AO 120 (Rev. 08/10)

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

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 Eastern District of Texas on the following

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

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
2:22-cv-394	10/10/2022	Eastern District of Texas

PLAINTIFF	DEFENDANT
General Access Solutions, LTD.	Verizon Communications, Inc., et al

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	7,230,931	6/12/2007	General Access Solutions, LTD.
2	9,426,794	8/23/2016	General Access Solutions, LTD.
3			
4			
5			

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

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ 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**

PETITIONER VERIZON
Ex. 1008

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/488,374	06/04/2012	Paul F. Struhsaker	000189-0022-110

CONFIRMATION NO. 2192

POA ACCEPTANCE LETTER

164543
Haley Guiliano LLP
75 Broad Street
Suite 1000
NEW YORK, NY 10004-3226

OC000000111571134

Date Mailed: 10/01/2019

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 09/25/2019.

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.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/vnguyen/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/488,374	06/04/2012	Paul F. Struhsaker	9030101.141-US0

CONFIRMATION NO. 2192

POWER OF ATTORNEY NOTICE

70763
Byrne Poh LLP
11 Broadway, Ste 760
New York, NY 10004

OC000000111571112

Date Mailed: 10/01/2019

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 09/25/2019.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/vnguyen/

PTO/SB/80 (11-08)
Approved for use through 11/30/2020. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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(b).

I hereby appoint:

☑ Practitioners associated with the Customer Number: 164543

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: 164543

OR

☐ Firm or Individual Name			
Address			
City		State	Zip
Country			
Telephone		Email	

Assignee Name and Address:

General Access Solutions, Ltd.
3400 Welborn St., #216
Dallas, TX 75219

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	/Michael S. Hynek/	Date	September 23, 2019
Name	Michael S. Hynek	Telephone	
Title	Manager of General Access, LLC which is GP of General Access I, Ltd., GP of Applicant		

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.

SCHEDULE A

Docket No.:	**000189-0022-110**	**Conf. No.:**	**2192**
Application No.:	**13/488,374**	**Patent No.:**	**9,426,794**

Total Assignments: 3

Application #: 09839499 Filing Dt: 04/20/2001 Patent #: 7346347 Issue Dt: 03/18/2008

PCT #: NONE Intl Reg #: Publication #: US20020098843 Pub Dt: 07/25/2002

Inventor: Paul F. Struhsaker

Title: APPARATUS, AND AN ASSOCIATED METHOD, FOR PROVIDING WLAN SERVICE IN A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM

Assignment: 1

Reel/Frame: 011734 / 0553 Received: 05/01/2001 Recorded: 04/20/2001 Mailed: 07/12/2001 Pages: 3

Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).

Assignor: STRUHSAKER, PAUL F. Exec Dt: 04/19/2001

Assignee: RAZE TECHNOLOGIES, INC.
2540 EAST PLANO PARKWAY, SUITE 188
PLANO, TEXAS 75074

Assignment: 2

Reel/Frame: 012449 / 0730 Received: 01/15/2002 Recorded: 01/10/2002 Mailed: 03/06/2002 Pages: 8

Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).

Assignor: RAZE TECHNOLOGIES, INC. Exec Dt: 12/20/2001

Assignee: ACCESS SOLUTIONS, LTD.
17519 MUIRFIELD
DALLAS, TEXAS 75287

Assignment:

Reel/Frame: 050326 / 0971 **Received:** 09/10/2019 **Recorded:** 09/10/2019 **Mailed:** 09/11/2019 **Pages:** 8

Conveyance: CHANGE OF NAME (SEE DOCUMENT FOR DETAILS).

Assignor: ACCESS SOLUTIONS, LTD. **Exec Dt:** 08/15/2011

Assignee: GENERAL ACCESS SOLUTIONS, LTD.
3400 WELBORN ST., #216
DALLAS, TEXAS 75219

PTO/SB/96 (07-09)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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(b)

Applicant/Patent Owner: GENERAL ACCESS SOLUTIONS, LTD.

Application No./Patent No.: See Schedule A Filed/Issue Date: See Schedule A

Titled: See Schedule A

GENERAL ACCESS SOLUTIONS, LTD. (Name of Assignee) , Corporation (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that it is:

1. [x] 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. [ ] an 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 _____, Frame _____, or for which a copy thereof is attached.

OR

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

1. From: See Schedule A To: See Schedule A
The document was recorded in the United States Patent and Trademark Office at
Reel See Schedule A, Frame See Schedule A, or for which a copy thereof is attached.

2. From: See Schedule A To: See Schedule A
The document was recorded in the United States Patent and Trademark Office at
Reel See Schedule A, Frame See Schedule A, or for which a copy thereof is attached.

3. From: See Schedule A To: See Schedule A
The document was recorded in the United States Patent and Trademark Office at
Reel See Schedule A, Frame See Schedule A, or for which a copy thereof is attached.

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

[x] 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.

/Michael S. Hynek/	September 23, 2019
Signature	Date
Michael S. Hynek	Manager of General Access, LLC which is GP of General Access I, Ltd., GP of Applicant
Printed or Typed Name	Title or Registration No.

SCHEDULE A

Docket No.:	**000189-0022-110**	**Conf. No.:**	**2192**
Application No.:	**13/488,374**	**Patent No.:**	**9,426,794**

Total Assignments: 3

Application #: 09839499 Filing Dt: 04/20/2001 Patent #: 7346347 Issue Dt: 03/18/2008

PCT #: NONE Intl Reg #: Publication #: US20020098843 Pub Dt: 07/25/2002

Inventor: Paul F. Struhsaker

Title: APPARATUS, AND AN ASSOCIATED METHOD, FOR PROVIDING WLAN SERVICE IN A FIXED WIRELESS ACCESS COMMUNICATION SYSTEM

Assignment: 1

Reel/Frame: 011734 / 0553 Received: 05/01/2001 Recorded: 04/20/2001 Mailed: 07/12/2001 Pages: 3

Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).

Assignor: STRUHSAKER, PAUL F. Exec Dt: 04/19/2001

Assignee: RAZE TECHNOLOGIES, INC.
2540 EAST PLANO PARKWAY, SUITE 188
PLANO, TEXAS 75074

Assignment: 2

Reel/Frame: 012449 / 0730 Received: 01/15/2002 Recorded: 01/10/2002 Mailed: 03/06/2002 Pages: 8

Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).

Assignor: RAZE TECHNOLOGIES, INC. Exec Dt: 12/20/2001

Assignee: ACCESS SOLUTIONS, LTD.
17519 MUIRFIELD
DALLAS, TEXAS 75287

Assignment:

Reel/Frame: 050326 / 0971 **Received:** 09/10/2019 **Recorded:** 09/10/2019 **Mailed:** 09/11/2019 **Pages:** 8

Conveyance: CHANGE OF NAME (SEE DOCUMENT FOR DETAILS).

Assignor: ACCESS SOLUTIONS, LTD. **Exec Dt:** 08/15/2011

Assignee: GENERAL ACCESS SOLUTIONS, LTD.
3400 WELBORN ST., #216
DALLAS, TEXAS 75219

Electronic Acknowledgement Receipt

EFS ID:	37262247
Application Number:	13488374
International Application Number:	
Confirmation Number:	2192
Title of Invention:	WIRELESS COMMUNICATION SYSTEM AND DEVICE FOR COUPLING A BASE STATION AND MOBILE STATIONS
First Named Inventor/Applicant Name:	Paul F. Struhsaker
Customer Number:	70763
Filer:	Kevin Augustine Rieffel/Tracy Chu
Filer Authorized By:	Kevin Augustine Rieffel
Attorney Docket Number:	9030101.141-US0
Receipt Date:	25-SEP-2019
Filing Date:	04-JUN-2012
Time Stamp:	11:24:08
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	000189-0022-110_POA.pdf	1892251 0760b3441d9cc590e84321266cfe3c98765f15c1	no	2

Warnings:

Information:					
2	Assignee showing of ownership per 37 CFR 3.73	000189-0022-110_Stmt_373b.pdf	836773 d6e401476ad9545b0f3c0ff9f078974e7bebe1f1	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	2729024	

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.

New Applications Under 35 U.S.C. 111

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.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/488,374	08/23/2016	9426794	9030101.141-US0	2192

70763 7590 08/03/2016

Byrne Poh LLP
11 Broadway, Ste 1115
New York, NY 10004

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 64 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):

Paul F. Struhsaker, Plano, TX;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

PTO/SB/08a (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 3 of 7

Complete if Known	
Application Number	13/488,374
Filing Date	06-04-2012
First Named Inventor	Paul F. Struhsaker
Art Unit	2644
Examiner Name	Huy C. Ho
Attorney Docket Number	9030101.141-US0

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] *(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
		US- 20020098799	07-25-2002	Struhsaker et al.	
Change(s) applied to document, /J.H./ 7/26/2016		US- 20040213188	10-28-2004	Struhsaker et al.	
		US- 7075967	~~06-11-2006~~	Struhsaker et al.	07/2006
		US- 7099383	08-29-2006	Struhsaker et al.	
		US- 6947477	09-20-2005	Struhsaker et al.	
		US- 6564051	05-13-2003	Struhsaker et al.	
		US- 7069047	06-27-2006	Struhsaker et al.	
		US- 6804527	10-12-2004	Struhsaker et al.	
		US- 7065098	06-20-2006	Struhsaker et al.	
		US- 7002929	02-21-2006	Struhsaker et al.	
		US- 6925516	08-02-2005	Struhsaker et al.	
		US- 6052408	04-18-2000	Struhsaker et al.	
		US- 7230931	06-12-2007	Struhsaker, Paul F.	
		US- 6859655	02-22-2005	Struhsaker, Paul F.	
		US- 7274946	09-25-2007	Struhsaker, Paul F.	
		US- 7031738	04-18-2006	Struhsaker, Paul F.	
		US- 7035241	04-25-2006	Struhsaker, Paul F.	
		US- 6150955	11-21-2000	Tracy et al.	
		US- 6188873	02-13-2001	Wickman et al.	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] *(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[6]

Examiner Signature	/Huy Ho/ (06/13/2014)	Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6]Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.97 and 1.98. 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 2 hours 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, 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 (1-800-786-9199) and select option 2.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.H./

PTO/SB/08a (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 7

Complete if Known	
Application Number	13/488,374
Filing Date	06-04-2012
First Named Inventor	Paul F. Struhsaker
Art Unit	2644
Examiner Name	Huy C. Ho
Attorney Docket Number	9030101.141-US0

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] *(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
		US- 20020164991	11-07-2002	Arazi et al.	
		US- 5694424	12-02-1997	Ariyavisitakul	
		US- 5809086	09-15-1998	Ariyavisitakul	
		US- 6097968	08-01-2000	Bannister et al.	
		US- 6035178	03-07-2000	Chennakeshu et al.	
		US- 5416831	05-16-1995	Chewning et al.	
		US- 6023459	02-08-2000	Clark et al.	
		US- 2001-0004595	06-21-2001	Dent, Paul Wilkinson	
		US- 5790936	08-04-1998	Dinkins	
		US- 6289213	09-11-2001	Flint et al.	
		US- 5991292	11-23-1999	Focsaneanu et al.	
		US- 5745837	04-28-1998	Fuhrmann, Amir Michael	
		US- 20120147797	06-14-2012	Furuskar et al.	
		US- 6014546	01-11-2000	Georges et al.	
		US- 6222503	04-24-2001	Gietema et al.	
		US- 6016311	01-18-2000	Gilbert et al.	
		US- 6363252	03-26-2002	Hamalainen et al.	
		US- 5673307	09-30-1997	Holland et al.	
		US- 6560213	05-06-2003	Izadpanah et al.	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] *(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[6]
Change(s) applied to document, /J.H./ 7/26/2016		WO/1999/009762	~~12-30-1899~~	Elrefaie et al.	02/1999	
		WO/1999/029126	~~12-30-1899~~	Joeressen, Olaf J.	06/1999	
		EP 0690637	01-03-1996	Lerman, Ruvin I.		
		EP 0690638	01-03-1996	Lerman, Ruvin I.		

Examiner Signature	/Huy Ho/ (06/13/2014)	Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.97 and 1.98. 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 2 hours 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, 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 (1-800-786-9199) and select option 2.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /H.H./

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
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

70763 7590 04/12/2016

Byrne Poh LLP
11 Broadway, Ste 1115
New York, NY 10004

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

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.
13/488,374	06/04/2012	Paul F. Struhsaker	9030101.141-US0	2192

TITLE OF INVENTION: WIRELESS COMMUNICATION SYSTEM AND DEVICE FOR COUPLING A BASE STATION AND MOBILE STATIONS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$480	$0	$0	$480	07/12/2016

EXAMINER	ART UNIT	CLASS-SUBCLASS
CAI, WAYNE HUU	2644	455-443000

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 Byrne Poh LLP
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: Access Solutions, Ltd.

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Dallas, TX

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. Fees paid via EFS-Web

☒ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number 50-4207 (enclose an extra copy of this form).

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

☐ Applicant certifying micro entity status. See 37 CFR 1.29

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

☐ Applicant asserting small entity status. See 37 CFR 1.27

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

☐ Applicant changing to regular undiscounted fee status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Matthew T Byrne/ Date 07/12/2016

Typed or printed name Matthew T. Byrne Registration No. 40,934

Electronic Patent Application Fee Transmittal

Application Number:	13488374
Filing Date:	04-Jun-2012
Title of Invention:	WIRELESS COMMUNICATION SYSTEM AND DEVICE FOR COUPLING A BASE STATION AND MOBILE STATIONS
First Named Inventor/Applicant Name:	Paul F. Struhsaker
Filer:	Matthew T. Byrne/Nicole Beverly
Attorney Docket Number:	9030101.141-US0

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

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:				
Utility Appl Issue Fee	2501	1	480	480

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**480**

Electronic Acknowledgement Receipt

EFS ID:	26322005
Application Number:	13488374
International Application Number:	
Confirmation Number:	2192
Title of Invention:	WIRELESS COMMUNICATION SYSTEM AND DEVICE FOR COUPLING A BASE STATION AND MOBILE STATIONS
First Named Inventor/Applicant Name:	Paul F. Struhsaker
Customer Number:	70763
Filer:	Matthew T. Byrne/Nicole Beverly
Filer Authorized By:	Matthew T. Byrne
Attorney Docket Number:	9030101.141-US0
Receipt Date:	12-JUL-2016
Filing Date:	04-JUN-2012
Time Stamp:	15:13:02
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$480
RAM confirmation Number	071316INTEFSW15135500
Deposit Account	1045
Authorized User	Philip Poh

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	9030101_141_US0_IssueFeePayment.pdf	97691 c370ac552333fa61f6b16db2df9399b5dd375075	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30865 04c264b8f745a9ccb57bb4a95acbf90edd4e53ef	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	128556		

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.

New Applications Under 35 U.S.C. 111
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 Acknowledgement Receipt

EFS ID:	26322005
Application Number:	13488374
International Application Number:	
Confirmation Number:	2192
Title of Invention:	WIRELESS COMMUNICATION SYSTEM AND DEVICE FOR COUPLING A BASE STATION AND MOBILE STATIONS
First Named Inventor/Applicant Name:	Paul F. Struhsaker
Customer Number:	70763
Filer:	Matthew T. Byrne/Nicole Beverly
Filer Authorized By:	Matthew T. Byrne
Attorney Docket Number:	9030101.141-US0
Receipt Date:	12-JUL-2016
Filing Date:	04-JUN-2012
Time Stamp:	15:13:02
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$480
RAM confirmation Number	071316INTEFSW15135500
Deposit Account	504207
Authorized User	Philip Poh

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	9030101_141_US0_IssueFeePayment.pdf	97691 c370ac552333fa61f6b16db2df9399b5dd375075	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30865 04c264b8f745a9ccb57bb4a95acbf90edd4e53ef	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	128556		

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.

New Applications Under 35 U.S.C. 111
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.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/488,374	06/04/2012	Paul F. Struhsaker	9030101.141-US0	2192

70763 7590 04/25/2016

Byrne Poh LLP
11 Broadway, Ste 1115
New York, NY 10004

EXAMINER
CAI, WAYNE HUU

ART UNIT	PAPER NUMBER
2644	

NOTIFICATION DATE	DELIVERY MODE
04/25/2016	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

info@byrnepoh.com

Notice of Allowability	Application No. 13/488,374	Applicant(s) STRUHSAKER, PAUL F.	
	Examiner WAYNE CAI	Art Unit 2644	AIA (First Inventor to File) Status No

-- 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 *04/15/2016*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on_____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *1-6*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov .
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   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.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ 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. ☐ Notice of References Cited (PTO-892)
2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☐ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/WAYNE CAI/
Primary Examiner, Art Unit 2644

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /WHC/

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13488374
Filing Date	2012-06-04
First Named Inventor	Paul F. Struhsaker
Art Unit	2644
Examiner Name	Wayne Huu Cai
Attorney Docket Number	9030101.141-US0

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	6115367		2000-09-05	Archambaud et al.	
	2	8018907		2011-09-13	Kubler et al.	
	3	4797898		1989-01-10	Martinez, Aldo A.	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /WHC/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Application Number	13488374
	Filing Date	2012-06-04
	First Named Inventor	Paul F. Struhsaker
	Art Unit	2644
	Examiner Name	Wayne Huu Cai
	Attorney Docket Number	9030101.141-US0

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	Notice of Allowance dated 02/26/2016 in United States Patent Application No. 14/595,208.	

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature	/Wayne H Cai/	Date Considered	04/19/2016

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13488374
	Filing Date	2012-06-04
	First Named Inventor	Paul F. Struhsaker
	Art Unit	2644
	Examiner Name	Wayne Huu Cai
	Attorney Docket Number	9030101.141-US0

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the 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 the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

☓ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Matthew T Byrne/	Date (YYYY-MM-DD)	2016-04-15
Name/Print	Matthew T. Byrne	Registration Number	40,934

This collection of information is required by 37 CFR 1.97 and 1.98. 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 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: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

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.

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13488374
Filing Date	2012-06-04
First Named Inventor	Paul F. Struhsaker
Art Unit	2644
Examiner Name	Wayne Huu Cai
Attorney Docket Number	9030101.141-US0

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	6115367		2000-09-05	Archambaud et al.	
	2	8018907		2011-09-13	Kubler et al.	
	3	4797898		1989-01-10	Martinez, Aldo A.	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13488374
	Filing Date	2012-06-04
	First Named Inventor	Paul F. Struhsaker
	Art Unit	2644
	Examiner Name	Wayne Huu Cai
	Attorney Docket Number	9030101.141-US0

If you wish to add additional Foreign Patent Document citation information please click the Add button [Add]

NON-PATENT LITERATURE DOCUMENTS [Remove]

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	Notice of Allowance dated 02/26/2016 in United States Patent Application No. 14/595,208.	

If you wish to add additional non-patent literature document citation information please click the Add button [Add]

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13488374
	Filing Date	2012-06-04
	First Named Inventor	Paul F. Struhsaker
	Art Unit	2644
	Examiner Name	Wayne Huu Cai
	Attorney Docket Number	9030101.141-US0

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the 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 the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Matthew T Byrne/	Date (YYYY-MM-DD)	2016-04-15
Name/Print	Matthew T. Byrne	Registration Number	40,934

This collection of information is required by 37 CFR 1.97 and 1.98. 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 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: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

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.

Electronic Patent Application Fee Transmittal

Application Number:	13488374
Filing Date:	04-Jun-2012
Title of Invention:	WIRELESS COMMUNICATION SYSTEM AND DEVICE FOR COUPLING A BASE STATION AND MOBILE STATIONS
First Named Inventor/Applicant Name:	Paul F. Struhsaker
Filer:	Matthew T. Byrne/Nicole Beverly
Attorney Docket Number:	9030101.141-US0

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

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($)
Miscellaneous:				
Submission- Information Disclosure Stmt	2806	1	90	90
		Total in USD ($)		**90**

Electronic Acknowledgement Receipt

EFS ID:	25477868
Application Number:	13488374
International Application Number:	
Confirmation Number:	2192
Title of Invention:	WIRELESS COMMUNICATION SYSTEM AND DEVICE FOR COUPLING A BASE STATION AND MOBILE STATIONS
First Named Inventor/Applicant Name:	Paul F. Struhsaker
Customer Number:	70763
Filer:	Matthew T. Byrne/Nicole Beverly
Filer Authorized By:	Matthew T. Byrne
Attorney Docket Number:	9030101.141-US0
Receipt Date:	15-APR-2016
Filing Date:	04-JUN-2012
Time Stamp:	13:04:34
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$90
RAM confirmation Number	10195
Deposit Account	504207
Authorized User	BYRNE, MATTHEW T.

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 CFR 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 CFR 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 CFR 1.19 (Document supply fees)

Charge any Additional Fees required under 37 CFR 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	9030101_141_US0_IDSTransmittal.pdf	135521 b86755b25faab2527b354b3951090a44ad1937ec	no	1
Warnings:					
Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	9030101_141_US0_IDS_04_15_2016.pdf	611904 e50f95d929e06d50826db1031761e2a87ef40400	no	4
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30884 a00ea68ae85b6187c3ad5037e16f969e32524221	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	778309		

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.

New Applications Under 35 U.S.C. 111

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.

Attorney Docket No. 9030101.141-US0
PATENTS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Paul F. Struhsaker	Conf. No.:	2192
Application No.:	13/488,374	Examiner:	Wayne Huu Cai
Filing Date:	June 4, 2012	Art Unit:	2644
For:	WIRELESS COMMUNICATION SYSTEM AND DEVICE FOR COUPLING A BASE STATION AND MOBILE STATIONS		

Information Disclosure Statement

Dear Examiner:

Attached hereto are four sheets of SB08a identifying references in accordance with 37 CFR 1.56. No aspect of these submissions constitute a disclaimer of claim scope.

The Director is hereby authorized to charge any fees that may be due, or credit any overpayment of fees, to Deposit Account No. 50-4207.

Respectfully submitted,

Date: April 15, 2016

/Matthew T Byrne/
Matthew T. Byrne
Registration No. 40,934
Attorney for Applicant

Byrne Poh LLP
11 Broadway, Suite 1115
New York, NY 10004
Telephone: (212) 509-8870
Facsimile: (212) 931-8521

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

70763 7590 04/12/2016

Byrne Poh LLP
11 Broadway, Ste 1115
New York, NY 10004

EXAMINER
CAI, WAYNE HUU

ART UNIT	PAPER NUMBER
2644	

DATE MAILED: 04/12/2016

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/488,374	06/04/2012	Paul F. Struhsaker	9030101.141-US0	2192

TITLE OF INVENTION: WIRELESS COMMUNICATION SYSTEM AND DEVICE FOR COUPLING A BASE STATION AND MOBILE STATIONS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$480	$0	$0	$480	07/12/2016

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.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

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
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

70763 7590 04/12/2016
Byrne Poh LLP
11 Broadway, Ste 1115
New York, NY 10004

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission
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.
13/488,374	06/04/2012	Paul F. Struhsaker	9030101.141-US0	2192

TITLE OF INVENTION: WIRELESS COMMUNICATION SYSTEM AND DEVICE FOR COUPLING A BASE STATION AND MOBILE STATIONS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$480	$0	$0	$480	07/12/2016

EXAMINER	ART UNIT	CLASS-SUBCLASS
CAI, WAYNE HUU	2644	455-443000

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 _____
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:
- ❑ 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 credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ❑ Applicant certifying micro entity status. See 37 CFR 1.29 — NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
- ❑ Applicant asserting small entity status. See 37 CFR 1.27 — NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
- ❑ Applicant changing to regular undiscounted fee status. — NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/488,374	06/04/2012	Paul F. Struhsaker	9030101.141-US0	2192

70763 7590 04/12/2016

Byrne Poh LLP
11 Broadway, Ste 1115
New York, NY 10004

EXAMINER	
CAI, WAYNE HUU	

ART UNIT	PAPER NUMBER
2644	

DATE MAILED: 04/12/2016

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

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

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.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B 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. 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.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
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 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.

Notice of Allowability	Application No. 13/488,374	Applicant(s) STRUHSAKER, PAUL F.	
	Examiner WAYNE CAI	Art Unit 2644	AIA (First Inventor to File) Status No

-- 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 *02/18/2016*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on_____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *1-6*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov .
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   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.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ 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. ☐ Notice of References Cited (PTO-892)
2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☐ Examiner's Amendment/Comment
6. ☒ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/WAYNE CAI/
Primary Examiner, Art Unit 2644

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after allowance or after an Office action under *Ex Parte Quayle*, 25 USPQ 74, 453 O.G. 213 (Comm'r Pat. 1935). Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, prosecution in this application has been reopened pursuant to 37 CFR 1.114. Applicant's submission filed on February 18, 2016 has been entered.

Information Disclosure Statement

2. The information disclosure statement (IDS) submitted on February 18, 2016 was filed after the mailing date of the Notice of Allowance on January 26, 2016. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Allowable Subject Matter

3. Claims 1-6 are allowed as indicated in previous Notice of Allowance dated January 26, 2016.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to WAYNE CAI whose telephone number is (571)272-7798. The examiner can normally be reached on Monday-Thursday, from 8:00 a.m. to 6:00 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Edouard can be reached on (571) 272-7603. 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.

/WAYNE CAI/
Primary Examiner, Art Unit 2644

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /WHC/

PTO/SB/08a (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 3

Complete if Known	
Application Number	13/488,374
Filing Date	06-04-2012
First Named Inventor	Paul F. Struhsaker
Art Unit	2644
Examiner Name	Wayne Huu Cai
Attorney Docket Number	9030101.141-US0

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] *(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
		US- 6792286	09-14-2004	Bharath et al.	
		US- 5884148	03-16-1999	Bilgic et al.	
		US- 6377800	04-23-2002	Cho, Yoo-jin	
		US- 5999818	12-07-1999	Gilbert et al.	
		US- 6208871	03-27-2001	Hall et al.	
		US- 6611507	08-26-2003	Hottinen et al.	
		US- 5625623	04-29-1997	Kent et al.	
		US- 5732076	03-24-1998	Ketseoglou et al.	
		US- 5933776	08-03-1999	Kirkpatrick, George R.	
		US- 2002/0058513	05-16-2002	Klein et al.	
		US- 6163698	12-19-2000	Leitch et al.	
		US- 5995851	11-30-1999	Lim, Jae-bong	
		US- 5490252	02-06-1996	Macera et al.	
		US- 6023462	02-08-2000	Nieczyporowicz et al.	
		US- 6324384	11-27-2001	Nobuyasu et al.	
		US- 6185412	02-06-2001	Pentikainen et al.	
		US- 6654605	11-25-2003	Seo, Jae Joon	
		US- 20020171581	11-21-2002	Sheynblat et al.	
		US- 6192248	02-20-2001	Solondz, Mark A.	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] *(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[6]
/WHC/		WO/1999/037059	07-22-1999	Bellovin et al.		
/WHC/		WO/2001/056233	08-02-2001	Chen et al.		
/WHC/		WO/1999/026437	05-27-1999	Ericsson Inc.		
/WHC/		WO/1997/041699	11-06-1997	Johnson et al.		
/WHC/		WO/1999/027720	06-03-1999	Lysejko et al.		
/WHC/		EP 0444841	12-30-1899	Motorola Inc.		

Examiner Signature	/Wayne H Cai/	Date Considered	03/29/2016

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.97 and 1.98. 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 2 hours 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, 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 (1-800-786-9199) and select option 2.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /WHC/

PTO/SB/08a (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 3

Complete if Known	
Application Number	13/488,374
Filing Date	06-04-2012
First Named Inventor	Paul F. Struhsaker
Art Unit	2644
Examiner Name	Wayne Huu Cai
Attorney Docket Number	9030101.141-US0

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] *(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
		US- 20020097694	07-25-2002	Struhsaker, Paul F.	
		US- 20020098858	07-25-2002	Struhsaker, Paul F.	
		US- 20020065063	05-30-2002	Uhlik et al.	
		US- 6600914	07-29-2003	Uhlik et al.	
		US- 5603095	02-11-1997	Uola, Risto	
		US- 5659605	08-19-1997	Voit et al.	
		US- 6836546	12-28-2004	Willer, Bernd	
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] *(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[6]
/WHC/		WO/1998/024254	06-04-1998	Pentikainen et al.		
/WHC/		EP 0304955	03-01-1989	Sasaki, Yasutaka		
/WHC/		WO/1999/051043	10-07-1999	Zohar, Israel		

Examiner Signature	/Wayne H Cai/	Date Considered	03/29/2016

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.97 and 1.98. 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 2 hours 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, 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 (1-800-786-9199) and select option 2.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /WHC/

PTO/SB/08b (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 3 of 3

Complete if Known	
Application Number	13/488,374
Filing Date	06-04-2012
First Named Inventor	Paul F. Struhsaker
Art Unit	2644
Examiner Name	Wayne Huu Cai
Attorney Docket Number	9030101.141-US0

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
		Notice of Allowance dated 06/10/2014 in U.S. Patent Application No. 13/532,650.	
		Office Action dated 02/18/2015 in U.S. Patent Application No. 14/595,208.	
		Office Action dated 10/13/2010 in U.S. Patent Application No. 11/903,508.	
		Office Action dated 10/15/2015 in U.S. Patent Application No. 14/595,208.	
/WHC/		Povey, G.J. et al., "TDD-CDMA Extension to FDD-CDMA Based Third Generation Cellular System," In Proceedings of IEEE 6th International Conference on Universal Personal Communications Record, San Diego, CA, US, October 12-16, 1997, vol. 2, pp. 813-817.	
		United States Patent Application No. 11/903,508, filed 09/21/2007.	

Examiner Signature	/Wayne H Cai/	Date Considered	03/29/2016

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.98. 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 2 hours 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, 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 (1-800-786-9199) and select option 2.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13488374	STRUHSAKER, PAUL F.
	Examiner	Art Unit
	HUY C HO	2644

CPC- SEARCHED		
Symbol	Date	Examiner
H04W 84/045	2/24/2014	HH
H04W 84/14,12	01/19/16	WHC
Update All of Above	3/29/16	WHC

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner
H04W 88/06	2/24/2014	HH

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
455	443	10/8/2012	HH
455	443,426.2,444,448	01/19/16	WHC
	Update All of Above	3/29/16	WHC

SEARCH NOTES		
Search Notes	Date	Examiner
EAST Database Search	10/8/2012	HH
Inventor Search complete	10/8/2012	HH
Search update	6/26/2013	HH
Search update	2/24/2014	HH
Information Disclosure Statement (IDS) filed on 06/10/2014 is considered by the examiner.	6/13/2014	HH
Search update	10/15/2014	HH
Inventor Update Search	01/19/16	WHC
See Update Search History	01/19/16	WHC
Inventor Update Search	3/29/16	WHC
See Update Search History	3/29/16	WHC

INTERFERENCE SEARCH

US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
455	444, 554.2	10/8/2012	HH
370	274, 401	10/8/2012	HH
	Same As Above	01/19/16	WHC
	Same As Above	3/29/16	WHC

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13488374	STRUHSAKER, PAUL F.
	Examiner	**Art Unit**
	HUY C HO	2644

CPC						
Symbol					**Type**	**Version**
H04W		72	/	042	F	2013-01-01
H04W		84	/	12	A	2013-01-01
H04W		84	/	14	I	2013-01-01
H04W		88	/	02	A	2013-01-01
H04W		88	/	08	A	2013-01-01
			/			
			/			
			/			
			/			
			/			
			/			
			/			
			/			
			/			
			/			

CPC Combination Sets							
Symbol					**Type**	**Set**	**Ranking**	**Version**
			/					
			/					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	6	
/WAYNE CAI/ Primary Examiner.Art Unit 2644	03/29/16	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13488374	STRUHSAKER, PAUL F.
	Examiner	**Art Unit**
	HUY C HO	2644

US ORIGINAL CLASSIFICATION		INTERNATIONAL CLASSIFICATION										
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED				
455	443	H	0	4	W	36 / 00 (2009.01.01)	H	0	4	W	4 / 00 (2009.01.01)
							H	0	4	W	36 / 00 (2009.01.01)
							H	0	4	W	40 / 00 (2009.01.01)
							H	0	4	B	1 / 56 (2006.01.01)
							H	0	4	L	12 / 56

CROSS REFERENCE(S)					
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
455	426.2	444	448		
370	274	401			

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	6	
/WAYNE CAI/ Primary Examiner.Art Unit 2644	03/29/16	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13488374	STRUHSAKER, PAUL F.
	Examiner	**Art Unit**
	HUY C HO	2644

☒ **Claims renumbered in the same order as presented by applicant** ☐ **CPA** ☐ **T.D.** ☐ **R.1.47**

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1														
	2														
	3														
	4														
	5														
	6														

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	6	
/WAYNE CAI/ Primary Examiner.Art Unit 2644	03/29/16	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L12	5	8 and 11	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/04/04 08:54
L11	509	@ad<"20071031" and L10	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/04/04 08:31
L10	1269	(identif$9 determin$5 detect$5) near5 (parameter$2 characteristic$2) near10 (relay$5 forward$5 re-rout$5) near10 (equipment$2 device$2 terminal$2 phone$2)	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/04/04 08:31
L9	0	5 and 8	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/04/04 08:31
L8	17896	H04W84/12,14.cpc.	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/04/04 08:30
L7	2	@ad<"20071031" and 6	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/04/04 08:23
L6	8	(forward$5 divert$5) near10 ((first primary) near5 (phone$2 terminal$2 device$2 equipment$2)) near10 (second$5 near3 (phone$2 terminal$2 device$2 equipment$2)) same (condition$2 status$2 (signal$2 qualit$4) near3 (strength level$2 threshold$2)) same(wireless adj (lan local adj area$2 network$2) wlan)	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/04/04 08:22
L5	45	@ad<"20071031" and L4	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/04/04 08:07
L4	133	(forward$5 divert$5) near10 ((first primary) near5 (phone$2 terminal$2 device$2 equipment$2)) near10 (second$5 near3 (phone$2 terminal$2 device$2 equipment$2)) same (condition$2 status$2 (signal$2 qualit$4)	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/04/04 08:07

		near3 (strength level$2 threshold$2)) and (wireless adj (lan local adj area$2 network$2) wlan)				
L3	5	L1 and L2	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/04/04 07:47
L2	2193	455/443,426.2,444,448.ccls. and @ad<"20071031"	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/04/04 07:47
L1	2421	((relay$5 re-transmit$5 re-transmission$2 re-send$5) and (local adj area wlan wireless adj lan) and (wan wide adj area$2) and (track$5 monitor$5 detect$5 determin$5) near3 (characteristic$2 parameter$2 qualit$5) and (forward$5 adj link$2 downlink$2))	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/04/04 07:47
S50	28	S47 and S49	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/04/02 15:04
S49	1326	(forward$5 divert$5) near10 ((first primary) near5 (phone$2 terminal$2 device$2 equipment$2)) near10 (second$5 near3 (phone$2 terminal$2 device$2 equipment$2)) and (condition$2 status$2 (signal$2 qualit$4) near3 (strength level$2 threshold$2)) and (wireless adj (lan local adj area$2 network$2) wlan)	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/04/02 15:03
S48	2193	455/443,426.2,444,448.ccls. and @ad<"20071031"	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/04/02 15:03
S47	7456	@ad<"20071031" and S46	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/04/02 15:03
S46	17878	H04W84/12,14.cpc.	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/04/02 15:02
S44	2	struhsaker-paul-f.in. and ((wan wide adj area) and (lan or local adj area$2) and (downlink forward) and (signal$5 near5 (strengh characteristic$2 qualit$5 signature$2))).clm.	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/04/02 12:51
S43	84	struhsaker-paul-f.in.	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/04/02 12:51
S42	6	@ad<"20071031" and S41	US-	OR	OFF	2016/03/29

			PGPUB; USPAT; JPO; DERWENT			16:59
S41	15	(modem near3 sector$9) and (wlan or wireless adj (lan local adj area adj network$2)) and (forward$5 divert$5 re-transmit$5 re-transmission$2 retransmit$5 retransmission$2) and (first near3 (transceiver$2 transmitter$2 receiver$2)) same (second$5 near3 (transceiver$2 transmitter$2 receiver$2))	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/03/29 16:58
S40	36	@ad<"20071031" and S39	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/03/29 16:56
S39	52	(modem near3 sector$9) and (wlan or wireless adj (lan local adj area adj network$2)) and (forward$5 divert$5 re-transmit$5 re-transmission$2 retransmit$5 retransmission$2)	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/03/29 16:55
S38	57	(modem near3 sector$9) and (wlan or wireless adj (lan local adj area adj network$2))	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/03/29 16:55
S37	198	modem near3 sector$9	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/03/29 16:54
S36	3	13/488374	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/03/29 16:53
S35	45	@ad<"20071031" and S34	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/03/29 16:53
S34	133	(forward$5 divert$5) near10 ((first primary) near5 (phone$2 terminal$2 device$2 equipment$2)) near10 (second$5 near3 (phone$2 terminal$2 device$2 equipment$2)) same (condition$2 status$2 (signal$2 qualit$4) near3 (strength level$2 threshold$2)) and (wireless adj (lan local adj area$2 network$2) wlan)	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/03/29 16:52
S33	241	(forward$5 divert$5) with ((first primary) near5 (phone$2 terminal$2 device$2 equipment$2)) same (second$5 near3 (phone$2 terminal$2 device$2 equipment$2)) same (condition$2 status$2 (signal$2 qualit$4) near3 (strength level$2 threshold$2)) and (wireless adj (lan local adj area$2 network$2) wlan)	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/03/29 16:50

S32	184	@ad<"20071031" and S31	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/03/29 16:43
S31	467	(forward$5 divert$5) same ((first primary) near5 (phone$2 terminal$2 device$2 equipment$2)) same (second$5 near3 (phone$2 terminal$2 device$2 equipment$2)) same (wireless adj (lan local adj area$2 network$2) wlan)	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/03/29 16:41
S30	31861	(forward$5 divert$5) same ((first primary) near5 (phone$2 terminal$2 device$2 equipment$2)) same (second$5 near3 (phone$2 terminal$2 device$2 equipment$2))	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/03/29 16:41
S29	42	(("6792286") or ("5884148") or ("6377800") or ("5999818") or ("6208871") or ("6611507") or ("5625623") or ("5732076") or ("5933776") or ("20020058513") or ("6163698") or ("5995851") or ("5490252") or ("6023462") or ("6324384") or ("6185412") or ("6654605") or ("20020171581") or ("6192248")).PN.	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/03/29 13:53

4/ 4/ 2016 9:20:48 AM
C:\ Users\ wcai1\ Documents\ EAST\ Workspaces\ 13488374.wsp

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13488374	STRUHSAKER, PAUL F.
	Examiner	Art Unit
	HUY C HO	2644

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

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	10/08/2012	06/26/2013	01/19/2016	03/29/2016					
	1	✓	✓	=	=					
	2	✓	✓	=	=					
	3	✓	✓	=	=					
	4	✓	✓	=	=					
	5	✓	✓	=	=					
	6			=	=					

Doc code: RCEX
Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (07-14)
Approved for use through 07/31/2016. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	13/488,374	Filing Date	2012-06-04	Docket Number (if applicable)	9030101.141-US0	Art Unit	2644
First Named Inventor	Paul F. Struhsaker			Examiner Name	Wayne Huu Cai		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, to any international application that does not comply with the requirements of 35 U.S.C. 371, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV.

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

- ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____
- ☐ Other _____

☒ Enclosed

- ☐ Amendment/Reply
- ☒ Information Disclosure Statement (IDS)
- ☐ Affidavit(s)/ Declaration(s)
- ☐ Other _____

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____ (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other _____

FEES

The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.

☒ The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No 504207

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature

Applicant Signature

PTO/SB/30EFS (07-14)
Approved for use through 07/31/2016. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Signature of Registered U.S. Patent Practitioner			
Signature	/Matthew T Byrne/	Date (YYYY-MM-DD)	2016-02-18
Name	Matthew T. Byrne	Registration Number	40934

This collection of information is required by 37 CFR 1.114. 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.

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

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.

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.

Electronic Patent Application Fee Transmittal

Application Number:	13488374
Filing Date:	04-Jun-2012
Title of Invention:	WIRELESS COMMUNICATION SYSTEM AND DEVICE FOR COUPLING A BASE STATION AND MOBILE STATIONS
First Named Inventor/Applicant Name:	Paul F. Struhsaker
Filer:	Matthew T. Byrne/Nicole Beverly
Attorney Docket Number:	9030101.141-US0

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

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($)
Miscellaneous:				
RCE- 2nd and Subsequent Request	2820	1	850	850
		Total in USD ($)		**850**

Electronic Acknowledgement Receipt

EFS ID:	24938031
Application Number:	13488374
International Application Number:	
Confirmation Number:	2192
Title of Invention:	WIRELESS COMMUNICATION SYSTEM AND DEVICE FOR COUPLING A BASE STATION AND MOBILE STATIONS
First Named Inventor/Applicant Name:	Paul F. Struhsaker
Customer Number:	70763
Filer:	Matthew T. Byrne/Nicole Beverly
Filer Authorized By:	Matthew T. Byrne
Attorney Docket Number:	9030101.141-US0
Receipt Date:	18-FEB-2016
Filing Date:	04-JUN-2012
Time Stamp:	17:05:45
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$850
RAM confirmation Number	4223
Deposit Account	504207
Authorized User	BYRNE, MATTHEW T.

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 CFR 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 CFR 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 CFR 1.19 (Document supply fees)

Charge any Additional Fees required under 37 CFR 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	9030101_141_US0_IDSTransmittal.pdf	135493 f6acfe0acc7f3bb6b152fc6da55022d938ec965f	no	1
Warnings:					
Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	9030101_141_US0_IDS_02_18_2016.pdf	403913 c341a3b439f8347c2c4420ace15865642b0369cf	no	3
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
3	Foreign Reference	Bellovin_1999.PDF	703703 46acefedc02cf9e7a35a74f1be0896bd366e6a19	no	18
Warnings:					
Information:					
4	Foreign Reference	Chen_2001.PDF	2206497 b98d8de02d3358c630475eb918007239635daa8a	no	66
Warnings:					
Information:					
5	Foreign Reference	EricssonInc_1999.PDF	1047366 faa6d3e2989dc246f4bdad6d142d6fdc2875f09e	no	30
Warnings:					
Information:					
6	Foreign Reference	Johnson_1997.PDF	617116 73208703ecd345b5bbdeba1352490f74bc272882	no	17
Warnings:					
Information:					
7	Foreign Reference	Lysejko_1999.PDF	2200749 1f3e50777c3d01438228245O2d3bb9c0083f305f	no	50
Warnings:					
Information:					

8	Foreign Reference	Motorola_1991.PDF	437975 2b56f46bd7600a4cf4aabf7278ff979aa86f61e8	no	5
Warnings:					
Information:					
9	Foreign Reference	Pentikainen_1998.PDF	675767 b99fb675b8383e73b458323f0b5a1d6f412c8730	no	17
Warnings:					
Information:					
10	Foreign Reference	Sasaki_1989.PDF	1396305 c8c77341627f15652d26bcdbae3d3592667107af	no	28
Warnings:					
Information:					
11	Foreign Reference	Zohar_1999.PDF	869755 16a869c34a2dc38b88665149bc9d7c03e41a2ad7	no	25
Warnings:					
Information:					
12	Non Patent Literature	Povey_1997.PDF	365729 4a96a453e26cae7d8d2d1a57f1d994e23ae8279a	no	5
Warnings:					
Information:					
13	Request for Continued Examination (RCE)	9030101_141_US0_RCE.pdf	1349706 ac081866b0d1145d149f46618f04f24b59eb4e73	no	3
Warnings:					
Information:					
14	Fee Worksheet (SB06)	fee-info.pdf	30909 1411f7062d6966f13352993434e1340d9a653269	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	12440983	

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.

New Applications Under 35 U.S.C. 111

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.

Attorney Docket No. 9030101.141-US0
PATENTS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Paul F. Struhsaker	Conf. No.:	2192
Application No.:	13/488,374	Examiner:	Wayne Huu Cai
Filing Date:	June 4, 2012	Art Unit:	2644
For:	WIRELESS COMMUNICATION SYSTEM AND DEVICE FOR COUPLING A BASE STATION AND MOBILE STATIONS		

Information Disclosure Statement

Dear Examiner:

Attached hereto are three sheets of SB08a identifying references in accordance with 37 CFR 1.56. No aspect of these submissions constitute a disclaimer of claim scope.

The Director is hereby authorized to charge any fees that may be due, or credit any overpayment of fees, to Deposit Account No. 50-4207.

Respectfully submitted,

Date: February 18, 2016

/Matthew T Byrne/
Matthew T. Byrne
Registration No. 40,934
Attorney for Applicant

Byrne Poh LLP
11 Broadway, Suite 1115
New York, NY 10004
Telephone: (212) 509-8870
Facsimile: (212) 931-8521

PTO/SB/08a (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 3

Complete if Known	
Application Number	13/488,374
Filing Date	06-04-2012
First Named Inventor	Paul F. Struhsaker
Art Unit	2644
Examiner Name	Wayne Huu Cai
Attorney Docket Number	9030101.141-US0

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] *(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
		US- 6792286	09-14-2004	Bharath et al.	
		US- 5884148	03-16-1999	Bilgic et al.	
		US- 6377800	04-23-2002	Cho, Yoo-jin	
		US- 5999818	12-07-1999	Gilbert et al.	
		US- 6208871	03-27-2001	Hall et al.	
		US- 6611507	08-26-2003	Hottinen et al.	
		US- 5625623	04-29-1997	Kent et al.	
		US- 5732076	03-24-1998	Ketseoglou et al.	
		US- 5933776	08-03-1999	Kirkpatrick, George R.	
		US- 2002/0058513	05-16-2002	Klein et al.	
		US- 6163698	12-19-2000	Leitch et al.	
		US- 5995851	11-30-1999	Lim, Jae-bong	
		US- 5490252	02-06-1996	Macera et al.	
		US- 6023462	02-08-2000	Nieczyporowicz et al.	
		US- 6324384	11-27-2001	Nobuyasu et al.	
		US- 6185412	02-06-2001	Pentikainen et al.	
		US- 6654605	11-25-2003	Seo, Jae Joon	
		US- 20020171581	11-21-2002	Sheynblat et al.	
		US- 6192248	02-20-2001	Solondz, Mark A.	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] *(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[6]
		WO/1999/037059	07-22-1999	Bellovin et al.		
		WO/2001/056233	08-02-2001	Chen et al.		
		WO/1999/026437	05-27-1999	Ericsson Inc.		
		WO/1997/041699	11-06-1997	Johnson et al.		
		WO/1999/027720	06-03-1999	Lysejko et al.		
		EP 0444841	12-30-1899	Motorola Inc.		

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.97 and 1.98. 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 2 hours 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, 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 (1-800-786-9199) and select option 2.

PTO/SB/08a (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 3

Complete if Known	
Application Number	13/488,374
Filing Date	06-04-2012
First Named Inventor	Paul F. Struhsaker
Art Unit	2644
Examiner Name	Wayne Huu Cai
Attorney Docket Number	9030101.141-US0

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] *(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
		US- 20020097694	07-25-2002	Struhsaker, Paul F.	
		US- 20020098858	07-25-2002	Struhsaker, Paul F.	
		US- 20020065063	05-30-2002	Uhlik et al.	
		US- 6600914	07-29-2003	Uhlik et al.	
		US- 5603095	02-11-1997	Uola, Risto	
		US- 5659605	08-19-1997	Voit et al.	
		US- 6836546	12-28-2004	Willer, Bernd	
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			
		US-			

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] *(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[6]
		WO/1998/024254	06-04-1998	Pentikainen et al.		
		EP 0304955	03-01-1989	Sasaki, Yasutaka		
		WO/1999/051043	10-07-1999	Zohar, Israel		

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.97 and 1.98. 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 2 hours 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, 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 (1-800-786-9199) and select option 2.

