes an interleaver and the second latency path includes a deinterleaver.
4. The method of claim 1, wherein the first latency path includes a deinterleaver and the second latency path includes a deinterleaver.
5. The method of claim 1, further comprising transmitting to another transceiver information that is used to determine a maximum amount of shared memory that can be allocated.
6. The method of claim 1, further comprising receiving from another transceiver information that is used to determine a maximum amount of shared memory that can be allocated.
7. The method of claim 1, further comprising allocating a shared processing module to a plurality of coding and/or decoding modules.
8. The method of claim 1, wherein the allocating of at least one portion of the shared memory is based on one or more communication parameters.
9. The method of claim 8, wherein at least one of the communication parameters is a data rate, a latency, an INP value or a bit error rate (BER).

10. A transceiver comprising:  
a first portion of shared memory that is allocated to a first latency path;  
and  
a second portion of the shared memory that is allocated to a second latency path.
11. The transceiver of claim 10, further comprising:  
an allocation module designed to allocate the shared memory based on one or more communication parameters.
12. The transceiver of claim 11, wherein at least one of the communication parameters is a data rate, a latency, an INP value or a Bit Error Rate (BER).
13. The transceiver of claim 10, wherein the first latency path includes an interleaver and the second latency path includes an interleaver.
14. The transceiver of claim 10, wherein the first latency path includes an interleaver and the second latency path includes a deinterleaver.
15. The transceiver of claim 10, wherein the first latency path includes a deinterleaver and the second latency path includes a deinterleaver.
16. The transceiver of claim 10, further comprising a shared resource management module designed to determine information that is transmitted to another transceiver, wherein the information is used to determine a maximum amount of shared memory that can be allocated.
17. The transceiver of claim 10, further comprising a shared resource management module designed to utilize information that is received from another transceiver, wherein the information is used to determine a maximum amount of shared memory that can be allocated.

18. The transceiver of claim 10, further comprising a shared processing module designed to provide processing resources to a plurality of coding and/or decoding modules.
19. A system for sharing resources in a transceiver comprising:  
means for allocating a first portion of shared memory to a first latency path and means for allocating a second portion of the shared memory to a second latency path.
20. The system of claim 19, wherein the first latency path includes an interleaver and the second latency path includes an interleaver.
21. The system of claim 19, wherein the first latency path includes an interleaver and the second latency path includes a deinterleaver.
22. The system of claim 19, wherein the first latency path includes a deinterleaver and the second latency path includes a deinterleaver.
23. The system of claim 19, further comprising means for transmitting to another transceiver information that is used to determine a maximum amount of shared memory that can be allocated.
24. The system of claim 19, further comprising means for receiving from another transceiver information that is used to determine a maximum amount of shared memory that can be allocated.
25. The system of claim 19, further comprising means for allocating a shared processing module to a plurality of coding and/or decoding modules.
26. The system of claim 19, wherein the allocating of at least one portion

of the shared memory is based on one or more communication parameters.

27. The system of claim 26, wherein at least one of the communication parameters is a data rate, a latency, an INP value or a bit error rate (BER).

28. A protocol for sharing resources in a transceiver comprising:  
allocating a first portion of shared memory to a first latency path and  
allocating a second portion of the shared memory to a second latency path.

29. The protocol of claim 28, wherein the first latency path includes an interleaver and the second latency path includes an interleaver.

30. The protocol of claim 28, wherein the first latency path includes an interleaver and the second latency path includes a deinterleaver.

31. The protocol of claim 28, wherein the first latency path includes a deinterleaver and the second latency path includes a deinterleaver.

32. The protocol of claim 28, further comprising transmitting to another transceiver information that is used to determine a maximum amount of shared memory that can be allocated.

33. The protocol of claim 28, further comprising receiving from another transceiver information that is used to determine a maximum amount of shared memory that can be allocated.

34. The protocol of claim 28, further comprising allocating a shared processing module to a plurality of coding and/or decoding modules.

35. The protocol of claim 28, wherein the allocating of at least one portion of the shared memory is based on one or more communication parameters.

36. The protocol of claim 35, wherein at least one of the communication parameters is a data rate, a latency, an INP value or a bit error rate (BER).

37. An information storage media having stored thereon information that when executed allows sharing of resources in a transceiver comprising:  
information that allocates a first portion of shared memory to a first latency path and information that allocates a second portion of the shared memory to a second latency path.

38. The media of claim 37, wherein the first latency path includes an interleaver and the second latency path includes an interleaver.

39. The media of claim 37, wherein the first latency path includes an interleaver and the second latency path includes a deinterleaver.

40. The media of claim 37, wherein the first latency path includes a deinterleaver and the second latency path includes a deinterleaver.

41. The media of claim 37, further comprising information that transmits to another transceiver information that is used to determine a maximum amount of shared memory that can be allocated.

42. The media of claim 37, further comprising information that receives from another transceiver information that is used to determine a maximum amount of shared memory that can be allocated.

43. The media of claim 37, further comprising information that allocates a shared processing module to a plurality of coding and/or decoding modules.

44. The media of claim 37, wherein the allocating of at least one portion of

the shared memory is based on one or more communication parameters.

45. The media of claim 44, wherein at least one of the communication parameters is a data rate, a latency, an INP value or a bit error rate (BER).

ABSTRACT

A transceiver is designed to share memory and processing power amongst a plurality of transmitter and/or receiver latency paths, in a communications transceiver that carries or supports multiple applications. For example, the transmitter and/or receiver latency paths of the transceiver can share an interleaver/deinterleaver memory. This allocation can be done based on the data rate, latency, BER, impulse noise protection requirements of the application, data or information being transported over each latency path, or in general any parameter associated with the communications system.