PTO/SB/08b (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 3 of 3

Complete if Known	
Application Number	13/488,374
Filing Date	06-04-2012
First Named Inventor	Paul F. Struhsaker
Art Unit	2644
Examiner Name	Wayne Huu Cai
Attorney Docket Number	9030101.141-US0

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
		Notice of Allowance dated 06/10/2014 in U.S. Patent Application No. 13/532,650.	
		Office Action dated 02/18/2015 in U.S. Patent Application No. 14/595,208.	
		Office Action dated 10/13/2010 in U.S. Patent Application No. 11/903,508.	
		Office Action dated 10/15/2015 in U.S. Patent Application No. 14/595,208.	
		Povey, G.J. et al., "TDD-CDMA Extension to FDD-CDMA Based Third Generation Cellular System," In Proceedings of IEEE 6th International Conference on Universal Personal Communications Record, San Diego, CA, US, October 12-16, 1997, vol. 2, pp. 813-817.	
		United States Patent Application No. 11/903,508, filed 09/21/2007.	

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.98. 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 2 hours 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, 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 (1-800-786-9199) and select option 2.

PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : **H04L 12/28, 29/06, H04Q 11/04** — **A1**

(11) International Publication Number: **WO 99/37059**

(43) International Publication Date: 22 July 1999 (22.07.99)

(21) International Application Number: PCT/US99/00175

(22) International Filing Date: 14 January 1999 (14.01.99)

(30) Priority Data:
60/071,346 14 January 1998 (14.01.98) US

(71) Applicant: AT & T CORP. [US/US]; 32 Avenue of the Americas, New York, NY 10013–2412 (US).

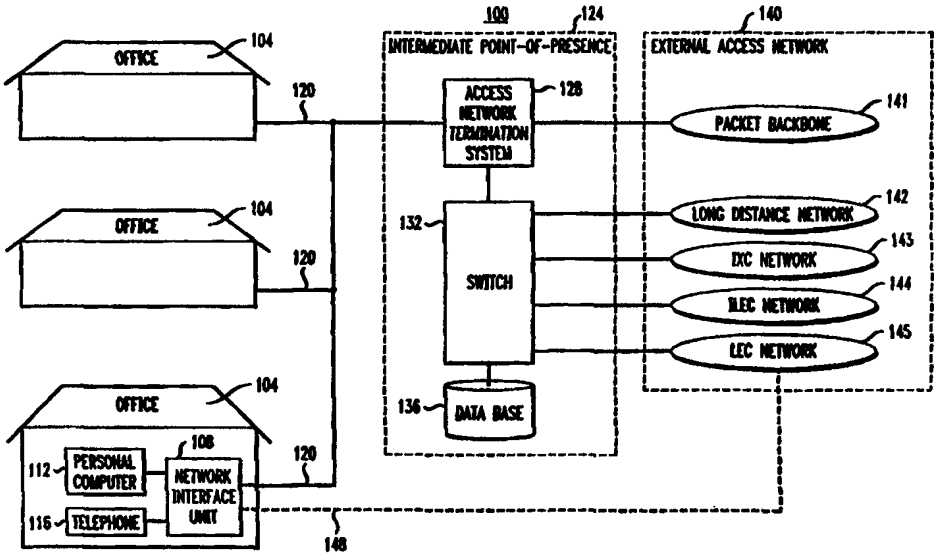
(72) Inventors: BELLOVIN, Steven, Michael; 710 Castleman Drive, Westfield, NJ 07090 (US). CONDON, Joseph, Henry; 190 Kent Place Boulevard, Summit, NJ 07901 (US). COX, Richard, Vandervoort; 155 Sagamore Drive, New Providence, NJ 07974 (US). FRASER, Alexander, Gibson; 62 Carriage House Road, Bernardsville, NJ 07924 (US). KALMANEK, Charles, Robert; 86 Great Hills Road, Short Hills, NJ 07078 (US). KAPLAN, Alan, Edward; 9 Cromwell Drive, Morris Township, NJ 07960 (US). KILLIAN, Thomas, Joseph; 321 Saint Georges Place, Westfield, NJ 07090 (US). MARSHALL, William, Todd; 113 North Summit Avenue, Chatham, NJ 07928 (US). ONUFRYK, Peter, Z.; 232 Pleasant Hill Road, Flanders, NJ 07836 (US). RAMAKRISHNAN, Kadangode, K.; 9 Highland Circle, Berkeley Heights, NJ 07922 (US). SCHRYER, Norman, Loren; 122 Sulfrian Road, New Providence, NJ 07974 (US).

(74) Agents: DWORETSKY, Samuel, H.; AT & T Corp., P.O. Box 4110, Middletown, NJ 07748 (US) et al.

(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: A METHOD AND SYSTEM FOR TELEPHONY AND HIGH SPEED DATA ACCESS ON A BROADBAND ACCESS NETWORK



(57) Abstract

A system and method for providing telephony and high speed data access over a broadband access network, comprising a network interface unit (NIU) coupled to a backup local exchange carrier (LEC) line, the broadband access network coupled to the NIU, an intermediate point–of–presence (IPOP) coupled to the broadband access network, and a least one external access network coupled to the IPOP. The system also provides for a fail–safe mode in which the NIU supports the LEC line for lifeline services.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	**ES**	Spain	**LS**	Lesotho	**SI**	Slovenia
AM	Armenia	**FI**	Finland	**LT**	Lithuania	**SK**	Slovakia
AT	Austria	**FR**	France	**LU**	Luxembourg	**SN**	Senegal
AU	Australia	**GA**	Gabon	**LV**	Latvia	**SZ**	Swaziland
AZ	Azerbaijan	**GB**	United Kingdom	**MC**	Monaco	**TD**	Chad
BA	Bosnia and Herzegovina	**GE**	Georgia	**MD**	Republic of Moldova	**TG**	Togo
BB	Barbados	**GH**	Ghana	**MG**	Madagascar	**TJ**	Tajikistan
BE	Belgium	**GN**	Guinea	**MK**	The former Yugoslav Republic of Macedonia	**TM**	Turkmenistan
BF	Burkina Faso	**GR**	Greece			**TR**	Turkey
BG	Bulgaria	**HU**	Hungary	**ML**	Mali	**TT**	Trinidad and Tobago
BJ	Benin	**IE**	Ireland	**MN**	Mongolia	**UA**	Ukraine
BR	Brazil	**IL**	Israel	**MR**	Mauritania	**UG**	Uganda
BY	Belarus	**IS**	Iceland	**MW**	Malawi	**US**	United States of America
CA	Canada	**IT**	Italy	**MX**	Mexico	**UZ**	Uzbekistan
CF	Central African Republic	**JP**	Japan	**NE**	Niger	**VN**	Viet Nam
CG	Congo	**KE**	Kenya	**NL**	Netherlands	**YU**	Yugoslavia
CH	Switzerland	**KG**	Kyrgyzstan	**NO**	Norway	**ZW**	Zimbabwe
CI	Côte d'Ivoire	**KP**	Democratic People's Republic of Korea	**NZ**	New Zealand		
CM	Cameroon			**PL**	Poland		
CN	China	**KR**	Republic of Korea	**PT**	Portugal		
CU	Cuba	**KZ**	Kazakstan	**RO**	Romania		
CZ	Czech Republic	**LC**	Saint Lucia	**RU**	Russian Federation		
DE	Germany	**LI**	Liechtenstein	**SD**	Sudan		
DK	Denmark	**LK**	Sri Lanka	**SE**	Sweden		
EE	Estonia	**LR**	Liberia	**SG**	Singapore		

A METHOD AND SYSTEM FOR TELEPHONY AND HIGH SPEED DATA ACCESS ON A BROADBAND ACCESS NETWORK

Priority Claim

We hereby claim the benefit under 35 U.S.C. § 119(e) of U.S. Provisional Application No. 60/071,346 filed January 14, 1998, entitled "Telephony On A Broadband Network."

Field of the Invention

This invention relates to the field of broadband access networks, and more specifically to a method and system for telephony and high speed data access on a broadband access network.

Background of the Invention

Broadband access networks may provide a viable alternative to present local exchange carrier (LEC) loops in providing voice and data transmissions. Although a number of innovations have occurred concerning high speed cable modems and radio frequency (RF) telephony equipment, these innovations do not support both data and telephony well. Furthermore, present broadband access networks such as cable systems are susceptible to network failures and power outages. During, for example, a power outage, transmission over the cable system is not possible. LEC loops have very limited bandwidths; however, the LEC loops have separate power sources and operate even during power outages providing for emergency calls or other lifeline services.

What is needed is an invention that supports data and telephony access over broadband access networks while still providing, at least, basic telephony service during power outages.

Summary of the Invention

The present invention provides for a system for providing telephony and high speed data access over a broadband access network. The system includes a network interface unit (NIU) coupled to a telephone line, the NIU coupled also to the broadband access network, the broadband access network coupled to an intermediate point-of-presence (IPOP), and the IPOP coupled to at least one external access network.

The present invention also provides for a network interface unit (NIU) of a system for providing telephony and high speed data access on a cable network. The system includes a broadband telephone interface (BTI) coupled to a backup local exchange carrier

(LEC) line, and a cable modem coupled to the BTI. The cable modem is coupled to the cable network.

The present invention also provides for an office in a system for providing telephony and high speed data access on a cable network. The office includes a network interface unit (NIU) having a broadband telephone interface (BTI) and a cable modem. The office also includes a telephone line coupled to the BTI and a cable coupled to the cable modem.

The present invention provides for a network interface unit (NIU) in a system for providing telephony and high speed data access on a cable network. The NIU includes a cable modem and a means for accessing a telephone line during a power outage.

The present invention provides for an intermediate point-of-presence (IPOP) in a system for providing telephony and high speed data access on a broadband access network. The IPOP includes means for separating voice and data traffic, means for switching to an external access network, and means for routing to the external access network. The separating means is coupled to the switching means and the routing means is coupled to the switching means.

The present invention further provides for an intermediate point-of-presence (IPOP) in a system for providing telephony and high speed data access on a broadband access network. The IPOP includes an access network termination system (ANTS), a switch coupled to the ANTS, and at least one number translation database coupled to the switch.

The present invention provides for a method for providing telephony and high speed data access on a broadband access network. The method includes the steps of providing a network interface unit (NIU), coupling a telephone line and the broadband access network to the NIU, using the NIU to provide telephony and high speed data access on the broadband access network, and using the NIU to support the telephone line during power outages.

The present invention provides for a method for providing a network interface unit (NIU) in a system for providing telephony and high speed data access on a cable network. The method includes the steps of supporting a backup, local exchange carrier (LEC) line with a broadband telephone interface (BTI), using the backup LEC line during a failure of

the cable network, and accessing telephony and high speed data through a cable modem coupled to the cable network.

The present invention provides for a method for providing lifeline services during a power outage in a system for providing telephony and high speed data access on a broadband access network. The method includes the steps of connecting a backup local exchange carrier (LEC) line to the system and accessing the backup LEC line.

Brief Description of the Drawings

Figure 1 illustrates a system which provides telephony and high speed data access on a broadband access network.

Figure 2 illustrates an office in a system which provides telephony and high speed data access on a cable system.

Detailed Description

Figure 1 illustrates a system which provides telephony and high speed data access on a broadband access network in accordance with a preferred embodiment of the present invention. The system 100 comprises offices 104, network interface units (NIUs) 108, personal computers 112, telephones 116, a broadband access network 120, an intermediate point-of-presence (IPOP) 124, an access network termination system (ANTS) 128, a switch 132, at least one number translation database 136, at least one external access network 140 and a local exchange carrier (LEC) line 148.

Each office 104 comprises the NIU 108, the personal computer 112 and the telephone 116. The personal computer 112 is coupled to the NIU 108, the coupling being preferably through a local area network (LAN) such as, for example, an ethernet. As such, there may be a plurality of personal computers 112 coupled to the NIU. The telephone 116 is also coupled to the NIU. There may be more than one telephone 116 within the office 104 coupled to the NIU either directly or indirectly. Furthermore, the telephone 116 may include any variety of office equipment such as fax machines, voice grade modems, hand sets and internal housing wiring.

Each office 104 is coupled to the broadband access network 120 through its NIU 108. The broadband access network 120 is coupled to the IPOP 124. The broadband access network 120 in the system 100 is intended to accommodate a range of transport

technologies such as, but not limited to, hybrid-fiber coaxial cable, mini-fiber node and wireless technologies.

The IPOP 124 comprises the ANTS 128, the switch 132 and the at least one number translation database 136. The ANTS 128 is coupled to the switch 132 which, in turn, is coupled to the at least one number translation database 136. The ANTS 128 is coupled to the broadband access network 120. In a preferred embodiment, the at least one external access network 140 is coupled either to the ANTS 128 and/or to the switch 132. In a preferred embodiment, the at least one external access network 140 comprises a packet backbone 141 coupled to the ANTS 128. In another preferred embodiment, the at least one external access network 140 comprises an asynchronous transfer mode (ATM) backbone (not shown) coupled to the ANTS 128. In another preferred embodiment, the at least one external access network 140 comprises a long distance carrier network 142 coupled to the switch 132. In another preferred embodiment, the at least one external access network 140 comprises an LEC network 145 coupled to the switch 132. In another preferred embodiment, the at least one external access network 140 comprises an incumbent local exchange carrier (ILEC) network 144 coupled to the switch 132. In another preferred embodiment, the at least one external access network 140 comprises an inter-exchange carrier (IXC) network 143 coupled to the switch 132. In another preferred embodiment, the at least one external access network 140 comprises the ATM backbone (not shown) coupled to the switch 132. The present invention contemplates any permutations and combinations of the above possible external access networks 140 and possible couplings to the IPOP 124.

In a preferred embodiment, the LEC line 148 couples the NIU 108 and the LEC network 145.

The general use and operation of the system 100 will now be described with reference to Figure 1. A user accesses the broadband access network 120 by using existing personal computers 112 or telephones 116 in the office 104. The voice and/or high speed data traffic transferred or received by these devices 112 and 116 passes through the NIU 108. The NIU 108 terminates the data-link layer protocol from the broadband access network 120 and provides services for voice, high speed data and any combination thereof.

High speed data and telephony services share allocated bandwidth in the downstream direction as well as in the frequency agile upstream channel.

A remote data-link layer termination is performed at the IPOP 124 by the ANTS 128. Voice and high speed data traffic flowing to and from the offices 104 pass through the ANTS 128. Upstream voice and high speed data traffic are separated or groomed by the ANTS 128, if necessary, before being forwarded onwards. In a preferred embodiment, upstream voice traffic may be processed within the ANTS 128 which connects the voice to a circuit switched public switched telephone network (PSTN). Upstream data may be processed within the ANTS 128 before being handed to a router. In another preferred embodiment, upstream voice traffic is separated and routed to, for example, the packet backbone 141. Voice traffic is separated and routed to, for example, the local exchange switch 132. In another preferred embodiment, the ANTS 128 interfaces to the local switch 132 like a conventional subscriber loop carrier (SLC) system.

The system 100 acts as an LEC, providing voice service over the broadband access network 120. Calls originating from office 104 may be routed to the long distance network 142, the IXC network 143, the ILEC network 144 or the LEC network 145. Incoming long distance calls are routed to the LEC that serves the local number using the local number portability database. Several number translation databases 136 are typically needed in order to manage call routing.

If communication to the IPOP 124 over the broadband access network 120 is not possible, lifeline services are provided through an LEC line 148 connected to the NIU 108.

Figure 2 illustrates an office in a system which provides telephony and high speed data access on a cable system in accordance with another preferred embodiment of the present invention. The office 104 houses the NIU 108, the personal computer 112, the telephone 116, a local area network (LAN) 212 and a television 216. The NIU 108 further comprises a broadband telephone interface (BTI) 204 coupled to a cable modem 208.

The office 104 is coupled to the LEC line 148 and the broadband access network 120, which is illustrated in this preferred embodiment as a cable network. The LEC line 148 is coupled to the BTI 204 which is coupled to the telephone 116. The telephone 116 may be one of many telephones in an internal telephone network and may also be legacy equipment such as, but not limited to, fax machines, voice grade modems, hand sets and

internal housing wiring. The BTI 204 may have a plurality of standard RJ-11 jacks to support a plurality of lines of telephony service.

The cable network 120 is coupled to the cable modem 208 which is coupled to the LAN 212 which is coupled to the personal computer 112. The LAN 212 may be an ethernet, for example, and the personal computer 112 may be a plurality of personal computers coupled to the ethernet. The cable 120 is also coupled to the television 216.

In operation and use, the personal computers 112 through an ethernet 212 access high speed data ports in the cable modem 208. Through the cable modem 208, the ethernet 212 is provided, for example, internet services on the cable network 120. The television 216 accesses voice, high speed data and combinations thereof directly from the cable network 120.

In a preferred embodiment, the BTI 108 provides custom telephony services including, but not limited to, caller-identification, call waiting, tone block, return call, repeat call, call block, call forwarding, call forwarding on busy, call forwarding when no answer, anonymous call rejection, identa-ring, priority call, three-way calling and blocking. Furthermore, a wide ranging list of destinations may be dialed including, but not limited to, local calls, directory assistance, emergency calls, recorded announcements, domestic long distance calls, carrier-selected long distance calls, toll-free calls, operator services, international calls, and so-called 500/700/900 calls.

The BTI 204 supports voice packetization and a dynamic fail-safe switch to the LEC backup line 148. For the telephone ports, in the upstream direction, the BTI 204 samples the signal, performs speech compression, and performs packetization. The cable modem 208 places the packets on the cable network 120. In the downstream direction, the BTI 204 receives packets from the cable network 120 through the cable modem 208, performs jitter compensation in a playout buffer, performs decompression and plays out the samples. The BTI 204 is also responsible for dual tone multi-frequency (DTMF) generation and detection, ringing voltage generation and off-hook detection.

Transmission on the cable network 120 requires power. During power outages, the LEC line 148 is used to complete inbound and outbound telephone calls. In a preferred embodiment, the transition from the cable network 120 to the LEC line 148 is performed automatically and transparently with almost imperceptible performance differences. In

some embodiments, calls in progress at the time of a power loss are dropped, and the user must redial. In other embodiments, custom calling features are not available during power outages. In another embodiment, the BTI 204 provides, for example, all PSTN features and functions, except during the fail-safe mode. In the fail-safe mode of another embodiment, the LEC backup line 148 provides basic plain old telephone service (POTS).

In a preferred embodiment, the NIU 108 provides the architecture for a migration plan by accommodating future networks by providing compatibility with the ATM backbone as well as adaptability to any new features and functions that may arise.

Although the foregoing invention has been described in terms of certain embodiments, other embodiments will become apparent to those of ordinary skill in the art in view of the disclosure herein. Accordingly, the present invention is not intended to be limited by the recitation of embodiments, but is intended to be defined solely by reference to the appended claims.

WHAT IS CLAIMED IS:

1. A system for providing telephony and high speed data access over a broadband access network, comprising:

a network interface unit (NIU) coupled to a telephone line;

the broadband access network coupled to the NIU;

an intermediate point-of-presence (IPOP) coupled to the broadband access network; and

at least one external access network coupled to the IPOP.

2. The system of Claim 1, wherein the NIU comprises a broadband telephone interface (BTI), the BTI coupled to the telephone line.

3. The system of Claim 1, wherein the NIU comprises a cable modem and wherein the broadband access network is a hybrid-fiber coaxial cable, the cable modem coupled to the hybrid-fiber coaxial cable.

4. The system of Claim 1, wherein the IPOP comprises an access network termination system (ANTS) coupled to a switch, the ANTS coupled to the broadband access network.

5. The system of Claim 4, wherein the at least one external access network comprises a packet backbone coupled to the ANTS.

6. The system of Claim 4, wherein the at least one external access network comprises a long distance network, the long distance network coupled to the switch.

7. The system of Claim 4, wherein the at least one external access network comprises an inter-exchange net (IXC) network, the IXC network coupled to the switch.

8. The system of Claim 4, wherein the at least one external access network comprises a local exchange carrier (LEC) network, the LEC network coupled to the switch.

9. The system of Claim 4, wherein the at least one external access network comprises an incumbent local exchange carrier (ILEC) network, the ILEC network coupled to the switch.

10. The system of Claim 4, wherein the at least one external access network comprises an asynchronous transfer mode (ATM) backbone, the ATM backbone coupled to the switch.

11. The system of Claim 4, wherein the IPOP further comprises at least one number translation database, the at least one number translation database coupled to the switch.

12. The system of Claim 1, wherein the broadband access network is a wireless network.

13. The system of Claim 1, wherein the at least one external access network comprises an asynchronous transfer mode (ATM) backbone.

14. A network interface unit (NIU) of a system for providing telephony and high speed data access on a cable network, comprising:

a broadband telephone interface (BTI) coupled to a backup local exchange carrier (LEC) line; and

a cable modem coupled to the BTI, the cable modem coupled to the cable network.

15. An office in a system for providing telephony and high speed data access on a cable network, comprising:

a network interface unit (NIU) including a broadband telephone interface (BTI) and a cable modem;

a telephone line coupled to the BTI; and

a cable coupled to the cable modem.

16. The office of Claim 15, wherein the BTI has at least one RJ-11 jack.

17. The office of Claim 15, further comprising at least one telephone coupled to the BTI.

18. The office of Claim 15, further comprising legacy equipment in the office, the legacy equipment coupled to the BTI.

19. The office of Claim 15, further comprising an ethernet and a personal computer, the personal computer coupled to the cable modem through the ethernet.

20. The office of Claim 15, further comprising a television coupled to the cable.

21. The office of Claim 15, further comprising a monitor coupled to the cable.

22. The office of Claim 15, wherein the cable is a hybrid-fiber coaxial cable.

23. A network interface unit (NIU) in a system for providing telephony and high speed data access on a cable network, comprising:

a cable modem; and

a means for accessing a telephone line during a power outage.

24. An intermediate point-of-presence (IPOP) in a system for providing telephony and high speed data access on a broadband access network, comprising:

means for separating voice and data traffic;

means for switching to an external access network, the separating means coupled to the switching means; and

means for routing to the external access network, the routing means coupled to the switching means.

25. An intermediate point-of-presence (IPOP) in a system for providing telephony and high speed data access on a broadband access network, comprising:

an access network termination system (ANTS);

a switch coupled to the ANTS; and

at least one number translation database coupled to the switch.

26. A method for providing telephony and high speed data access on a broadband access network, comprising the steps of:

providing a network interface unit (NIU);

coupling a telephone line and the broadband access network to the NIU;

using the NIU to provide telephony and high speed data access on the broadband access network; and

using the NIU to support the telephone line during power outages.

27. A method for providing a network interface unit (NIU) in a system for providing telephony and high speed data access on a cable network, comprising the steps of:

supporting a backup, local exchange carrier (LEC) line with a broadband telephone interface (BTI);

using the backup LEC line during a failure of the cable network; and

accessing telephony and high speed data through a cable modem coupled to the cable network.

28. A method for providing lifeline services during a power outage in a system for providing telephony and high speed data access on a broadband access network, comprising the steps of:

connecting a backup local exchange carrier (LEC) line to the system; and

accessing the backup LEC line.

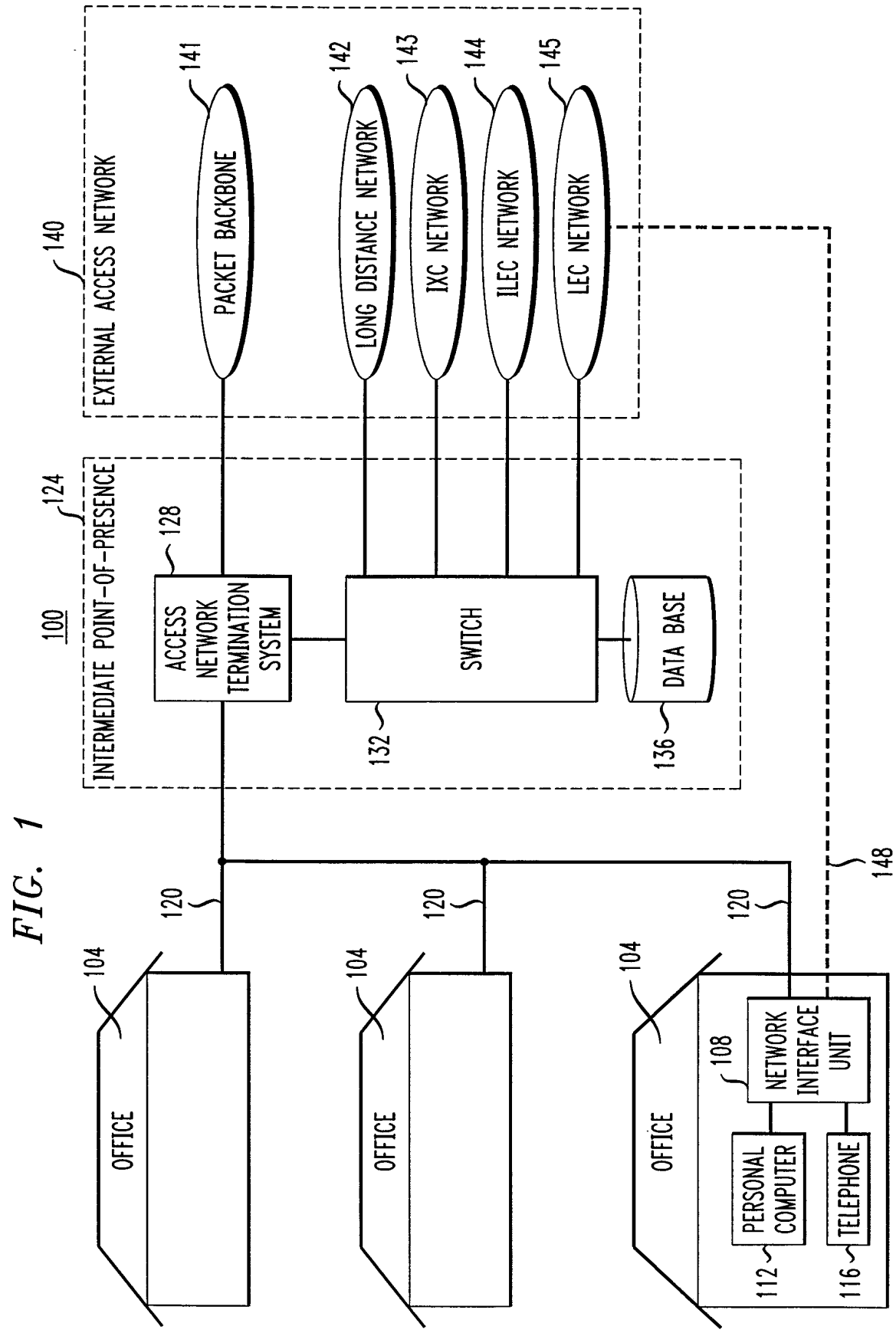
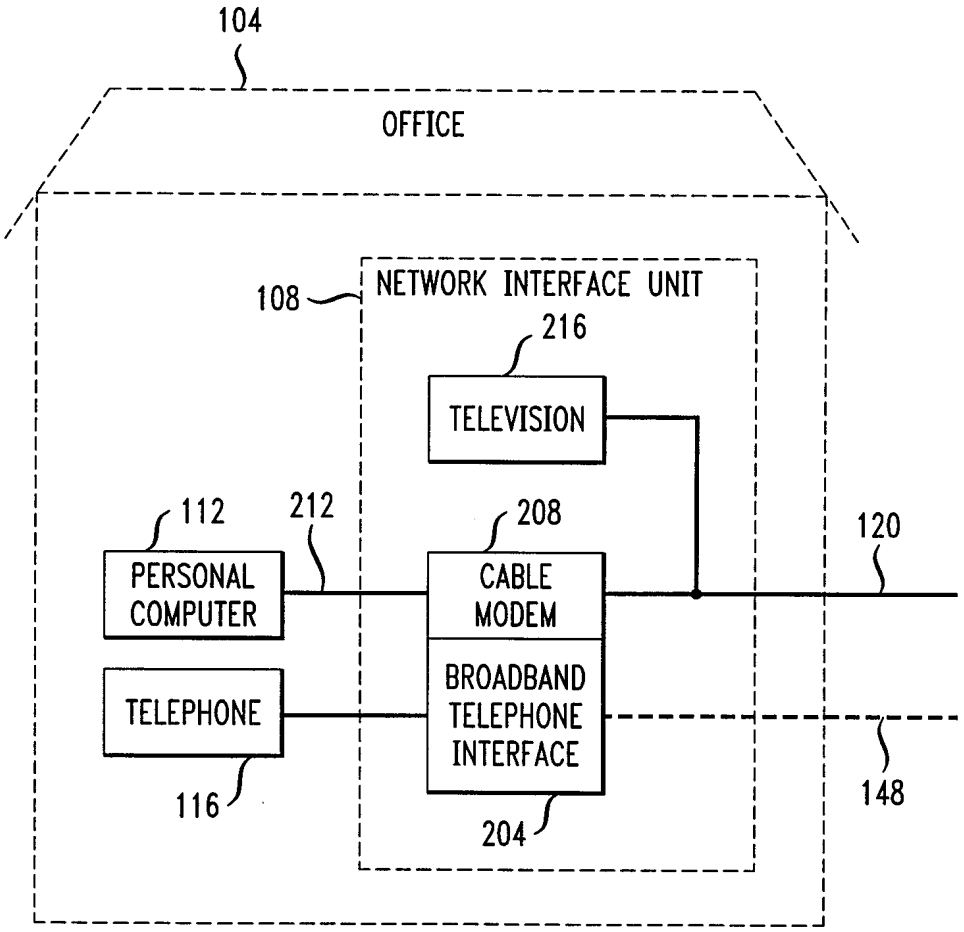

140
EXTERNAL ACCESS NETWORK
141
PACKET BACKBONE
142
LONG DISTANCE NETWORK
143
IXC NETWORK
144
ILEC NETWORK
145
LEC NETWORK
124
INTERMEDIATE POINT-OF-PRESENCE
100
128
ACCESS NETWORK TERMINATION SYSTEM
SWITCH
132
DATA BASE
136
148
120
104
OFFICE
108
NETWORK INTERFACE UNIT
PERSONAL COMPUTER
112
TELEPHONE
116

FIG. 1

FIG. 2


104
OFFICE
108
NETWORK INTERFACE UNIT
216
TELEVISION
112
212
208
120
PERSONAL COMPUTER
CABLE MODEM
BROADBAND TELEPHONE INTERFACE
TELEPHONE
116
204
148

INTERNATIONAL SEARCH REPORT

Int ional Application No
PCT/US 99/00175

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04L12/28 H04L29/06 H04Q11/04

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04L H04Q

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	HERNANDEZ-VALENCIA E J: "ARCHITECTURES FOR BROADBAND RESIDENTIAL IP SERVICES OVER CATV NETWORKS" IEEE NETWORK: THE MAGAZINE OF COMPUTER COMMUNICATIONS, vol. 11, no. 1, 1 January 1997, pages 36-43, XP000679054	1-3,14, 15,22,23
Y	see page 36, left-hand column, line 1 - page 41, right-hand column, line 19	4-13, 16-21, 25-28
A		24

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

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

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

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

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

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

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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
14 June 1999	23/06/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Karavassilis, N

1

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Inte ional Application No
PCT/US 99/00175

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	IRIE K ET AL: "LOW-END CARD FOR REGIONAL PC COMMUNICATION NETWORK" ELECTRONICS & COMMUNICATIONS IN JAPAN, PART I - COMMUNICATIONS, vol. 80, no. 10, 1 October 1997. pages 20-27, XP000724512	24
Y	especially fig. 1 see the whole document	16-19, 26-28
A		14,15,23
Y	"AN ULTRABROADBAND OPTICAL ACCESS NETWORK: GIGABIT-TO-THE -HOME(GTTH)" NEC RESEARCH AND DEVELOPMENT, vol. 38, no. 4, 1 October 1997, page 489 XP000766967 see the whole document	4-11,13, 25
Y	EP 0 719 062 A (AT & T CORP) 26 June 1996 see page 2, column 1, line 39 - column 2, line 3; figure 1	12
Y	US 5 488 412 A (MIDANI MOWAFFAK T ET AL) 30 January 1996 see column 3, line 3 - line 65; figure 1	20,21

1

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

Int. ional Application No
PCT/US 99/00175

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0719062 A	26-06-1996	US 5592470 A	07-01-1997
		JP 8280058 A	22-10-1996
US 5488412 A	30-01-1996	CA 2186221 A	12-10-1995
		EP 0753224 A	15-01-1997
		JP 9511628 T	18-11-1997
		WO 9527348 A	12-10-1995

Form PCT/ISA/210 (patent family annex) (July 1992)

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
2 August 2001 (02.08.2001)

PCT

(10) International Publication Number
WO 01/56233 A1

(51) International Patent Classification[7]: H04L 12/56, H04Q 11/04

(21) International Application Number: PCT/US01/03177

(22) International Filing Date: 31 January 2001 (31.01.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

60/179,042	31 January 2000 (31.01.2000)	US
60/189,870	16 March 2000 (16.03.2000)	US
09/773,103	31 January 2001 (31.01.2001)	US

(71) Applicant *(for all designated States except US)*: **AEPTEC MICROSYSTEMS INC.** [US/US]; Suite 290, 15800 Crabbs Branch Way, Rockville, MD 20855 (US).

(72) Inventors; and

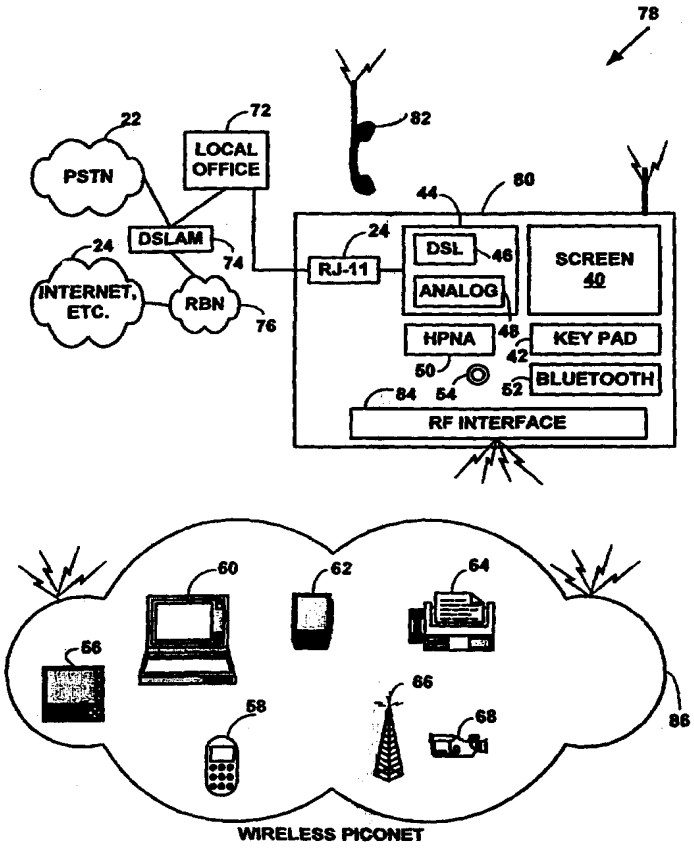
(75) Inventors/Applicants *(for US only)*: **CHEN, Steven, Chien-Young** [US/US]; 7404 Deerpoint Road, Derwood, MD 20855 (US). **WANG, Ray** [US/US]; 6875 Churchill road, McLean, VA 22101 (US).

(74) Agent: **LESAVICH, Stephen**; McDonnell Boehnen Hulbert & Berghoff, Suite 3200, 300 South Wacker Drive, Chicago, IL 60606 (US).

(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

[Continued on next page]

(54) Title: BROADBAND COMMUNICATIONS ACCESS DEVICE



(57) Abstract: An integrated phone-based home gateway system is disclosed. The integrated phone-based home gateway system includes a broadband communication device, such as digital subscriber line ("DSL") device, an analog modem, a wireless interface, integrated into a screen-phone for providing broadband communication service to home users. Multiple home users are able to access the Internet and the content services for conducting e-commerce, receiving content news, entertaining on-demand, making audio or video communications, and telecommuting or working at home. This screen-phone based, modular, plug-n-play home gateway interface allows in-home as well as to-home networking, provides automatic data and broadband initialization, configuration and service provisioning, routing and bridging functionality and allows resource sharing among home devices via the existing phone wire, wireless, coaxial or optical cable connections.

WO 01/56233 A1

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

BROADBAND COMMUNICATIONS ACCESS DEVICE

CROSS REFERENCES TO RELATED APPLICATIONS

This application claims priority from U.S. Provisional Patent Application Nos. 60/179,942, filed on January 31, 2000, and 60/189,870, filed on March 16, 2000, the contents of which are incorporated herein by reference.

FIELD OF THE INVENTION

This invention relates to communications devices. More specifically it relates to a broadband communications devices including phone-based home gateway interfaces.

BACKGROUND OF THE INVENTION

With the advent of the communication technologies and breakthroughs in Digital Signal Processing ("DSP"), Digital Subscriber Lines ("DSL"), fiber optic and coaxial cable and wireless connections, more bandwidth is now available for home communications than was once provided by traditional voice-grade analog modems. There is widespread interest among home users in faster access to content provided by service providers via high-speed facilities such as DSL, cable, or wireless connections.

This interest appears to be driving the evolution of the home communications from narrow-band communications to broadband communications. As is known in the art, broadband communications include communications signals that are typically transmitted over separate inbound and outbound channels. Network devices on a broadband network are connected by copper, coaxial or fiber-optic cable or wireless

connections that can carry data, voice, and video simultaneously. Broadband communications are capable of high-speed operation (e.g., megabits-per-second, ("Mbps")).

There are a number of problems associated with providing broadband communications to the home environment. One problem is that before DSL, broadband access via shared Local Area Network ("LAN"), Frame Relay, Asynchronous Transmission Mode ("ATM") or other broadband communications services had only been used in commercial or business environment. Most to-home communications.are narrow-band and use either Integrated Service Digital Network ("ISDN") line or analog modems.

Another problem is that broadband communications are operationally complex. Broadband communications typically include a large number of broadband communications parameters that must be configured before a broadband communications application can be used. Service provisioning is also required to use broadband communications. As is known in the art, service provisioning includes allocating, configuring and maintaining multiple transmission channels and virtual communications paths used for broadband communications.

Normally, in the commercial or business environment, trained professionals are required to manage such complexity. It is undesirable however, to have trained networking personnel managing a home network. It may also be unreasonable to expect any home user to have enough networking experience to configure and provision broadband communications in the home environment.

Another problem is that it is becoming common for home users to have small office or home office ("SOHO") home networks. Such home networks typically include one or more personal computers, printers, facsimile machines, mobile

phones, personal data assistants ("PDA") that are all connected in the home and to another networks such as the Internet. The home networks typically require gateway, router or bridge functionality to allow devices connected to the home network to communicate over data connections (e.g., Internet Protocol ("IP")) with other devices connected to the Internet.

As is known in the art, a gateway connects computer networks using different network protocols and/or operating at different transmission capacities. A router receives transmitted messages and forwards them to their correct destinations over the most efficient available route. A bridge is a device that connects networks using the same communications protocols so that information can be passed from one network device to another.

Such gateway, router or bridge functionality typically requires configuration, initialization and management of various gateway, routing or bridging tables. It may also be unreasonable to expect any home user to have enough networking experience to configure, initialize or manage such tables in the home environment.

Another problem is that for many home users do not have the physical space to include additional modules or equipment that is used as a home gateway. The home users also may not have the additional wired or wireless connections available to connect a home gateway (e.g., an additional telephone line).

Another problem is that many home users desire to use home gateway functionality, but already have existing phone systems. Many existing phone systems are incompatible with, and cannot be used with products that may offer any type of home gateway functionality.

Another problem is that many devices used on a home network are wireless. It is often necessary to connect such wireless devices to a broadband

communications path.

Another problem is that most broadband communication devices allow to-home networking, but do not allow in-home networking with other devices connected to a home network. It is often necessary to provide broadband communications for to-home and in-home networking.

Thus, it is desirable to provide broadband communications to the home environment in a device that overcomes the problems described herein and other problems associated with providing broadband communications to the home.

SUMMARY OF THE INVENTION

In accordance with preferred embodiments of the present invention, some of the problems associated with providing broadband communications to the home environment are overcome. An integrated phone-based home gateway system is disclosed.

The integrated phone-based home gateway system includes, but is not limited to a home gateway interface for initializing broadband communications service configurations and provisions and for providing routing or bridging for networking communications, a communications interface for connecting to one or more networks, for providing data communications, for providing broadband communications and for providing narrow band communications including voice communications, a processor for processing information from the one or more networks, a display interface for displaying the information from the one or more networks; and a wireless communications interface for connecting to external wireless devices. The integrated phone-based home gateway system may further include a portable multi-function handset.

However, more fewer or equivalent components can also be used in the phone-based home gateway interface and the present invention is not limited to these components.

The integrated phone-based home gateway system described herein may be used as conventional telephony device, a broadband home gateway, a wireless local loop home gateway, a set-top box for a cable television access as well as for other communications functionality in one integrated device. The integrated phone-based home gateway system may help hide both data (e.g., Internet Protocol) and

broadband (e.g., DSL, cable, wireless, etc.) service configuration and provisioning complexity from home users by providing automatic establishment of communications channels and automatic provisioning and initialization of broadband, data, routing, bridging and other communication parameters.

The foregoing and other features and advantages of preferred embodiments of the present invention will be more readily apparent from the following detailed description. The detailed description proceeds with references to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the present invention are described with reference to the following drawings, wherein:

FIG. 1 is a block diagram illustrating an exemplary phone-based home gateway system;

FIG. 2 is a block diagram illustrating an ADSL component of a phone-based home gateway system;

FIG. 3 is a block diagram illustrating an integrated phone-based home gateway system;

FIG. 4 is a block diagram illustrating a wireless, integrated phone-based home gateway system;

FIG. 5 is a block diagram illustrating to-home wireless networking with the wireless, integrated phone-based home gateway system of FIG. 4;

FIG. 6A is a block diagram illustrating an exemplary integrated phone-based home gateway interface architecture;

FIG. 6B is a block diagram illustrating an exemplary wireless, integrated phone-based home gateway interface architecture;

FIG. 7 is a block diagram illustrating an exemplary phone-based home gateway interface software architecture;

FIG. 8 is a block diagram illustrating an exemplary session manager software architecture;

FIG. 9 is a block diagram illustrating an exemplary service manager software architecture;

FIG. 10 is a block diagram illustrating an exemplary interface manger software

architecture;

FIG. 11 is a block diagram illustrating an exemplary display manager software architecture;

FIG. 12 is a block diagram illustrating an integrated phone-based home gateway conversion system for an existing phone system;

FIG. 13 is a flow diagram illustrating a method for initializing communications from a home gateway interface.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

EXEMPLARY PHONE-BASED HOME GATEWAY SYSTEMS

FIG. 1 illustrates an exemplary phone-based home gateway system 10 for one exemplary embodiment of the present invention. As is known in the art, a gateway connects computer networks using different network protocols and/or operating at different transmission capacities. The exemplary phone-based home gateway system 10 includes a local area network ("LAN") 12 with one or more network devices 14, 16, two of which are illustrated, and a phone-based home gateway interface 18 with an optional portable telephony handset 20. If the optional portable telephony 20 handset is not used, the phone-based home gateway interface 18 includes a speaker-phone with a built in microphone and speaker for sending and receiving voice information. The network devices 14, 16 include, but are not limited to, personal computers, printers, personal data assistants ("PDAs"), network appliances and other electronic devices.

The phone-based home gateway interface 18 is connected to a public switched telephone network ("PSTN") 22 via one or more twisted pairs of copper wires, coaxial cable, fiber optic cable, other connection media or other connection interfaces such as wireless interfaces. The PSTN 22 is any public switched telephone network provided by AT&T, GTE, Sprint, MCI and others. The phone-based home gateway interface 18 may also be connected to other computer networks 24 such as the Internet, an intranet, etc. via coaxial cable, fiber optic cable other connection media or other connection interfaces such as wireless interfaces.

The phone-based home gateway interface 18 may also be connected to other telephony networks via a wireless local loop. The network devices 14, 16 are connected to LAN 12 with RJ-11 interfaces 24. As is known in the art, a Registered Jack-11 ("RJ-11") interface is a four or six-wire connector used primarily to connect

network devices to telephony equipment and to local area networks.

However, the present invention is not limited to such an embodiment and more, fewer or equivalent components can also be used in the phone-based home gateway system 10. In addition, the phone-based home gateway interface 18 is illustrated as separate device from the network devices 14, 16. However, the phone-based home gateway interface 18 may also be an internal component in a network device 14, 16.

Preferred embodiments of the present invention include network devices and home gateway interfaces that are compliant with all or part of standards proposed by the Institute of Electrical and Electronic Engineers ("IEEE"), International Telecommunications Union-Telecommunication Standardization Sector ("ITU"), Internet Engineering Task Force ("IETF"), American National Standard Institute ("ANSI"), Wireless Application Protocol ("WAP") Forum, Bluetooth Forum, or the ADSL Forum. However, network devices based on other standards could also be used. IEEE standards can be found on the World Wide Web at the Universal Resource Locator ("URL") "www.ieee.org." The ITU, (formerly known as the CCITT) standards can be found at the URL "www.itu.ch." IETF standards can be found at the URL "www.ietf.org." The ANSI standards can be found at the URL "www.ansi.org." Bluetooth Forum documents can be found at the URL "www.bluetooth.com." WAP Forum documents can be found at the URL "www.wapforum.org." ADSL Forum documents can be found at the URL "www.adsl.com."

An operating environment for network devices and home gateway interfaces of the present invention include a processing system with one or more high speed Central Processing Unit(s) ("CPU") and a memory. In accordance with the practices of persons skilled in the art of computer programming, the present invention is

described below with reference to acts and symbolic representations of operations or instructions that are performed by the processing system, unless indicated otherwise. Such acts and operations or instructions are referred to as being "computer-executed," "CPU executed" or "processor executed."

It will be appreciated that acts and symbolically represented operations or instructions include the manipulation of electrical signals by the CPU. An electrical system represents data bits which cause a resulting transformation or reduction of the electrical signals, and the maintenance of data bits at memory locations in a memory system to thereby reconfigure or otherwise alter the CPU's operation, as well as other processing of signals. The memory locations where data bits are maintained are physical locations that have particular electrical, magnetic, optical, or organic properties corresponding to the data bits.

The data bits may also be maintained on a computer readable medium including magnetic disks, optical disks, organic memory, and any other volatile (e.g., Random Access Memory ("RAM")) or non-volatile (e.g., Read-Only Memory ("ROM")) mass storage system readable by the CPU. The computer readable medium includes cooperating or interconnected computer readable medium, which exist exclusively on the processing system or be distributed among multiple interconnected processing systems that may be local or remote to the processing system.

The phone-based home gateway interface 18 provides broadband communications in the megabits-per-second or higher range. The phone-based home gateway interface 18 also provides routing or bridging for networking communications and automatically initializes communications service configurations and provisions communications services. As is know in the art, a router is an

intermediary device on a communications network that expedites message delivery. A router receives transmitted messages and forwards them to their correct destinations over the most efficient available route. A bridge is a device that connects networks using the same communications protocols so that information can be passed from one network device to another.

The phone-based home gateway interface 18 is connected to the PSTN 22 via one or more high-speed telephony interfaces to provide broadband communications, and/or one or more low-speed telephony interfaces to provide other telephony communications. The phone-based home gateway interface 18 is also connected to the Internet 24, or other computer network via one or more data interfaces, such as Internet Protocol ("IP") interfaces to provide data communications.

As is known in the art, IP is a routing protocol designed to route traffic within a network or between networks. IP is described in IETF RFC-791, incorporated herein by reference. However, the present invention is not limited to IP data interfaces and other data interfaces can also be used.

The phone-based home gateway interface 18 allows multiple home users to access the Internet, other computer networks and content services for conducting e-commerce, receiving content news, entertaining on-demand, making audio or video communications, and telecommuting or working at home. This phone-based home gateway interface 18 allows in-home as well as to-home networking and allows resource sharing among home devices via the existing phone wire, wireless, coaxial or optical cable connections.

FIG. 2 is a block diagram 26 illustrating an Asymmetric Digital Subscriber Line ("ADSL") component 28 of the phone-based home gateway interface 18. The ADSL component 28 is illustrated as integral to the phone-based home gateway interface 18.

However, the ADSL component 28 can also be an external or separate component of the phone-based home gateway interface 18.

As is known in the art, ADSL is a communications technology that transmits an asymmetric data stream over a conventional twisted pair of copper telephone wires. An ADSL typically transmits a larger data rate downstream to a subscriber from a telephony switching office than from a subscriber back to the telephony switching office. ADSLs typically transmit about 1.5 Mega bits-per-second ("Mbps") to about 9 Mbps downstream to a subscriber, and about 16 kilo-bps ("kbps") to 640 kbps upstream back to a telephony switching office.

However, the phone-based home gateway interface 18 may also include a symmetric, other or equivalent communications component and the present invention is not limited to the ADSL component 28. The ADSL component 28 allows the phone-based home gateway interface 18 to be used to provide broadband, or other faster transmission rates than can be obtained with analog modems over a conventional telephone wire.

An ADSL system typically comprises two asymmetric devices connected by a conventional twisted pair of copper wires. An ADSL Transmission Unit-Central ("ATU-C") is a device at one end of an ADSL connection at a telephony or other switching office on the PSTN 22 or other network. An ADSL Transmission Unit-Remote ("ATU-R") is a device at another end of an ADSL connection at a subscriber or customer site. The ADSL connection can be used either with or without a splitter.

Returning to FIG. 2, the phone-based home gateway interface 18 includes an ADSL terminating unit (ATU-R) 28 that is used to connect the phone-based home gateway interface 18 to the LAN 12. In another embodiment of the present invention, the LAN 12 can also include a 10/100 Base-T Ethernet LAN as is

illustrated in FIG. 2. As is known in the art, 10/100 Base-T is an Ethernet standard for LANs using twisted-pair cable transmitting at 10 to 100 Mbps. However, the present invention is not limited to such an embodiment, and other or equivalent LANs can also be used. The ATU-R 28 is also used to connect to network devices 14, 16 to the PSTN 22 via a peripheral component interconnect ("PCI") 30 bus or a Universal Serial Bus ("USB") 32 connection.

As is know in the art, a PCI is a local bus standard. Most modern computers include a PCI bus 30. PCI is a 64-bit bus, though it is usually implemented as a 32-bit bus. As is known in the art, a USB 32 is an external bus standard that supports data transfer rates of up to 12 Mbps or higher. A single USB port can be used to connect up to 127 peripheral devices such as mice, modems, and keyboards. USB also supports plug-and-play installation and hot plugging. Plug-and-play refers to the ability of a computer system to automatically configure expansion boards and other devices without worrying about setting DIP switches, jumpers and other hardware and software configuration elements.

EXEMPLARY INTEGRATED PHONE-BASED HOME GATEWAY SYSTEM

FIG. 3 is a block diagram illustrating an integrated phone-based home gateway system 34. The integrated phone-based home gateway system 34 includes an integrated, phone-based home gateway interface 36 with an optional portable wireless handset 38, a display screen 40, a key pad 42, a communications interface 44 including a DSL component 46 and an analog component 48, a home phoneline network adapter ("HPNA") component 50, a Bluetooth component 52, and an optional video camera component 54. The integrated phone-based home gateway system 34 also includes one or more processors, one more banks of memory and one or more software modules (not illustrated in FIG. 3). However, the present invention is not limited to such an

embodiment and more, fewer or equivalent components can also be used in the integrated phone-based home gateway system 34. The integrated phone-based home gateway system 34 provides "in-home" as well as "to-home" networking for voice, video and data.

The integrated, phone-based home gateway interface 36 may include one or more physical buttons or controls for selecting features of a base station. One or more graphical buttons or controls may also be included on the display screen 40. The integrated, phone-based home gateway interface 36 is modular and allows the components described above and other or equivalent types of components to be easily interchanged.

The integrated, phone-based home gateway interface 36 may include an optional portable wireless telephone handset 38 that allows a user to use the handset 38 in the vicinity of the integrated, phone-based home gateway interface 36. In one embodiment of the present invention, the handset 38 is a 4-in-1 phone set including a cordless phone, mobile phone, web-phone (e.g., for Voice over IP ("VoIP")) and walkie-takie radio capabilities. However, the present invention is not limited to such an embodiment and other or equivalent handsets can also be used. In addition, the handset 38 can also provide only one, two or three of the 4-in-1 phone set capabilities. I

f the optional portable wireless handset 38 is not used, the communications interface 44 may include a speaker-phone with a built in microphone and speaker for sending and receiving voice information. The communications interface 44 may include a speaker-phone whether or not the portable wireless handset 38 is used.

The integrated, phone-based home gateway interface 36 also provides routing or bridging for networking communications, including voice, video and data communications and coordinates establishing, initializing and provisioning

broadband, narrow-band and data communications parameters and channels. In one embodiment of the present invention, this functionality is provided in integrated, phone-based home gateway interface 36 with software modules illustrated in FIGS. 7-11. However, the present invention is not limited to such an embodiment, and this functionality can also be provided in firmware, hardware, or software, or any combination thereof.

The display screen 40 includes a conventional computer display screen, a liquid crystal display screen with color, black and white or grey scale capabilities, or other types of display screens, including touch screens. The display screen 40 is used to display and access voice, video, data and other Internet messages (e.g., e-mail). In one embodiment of the present invention, the display screen 40 is a removable module that can be used as portable wireless hand-held device (e.g., infra-red, Bluetooth, other wireless, etc.) in the vicinity of the integrated, phone-based, home gateway interface 36. In one embodiment of the present invention, the display screen 40 is used to display at least one line of real-time stock quote, weather, headline news, community news, electronic address, or other information from the Internet 24. The optional video camera component 54 is used to collect and send data for video conference calls, video e-mail, etc.

The keypad 42 includes a telephone key pad, other numeric keypad, an alpha-numeric keypad, other specialized key pad, a keyboard, or other alpha-numeric data entry device. The keypad 42 can include physical devices as well as graphical representations of key pads that are made available on the display screen 40.

The communications interface 44 includes a DSL component 46 and an analog component 48. The DSL component 46 provides broadband communications. The DSL component 46 may include a DSL device with one of

the following interfaces: ADSL, symmetric DSL ("SDSL"), high-bit-rate DSL ("HDSL") or very-high-bit-rate ("VDSL"). The DSL component 46 is integrated inside a phone set, which provides conventional telephony as well as an always-on connectivity to broadband networks, the Internet or other computer networks. The analog component 48 may include analog modems, such as a V.90 56 kbps or other analog modems operating at a different speed or using a different communication protocol than the DSL component 46. In one embodiment of the present invention, the analog component 48 includes using plain old telephone service ("POTS"), and is also integrated inside a phone set for the purpose of providing channel redundancy, broadband service provisioning and configuration.

In one embodiment of the present invention, the communications interface 44 is connected to a POTS splitter that allows the DSL component 46 and the analog component 48 to use the same twisted pairs of telephone lines (See FIG. 6). The POTS splitter may also be used to provide broadband as well as other higher-bandwidth services (e.g., Asynchronous Transport Mode ("ATM"), Optical transmission, Integrated Services Digital Network, ("ISDN"), Frame Relay, etc.) and lower-bandwidth services (e.g., POTS).

The HPNA component 50 provides a convenient and flexible way to interconnect computers and peripherals to a network, including plug-and-play. The HPNA component 50 also enables existing telephone wiring to be used for broadband network access. In addition, HPNAs enable VoIP phones that have Ethernet connectors to interface with non-Ethernet broadband connections. FIG. 3 illustrates network devices 14, 16, comprising a small home network connected to the HPNA 50 via RJ-11 interfaces 24. However, the present invention is not limited to such an embodiment. In addition, the network devices 14, 16 can also be connected

using PCI 30 or USB 32 connections (FIG. 2) as was described above.

The Bluetooth component 52 simplifies data synchronization and transmission between network devices and the LAN 12 with a common short-range wireless protocol. As is known in the art, Bluetooth is a short-range radio frequency technology aimed at simplifying communications among network devices and between network devices. Bluetooth wireless technology supports both short-range point-to-point and point-to-multipoint connections. The Bluetooth specification, version 1.0, 1999, is incorporated by reference. In another embodiment of the present invention, the Bluetooth component can be replaced with virtually any other short-range radio interface component.

In one embodiment of the present invention, wired and wireless home electronic or other electronic devices, such as a WEB pad 56, a mobile phone 58, a lap top or notebook computer, a desk top personal computer 60, a PDA 62, smart appliances 64, alarm systems 66, home video monitoring equipment 68, etc. may interface with the integrated phone-based home gateway interface 36 through modular interfaces (e.g., RJ-11 or HPNA interfaces) or Bluetooth wireless interfaces. The wireless devices are connected to the integrated phone-based home gateway interface 36 over a Bluetooth piconet 70 or Bluetooth scatternet using the Bluetooth component 52.

As is known in the art, a "piconet" is a network in which "slave" devices can be set to communicate with a "master" radio controller in one device such as a gateway. Piconet are typically limited to a certain range and vicinity in which wireless devices must be present to operate (e.g., a few feet up to few miles away from the master radio controller). Several "piconets" can be established and linked together in "scatternets" to allow communication among several networks providing

continually flexible configurations.

In one embodiment of the present invention, the communications interface 44 is connected to a local switching office 72 on the PSTN 22 via a RJ-11 jack 24. The RJ-11 jack 24 provides narrow band (e.g., voice) and broadband communications and data communications via the PSTN 22 and Internet 24. The local switching office 72 is connected to a digital subscriber line access multiplexer ("DSLAM") 74, which is in turn in communications with other telephony equipment via the PSTN 22. As is known in the art, a DSLAM concentrates individual voice lines to T1 lines, wireless antenna sites, Private Branch Exchanges ("PBXs"), Optical Network Units ("ONUs") or other carrier systems. The DSLAM 74 may also be connected to a regional broadband network ("RBN") 76, or other broadband or narrow-band voice, video or data networks which in turn may be communications with other networking equipment on the Internet 24.

The integrated phone-based home gateway system 34 provides gateway functionality, broadband communications as well as normal voice telephony to the home environment. The integrated, phone-based home gateway interface 36 is a modular, flexible home network appliance, as well as broadband or narrow-band telephony and data communications device that provides in-home as well as to-home networking.

EXEMPLARY WIRELESS INTEGRATED PHONE-BASED HOME GATEWAY SYSTEM

FIG. 4 is a block diagram illustrating a wireless, integrated phone-based home gateway system 78. In such an embodiment, the wireless, integrated phone-based home gateway system 78 is typically not connected directly to any other network device with any wires. In one embodiment of the present invention, all connection are wireless,

including those to the PSTN 22 and the Internet 24. In another embodiment of the present invention, all connections to network devices are wireless, however, connections to the PSTN 22 and/or the Internet 24 may be with wires as is illustrated in FIG. 4. However, the present invention is not limited to such embodiments and the wireless, integrated, phone-based home gateway system 78 can also be used with a variety of other connection options.

The wireless, integrated, phone-based home gateway system 78 includes a wireless, integrated phone-based home gateway interface 80 and optional portable wireless telephone handset 82. The wireless, integrated phone-based home gateway interface 80 includes the same components as the integrated phone-based home gateway interface 36 described above for FIG. 3. In addition, the wireless phone-based home gateway interface 80 includes an additional plug-in radio frequency ("RF") interface 84.

In one embodiment of the present invention, the RF interface 84 is an IEEE standard 802.11b wireless interface. However, the present invention is not limited to such an embodiment and other wireless interfaces can also be used. For example, the RF interface can include RF Home and other wireless interfaces. As is known in the art, the IEEE 802.11b standard defines wireless interfaces that provide up to 11 Mbps wireless data transmission to and from wireless devices over short ranges. The IEEE 802.11b standard is incorporated herein by reference.

As is known in the art, RF Home is a standard for wireless networking access devices to both local content and the Internet for voice, data and streaming media in home environments. More information on RF Home can be found at the URL "www.homerf.org." RF Home includes the Shared Wireless Access Protocol ("SWAP"). The SWAP specification defines a new common interface protocol that

supports wireless voice and data networking in the home. The RF Home SWAP protocol specification, March 1998, is incorporated herein, by reference.

In one embodiment of the present invention, the RF interface 84 is a short-range RF interface that is capable of communicating with wireless devices over a wireless piconet 86 or wireless scatternet using wireless communications protocols. In another embodiment of the present invention, the RF interface 78 is a long-range radio interface (e.g., WAP interface) used for communicating with wireless devices on wireless networks outside the range of a wireless piconet 80. In yet another embodiment of the present invention, the RF interface 78 includes both short-range and long-range RF interfaces. However, the RF interface 78 can be virtually any other or equivalent short-range or long-range RF interface and the present invention is not limited to the short-range or long-range RF interfaces described.

FIG. 5 is a block diagram illustrating "to-home" wireless networking 88 with the phone-based, integrated, wireless phone-based home gateway system 78. The wireless, integrated, phone-based home gateway system 78 can be used to provide long range to-home wireless networking as well as long range in-home wireless networking with wireless protocols.

For example, the wireless, integrated, phone-based home gateway interface 80 can be in communications with a WAP gateway 90 to provide long-range to-home wireless networking at the wireless, integrated phone-based home gateway interface 80 from a WAP enabled devices 92 or other long-range wireless devices via a wireless wide-area network ("WAN") 94. The "Wireless Application Protocol Architecture Specification", by the Wireless Application Protocol Forum, WAP-100-WAPArch-1998-0430-a, April 1998, is incorporated herein by reference. The wireless wide-area network 88 allows devices outside a certain range and vicinity (e.g., greater than a few

miles and/or outside the range of a piconet) to be in communications with the wireless, integrated phone-based home gateway interface 80.

The wireless, integrated phone-based home gateway system 78 provides gateway functionality, broadband communications, short-range and/or long-range wireless communications, as well as normal voice telephony to the home environment. The wireless, integrated, phone-based home gateway interface 80 is a modular, flexible home network appliance, as well as broadband telephony and data communications device that provides short-range and long-range wireless in-home as well as to-home networking.

EXEMPLARY INTEGRATED PHONE-BASED HOME GATEWAY SYSTEM HARDWARE ARCHITECTURE

FIG. 6A is a block diagram illustrating an exemplary integrated phone-based home gateway interface hardware architecture 100. FIG. 6B is a block diagram illustrating an exemplary wireless, integrated phone-based home gateway interface hardware architecture 100'. The exemplary phone-based home gateway interface architecture 100 illustrated in FIG. 6A is used with the integrated phone-based home gateway interface 36 (FIG. 3). The exemplary wireless, integrated phone-based home gateway interface hardware architecture 100' is used with the wireless, integrated phone-based home gateway interface 80 (FIG. 4).

The exemplary integrated phone-based home gateway interface architecture 100 includes a receive and transmit or transceiver ("XCIVER") buffer 102, an ADSL ATU-R 104, a splitter 106 including a high-pass filter and a low pass filter, a POTS telephone module 108 and a RJ-11 interface 110. An expansion header (not illustrated) may also be used between the ATU-R 104 and the XCIVER buffer 102.

The POTS telephone module 108 may include an analog V.90 59K modem,

other analog or digital modem and/or a 900 MHz-2.4 GHz cordless phone module (Not illustrated in FIG. 6A). The POTS telephone module 108 is connected to a universal asynchronous receiver-transmitter ("UART") 112, which is turn connected to an integrated communications micro-controller 114.

An ADSL system typically includes one or more splitters 106. The splitter 106 is a filter that separates high frequency and low frequency telephony signals. A splitter may be integrated the ATU-R 104, physically separated from ATU-R 104, and may be divided between high pass and low pass functionality as is illustrated in FIG. 6A.

In one exemplary preferred embodiment of the present invention, the ADSL ATU-R 104 is used with the splitter 106 and is compliant with the ANSI standard "Network and Customer Installation Interfaces - Asymmetric Digital Subscriber Line (ADSL) Metallic interface," ANSI-T1.413-1995, and the ITU standards "Asymmetrical digital subscriber line (ADSL) transceiver," ITU-G.992.1-1999, the contents of which are incorporated by reference.

In another exemplary preferred embodiment of the present invention, the ADSL ATU-R 104 is used without splitter 106. A splitterless ADSL system typically delivers a maximum downstream bandwidth of about 1.4 Mbps, but is less sensitive to noise and other transmission problems typically encountered by ADSL system that use splitters. The splitterless ADSL standard is called "G.lite." In such a splitterless embodiment, the ADSL ATU-R 104 is compliant with the ANSI-T1.413-1995 standard and the ITU-T "Splitterless Asymmetrical Digital Subscriber Line Transceivers," ITU-G.992.2-1999, the contents of which are incorporated herein by reference.

In another embodiment of the present invention, the ADSL ATU-R 104 is

replaced with a high-speed wireless interface 107 as is illustrated in FIG. 6B. This high-speed wireless interface 107 provides a "wireless local loop" ("WLP") for use in wireless, integrated, phone-based home gateway interface 84 (FIG. 4), to provide in-home and as well as to-home wireless networking. In one embodiment of the present invention, the high-speed wireless interface is an IEEE 802.11b wireless interface. However, the present invention is not limited to such a wireless interface, and the high-speed wireless interface 107 include other or equivalent short-range or long-range wireless interfaces.

In such an embodiment, the high-speed wireless interface 107 is used without the ADSL ATU-R 104, but in combination with the RJ-11 interface 110 and the POTS telephone module 108. In such an embodiment, the RJ-11 interface 110 and the POTS telephone module 108 are used to provide service provisioning and voice calls via the PSTN 22 that can be connected to other wireless devices via the high-speed wireless interface 107. In such an embodiment, the high-speed wireless interface 107 is also connected to the POTS telephone module 110.

In yet another embodiment of the present invention (not illustrated in FIG. 6), the high-speed wireless interface 107 is used in combination with the ADSL ATU-R 94, the RJ-11 interface 108 and the POTS telephone module 110 to provide both wireless and wired access to integrated, phone-based home gateway interface 36 (FIG. 3). For one skilled in the art, various other combinations of the wireless and wired components described herein are also possible to provide both data and voice communications in a phone-based home gateway.

In one embodiment of the present invention, the integrated communications micro-controller 114 includes a StrongARM SA-110, from the Intel Corporation of Santa Clara, California. The StrongARM SA-110 is a high-performance, low-power

processor for portable wireless multi-media devices. However, other or equivalent micro-controllers can also be used and the present invention is not limited to this Intel micro-controller.

The integrated phone-based home gateway interface architecture 100 also includes one or more banks of memory such as synchronous dynamic random access memory ("SDRAM") 116, synchronous mask read only memory ("SMROM") 118, flash memory 120, static RAM ("SRAM") 122 and one or more RS-232 interfaces 124 for connecting serial devices. Memory 116, 118, 120, 122 and RS-232 interfaces 124 are connected to the integrated communications micro-controller 114.

As is known in the art, SDRAM 116 is a form of dynamic random access memory ("DRAM") that can run at higher clock speeds than conventional DRAM. The SDRAM 116 is connected to receive and transmit buffer 102. SMROM 118 is a form of ROM that can be accessed using bit-masks that are typically 32-bits in size. Flash memory 120 is special type of erasable programmable ROM that can be erased and reprogrammed in blocks instead of one byte at a time. SRAM 122 is form of RAM that retains information as long as there is enough power to run a device. The RS-232 interface 124 standard defines specific lines and signal characteristics used by serial communications controllers to standardize the transmission of serial data between devices.

In a typical configuration memory 116, 118, 120, 122 includes memory blocks of 64 Mbytes to 512 Mbytes in size. The memory 116, 118, 120, 122 can be configured using many different types of memory layouts and memory sizes.

The integrated communications micro-controller 114 is connected with one or more high-speed serial ports ("HSSP") 126 or a high-speed serial bus (not illustrated) to a black and white, grey scale or color liquid crystal display ("LCD") component

128 used for the display screen 40, a Bluetooth radio module 130 included in the Bluetooth component 52, an infra data association ("IrDA") module 132, an HPNA module 134 included in the HPNA component 50, one more audio/video CODEC modules 136, and one or more Personal Computer Memory Card International Association ("PCMCIA") interface modules 138.

As is known in the art, the IrDA module 132 is used for synchronizing and transmitting data via infrared light waves and is used to provide one type of short-range wireless connection. The audio/video CODECs 136 are coders/decoders used to convert audio or video signals between analog and digital forms and/or are compressors/decompressors for compressing and decompressing audio and video data.

In one embodiment of the present invention, Motion Pictures Expert Group ("MPEG-2") codecs are used. As is known in the art, MPEG is a set of standards for audio and video compression established by the Joint ISO/IEC Technical Committee on Information Technology. The original MPEG standard for storing and retrieving video and audio information, was designed for CD-ROM technology. MPEG-1 defines data cell encoding for a medium bandwidth of up to 1.5 Mbps, two audio channels, and non-interlaced video. MPEG-2 is an extension of the MPEG-1 standard designed for broadcast television, including HDTV. MPEG-2 defines a higher bandwidth of up to 40 Mbps, five audio channels, a wider range of frame sizes, and interlaced video.

MPEG-2 in general is defined in the ISO/IEC Standard JTC1/SC29/WG11, entitled "Coding of Moving Pictures and Audio," incorporated herein by reference. MPEG-2 is also defined by the ITU-T H.222.0, standard entitled "Generic coding of moving pictures and associated audio information," the contents of which is

incorporated by reference. However, other audio/video data codecs could also be used and the present invention is not limited to the MPEG codecs described.

During an audio/video conferencing call, or a voice call, audio information is typically supplied by audio equipment (e.g., a handset, microphone/speaker, speaker-phone, etc.) that uses an audio codec to capture audio information. For example, such audio codecs are compliant ITU-T G.711, G.722, G.723, G.728 and G.729 standards, the contents of which are incorporated by reference. However, other audio codecs could also be used and the present invention is not limited to such audio codecs.

The one or more PCMCIA interfaces 148 are standard interfaces for small credit-card size peripherals and slots designed to hold them, primarily on laptop, palmtop, and other portable devices including intelligent electronic devices. As is known in the art, PCMCIA interfaces 138 comprises group of manufacturers and vendors who collaborated to promote a common standard for PC Card-based peripherals.

The integrated phone-based home gateway interface architecture 100 system and wireless, integrated phone-based home gateway interface architecture 100' are described with a number of specific components. However, the present invention is not limited to these specific components and more, fewer or equivalent components can also be used in the integrated phone-based home gateway interface architecture 100 and wireless, integrated phone-based home gateway interface architecture 100'

EXEMPLARY HOME GATEWAY INTERFACE SOFTWARE ARCHITECTURE

FIG. 7 is a block diagram illustrating an exemplary home gateway interface software architecture 140. The home gateway interface software architecture 140

includes a session manager 142, a service manager 144, an interface manager 146 and a display manger 148. However, more, fewer or equivalent software components can be used and the present invention is not limited to these software components. In FIGS. 7-11, external communications paths, i.e., communications paths external to a component in the software architecture 140 are illustrated with two-way arrows. Internal communications paths, i.e., communications paths internal to a component in the software architecture 140 are illustrated with lines without arrow heads. However, the internal communications path also provide two-way communications.

FIG. 8 is a block diagram illustrating an exemplary session manager 142 software architecture 150. The session manager 142 includes a session controller module 152 that sends and receives status information to and from the service manager 144. The session controller module 152 also sends and receives interface information to and from the interface manager 146 and sends and receives data messages to and from the display manager 148. The session controller module 152 also helps initialize data interfaces, such as IP interfaces with cooperation from the provisioning manager module 164 (FIG. 9) in the service manager 144.

The session controller module 152 also sends and receives session control and status information to and from a transport layer 154 that is in communications with a network layer 156.

As is known in the art, the Open Systems Interconnection ("OSI") reference model is a layered architecture that standardizes levels of service and types of interaction for computers exchanging information through a communications network. The OSI reference model separates network device-to-network device communications into seven protocol layers, or levels, each building-and relying--upon the standards contained in the levels below it. The OSI reference model

includes from lowest-to-highest, a physical, data-link, network, transport, session, presentation and application layer. The lowest of the seven layers deals solely with hardware links; the highest deals with software interactions at the application-program level.

The transport layer 154 is the fourth of the seven layers in the OSI reference model. The transport layer 154 is typically responsible for both quality of service and accurate delivery of information. Among the tasks performed on this layer are error detection and correction.

The transport layer 154 sends and receives transport layer protocol data units ("PDU") to and from the network layer 156. As is known in the art, a PDU is a data packet layout with a header and a data payload. The transport layer 154 also sends and receives session control and status information to and from the session controller module 152 and sends and receives interface control and status information to and from the interface manager 146.

The network layer 156 is the third of the seven layers in OSI reference. The network layer 156 is one level above the data-link layer and ensures that information arrives at its intended destination. The network layer 156 sends network layer PDUs to a latency management module 158. The latency management module 158 manages latency of information on the network layer 156. The latency management module 158 sends and receives protocol data units to and from the ADSL ATU-R 104 and/or wireless RF module 107.

In one embodiment of the present invention, the session controller module 152 provides routing and bridging functionality for networking communications and coordinates initialization of broadband communications service configurations and provisions with the provisioning manager module 164 in the service manager 144

(FIG. 9). In such an embodiment, the session controller module 152 in the session manager 142 initializes and maintains routing and bridging tables for the phone-based home gateway interfaces 36, 80. However, the present invention is not limited to such and embodiment and routing and bridging functionality can also be provided by other hardware or software components in the integrated, phone-based home gateway interfaces 36, 80.

FIG. 9 is a block diagram illustrating an exemplary service manager 144 software architecture 160. The service manager 144 includes a device manager module 162 that sends and receives status information to and from the session manager 142, and sends and receives service and voice information messages to and from the display manager 148.

The device manager module 162 also sends and receives service registration information to and from a provisioning manager module 164. The provisioning manager module 164 sends and receives service initialization information and service session information to and from the PSTN 22 via the POTS telephone module 108. The POTS telephone module 108 helps with service provisioning requests as well as handles voice calls including VoIP via the PSTN 22. The provisioning manager module 164 also sends and receives broadband service session information and data session information to and from the ADSL ATU-R 104 or wireless module 107. The ADSL ATU-R 104 or wireless module 107 also handles data communications via the PSTN 22, the Internet, wireless WAN 94, etc.

As is known in the art, an Asynchronous Transfer Mode ("ATM") system can use high-speed services on ADSL systems as a physical layer to transport data packets. ATM is a high-speed packet transmission system. ATM segments and multiplexes data traffic into small, fixed-length units called "cells." A cell is 53-

octects, with 5-octects for the cell header, and 48-octects for the cell data. ATM provides four service category classes that may use constant bit-rates, variable bit-rates, available bit-rates and unspecified bit-rate services. The four ATM service classes can be used to provide Quality-of-Service ("QoS") functionality. The provisioning manager module 164 is used to set-up ATM virtual channel connections ("VCC") and other types of virtual connections or data sessions.

FIG. 10 is a block diagram illustrating an exemplary interface manger 146 software architecture 166. The interface manager 146 includes an interface module 168. The interface module 168 sends and receives interface information to and from the session manager 142 and sends and receives service messages to and from the display manager 148.

The interface module 168 also sends and receives Bluetooth data and management information to and from a Bluetooth baseband module 170. The Bluetooth baseband module 170 sends and receives Bluetooth radio information to and from the Bluetooth radio module 130.

The interface module 168 also sends and receives HPNA data and management information to and from an HPNA interface module 172. The HPNA interface module 172 sends and receives HPNA information to and from HPNA module 134.

FIG. 11 is a block diagram illustrating an exemplary display manger 148 software architecture 174. The display manager 148 includes a content manager module 176. The content manager module 176 sends and receives data messages to and from the session manager 142, sends and receives services and voice messages to and from the service manager 144 and sends and receives service messages to and from the interface manger 146.

The content manager module 176 also sends and receives messages to and from

a LCD display module 178 and a storage handler module 180. The LCD display module 178 sends and receives display messages to and from the LCD module 128. The storage handler module 180 sends and receives storage messages to and from memory 116, 120, 122.

FIGS. 1-5 illustrate exemplary stand-alone integrated phone-based home gateway systems. In many instances however, a home user will already have an existing phone system, and desire to use the functionality of the integrated or wireless, integrated phone-based home gateway systems described herein. In another embodiment of the present invention, the integrated phone-based home gateway system comprises an integrated phone-based home gateway conversion system without a display screen 40, keypad 42, optical video camera 54, etc.

FIG. 12 is a block diagram illustrating an integrated phone-based home gateway conversion system 182. The integrated phone-based home gateway conversion system 182 includes an integrated phone-based home gateway conversion module 184 that is used in combination with an existing phone system 186. In one embodiment of the present invention, the integrated phone-based home gateway conversion module 184 is approximately the same size and shape of the existing phone system 182 and includes multiple RJ-11 jacks 24, a HPNA 50 connector as well as other communications components described above for phone-based home gateway systems 34, 78. The multiple RJ-11 jacks and the HPNA 50 connector allow the existing phone system 186 to be connected to the integrated phone-based home gateway conversion module 184, other devices on LAN 12 in a SOHO network, as well as to the PSTN 22 and/or Internet 24.

Since the integrated phone-based home gateway conversion module 184 is approximately the same size and shape of the existing phone system 182, the

conversion module 184 can be used with an existing phone system 182 without taking up much additional space in the home or office of a home user. The size of the illustrated conversion module 184 is slightly larger than the existing phone system only for the purposes of illustration in the drawing. The integrated phone-based home gateway conversion module 184 includes wired 188 and/or wireless 190 connections as were discussed above for the integrated and wireless integrated home gateway systems 34, 78.

EXEMPLARY HOME GATEWAY INTERFACE INITIALIZATION

FIG. 13 is a flow diagram illustrating a Method 192 for initializing communications from the phone-based home gateway interfaces 36, 80. At Step 194, one or more narrow-band communications channels are automatically established with a public switched telephone network 22 from the phone-based home gateway interfaces 36, 80. At Step 196, one or more broadband communications channels are automatically established with a public switched telephone network 22 from the phone-based home gateway interfaces 36, 80. At Step 198, a data communications interface is automatically initialized for a data network 24 from the phone-based home gateway interfaces 36, 80. At Step 200, routing or bridging tables are automatically initialized on the phone-based home gateway interfaces 36, 80. At Step 202, broadband communications service configurations and provisions are automatically initialized via the phone-based home gateway interfaces 36, 80.

Method 192 helps hide data and broadband configuration and service provisioning complexity from home users by automatically establishing communications channels and providing automatic initialization communications and networking configuration parameters. Method 192 is illustrated with one exemplary embodiment of the present invention. However, the present invention is not limited

to such an embodiment and other or equivalent embodiments can also be used.

In such an embodiment at Step 194, one or more narrow-band communications channel, such as an analog 48 communication channels for POTS 108, are established automatically with the PSTN 22 from the phone-based home gateway interfaces 36, 80.

In one embodiment of the present invention, the narrow-band communications channel is used to provide a conventional wired voice channel, communications channel redundancy, as well as provide automatic broadband service provisioning and configuration. In such an embodiment the narrow-band communications channel is also used to help initialize other components of the phone-based home gateway interfaces 36, 80. However, the present invention is not limited to such and embodiment.

At Step 196, one or more broadband communications channels such as an ADSL 104, ATM over ADSL 104 or other broadband communications channel is established automatically with the PSTN 22. In one embodiment of the present invention, the broadband communications channel is used to provide broadband voice, video or data communications with the PSTN 22 or Internet 24. However, the present invention is not limited to such an embodiment.

At Step 198, a data communications interface is automatically initialized, such as an IP interface, for the Internet 24. The automatic initialization includes initializing network addresses such as IP and other types of network addresses, and initializing data network configuration parameters. The automatic initialization helps hide initialization and configuration complexity from users of the home gateway interfaces.

At Step 200, routing or bridging tables are automatically initialized in the

communications interface 44. As is known in the art, a routing table is table of information that provides network hardware (bridges and routers) with the directions needed to forward packets of data to locations on other networks. The information included in a routing table differs according to whether it is used by a bridge or a router.

A bridge relies on both a source (i.e., originating) and destination addresses to determine where and how to forward a packet. A router relies on the destination address and on information in the table that gives the possible routes-in hops or in number of jumps--between itself, intervening routers, and a destination. The routing or bridging tables also provide network address translation ("NAT") for the phone-based home gateway interfaces 36, 80. In one embodiment of the present invention, the routing and bridging tables are initialized by the session manager 142. However, the present invention is not limited to this embodiment and the routing and bridging tables can be initialized by other components or modules in the phone-based home gateway interfaces 36, 80 and/or with or without help from the remote applications.

At Step 202, broadband communications service configurations and provisions are automatically initialized via the phone-based home gateway interfaces 36, 80. In one embodiment of the present invention, the session manager 142 coordinates this task with the provisioning manager module 164 in the service manager 148. However, the present invention is not limited to such an embodiment. The narrow-band communications channel is used to automatically initialize broadband communications services, such as ASDL, ATM, etc. services.

In a preferred embodiment of the present invention, Method 192 is practiced with the phone-based home gateway interfaces 36, 80 by sending and receiving telephony initialization and provisioning signals to and from the PSTN 22, and data

protocol initialization sequences to and from the Internet 24, to provision, establish and initialize narrow-band and broadband communications channels and automatically populate routing and bridging tables.

In another embodiment of the present invention, the narrow-band communication channel is used to call a toll free number (e.g., 800, 888, etc.) to establish communications with specialized remote software applications that assist in automatically populating routing and bridging tables and provisioning, establishing and initializing communications channels to/from the phone-based home gateway interfaces 36, 80. In such an embodiment, the remote applications may be included at the local switching office 72 or at some other location on the PSTN 22 or the Internet 24 (e.g., at Aeptech's home site on the Internet).

In such an embodiment, the remote applications specifically help configure and initialize the phone-based home gateway interfaces 36, 80 with two-way dynamic communications any time a home user desires to configure and initialize an interface 36, 80. The dynamic two-way communications over the narrow-band communications channel are used to assist in automatically populating routing and bridging tables, provisioning, establishing and initializing other communications channels to/from the phone-based home gateway interfaces 36, 80.

In another embodiment of the present invention, a remote application may send a static configuration file that is then used by the phone-based home gateway interfaces for automatically populating routing and bridging tables and provisioning, initializing and establishing other communications channels to/from the phone-based home gateway interfaces 36, 80. The configuration file can be dynamically updated by periodically contacting the remote application for updates.

However, the present invention is not limited to such embodiments and other

or equivalent embodiments can also be used. In addition, no remote software applications are necessary to practice preferred embodiments of present invention.

The phone-based home gateway interfaces described herein can used as broadband home gateway, a wireless local loop home gateway, as well as a set-top box for a cable television access. The phone-based home gateway interfaces are modular, flexible, plug-n-play home gateways. The home gateway interfaces hide routing and bridging table population, data (e.g., IP) and broadband service configuration and provisioning complexity from home users by providing automatic population of routing and bridging tables, establishment of communications channels, initialization and provisioning of communication channel parameters.

It should be understood that the programs, processes, methods and system described herein are not related or limited to any particular type of computer or network system (hardware or software), unless indicated otherwise. Various combinations of general purpose, specialized or equivalent computer components including hardware, software, and firmware and combinations thereof may be used with or perform operations in accordance with the teachings described herein.

In view of the wide variety of embodiments to which the principles of the present invention can be applied, it should be understood that the illustrated embodiments are exemplary only, and should not be taken as limiting the scope of the present invention. For example, the steps of the flow diagrams may be taken in sequences other than those described, and more fewer or equivalent elements may be used in the block diagrams.

The claims should not be read as limited to the described order or elements unless stated to that effect. Therefore, all embodiments that come within the scope and spirit of the following claims and equivalents thereto are claimed as the

invention.

WE CLAIM:

1. An integrated phone-based home gateway system providing in-home and to-home networking, comprising in combination:

a home gateway interface for initializing broadband communications service configurations and provisions, initializing data communications parameters and for providing routing or bridging for networking communications;

a communications interface for connecting to one or more networks, for providing data communications, for providing broadband communications and for providing narrow-band communications including voice communications;

a processor for processing information from the one or more networks;

a display interface for displaying the information from the one or more networks; and

a wireless communications interface for connecting to external wireless devices.

2. The integrated phone-based home gateway system of Claim 1, further comprising a portable multi-function handset.

3. The integrated phone-based home gateway system of Claim 1, wherein the portable multi-function handset performs the function of at least one of a cordless phone, a mobile phone, a web phone, or a walkie-talkie radio.

4. The integrated phone-based home gateway system of Claim 1, wherein the communication interface includes a speaker-phone.

5. The integrated phone-based home gateway system of Claim 1, wherein the communication interface includes a digital subscriber line ("DSL") device and an analog modem.

6. The integrated phone-based home gateway system of Claim 5, wherein the DSL device includes an asymmetric digital subscriber line ("ADSL") device, symmetric DSL ("SDSL") device, high-bit-rate DSL ("HDSL") device or very-high-bit-rate ("VDSL") device.

7. The integrated phone-based home gateway system of Claim 1, wherein the communication interface includes voice communications using Plain Old Telephone Service ("POTS") or Voice over Internet Protocol ("VoIP") channels.

8. The integrated phone-based home gateway system of Claim 1, further comprising:

at least one module for interfacing with an external device.

9. The integrated phone-based home gateway system of Claim 8, wherein the external device includes a desk-top computer, lap-top computer, notebook computer, a home security device, a mobile phone, a personal digital assistant, a Internet Protocol-based home appliance, a printer, a facsimile machine, a video camera, or a scanner.

10. The integrated phone-based home gateway system of Claim 8, wherein the at least one module for interfacing with an external device includes an RJ-11

module, a peripheral component interconnect ("PCI") module, a Universal Serial Bus ("USB") module, a home phoneline network adapter ("HPNA") module, a Personal Computer Memory Card International Association ("PCMCIA") interface module, a Bluetooth module, an infra data association ("IrDA") module, or a wireless interface module.

11. The integrated phone-based home gateway system of Claim 1, further comprising one or more modular plug-and-play interfaces.

12. The integrated phone-based home gateway system of Claim 1, wherein the display interface comprises a removable display unit.

13. The integrated phone-based home gateway system of Claim 12, wherein the removable display unit interfaces with the home gateway interface through a wireless infrared or a wireless radio frequency communications interface.

14. The integrated phone-based home gateway system of Claim 1, wherein the display interface displays and accesses voice, video and data messages.

15. The integrated phone-based home gateway system of Claim 14 wherein the data messages include Internet Protocol messages or e-mail messages.

16. The integrated phone-based home gateway system of Claim 1 wherein the display interface displays a graphical representation of a keypad.

17. The integrated phone-based home gateway system of Claim 1, wherein the display interface displays at least one line of real-time stock quote, weather, headline news, community news, or a electronic address information from the Internet.

18. The integrated phone-based home gateway system of Claim 1, further comprising a keypad.

19. The integrated phone-based home gateway system of Claim 18 wherein the keypad is a graphical representation of a key pad on the display, a numeric key pad, an alpha-numeric key pad or a keyboard.

20. The integrated phone-based home gateway system of Claim 1, further comprising a video camera.

21. The integrated phone-based home gateway system of Claim 1 wherein the one or more networks include a public switched telephone network, a regional broadband network, or the Internet.

22. The integrated phone-based home gateway system of Claim 1 wherein the wireless communication interface includes an infrared or radio frequency wireless communication interface.

23. The integrated phone-based home gateway system of Claim 1 wherein the wireless communication interface includes a Bluetooth protocol based interface a

Shared Wireless Access Protocol based interface or a Wireless Application Protocol based interface.

24. The integrated phone-based home gateway system of Claim 1 wherein the wireless communication interface includes a short-range wireless communication interface for connecting to external wireless network devices on a wireless piconet.

25. The integrated phone-based home gateway system of Claim 1 wherein the wireless communication interface includes a long-range wireless communication interface for connecting to external wireless network devices on a wireless wide area network.

26. The integrated phone-based home gateway system of Claim 22 wherein the wireless communication interface includes a long-range and a short-range radio frequency wireless communication interface.

27. The integrated phone-based home gateway system of Claim 1, further comprising a computer readable medium having stored therein a plurality of computer software modules with a plurality of instructions executable by the processor, including:

a session manager module for controlling an information session from the one or more networks, controlling a service manager module, controlling an interface manager module, controlling a display manager module and for automatically populating routing and bridging tables and providing routing or bridging for networking communications;

a service manager module for controlling the communications interface and the wireless communication interface, and initializing broadband communications service configurations and provisions and initializing data communications parameters;

an interface manager module for controlling interface modules to external devices; and

a display manager module for controlling the display interface and the display of information from the one or more networks.

28. An integrated phone-based home gateway system providing in-home and to-home networking, comprising in combination:

a home gateway interface for initializing broadband communications service configurations and provisions and for providing routing or bridging for networking communications;

a communications interface for connecting to one or more networks, wherein the communications interface includes a digital subscriber line ("DSL") device and an analog modem;

a processor for processing information from the one or more networks;

a removable display unit for displaying the information from the one or more networks for accessing and displaying voice, video or data messages;

a key pad for entering alpha-numeric data;

a home phone line network adapter ("HPNA") module;

a Bluetooth module for interfacing with wireless devices using the Bluetooth wireless protocol;

a portable multi-function wireless handset for performing cordless phone, a

mobile phone, a web phone, or walkie-talkie radio functions;

one or more short-range or long-range wireless interfaces for interfacing with external wireless devices;

one or more RJ-11 interface jacks;

at least one modular plug-and-play interface for interfacing with other external devices; and

an optional video camera for sending and receiving video data to and from the one or more networks.

29. The integrated phone-based home gateway system of Claim 28, further comprising a computer readable medium having stored therein a plurality of computer software modules with a plurality of instructions executable by the processor, including:

a session manager module for controlling an information session from the one or more networks, controlling a service manager module, controlling an interface manager module, controlling a display manager module and for automatically populating routing and bridging tables and providing routing or bridging for networking communications;

a service manager module for controlling the communications interface and the wireless communication interface, and initializing broadband communications service configurations and provisions and initializing data communications parameters;

an interface manager module for controlling interface modules to external devices; and

a display manager module for controlling the display interface and the display

of information from the one or more networks.

30. In integrated phone-based home gateway system conversion system for connecting to existing phone systems, providing in-home and to-home networking, comprising in combination:

a home gateway interface for initializing broadband communications service configurations and provisions and for providing routing or bridging for networking communications;

a communications interface for connecting to one or more networks, for providing data communications, for providing broadband communications and for providing narrow band communications including voice communications;

a processor for processing information from the one or more networks;

a wireless communications interface for connecting to external wireless devices; a home phone line network adapter ("HPNA") module; and

one or more RJ-11 interface jacks.

31. The integrated phone-based home gateway system conversion system of Claim 30, further comprising a computer readable medium having stored therein a plurality of computer software modules with a plurality of instructions executable by the processor, including:

a session manager module for controlling an information session from the one or more networks, controlling a service manager module, controlling an interface manager module, controlling a display manager module and for automatically populating routing and bridging tables and providing routing or bridging for networking communications;

a service manager module for controlling the communications interface and the wireless communication interface, and initializing broadband communications service configurations and provisions and initializing data communications parameters;

an interface manager module for controlling interface modules to external devices; and

a display manager module for controlling the display interface and the display of information from the one or more networks.

32. A method for initializing an integrated phone-based home gateway system, comprising:

establishing one or more narrow-band communications channels with a public switched telephone network from the integrated phone-based home gateway system;

establishing one or more broadband communications channels with a public switched telephone network from the integrated phone-based home gateway system;

initializing a data communications interface for a data network from the integrated phone-based home gateway system;

initializing routing or bridging tables on integrated phone-based home gateway system; and

initializing broadband communications service configurations and provisions from the integrated phone-based home gateway system.

33. The method of Claim 32 further comprising computer readable medium having stored therein instructions for causing a processor to execute the steps of the

method.

34. The method of Claim 32 wherein the step of establishing one or more narrow-band communications channel includes establishing a plain old telephone service ("POTS") channel or a Voice-over-Internet Protocol ("VoIP") channel.

35. The method of Claim 32 wherein the step of establishing one or more broadband communications channels includes establishing an asymmetric digital subscriber line ("ADSL"), symmetric DSL ("SDSL"), high-bit-rate DSL ("HDSL"), very-high-bit-rate DSL ("VDSL") or an asynchronous transport mode ("ATM") channel.

36. The method of Claim 32 wherein the step of initializing a data communications interface for a data network from the home gateway interface includes initializing an Internet Protocol ("IP") interface.

37. The method of Claim 32 wherein the step of initializing broadband communications service configurations and provisions via the home gateway interface includes initializing asymmetric digital subscriber line ("ADSL"), symmetric DSL ("SDSL"), high-bit-rate DSL ("HDSL") very-high-bit-rate DSL ("VDSL") or asynchronous transport mode ("ATM") service configurations and provisions.