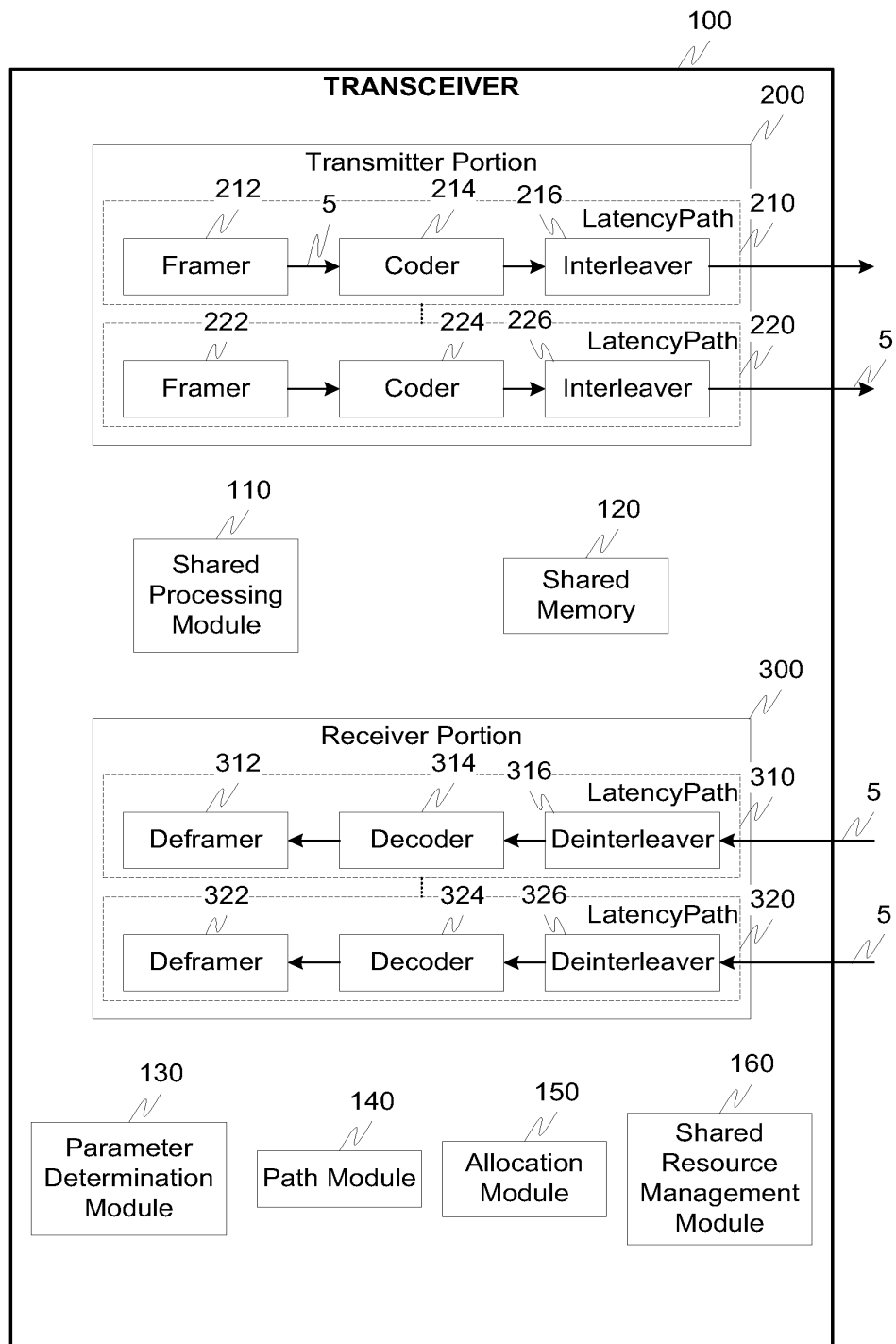


Fig. 1

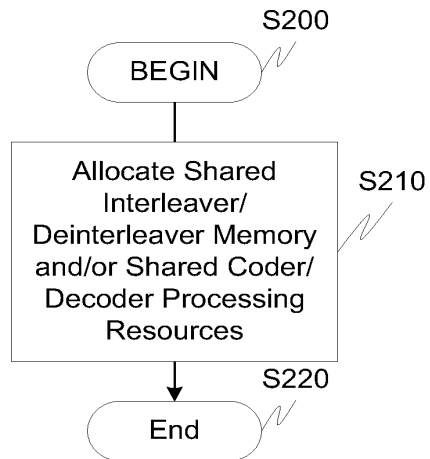


Fig. 2

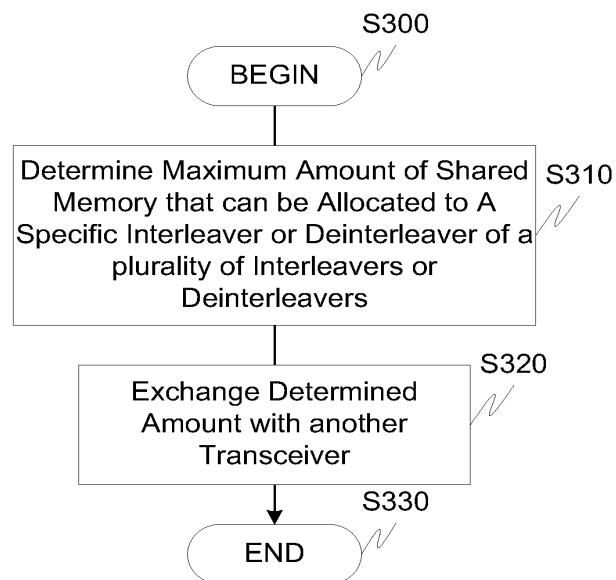


Fig. 3

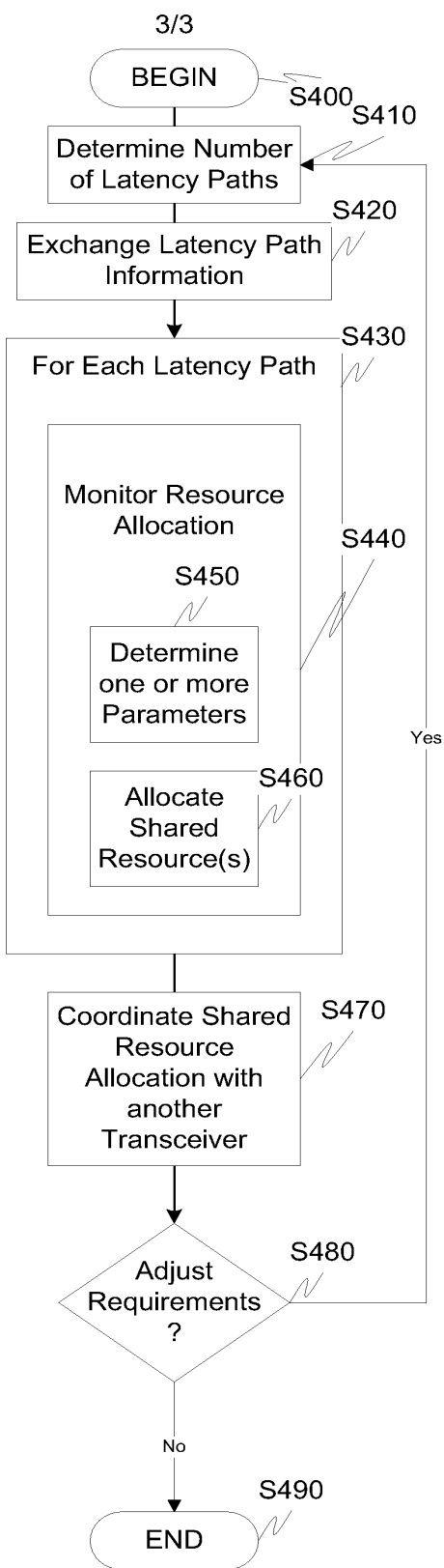


Fig. 4

**A COMPUTER READABLE MEDIUM WITH INSTRUCTIONS FOR**  
**RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT**

RELATED APPLICATION DATA

[0001] This application is a Continuation of U.S. Application No. 11/246,163 filed October 11, 2005, which ~~This application~~ claims the benefit of and priority under 35 U.S.C. § 119(e) to U.S. Patent Application No. 60/618,269, filed October 12, 2004, entitled “Sharing Memory and Processing Resources in DSL Systems,” each of which ~~are~~is incorporated herein by reference in ~~their~~its entirety.

BACKGROUND

Field of the Invention

[0002] This invention generally relates to communication systems. More specifically, an exemplary embodiment of this invention relates to memory sharing in communication systems. Another exemplary embodiment relates to processing or coding resource sharing in a communication system.

Description of Related Art

[0003] U.S. Patent Nos. 6,775,320 and 6,778,589, ~~which are both incorporated herein by reference in their entirety,~~ describe DSL systems supporting multiple applications and multiple framer/coder/interleaver FCI blocks (an FCI block is also referred to as a latency path). DSL systems carry applications that have different transmission requirements with regard to, for example, data rate, latency (delay), bit error rate (BER), and the like. For example, video typically requires a low BER ( $<1E-10$ ) but can tolerate higher latency ( $>20$  ms). Voice, on the other hand, typically

requires a low latency ( $<1$  ms) but can tolerate BER ( $>1E-3$ ).

[0004] As described in U.S. Patent No. 6,775,320, different applications can use different latency paths in order to satisfy the different application requirements of the communication system. As a result a transceiver must support multiple latency paths in order to support applications such as video, Internet access and voice telephony. When implemented in a transceiver, each of the latency paths will have a framer, coder, and interleaver block with different capabilities that depend on the application requirements.

#### SUMMARY

[0005] One difficulty with implementing multiple latency paths in a transceiver is the fact that a latency path is a complicated digital circuit that requires a large amount of memory and processing power. An interleaver within a latency path can consume a large amount of memory in order to provide error correcting capability. For example, a typical DSL transceiver will have at least one latency path with approximately 16 kbytes of memory for the interleaver. Likewise, the coding block, for example, a Reed Solomon coder, consumes a large amount of processing power. In general, as the number of latency paths increase, the memory and processing power requirements for a communication system become larger.

[0006] Accordingly, an exemplary aspect of this invention relates to sharing memory between one or more interleavers and/or ~~deinterleavers~~ deinterleavers in a transceiver. More particularly, an exemplary aspect of this invention relates to shared

latency path memory in a transceiver.

**[0007]** Additional aspects of this invention relate to configuring and initializing shared memory in a communication system. More particularly, an exemplary aspect of this invention relates to configuring and initializing interleaver/deinterleaver memory in a communication system.

**[0008]** Additional aspects of the invention relate to determining the amount of memory that can be allocated to a particular component by a communication system. More specifically, an exemplary aspect of the invention relates to determining the maximum amount of shared memory that can be allocated to one or more interleaves or deinterleavers.

**[0009]** According to another exemplary aspect of the invention, processing power is shared between a number of transceiver modules. More specifically, and in accordance with an exemplary embodiment of the invention, a coding module is shared between one or more coders and/or decoders.

**[0010]** Another exemplary embodiment of the invention relates to transitioning from a fixed memory configuration to a shared memory configuration during one or more of initialization and SHOWTIME (user data transmission).

**[0011]** An additional exemplary aspect of the invention relates to dynamically updating one or more of shared memory and processing resources based on changing

communication conditions.

**[0012]** An additional exemplary aspect of the invention relates to updating one or more of shared memory and processing resources based on an updated communication parameter.

**[0013]** An additional exemplary aspect of the invention relates to updating the allocation of one or more of shared memory and processing resources based on an updated communication parameter(s).

**[0014]** Additional aspects of the invention relate to exchanging shared resource allocations between transceivers.

**[0015]** Additional exemplary aspects relate to a method of allocating shared memory in a transceiver comprising allocating the shared memory to a plurality of modules, wherein each of the plurality of modules comprise at least one interleaver, at least one deinterleaver or a combination thereof.

**[0016]** Still further aspects relate to the above method wherein the plurality of modules comprise interleavers.

**[0017]** Still further aspects relate to the above method wherein the plurality of modules comprise deinterleavers.

**[0018]** Still further aspects relate to the above method wherein the plurality of modules comprise at least one interleaver and at least one deinterleaver.

**[0019]** Additional exemplary aspects relate to a transceiver comprising a plurality

of modules each including at least one interleaver, at least one deinterleaver or a combination thereof and a shared memory designed to be allocated to a plurality of the modules.

[0020] Still further aspects relate to the above transceiver wherein the plurality of modules comprise interleavers.

[0021] Still further aspects relate to the above transceiver wherein the plurality of modules comprise deinterleavers.

[0022] Still further aspects relate to the above transceiver wherein the plurality of modules comprise at least one interleaver and at least one deinterleaver.

[0023] These and other features and advantages of this invention are described in, or are apparent from, the following description of the embodiments.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0024] The embodiments of the invention will be described in detail, with reference to the following figures, wherein:

[0025] Fig. 1 is a functional block diagram illustrating an exemplary transceiver according to this invention;

[0026] Fig. 2 is a flowchart outlining an exemplary method of sharing resources according to this invention;

[0027] Fig. 3 is a flowchart outlining an exemplary method of determining a maximum amount of shared memory according to this invention; and

[0028] Fig. 4 is a flowchart outlining an exemplary resource sharing methodology according to this invention.



DETAILED DESCRIPTION

[0029] The exemplary embodiments of this invention will be described in relation to sharing resources in a wired and/or wireless communications environment. However, it should be appreciated, that in general, the systems and methods of this invention will work equally well for any type of communication system in any environment.

[0030] The exemplary systems and methods of this invention will also be described in relation to multicarrier modems, such as DSL modems and VDSL modems, and associated communication hardware, software and communication channels. However, to avoid unnecessarily obscuring the present invention, the following description omits well-known structures and devices that may be shown in block diagram form or otherwise summarized.

[0031] For purposes of explanation, numerous details are set forth in order to provide a thorough understanding of the present invention. It should be appreciated however that the present invention may be practiced in a variety of ways beyond the specific details set forth herein.

[0032] Furthermore, while the exemplary embodiments illustrated herein show the various components of the system collocated, it is to be appreciated that the various components of the system can be located at distant portions of a distributed

network, such as a telecommunications network and/or the Internet, or within a dedicated secure, unsecured and/or encrypted system. Thus, it should be appreciated that the components of the system can be combined into one or more devices, such as a modem, or collocated on a particular node of a distributed network, such as a telecommunications network. As will be appreciated from the following description, and for reasons of computational efficiency, the components of the system can be arranged at any location within a distributed network without affecting the operation of the system. For example, the various components can be located in a Central Office modem (CO, ATU-C, VTU-O), a Customer Premises modem (CPE, ATU-R, VTU-R), a DSL management device, or some combination thereof. Similarly, one or more functional portions of the system could be distributed between a modem and an associated computing device.

**[0033]** Furthermore, it should be appreciated that the various links, including communications channel 5, connecting the elements can be wired or wireless links, or any combination thereof, or any other known or later developed element(s) that is capable of supplying and/or communicating data to and from the connected elements. The term module as used herein can refer to any known or later developed hardware, software, firmware, or combination thereof that is capable of performing the functionality associated with that element. The terms determine, calculate and compute, and variations thereof, as used herein are used interchangeably and include any type of methodology, process, mathematical operation or technique. FCI block and latency path are used interchangeably herein as well as transmitting modem and transmitting transceiver. Receiving modem and receiving transceiver are also used

interchangeably.

[0034] Fig. 1 illustrates an exemplary embodiment of a transceiver 100 that utilizes shared resources. It should be appreciated that numerous functional components of the transceiver have been omitted for clarity. However, the transceiver 100 can also include the standard components found in typical communications device(s) in which the technology of the subject invention is implemented into.

[0035] According to an exemplary embodiment of the invention, memory and processing power can be shared among a plurality of transmitter and/or receiver latency paths, in a communications transceiver that carries or supports multiple applications. For example, the transmitter and/or receiver latency paths of the transceiver can share an interleaver/deinterleaver memory and the shared memory can be allocated to the interleaver and/or deinterleaver of each latency path. This allocation can be done based on the data rate, latency, BER, impulse noise protection requirements of the application, data or information being transported over each latency path, or in general any parameter associated with the communications system.

[0036] Likewise, for example, the transmitter and/or receiver latency paths can share a Reed-Solomon coder/decoder processing module and the processing power of this module can be allocated to each encoder and/or decoder. This allocation can be done based on the data rate/latency, BER, impulse noise protection requirements of the application data or information being transported over each latency path, or in general based on any parameter associated with the communication system.

[0037] In accordance with an exemplary operational embodiment, a first transceiver and a second transceiver transmit to one another messages during, for example, initialization which contain information on the total and/or shared memory capabilities of each transceiver and optionally information about the one or more latency paths. This information can be transmitted prior to determining how to configure the latency paths to support the application requirements. Based on this information, one of the modems can select an FCI configuration parameter(s) that meets the transmission requirements of each application being transported over each latency paths. While an exemplary of the embodiment of the invention will be described in relation to the operation of the invention and characteristics thereof being established during initialization, it should be appreciated that the sharing of resources can be modified and messages transmitted between a two transceivers at any time during initialization and/or user data transmission, i.e., SHOWTIME.

[0038] Fig. 1 illustrates an exemplary embodiment of a transceiver 100. The transceiver 100 includes a transmitter portion 200 and a receiver portion 300. The transmitter portion 200 includes one or more latency paths 210, 220, .... Similarly, the receiver portion 300 includes one or more latency paths 310, 320, .... Each of the latency paths in the transmitter portion 200 includes a framer, coder, and interleaver designated as 212, 214, 216 and 222, 224 and 226, respectively. Each of the latency paths in the receiver portion includes a deframer, decoder, and deinterleaver designated as 312, 314, 316 and 322, 324, and 326, respectively. The transceiver 100 further includes a shared processing module 110, a shared memory 120, a parameter

determination module 130, a path module 140, an allocation module 150, and a shared resource management module 160, all interconnected by one or more links (not shown).

**[0039]** In this exemplary embodiment, the transceiver 100 is illustrated with four total transmitter portion and receiver portion latency paths, i.e., 210, 220, 310, and 320. The shared memory 120 is shared amongst the two transmitter portion interleavers 216 and 226 and two receiver portion deinterleavers 316 and 326. The shared processing module 110, such as a shared coding module, is shared between the two transmitter portion coders 214 and 224 and the two receiver portion decoders 314 and 324.

**[0040]** While the exemplary embodiment of the invention will be described in relation to a transceiver having a number of transmitter portion latency paths and receiver portion latency paths, it should be appreciated that this invention can be applied to any transceiver having any number of latency paths. Moreover, it should be appreciated that the sharing of resources can be allocated such that one or more of the transmitter portion latency paths are sharing a shared resource, one or more of the receiver portion latency paths are sharing a shared resource, or a portion of the transmitter portion latency paths and a portion of the receiver portion latency paths are sharing shared resources. Moreover, any one or more of the latency paths, or portions thereof, could also be assigned to a fixed resource while, for example, another portion of the latency path(s) assigned to a shared resource. For example, in latency path 210, the interleaver 216 could be allocated a portion of the shared

memory 120, while the coder 214 could be allocated to a dedicated processing module, vice versa, or the like.

**[0041]** In accordance with the exemplary embodiment, a plurality of transmitter portion or receiver portion latency paths share an interleaver/deinterleaver memory, such as shared memory 120, and a coding module, such as shared processing module 110. For example, the interleaver/deinterleaver memory can be allocated to different interleavers and/or deinterleavers. This allocation can be based on parameters associated with the communication systems such as data rate, latency, BER, impulse noise protection, and the like, of the applications being transported. Similarly, a coding module, which can be a portion of the shared processing module 110, can be shared between any one or more of the latency paths. This sharing can be based on requirements such as data rate, latency, BER, impulse noise protection, and the like, of the applications being transported.

**[0042]** For example, an exemplary transceiver could comprise a shared interleaver/deinterleaver memory and could be designed to allocate a first portion of the shared memory 120 to an interleaver, such as interleaver 216 in the transmitter portion of the transceiver and allocate a second portion of the shared memory 120 to a deinterleaver, such as 316, in the receiver portion of the transceiver.

**[0043]** Alternatively, for example, an exemplary transceiver can comprise a shared interleaver/deinterleaver memory, such as shared memory 120, and be designed to allocate a first portion of shared memory 120 to a first interleaver, e.g.,

216, in the transmitter portion of the transceiver and allocate a second portion of the shared memory to a second interleaver, e.g., 226, in the transmitter portion of the transceiver.

**[0044]** Alternatively, for example, an exemplary transceiver can comprise a shared interleaver/deinterleaver memory and be designed to allocate a first portion of the shared memory 120 to a first deinterleaver, e.g., 316, in the receiver portion of the transceiver and allocate a second portion of the shared memory to a second deinterleaver, e.g., 326, in the receiver portion of the transceiver. Regardless of the configuration, in general any interleaver or deinterleaver, or grouping thereof, be it in a transmitter portion or receiver portion of the transceiver, can be associated with a portion of the shared memory 120.

**[0045]** Establishment, configuration and usage of shared resources is performed in the following exemplary manner. First, and in cooperation with the path module 140, the number of transmitter and receiver latency paths (N) is determined. The parameter determination module 130 then analyses one or more parameters such as data rate, transmitter data rate, receiver data rate, impulse noise protection, bit error rate, latency, or the like. Based on one or more of these parameters, the allocation module 150 allocates a portion of the shared memory 120 to one or more of the interleaver and/or deinterleavers, or groupings thereof. This process continues until the memory allocation has been determined and assigned to each of the N latency paths.

[0046] Having determined the memory allocation for each of the latency paths, and in conjunction with the shared resource management 160, the transceiver 100 transmits to a second transceiver one or more of the number of latency paths (N), the maximum interleaver memory for any one or more of the latency paths and/or the maximum total and/or shared memory for all of the latency paths.

[0047] Three examples of sharing interleaver/deinterleaver memory and coding processing in a transceiver are described below. The latency paths in these examples can be in the transmitter portion of the transceiver or the receiver portion of the transceiver.