FIG. 1

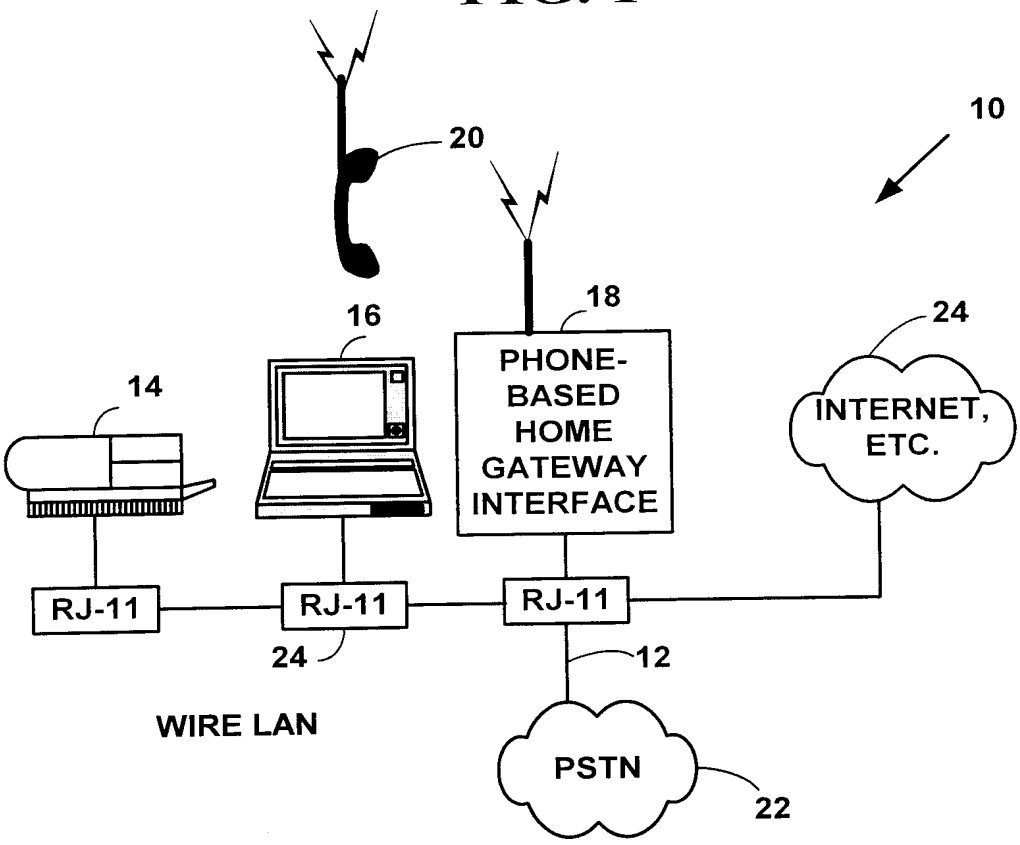

10
20
18
16
24
14
PHONE-
BASED
HOME
GATEWAY
INTERFACE
INTERNET,
ETC.
RJ-11
RJ-11
RJ-11
24
12
WIRE LAN
PSTN
22

FIG. 2

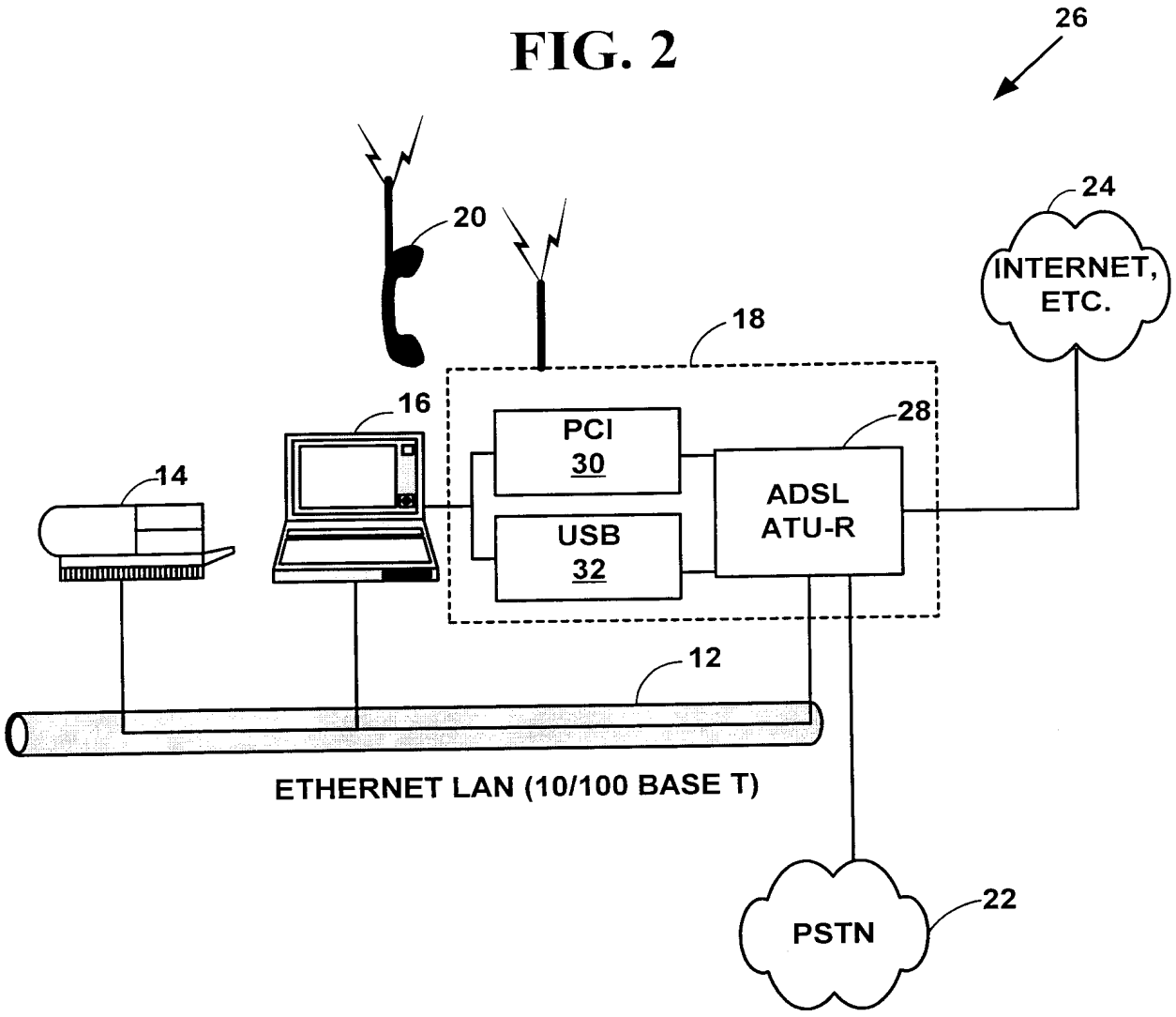

26
24
INTERNET, ETC.
20
18
16
28
PCI
30
14
ADSL
ATU-R
USB
32
12
ETHERNET LAN (10/100 BASE T)
PSTN
22

FIG. 3

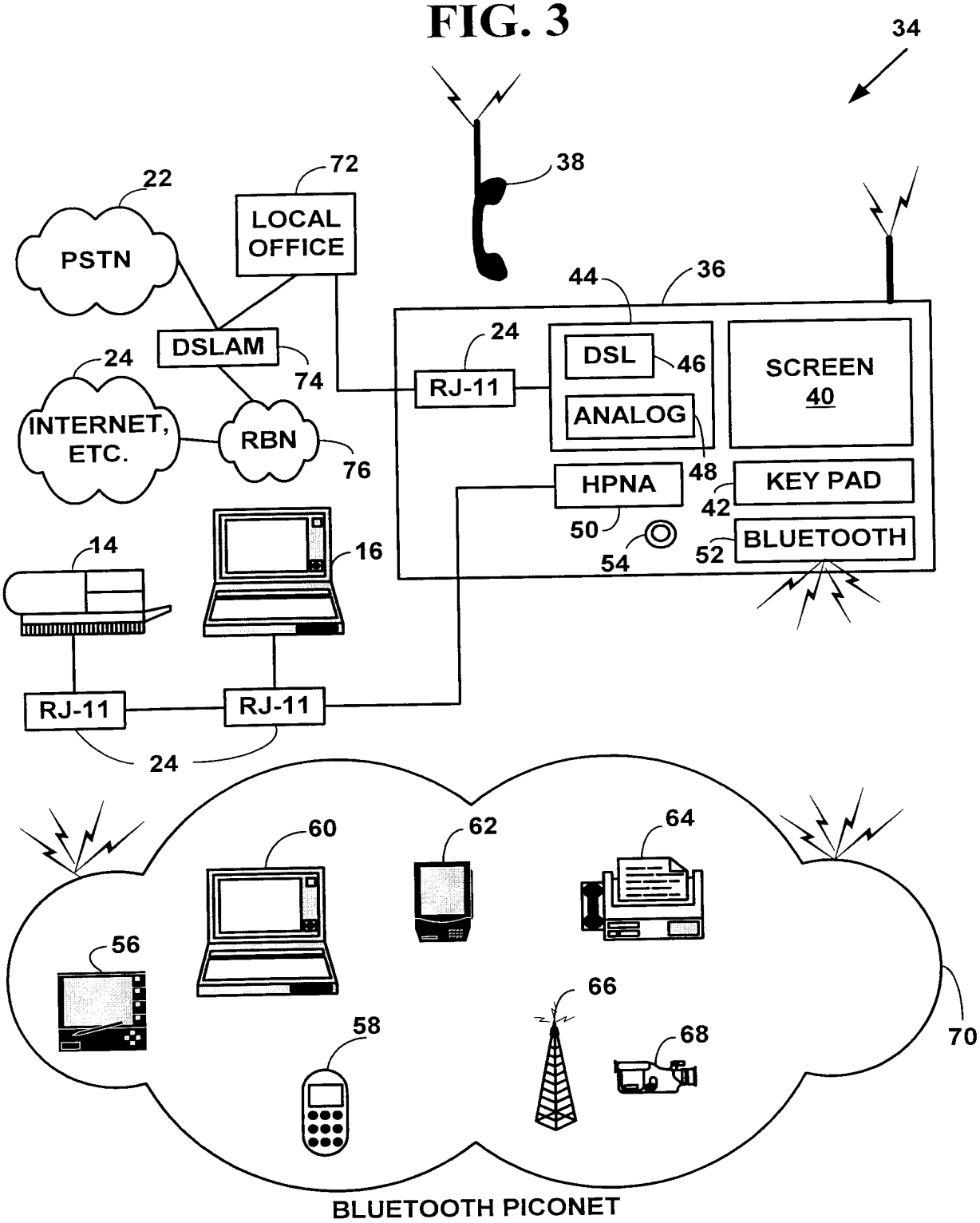

34
38
22
72
PSTN
LOCAL OFFICE
44
36
24
DSLAM
74
RJ-11
DSL
46
SCREEN
40
24
INTERNET, ETC.
RBN
76
ANALOG
48
HPNA
KEY PAD
42
50
54
BLUETOOTH
52
14
16
RJ-11
RJ-11
24
60
62
64
56
66
58
68
70
BLUETOOTH PICONET

FIG. 4

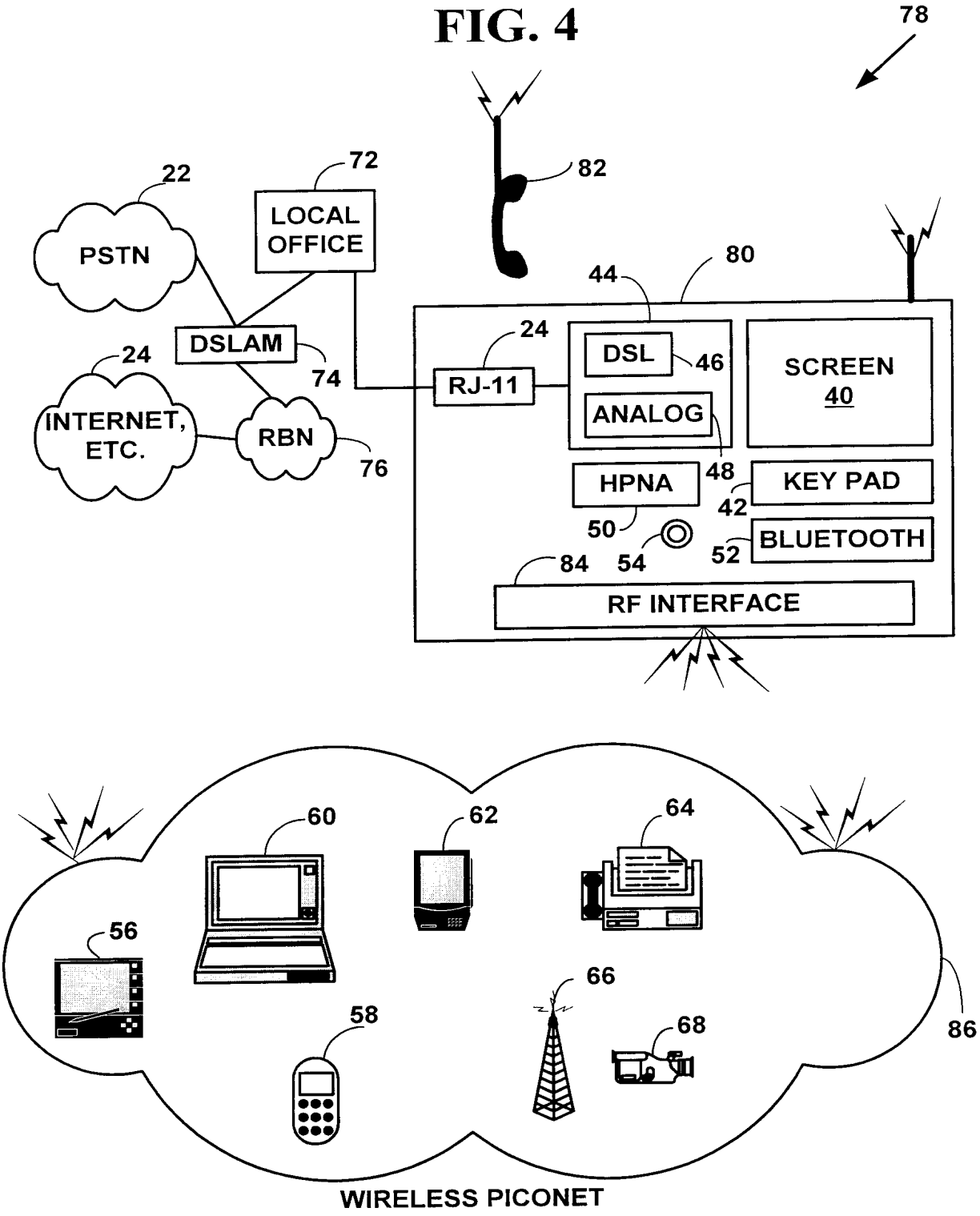

78
82
22
72
PSTN
LOCAL OFFICE
44
80
24
DSLAM
74
DSL
46
SCREEN
40
24
INTERNET, ETC.
RBN
76
RJ-11
ANALOG
48
HPNA
KEY PAD
42
50
BLUETOOTH
52
54
84
RF INTERFACE
60
62
64
56
66
58
68
86
WIRELESS PICONET

FIG. 5

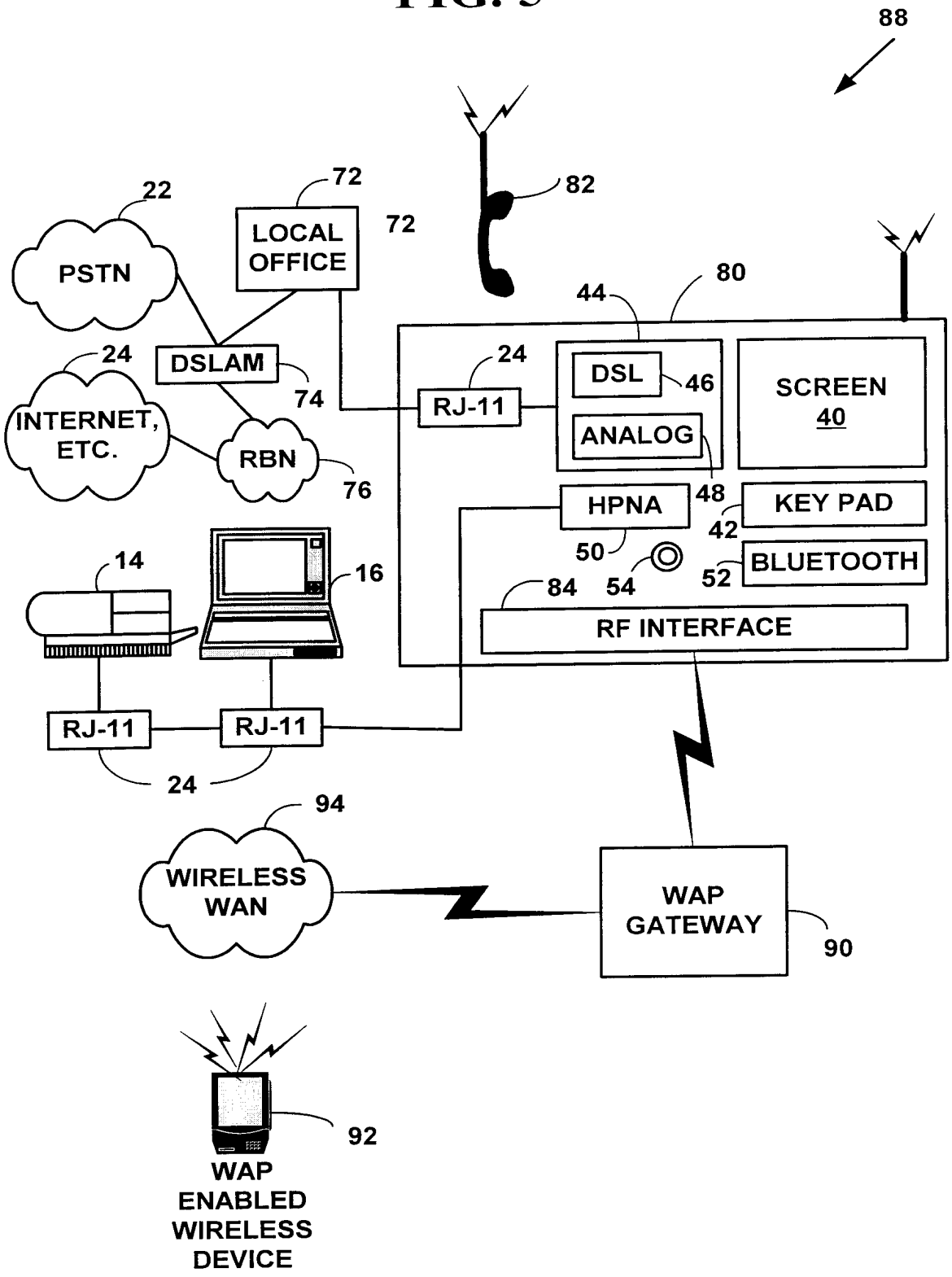
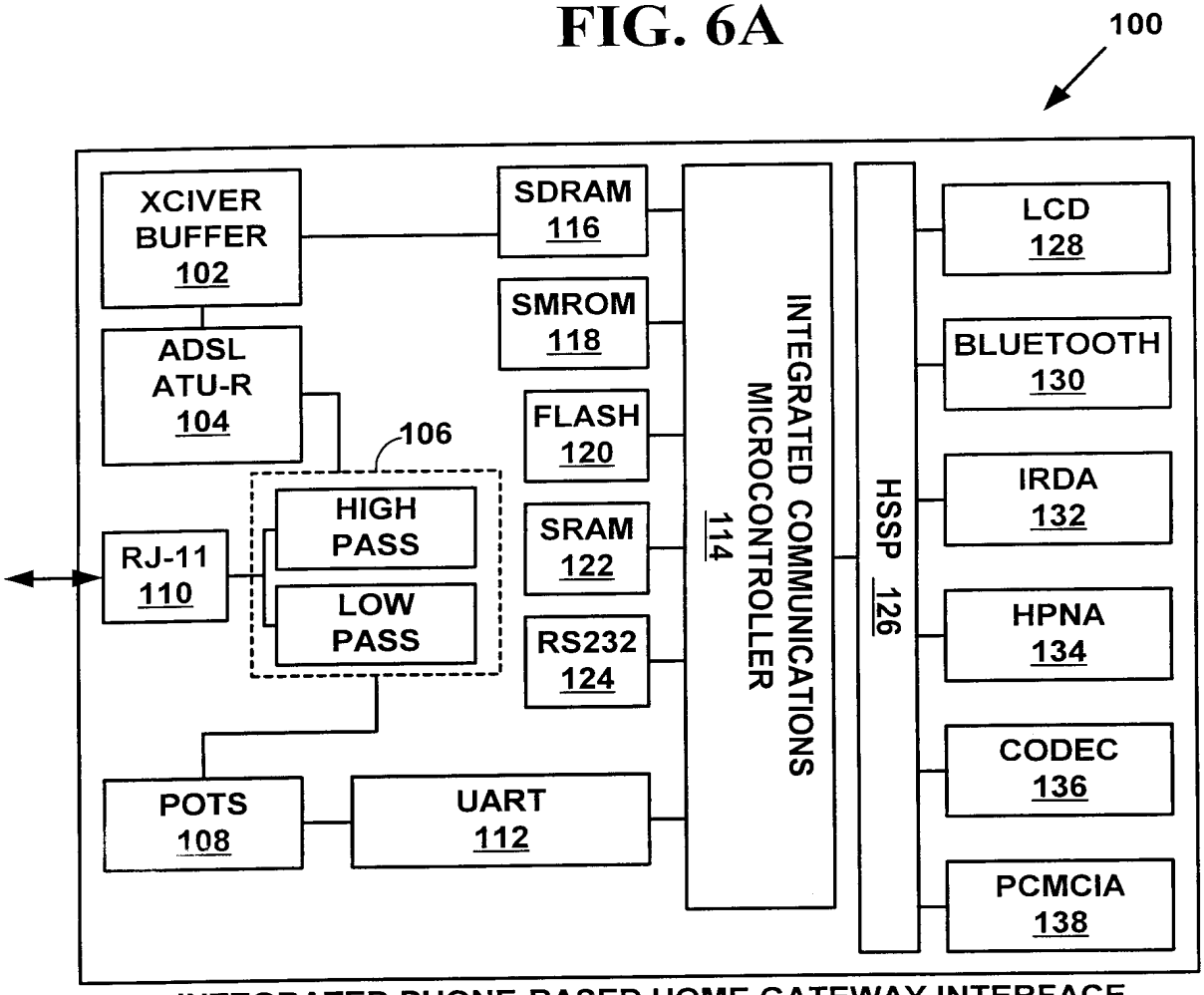
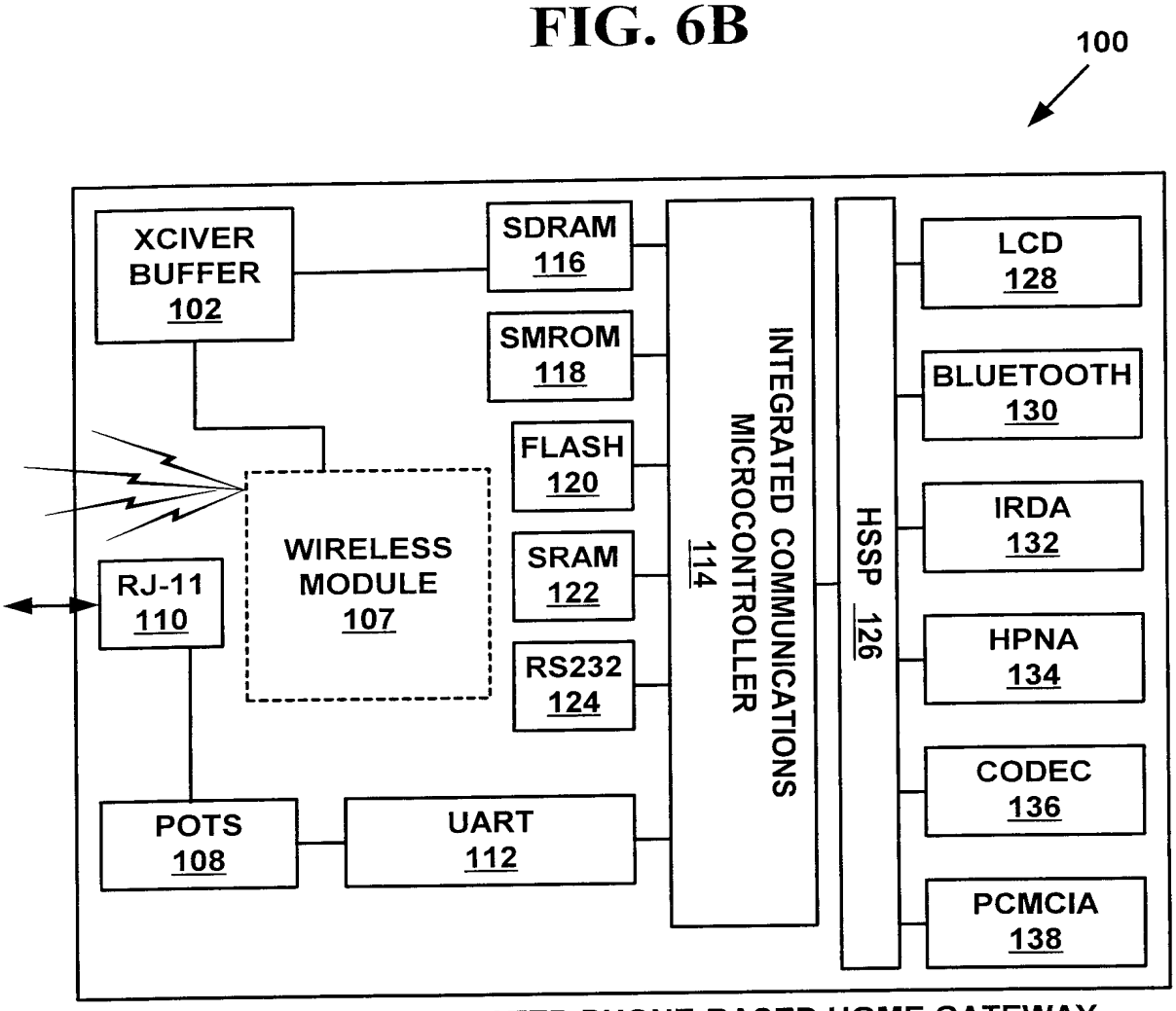

88
82
72
22
72
LOCAL OFFICE
PSTN
80
44
24
DSLAM
74
24
RJ-11
DSL
46
SCREEN
40
INTERNET, ETC.
RBN
76
ANALOG
48
HPNA
KEY PAD
42
50
54
52
BLUETOOTH
14
16
84
RF INTERFACE
RJ-11
RJ-11
24
94
WIRELESS WAN
WAP GATEWAY
90
92
WAP ENABLED WIRELESS DEVICE

FIG. 6A



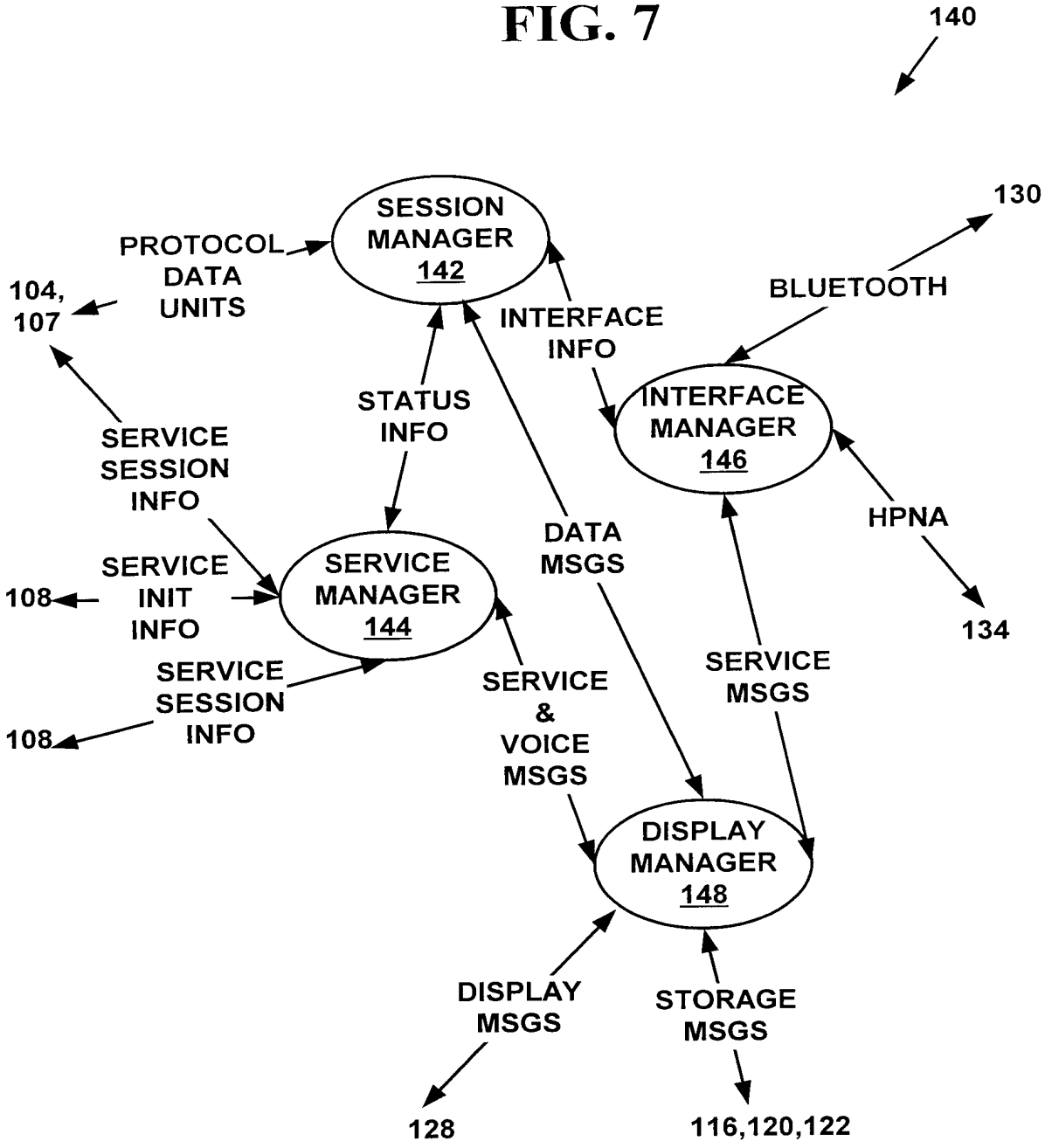
INTEGRATED PHONE-BASED HOME GATEWAY INTERFACE HARDWARE ARCHITECTURE

FIG. 6B



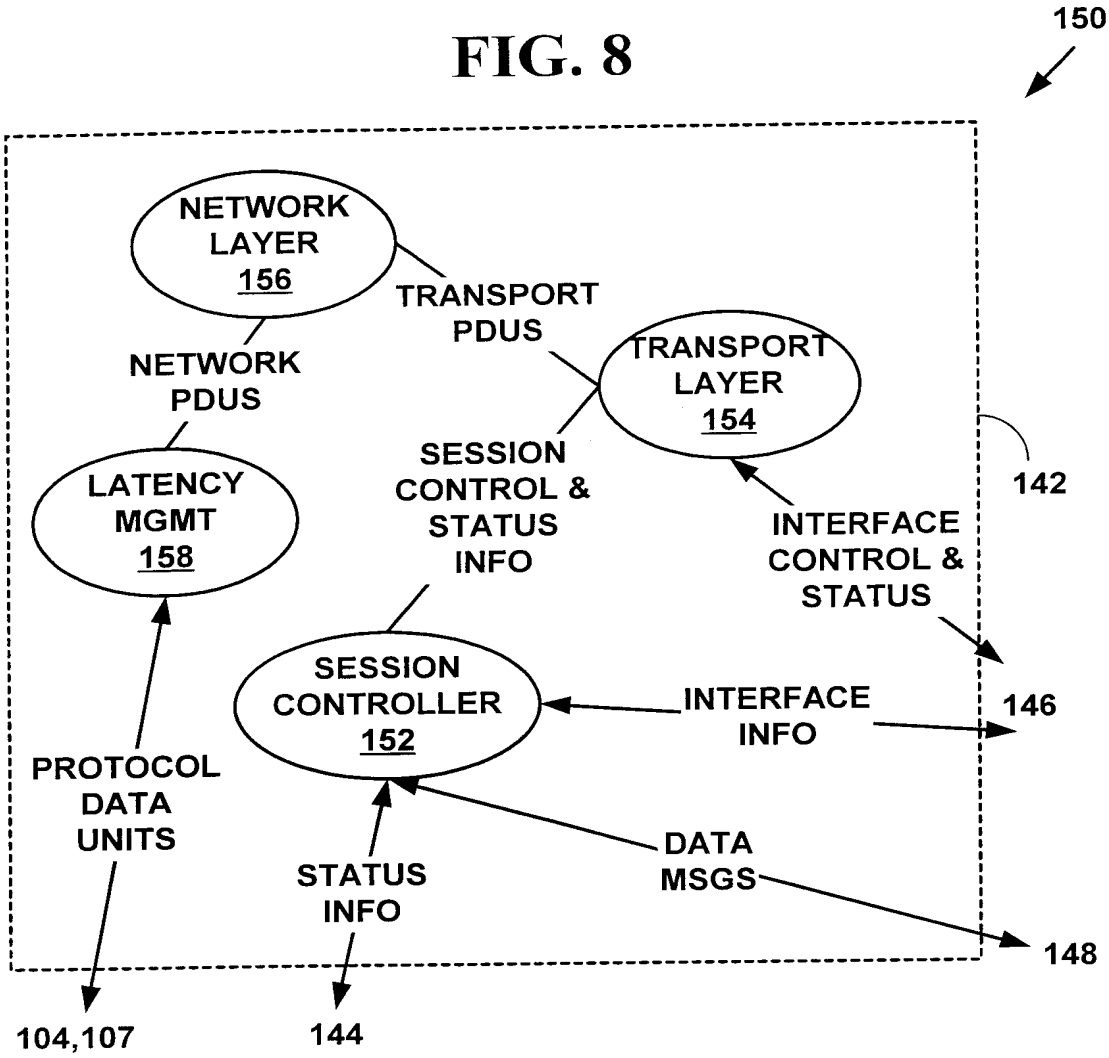
WIRELESS, INTEGRATED PHONE-BASED HOME GATEWAY INTERFACE HARDWARE ARCHITECTURE

FIG. 7



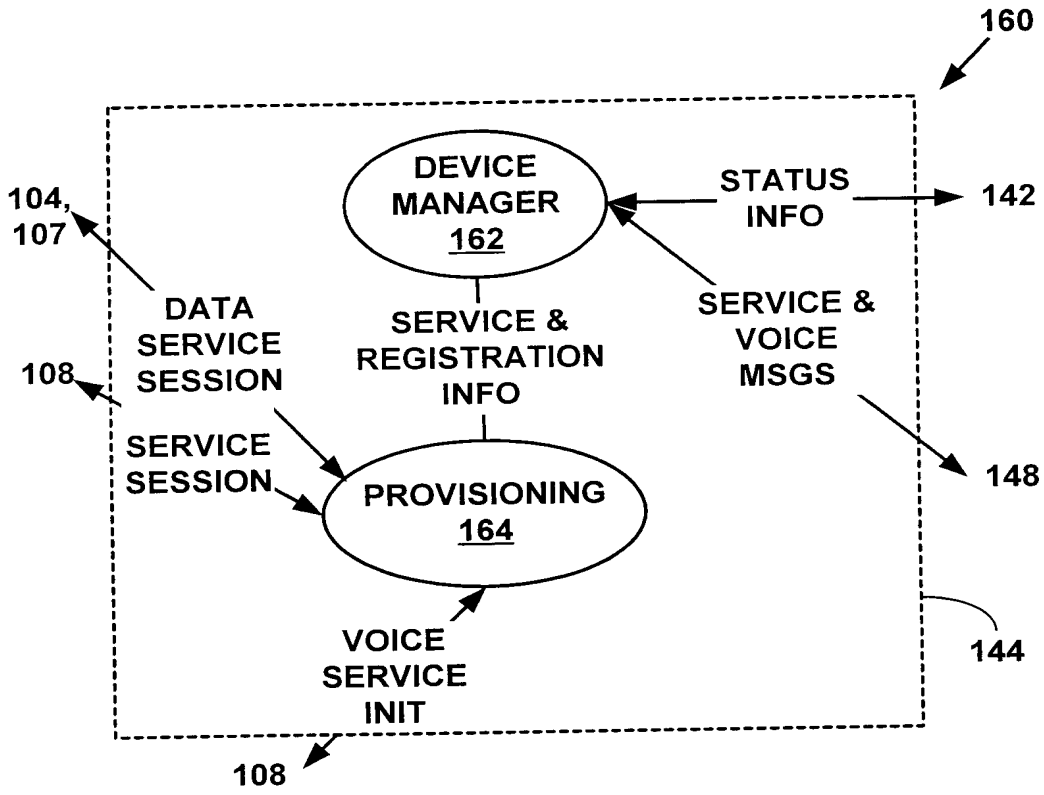
INTEGRATED PHONE-BASED HOME GATEWAY INTERFACE SOFTWARE ARCHITECTURE

FIG. 8



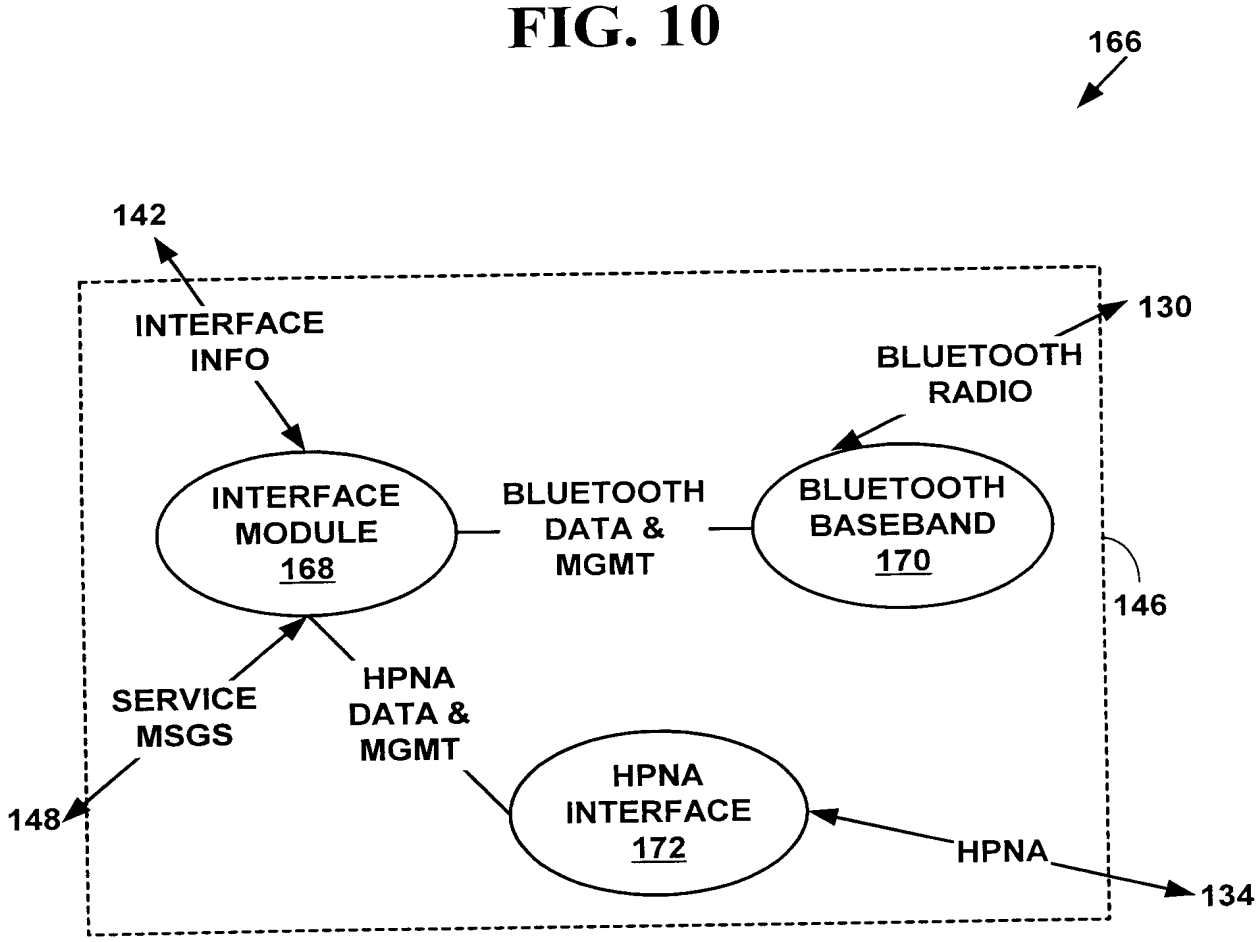
SESSION MANAGER SOFTWARE ARCHITECTURE

FIG. 9



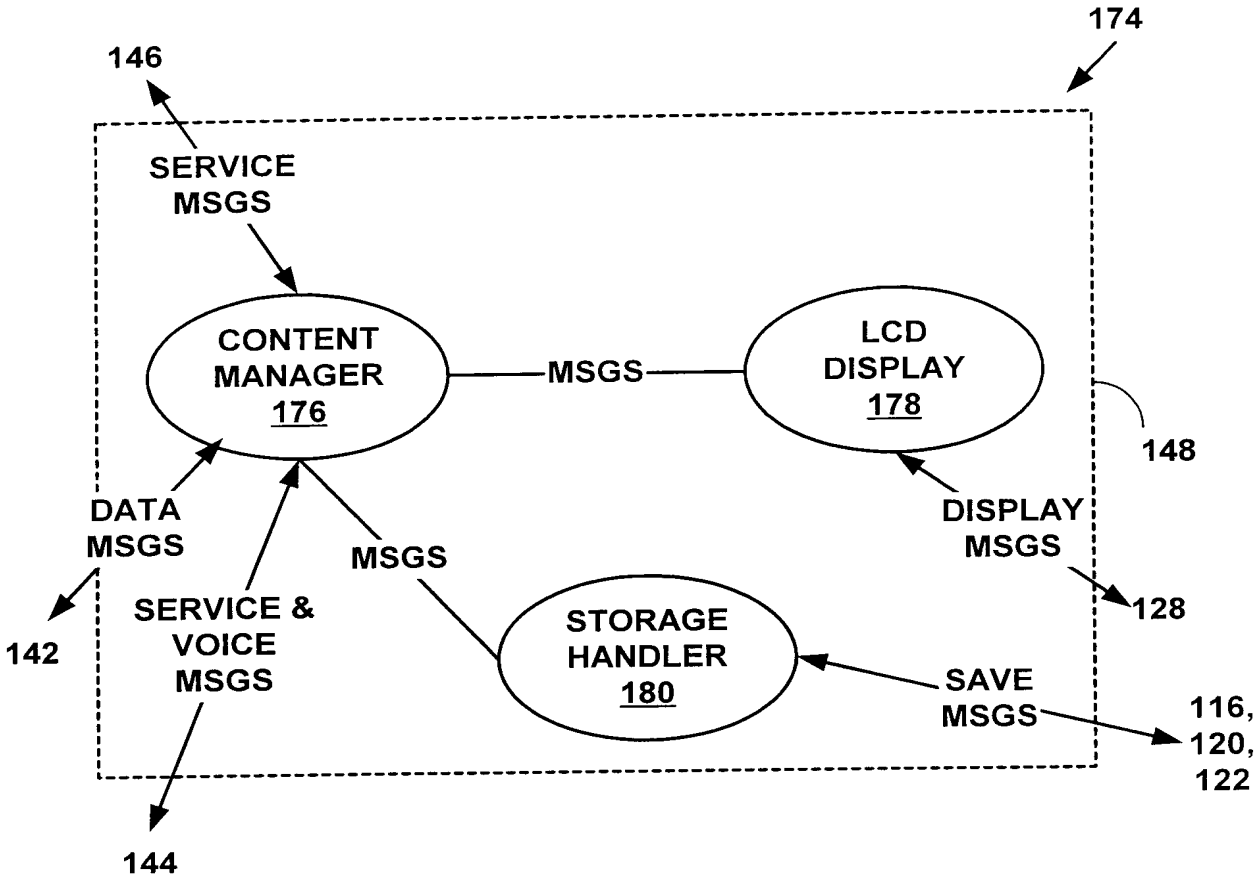
SERVICE MANAGER SOFTWARE ARCHITECTURE

FIG. 10



INTERFACE MANAGER SOFTWARE ARCHITECTURE

FIG. 11



DISPLAY MANAGER SOFTWARE ARCHITECTURE

FIG. 12

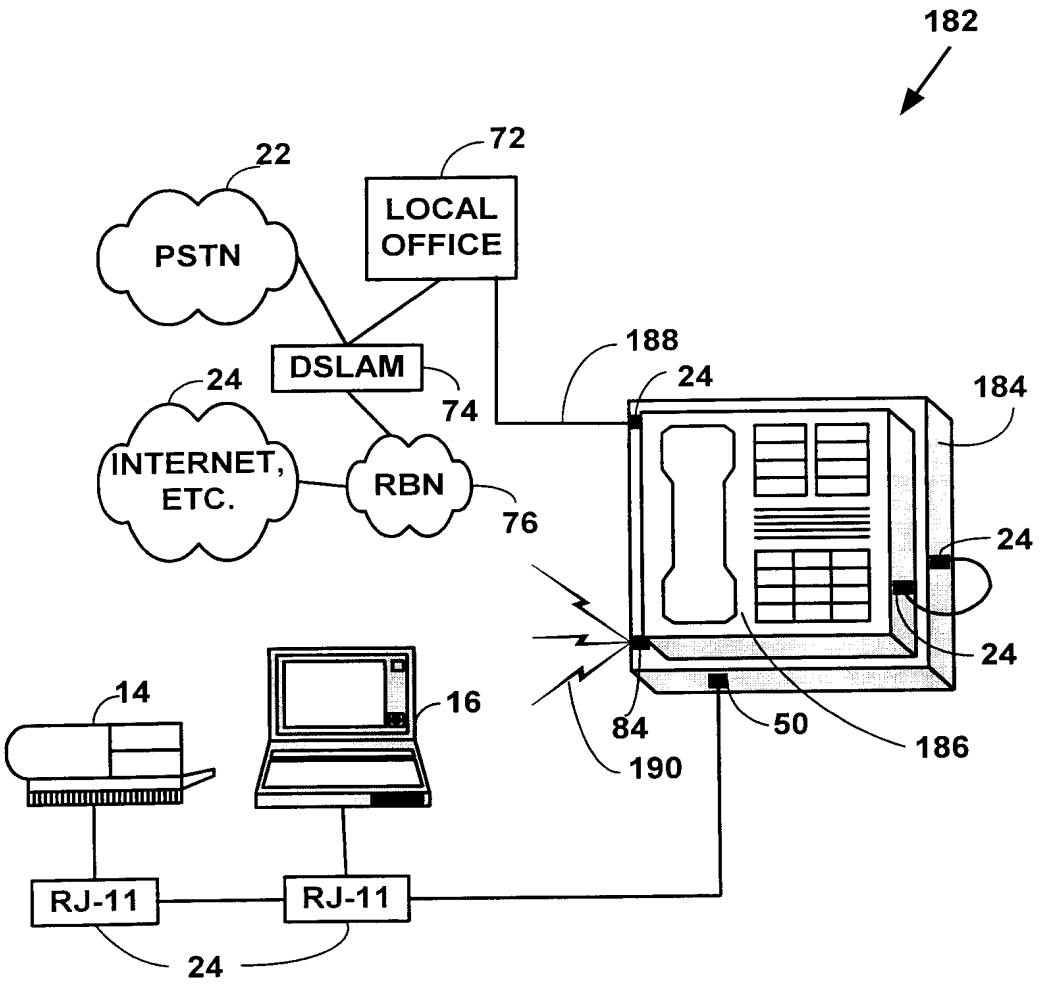
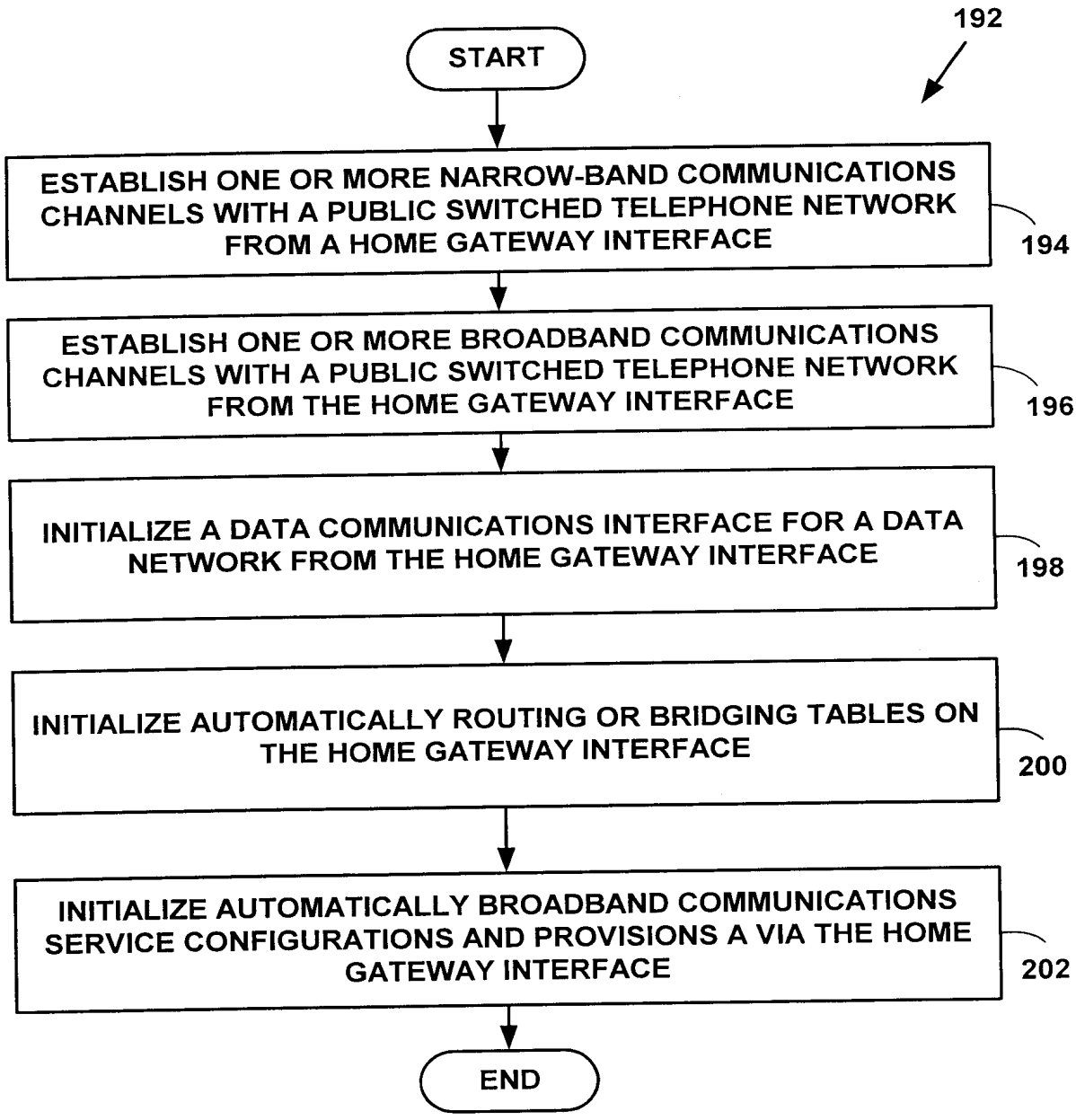

182
22
72
PSTN
LOCAL OFFICE
DSLAM
74
188
24
184
24
INTERNET, ETC.
RBN
76
24
24
14
16
84
50
186
190
RJ-11
RJ-11
24

FIG. 13


192
START
ESTABLISH ONE OR MORE NARROW-BAND COMMUNICATIONS CHANNELS WITH A PUBLIC SWITCHED TELEPHONE NETWORK FROM A HOME GATEWAY INTERFACE
194
ESTABLISH ONE OR MORE BROADBAND COMMUNICATIONS CHANNELS WITH A PUBLIC SWITCHED TELEPHONE NETWORK FROM THE HOME GATEWAY INTERFACE
196
INITIALIZE A DATA COMMUNICATIONS INTERFACE FOR A DATA NETWORK FROM THE HOME GATEWAY INTERFACE
198
INITIALIZE AUTOMATICALLY ROUTING OR BRIDGING TABLES ON THE HOME GATEWAY INTERFACE
200
INITIALIZE AUTOMATICALLY BROADBAND COMMUNICATIONS SERVICE CONFIGURATIONS AND PROVISIONS A VIA THE HOME GATEWAY INTERFACE
202
END

INTERNATIONAL SEARCH REPORT

Inte ional Application No
PCT/US 01/03177

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04L12/56 H04Q11/04

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04L

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 98 47251 A (NEXT LEVEL COMM) 22 October 1998 (1998-10-22) page 11, line 30 - line 35; figure 3 page 18, line 1 - line 5 figure 11B	1,28, 30-32
A	WO 99 12330 A (TRAVERTINE SYSTEMS INC) 11 March 1999 (1999-03-11) figure 2	1-37

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

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

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

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

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

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

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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
2 July 2001	13/07/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Gregori, S

1

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inte onal Application No
PCT/US 01/03177

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9847251 A	22-10-1998	AU 7111798 A	11-11-1998
		BR 9808530 A	13-06-2000
		EP 0976210 A	02-02-2000
		US 6208637 B	27-03-2001
WO 9912330 A	11-03-1999	US 6069899 A	30-05-2000
		AU 8916798 A	22-03-1999

PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : H04Q 7/30

A1

(11) International Publication Number: **WO 99/26437**

(43) International Publication Date: 27 May 1999 (27.05.99)

(21) International Application Number: PCT/US98/24370

(22) International Filing Date: 13 November 1998 (13.11.98)

(30) Priority Data:

60/065,797	14 November 1997 (14.11.97)	US
Not furnished	12 November 1998 (12.11.98)	US

(71) Applicant: ERICSSON INC. [US/US]; 7001 Development Drive, Research Triangle Park, NC 27709 (US).