[0048] Example #1

A first transmitter portion or receiver portion latency path may carry data from a video application, which needs a very low BER but can tolerate higher latency. In this case, the video will be transported using an latency path that has a large amount of interleaving/deinterleaving and coding (also known as Forward Error Correction (FEC) coding). For example, the latency path may be configured with Reed-Solomon coding using a codeword size of 255 bytes ( $N=255$ ) with 16 checkbytes ( $R=16$ ) and interleaving/deinterleaving using an interleaver depth of 64 ( $D=64$ ). This latency path will require  $N \cdot D = 16 \cdot 255 = 16\text{Kbytes}$   ~~$N \cdot D = 255 \cdot 64 = 16\text{Kbytes}$~~  of interleaver memory at the transmitter (or de-interleaver memory at the receiver). This latency path will be able to correct a burst of errors that is less than 512 bytes in duration.

[0049] A second transmitter portion or receiver portion latency path may carry an



internet access application that requires a medium BER and a medium amount of latency. In this case, the internet access application will be transported using a latency path that has a medium amount of interleaving and coding. For example, the latency path may be configured with Reed-Solomon coding using a codeword size of 128 bytes ( $N=128$ ) with 8 checkbytes ( $R=8$ ) and interleaving using an interleaver depth of 16 ( $D=32$ ). This latency path will require  $N*D=128*32=4\text{Kbytes}$  of interleaver memory and the same amount of deinterleaver memory. This latency path will be able to correct a burst of errors that is less than 128 bytes in duration.

**[0050]** A third transmitter portion or receiver portion latency path may carry a voice telephony application, which needs a very low latency but can tolerate BER. In this case, the video will be transported using an latency path that has a large amount of interleaving and coding. For example, the third transmitter portion or receiver portion latency path may be configured with no interleaving or coding which will result in the lowest possible latency through the latency path but will provide no error correction capability.

**[0051]** According to the principles of this invention, a system carrying the three applications described above in Example #1, would have three latency paths that share one memory space containing at least  $(16+4)=20$  Kbytes. The three latency paths also share a common coding block that is able to simultaneously encode (in the transmitter portion) or decode (in a receiver portion) two codewords with  $N=255/R=16$  and  $N=128/R=8$ .

[0052] According to an exemplary embodiment of this invention, the latency paths can be reconfigured at initialization or during data transmission mode (also known as SHOWTIME in ADSL and VDSL transceivers). This would occur if, for example, the applications or application requirements were to change.

[0053] Example #2

If instead of 1 video application, 1 internet application and 1 voice application, there were 3 internet access applications then the transmitter portion and/or receiver portion latency paths would be reconfigured to utilize the shared memory and coding module in a different way. For example, the system could be reconfigured to have 3 transmitter portion or receiver portion latency paths, with each latency path being configured with Reed-Solomon coding using a codeword size of 128 bytes ( $N=128$ ) with 8 checkbytes ( $R=8$ ) and interleaving using an interleaver depth of 16 ( $D=32$ ). Each latency path will require  $N*D=128*32=4\text{Kbytes}$  of interleaver memory and each block will be able to correct a burst of errors that is less than 128 bytes in duration. Based on the example of carrying the three internet access applications described, the three latency path share one memory space containing at least  $3*4=12\text{ Kbytes}$ . Also the three latency paths share a common coding block that is able to simultaneously encode (on the transmitter side) or decode (on the receiver side) three codewords with  $N=128/R=16$ ,  $N=128/R=8$  and  $N=128/R=8$ .

[0054] Example #3

The system could be configured to carry yet another set of applications. For example, the latency paths could be configured to carry 2 video applications. In this case only

2 transmitter portion or receiver portion latency paths are needed, which means that the third latency path could be simply disabled. Also, assuming that the memory is constrained based on the first example above, then the maximum shared memory for these 2 latency paths is 20 kBytes. In this case, the system could be reconfigured to have 2 latency paths, with each block being configured with Reed-Solomon coding using a codeword size of 200 bytes ( $N=200$ ) with 10 checkbytes ( $R=10$ ) and interleaving/deinterleaving using an interleaver depth of 50 ( $D=50$ ). Each latency path will require  $N*D=200*50=10\text{Kbytes}$  of interleaver memory and each block will be able to correct a burst of errors that is less than 250 bytes in duration. This configuration results in 20K of shared memory for both latency paths, which is the same as in the first example. In order to stay within the memory constraints of the latency paths, the error correction capability for each latency path is decreased to 250 bytes from 512 bytes in Example #1.

**[0055]** Another aspect of this invention is the how FCI configuration information is transmitted between a first modem and a second modem. FCI configuration information will depend on the requirements of the applications being transported over the DSL connection. This information may need to be forwarded during initialization in order to initially configure the DSL connection. This information may also need to be forwarded during SHOWTIME in order to reconfigure the DSL connection based on a change in applications or the application requirements.

**[0056]** According to one embodiment, a first modem determines the specific FCI configuration parameters, e.g.,  $N$ ,  $D$ ,  $R$  as defined above, needed to meet specific

application requirements, such as latency, burst error correction capability, etc. In order to determine the FCI configuration parameters, the first modem must know what are the capabilities of a second modem. For example, the first modem must know how many latency paths (FCI blocks) the second modem can support. Also the first modem must know the maximum amount of interleaver memory for each transmitter latency path. In addition, since the transmitter latency paths may share a common memory space the first modem must know the total shared memory for all transmitter latency paths. This way the first modem will be able to choose a configuration that can meet application requirements and also meet the transmitter portion latency path capabilities of the second modem.

**[0057]** For example, using values from examples above, a first transceiver could send a message to a second transceiver during initialization or during SHOWTIME containing the following information:

- Number of supported transmitter and receiver latency paths = 3
- Max Interleaver Memory for latency path #1= 16 Kbytes
- Max Interleaver Memory for latency path #2= 16 Kbytes
- Max Interleaver Memory for latency path #3= 16 Kbytes
- Maximum total/shared memory for all latency paths = 20 kBytes

Based on this information, and the application requirements, the first transceiver would select latency path settings. For example, if the applications are 1 video, 1 internet access and 1 voice application, the first transceiver could configure 3 latency paths as follows:

latency path #1 – Video: N=255, R=16, D=64

latency path #2 – Video:  $N=128$ ,  $R=8$ ,  $D=32$

latency path #3 – Video:  $N=0$ ,  $R=0$ ,  $D=1$  (no coding or interleaving)

**[0058]** This would result in a total interleaver memory of 20 kbytes.

**[0059]** Alternatively, if for example, there are only 2 video applications, the first transceiver could configure 2 latency paths as follows:

latency path #1 – Video:  $N=200$ ,  $R=10$ ,  $D=50$

latency path #2 – Video:  $N=200$ ,  $R=10$ ,  $D=50$

latency path #3 – Video:  $N=0$ ,  $R=0$ ,  $D=1$  (no coding or interleaving)

**[0060]** This would also result in a total interleaver memory of 20 kbytes.

**[0061]** Alternatively, the second transceiver can determine the specific FCI configuration parameters, e.g.,  $N$ ,  $D$ ,  $R$  as defined above, needed to meet specific application requirements, such as latency, burst error correction capability, etc. As described above for the first transceiver, in order to determine the FCI configuration parameters, the second transceiver must first know what are the capabilities of the first transceiver. In this case, the first transceiver would send a message to the second transceiver containing the information described above and based on this information and the application requirements the second transceiver would select latency path settings.

**[0062]** Fig. 2 outlines an exemplary method of allocating shared memory in a

transceiver. More specifically, control begins in step S200 and continues to step S210. In step S210, one or more of shared interleaver/deinterleaver memory and/or shared coder/decoder processing resources are allocated to one or more latency paths, in a transceiver. Control then continues to step S220 where the control sequence ends.

**[0063]** Fig. 3 outlines an exemplary method of exchanging shared resource allocations according to an exemplary embodiment of this invention. In particular, control begins in step S310. In step S310, a maximum amount of shared memory that can be allocated to a specific interleaver or deinterleaver of a plurality of interleavers or deinterleavers in a transceiver is determined. Next, in step S320, the determined maximum amount for one or more of the deinterleavers and/or interleavers is transmitted to another transceiver. Messages containing additional information can also be transmitted to the other transceiver and/or received from the other transceiver. Control then continues to step S330 where the control sequence ends.

**[0064]** Fig. 4 outlines an exemplary procedure for resource sharing according to an exemplary embodiment of this invention. In particular, control begins in step S400 and continues to step S410. In step S410, the number of latency paths are determined. Then, in step S420, the latency path information (FCI block information) is transmitted to another transceiver. Messages containing additional information can also be transmitted to the other transceiver and/or received from the other transceiver. This information can be used to, for example, assist with the determination of memory allocation in the transceiver. Moreover, the messages received from the

other transceiver could specify what the memory allocation is to be based on, for example, the number of latency paths, memory allocation in the remote transceiver and required applications. Control then continues to step S430.

**[0065]** In step S430, and for each latency path, the steps in step 440 are performed.

**[0066]** In step S440, and while monitoring of allocation of resources is being performed, steps 450 and 460 are performed. More specifically, in step S450, one or more parameters associated with the communication system are determined. Then, in step S460, shared resources are allocated based on one or more of the communication parameters. Control then continues to step S470.