(72) Inventors: LENZO, Michael; 314 Widdington Lane, Apex, NC 27502 (US). SHEN, Qun; 110 Connors Circle, Cary, NC 27502 (US).

(74) Agents: GRUDZIECKI, Ronald, L. et al.; Burns, Doane, Swecker & Mathis, L.L.P., P.O. Box 1404, Alexandria, VA 22313–1404 (US).

(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published

With international search report.

Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: FLEXIBLE FREQUENCY–TIME DIVISION DUPLEX IN RADIO COMMUNICATIONS SYSTEMS

(57) Abstract

A flexible channel architecture supports full–duplex, radio–frequency communication between a base station, such as a PWT or DECT base station, and a group of remote terminals. Downlink communication from the base to the terminals is by way of a first radio–frequency carrier, and uplink communication from the terminals to the base is by way of a first radio–frequency carrier, and uplink communication from the terminals to the base is by way of a second radio–frequency carrier. Each carrier is organized to provide an N–timeslot time–division multiple access data stream (N an integer), so that together the two carriers provide a 2N–timeslot system. Within each frame, data from the base to a terminal is sent on the first carrier during a first time slot, and data from the terminal to the base is sent on the second carrier during a second time slot, the first and second time slots being offset by a time offset which can vary across communications links. The disclosed system provides a unified architecture which allows a single time–division multiple–access hardware platform to efficiently and selectively support either time–division duplex or frequency–division duplex.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	**ES**	Spain	**LS**	Lesotho	**SI**	Slovenia
AM	Armenia	**FI**	Finland	**LT**	Lithuania	**SK**	Slovakia
AT	Austria	**FR**	France	**LU**	Luxembourg	**SN**	Senegal
AU	Australia	**GA**	Gabon	**LV**	Latvia	**SZ**	Swaziland
AZ	Azerbaijan	**GB**	United Kingdom	**MC**	Monaco	**TD**	Chad
BA	Bosnia and Herzegovina	**GE**	Georgia	**MD**	Republic of Moldova	**TG**	Togo
BB	Barbados	**GH**	Ghana	**MG**	Madagascar	**TJ**	Tajikistan
BE	Belgium	**GN**	Guinea	**MK**	The former Yugoslav Republic of Macedonia	**TM**	Turkmenistan
BF	Burkina Faso	**GR**	Greece			**TR**	Turkey
BG	Bulgaria	**HU**	Hungary	**ML**	Mali	**TT**	Trinidad and Tobago
BJ	Benin	**IE**	Ireland	**MN**	Mongolia	**UA**	Ukraine
BR	Brazil	**IL**	Israel	**MR**	Mauritania	**UG**	Uganda
BY	Belarus	**IS**	Iceland	**MW**	Malawi	**US**	United States of America
CA	Canada	**IT**	Italy	**MX**	Mexico	**UZ**	Uzbekistan
CF	Central African Republic	**JP**	Japan	**NE**	Niger	**VN**	Viet Nam
CG	Congo	**KE**	Kenya	**NL**	Netherlands	**YU**	Yugoslavia
CH	Switzerland	**KG**	Kyrgyzstan	**NO**	Norway	**ZW**	Zimbabwe
CI	Côte d'Ivoire	**KP**	Democratic People's Republic of Korea	**NZ**	New Zealand		
CM	Cameroon			**PL**	Poland		
CN	China	**KR**	Republic of Korea	**PT**	Portugal		
CU	Cuba	**KZ**	Kazakstan	**RO**	Romania		
CZ	Czech Republic	**LC**	Saint Lucia	**RU**	Russian Federation		
DE	Germany	**LI**	Liechtenstein	**SD**	Sudan		
DK	Denmark	**LK**	Sri Lanka	**SE**	Sweden		
EE	Estonia	**LR**	Liberia	**SG**	Singapore		

FLEXIBLE FREQUENCY-TIME DIVISION DUPLEX IN RADIO COMMUNICATIONS SYSTEMS

Field of the Invention

The present invention relates to radio communications systems, and more particularly to duplex schemes in time-division multiple-access (TDMA) systems.

Background of the Invention

Most time-division multiple-access wireless communications systems employ either a time-division duplex (TDD) scheme or a frequency-division duplex (FDD) scheme to separate uplink and downlink transmissions. Since both duplex schemes provide certain advantages and disadvantages, both schemes are routinely utilized in wireless communications applications.

For example, in the Personal Wireless Telecommunication (PWT) standard, time-division multiple-access with time-division duplex is used for frequency planning as well as signal packet and time slot assignment. Such a time-division multiple-access / time-division duplex scheme is well suited for many business wireless communication applications (e.g., small-campus systems with micro or pico cells).

On the other hand, time-division multiple-access with either time-division duplex or frequency-division duplex can be preferable for licensed Personal Communication Service (PCS) frequency bands, depending upon customer demands and marketplace requirements. In other words, since the structure of a Personal Communications Service system is primarily determined by a service provider having acquired a portion of the frequency spectrum, the technology and

frequency usage implemented in such a system is ultimately driven by customer demand as well as legal and practical constraints. While a first customer may request a time-division multiple access / time-division duplex system for a particular business wireless application, a second customer may thereafter demand a time-division multiple access / frequency-division duplex system for a wireless local loop application.

Thus, service providers are often required to convert between duplex schemes. Converting between schemes, however, typically results in duplicated effort and therefore wastes significant time and resources. For example, since the conventional time-division duplex and frequency-division duplex schemes are fundamentally different, it generally is not feasible to use a common hardware platform for both types of system. As a result, two development teams are typically assigned, and two separate product lines are usually established, to provide for both time-division duplex and frequency-division duplex implementations.

Thus, there is a need for a flexible duplex scheme which will allow a communications system to be adapted to satisfy varying customer needs without requiring modification of basic system hardware architecture.

Summary of the Invention

The present invention fulfills the above-described and other needs by providing a flexible division duplex mechanism in a time-division multiple-access communications system. More specifically, the disclosed system utilizes a mixed, or hybrid, division duplex mechanism such that uplink and downlink transmissions are separated in frequency while time slots associated with transmission and reception are also separated in time. The hybrid duplex scheme, referred to herein as frequency-time division duplex (FTDD), allows alternative division

duplex mechanisms to be selectively implemented within a communications system without requiring modification of the basic system hardware architecture.

The frequency-time division duplex system of the present invention provides the advantages of low power consumption and reduced hardware complexity normally associated with conventional time-division multiple-access / time-division duplex systems, while also providing improved interference characteristics by separating uplink and downlink frequency bands. Further, the proposed system allows a single hardware platform to be used for multiple technologies and applications. For example, base stations designed for a business wireless system based on time-division multiple-access / time-division duplex technology can also be used, with minor changes, for wireless local loop (WLL) applications conventionally based on time-division multiple-access / frequency-division duplex technology. Thus, embodiments of the invention allow the non-recurring engineering costs typically associated with technology and product development to be substantially reduced. As a result, development schedules and production cycles for implemented systems can be shortened, and service and product providers can respond more quickly to customer and market demand.

According to an exemplary embodiment, a base station includes a transceiver configured to transmit downlink communications signals to mobile stations via a first carrier frequency and to receive uplink communications signals from the mobile stations via a second carrier frequency, the downlink and uplink communications signals being transmitted and received via successive time division multiple access frames, each frame including a plurality of time slots. For each active communications link between said the station and a particular mobile station, a first time slot in each frame is allocated for downlink communication to the particular mobile station and a second time slot in each frame is allocated for uplink communication from the particular mobile station,

the first and second allocated time slots being separated in time by a fixed time offset. Advantageously, a duration of the fixed time offset can be different for each active communication link (e.g., for each call established). For example, where each frame is of duration T and includes 2N time slots, each time slot being of duration T/2N, the fixed time offset for each active communication link can be $\Delta T = (T/2N)*m$, where m is an integer in the range from 1 to 2N-1.

According to an alternative embodiment, a base station includes a transceiver configured to transmit downlink communications signals to mobile stations via a first carrier frequency and to receive uplink communications signals from the mobile stations via a second carrier frequency, the downlink and uplink communications signals being transmitted and received via successive time division multiple access frames, each frame including a plurality of time slots. Advantageously, a downlink signal processing path and an uplink signal processing path of the transceiver share common signal processing components. For example, the shared signal processing components can include one or more of a filter, a local oscillator and a modem.

The above described and additional features of the present invention are explained in greater detail hereinafter with reference to the illustrative examples shown in the accompanying drawings. Those skilled in the art will appreciate that the described embodiments are provided for purposes of illustration and understanding and that all equivalent embodiments are contemplated herein.

Brief Description of the Drawings

Figure 1 depicts an exemplary wireless communications system in which the teachings of the present invention can be implemented.

Figure 2A depicts a base station and a mobile station communicating in accordance with a conventional time-division multiple-access / time-division duplex scheme.

Figure 2B depicts an exemplary time slot arrangement in a conventional time-division multiple-access / time-division duplex system.

Figure 3A depicts a base station and a mobile station communicating in accordance with a conventional time-division multiple-access / frequency-division duplex scheme.

Figure 3B depicts an exemplary time slot arrangement in a conventional time-division multiple-access / frequency-division duplex system.

Figure 4A depicts a base station and a mobile station communicating in accordance with a flexible time-division multiple-access / frequency-time division duplex scheme according to the present invention.

Figure 4B depicts an exemplary time slot arrangement in a flexible time-division multiple-access / frequency-time division duplex system according to the invention.

Figure 4C depicts an alternative time slot arrangement in a flexible time-division multiple access / frequency-time division duplex system according to the invention.

Figure 5 is a block diagram of an exemplary transceiver constructed in accordance with the present invention.

Detailed Description of the Invention

Figure 1 depicts a wireless communications system 100 in which the teachings of the present invention can be implemented. As shown, the exemplary

wireless system includes ten cells or coverage areas C1-C10, ten base stations B1-B10, a timing master TM and ten mobile stations M1-M10. Such a wireless system can be constructed, for example, in accordance with the Personal Wireless Telecommunication (PWT) standard, and can therefore be used, for example, to provide mobile communications within a building or throughout a campus including many buildings and open areas. Generally, a wireless system can include far more than ten cells, ten base stations and ten mobile stations; however, ten of each is sufficient for illustrative purposes.

As shown, one or more base stations can be situated in each of the cells. Although Figure 1 shows the base stations located toward the cell centers, each base station can instead be located anywhere within a cell. Base stations located toward a cell center typically employ omni-directional antennas, while base stations located toward a cell boundary typically employ directional antennas. The timing master TM, or radio exchange, maintains timing synchronization between the base stations as is known in the art. The timing master can be connected to the base stations by cable, radio links, or both.

Each base station and each mobile station includes a transceiver for transmitting and receiving communications signals over the air interface. Typically, the base and mobile stations communicate using a form of time, frequency or code division multiple access (i.e., TDMA, FDMA or CDMA) as is known in the art. As the mobile stations move within a cell and from cell to cell, communication with at least one base station is always possible. As a result, mobile station users are able to place, receive and conduct calls anywhere within the overall system coverage area.

To illuminate the features and advantages of the hybrid, frequency-time division duplex (FTDD) scheme of the present invention, conventional time-division duplex (TDD) and frequency-division duplex (FDD) schemes are

described hereafter with respect to Figures 2A, 2B, 3A and 3B. Without loss of generality, the channel definition in the Personal Wireless Telecommunication standard is used to illustrate a conventional time-division multiple-access (TDMA) / TDD system. Although channel definitions can differ between standards, the underlying multiplexing and duplexing concepts remain the same.

Figure 2A depicts uplink and downlink communication according to a conventional TDD scheme. As shown, signals transmitted from a TDD base station B20 to a TDD handset M20, and those transmitted from the TDD handset M20 to the TDD base station B20, are separated in time. If, as shown in Figure 2B, a predetermined time interval T represents the duration of a single TDMA / TDD frame T20, then the separation between uplink and downlink transmissions is typically one half of the predetermined time interval T, or T/2. In a Personal Wireless Telecommunications system, each frame is 10 milliseconds in duration and includes twenty-four data slots. Within a data frame, twelve time slots are used for transmission (from the TDD base station B20 to the TDD handset M20), and the remaining twelve time slots are used for reception (i.e., transmission from the TDD handset M20 to the TDD base station B20). Though transmissions and receptions are separated by certain fixed (or variable) time, they share a common frequency band. The channel of such a system is therefore defined by a predetermined frequency and time reference pair.

Such TDMA / TDD systems are widely adopted in various wireless communications applications. An advantage of these systems is that of frequency efficiency, as both uplink and downlink transmissions use a common frequency carrier. Additionally, since transmissions and receptions are separated in time, a single hardware path (including filters, local oscillators, etc.) can be used for both functions. As a result, TDD systems are relatively low cost. Also, since receiving hardware can be turned off during transmission (and transmitting

hardware can be turned off during reception), TDD systems consume relatively little power.

By way of contrast, frequency-division duplex (FDD) systems require separate frequency bands for uplink and downlink communications. This results from the fact that the receive and transmit operations are executed simultaneously in time at different frequencies. A channel in a FDD system is thus defined by the frequency of operation. Figure 3A depicts uplink and downlink communications between a conventional FDD base station B30 and a conventional FDD handset M30, and Figure 3B shows an exemplary TDMA / FDD frame T30. Since both transmit and receive are accomplished simultaneously, separate hardware paths are required in both base stations and terminals. As a result, FDD systems are typically higher cost and consume more power as compared to conventional TDD systems. However, FDD systems provide relatively little cross-channel interference and are sometimes preferred from an inter-system perspective. In other words, a FDD scheme may be required to make a system compatible with proximate systems using an adjacent portion of the frequency spectrum. As a result, FDD systems have also been widely adopted in wireless communications applications.

Though both TDD and FDD systems do provide certain advantages, neither is ideally suited for all wireless communications applications. Further, as described above, the fundamental differences between TDD and FDD make it difficult to adapt a system configured specifically for one or the other to conform with a particular application need. Advantageously, the present invention provides a hybrid, frequency-time division duplex (FTDD) scheme which provides certain of the advantages of both types of conventional system and which further allows a single hardware configuration to be readily adapted to suit virtually any wireless communications application.

To illustrate the FTDD system of the present invention, a TDMA data frame is defined as including 2N time slots (N an integer) in which N slots are reserved for downlink transmission from a base station to a portable and the remaining N slots are reserved for uplink transmission from a portable to a base station. Assuming, without loss of generality, that the time durations of uplink and downlink slots are u and d, respectively, then the duration T of a single frame is given by:

$$N(d+u) = T. \quad (1)$$

Since transmit and receive time slots are usually of the same time duration (i.e., d = u), half of the frame, or T/2, is usually reserved for downlink transmission and the remaining half of the frame is usually reserved for uplink transmission.

According to the invention, a duplex link is set up with both frequency and time separation. Specifically, the uplink frequency f_u is separated from the downlink frequency f_d by a pre-determined frequency offset Δf as follows:

$$f_u = f_d - \Delta f \quad (2)$$

or

$$f_u = f_d + \Delta f. \quad (3)$$

Equations (2) and (3) describe the frequency-division duplex aspect of the system. In addition to frequency separation, time separation is also provided. Specifically, the uplink and downlink communications between a base station and a portable are also separated by a fixed time offset. The specific time offset is based on a frame length of 2N slots with a period of T/2N seconds/slot. The time duplexing can then be defined generally for an uplink packet as $S_u(t_1)$ and for a downlink packet as $S_d(t_1 \pm \Delta T)$, where t_1 is defined as the start time of the uplink packet and

$$\Delta T = \text{time offset} = (T/2N) * m \qquad (1 \leq m \leq 2N - 1) \quad (4)$$

(m being an integer which, according to the invention, can be different for each communications link established between a base station and a mobile station). The combined time-division and frequency-division aspects of the system can thus be described generally for the uplink packet as $S_u(t_1,f_u)$ and for the downlink packet as $S_d(t_1+\Delta T,f_u\pm\Delta F)$ or $S_d(t_1-\Delta T,f_u\pm\Delta F)$.

Thus, according to the invention, uplink and downlink transmissions occur at separate frequencies and on allocated time slot pairs, one time slot pair being allocated for each active link established between a base station and a mobile station. For each active link, the allocated uplink time slot either precedes or follows the corresponding allocated downlink time slot, within each TDMA frame, by the time offset ΔT. The allocated time slot pairing is then maintained for the duration of the link.

Selection of the uplink and downlink time slots for each link can be based, for example, on a channel selection process which determines the best link arrangement. Determination of the best link arrangement can in turn be based, for example, on an assessment of adjacent-channel and/or co-channel interference existing at the time of call setup. Advantageously, either the base station or the mobile station can be responsible for time slot selection and allocation. For example, the base station can select the uplink time slot based on interference conditions at the base station, while the mobile station selects the downlink time slot based on conditions at the mobile. Alternatively, the base station can select both uplink and downlink time slots, either independently or on command from the mobile stations.

Note that, because each base station is not limited to a particular portion of a frame for uplink or downlink transmission, a single base station can be used to support portables throughout a particular coverage area. In other words, since each slot within each TDMA frame can be allocated for either uplink or downlink

transmission, and since the time offset between an allocated uplink and downlink time slot pair can be different for each active link, a single base station can communicate with a mobile station using any available time slot arrangement which may be preferable for the mobile. Of course, a single base station can support at most N duplex links simultaneously (assuming 2N time slots per TDMA frame), and if traffic conditions warrant it, a second base station can be added in the coverage area to provide for full time and spectral efficiency (i.e., both base stations together can support 2N simultaneous conversations).

Figure 4A depicts a FTDD base station B40 and a FTDD terminal M40 communicating in accordance with the above described TDMA / FTDD scheme. As shown, uplink and downlink communications are separated in both frequency and time. Figure 4B then depicts an exemplary combination of time slot pairings within a TDMA / FTDD data frame T40a for a single base station. Those skilled in the art will appreciate that the combination of pairings in Figure 4B is but one example and that every possible combination of pairings is contemplated by the invention. Furthermore, although each uplink and downlink pair in Figure 4B utilizes the same time offset (i.e., $\Delta T = T/2$), those skilled in the art will realize that each pair can use a different time offset as described above. However, assuming for purposes of illustration that the depicted time slot pairing is in effect for a first base station, Figure 4C then depicts a complimentary time slot pairing which can be used, for example, by a second co-located base station without causing interference with the first base station. Together, the first and second co-located base stations provide full time and spectral efficiency for the coverage area in which they are situated (i.e., each frequency in each time slot within each TDMA frame is utilized for either uplink or downlink communication).

According to the invention, appropriate base station synchronization is used to enable a handset to conduct communication with any base station in an

overall system. As is known in the art, such base station synchronization can be implemented via a timing master TM such as that depicted in Figure 1. In implementations in which the time offset ΔT between paired uplink and downlink time slots is variable across communications links (i.e., where each active communication link can potentially utilize a different time offset), appropriate overhead signaling is required between base stations to implement handovers (e.g., information identifying the presently allocated pair is passed between base stations during a handover). However, in implementations in which each active link utilizes a common time offset ΔT, the overhead can be significantly reduced. See, for example, copending U.S. Patent Application No. _____, entitled "Fixed Frequency-Time Division Duplex in Radio Communications Systems" filed on even date herewith, which is incorporated herein in its entirety by reference. Those skilled in the art will appreciate that the above described synchronization can be achieved via straightforward software modification of existing systems.

An exemplary embodiment of the above described TDMA / FTDD system utilizes the U.S. Personal Communication Service band definition for uplink and downlink frequencies combined with the PWT(E) time-division definition. The embodiment utilizes a fixed $\Delta T = T/2$ for all duplex links and operates with the following parameters:

$\Delta T = T/2 = 5$ msec
$\Delta F = 80$ MHz
$T/2N = 416.667$ μsec
$S_u (t_1, f_u)$
$S_d (t_1 \pm 5$ msec, $f_u + 80$ MHz).

As noted above, the TDMA / FTDD scheme of the invention provides, among other advantages, the power savings benefits typically associated with conventional TDMA / TDD systems. For example, since uplink and downlink transmissions are separated in time, the disclosed FTDD scheme enables the

transmit and receive paths of a base station or mobile station transceiver to share certain components. This aspect of the invention is depicted in Figure 5.

In Figure 5, an exemplary base station transceiver 500 includes a transmit signal processing path and a receive signal processing path. As shown, the transmit processing path includes first and second transmit blocks 510, 520, first and second transmit / receive blocks 530, 540, a local oscillator 550, a duplexor 560 and an antenna 570. Additionally, the receive signal processing path includes the local oscillator 550, the duplexor 560 and the antenna 570, as well as first and second receive blocks 580, 590.

The first transmit block 510 can include, for example, a conventional upconverter, and the second transmit block 520 can include, for example, power amplifiers and mixers. Additionally, the first receive block 580 can include, for example, low noise amplifiers (LNAs) and mixers, and the second receive block 590 can include, for example, a conventional downcoverter and limiter. The first transmit / receive block 530 can include, for example, a modem, and the second transmit / receive block 540 can include, for example, bandpass filters. The duplexor 560 can be, for example, a two-way filter or a switch.

During downlink transmission, the duplexor 560 couples the antenna 570 to the second transmit block 520 and isolates the antenna 570 from the first receive block 580. Baseband transmit signals are processed by the first transmit / receive block 530 and are then upconverted, filtered and amplified in blocks 510, 540, 520, respectively, prior to transmission via the antenna 570. Conversely, during uplink reception, the duplexor 560 couples the antenna 570 to the first receive block 580 and isolates the antenna 570 from the second transmit block 520. Radio frequency signals are received at the antenna 570 and then amplified, filtered and downconverted in blocks 580, 540 and 590, respectively, prior to being processed by the first transmit / receive block 530. Because the transmit

and receive processing paths share certain components (i.e., those components in the first and second transmit / receive blocks 530, 540, which are typically very expensive), a base station transceiver constructed in accordance with the invention can be made smaller and less costly as compared to conventional TDMA / FDD transceivers.

In sum, the present invention teaches a time-division multiple-access system including a flexible frequency-time division duplex mechanism. The disclosed system enables existing time-division multiple-access / time-division duplex hardware to be utilized for applications where dual duplex frequency bands are required. The system maintains the flexibility of either using the same frequency band or separate bands for uplink and downlink communication. In each case, time-division duplex capability is maintained such that hardware cost and power consumption is minimized.

Those skilled in the art will appreciate that the present invention is not limited to the specific exemplary embodiments which have been described herein for purposes of illustration. The scope of the invention, therefore, is defined by the claims which are appended hereto, rather than the foregoing description, and all equivalents which are consistent with the meaning of the claims are intended to be embraced therein.

We Claim:

1. A base station for use in a wireless communications system including a plurality of mobile stations, said base station comprising:

a transceiver configured to transmit downlink communications signals to said mobile stations via a first carrier frequency and to receive uplink communications signals from said mobile stations via a second carrier frequency, the downlink and uplink communications signals being transmitted and received via successive time division multiple access frames, each frame including a plurality of time slots,

wherein, for each active communications link between said base station and a particular mobile station, a first time slot in each frame is allocated for downlink communication to the particular mobile station and a second time slot in each frame is allocated for uplink communication from the particular mobile station, the first and second allocated time slots being separated in time by a fixed time offset, and

wherein a duration of the fixed time offset can be different for each active communications link.

2. A base station according to claim 1, wherein each time slot in the time division multiple access frames can be allocated for either one of downlink and uplink communication.

3. A base station according to claim 1, wherein said base station is configured to select, for each active communication link, the time slot which is allocated for uplink communications.

4. A base station according to claim 1, wherein said base station is configured to select, for each active communication link, the time slots which are allocated for uplink and downlink communications.

5. A base station according to claim 1, wherein, for each active communication link, said base station is configured to select, on command from a mobile station, the time slots which are allocated for uplink and downlink communications.

6. A base station according to claim 1, wherein each frame is of a duration T and includes a number, 2N, of time slots, each time slot being of a duration T/2N, and wherein the fixed time offset for each active communication link is given by $\Delta T = (T/2N)*m$, m being an integer in a range from 1 to 2N-1.

7. A wireless communications system, comprising:

a plurality of mobile stations; and

at least one base station configured to transmit downlink communications signals to said mobile stations via a first carrier frequency and to receive uplink communications signals from said mobile stations via a second carrier frequency, the downlink and uplink communications signals being transmitted and received via successive time division multiple access frames, each frame including a plurality of time slots,

wherein, for each active communications link between a particular base station and a particular mobile station, a first frame time slot is allocated for downlink communication from the particular base station to the particular mobile station and a second frame time slot is allocated for uplink communication from

the particular mobile station to the particular base station, the first and second allocated time slots being separated in time by a fixed time offset, and

wherein a duration of the fixed time offset can be different for each active communications link.

8. A communications system according to claim 7, wherein each time slot in a time division multiple access frame can be allocated for either one of downlink and uplink communication.

9. A communications system according to claim 7, wherein base stations are configured to select, for each active communication link with a mobile station, the time slots which are allocated for downlink and uplink communications.

10. A communications system according to claim 7, wherein mobile stations are configured to select the time slots which allocated for downlink and uplink communications.

11. A communications system according to claim 7, wherein mobile stations are configured to select the time slots allocated for downlink communication and base stations are configured to select the time slots allocated for uplink communication.

12. A communications system according to claim 7, wherein each time division multiple access frame is of a duration T and includes a number, 2N, of time slots, each time slot being of a duration T/2N, and wherein the fixed time offset for each active communication link between a base station and a mobile

station is given by $\Delta T = (T/2N)*m$, m being an integer in a range from 1 to 2N-1.

13. A communications system according to claim 7, wherein two base stations are co-located to provide complete time and spectral coverage for a particular system coverage area.

14. A method for conducting communications between a base station and mobile stations in a wireless communications system, comprising the steps of:

transmitting downlink and uplink communications signals between the base station and the mobile stations using successive time division multiple access frames, each frame including a plurality of time slots, wherein the downlink communications signals are transmitted from the base stations to the mobile stations using a first carrier frequency and the uplink communications signals are transmitted from the mobile stations to the base station using a second carrier frequency; and

for each active communications link between the base station and a particular mobile station,

allocating a first time slot in each frame for downlink communication to the particular mobile station,

allocating a second time slot in each frame for uplink communication from the particular mobile station, and

selecting a duration of a fixed time offset between the first and second allocated time slots.

15. A method according to claim 14, further comprising the step of co-locating the base station with a similarly constructed second base station to thereby provide complete time and spectral coverage for the mobile stations.

16. A base station for use in a wireless communications system including a plurality of mobile stations, said base station comprising:

a transceiver configured to transmit downlink communications signals to said mobile stations via a first carrier frequency and to receive uplink communications signals from said mobile stations via a second carrier frequency, the downlink and uplink communications signals being transmitted and received via successive time division multiple access frames, each frame including a plurality of time slots,

wherein a downlink signal processing path and an uplink signal processing path of said transceiver share common signal processing components.

17. A base station according to claim 16, wherein said shared signal processing components include at least one of a filter, a local oscillator and a modem.

18. A base station according to claim 16, wherein, for each active communications link between said base station and a particular mobile station, a first time slot in each frame is allocated for downlink communication to the particular mobile station and a second time slot in each frame is allocated for uplink communication from the particular mobile station, the first and second allocated time slots being separated in time by a fixed time offset.

19. A base station according to claim 18, wherein each time slot in the time division multiple access frames can be allocated for either one of downlink and uplink communication.

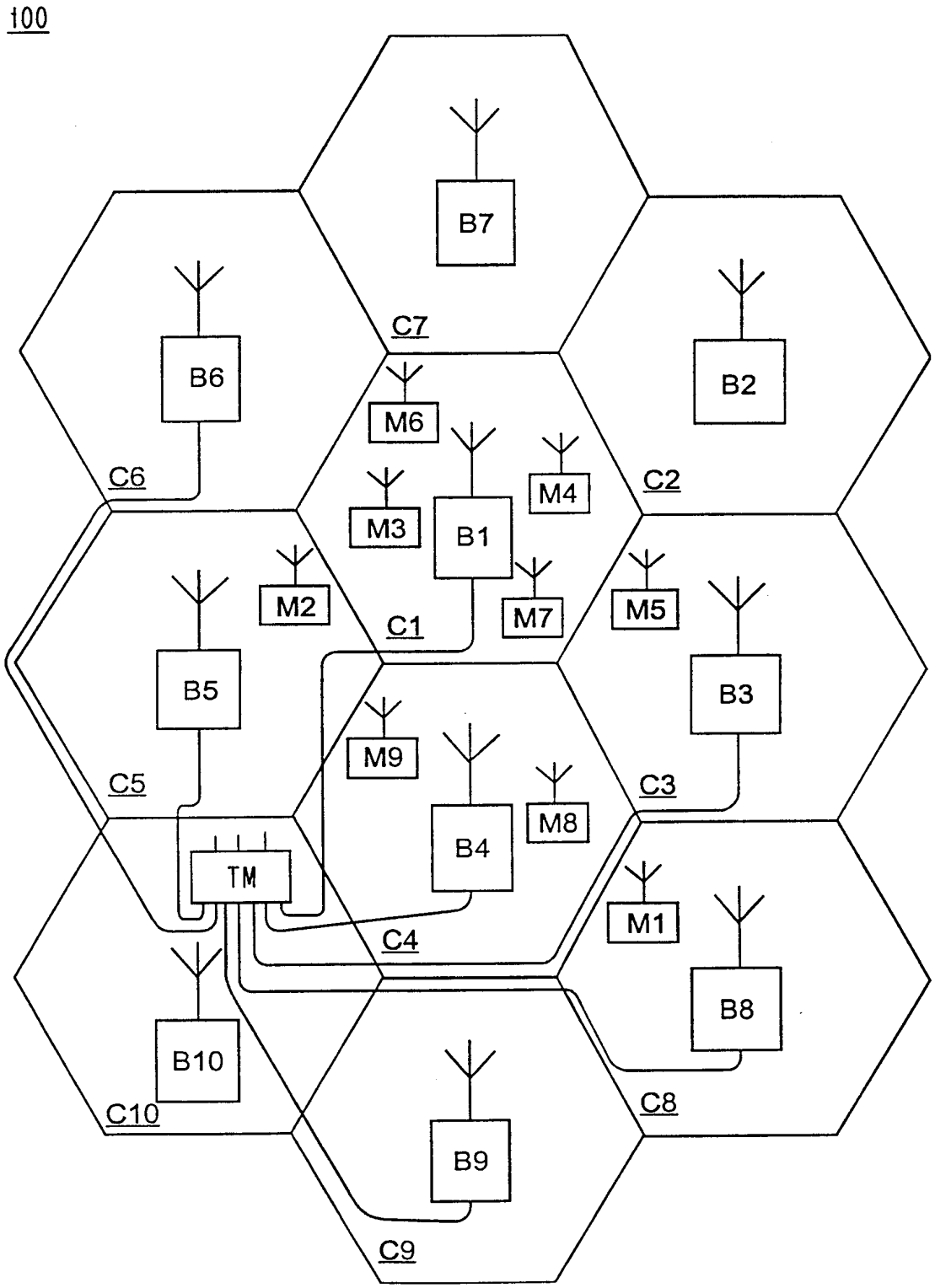
20. A base station according to claim 18, wherein a duration of the fixed time offset can be different for each active communications link.

21. A base station according to claim 20, wherein each frame is of a duration T and includes a number, 2N, of time slots, each time slot being of a duration T/2N, and wherein the duration of the fixed time offset for each active communications link is given by $\Delta T = (T/2N)*m$, m being an integer in a range from 1 to 2N-1.

22. A base station according to claim 18, wherein a duration of the fixed time offset is the same for each active communications link.

23. A base station according to claim 22, wherein each frame is of a duration T and includes a number, 2N, of time slots, each time slot being of a duration T/2N, and wherein the duration of the fixed time offset for each active communications link is T/2.

Fig. 1


100
B7
B6
B2
C7
M6
C6
M4
C2
M3
B1
M2
M7
M5
C1
B5
B3
M9
C5
C3
M8
B4
TM
M1
C4
B8
B10
C8
C10
B9
C9

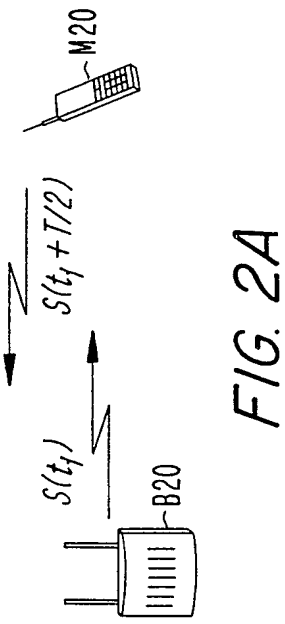

M20
$S(t_1+T/2)$
$S(t_1)$
B20

FIG. 2A

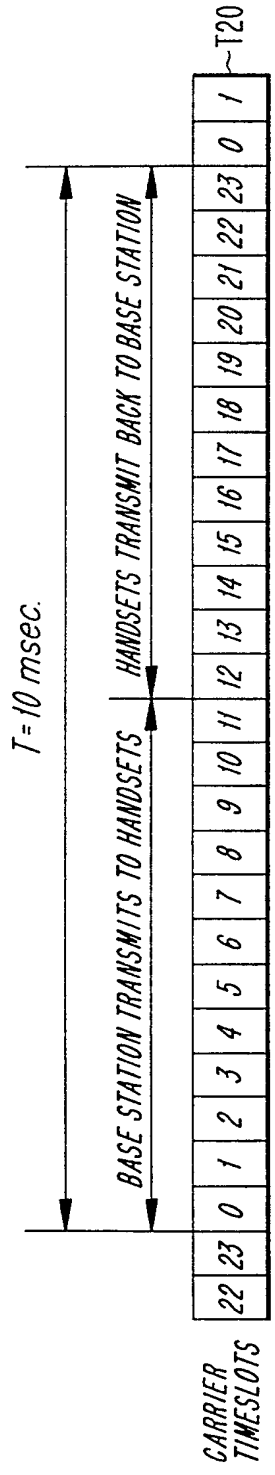

T20
1
0
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
23
22
T = 10 msec.
HANDSETS TRANSMIT BACK TO BASE STATION
BASE STATION TRANSMITS TO HANDSETS
CARRIER TIMESLOTS

FIG. 2B

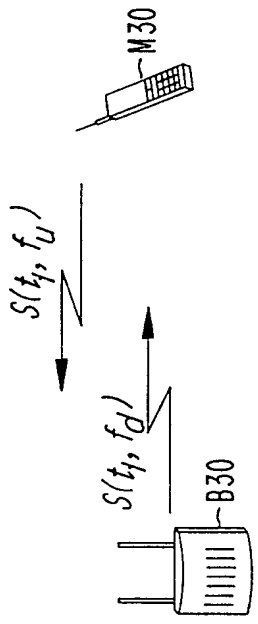

M30
S(t, f_U)
S(t, f_D)
B30

FIG. 3A

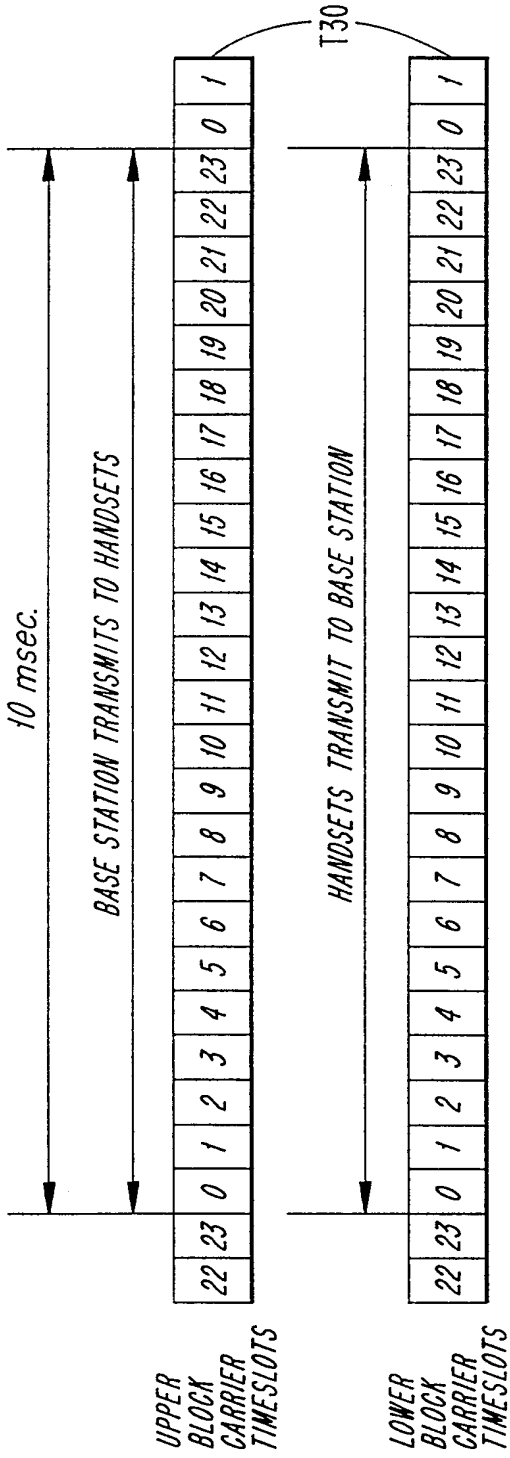

T30
10 msec.
BASE STATION TRANSMITS TO HANDSETS
HANDSETS TRANSMIT TO BASE STATION
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
UPPER BLOCK CARRIER TIMESLOTS
LOWER BLOCK CARRIER TIMESLOTS

FIG. 3B

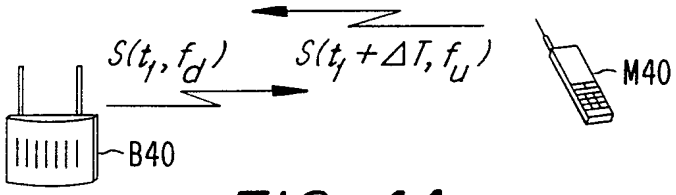


FIG. 4A

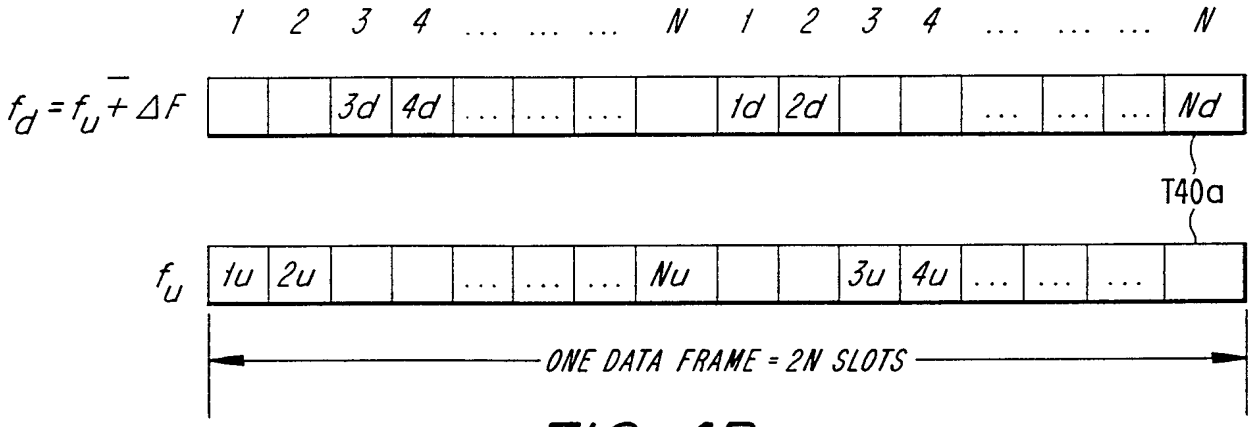


FIG. 4B

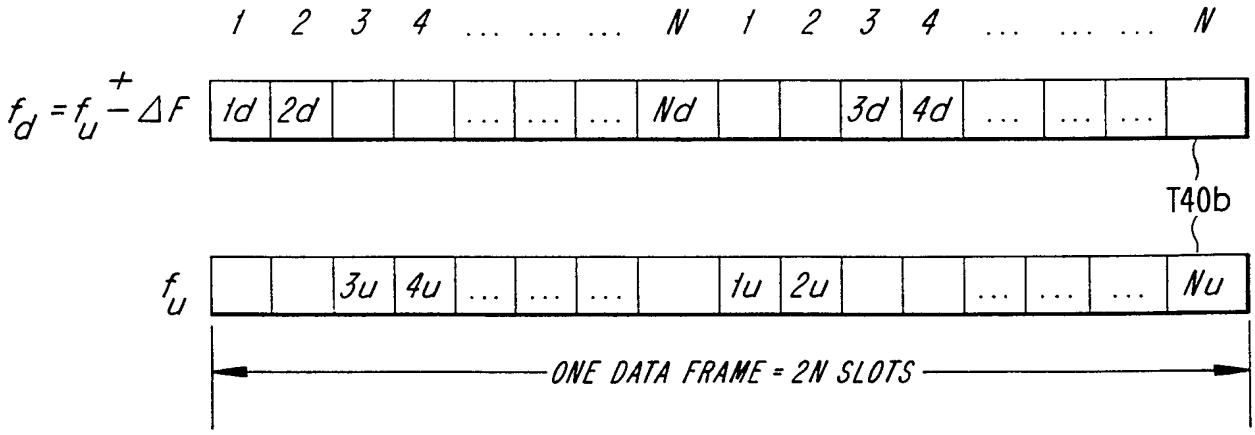


FIG. 4C

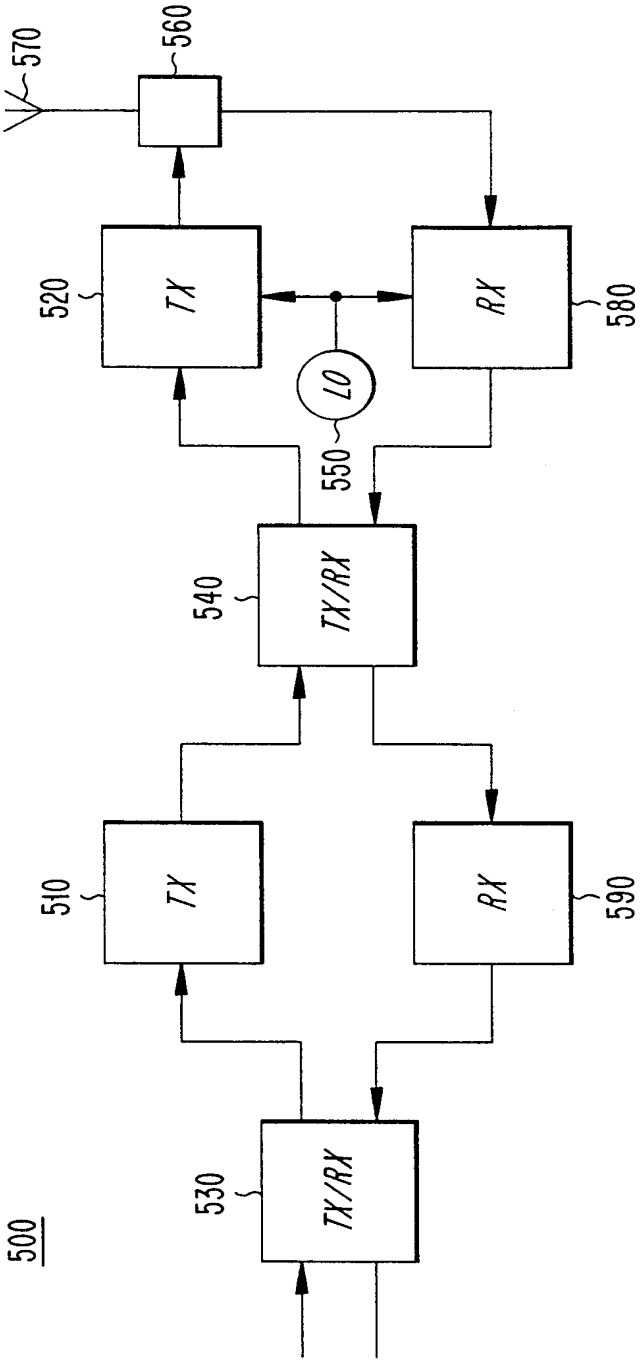


FIG. 5

INTERNATIONAL SEARCH REPORT

Ir ational Application No
PCT/US 98/24370

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04Q7/30

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04Q H04B

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	US 5 689 502 A (SCOTT) 18 November 1997 see column 8, line 59 - column 9, line 10; figures 4,5A	1
A	US 5 617 412 A (DELPRAT ET AL.) 1 April 1997 see abstract; figure 1 see column 6, line 4 - line 13	1
A	US 5 475 677 A (ARNOLD ET AL.) 12 December 1995 see abstract; figure 5 see column 12, line 15 - line 51	1,7,14, 16
A	US 5 602 836 A (PAPADOPOULOS ET AL.) 11 February 1997 see column 5, line 1 - line 26; figures 4,5	1,9

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

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

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

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

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

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

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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 March 1999	17/03/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Danielidis, S

1

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 98/24370

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 444 696 A (PETRANOVICH) 22 August 1995 see figures 1-3 see column 1, line 38 - line 57 see column 5, line 25 - line 50	1

1

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 98/24370

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5689502 A	18-11-1997	AU 6025796 A	24-12-1996
		CA 2223321 A	12-12-1996
		CN 1192300 A	02-09-1998
		EP 0873593 A	28-10-1998
		WO 9639749 A	12-12-1996
US 5617412 A	01-04-1997	FR 2718907 A	20-10-1995
		EP 0677930 A	18-10-1995
US 5475677 A	12-12-1995	CA 2206473 A	11-07-1996
		CN 1171871 A	28-01-1998
		EP 0809894 A	03-12-1997
		JP 10501397 T	03-02-1998
		WO 9621289 A	11-07-1996
US 5602836 A	11-02-1997	US 5420851 A	30-05-1995
		CA 2162938 A	28-06-1996
		EP 0720321 A	03-07-1996
		JP 8274740 A	18-10-1996
		CA 2135950 A	25-05-1995
		EP 0654916 A	24-05-1995
		FI 945507 A	25-05-1995
		JP 7203545 A	04-08-1995
		NO 944404 A	26-05-1995
		US 5594720 A	14-01-1997
US 5444696 A	22-08-1995	AU 1039495 A	22-05-1995
		CA 2175356 A	04-05-1995
		WO 9512258 A	04-05-1995
		US 5710762 A	20-01-1998

PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : H04Q 7/24 | A1

(11) International Publication Number: WO 97/41699

(43) International Publication Date: 6 November 1997 (06.11.97)

(21) International Application Number: PCT/SE97/00503

(22) International Filing Date: 24 March 1997 (24.03.97)

(30) Priority Data:
9601618-3 29 April 1996 (29.04.96) SE

(71) Applicant *(for all designated States except US)*: RADIO DESIGN INNOVATION AB [SE/SE]; P.O. Box 1223, S-164 28 Kista (SE).