**[0067]** In step S470, the allocation of shared resources is communicated to another transceiver. Next, in step S480, a determination is made as to whether there is a change in communications that would require the adjustment of the shared resource allocation. Examples of changes in communications conditions include a change in applications being transported over the system and/or changes in the channel condition, etc. If adjustments are required, control jumps back to step S410. Otherwise, control jumps to step S490 where the control sequence ends.

**[0068]** The above-described system can be implemented on wired and/or wireless telecommunications devices, such a modem, a multicarrier modem, a DSL modem, an ADSL modem, an XDSL modem, a VDSL modem, a linecard, test equipment, a

multicarrier transceiver, a wired and/or wireless wide/local area network system, a satellite communication system, a modem equipped with diagnostic capabilities, or the like, or on a separate programmed general purpose computer having a communications device or in conjunction with any of the following communications protocols: CDSL, ADSL2, ADSL2+, VDSL1, VDSL2, HDSL, DSL Lite, IDSL, RADSL, SDSL, UDSL or the like.

**[0069]** Additionally, the systems, methods and protocols of this invention can be implemented on a special purpose computer, a programmed microprocessor or microcontroller and peripheral integrated circuit element(s), an ASIC or other integrated circuit, a digital signal processor, a hard-wired electronic or logic circuit such as discrete element circuit, a programmable logic device such as PLD, PLA, FPGA, PAL, a modem, a transmitter/receiver, any comparable means, or the like. In general, any device capable of implementing a state machine that is in turn capable of implementing the methodology illustrated herein can be used to implement the various communication methods, protocols and techniques according to this invention.

**[0070]** Furthermore, the disclosed methods may be readily implemented in software using object or object-oriented software development environments that provide portable source code that can be used on a variety of computer or workstation platforms. Alternatively, the disclosed system may be implemented partially or fully in hardware using standard logic circuits or VLSI design. Whether software or hardware is used to implement the systems in accordance with this invention is



dependent on the speed and/or efficiency requirements of the system, the particular function, and the particular software or hardware systems or microprocessor or microcomputer systems being utilized. The communication systems, methods and protocols illustrated herein can be readily implemented in hardware and/or software using any known or later developed systems or structures, devices and/or software by those of ordinary skill in the applicable art from the functional description provided herein and with a general basic knowledge of the computer and telecommunications arts.

**[0071]** Moreover, the disclosed methods may be readily implemented in software that can be stored on a storage medium, executed on programmed general-purpose computer with the cooperation of a controller and memory, a special purpose computer, a microprocessor, or the like. In these instances, the systems and methods of this invention can be implemented as program embedded on personal computer such as an applet, JAVA® or CGI script, as a resource residing on a server or computer workstation, as a routine embedded in a dedicated communication system or system component, or the like. The system can also be implemented by physically incorporating the system and/or method into a software and/or hardware system, such as the hardware and software systems of a communications transceiver.

**[0072]** It is therefore apparent that there has been provided, in accordance with the present invention, systems and methods for sharing resources. While this invention has been described in conjunction with a number of embodiments, it is evident that many alternatives, modifications and variations would be or are apparent

to those of ordinary skill in the applicable arts. Accordingly, it is intended to embrace all such alternatives, modifications, equivalents and variations that are within the spirit and scope of this invention.

#### ABSTRACT

A transceiver is designed to share memory and processing power amongst a plurality of transmitter and/or receiver latency paths, in a communications transceiver that carries or supports multiple applications. For example, the transmitter and/or receiver latency paths of the transceiver can share an interleaver/deinterleaver memory. This allocation can be done based on the data rate, latency, BER, impulse noise protection requirements of the application, data or information being transported over each latency path, or in general any parameter associated with the communications system.

**A COMPUTER READABLE MEDIUM WITH INSTRUCTIONS FOR  
RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT**

RELATED APPLICATION DATA

**[0001]** This application is a Continuation of U.S. Application No. 11/246,163 filed October 11, 2005, which claims the benefit of and priority under 35 U.S.C. § 119(e) to U.S. Patent Application No. 60/618,269, filed October 12, 2004, entitled “Sharing Memory and Processing Resources in DSL Systems,” each of which are incorporated herein by reference in their entirety.

BACKGROUND

Field of the Invention

**[0002]** This invention generally relates to communication systems. More specifically, an exemplary embodiment of this invention relates to memory sharing in communication systems. Another exemplary embodiment relates to processing or coding resource sharing in a communication system.

Description of Related Art

**[0003]** U.S. Patent Nos. 6,775,320 and 6,778,589 describe DSL systems supporting multiple applications and multiple framer/coder/interleaver FCI blocks (an FCI block is also referred to as a latency path). DSL systems carry applications that have different transmission requirements with regard to, for example, data rate, latency (delay), bit error rate (BER), and the like. For example, video typically requires a low BER ( $<1E-10$ ) but can tolerate higher latency ( $>20$  ms). Voice, on the other hand, typically requires a low latency ( $<1$  ms) but can tolerate BER ( $>1E-3$ ).

**[0004]** As described in U.S. Patent No. 6,775,320, different applications can use different latency paths in order to satisfy the different application requirements of the communication system. As a result a transceiver must support multiple latency paths in order to support applications such as video, Internet access and voice telephony. When implemented in a transceiver, each of the latency paths will have a framer, coder, and interleaver block with different capabilities that depend on the application requirements.

#### SUMMARY

**[0005]** One difficulty with implementing multiple latency paths in a transceiver is the fact that a latency path is a complicated digital circuit that requires a large amount of memory and processing power. An interleaver within a latency path can consume a large amount of memory in order to provide error correcting capability. For example, a typical DSL transceiver will have at least one latency path with approximately 16 kbytes of memory for the interleaver. Likewise, the coding block, for example, a Reed Solomon coder, consumes a large amount of processing power. In general, as the number of latency paths increase, the memory and processing power requirements for a communication system become larger.

**[0006]** Accordingly, an exemplary aspect of this invention relates to sharing memory between one or more interleavers and/or deinterleavers in a transceiver. More particularly, an exemplary aspect of this invention relates to shared latency path memory in a transceiver.

**[0007]** Additional aspects of this invention relate to configuring and initializing shared memory in a communication system. More particularly, an exemplary aspect of this invention relates to configuring and initializing interleaver/deinterleaver memory in a communication system.

**[0008]** Additional aspects of the invention relate to determining the amount of memory that can be allocated to a particular component by a communication system. More specifically, an exemplary aspect of the invention relates to determining the maximum amount of shared memory that can be allocated to one or more interleaves or deinterleavers.

**[0009]** According to another exemplary aspect of the invention, processing power is shared between a number of transceiver modules. More specifically, and in accordance with an exemplary embodiment of the invention, a coding module is shared between one or more coders and/or decoders.

**[0010]** Another exemplary embodiment of the invention relates to transitioning from a fixed memory configuration to a shared memory configuration during one or more of initialization and SHOWTIME (user data transmission).

**[0011]** An additional exemplary aspect of the invention relates to dynamically updating one or more of shared memory and processing resources based on changing communication conditions.

**[0012]** An additional exemplary aspect of the invention relates to updating one or more of shared memory and processing resources based on an updated communication parameter.

**[0013]** An additional exemplary aspect of the invention relates to updating the allocation of one or more of shared memory and processing resources based on an updated communication parameter(s).

**[0014]** Additional aspects of the invention relate to exchanging shared resource allocations between transceivers.

**[0015]** Additional exemplary aspects relate to a method of allocating shared memory in a transceiver comprising allocating the shared memory to a plurality of modules, wherein each of the plurality of modules comprise at least one interleaver, at least one deinterleaver or a combination thereof.

**[0016]** Still further aspects relate to the above method wherein the plurality of modules comprise interleavers.

**[0017]** Still further aspects relate to the above method wherein the plurality of modules comprise deinterleavers.

**[0018]** Still further aspects relate to the above method wherein the plurality of modules comprise at least one interleaver and at least one deinterleaver.

**[0019]** Additional exemplary aspects relate to a transceiver comprising a plurality of modules each including at least one interleaver, at least one deinterleaver or a

combination thereof and a shared memory designed to be allocated to a plurality of the modules.

**[0020]** Still further aspects relate to the above transceiver wherein the plurality of modules comprise interleavers.

**[0021]** Still further aspects relate to the above transceiver wherein the plurality of modules comprise deinterleavers.

**[0022]** Still further aspects relate to the above transceiver wherein the plurality of modules comprise at least one interleaver and at least one deinterleaver.

**[0023]** These and other features and advantages of this invention are described in, or are apparent from, the following description of the embodiments.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0024]** The embodiments of the invention will be described in detail, with reference to the following figures, wherein:

**[0025]** Fig. 1 is a functional block diagram illustrating an exemplary transceiver according to this invention;

**[0026]** Fig. 2 is a flowchart outlining an exemplary method of sharing resources according to this invention;

**[0027]** Fig. 3 is a flowchart outlining an exemplary method of determining a maximum amount of shared memory according to this invention; and

**[0028]** Fig. 4 is a flowchart outlining an exemplary resource sharing methodology according to this invention.



DETAILED DESCRIPTION

[0029] The exemplary embodiments of this invention will be described in relation to sharing resources in a wired and/or wireless communications environment. However, it should be appreciated, that in general, the systems and methods of this invention will work equally well for any type of communication system in any environment.

[0030] The exemplary systems and methods of this invention will also be described in relation to multicarrier modems, such as DSL modems and VDSL modems, and associated communication hardware, software and communication channels. However, to avoid unnecessarily obscuring the present invention, the following description omits well-known structures and devices that may be shown in block diagram form or otherwise summarized.

[0031] For purposes of explanation, numerous details are set forth in order to provide a thorough understanding of the present invention. It should be appreciated however that the present invention may be practiced in a variety of ways beyond the specific details set forth herein.

[0032] Furthermore, while the exemplary embodiments illustrated herein show the various components of the system collocated, it is to be appreciated that the various components of the system can be located at distant portions of a distributed network, such as a telecommunications network and/or the Internet, or within a

dedicated secure, unsecured and/or encrypted system. Thus, it should be appreciated that the components of the system can be combined into one or more devices, such as a modem, or collocated on a particular node of a distributed network, such as a telecommunications network. As will be appreciated from the following description, and for reasons of computational efficiency, the components of the system can be arranged at any location within a distributed network without affecting the operation of the system. For example, the various components can be located in a Central Office modem (CO, ATU-C, VTU-O), a Customer Premises modem (CPE, ATU-R, VTU-R), a DSL management device, or some combination thereof. Similarly, one or more functional portions of the system could be distributed between a modem and an associated computing device.

**[0033]** Furthermore, it should be appreciated that the various links, including communications channel 5, connecting the elements can be wired or wireless links, or any combination thereof, or any other known or later developed element(s) that is capable of supplying and/or communicating data to and from the connected elements. The term module as used herein can refer to any known or later developed hardware, software, firmware, or combination thereof that is capable of performing the functionality associated with that element. The terms determine, calculate and compute, and variations thereof, as used herein are used interchangeably and include any type of methodology, process, mathematical operation or technique. FCI block and latency path are used interchangeably herein as well as transmitting modem and transmitting transceiver. Receiving modem and receiving transceiver are also used interchangeably.

[0034] Fig. 1 illustrates an exemplary embodiment of a transceiver 100 that utilizes shared resources. It should be appreciated that numerous functional components of the transceiver have been omitted for clarity. However, the transceiver 100 can also include the standard components found in typical communications device(s) in which the technology of the subject invention is implemented into.

[0035] According to an exemplary embodiment of the invention, memory and processing power can be shared among a plurality of transmitter and/or receiver latency paths, in a communications transceiver that carries or supports multiple applications. For example, the transmitter and/or receiver latency paths of the transceiver can share an interleaver/deinterleaver memory and the shared memory can be allocated to the interleaver and/or deinterleaver of each latency path. This allocation can be done based on the data rate, latency, BER, impulse noise protection requirements of the application, data or information being transported over each latency path, or in general any parameter associated with the communications system.

[0036] Likewise, for example, the transmitter and/or receiver latency paths can share a Reed-Solomon coder/decoder processing module and the processing power of this module can be allocated to each encoder and/or decoder. This allocation can be done based on the data rate/latency, BER, impulse noise protection requirements of the application data or information being transported over each latency path, or in general based on any parameter associated with the communication system.

[0037] In accordance with an exemplary operational embodiment, a first transceiver and a second transceiver transmit to one another messages during, for example, initialization which contain information on the total and/or shared memory capabilities of each transceiver and optionally information about the one or more latency paths. This information can be transmitted prior to determining how to configure the latency paths to support the application requirements. Based on this information, one of the modems can select an FCI configuration parameter(s) that meets the transmission requirements of each application being transported over each latency paths. While an exemplary of the embodiment of the invention will be described in relation to the operation of the invention and characteristics thereof being established during initialization, it should be appreciated that the sharing of resources can be modified and messages transmitted between a two transceivers at any time during initialization and/or user data transmission, i.e., SHOWTIME.

[0038] Fig. 1 illustrates an exemplary embodiment of a transceiver 100. The transceiver 100 includes a transmitter portion 200 and a receiver portion 300. The transmitter portion 200 includes one or more latency paths 210, 220, .... Similarly, the receiver portion 300 includes one or more latency paths 310, 320, .... Each of the latency paths in the transmitter portion 200 includes a framer, coder, and interleaver designated as 212, 214, 216 and 222, 224 and 226, respectively. Each of the latency paths in the receiver portion includes a deframer, decoder, and deinterleaver designated as 312, 314, 316 and 322, 324, and 326, respectively. The transceiver 100 further includes a shared processing module 110, a shared memory 120, a parameter determination module 130, a path module 140, an allocation module 150, and a shared

resource management module 160, all interconnected by one or more links (not shown).

**[0039]** In this exemplary embodiment, the transceiver 100 is illustrated with four total transmitter portion and receiver portion latency paths, i.e., 210, 220, 310, and 320. The shared memory 120 is shared amongst the two transmitter portion interleavers 216 and 226 and two receiver portion deinterleavers 316 and 326. The shared processing module 110, such as a shared coding module, is shared between the two transmitter portion coders 214 and 224 and the two receiver portion decoders 314 and 324.

**[0040]** While the exemplary embodiment of the invention will be described in relation to a transceiver having a number of transmitter portion latency paths and receiver portion latency paths, it should be appreciated that this invention can be applied to any transceiver having any number of latency paths. Moreover, it should be appreciated that the sharing of resources can be allocated such that one or more of the transmitter portion latency paths are sharing a shared resource, one or more of the receiver portion latency paths are sharing a shared resource, or a portion of the transmitter portion latency paths and a portion of the receiver portion latency paths are sharing shared resources. Moreover, any one or more of the latency paths, or portions thereof, could also be assigned to a fixed resource while, for example, another portion of the latency path(s) assigned to a shared resource. For example, in latency path 210, the interleaver 216 could be allocated a portion of the shared memory 120, while the coder 214 could be allocated to a dedicated processing

module, vice versa, or the like.

**[0041]** In accordance with the exemplary embodiment, a plurality of transmitter portion or receiver portion latency paths share an interleaver/deinterleaver memory, such as shared memory 120, and a coding module, such as shared processing module 110. For example, the interleaver/deinterleaver memory can be allocated to different interleavers and/or deinterleavers. This allocation can be based on parameters associated with the communication systems such as data rate, latency, BER, impulse noise protection, and the like, of the applications being transported. Similarly, a coding module, which can be a portion of the shared processing module 110, can be shared between any one or more of the latency paths. This sharing can be based on requirements such as data rate, latency, BER, impulse noise protection, and the like, of the applications being transported.

**[0042]** For example, an exemplary transceiver could comprise a shared interleaver/deinterleaver memory and could be designed to allocate a first portion of the shared memory 120 to an interleaver, such as interleaver 216 in the transmitter portion of the transceiver and allocate a second portion of the shared memory 120 to a deinterleaver, such as 316, in the receiver portion of the transceiver.

**[0043]** Alternatively, for example, an exemplary transceiver can comprise a shared interleaver/deinterleaver memory, such as shared memory 120, and be designed to allocate a first portion of shared memory 120 to a first interleaver, e.g., 216, in the transmitter portion of the transceiver and allocate a second portion of the

shared memory to a second interleaver, e.g., 226, in the transmitter portion of the transceiver.

**[0044]** Alternatively, for example, an exemplary transceiver can comprise a shared interleaver/deinterleaver memory and be designed to allocate a first portion of the shared memory 120 to a first deinterleaver, e.g., 316, in the receiver portion of the transceiver and allocate a second portion of the shared memory to a second deinterleaver, e.g., 326, in the receiver portion of the transceiver. Regardless of the configuration, in general any interleaver or deinterleaver, or grouping thereof, be it in a transmitter portion or receiver portion of the transceiver, can be associated with a portion of the shared memory 120.

**[0045]** Establishment, configuration and usage of shared resources is performed in the following exemplary manner. First, and in cooperation with the path module 140, the number of transmitter and receiver latency paths (N) is determined. The parameter determination module 130 then analyses one or more parameters such as data rate, transmitter data rate, receiver data rate, impulse noise protection, bit error rate, latency, or the like. Based on one or more of these parameters, the allocation module 150 allocates a portion of the shared memory 120 to one or more of the interleaver and/or deinterleavers, or groupings thereof. This process continues until the memory allocation has been determined and assigned to each of the N latency paths.

**[0046]** Having determined the memory allocation for each of the latency paths,

and in conjunction with the shared resource management 160, the transceiver 100 transmits to a second transceiver one or more of the number of latency paths (N), the maximum interleaver memory for any one or more of the latency paths and/or the maximum total and/or shared memory for all of the latency paths.

**[0047]** Three examples of sharing interleaver/deinterleaver memory and coding processing in a transceiver are described below. The latency paths in these examples can be in the transmitter portion of the transceiver or the receiver portion of the transceiver.

**[0048]** Example #1

A first transmitter portion or receiver portion latency path may carry data from a video application, which needs a very low BER but can tolerate higher latency. In this case, the video will be transported using an latency path that has a large amount of interleaving/deinterleaving and coding (also known as Forward Error Correction (FEC) coding). For example, the latency path may be configured with Reed-Solomon coding using a codeword size of 255 bytes ( $N=255$ ) with 16 checkbytes ( $R=16$ ) and interleaving/deinterleaving using an interleaver depth of 64 ( $D=64$ ). This latency path will require  $N*D=255*64=16\text{Kbytes}$  of interleaver memory at the transmitter (or de-interleaver memory at the receiver). This latency path will be able to correct a burst of errors that is less than 512 bytes in duration.