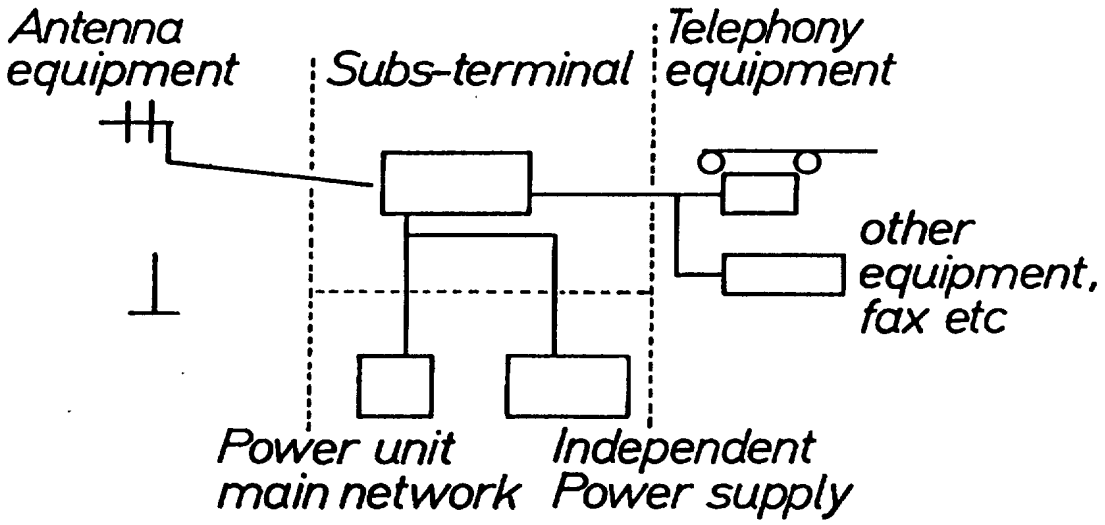
(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: JOHNSON, Torbjörn [SE/SE]; Lidvägen 1, S-175 40 Järfälla (SE). STRÖM, Martin [SE/SE]; Vallmovägen 23, S-191 43 Sollentuna (SE).

(74) Agents: HOLMQVIST, Lars, J., H. et al.; Albihn Holmqvist AB, P.O. Box 4289, S-203 14 Malmö (SE).

(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: SUBSCRIBER TERMINAL ARRANGEMENT



(57) Abstract

The invention relates to a subscriber terminal arrangement in a telecommunication system utilizing radio in the local loop. According to the invention, the arrangement comprises a subscriber terminal comprising a low power radio part, a pulse code modulation air interface and a low power paging channel for the call set-up procedure, a power supply part, and a user terminal comprising a hand-set and a dialling device. Ordinary telephone equipment, telephone fax, answering machine, data modem, PCs etc, may be connected to the subscriber terminal. In some cases the radio parts and telephony parts would be integrated in the same unit. The power supply part may be connected to an independent power supply unit comprising a power generator, e.g. solar panels and/or a wind generator, rechargeable batteries, and a control unit for controlling the charging procedure. The air interface is capable of supporting 64 kb/s PCM coding offering high quality audio, and/or variable data rates up to 64 kb/s.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	**ES**	Spain	**LS**	Lesotho	**SI**	Slovenia
AM	Armenia	**FI**	Finland	**LT**	Lithuania	**SK**	Slovakia
AT	Austria	**FR**	France	**LU**	Luxembourg	**SN**	Senegal
AU	Australia	**GA**	Gabon	**LV**	Latvia	**SZ**	Swaziland
AZ	Azerbaijan	**GB**	United Kingdom	**MC**	Monaco	**TD**	Chad
BA	Bosnia and Herzegovina	**GE**	Georgia	**MD**	Republic of Moldova	**TG**	Togo
BB	Barbados	**GH**	Ghana	**MG**	Madagascar	**TJ**	Tajikistan
BE	Belgium	**GN**	Guinea	**MK**	The former Yugoslav Republic of Macedonia	**TM**	Turkmenistan
BF	Burkina Faso	**GR**	Greece			**TR**	Turkey
BG	Bulgaria	**HU**	Hungary	**ML**	Mali	**TT**	Trinidad and Tobago
BJ	Benin	**IE**	Ireland	**MN**	Mongolia	**UA**	Ukraine
BR	Brazil	**IL**	Israel	**MR**	Mauritania	**UG**	Uganda
BY	Belarus	**IS**	Iceland	**MW**	Malawi	**US**	United States of America
CA	Canada	**IT**	Italy	**MX**	Mexico	**UZ**	Uzbekistan
CF	Central African Republic	**JP**	Japan	**NE**	Niger	**VN**	Viet Nam
CG	Congo	**KE**	Kenya	**NL**	Netherlands	**YU**	Yugoslavia
CH	Switzerland	**KG**	Kyrgyzstan	**NO**	Norway	**ZW**	Zimbabwe
CI	Côte d'Ivoire	**KP**	Democratic People's Republic of Korea	**NZ**	New Zealand		
CM	Cameroon			**PL**	Poland		
CN	China	**KR**	Republic of Korea	**PT**	Portugal		
CU	Cuba	**KZ**	Kazakstan	**RO**	Romania		
CZ	Czech Republic	**LC**	Saint Lucia	**RU**	Russian Federation		
DE	Germany	**LI**	Liechtenstein	**SD**	Sudan		
DK	Denmark	**LK**	Sri Lanka	**SE**	Sweden		
EE	Estonia	**LR**	Liberia	**SG**	Singapore		

TITLE OF INVENTION: SUBSCRIBER TERMINAL ARRANGEMENT

FIELD OF THE INVENTION

The present invention relates to a subscriber terminal arrangement in a telecommunication system utilizing radio in the local loop. Radio in the Local Loop (RLL) is, substituting the copper lines in the local loop, the part of the network which is between the local exchange and the subscriber at home, with radio. The market for these applications is enormous, especially in the new growing economies like Far East, Russia and Brazil. Another growing market is the industrial countries where radio is the best solution for a new operator to compete with services in the local loop. Fixed subscriber terminals mean terminals which are not designed for mobility purpose. The terminal is placed in the home, office etc. and can be moved in the in the premises but not like hand held portable telephone. Ordinary telephone equipment, telephone fax, answering machine, data modem, PCs etc, could be connected to the terminal. In some cases the radio parts and telephony parts would be integrated in the same unit.

STATE OF THE ART

Today there are two main categories of radio subscriber terminals; for mobile use and fixed telephones connected to ordinary fixed network for telephony (POTS, Plain Ordinary Telephony System).

Today's radio subscriber terminals are power-consuming, expensive (due to standardized POTS interface), bad audio quality, no variable data rates etc. When the receiver is lifted there is a long delay before the dial tone is given. When mobile telephones are used, the subscriber have to

enter the number and thereafter have access to the radio channel (the send button is pressed).

The present invention solves the above-mentioned problem by providing an improved subscriber terminal arrangement.

The unique features of the subscriber terminals are based on:

- 64 kb/s PCM coding, (Pulse Code Modulation) which can offer:
  + high quality audio 7, 2 kHz bandwidth compared with today's 3,1 kHz bandwidth for today's POTS (Plain Ordinary Telephony System)
  + by multiplexing several (3-4) PCM channels, high quality hi-fi audio is offered
  + variable data bit rates up to 64 kb/s
  + multiplexing of PCM channels to offer ISDN BRA, Integrated Services Digital Network, Basic Rate Access

- a simplified version of POTS

- multi-user terminals with internal switch functionality in order to reduce the capacity requirement on the network.

- an independent power supply unit where there is no need of external power supply

- low power paging channel giving;
  + low power consumption
  + no delay for giving dial tone when receiver is lifted

- an integrated radio head in the antenna

SUMMARY OF THE INVENTION

Thus, the present invention provides a subscriber terminal arrangement in a telecommunication system utilizing radio in the local loop.

According to the invention, the arrangement comprises a subscriber terminal comprising a low power radio part, a pulse code modulation air interface and a low power paging channel for the call set-up procedure, a power supply part,

and a user terminal comprising a hand-set and a dialling device.

The invention is set forth in detail in the accompanying claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is described below with reference to the attached drawings, in which

Figure 1 is a block diagram of a first embodiment of the invention for ordinary POTS;

Figure 2 is a block diagram of a second embodiment of the invention in which the subscriber terminal equipment and the telephony equipment are integrated in the same physical unit;

Figure 3 is a block diagram of a third embodiment of the invention in which the radio part and the power supply unit are integrated in the same unit;

Figure 4 is a block diagram of a fourth embodiment of the invention including a multi-subscriber terminal; and

Figure 5 is a block diagram of a further embodiment of the invention in which the RF part is integrated with the antenna.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

There are two main groups of digital radio fixed subscriber terminals:

- the single user terminal family
- a multi-user terminal family

All the terminals are based on low power radio with 0,1 W output. Both families could either be connected to an ordinary power supply unit, utilising the mains power supply, or an independent power supply unit. This unit is utilising solar/wind energy and rechargeable batteries. All terminals are utilising a low power paging channel for implementing the alert function. This sleep mode function results in very low power consumption between calls. Therefore, the terminals could be used with powering from only solar/wind energy and batteries. The paging channel will be used in the call set up procedure i. e. the dialled number will transferred immediately to the network at the same time as the radio

speech channels is allocated. This will result in no delay when the receiver is lifted and an immediate dial tone is given.

The paging function is similar to the POGSAG defacto standard which is capable to transfer 512 baud. For easy customer installation, the terminals are equipped with a LED indicator, showing red (no radio reception), yellow (not enough reception) and green (good radio reception).

In Figure 2, an embodiment of the single subscriber terminal family is shown.

As may be seen from Figure 1, the copper lines of an ordinary telephone network is replaced by an antenna equipment. The antenna equipment is connected to a subscriber terminal (Subs-terminal) which in turn is connected to the telephony equipment. The subscriber terminal includes the radio.

The terminal family is based on a digital radio with 0,1 W output. The service is based on 64 kb/s PCM coded radio channels. The telephony equipment at least consists of a hand-set and a dialling device, such as a key pad.

The following services would be offered:

- Ordinary POTS, including DTMF signalling (Dual Tone Multifrequency)
- Data over modem; 9,6, 14,4 28,8 up to 64 kbit/s
- Dedicated data up to 64 kb/s

The ordinary telephone equipment is connected to a line interface (CCITT recommendation) which would be able to support an ordinary ringing generator and 2000 meter 2 wire copper cable i.e. 2/4 wire ordinary line interface.

There are three different versions of antenna installations:

- an antenna connected directly to the user terminal (omnidirectional, radiation in all directions)
- a separate antenna which could be placed in the window (omni/directional, radiation in a specific direction)
- an outdoor roof or wall/roof mounted antenna (directional)

There is an antenna connector at the subscriber terminal for connection of different types of antenna alternatives.

The present invention also provides a simplified sub-

scriber terminal; "Proprietary POTS". There are three different versions:

Version 1

The main difference is the subscriber telephone equipment. One possibility is a telephony equipment, which is specially adapted to the subscriber terminal, without ringing generator and no lightning protection i. e. no standard POTS interface. The ringing signal is generated by a piezoelectric ringer in the hand-set. This would lead to a less complex implementation and therefore a reduction in cost because there is no standard line interface circuitry. The distance between the radio subscriber terminal and proprietary telephone equipment is maximum 50 meters. The power supply is 2 W DC. This solution would need a proprietary telephone equipment.

The same services as above is offered.

Version 2

Another version is where the subscriber terminal equipment and the telephony equipment are integrated in the same physical unit. In order to save cost through simplicity there is no external line interface at all. The implementation is shown in Figure 2.

Version 3

There is one version where the radio part and power equipment are integrated in the same unit. This unit should be plugged directly into the wall. There are three input/output connections for: external antenna connection, a connection for the telephone equipment and one for DC input (battery backup or in case of no main supply) see Figure 3.

There are two different versions of antenna installations:

- a separate antenna which could be placed in the window (omni/directional, radiation in a specific direction)
- an outdoor roof or wall/roof mounted antenna (directional)

There is an antenna connector at the radio terminal for connection of different antenna alternatives.

One embodiment of the invention features a radio terminal which would provide ISDN Basic Rate Access, BRA. As an alternative the terminal can offer two ordinary POTS lines in accordance with the first embodiment.

Similarly, there are three different versions of antennas.

The invention provides a multi-subscriber family suitable for apartment buildings or offices, where it is desired to connect several user terminals.

This terminal family is also based on low power radio with 0,1 W output. The service is based on 64 kb/s PCM coded radio channel. There will be three different sizes serving up to 4, 8, 16 and 16-32 subscribers. All versions would provide the following services:

- Ordinary POTS
- Data over modem; 9,6, 14,4 28,8 up to 64 kbit/s
- Dedicated data up to 64 kb/s
- One version combining ISDN and POTS.

The later could in a flexible way be tailored for 16-32 subscribers. Depending on the number of subscribers there are 16-32 64 kb/s PCM radio channels which will basically serve up to 32 subscribers. There would even be a version which would be utilising concentration i. e. there are fewer radio channel connections than the number of subscribers connected to the terminal. For example 30 PCM channels can support 290 customers (Traffic requirements: 70 mE/customer, 0,01 % blocking).

The principles of the multi-subscriber terminal family is shown in Figure 4:

In order to not be independent of mains power supply (from the electricity company) there should be an option where the user terminals are connected to an independent power supply unit. The unit consists of:

- Power generator; solar panels or/and wind generator
- rechargeable batteries
- control unit, controlling the charging procedure

There would be one terminal version where the radio

frequency parts (RF parts) are moved from the subscriber terminal unit and are integrated together with the antenna. The radio parts in the RF unit are DC powered (Direct Current) by the subscriber terminal via the antenna cable.

Thus, the present invention provides an improved subscriber terminal arrangement having the advantages stated above. Of course, many variations and modifications as well as combinations of the disclosed embodiments will be recognized by a person skilled in the art. The invention is only restricted by the claims below.

CLAIMS

1. A subscriber terminal arrangement in a telecommunication system utilizing radio in the local loop, **characterised** by a subscriber terminal comprising a low power radio part, a pulse code modulation (PCM) air interface, and a low power paging channel for the call set-up procedure, a power supply part, and a user terminal comprising a hand-set and a dialling device.

2. An arrangement according to claim 1, **characterised** by a standard (e.g. CCITT) line interface between the subscriber terminal and the user terminal, the interface supporting a ringing generator and a two wire copper cable.

3. An arrangement according to claim 1, **characterised** by a simple two wire connection between the subscriber terminal and the user terminal, the user terminal further including a piezoelectric ringer.

4. An arrangement according to claim 1, **characterised** in that the subscriber terminal and the user terminal are integrated in the same unit.

5. An arrangement according to any one of the preceding claims, **characterised** in that the power supply part is integrated in the subscriber terminal.

6. An arrangement according to claim 1, **characterised** in that the subscriber terminal includes an interface for connecting a number of user terminals, e.g. up to 4, 8, 16, 32 or more.

7. An arrangement according to any one of the preceding claims, **characterised** by concentration in the radio part for supporting a greater number of user terminals than the number of radio channels.

8. An arrangement according to any one of claims 1 to 5, **characterised** in that an omnidirectional antenna is connected directly to the user terminal.

9. An arrangement according to any one of claims 1 to 7, **characterised** in that a separate antenna is connected to the subscriber terminal, e.g. directly on the subscriber terminal or via lines to a window, wall or roof mounted antenna.

10. An arrangement according to any one of the preceding claims, **characterised** in that the power supply

part is connected to an independent power supply unit comprising a power generator, e.g. solar panels and/or a wind generator, rechargeable batteries, and a control unit for controlling the charging procedure.

11. An arrangement according to any one of the preceding claims, **characterised** in that the air interface is capable of supporting 64 kb/s PCM coding offering high quality audio, and/or variable data rates up to 64 kb/s.

12. An arrangement according to claim 11, **characterised** in that that the air interface is capable of multiplexing several PCM channels offering hi-fi audio, or ISDN basic rate access (BRA).

13. An arrangement according to any one of claims 1-3, 5-7, and 9-12, **characterised** in that the RF unit of the radio part is integrated with an antenna, the RF unit being powered from the subscriber terminal by an antenna cable.

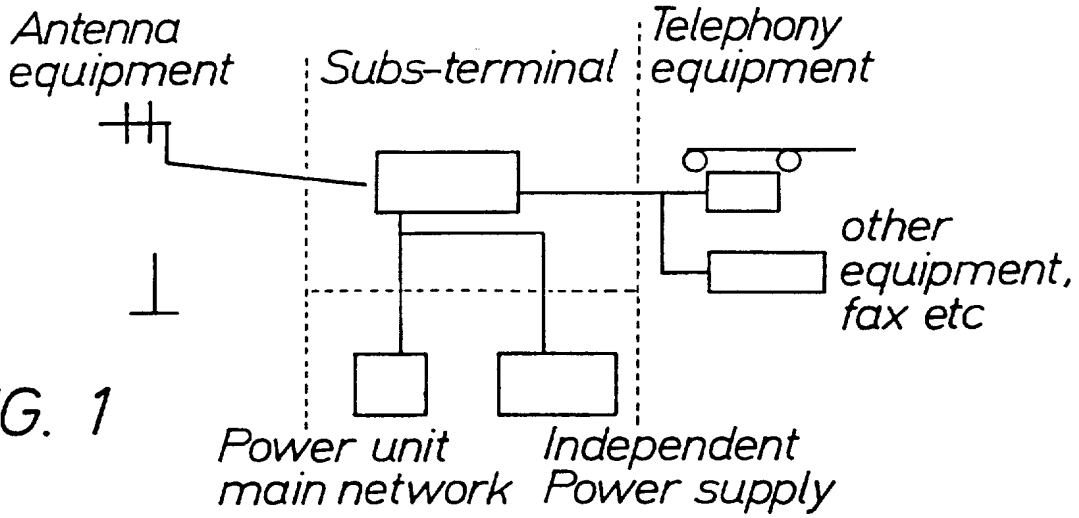


FIG. 1

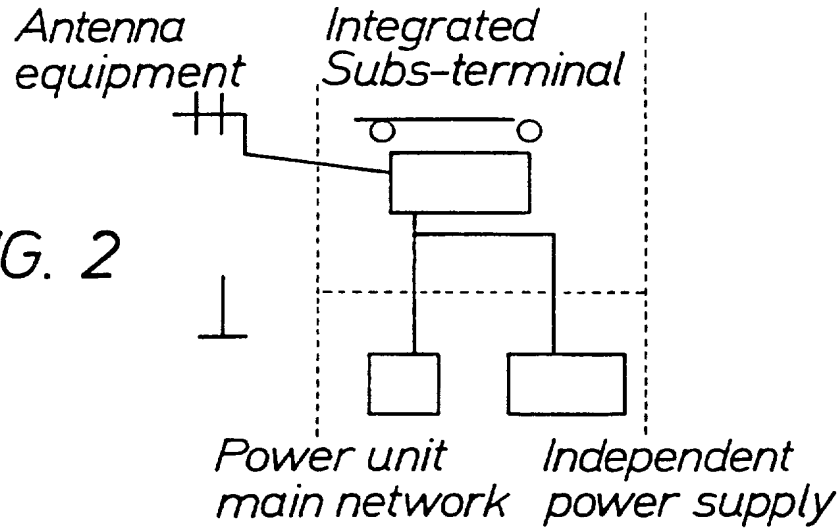


FIG. 2

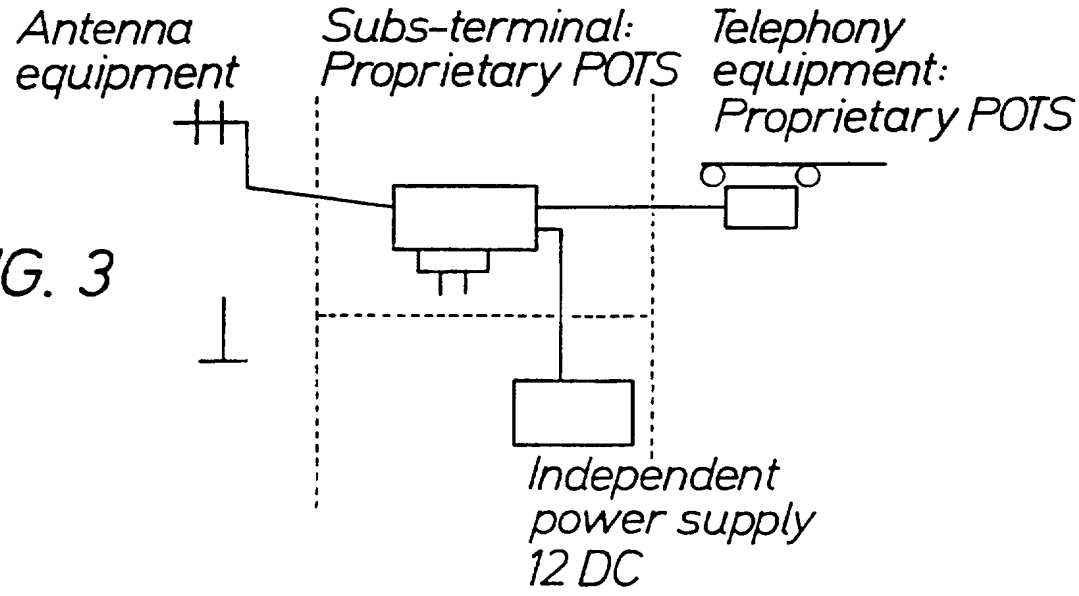


FIG. 3

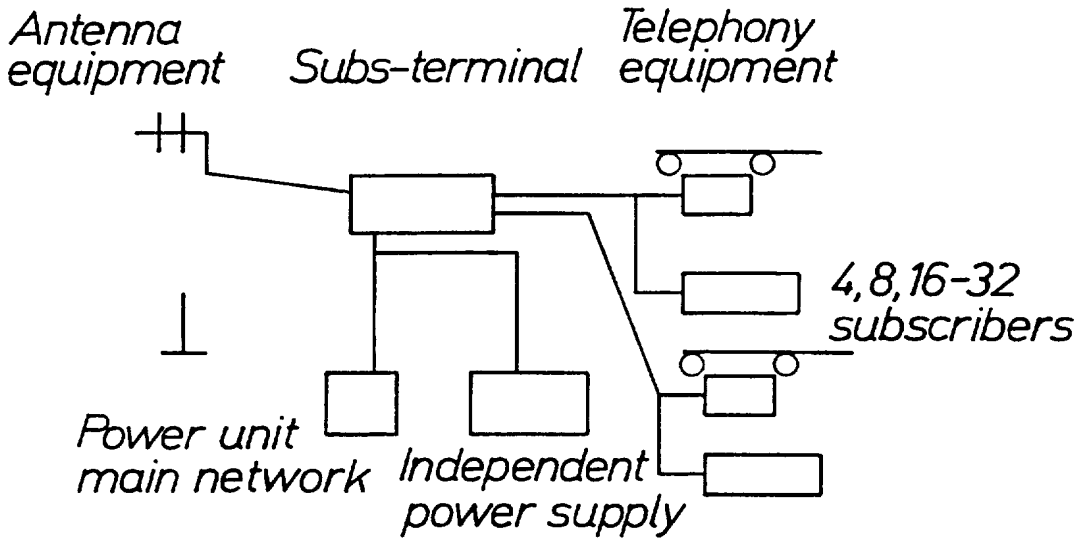

Antenna equipment
Subs-terminal
Telephony equipment
4,8,16-32 subscribers
Power unit main network
Independent power supply

FIG. 4

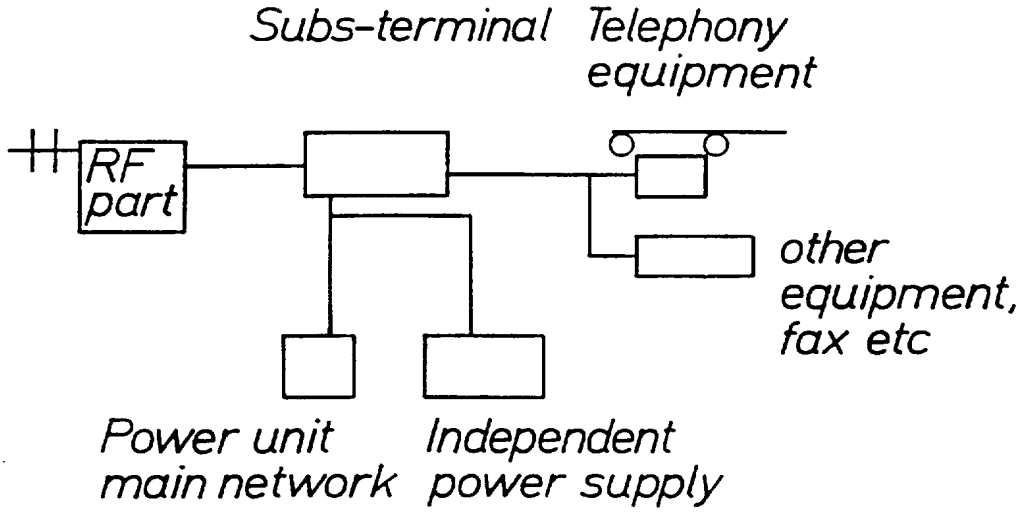

Subs-terminal
Telephony equipment
RF part
other equipment, fax etc
Power unit main network
Independent power supply

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 97/00503

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04Q 7/24
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H04Q, H04L

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

SE,DK,FI,NO classes as above

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0583233 A2 (HUGHES AIRCRAFT COMPANY), 16 February 1994 (16.02.94), column 6, line 4 - line 22; column 17, line 5 - line 12, abstract --	1-9,10
Y	GB 2230162 A (MITSUBISHI DENKI KABUSHIKI KAISHA), 10 October 1990 (10.10.90), page 5, line 18 - page 7, line 2 --	1-9,10
Y	US 5444867 A (KUNIYOSHI MARUI ET AL), 22 August 1995 (22.08.95), column 1, line 39 - line 54; column 2, line 16 - line 28 --	10

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
9 July 1997	12 -07- 1997
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Peter Hedman Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 97/00503

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9419877 A1 (TELEFONAKTIEBOLAGET LM ERICSSON), 1 Sept 1994 (01.09.94), page 7, line 13 - page 8, line 19; page 10, line 18 - line 29 -- --------	1-6,8,9

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International application No. PCT/SE 97/00503

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

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

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos.: 7, 11-13
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

Neither the description, nor the claims comprise any characteristical details on how the arrangements mentioned in claims 7,11,12 and 13 are supposed to be realized.

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (1)) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

01/07/97

International application No.
PCT/SE 97/00503

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0583233 A2	16/02/94	AU 654444 B	03/11/94
		AU 4465293 A	17/02/94
		CA 2103986 A	14/02/94
		FI 933560 A	14/02/94
		JP 6177832 A	24/06/94
		KR 9612090 B	12/09/96
		US 5633873 A	27/05/97
GB 2230162 A	10/10/90	GB 2267797 A,B	15/12/93
		GB 2271914 A,B	27/04/94
		GB 2271915 A,B	27/04/94
		JP 2262730 A	25/10/90
		JP 7073385 B	02/08/95
		US 5054052 A	01/10/91
US 5444867 A	22/08/95	CA 2059189 A	12/07/92
		DE 69218465 D,T	03/07/97
		EP 0494780 A,B	15/07/92
		KR 9604319 B	30/03/96
		US 5584055 A	10/12/96
		US 5590414 A	31/12/96
		JP 4250757 A	07/09/92
		JP 4239249 A	27/08/92
		JP 4239250 A	27/08/92
		JP 4239251 A	27/08/92
		US 5367556 A	22/11/94
WO 9419877 A1	01/09/94	AU 5825294 A	14/09/94
		CA 2133735 A	17/08/94
		CN 1108450 A	13/09/95
		EP 0636290 A	01/02/95
		EP 0647302 A	12/04/95
		FI 944845 A	14/10/94
		JP 8507183 T	30/07/96
		NO 943926 A	17/10/94
		NZ 259444 A	24/06/97
		SE 9300495 A	17/08/94
		US 5464258 A	07/11/95
		US 5533027 A	02/07/96

Form PCT/ISA/210 (patent family annex) (July 1992)

PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 :		(11) International Publication Number:	WO 99/27720
H04Q 7/20, H04B 17/00	A1	(43) International Publication Date:	3 June 1999 (03.06.99)

(21) International Application Number: PCT/GB98/03420

(22) International Filing Date: 13 November 1998 (13.11.98)

(30) Priority Data:
9724612.8 20 November 1997 (20.11.97) GB

(71) Applicant: AIRSPAN COMMUNICATIONS CORPORATION [US/US]; 1209 Orange Street, Wilmington, DE 19801 (US).

(71) Applicant *(for MC only)*: AIRSPAN COMMUNICATIONS LIMITED [GB/GB]; 5 New Square, Feltham, Middlesex TW14 8HA (GB).

(72) Inventors: LYSEJKO, Martin; 61 Cedar Close, Bagshot, Surrey GU19 5AB (GB). COOPER, Ian, Leslie; 20 Higher Mead, Old Basing, Basingstoke, Hampshire RG24 8YL (GB). GOHLAR, Tarlochan, Singh; 34 Dean Road, Hounslow, Middlesex TW3 2EZ (GB).

(74) Agent: HORNER, David, Richard; D. Young and Co., 21 New Fetter Lane, London EC4A 1DA (GB).

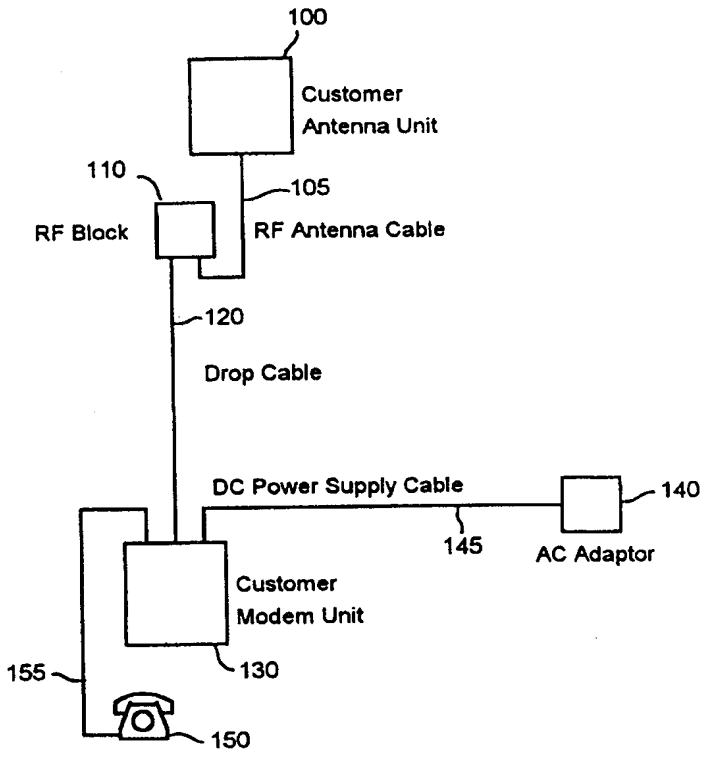
(81) Designated States: BR, CA, CZ, ID, MX, NO, PL, TR, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.

(54) Title: SUBSCRIBER TERMINAL FOR WIRELESS TELECOMMUNICATIONS SYSTEM

(57) Abstract

The present invention provides a subscriber terminal for communicating over a wireless link with a central terminal of a wireless telecommunications system, the subscriber terminal comprising a first signal processing unit (110) associated with an antenna (100) to transmit and receive signals over the wireless link at first frequencies within an operating frequency band. The first signal processing unit comprises a frequency converter for converting signals between said first frequencies and a second frequency. Further, a second signal processing unit (130) is provided remote from the first signal processing unit and associated with an item of telecommunications equipment (150) to pass signals between said item of telecommunications equipment and the first signal processing unit. The second signal processing unit is formed from signal processing circuitry which is independent of the operating frequency band via a connection medium (120).



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	**ES**	Spain	**LS**	Lesotho	**SI**	Slovenia
AM	Armenia	**FI**	Finland	**LT**	Lithuania	**SK**	Slovakia
AT	Austria	**FR**	France	**LU**	Luxembourg	**SN**	Senegal
AU	Australia	**GA**	Gabon	**LV**	Latvia	**SZ**	Swaziland
AZ	Azerbaijan	**GB**	United Kingdom	**MC**	Monaco	**TD**	Chad
BA	Bosnia and Herzegovina	**GE**	Georgia	**MD**	Republic of Moldova	**TG**	Togo
BB	Barbados	**GH**	Ghana	**MG**	Madagascar	**TJ**	Tajikistan
BE	Belgium	**GN**	Guinea	**MK**	The former Yugoslav Republic of Macedonia	**TM**	Turkmenistan
BF	Burkina Faso	**GR**	Greece			**TR**	Turkey
BG	Bulgaria	**HU**	Hungary	**ML**	Mali	**TT**	Trinidad and Tobago
BJ	Benin	**IE**	Ireland	**MN**	Mongolia	**UA**	Ukraine
BR	Brazil	**IL**	Israel	**MR**	Mauritania	**UG**	Uganda
BY	Belarus	**IS**	Iceland	**MW**	Malawi	**US**	United States of America
CA	Canada	**IT**	Italy	**MX**	Mexico	**UZ**	Uzbekistan
CF	Central African Republic	**JP**	Japan	**NE**	Niger	**VN**	Viet Nam
CG	Congo	**KE**	Kenya	**NL**	Netherlands	**YU**	Yugoslavia
CH	Switzerland	**KG**	Kyrgyzstan	**NO**	Norway	**ZW**	Zimbabwe
CI	Côte d'Ivoire	**KP**	Democratic People's Republic of Korea	**NZ**	New Zealand		
CM	Cameroon			**PL**	Poland		
CN	China	**KR**	Republic of Korea	**PT**	Portugal		
CU	Cuba	**KZ**	Kazakstan	**RO**	Romania		
CZ	Czech Republic	**LC**	Saint Lucia	**RU**	Russian Federation		
DE	Germany	**LI**	Liechtenstein	**SD**	Sudan		
DK	Denmark	**LK**	Sri Lanka	**SE**	Sweden		
EE	Estonia	**LR**	Liberia	**SG**	Singapore		

SUBSCRIBER TERMINAL FOR WIRELESS TELECOMMUNICATIONS SYSTEM

FIELD OF THE INVENTION

The present invention relates generally to wireless telecommunications systems, and more particularly to subscriber terminals for wireless telecommunications systems.

BACKGROUND OF THE INVENTION

A wireless telecommunications system has been proposed in which a geographical area is divided into cells, each cell having one or more central terminals (CTs) for communicating over wireless links with a number of subscriber terminals (STs) in the cell. These wireless links are established over predetermined frequency channels, a frequency channel typically consisting of one frequency for uplink signals from a subscriber terminal to the central terminal, and another frequency for downlink signals from the central terminal to the subscriber terminal.

The system finds a wide variety of possible applications, for example in rural, remote, or sparsely populated areas where the cost of laying permanent wire or optical networks would be too expensive, in heavily built-up areas where conventional wired systems are at full capacity or the cost of laying such systems would involve too much interruption to the existing infrastructure or be too expensive, and so on.

In one embodiment, the central terminal may be connected to a telephone network and exists to relay messages from subscriber terminals in the cell controlled by the central terminal to the telephone network, and vice versa. By this approach, an item of telecommunications equipment connected to a subscriber terminal may make an outgoing call to the telephone network, and may receive incoming calls from the telephone network.

However, such a wireless telecommunications system is not restricted to use with telephone signals, but could instead handle any other appropriate type of telecommunications signal, such as video signals, or data signals such as those used for transmitting data over the Internet, and in order to support new technologies such as broadband and video-on-demand technologies.

Figure 1 illustrates an example of a typical prior art configuration for a subscriber terminal for such a wireless telecommunications system. Figure 1 includes a schematic representation of customer premises 22. A customer radio unit (CRU) 24 would typically be mounted on the customer's premises and may include a flat panel antenna or the like 23. The customer radio unit is mounted at a location on the customer's premises, or on a mast, etc, and in an orientation such that the flat panel antenna 23 within the customer radio unit 24 faces in the direction 26 of the central terminal for the service area in which the customer radio unit 24 is located.

The customer radio unit 24 is typically connected via a drop line 28 to a power supply unit (PSU) 30 within the customer's premises. The power supply unit 30 is connected to the local power supply for providing power to the customer radio unit 24 and to a network terminal unit (NTU) 32. The customer radio unit is also connected via the power supply unit 30 to the network terminal unit 32, which in turn is connected to telecommunications equipment in the customer's premises, for example to one or more telephones 34, facsimile machines 36 and computers 38. The telecommunications equipment is represented as being within a single customer's premises. However, this need not be the case, as the subscriber terminal 20 may support more than one line, so that a number of items of subscriber telecommunications equipment could be supported by a single subscriber terminal 20. The subscriber terminal 20 can also be arranged to support analog and digital communications, for example analog communications at 16, 32 or 64Kbits/sec or digital communications in accordance with the ISDN BRA standard.

The CRU 24 typically includes all of the necessary processing circuitry to convert incoming wireless telecommunications signals into signals recognisable by the items of telecommunications equipment, and also to convert such signals from those items of telecommunications equipment into wireless telecommunications signals for transmission from the antenna 23.

A significant problem with this approach is that the CRU 24 is an expensive item of equipment to replace. Since this is generally located on the outside of the customer's premises, it is prone to theft. In addition, all of the components within the CRU 24 have to be able to withstand the exposure to varying climatic conditions

that arise as a result of the CRU 24 being mounted externally. For example, the components must be able to withstand significant variations in temperature, and variations in humidity.

However, one reason why the CRU 24 has previously included all of the necessary processing circuitry to convert incoming wireless telecommunications signals into signals recognisable by the items of telecommunications equipment is that it reduces the technical complexity of the subscriber terminal to have all of the processing circuitry in one housing.

Further, problems with attenuation of the wireless signals transmitted between the central terminal and the subscriber terminal, and vice versa, have previously dictated that the processing circuits of the subscriber terminal should be located physically close to the antenna 23. To illustrate this, it will be appreciated that a signal transmitted from the central terminal at a predetermined power level will be attenuated as it is propagated to the antenna 23 of the subscriber terminal 20. Once the signal has been received by the antenna 23, there will also be further attenuation within the subscriber terminal as the signal is passed from the antenna to the processing circuits within the subscriber terminal. Clearly, the further away those processing circuits are from the antenna, then the greater the attenuation is likely to be. A signal strength threshold will be determined below which a signal cannot be processed by the processing circuits within the subscriber terminal 20. Hence, in order to improve the range of the wireless telecommunications system, it has been considered advisable to minimise the distance between the antenna 23 and the processing circuitry of the subscriber terminal provided to process that received signal.

The above requirements have led to the development of subscriber terminals such as those illustrated in Figure 1, in which an expensive customer radio unit 24 engineered to withstand exposure to varying climatic conditions has been mounted on the exterior of a subscriber's premises.

SUMMARY OF THE INVENTION

Viewed from a first aspect, the present invention provides a subscriber terminal for communicating over a wireless link with a central terminal of a wireless

telecommunications system, the subscriber terminal comprising: a first signal processing unit associated with an antenna to transmit and receive signals over the wireless link at first frequencies within an operating frequency band, the first signal processing unit comprising a frequency converter for converting signals between said first frequencies and a second frequency; a second signal processing unit remote from the first signal processing unit and associated with an item of telecommunications equipment to pass signals between said item of telecommunications equipment and the first signal processing unit, the second signal processing unit being formed from signal processing circuitry which is independent of the operating frequency band, the signals being passed between the first signal processing unit and the second signal processing unit at the second frequency via a connection medium connecting the first and second signal processing units.

In accordance with the present invention, the subscriber terminal comprises two distinct signal processing units, the first signal processing unit being associated with an antenna of the subscriber terminal, and the second signal processing unit being associated with an item of telecommunications equipment connected to the subscriber terminal. Signals are transmitted from the antenna, and received by the antenna, via a wireless link at first frequencies within an operating frequency band. In accordance with the present invention, the first signal processing unit comprises a frequency converter for converting signals between said first frequencies and a second frequency. Typically, the second frequency will be less than the first frequency.

The first and second signal processing units are connected via a connection medium, and the telecommunications signals are then passed between the first and second signal processing units via the connection medium at the second frequency.

Given this approach, the second signal processing unit can then be formed from signal processing circuitry which is independent of the operating frequency band. Hence, the same second signal processing unit can be used irrespective of the operating frequency band used for the wireless communications between the subscriber terminal and a central terminal. Further, the above approach significantly reduces the amounts of circuitry required within the first signal processing unit

associated with the antenna, thereby reducing the complexity of the first signal processing unit.

The actual location of the first and second signal processing units within the subscriber's premises is a matter of installation choice. However, since the first signal processing unit is associated with the antenna, it is likely to be mounted close to the antenna, and so is likely to be mounted externally. In such an embodiment, the subscriber terminal of the present invention offers significant advantages over the prior art, since the first signal processing unit contains significantly less processing circuitry than the customer radio unit of the prior art subscriber terminal. Indeed, a significant amount of processing which was previously performed within the customer radio unit is in accordance with the present invention performed within the second signal processing unit associated with the item of telecommunications equipment. Assuming the first signal processing unit is manufactured to withstand external use, then the components within the first signal processing unit will have to be able to withstand the exposure to varying climatic conditions in the same way that the components within the customer radio unit of the prior art subscriber terminal had to withstand those climatic conditions. However, since the first signal processing unit has significantly less components, it is cheaper to produce a first signal processing unit with the necessary specifications than it is to produce a customer radio unit of the prior art.

Given that the first signal processing unit is cheaper than the customer radio unit of the prior art, then it is also less prone to theft than the customer radio unit of the prior art subscriber terminal.

As mentioned earlier, the exact location of the first and second signal processing units is a matter of installation choice. However, in preferred embodiments, the first signal processing unit is arranged to be mounted on the exterior of a subscriber's premises, whereas the second signal processing unit is arranged to be located within the subscriber's premises.

Since the first signal processing unit is intended in preferred embodiments to be mounted on the exterior of a subscriber's premises, then it needs to be manufactured to an appropriate specification which will ensure satisfactory operation

of the first signal processing unit when mounted externally. Examples of environmental issues which would typically be taken into consideration when designing the first signal processing unit are temperature variation, humidity, corrosion, protection against the ingress of moisture, vibration, etc.

However, in preferred embodiments, the second signal processing unit is arranged to be located within the subscriber's premises, and hence does not need to be manufactured to such a high specification. Whilst the same general environmental issues are again likely to be considered when designing the second signal processing unit, it is clear that the environmental issues are unlikely to place such stringent constraints on a processing unit intended for internal use.

The connection medium connecting the first and second signal processing units may be any suitable connection medium for sending telecommunication signals at the second frequency between the first and second signal processing units. However, in preferred embodiments, the connection medium is a cable over which signals at the second frequency are passed. Preferably, the cable is a coaxial cable. The attenuation of a signal transmitted over a coaxial cable increases with the frequency of the signal. This can be compensated to some extent by appropriate amplification of the signal prior to its transmission over the coaxial cable. At the radio frequencies used for communications over the wireless link between the central terminal and the subscriber terminal, which are of the order of Gigahertz, the coaxial cable has been found to attenuate the signal to an unacceptable level. However, by appropriate choice of a second frequency which is lower than the frequencies used over the wireless link, it has been found that a coaxial cable does provide a suitable medium for transmitting signals between the first and second signal processing units. This is a significant advantage, since coaxial cable is relatively cheap, and hence the use of coaxial cable to pass signals between the first and second signal processing units helps to reduce the overall cost of the subscriber terminal. A further advantage of coaxial cable is that it is also easy to terminate.

In preferred embodiments, the second frequency comprises a downlink second frequency for signals passed from the first signal processing unit to the second signal processing unit and an uplink second frequency for signals passed from the second

signal processing circuit to the first signal processing circuit. It will be appreciated by those skilled in the art that many different frequencies may be chosen for the downlink second frequency and the uplink second frequency, dependent on the properties of the connection medium used to pass signals at the second frequency between the first and second signal processing units. However, in preferred embodiments the downlink second frequency is centred on 935MHz, and the uplink second frequency is centred on 835MHz. In the preferred embodiments of the present invention, the signals passed between the first and second signal processing units are spread-spectrum signals, and in such cases the downlink second frequency preferably has a frequency range of 915.75 to 954.25MHz, whilst the uplink second frequency preferably has a frequency range of 815.75 to 854.25MHz. It has been found that a coaxial cable offers satisfactory performance for the transmission of signals at such frequencies.

The second frequency may be chosen to be the frequency used by the item of telecommunications equipment for transmitting and receiving signals. However, in preferred embodiments, the second frequency is an intermediate frequency, the second signal processing unit comprising a radio modem circuit arranged to process a signal received via the connection medium at the intermediate frequency to generate a baseband signal for passing to the item of telecommunications equipment, and to process a baseband signal from the item of telecommunications equipment to generate a signal at the intermediate frequency for outputting to the first signal processing unit via the connection medium. This approach ensures that the same second frequency can be chosen for all subscriber terminals, irrespective of the actual telecommunications equipment connected to the subscriber terminal.