**[0049]** A second transmitter portion or receiver portion latency path may carry an internet access application that requires a medium BER and a medium amount of



latency. In this case, the internet access application will be transported using a latency path that has a medium amount of interleaving and coding. For example, the latency path may be configured with Reed-Solomon coding using a codeword size of 128 bytes ( $N=128$ ) with 8 checkbytes ( $R=8$ ) and interleaving using an interleaver depth of 16 ( $D=32$ ). This latency path will require  $N*D=128*32=4$ Kbytes of interleaver memory and the same amount of deinterleaver memory. This latency path will be able to correct a burst of errors that is less than 128 bytes in duration.

**[0050]** A third transmitter portion or receiver portion latency path may carry a voice telephony application, which needs a very low latency but can tolerate BER. In this case, the video will be transported using an latency path that has a large amount of interleaving and coding. For example, the third transmitter portion or receiver portion latency path may be configured with no interleaving or coding which will result in the lowest possible latency through the latency path but will provide no error correction capability.

**[0051]** According to the principles of this invention, a system carrying the three applications described above in Example #1, would have three latency paths that share one memory space containing at least  $(16+4)=20$  Kbytes. The three latency paths also share a common coding block that is able to simultaneously encode (in the transmitter portion) or decode (in a receiver portion) two codewords with  $N=255/R=16$  and  $N=128/R=8$ .

**[0052]** According to an exemplary embodiment of this invention, the latency

paths can be reconfigured at initialization or during data transmission mode (also known as SHOWTIME in ADSL and VDSL transceivers). This would occur if, for example, the applications or application requirements were to change.

**[0053]** Example #2

If instead of 1 video application, 1 internet application and 1 voice application, there were 3 internet access applications then the transmitter portion and/or receiver portion latency paths would be reconfigured to utilize the shared memory and coding module in a different way. For example, the system could be reconfigured to have 3 transmitter portion or receiver portion latency paths, with each latency path being configured with Reed-Solomon coding using a codeword size of 128 bytes ( $N=128$ ) with 8 checkbytes ( $R=8$ ) and interleaving using an interleaver depth of 16 ( $D=32$ ). Each latency path will require  $N*D=128*32=4\text{Kbytes}$  of interleaver memory and each block will be able to correct a burst of errors that is less than 128 bytes in duration. Based on the example of carrying the three internet access applications described, the three latency path share one memory space containing at least  $3*4=12\text{ Kbytes}$ . Also the three latency paths share a common coding block that is able to simultaneously encode (on the transmitter side) or decode (on the receiver side) three codewords with  $N=128/R=16$ ,  $N=128/R=8$  and  $N=128/R=8$ .

**[0054]** Example #3

The system could be configured to carry yet another set of applications. For example, the latency paths could be configured to carry 2 video applications. In this case only 2 transmitter portion or receiver portion latency paths are needed, which means that

the third latency path could be simply disabled. Also, assuming that the memory is constrained based on the first example above, then the maximum shared memory for these 2 latency paths is 20 kBytes. In this case, the system could be reconfigured to have 2 latency paths, with each block being configured with Reed-Solomon coding using a codeword size of 200 bytes ( $N=200$ ) with 10 checkbytes ( $R=10$ ) and interleaving/deinterleaving using an interleaver depth of 50 ( $D=50$ ). Each latency path will require  $N*D=200*50=10\text{Kbytes}$  of interleaver memory and each block will be able to correct a burst of errors that is less than 250 bytes in duration. This configuration results in 20K of shared memory for both latency paths, which is the same as in the first example. In order to stay within the memory constraints of the latency paths, the error correction capability for each latency path is decreased to 250 bytes from 512 bytes in Example #1.

**[0055]** Another aspect of this invention is the how FCI configuration information is transmitted between a first modem and a second modem. FCI configuration information will depend on the requirements of the applications being transported over the DSL connection. This information may need to be forwarded during initialization in order to initially configure the DSL connection. This information may also need to be forwarded during SHOWTIME in order to reconfigure the DSL connection based on a change in applications or the application requirements.

**[0056]** According to one embodiment, a first modem determines the specific FCI configuration parameters, e.g.,  $N$ ,  $D$ ,  $R$  as defined above, needed to meet specific application requirements, such as latency, burst error correction capability, etc. In

order to determine the FCI configuration parameters, the first modem must know what are the capabilities of a second modem. For example, the first modem must know how many latency paths (FCI blocks) the second modem can support. Also the first modem must know the maximum amount of interleaver memory for each transmitter latency path. In addition, since the transmitter latency paths may share a common memory space the first modem must know the total shared memory for all transmitter latency paths. This way the first modem will be able to choose a configuration that can meet application requirements and also meet the transmitter portion latency path capabilities of the second modem.

**[0057]** For example, using values from examples above, a first transceiver could send a message to a second transceiver during initialization or during SHOWTIME containing the following information:

- Number of supported transmitter and receiver latency paths = 3
- Max Interleaver Memory for latency path #1= 16 Kbytes
- Max Interleaver Memory for latency path #2= 16 Kbytes
- Max Interleaver Memory for latency path #3= 16 Kbytes
- Maximum total/shared memory for all latency paths = 20 kBytes

Based on this information, and the application requirements, the first transceiver would select latency path settings. For example, if the applications are 1 video, 1 internet access and 1 voice application, the first transceiver could configure 3 latency paths as follows:

latency path #1 – Video: N=255, R=16, D=64

latency path #2 – Video: N=128, R=8, D=32

latency path #3 – Video: N=0, R=0, D=1 (no coding or interleaving)

**[0058]** This would result in a total interleaver memory of 20 kbytes.

**[0059]** Alternatively, if for example, there are only 2 video applications, the first transceiver could configure 2 latency paths as follows:

latency path #1 – Video: N=200, R=10, D=50

latency path #2 – Video: N=200, R=10, D=50

latency path #3 – Video: N=0, R=0, D=1 (no coding or interleaving)

**[0060]** This would also result in a total interleaver memory of 20 kbytes.

**[0061]** Alternatively, the second transceiver can determine the specific FCI configuration parameters, e.g., N, D, R as defined above, needed to meet specific application requirements, such as latency, burst error correction capability, etc. As described above for the first transceiver, in order to determine the FCI configuration parameters, the second transceiver must first know what are the capabilities of the first transceiver. In this case, the first transceiver would send a message to the second transceiver containing the information described above and based on this information and the application requirements the second transceiver would select latency path settings.

**[0062]** Fig. 2 outlines an exemplary method of allocating shared memory in a transceiver. More specifically, control begins in step S200 and continues to step

S210. In step S210, one or more of shared interleaver/deinterleaver memory and/or shared coder/decoder processing resources are allocated to one or more latency paths, in a transceiver. Control then continues to step S220 where the control sequence ends.

**[0063]** Fig. 3 outlines an exemplary method of exchanging shared resource allocations according to an exemplary embodiment of this invention. In particular, control begins in step S310. In step S310, a maximum amount of shared memory that can be allocated to a specific interleaver or deinterleaver of a plurality of interleavers or deinterleavers in a transceiver is determined. Next, in step S320, the determined maximum amount for one or more of the deinterleavers and/or interleavers is transmitted to another transceiver. Messages containing additional information can also be transmitted to the other transceiver and/or received from the other transceiver. Control then continues to step S330 where the control sequence ends.

**[0064]** Fig. 4 outlines an exemplary procedure for resource sharing according to an exemplary embodiment of this invention. In particular, control begins in step S400 and continues to step S410. In step S410, the number of latency paths are determined. Then, in step S420, the latency path information (FCI block information) is transmitted to another transceiver. Messages containing additional information can also be transmitted to the other transceiver and/or received from the other transceiver. This information can be used to, for example, assist with the determination of memory allocation in the transceiver. Moreover, the messages received from the other transceiver could specify what the memory allocation is to be based on, for

example, the number of latency paths, memory allocation in the remote transceiver and required applications. Control then continues to step S430.

**[0065]** In step S430, and for each latency path, the steps in step 440 are performed.

**[0066]** In step S440, and while monitoring of allocation of resources is being performed, steps 450 and 460 are performed. More specifically, in step S450, one or more parameters associated with the communication system are determined. Then, in step S460, shared resources are allocated based on one or more of the communication parameters. Control then continues to step S470.

**[0067]** In step S470, the allocation of shared resources is communicated to another transceiver. Next, in step S480, a determination is made as to whether there is a change in communications that would require the adjustment of the shared resource allocation. Examples of changes in communications conditions include a change in applications being transported over the system and/or changes in the channel condition, etc. If adjustments are required, control jumps back to step S410. Otherwise, control jumps to step S490 where the control sequence ends.

**[0068]** The above-described system can be implemented on wired and/or wireless telecommunications devices, such a modem, a multicarrier modem, a DSL modem, an ADSL modem, an XDSL modem, a VDSL modem, a linecard, test equipment, a multicarrier transceiver, a wired and/or wireless wide/local area network system, a

satellite communication system, a modem equipped with diagnostic capabilities, or the like, or on a separate programmed general purpose computer having a communications device or in conjunction with any of the following communications protocols: CDSL, ADSL2, ADSL2+, VDSL1, VDSL2, HDSL, DSL Lite, IDSL, RADSL, SDSL, UDSL or the like.