In preferred embodiments, the second signal processing circuit further comprises a customer interface unit for interfacing between the radio modem circuit and the item of telecommunications equipment. Preferably, the configuration of the customer interface unit is dependent on the item of telecommunications equipment supported by the second signal processing circuit, whereas the configuration of the radio modem circuit is independent of the item of telecommunications equipment supported by the second signal processing circuit. Hence, since the second frequency

is in preferred embodiments pre-defined for all subscriber terminals, then the radio modem circuit can have exactly the same configuration, irrespective of the item of telecommunications equipment to be supported by the subscriber terminal, and irrespective of the operating frequency band used for the wireless link between the subscriber terminal and the central terminal.

It will be apparent that the first and second signal processing units can each be provided with separate connections to a power supply. However, in preferred embodiments, the first signal processing unit will generally be mounted at an elevated position on the exterior of a subscriber's premises, and then connected to the second signal processing unit, which is preferably located within the subscriber's premises. Preferably, in such situations, the power required to operate the first signal processing unit is supplied by the second signal processing unit. Further, to reduce the amount of wiring which needs to pass between the first and second signal processing units, then in preferred embodiments the power is supplied to the first signal processing unit via the connection medium, in preferred embodiments the connection medium being a coaxial cable.

Given that in accordance with the present invention, two separate signal processing units are provided, then it will be apparent that it may be necessary for certain control information to be passed between the two units during their operation. Hence, in preferred embodiments, a communications link is provided to allow control signals to be passed between the first and second signal processing units. Preferably, the communications link is established over the connection medium, and the control signals are issued at a predetermined frequency distinct from said second frequency. As an example of the control signals which may be transmitted via the connection medium, the second signal processing unit may send a control signal to the first signal processing unit to turn the transmit circuitry within the first signal processing unit on or off. Further, the first signal processing unit may send a control signal to the second signal processing unit providing information about the transmit power level currently being used.

The first signal processing unit may be provided as a separate component from the antenna, this providing for a greater flexibility over the choice of the antenna.

However, in one embodiment, the first signal processing unit and the antenna are integrated into a single housing. This provides a neat packaging, and would typically include a fairly standard specification antenna suitable for most deployments.

It is intended that the subscriber terminal of the present invention may be connected to one or more items of telecommunications equipment. Hence, the second signal processing unit may be associated with more than one item of telecommunications equipment.

Viewed from a second aspect, the present invention provides a first signal processing unit for a subscriber terminal according to the first aspect of the present invention, the first signal processing unit being associated with an antenna to transmit and receive signals over the wireless link at first frequencies within an operating frequency band, and the first signal processing unit comprising a frequency converter for converting signals between said first frequencies and a second frequency.

Viewed from a third aspect, the present invention provides a second signal processing unit for a subscriber terminal according to the first aspect of the present invention, the second signal processing unit being associated with an item of telecommunications equipment to pass signals between said item of telecommunications equipment and the first signal processing unit, the second signal processing unit being formed from signal processing circuitry which is independent of the operating frequency band.

Viewed from a fourth aspect, the present invention provides a method of communicating over a wireless link with a central terminal of a wireless telecommunications system, comprising the steps of: providing a first signal processing unit associated with an antenna to transmit and receive signals over the wireless link at first frequencies within an operating frequency band; converting, within the first signal processing unit, signals between said first frequencies and a second frequency; providing a second signal processing unit remote from the first signal processing unit and associated with an item of telecommunications equipment to pass signals between said item of telecommunications equipment and the first signal processing unit; forming the second signal processing unit from signal processing circuitry which is independent of the operating frequency band; and passing the

signals between the first signal processing unit and the second signal processing unit at the second frequency via a connection medium connecting the first and second signal processing units.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be described further, by way of example only, with reference to a preferred embodiment thereof as illustrated in the accompanying drawings, in which:

Figure 1 is a schematic illustration of an example of a typical prior art subscriber terminal;

Figure 2 is a schematic overview of an example of a wireless telecommunications system in which the present invention may be employed;

Figure 3 is an illustration of an example of a frequency plan for the telecommunications system of Figure 2;

Figure 4 is a schematic block diagram of a subscriber terminal in accordance with preferred embodiments of the present invention;

Figure 5 is a circuit diagram illustrating components within the RF block of the subscriber terminal of preferred embodiments;

Figure 6 is a block diagram illustrating the main components of the customer modem unit of the subscriber terminal of preferred embodiments;

Figure 7A is a circuit diagram illustrating the components within the radio modem card used to perform IF processing in accordance with preferred embodiments of the present invention;

Figure 7B is a block diagram illustrating the main components of the CDMA modem within the radio modem card which is used to control the circuitry of Figure 7A;

Figures 8A and 8B provide more detailed illustrations of portions of the circuitry illustrated in Figure 7;

Figure 9 is a diagram illustrating the spectrum utilisation of the drop cable used in subscriber terminals of preferred embodiments of the present invention;

Figure 10 provides a more detailed illustration of the serial communications controller illustrated in Figure 7; and

Figure 11 illustrates the use of a receive signal strength meter that may be used in embodiments of the present invention to assist in antenna alignment during installation of the subscriber terminal.

DESCRIPTION OF PREFERRED EMBODIMENT

The present invention may be used in connection with any appropriate type of telecommunications signal, for example a telephone signal, a video signal, or data signals such as those used for transmitting data over the Internet, and in order to support new technologies such as broadband and video-on-demand technologies. However, for the purpose of describing a preferred embodiment of the present invention, a wireless telecommunications system will be considered that is used for handling telephony signals, such as POTS (Plain Old Telephony Service) signals.

For the purpose of describing the subscriber terminal of preferred embodiments of the present invention, a wireless telecommunications system will be discussed in which a central station is connected to the public telephone network and exists to relay messages from subscribers in the cell controlled by the central station to the public telephone network, and vice versa. Figure 2 is a schematic overview of an example of such a wireless telecommunications system. The telecommunications system includes one or more service areas 12, 14 and 16, each of which is served by a respective central terminal (CT) 10 which establishes a radio link with subscriber terminals (ST) 20 within the area concerned. The area which is covered by a central terminal 10 can vary. For example, in a rural area with a low density of subscribers, a service area 12 could cover an area with a radius of 15-20Km. A service area 14 in an urban environment where there is a high density of subscriber terminals 20 might only cover an area with a radius of the order of 100m. In a suburban area with an intermediate density of subscriber terminals, a service area 16 might cover an area with a radius of the order of 1Km. It will be appreciated that the area covered by a particular central terminal 10 can be chosen to suit the local requirements of expected or actual subscriber density, local geographic considerations, etc, and is not limited to the examples illustrated in Figure 2. Moreover, the coverage need not be, and typically will not be circular in extent due to antenna design considerations, geographical factors, buildings and so on, which will affect the distribution of

transmitted signals.

The central terminals 10 for respective service areas 12, 14, 16 can be connected to each other by means of links 13, 15 and 17 which interface, for example, with a public switched telephone network (PSTN) 18. The links can include conventional telecommunications technology using copper wires, optical fibres, satellites, microwaves, etc.

The wireless telecommunications system of Figure 2 is based on providing fixed radio links between subscriber terminals 20 at fixed locations within a service area (e.g., 12, 14, 16) and the central terminal 10 for that service area. In one embodiment, each subscriber terminal 20 is provided with a permanent fixed access link to its central terminal 10. However, in alternative embodiments, demand-based access could be provided, so that the number of subscribers which can be serviced exceeds the number of telecommunications links which can currently be active.

The wireless telecommunications between a central terminal 10 and the subscriber terminals 20 could operate on various frequencies. Figure 3 illustrates one possible example of the frequencies which could be used. In the present example, the wireless telecommunications system is intended to operate in the 3.4-3.6GHz Band. In particular the present example is intended to operate in the Band defined by the CEPT SE19 Recommendation. Figure 3 illustrates the frequencies used for the uplink from the subscriber terminals 20 to the central terminal 10 and for the downlink from the central terminal 10 to the subscriber terminals 20 in preferred embodiments. It will be noted that 12 uplink and 12 downlink radio channels of 3.5MHz each are provided about a frequency of 3502MHz. The spacing between the receive and transmit channels is 100MHz.

Hence, a frequency channel will be defined by one uplink frequency plus the corresponding downlink frequency. Techniques such as 'Code Division Multiplexed Access' (CDMA) may be used to enable a plurality of wireless links to subscriber terminals to be simultaneously supported on each frequency channel.

Typically, the radio traffic from a particular central terminal 10 will extend into the area covered by a neighbouring central terminal 10. To avoid, or at least to reduce interference problems caused by adjoining areas, only a limited number of

the available frequencies will be used by any given central terminal 10. This is discussed in more detail in GB-A-2,301,751, which also provides further details on CDMA encoding/decoding, and on the signal processing stages employed in the subscriber terminals and central terminal to manage communications between them.

Having described a wireless telecommunications system in which a subscriber terminal in accordance with preferred embodiments of the present invention may be employed, the subscriber terminal of preferred embodiments will now be described further with reference to Figure 4, which is a block diagram illustrating the main components of the subscriber terminal.

In preferred embodiments, the functionality of the subscriber terminal is split between outdoor and indoor units. Hence, an RF block 110 is provided which is typically mounted on the exterior of a subscriber's premises, preferably the RF block 110 being mounted in proximity to a customer antenna unit 100 used to transmit and receive wireless telecommunications signals. The customer antenna unit 100 is then connected to the RF block 110 via an RF antenna cable 105. Although the RF block 110 and customer antenna unit 100 are illustrated in Figure 4 as separate units connected by an antenna cable 105, it will be appreciated by those skilled in the art that, if desired, the antenna unit can be integrated within the RF block 110 so as to provide a single unit for mounting on the exterior of the subscriber's premises.

In preferred embodiments, all of the electronic circuitry which is dependent on the operating frequency band used for the wireless communications between the subscriber terminal and the central terminal is located within the RF block 110, the purpose of the RF block 110 being to translate received downlink signals from the RF frequency to a standard intermediate frequency suitable for transmission to the customer modem unit 130, and similarly to translate received signals from the customer modem unit 130 at a standard intermediate frequency into an RF uplink signal for transmission from the customer antenna unit 100.

The RF block 110 and the customer modem unit 130 are connected via a drop cable 120, the drop cable 120 preferably being provided by a coaxial cable. The customer modem unit 130 incorporates a CDMA modem operating at a fixed intermediate frequency, and also includes the electronics required to interface to the

one or more items of telecommunications equipment connected to the subscriber terminal. In preferred embodiments, the customer modem unit 130 is located within the subscriber's premises, for example close to the item(s) of telecommunications equipment. Hence, an item of telecommunications equipment 150 is connected to the customer modem unit 130 via a lead 155. Further, the customer modem unit is preferably connected to an AC adaptor 140 via a DC power supply cable 145, the AC adaptor 140 providing power to the customer modem unit 130.

Under the relevant legislation in many countries, it is often required that telecommunications equipment operating via wireless links be provided with a separate source of power so that the telecommunications equipment can be used in an emergency, even in the event of a power cut disabling the main source of power to the equipment. Hence, in preferred embodiments a battery backup unit is incorporated within the customer modem unit, for example a lead acid battery.

The circuitry within the RF block 110 will also require a source of power in order to operate, and in preferred embodiments, the necessary power is provided from the customer modem unit 130 via the drop cable 120.

The architecture illustrated in Figure 4 enables a number of cost reductions to be made. For example, if the antenna 100 were to be integrated within the RF block 110, then this would result in a neat packaging, but would require that the antenna be designed for universal deployment. This typically means designing an antenna with as high a gain as possible, contributing to expense. However, by retaining the antenna 100 as a separate unit to the RF block 110, then the subscriber terminal can be equipped with a lower cost "regular" specification antenna which would be suitable for most deployments. Then, in situations where signal strength is unusually low, the subscriber terminal could optionally be equipped with a high gain antenna, for example as a cost option to the subscriber. This approach increases flexibility, and enables a lower cost antenna to be used for most situations where that antenna will be sufficient.

The subscriber terminal of preferred embodiments will preferably be provided with an antenna which is significantly smaller and lighter than the combined antenna/customer radio unit used in the subscriber terminals of the prior art. By

using a smaller and lighter antenna, fewer restrictions on location and mounting hardware are present. For example, since the unit is smaller than that used in prior art subscriber terminals, it is more suitable for pole mounting above the roof line. At higher elevations, the increased receive signal will offset any lower antenna gain resulting from the use of a smaller antenna.

The antenna design and/or technology choice changes with frequency. When designing for a new operating frequency band, changes in the antenna design are likely to result in changes in the subscriber terminal mechanical design and/or packaging, resulting in a large number of manufacturing variants. If the subscriber terminal mechanics cannot be changed, then antenna performance may be compromised. However, the subscriber terminal of preferred embodiments of the present invention allows the option of providing a readily available antenna for a new operating frequency band until volume of sales justifies altering the design of the subscriber terminal. Hence, it will be possible to readily provide a subscriber terminal that will operate in a different RF operating frequency band.

Apart from the above described cost reductions that arise from the RF block/antenna architecture, a number of other cost reductions can be realised as a result of employing the architecture illustrated in Figure 4. For example, since all of the operating frequency band sensitive components are preferably restricted to the RF block 110, then the modem within the customer modem unit 130 operates at a standard intermediate frequency for all RF operating frequency bands. Hence, the customer modem unit 130 may be manufactured in large volumes regardless of which operating frequency band the equipment will operate in. Subsequent design modifications would then preferably be restricted to the RF block 110.

The drop cables used in the prior art subscriber terminal, such as that illustrated in Figure 1, typically would comprise a high specification screened five-pair cable. This cable is expensive, as are the connectors required to terminate the cable and protection networks. However, in preferred embodiments of the present invention, a simple coaxial cable is used to carry power, control and IF uplink and downlink signals between the RF block 110 and the customer modem unit 130, thereby removing the need for costly cable and connectors.

In preferred embodiments, the customer interface and radio modem functions are separated within the customer modem unit. A radio modem card is provided which is designed to operate at a standard IF, and to present a fixed interface to a customer interface card. The customer interface card is then dependent on the particular item(s) of telecommunications equipment supported by the subscriber terminal. By this arrangement, the radio modem card will operate with any customer interface variant, and so the radio modem card can be manufactured in high volume with a design that is independent of the telecommunications equipment supported by the subscriber terminal, thereby providing cost savings. Preferably, customer specific variants of the customer interface card may be developed as and when required, and such design changes in the customer interface card will not require re-qualification of the radio modem card. Furthermore, any cost reduction of the radio modem card arising through higher integration of the components will not in preferred embodiments require design changes in the customer interface card.

In preferred embodiments, the AC adaptor 140 used to supply power to the subscriber terminal is a low cost universal AC adaptor supplying 18V DC to the customer modem unit 130 and the RF block 110. The customer modem unit 130 also in preferred embodiments incorporates a low cost 20W hr lead acid battery for backup in the event of a mains failure. Power dissipation and hence battery cost are reduced in preferred embodiments by arranging logic circuitry to operate from 3.3V where possible, and for all circuitry not required when the RF link is not in use to be powered down, including RF transmit, IF transmit, baseband transmit and codec circuitry. Further, the processors preferably exploit power saving modes of operation.

The low power dissipation results in further cost reductions by easing thermal management requirements. Further, since the outdoor RF block enclosure is smaller and lighter than the prior art customer radio unit, the mounting hardware can be lighter duty, and hence cheaper. Further, the indoor customer modem unit contains a significant proportion of the processing circuitry, and lower cost plastics and assembly methods can be used than were typically required for the customer radio unit of prior art subscriber terminals, since the indoor environment requires less

mechanical integrity.

Having discussed some of the benefits arising from employing an architecture as set out in Figure 4, the RF architecture of the subscriber terminal of preferred embodiments will now be discussed in more detail. As previously discussed with reference to Figure 4, the RF architecture is split between indoor electronics within the customer modem unit 130 that up/down-converts baseband information to a standard IF band, and outdoor electronics within the RF block 110 that performs the up/down-conversion to RF.

Figure 5 is a diagram illustrating the arrangement of components within the RF block 110 used to convert signals between IF and RF. Considering first an RF signal received by the subscriber terminal, this received signal will be passed via the antenna 202 to an RF filter 200 which is arranged to only let signals with frequencies within a predetermined frequency range to be output over path 204. The RF filter 200 and RF filter 210 together form a duplex filter, filter 210 being of a type which will allow transmit signals on path 206 to be output to the antenna 202 whilst preventing received RF signals being passed from the antenna 202 to the path 206. Similarly, the RF filter 200 is of a type which prevents transmit signals on path 206 being propagated onto the path 204 whilst allowing received signals via the antenna 202 to be passed to the path 204. In preferred embodiments, the RF filter 200 will allow received downlink signals with centre frequencies ranging from 3511.75 to 3550.25MHz to be passed through the filter, whilst the RF filter 200 will allow uplink signals with centre frequencies ranging from 3411.75 to 3450.25MHz to be passed through the filter.

Hence, in preferred embodiments, a received RF signal at the antenna 202 will be passed through the RF filter 200 over path 204 to a switch 240. In normal operation, the switch 240 is arranged to pass the received signal to a low noise amplifier (LNA) 230. However, in a calibration mode of operation, which will be discussed in more detail later, the switch 240 can be used to block out any signals received by the antenna 202, and instead pass a signal from a calibrated noise source 245 to the LNA 230.

Once the signal has passed through the switch 240, it is amplified by the LNA

230 and further amplifier 235 before being passed to an attenuation network of resistors 212, 214, 216. These three resistors 212, 214 and 216 act in combination to attenuate the received signal prior to it being passed on to a filter 250. It is advisable to include such attenuation circuitry 212, 214, 216 so as to ensure that the subsequent circuitry is not exposed to a signal having a higher power level than those components are designed for. Such a high powered signal may, for example, be received at the antenna 202 if the subscriber terminal is placed particularly close to the central terminal with which it is arranged to communicate. The attenuation circuitry 212, 214 and 216 then serves to ensure that this initially received signal is attenuated prior to its propagation through the rest of the processing circuitry. If, subsequently, it is determined that the attenuation performed by the resistors 212, 214 and 216 is unnecessary, then a control signal C2 can be passed to a switch 220 to turn the switch on and thereby bypass the attenuation circuitry.

Once the signal has passed through the attenuation circuitry 212, 214, 216 or switch 220, it is passed to a filter 250. The filter 250 is arranged to remove wide band noise generated by the LNA 230, by only allowing signals within a specified bandwidth centred on a predetermined frequency to pass through the filter. In preferred embodiments, the bandwidth allowed through the filter is 42MHz, centred on a frequency of 3531MHz, i.e. the middle of the frequency range for downlink signals passed from the antenna 202 through the RF filter 200.

The signal output by the filter 250 is then passed to a mixer 260 via a matching network of resistors 252, 254, 256. The matching network serves to match the impedance at the output of the filter 250 with the impedance of the input to the mixer 260. The mixer 260 is also arranged to receive an input from an RF synthesizer 280, the RF synthesizer 280 being controlled by configuration logic 285. In preferred embodiments, the signal output by the RF synthesizer 280 to the mixer 260 is at a frequency of 2596MHz. Based on two input signals at frequencies f_1 and f_2, a mixer such as mixer 260 will produce signals at two output frequencies, namely $f_1 + f_2$ and $f_1 - f_2$.

Signals output by the mixer 260 are then amplified by an amplifier 270 before being received by a duplex filter comprising filter 290 and filter 295. In preferred

embodiments, the filter 290 is arranged to remove the $f_1 + f_2$ component of the signals produced by the mixer 260, and to only allow the $f_1 - f_2$ component to be passed through to the drop cable 120. Further, the filter 295 is arranged to prevent any signals from the amplifier 270 being propagated through to the path 305. Hence, in preferred embodiments, the intermediate frequency used to transmit received signals via the drop cable between the RF block 110 and the customer modem unit 130 comprises the $f_1 - f_2$ component generated by the mixer 260 from the signals received from both the RF synthesizer 280 and the filter 250.

Considering now signals to be transmitted from the antenna 202, signals at an intermediate frequency in the range of 815.75 to 854.25MHz are preferably generated by the customer modem unit 130 and transmitted over the drop cable 120, where they are then received by the duplex filter 290, 295. The filter 295 is arranged to propagate such signals over the path 305 to an amplifier 310, whilst the filter 290 prevents such signals from being passed back through the circuitry described earlier. The amplifier 310 amplifies the signals and then passes them to the mixer 320 via a matching network 312, 314, 316. This matching network matches the impedance at the output of the amplifier 310 with the impedance at the input of the mixer 320.

The mixer 320 also receives an input from the RF synthesizer 280, in preferred embodiments this signal being at the same frequency as the signal transmitted from the RF synthesizer 280 to the mixer 260. The $f_1 + f_2$ and $f_1 - f_2$ components generated by the mixer 320 are then passed via another matching network 322, 324, 326 and an amplifier 330 to a filter 340.

The filter 340 is arranged to only allow signals in a bandwidth of 42MHz centred on a predetermined frequency to be passed through the filter 340, in preferred embodiments this predetermined frequency being 3431MHz so as to remove the $f_1 - f_2$ component produced by the mixer 320. Subsequent amplification of the signal is performed by amplifiers 350 and 360 to counteract the loss of the filter 340, prior to the signals being output via the switch 370 to the filter 210, and from there to the antenna 202 for transmission. During normal operation, the switch 370 is arranged to pass the signals output by the amplifier 360 to the RF filter 210. However, during installation calibration procedures, the switch 370 can be switched such that the signal

is earthed via the resistor 380 to prevent transmission of a test signal generated during calibration.

Further, the signal output by the amplifier 360 to the switch 370 is coupled via a coupler 385 to a diode 390. This provides an indication 'P' of the transmit power of the signal, this indication 'P' being provided to a serial communications controller 410 within the RF block 110, which then passes that information via the drop cable 120 to the customer modem unit 130.

The circuitry illustrated in Figure 5 is intended for use in a subscriber terminal using the CEPT SE19 Recommendation for wireless telecommunications, where the duplex spacing is 100MHz. However, other duplex spacings, such as 175MHz and 94MHz, can easily be accommodated by incorporating an additional fixed frequency synthesizer.

In order for the automatic frequency control (AFC) loop to operate correctly, the RF synthesizer 280 must be phase locked to a 13MHz frequency reference located in the customer modem unit 130. This is achieved by sending a 13MHz tone up the drop cable from the customer modem unit, this tone then being isolated using a filter 400. This filter 400 is arranged to allow signals within a bandwidth of 50KHz and centred on a frequency of 13MHz to be received by the RF synthesizer 280.

Further, certain control signals can be passed between the customer modem unit 130 and the RF block 110 via the drop cable. To facilitate this, the serial communications controller 410 is provided within the RF block 110, which is arranged to transmit and receive signals centred on a frequency of 455KHz. A filter 420 is used to isolate signals within a bandwidth of 20KHz and centred on a frequency of 455KHz that are passed over the drop cable from the customer modem unit 130 for subsequent processing by the serial communications controller 410. Further, signals emitted by the serial communications controller 410 at a frequency of 455KHz will be passed through the filter 420 and over the drop cable to the customer modem unit 130. Hence, the serial communications controller 410 allows for bidirectional communications with the CDMA modem in the customer modem unit 130. The communications controller amplitude modulates a 455KHz carrier with binary data. In preferred embodiments, the data transmitted from the RF block 110

to the CMU 130 comprises transmit power level (P) only. However, preferably the data transmitted from the customer modem unit 130 to the RF block 110 may comprise the following:

1. Transmit on/off control (C1);
2. Transmit calibrate control (C4);
3. Receive calibrate control (C3);
4. Receive gain trim (loud switch) (C2); and
5. Receive signal strength indication (used in installation mode).

The above control signals C1 to C4 are then output by the serial communications controller 410 to the relevant components within the RF block 110, as illustrated in Figure 5. Further, the receive signal strength indication may be used to drive LEDs 430 provided on the RF block 110 so as to provide a visual indication of the received signal strength, which, as will be discussed in more detail later, is useful during installation. Alternatively, or additionally, the receive signal strength indication may be passed to a DAC 440 to generate an analogue signal at an output port of the RF block 110. A device such as a voltmeter may then be connected to the output port to receive a signal indicative of the received signal strength.

In preferred embodiments, the power required to operate the RF block 110 is received via the customer modem unit 130 over the drop cable 120. A DC-DC converter 450 is provided within the RF block 110 to process the received power signal in order to generate a regulated voltage for supply to the circuitry within the RF block.

The customer modem unit 130 will now be discussed in more detail with reference to Figures 6 and 7. As illustrated in Figure 6, the customer modem unit 130 comprises a radio modem card 500 which is connected to the drop cable 120, the radio modem card 500 communicating with the RF block 110 via the drop cable 120 at an intermediate frequency. The radio modem card 500 incorporates all of the functions required to implement the baseband and IF parts of the CDMA modem. As mentioned earlier, the radio modem card 500 is designed as a generic modem to be manufactured in high volume independent of the customer interface. The interface to the customer interface card 510 is designed to support all anticipated applications,

including 1 to 4 line POTS, basic rate ISDN and D128 data. A more detailed description of the radio modem card will be provided later with reference to Figure 7B.

The customer interface card 510 is connected to the radio modem card 500, and incorporates the following functions:

1. A CPE interface, one or two line POTS, or ISDN. Preferably, the POTS CPE interface uses a programmable digital signal processor (DSP) to implement voice compression, tone generation and detection. Line hybrid balance and gain trim may also be implemented by a DSP, but alternatively could be implemented with external circuitry;
2. A microcontroller with two full software images held in FLASH of software used to control the customer interface card, downloadable over the air or via a Local Access Terminal (LAT) port. A software image is a specific instance of a piece of software, and providing two software images allows one to be active whilst the other is in standby, thereby allowing the standby image to be updated whilst the active image is running;
3. A Local Access Terminal (LAT) port;
4. A reset switch;
5. An interface to the radio modem card 500;
6. A switching power converter, a battery charger and a backup switch;
7. An LED panel driver; and
8. A smartcard interface.

As illustrated in Figure 6, the customer modem unit 130 also incorporates a single lead-acid battery 530, this battery having a nominal output voltage of 12 volts for power backup. In preferred embodiments, battery access is via a removable panel on the customer modem unit. Flying or captive leads may be used to connect the battery to the customer interface card 510, which incorporates the battery charging circuitry and switching that is activated in the event of DC input failure.

An LED panel 520 is also provided within the customer modem unit 130 in preferred embodiments, this LED panel being used to provide status information to the user. In preferred embodiments the following indications are provided:

Position	Type	Function	Off	Flash	On (Red)	On (Green)
1	Red	Fault	Unit OK	Unit requires configuration	Fault	-
2	Green	Power	No power	Switched to battery	-	DC input OK
3	Bi-colour	Link	No link	-	Link in use	Downlink OK

It will be appreciated by those skilled in the art that an LCD panel could be used instead of the LED panel.

Having described the main elements of the customer modem unit 130, the circuitry within the radio modem card 500 used to perform IF processing will now be discussed in detail with reference to Figure 7A.

Considering first an IF signal transmitted to the radio modem card 500 from the RF block 110 via the drop cable 120, this signal will be received by the duplex filter 600, 605. The duplex filter is arranged such that the filter 600 will allow the IF signal to pass to the path 604, whilst the filter 605 will prevent the signal passing to the path 602. Hence, the received signal is passed via the path 604 to a variable attenuator 640, prior to being passed on through an amplifier 630 to a mixer 650. The variable attenuator 640 is controlled by the CDMA modem within the radio modem card (which will be discussed in more detail later with reference to Figure 7B), and is used to compensate for the losses introduced by the drop cable 120.

The mixer 650 also receives a signal from a first IF synthesizer 665, which is referenced back to a 13MHz frequency reference oscillator 700. The oscillator 700 is controlled by the CDMA modem within the radio modem card 500 as part of an AFC loop. The first IF synthesizer 665 may be programmed to any one of twelve 3.5MHz channels within the 42MHz band spanning the range 815.75 to 854.25MHz, and hence performs RF channel selection. The $f_1 + f_2$ and $f_1 - f_2$ components then generated by the mixer 650 are amplified by an amplifier 655 before being passed to a SAW filter 660. The SAW filter is arranged to allow signals in a bandwidth of 3.5MHz centred on a frequency of 100MHz to be passed through the filter, and hence the SAW filter 660 removes the $f_1 + f_2$ component produced by the mixer 650. The

3.5MHz SAW filter 660 in effect isolates the RF channel selected by the first IF synthesizer 665.

The output from the SAW filter 660 is then passed via a matching network 672, 674, 676 to a variable amplifier 680, this amplifier 680 performing automatic gain control (AGC). The signal is then passed to the demodulator circuit 690, which performs quadrature demodulation to baseband I and Q components. The I component is then passed via an amplifier 694 to a CDMA demodulator within the radio modem card 500, whilst the Q component is passed via an amplifier 692 to the CDMA demodulator.

A more detailed illustration of the circuitry 690 is provided in Figure 8A. As can be seen, the signal from the AGC amplifier 680 is divided into two separate signals, one received by the mixer 702 and one received by the mixer 704. A "divide by 4" circuit is arranged to generate four 100MHz signals, phase shifted by 90° from each other, from a 400MHz signal generated by a second IF synthesizer 695, this second IF synthesizer also being referenced back to the 13MHz frequency reference oscillator 700. The mixer 702 receives one of these 100MHz signals and then uses its two input signals to generate an "I" component. Meanwhile, a second 100MHz signal phase shifted by 90° is input to the mixer 704, and the mixer 704 then creates the "Q" component from the phase shifted 100MHz signal and from the other input signal.

Considering now signals to be transmitted by the subscriber terminal, the I and Q components of the transmit signal are first passed through filters 730 and 735, respectively. These two filters have a bandwidth of 2MHz in preferred embodiments, and serve to extract the fundamental from the digitally generated signals. The output from the filters 730 and 735 are then amplified by the amplifiers 740 and 745, respectively, before being passed to the circuitry 750. The circuitry 750 is illustrated in more detail in Figure 8B. As illustrated in Figure 8B, the I component of the signal is received by a mixer 752, and the Q component of the signal is received by a mixer 754. Both mixers also receive a signal from the first IF synthesizer 665, although the signal received by the mixer 754 is phase shifted by 90° prior to being received by the mixer 754. As mentioned earlier, the first IF synthesizer 665

operates from 815.75 to 854.25MHz and can be programmed to any one of twelve 3.5MHz channels within the 42MHz band in order to perform RF channel selection. The signals generated by the mixers 752 and 754 are then passed to the combiner 756 where they are combined into a single signal.

The combined signal is then passed via a matching network 762, 764, 766 to an amplifier 775. The signal output by the amplifier 775 is then passed through a variable attenuator 780, and a matching network 782, 784, 786. Then the signal is again passed through a variable attenuator 795 before being passed to an amplifier 810.

Then the signal is passed through a variable attenuator 815 prior to being passed over path 602 to the duplex filter 600, 605. The variable attenuator 815 is arranged to compensate for the losses that will be introduced by the drop cable 120. The filter 605 is then arranged to cause the signal on path 602 to be output on to the drop cable 120, whilst the filter 600 prevents that signal from being propagated on to the path 604.

As also illustrated in Figure 7A, the 13MHz reference frequency generated by the oscillator 700 is passed through a filter 825 having a bandwidth of 50KHz centred on a frequency of 13MHz. The output of the filter 825 is then passed to the drop cable 120 for transmission over the cable to the RF block 110. As mentioned earlier, in order for the AFC loop within the RF block 110 to operate correctly, the RF synthesizer 280 within the RF block 110 must be phase locked to the 13MHz frequency reference generated by the oscillator 700 in the customer modem unit 130. By sending this 13MHz tone up the drop cable, the required phase locking of the RF synthesizer can be achieved.

Further, as illustrated in Figure 7A, a serial communications controller 830 is provided to allow low rate bidirectional communications with the RF block 110, the communications controller amplitude modulating a 455KHz carrier with binary data. This signal is then passed via a filter 840 having a bandwidth of 20KHz centred on a frequency of 455KHz, and from there the signal is passed to the drop cable 120. The filter 840 also serves to isolate any control signals issued by the RF block 110 and passed over the drop cable 120 to the radio modem card 500. As mentioned

earlier, in preferred embodiments the RF block 110 may for example issue a control signal identifying the transmit power level. The filter 840 then isolates that signal, and passes it on to the serial communications controller 830.

Also, the radio modem card 500 is arranged to provide DC power to the drop cable 120 for transmission to the RF block 110 to power the RF block components.

The CDMA modem within the radio modem card 500 which is used to control the circuitry of Figure 7A will now be described in more detail with reference to Figure 7B. The CDMA modem of preferred embodiments essentially consists of a Digital Signal Processor (DSP) 855 which is connected to both a CDMA modulator 850 and a CDMA demodulator 860. The RXI and RXQ signals generated by the demodulator circuit 690 are passed through ADCs 868 and 870, respectively, prior to being received by the CDMA demodulator 860.

The CDMA demodulator 860 then performs CDMA demodulation under the control of the DSP 855, and outputs the received data (Rx data) and received clock (Rx clock) signals to the customer interface card 510. Further, the CDMA demodulator 860 generates a synchronisation (Sync) signal used to synchronise various circuitry within the customer modem unit 130. This Sync signal is output to the customer interface card 510 and is also provided to the CDMA modulator 850.

The CDMA demodulator receives data (Tx data) and clock (Tx clock) signals from the ST's connected telecommunications equipment via the customer interface card 510. This data is then used by the CDMA modulator 850 to generate CDMA modulated I and Q signals under the control of the DSP 855, these signals being passed through respective DACs 862 and 864 to generate the TXI and TXQ signals input to the circuitry of Figure 7A.

The DSP 855 has a host processor interface with the customer interface card 510 to enable communications with the microcontroller on the customer interface card to take place. Further the DSP 855 can receive signals from the CDMA demodulator 860, such as details of signal strength used by the DSP during installation of the ST, this being described in more detail later.

The DSP 855 is arranged to generate the various signals used to control the circuitry of Figure 7A. Hence, the DSP outputs signals to a multiple DAC 866, which

then outputs the AFC signal input to the oscillator 700 to perform automatic frequency control, and outputs the TX_GC and RX_GC gain control signals input to the variable attenuators 780, 795 and the variable amplifier 680 to control gain of the transmit and receive signals during normal operation.

Further, the DSP 855 generates the transmit enable (TX_EN) signal used to control the circuitry 750, and amplifiers 775, 810 to allow transmission to take place. In addition, during calibration of the circuitry (eg. on installation), the DSP 855 generates the TX_COMP and RX_COMP signals used to control the variable attenuators 815 and 640, respectively, to compensate for the losses incurred by transmission of the uplink and downlink IF signals over the drop cable 120. This process will be described in more detail later.

Finally, the DSP 855 is responsible for generating the various control signals (SCC_DATA) passed to the serial communications controller 830 for transmission over the drop cable 120 to the RF block 110. Additionally, the DSP 855 will receive via the serial communications controller 830 any control signals issued by the RF block 110, for example the transmit power level indication 'P'.

Having described the circuitry of the RF block 110 and the radio modem card 500, the signals passed between these two units via the drop cable 120 will now be discussed in more detail with reference to Figure 9, which illustrates the spectrum utilisation for the drop cable. As mentioned earlier, the drop cable 120 preferably comprises a two conductor coaxial cable carrying the following signals between the radio modem card 500 and the RF block 110:

1. Uplink IF spread-spectrum signal;
2. Downlink IF spread-spectrum signal;
3. 13MHz frequency reference;
4. 455KHz carrier data link; and
5. DC power, preferably 10 to 20 volts.

As mentioned earlier, elements of the RF block 110 are in preferred embodiments controlled by the CDMA modem on the radio modem card 500. Digital data is pulse position modulated on to a 455KHz carrier, this frequency being chosen due to ready availability of ceramic filters and resonators and because it is not

harmonically related to the 13MHz frequency reference signal (13/0.455 = 28.5714). In preferred embodiments, each data bit is sent using a line code comprising a start bit, data bit and stop bit. The correlation between the data bit and the line code in preferred embodiments is as follows:

Data bit	Line code
0	100
1	110

Preferably data is sent in packets as follows:

Packet Element	Number of Bits
Sync Header	3
Address	1
Payload	8
Parity	1

In preferred embodiments, the packets are time division multiplexed every 30ms. The CMU controller preferably acts as a protocol master, initiating communications every 30ms. The header preferably comprises a fixed sequence, say 001. Further, the address is typically set to zero for communication with the RF block 110, and a non-zero address is used for communications with equipment other than the RF block, for example a receive signal strength meter. The payload preferably comprises 8 bits and the packet is error protected with a single parity bit.

Figure 10 provides a more detailed illustration of the serial communications controller 830 and the filter 840 illustrated in Figure 7. An oscillator 900 is arranged to produce a carrier signal at 455KHz. Control inputs passed to the serial communications controller 830 then cause control data to be output from the serial communications controller to a switch 910, the switch 910 pulse position modulating that data on to the 455KHz carrier signal. This signal is then passed to the filter 840

which allows a bandwidth of 20KHz centred on 455KHz to be output to the drop cable 120.

For a control signal issued by the RF block 110, the filter 840 will isolate that signal and then pass it to the diode 920 which will rectify the signal. The rectified signal is then passed to a low pass filter 930 which removes the 455KHz carrier signal. The output from the filter 930 is then passed to a comparator 940 where the signal is compared with a threshold voltage to produce at the output a digital signal for passing to the serial communications controller 830. The serial communications controller then uses this signal to create parallel control outputs.

The architecture illustrated in Figure 10 is also applicable to the serial communications controller 410 and the filter 420 of the RF block 110 illustrated in Figure 5. The serial communications controller within the RF block 110 may also handle configuration of the RF synthesizer 280 at power-up.

Having described the subscriber terminal of preferred embodiments in detail, the installation of the subscriber terminal will now be discussed. Important aspects of the installation process are unit configuration and antenna alignment.

Before an ST becomes operational, configuration data must be entered into the unit. As an example the following minimum information may be required:

1. RF channel number;
2. PN code; and
3. An ST identifier (preferably a six digit number).

Two options exist for entering this data. Firstly, if a LAT port is fitted, as is the case for the customer modem unit 130 of preferred embodiments illustrated in Figure 6, then an external terminal may be used to configure the unit. This technique would generally be used for STs with ISDN or D128 interfaces. An alternative approach is to use a telephone connected to the subscriber terminal, such an approach typically being used if the subscriber terminal is to be used for POTS signalling. A technique that may be used for this purpose is described in detail in the patent application GB-A-2,301,738.

Once the necessary configuration data has been entered, then in preferred embodiments a calibration step is performed to calibrate the ST with respect to the

signal losses introduced by the drop cable. The technique used in preferred embodiments to perform this calibration will now be described with reference to Figures 5, 7A and 7B.

Firstly, to calibrate the downlink path to compensate for losses introduced by the drop cable, the DSP 855 generates the receive calibrate control signal C3 on the SCC_DATA channel, which is then passed by the serial communications controller 830 over the drop cable 120 to the serial communications controller 410 in the RF block 110. This causes the serial communications controller 410 to issue the C3 signal to the switch 240, to cause the calibrated noise source 245 provided in the RF block 110 to be switched into the downlink path. Preferably, this calibrated noise source produces additive white Gaussian noise at a predetermined power level. This noise signal is then passed through the receive path circuitry of Figure 5, over the drop cable 120, and through the receive path circuitry of Figure 7A to produce RXI and RXQ components which are output to the CDMA demodulator 860 of the CDMA modem illustrated in Figure 7B.

Here, predetermined criteria are stored which the calibrated noise source should exhibit when received by the CDMA demodulator 860 if the losses of the drop cable have been compensated for. By comparing the actual received noise signal with the predetermined criteria, the CDMA demodulator can determine whether the setting of the variable attenuator 640 should be incremented or decremented. One example of the predetermined criteria which may be stored is the frequency with which signals outside a certain number of standard deviations from the peak of the Gaussian signal should be received. Since the noise signal is digitised prior to being received by the CDMA demodulator 860, the CDMA demodulator can be arranged to keep a count of the number of times the signal is outside the determined number of standard deviations, and notify the DSP 855 if the number exceeds a certain threshold, thereby indicating that the setting of variable attenuator 640 should be altered.

When the DSP 855 receives a signal from the CDMA demodulator 860 identifying that the setting of the variable attenuator 640 should be altered, it generates a RX_COMP signal for outputting to the variable attenuator 640 to alter its setting. By appropriate setting of the variable attenuator 640, the losses introduced

by the drop cable in the receive path can be compensated for.

To calibrate the uplink path to compensate for losses introduced by the drop cable, the DSP 855 is arranged to instruct the CDMA modulator 850 to generate, in preferred embodiments, a calibrated noise signal for transmission through the transmit path circuitry of Figure 7A and Figure 5. To avoid the noise signal being transmitted from the antenna 202, the DSP 855 also generates a control signal C4 on the SCC_DATA output, which is passed via the serial communications controller 830 of the radio modem card 500 over the drop cable 120 to the serial communications controller 410 in the RF block, thereby causing the serial communications controller 410 to issue the C4 signal to the switch 370 to earth the transmit signal.

However, the coupler 385 in the RF block 110 still receives the transmitted noise signal, and hence provides an indication 'P' of the transmit power of the signal. This indication 'P' is provided to the serial communications controller 410 within the RF block 110, which then passes that information via the drop cable 120 to the serial communications controller 830 in the radio modem card 500. This data is then passed to the DSP 855 via the SCC_DATA channel, and the DSP compares the indication P with a predetermined value to determine whether the setting of the variable attenuator 815 should be altered. If alteration is necessary, then the DSP outputs a suitable TX_COMP signal to the variable attenuator 815 to alter its setting. By this approach, the losses introduced by the drop cable in the transmit path can be compensated for.

Once the necessary calibration steps have been performed, then the antenna 100 of the subscriber terminal is in preferred embodiments aligned so that it is pointing towards the central terminal with which it is intended to communicate. Since the antenna is typically mounted at an elevated position on the exterior of the subscriber's premises, then the engineer will generally have to climb up to the mounting location of the antenna and manually align the antenna unit.

Where a LAT port is fitted to the subscriber terminal, an external terminal may be used to monitor receive signal strength and act as a guide for antenna panning. However, since the LAT port, if any, will typically be provided at the customer modem unit 130 located inside the subscriber's premises, then such an

approach is very cumbersome if carried out by a single engineer, and so typically involves two engineers, one for adjusting the antenna, and one for monitoring the receive signal strength.

In accordance with preferred embodiments of the present invention, a number of simplified options are available for aiding antenna alignment. All of these options require that the subscriber terminal be placed in a special mode of operation which inhibits normal operation. This could for example be achieved by entering a special code into the subscriber terminal following unit reset. The unit would then remain in antenna alignment mode to enable the installation to be completed.

The receive signal strength is measured on de-spread data in the CDMA demodulator 860 within the customer modem unit 130, where the true signal power can be distinguished from access noise. One option for removing the requirement for an external terminal to be fitted via the LAT port is to use the customer modem unit LED/LCD panel to indicate receive signal strength. However, this would still typically require two engineers to perform the installation.

Hence, an alternative option is to incorporate LEDs into the RF block 110 to indicate receive signal strength, as was discussed earlier with reference to Figure 5. Since the RF block 110 is likely to be located very close to the antenna unit 100, and indeed in some implementations both the RF block 110 and the antenna unit 100 will be incorporated into the same physical device, then the engineer that is adjusting the antenna can also view the LED indication on the RF block. However, as mentioned earlier, the receive signal strength is preferably measured in the CDMA demodulator within the customer modem unit 130. Hence, in preferred embodiments, the receive signal strength as determined by the CDMA demodulator is then output by the DSP 855 on the SCC_DATA output and transmitted back up the drop cable 120 via the serial communications link, and subsequently displayed on the LEDs of the RF block 110.

As illustrated in Figure 5, as an alternative, or in addition, to the LEDs, a DAC 440 can be provided in the RF block 100 to generate at an output port of the RF block an analogue received signal strength indication (RSSI). Then, a device such as a voltmeter can be attached by the installation engineer to provide an indication of

received signal strength.

Further, since in preferred embodiments the ST has already been calibrated, prior to the antenna alignment process being performed, to compensate for losses introduced by the drop cable, the LEDs or voltmeter can be calibrated to provide a direct reading of received signal strength to the installation engineer.

Yet another alternative approach, depicted in Figure 11, is to place a receive signal strength meter 960 in line with the drop cable 120. As before, the receive signal level is transmitted up the RF block cable using the serial communications link, but in this instance is intercepted by the meter. The signal strength level is then displayed on an LED or LCD panel provided by the signal strength meter. When alignment is complete, the meter is removed and the drop cable fitted to the RF block 110.

The main advantage of providing either indication mechanisms in the RF block or a separate meter connected to the cable in the vicinity of the RF block is that the signal strength can be evaluated near the RF block, thereby enabling the ST to be installed by a single person. Further, in preferred embodiments, the indication can be calibrated to give a direct indication of "fade margin", i.e. the amount of dB variation before the communication path is lost.

It will be appreciated by those skilled in the art that the actual device used to provide the indication of received signal strength is not important. Any type of visual or audible indication could be used as appropriate.

Although a particular embodiment has been described herein, it will be appreciated that the invention is not limited thereto and that many modifications and additions thereto may be made within the scope of the invention. For example, various combinations of the features of the following dependent claims could be made with the features of the independent claims without departing from the scope of the present invention.

CLAIMS

1. A subscriber terminal for communicating over a wireless link with a central terminal of a wireless telecommunications system, the subscriber terminal comprising:

a first signal processing unit associated with an antenna to transmit and receive signals over the wireless link at first frequencies within an operating frequency band, the first signal processing unit comprising a frequency converter for converting signals between said first frequencies and a second frequency;

a second signal processing unit remote from the first signal processing unit and associated with an item of telecommunications equipment to pass signals between said item of telecommunications equipment and the first signal processing unit, the second signal processing unit being formed from signal processing circuitry which is independent of the operating frequency band, the signals being passed between the first signal processing unit and the second signal processing unit at the second frequency via a connection medium connecting the first and second signal processing units.

2. A subscriber terminal as claimed in Claim 1, wherein the first signal processing unit is arranged to be mounted on the exterior of a subscriber's premises, whereas the second signal processing unit is arranged to be located within the subscriber's premises.

3. A subscriber terminal as claimed in Claim 1 or Claim 2, wherein the connection medium is a cable over which signals at said second frequency are passed.

4. A subscriber terminal as claimed in Claim 3, wherein said cable is a coaxial cable.

5. A subscriber terminal as claimed in any preceding claim, wherein the second

frequency comprises a downlink second frequency for signals passed from the first signal processing unit to the second signal processing unit and an uplink second frequency for signals passed from the second signal processing circuit to the first signal processing circuit.

6. A subscriber terminal as claimed in any preceding claim, wherein the second frequency is an intermediate frequency, the second signal processing unit comprising a radio modem circuit arranged to process a signal received via the connection medium at the intermediate frequency to generate a baseband signal for passing to the item of telecommunications equipment, and to process a baseband signal from the item of telecommunications equipment to generate a signal at the intermediate frequency for outputting to the first signal processing unit via the connection medium.

7. A subscriber terminal as claimed in Claim 6, wherein the second signal processing circuit further comprises a customer interface unit for interfacing between the radio modem circuit and the item of telecommunications equipment.

8. A subscriber terminal as claimed in Claim 7, wherein the configuration of the customer interface unit is dependent on the item of telecommunications equipment supported by the second signal processing circuit, whereas the configuration of the radio modem circuit is independent of the item of telecommunications equipment supported by the second signal processing circuit.

9. A subscriber terminal as claimed in any preceding claim, wherein the power required to operate the first signal processing unit is supplied by the second signal processing unit.