**[0069]** Additionally, the systems, methods and protocols of this invention can be implemented on a special purpose computer, a programmed microprocessor or microcontroller and peripheral integrated circuit element(s), an ASIC or other integrated circuit, a digital signal processor, a hard-wired electronic or logic circuit such as discrete element circuit, a programmable logic device such as PLD, PLA, FPGA, PAL, a modem, a transmitter/receiver, any comparable means, or the like. In general, any device capable of implementing a state machine that is in turn capable of implementing the methodology illustrated herein can be used to implement the various communication methods, protocols and techniques according to this invention.

**[0070]** Furthermore, the disclosed methods may be readily implemented in software using object or object-oriented software development environments that provide portable source code that can be used on a variety of computer or workstation platforms. Alternatively, the disclosed system may be implemented partially or fully in hardware using standard logic circuits or VLSI design. Whether software or hardware is used to implement the systems in accordance with this invention is dependent on the speed and/or efficiency requirements of the system, the particular



function, and the particular software or hardware systems or microprocessor or microcomputer systems being utilized. The communication systems, methods and protocols illustrated herein can be readily implemented in hardware and/or software using any known or later developed systems or structures, devices and/or software by those of ordinary skill in the applicable art from the functional description provided herein and with a general basic knowledge of the computer and telecommunications arts.

**[0071]** Moreover, the disclosed methods may be readily implemented in software that can be stored on a storage medium, executed on programmed general-purpose computer with the cooperation of a controller and memory, a special purpose computer, a microprocessor, or the like. In these instances, the systems and methods of this invention can be implemented as program embedded on personal computer such as an applet, JAVA® or CGI script, as a resource residing on a server or computer workstation, as a routine embedded in a dedicated communication system or system component, or the like. The system can also be implemented by physically incorporating the system and/or method into a software and/or hardware system, such as the hardware and software systems of a communications transceiver.

**[0072]** It is therefore apparent that there has been provided, in accordance with the present invention, systems and methods for sharing resources. While this invention has been described in conjunction with a number of embodiments, it is evident that many alternatives, modifications and variations would be or are apparent to those of ordinary skill in the applicable arts. Accordingly, it is intended to embrace

all such alternatives, modifications, equivalents and variations that are within the  
spirit and scope of this invention.

#### ABSTRACT

A transceiver is designed to share memory and processing power amongst a plurality of transmitter and/or receiver latency paths, in a communications transceiver that carries or supports multiple applications. For example, the transmitter and/or receiver latency paths of the transceiver can share an interleaver/deinterleaver memory. This allocation can be done based on the data rate, latency, BER, impulse noise protection requirements of the application, data or information being transported over each latency path, or in general any parameter associated with the communications system.

Electronic Patent Application Fee Transmittal				
Application Number:				
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Title of Invention:		A COMPUTER READABLE MEDIUM WITH INSTRUCTIONS FOR RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT		
First Named Inventor/Applicant Name:		Marcos C. Tzannes		
Filer:		Jason Vick/Joanne Vos		
Attorney Docket Number:		5550-54-CON-2		
Filed as Large Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Utility application filing	1011	1	330	330
Utility Search Fee	1111	1	540	540
Utility Examination Fee	1311	1	220	220
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
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<b>Extension-of-Time:</b>				
<b>Miscellaneous:</b>				
<b>Total in USD (\$)</b>				<b>1090</b>

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<b>Confirmation Number:</b>	5009
<b>Title of Invention:</b>	A COMPUTER READABLE MEDIUM WITH INSTRUCTIONS FOR RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT
<b>First Named Inventor/Applicant Name:</b>	Marcos C. Tzannes
<b>Customer Number:</b>	62574
<b>Filer:</b>	Jason Vick/Joanne Vos
<b>Filer Authorized By:</b>	Jason Vick
<b>Attorney Docket Number:</b>	5550-54-CON-2
<b>Receipt Date:</b>	09-AUG-2010
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<b>Application Type:</b>	Utility under 35 USC 111(a)

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<b>Information:</b>					
2	Oath or Declaration filed	Executed_Declaration.pdf	67974  3d88ef6955ec0a701456b88ced507d6291a 2211b2	no	1
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	<b>Document Description</b>	<b>Start</b>	<b>End</b>		
	Preliminary Amendment	1	1		
	Specification	2	3		
	Claims	4	5		
	Applicant Arguments/Remarks Made in an Amendment	6	6		
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	Specification	1	23		
	Claims	24	29		
	Abstract	30	30		
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5	Drawings-only black and white line drawings	Figures_Final.pdf	26555	no	3
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<b>Application Data Sheet 37 CFR 1.76</b>		Attorney Docket Number	5550-54-CON-2
		Application Number	
Title of Invention	A COMPUTER READABLE MEDIUM WITH INSTRUCTIONS FOR RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT		
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	Marcos	C.		Tzannes		
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	Michael			Lund		
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<b>Application Data Sheet 37 CFR 1.76</b>		Attorney Docket Number	5550-54-CON-2	
		Application Number		
Title of Invention	A COMPUTER READABLE MEDIUM WITH INSTRUCTIONS FOR RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT			
Customer Number	62574			
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Title of the Invention	A COMPUTER READABLE MEDIUM WITH INSTRUCTIONS FOR RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT		
Attorney Docket Number	5550-54-CON-2	Small Entity Status Claimed	<input type="checkbox"/>
Application Type	Nonprovisional		
Subject Matter	Utility		
Suggested Class (if any)		Sub Class (if any)	
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Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	Continuation of	11/246163	2005-10-11
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<b>Application Data Sheet 37 CFR 1.76</b>		Attorney Docket Number	5550-54-CON-2
		Application Number	
Title of Invention	A COMPUTER READABLE MEDIUM WITH INSTRUCTIONS FOR RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT		

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<b>Application Data Sheet 37 CFR 1.76</b>		Attorney Docket Number	5550-54-CON-2
		Application Number	
Title of Invention	A COMPUTER READABLE MEDIUM WITH INSTRUCTIONS FOR RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT		

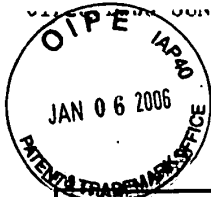
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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.



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 Docket No. T3653-9285US01

## DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of  
Invention

RESOURCE SHARING IN A TELECOMMUNICATIONS ENVIRONMENT

As the below named inventor(s), I/we declare that:

This declaration is directed to:

- ☐ The attached application, or  
☒ Application No. 11/246,163, filed on October 11, 2005  
☐ as amended on \_\_\_\_\_ (if applicable):

I/we believe that I/we am/are the original and first inventor(s) of the subject matter which is claimed and for which a patent is sought;

I/we have reviewed and understand the contents of the above-identified application, including the claims, as amended by any amendment specifically referred to above;

I/we acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me/us to be material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT International filing date of the continuation-in-part application.

All statements made herein of my/own knowledge are true, all statements made herein on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001, and may jeopardize the validity of the application or any patent issuing thereon.

### FULL NAME OF INVENTOR(S)

Inventor one: Marcos C. TZANNES

Signature: [Signature]

Citizen of: U.S.A.

Inventor two: Michael LUND

Signature: [Signature]

Citizen of: U.S.A.

Inventor three: \_\_\_\_\_

Signature: \_\_\_\_\_

Citizen of: \_\_\_\_\_

Inventor four: \_\_\_\_\_

Signature: \_\_\_\_\_

Citizen of: \_\_\_\_\_



Additional inventors or a legal representative are being named on \_\_\_\_\_ additional form(s) attached hereto.

This collection of information is required by 37 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Date: 08/09/10

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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875					Application or Docket Number <b>12/853,020</b>	
<b>APPLICATION AS FILED – PART I</b>						
(Column 1)		(Column 2)		SMALL ENTITY		OR
OTHER THAN SMALL ENTITY						
FOR	NUMBER FILED	NUMBER EXTRA	RATE (\$)	FEE (\$)	RATE (\$)	FEE (\$)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A		N/A	330
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A		N/A	540
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A		N/A	220
TOTAL CLAIMS (37 CFR 1.16(j))	8	minus 20 =	x\$26		x\$52	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2	minus 3 = *	x\$110		x\$220	
APPLICATION SIZE FEE (37 CFR 1.16(s))			If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$270 (\$135 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))			195		390	
			TOTAL		TOTAL	1090
* If the difference in column 1 is less than zero, enter "0" in column 2.						
<b>APPLICATION AS AMENDED – PART II</b>						
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY
OTHER THAN SMALL ENTITY						
AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	RATE (\$)
	Total (37 CFR 1.16(i))	Minus **	=	X =		X =
	Independent (37 CFR 1.16(h))	Minus ***	=	X =		X =
	Application Size Fee (37 CFR 1.16(s))			N/A		N/A
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))			TOTAL ADD'T FEE		TOTAL ADD'T FEE
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY
OTHER THAN SMALL ENTITY						
AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	RATE (\$)
	Total (37 CFR 1.16(i))	Minus **	=	X =		X =
	Independent (37 CFR 1.16(h))	Minus ***	=	X =		X =
	Application Size Fee (37 CFR 1.16(s))			N/A		N/A
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))			TOTAL ADD'T FEE		TOTAL ADD'T FEE
<p>* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.</p> <p>** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".</p> <p>*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".</p> <p>The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.</p>						

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.