10. A subscriber terminal as claimed in Claim 9, wherein the power is supplied to the first signal processing unit via the connection medium.

11. A subscriber terminal as claimed in any preceding claim, wherein a

communications link is provided to allow control signals to be passed between the first and second signal processing units.

12. A subscriber terminal as claimed in Claim 11, wherein the communications link is established over the connection medium, and the control signals are issued at a predetermined frequency distinct from said second frequency.

13. A subscriber terminal as claimed in any preceding claim, wherein the first signal processing unit and the antenna are integrated in to a single housing.

14. A subscriber terminal as claimed in any preceding claim, wherein the second signal processing unit is associated with more than one item of telecommunications equipment.

15. A first signal processing unit for a subscriber terminal as claimed in any preceding claim, the first signal processing unit being associated with an antenna to transmit and receive signals over the wireless link at first frequencies within an operating frequency band, and the first signal processing unit comprising a frequency converter for converting signals between said first frequencies and a second frequency.

16. A second signal processing unit for a subscriber terminal as claimed in any preceding claim, the second signal processing unit being associated with an item of telecommunications equipment to pass signals between said item of telecommunications equipment and the first signal processing unit, the second signal processing unit being formed from signal processing circuitry which is independent of the operating frequency band.

17. A method of communicating over a wireless link with a central terminal of a wireless telecommunications system, comprising the steps of:

providing a first signal processing unit associated with an antenna to transmit and receive signals over the wireless link at first frequencies within an operating frequency band;

converting, within the first signal processing unit, signals between said first frequencies and a second frequency;

providing a second signal processing unit remote from the first signal processing unit and associated with an item of telecommunications equipment to pass signals between said item of telecommunications equipment and the first signal processing unit;

forming the second signal processing unit from signal processing circuitry which is independent of the operating frequency band; and

passing the signals between the first signal processing unit and the second signal processing unit at the second frequency via a connection medium connecting the first and second signal processing units.

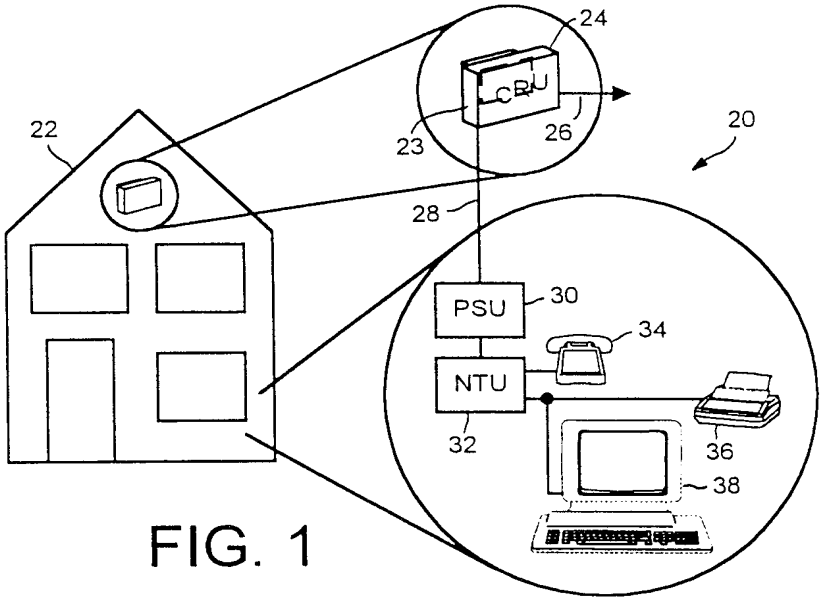

24
CRU
23
26
20
22
28
PSU
30
34
NTU
32
36
38

FIG. 1

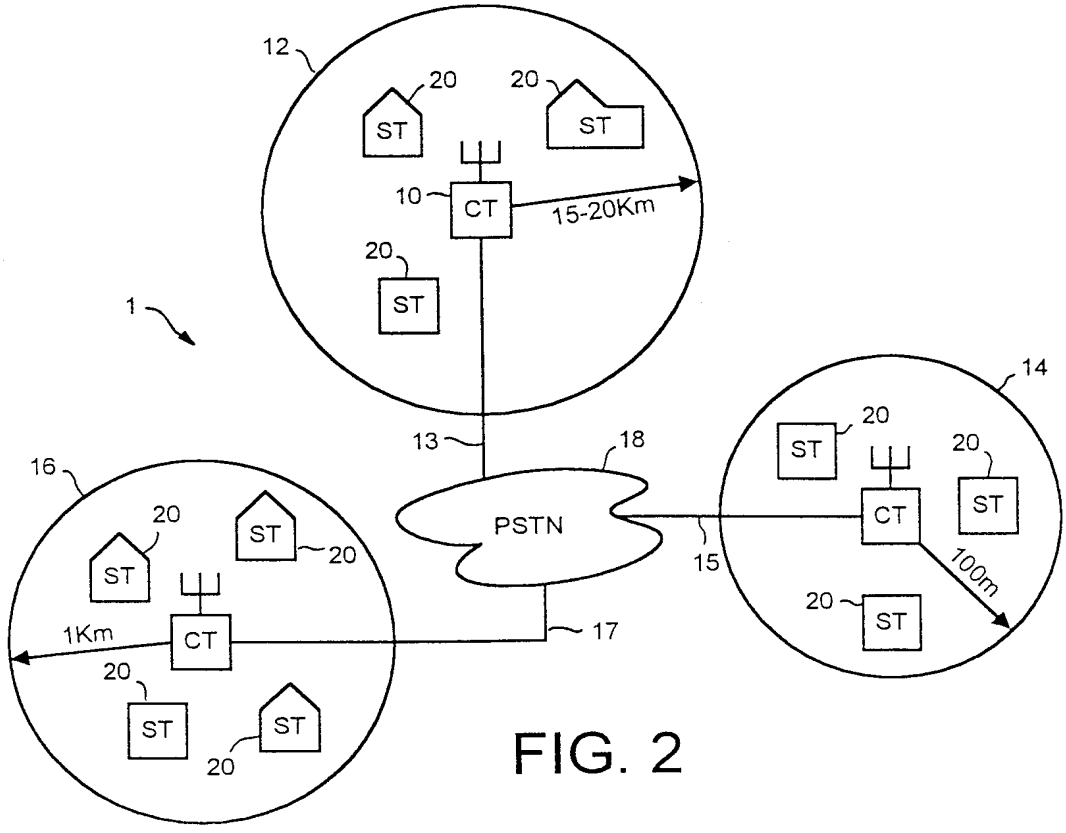

12
20
ST
20
ST
10
CT
15-20Km
20
ST
1
14
13
18
16
20
ST
ST
20
PSTN
15
20
ST
CT
ST
100m
1Km
CT
17
20
ST
ST
20
20
ST

FIG. 2

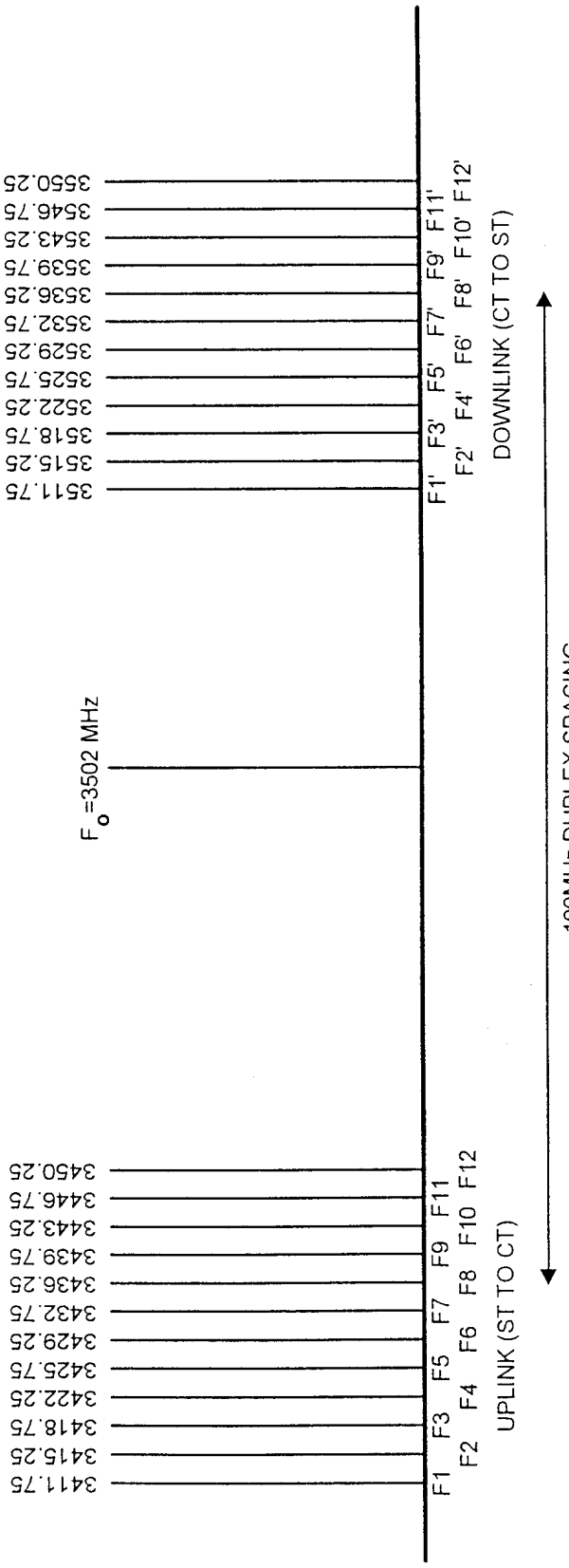

3550.25
3546.75
3543.25
3539.75
3536.25
3532.75
3529.25
3525.75
3522.25
3518.75
3515.25
3511.75
F1' F3' F5' F7' F9' F11'
F2' F4' F6' F8' F10' F12'
DOWNLINK (CT TO ST)
F0=3502 MHz
100MHz DUPLEX SPACING
(GO TO RETURN)
3450.25
3446.75
3443.25
3439.75
3436.25
3432.75
3429.25
3425.75
3422.25
3418.75
3415.25
3411.75
F1 F3 F5 F7 F9 F11
F2 F4 F6 F8 F10 F12
UPLINK (ST TO CT)

FIG. 3

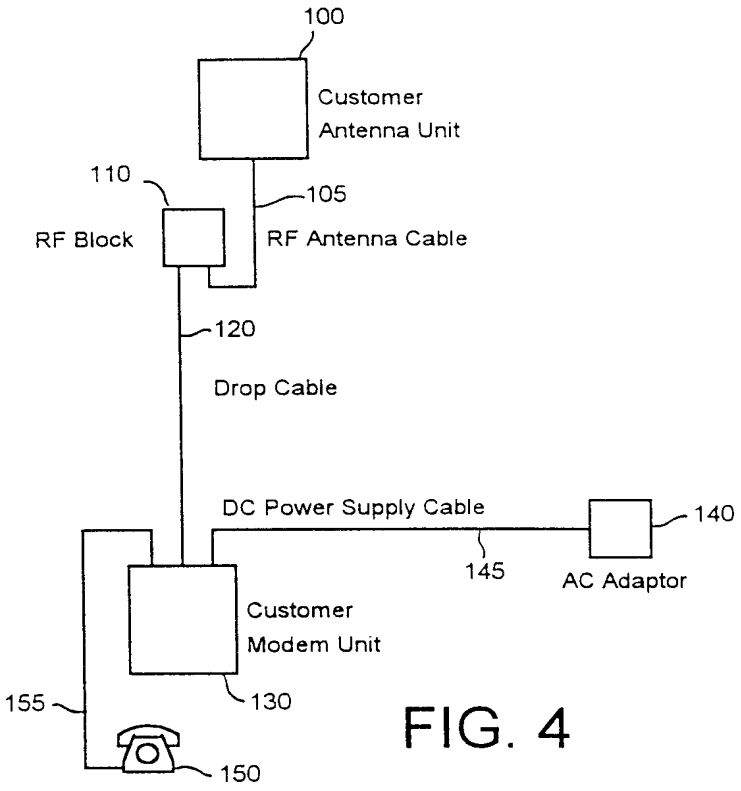

100
Customer
Antenna Unit
110
105
RF Block
RF Antenna Cable
120
Drop Cable
DC Power Supply Cable
140
145
AC Adaptor
Customer
Modem Unit
155
130
150

FIG. 4

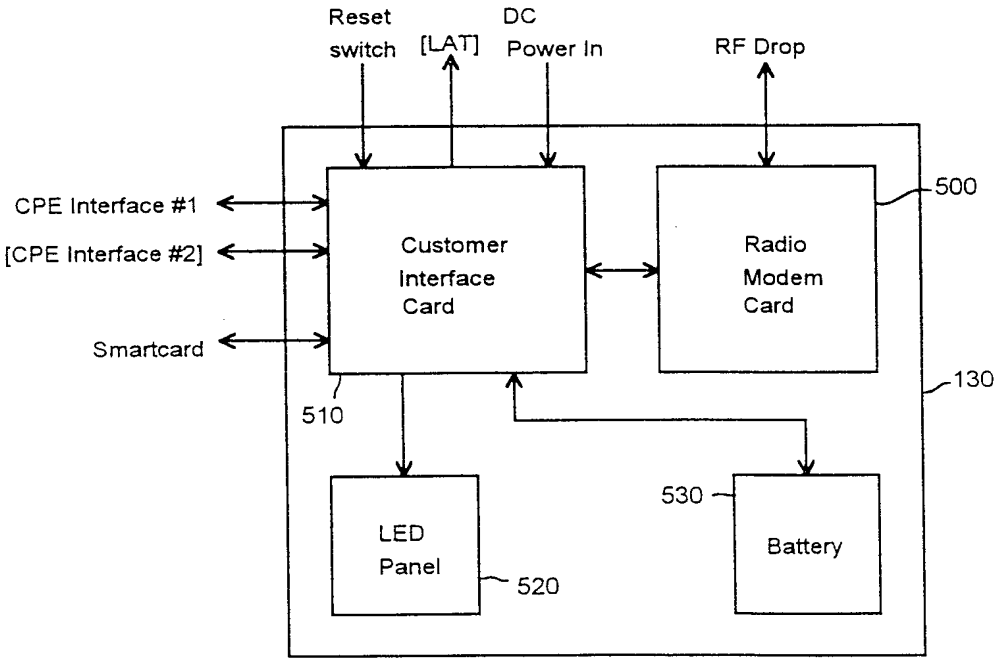

Reset
switch
[LAT]
DC
Power In
RF Drop
CPE Interface #1
[CPE Interface #2]
Smartcard
Customer
Interface
Card
Radio
Modem
Card
500
130
510
LED
Panel
520
530
Battery

FIG. 6

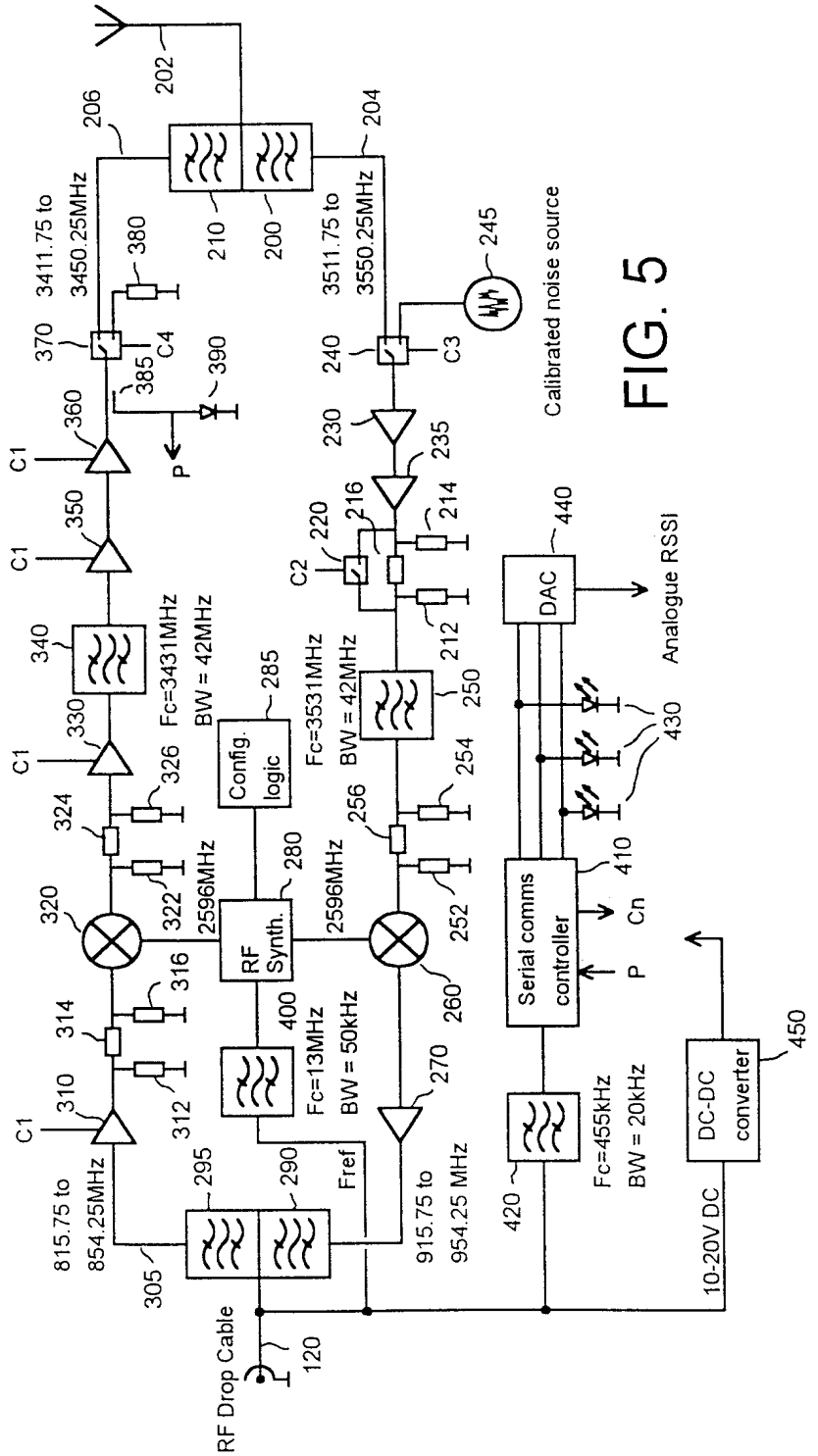

202
206
204
3411.75 to
3450.25MHz
3511.75 to
3550.25MHz
210
200
380
370
C4
385
390
360
C1
350
340
330
326
324
322
320
316
314
310
312
295
290
305
815.75 to
854.25MHz
RF Drop Cable
120
Fc=3431MHz
BW = 42MHz
Config.
logic
285
280
RF
Synth.
2596MHz
400
Fc=13MHz
BW = 50kHz
Fref
915.75 to
954.25 MHz
270
260
252
256
254
250
Fc=3531MHz
BW = 42MHz
212
214
216
220
C2
230
235
240
C3
245
Calibrated noise source
DAC
440
Analogue RSSI
430
Serial comms
controller
410
P
Cn
420
Fc=455kHz
BW = 20kHz
DC-DC
converter
450
10-20V DC

FIG. 5

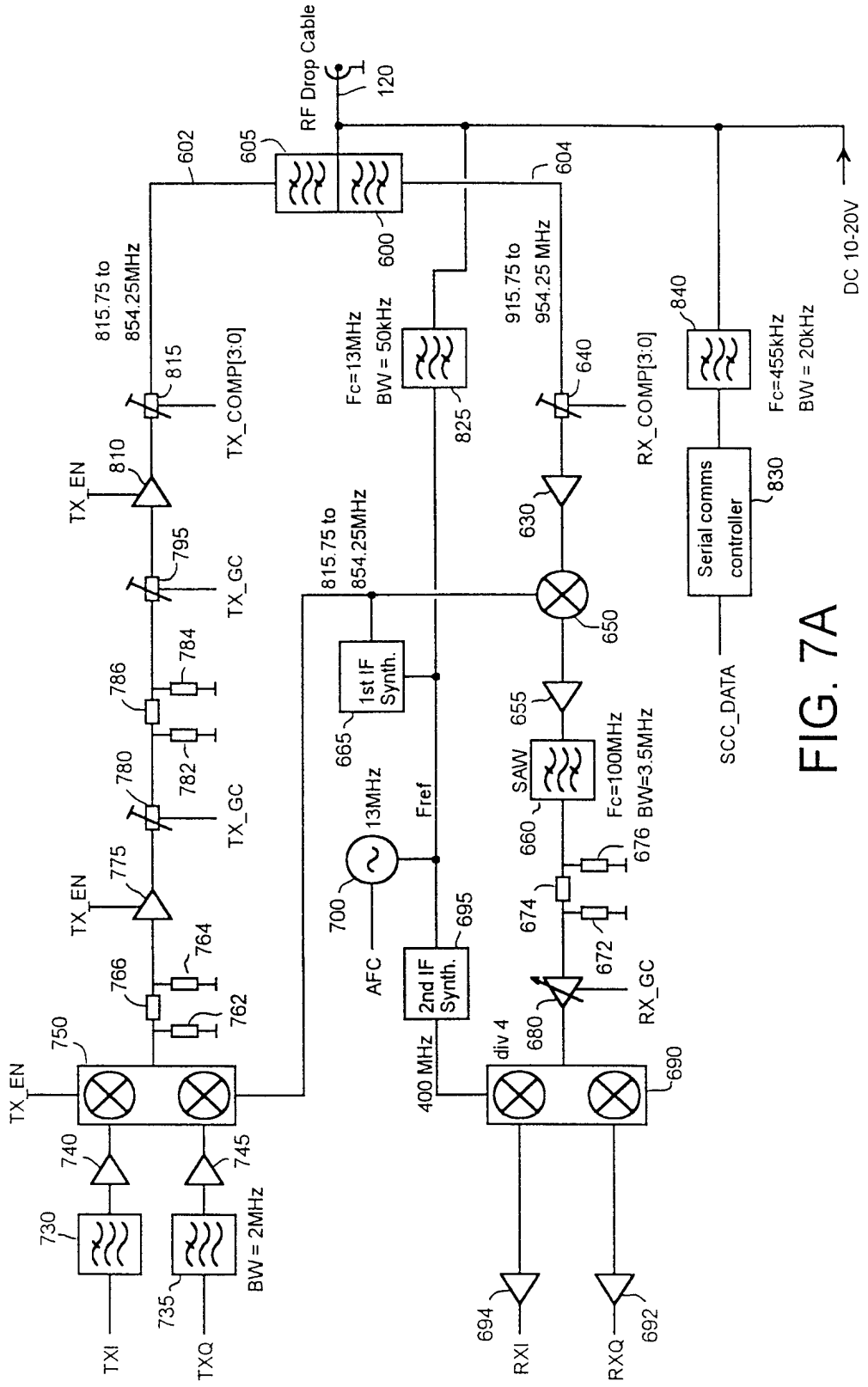

RF Drop Cable
120
605
602
600
604
DC 10-20V
815.75 to 854.25MHz
915.75 to 954.25 MHz
Fc=13MHz BW = 50kHz
825
840
Fc=455kHz BW = 20kHz
815
TX_COMP[3:0]
640
RX_COMP[3:0]
810
TX_EN
630
795
TX_GC
815.75 to 854.25MHz
650
Serial comms controller
830
SCC_DATA
784
786
1st IF Synth.
665
655
780
782
TX_GC
13MHz
Fref
SAW
660
Fc=100MHz BW=3.5MHz
676
775
TX_EN
700
AFC
695
674
672
766
764
2nd IF Synth.
RX_GC
680
762
750
400 MHz
div 4
690
TX_EN
740
745
730
BW = 2MHz
694
692
735
TXI
TXQ
RXI
RXQ

FIG. 7A

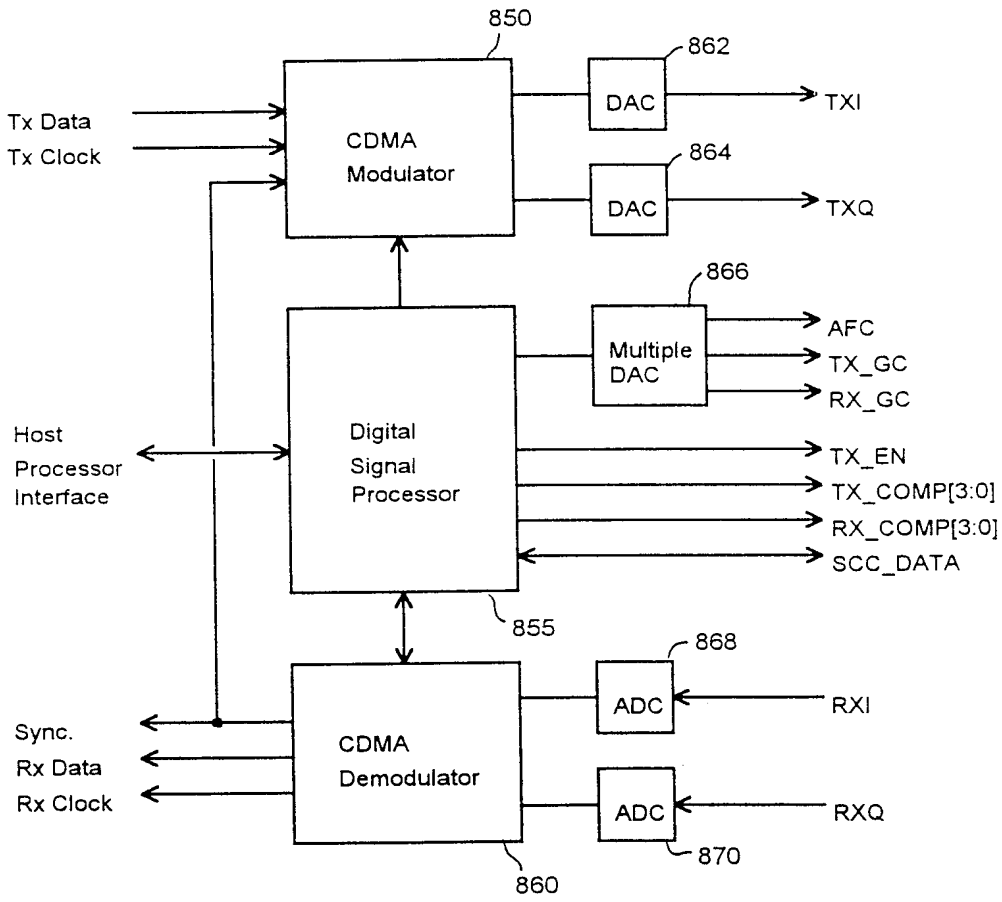

850
862
DAC
TXI
Tx Data
Tx Clock
CDMA
Modulator
864
DAC
TXQ
866
Multiple
DAC
AFC
TX_GC
RX_GC
Host
Processor
Interface
Digital
Signal
Processor
TX_EN
TX_COMP[3:0]
RX_COMP[3:0]
SCC_DATA
855
868
ADC
RXI
Sync.
Rx Data
Rx Clock
CDMA
Demodulator
ADC
RXQ
870
860

FIG. 7B

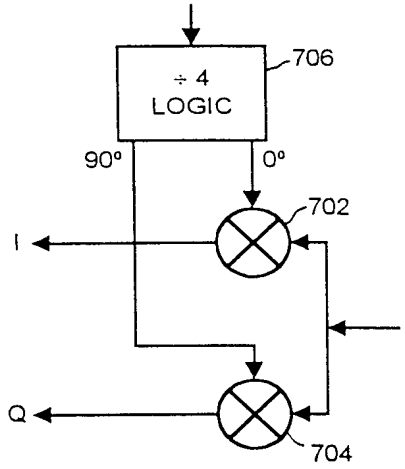


FIG. 8A

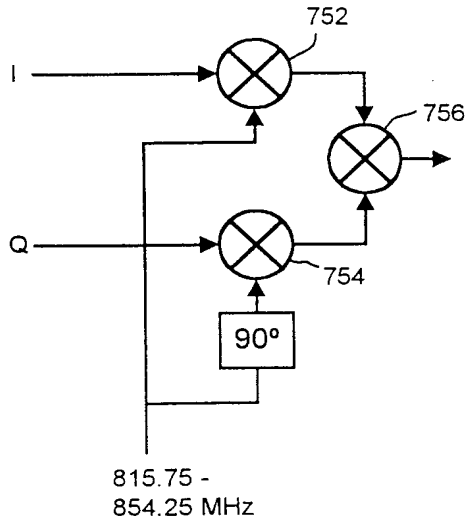


FIG. 8B

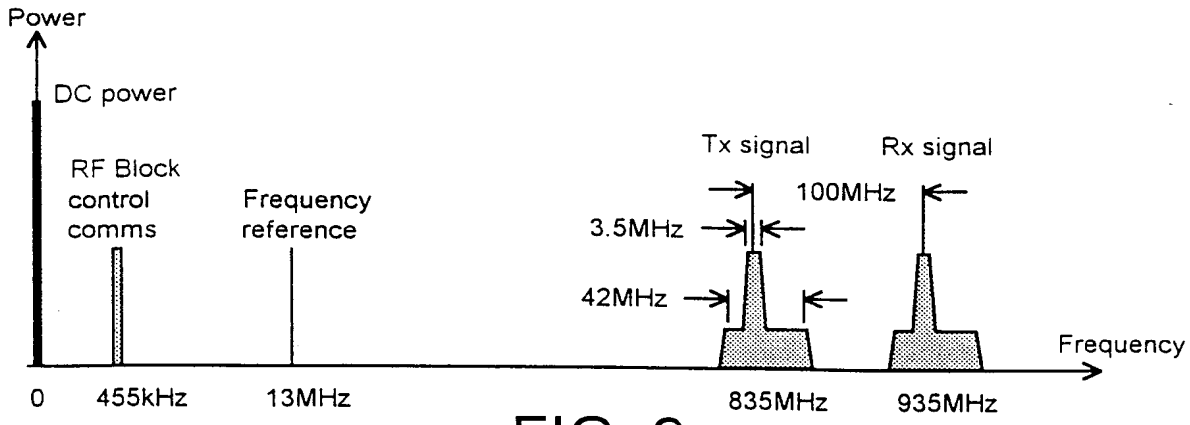


FIG. 9

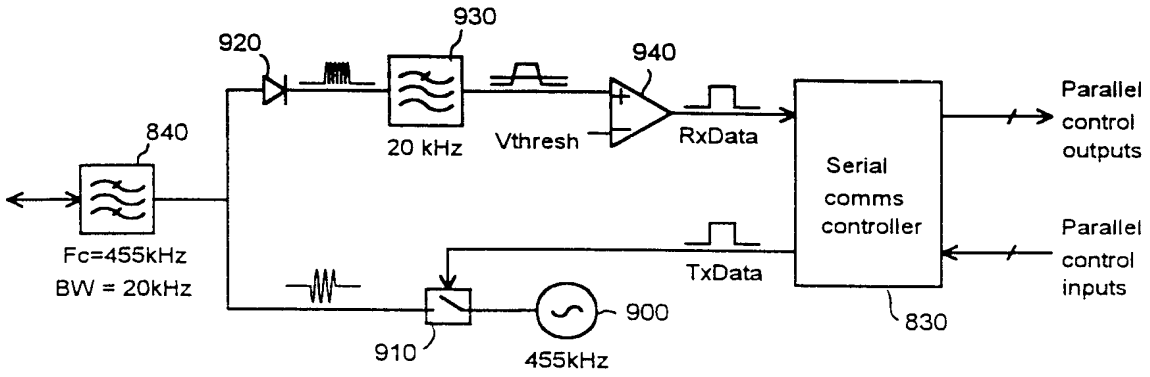


FIG. 10

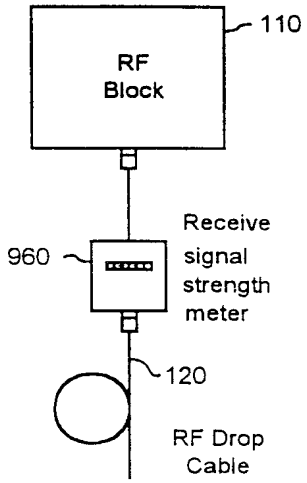


FIG. 11

INTERNATIONAL SEARCH REPORT

Int tional Application No
PCT/GB 98/03420

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04Q7/20 H04B17/00

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04Q H04B

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 750 405 A (NIPPON ELECTRIC CO) 27 December 1996	1-4,6, 9-12, 15-17
Y	see abstract; figures 1,2 see column 1, line 6 - line 36 see column 2, line 2 - line 22 see column 4, line 26 - line 28 see column 5, line 14 - line 40	7,8,14
X	US 5 442 811 A (KOBAYASHI FUMIHIKO ET AL) 15 August 1995 see figures 1,5 see column 1, line 33 - line 44; figure 31 see column 3, line 35 - line 41 see column 11, line 59 - column 12, line 16; figure 2 see column 15, line 7 - line 19; figure 12	1-3,5,6, 11,15-17

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

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

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

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

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

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

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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
4 February 1999	16/02/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Sieben, S

4

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

In ational Application No
PCT/GB 98/03420

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 907 291 A (YAMAMOTO OSAMU) 6 March 1990 see abstract; figures 1-3 see column 1, line 35 - line 64 see column 2, line 65 - line 67 see column 3, line 3 - line 8 see column 4, line 14 - line 31	1-6,13, 15-17
Y	WO 96 27242 A (QUALCOMM INC) 6 September 1996	7,8,14
A	see abstract; figures 2-4 see page 4, line 15 - line 26 see page 5, line 6 - line 15 see page 7, line 10 - line 27; figure 1	1-4,9,10

4

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

Int tional Application No
PCT/GB 98/03420

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0750405 A	27-12-1996	JP 9069802 A	11-03-1997
		US 5754943 A	19-05-1998
US 5442811 A	15-08-1995	JP 6237229 A	23-08-1994
US 4907291 A	06-03-1990	JP 1980982 C	17-10-1995
		JP 4066413 B	23-10-1992
		JP 62274934 A	28-11-1987
		AU 612977 B	25-07-1991
		AU 7330687 A	26-11-1987
		CA 1282877 A	09-04-1991
		EP 0246658 A	25-11-1987
WO 9627242 A	06-09-1996	US 5737687 A	07-04-1998
		AU 697823 B	15-10-1998
		AU 5091096 A	18-09-1996
		BR 9607466 A	23-12-1997
		CN 1185246 A	17-06-1998
		EP 0812497 A	17-12-1997

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: 0 444 841 A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number: 91301473.4

(51) Int. Cl.[5]: H04B 7/26

(22) Date of filing: 25.02.91

(30) Priority: 27.02.90 US 485420

(43) Date of publication of application:
04.09.91 Bulletin 91/36

(84) Designated Contracting States:
AT BE CH DE DK ES FR GB GR IT LI LU NL SE

(71) Applicant: MOTOROLA, INC.
1303 East Algonquin Road
Schaumburg, IL 60196 (US)

(72) Inventor: Spear, Stephen L.
25 Williamsburg Terrace
Skokie, Illinois 60203 (US)

(74) Representative: Dunlop, Hugh Christopher et al
Motorola European Intellectual Property Operations Jays Close Viables Industrial Estate
Basingstoke, Hampshire RG22 4PD (GB)

(54) Time-allocation of radio carriers.

(57) In a TDMA cellular system, there is provided a mechanism for splitting the allocation of time slots within a TDM frame between adjacent coverage areas. There is provided a method of and apparatus for time-allocation of TDMA channels. It is characterized by: periodically allocating some portion of a carrier (19A-24A) of radio traffic to one coverage area during one time interval and periodically allocating some other portion of that same carrier (19B-24B) to another coverage area during a substantially non-overlapping time interval, all in time synchronism with any proximal reuse of that carrier. The distribution of channels in adjacent coverage areas thereby approaches parity (8+8+5 ≈ 8+8+3+3) and the minimum channel capacity per coverage area is enhanced (8+8 ⇒ 8+8+3+3 ; 16 ⇒ 22).

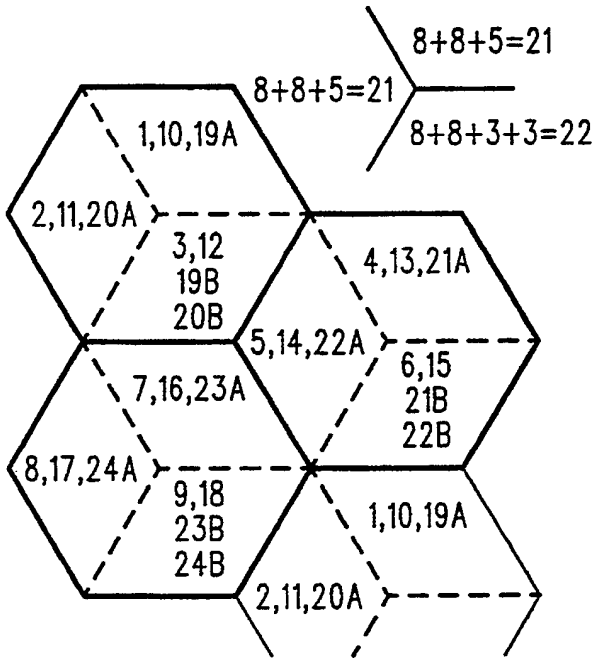


FIG. 2

EP 0 444 841 A2

Jouve, 18, rue Saint-Denis, 75001 PARIS

TIME-ALLOCATION OF RADIO CARRIERS

THE FIELD OF INVENTION

This invention is concerned with time-allocation of cellular radio carriers.

More particularly, in a TDMA cellular system, this invention is concerned with splitting the allocation of time slots within a TDM frame between adjacent coverage areas.

BACKGROUND OF THE INVENTION

Currently proposed FDMA/TDMA cellular radiotelephone systems are spectrally inefficient due to an undesirable granularity in their channel allocation.

Traditionally, in cellular systems, as capacity is needed at any cell site, additional frequencies are more or less permanently and fixedly allocated to that cell. In Time Division Multiple Access (TDMA) systems, like the next generation digital cellular system in Europe commonly known as GSM Pan-European Digital Cellular, each carrier has multiple (eight) time slots in each frequentially repeating time frame. Each slot represents a single channel of radio traffic capacity. Thus, channel capacity would ordinarily and naturally be added on a modulo-eight basis with the addition of each carrier, in others words -- a granularity of eight.

This granularity-by-eight is spectrally inefficient because overall nominal system capacity and planning is based upon providing the minimum number of traffic channels to serve the expected, offered load in a given area. Yet adjacent coverage areas might well exceed this nominal capacity by one or two orders of magnitude (modulo-eight) dur to this granularity. This is a particular problem in FDMA/TDMA systems because a fixed number of time slots per repeating frame are allocated every time a new carrier is allocated to a coverage area.

Others attempted to solve somewhat analogous capacity problems in FDMA systems by load shedding, or sharing carriers between adjacent sectors of a cell, but such frequency sharing disturbs the regular cellular frequency reuse pattern and causes co-channel interference. Cellular systems require a certain geographic separation of reused frequencies to avoid undo unterference. In other words, the level of co-channel interference (carrier-to-interference ratio) experienced by a cellular subscriber from a proximal reuse of that same carrier frequency establishes the distance at which co-channel, omni-directional antenna sites are allowed to exist, while the predictability of the directivity of sectored antennas serves to reduce the reuse distance (see US Patent No. 4,128,740 to Graziano and assigned to the instant assignee). Sharing a carrier frequency from its intended orientation to an adhacent sector of unintended orientation adversely affects the interference in that direction.

This invention takes as its object to overcome these shortcomings and to realize certain advantage presented below.

According to this invention, to even the granularity-induced discontinuities between adjacent coverage areas and to provide additional capacity as needed, certain time slots from one frame are allocated to one coverage area while other time slots in the frame are allocated to another coverage area.

SUMMARY OF THE INVENTION

In a TDMA cellular system, there is provided a mechanism for splitting the allocation of time slots within a TDM frame between adjacent coverage areas. There is provided a method of and apparatus for time-allocation of TDMA channels. Its comprises: periodically allocating some portion of a carrier of radio traffic to one coverage area during one time interval and periodically allocating some other portion of that same carrier to another coverage area during a substantially non-overlapping time interval, all in time synchronism with any proximal reuse of that carrier. The distribution of channels in adjacent coverage areas thereby approaches parity and the minimum channel capacity per coverage area is enhanced.

DESCRIPTION OF THE DRAWINGS

Additional objects, features and advantages of the invention will be more clearly understood and the best mode contemplated for practicing it in its preferred embodiment will be appreciated (by way of unrestricted example) from the following detailed description, taken together with the accompanying drawings in which:

Figure 1 is a cellular frequency planning diagram of the network in which the preferred embodiment of the invention operates.

Figure 2 illustrate cellular frequency planning according to the preferred embodiment of the invention.

Figure 3 is a block diagram of an apparatus for predeterminally subdividing a TDM frame according to the instant invention.

DETAILED DESCRIPTION

Figure 1 is a cellular frequency planning diagram of the network in which the preferred embodiment of the invention operates.

Figure 1 illustrates what would occur in a three cell site, nine-sector cellular repeat pattern if a set of twenty-four carrier frequencies were conventionally distributed such that every sector had roughly the same frequency capacity. The uneven division of 24 carriers by 9 leaves six sectors with three carriers each and three sectors with two carriers each. This doesn't seem quite so lopsided (because disparities of one were not conventionally thought to be divisible) until one realizes that in a TDM environment, each carrier frequency contains eight traffic channels. Thus, the real capacity disparity is not 3:3:2 or one channel, but eight times that, or 24:24:16 – a channel capacity disparity of eight. Frequency disparities of one were not thought to be divisible (other than by "sector sharing" with its attendant interference penalty), but time slot disparities of eight are readily divisible and capable of being reallocated to provide additional capacity and raise the local minimum channel capacity from 16 (basing system capacity on 24 channels per coverage area would have caused one-third of the system to have been constantly overloaded).

Figure 2 illustrates cellular frequency planning according to the preferred embodiment of the invention.

Figure 2 illustrates the same (24 carriers x 8 time slots =) 192 channels redistributed according to the invention, raising the local minimum channel capacity to 21 and providing parity among adjacent sectors, resulting in greater spectral efficiency.

Certain channel sets (19, 20, 21, 22, 23, and 24) have had their eight-slot frames split in two subframes of an A portion of five slots and a B portion of three slots. They are allocated between the sectors in time-synchronism with the repeat pattern, thereby avoiding the co-channel interference commonly experienced with sector sharing. Thus, six sectors have two carriers at eight channels each and one carrier at five A channels, or a channel capacity of 21, while three sectors have two carriers at eight channels each and two carriers at three B channels each, or a channel capacity of 22. Accordingly, substantial traffic channel parity has been achieved at 21:21:22, or a nominal stated system capacity increase from 16 to 21 channels. This foregoing allocation assumes time synchronism between all sectors. If all sectors are not time synchronized, each frame cannot be so neatly allocated between sectors. In that case, one A slot and one B slot must go unused to guard against co-channel interference due to loose synchronism or asynchronism between cells (or be reclaimed on lesser-grade-of-service calls). Notwithstanding the channel loss in these loosely synchronized systems, parity would still be achieved at 8+8+4 : 8+8+4 : 8+8+2+2 or 20:20:20, with a net increase of 4 over the previous local minimum channel capacity of 16.

Advantageously, the B intervals (say 19B and 20B) could themselves be arranged in time to be non-overlapping in a single frame such that both could be provided via a single, frequency-agile transceiver.

Figure 3 illustrates an apparatus for predeterminally subdividing a TDM frame. It illustrates a three bit (modulo-eight) time slot counter 301 to count the number of time slots per frame, following initial synchronization. A latch 303 holds the predetermined number of time slots allocated; five for an A set and three for a B set, for example. The comparator 305 (or its complimentary output) sets the flip-flop 307 to cause a control signal to be generated, enabling a transceiver 309 in that sector. The modulo-eight counter 301 resets the flip-flop 307 with each new frame.

Thus, in a TDMA cellular system, there has been provided a mechanism for splitting the allocation of time slots within a TDM frame between adjacent coverage areas. There has been provided a method of and apparatus for time-allocation of TDMA channels. It comprises: periodically allocating some portion of a carrier of radio traffic to one coverage area during one time interval and periodically allocating some other portion of that same carrier to another coverage area during a substantially non-overlapping time interval, all in time interval, all in time synchronism with any proximal reuse of that carrier. The distribution of channels in adjacent coverage areas thereby approaches parity and the minimum channel capacity per coverage area is enhanced.

While the preferred embodiment of the invention has been described and shown, it will be appreciated by those skilled in this field that other variations and modifications of this invention may be implemented. For example, although the foregoing discussion has been in terms of balancing or evening the net nominal system capacity, the claimed concept of time-allocation of carriers is equally applicable to providing time-of-day or other capacity increase on a dynamic basis. Similarly, althrough the discussion has revolved around TDMA channels because of their inherent divisibility, the invention finds utility in cellular systems having other forms of channelization, like conventional sectored-antenna and omni-directional antenna Frequency-Division Multiple Access (FDMA) cellular systems or any omni-directional antenna system where allocation of carriers in time could be implemented (provided time synchronism is established to coordinate co-channel proximal reuses of that carrier in time).

Although the foregoing discussion has been in terms of a fixed and predetermined allocation of channel capacity, dynamic allocation of channel capacity in accordance with the invention is equally feasible for time-of-day capacity needs and the like. Similarly, although the discussion has been in terms of modulo-eight TDM, modulo-three and modulo-six digital cellular systems are in development; this technique is clearly equally applicable to modulo-n systems,

whether frequency-hopped or not.

These and all other variations and adaptations are expected to fall within the ambit of the appended claims.

Claims

1. A method of time-allocation of cellular radio carriers characterized by:
allocating some portion of a carrier (19A-24A) of radio traffic to one coverage area during one time interval
and allocating some other portion of that same carrier (19B-24B) to another coverage area during a substantially non-overlapping time interval, all in time synchronism with any proximal reuse of that carrier.

2. A method as claimed in Claim 1 above, further characterized by allocating yet another portion of that same carrier to yet another coverage area during a substantially non-overlapping time interval, all in time synchronism with any proximal reuse of that carrier.

3. A method as claimed in Claim 1 above, wherein such allocation is done periodically.

4. A method as claimed in Claim 1 above, wherein such allocation is done predeterminally.

5. A method as claimed in Claim 1 above, wherein such allocation is done dynamically.

6. A method as claimed in Claim 1 above, wherein such carrier portion and such other carrier portion are characterized by time slots of a TDM time frame.

7. A method as claimed in Claim 1 above, wherein such carrier portion and such other carrier portion respectively are characterized by five and three time slots in a modulo-8 (301) system-synchronus TDM time frame.

8. A method as claimed in Claim 1 above, wherein such channels and such other channels respectively are characterized by four and two time slots in a modulo-8 (301) loosely-synchronus TDM time frame system.

9. A method as claimed in Claim 1 above, wherein a frequency-agile radio provides more than one carrier in time synchronism with the system.

10. A method as claimed in Claim 1 above, wherein a frequency-agile transceiver provides more than one carrier in time synchronism with the system.

11. A method of time-allocabon of cellular radio carriers characterized by:
periodically allocating some portion of a carrier (19A-24A) of radio traffic to one coverage area during one time interval
and periodically allocating some other portion (19B-24B) of that same carrier to another coverage area during a substantially non-overlapping time interval, all in time synchronism with any proximal reuse of that carrier,
whereby the distribution of carriers in adjacent coverage areas approaches parity (8+8+5 ≈ 8+8+3+3) and the minimum channel capacity per coverage area is enhanced.

12. An apparatus for time-allocation of TDMA channels characterized by:
means for periodically allocating some portion of a carrier (19A-24A) of radio traffic to one coverage area during one time interval operatively coupled with
means for periodically allocating some other portion of that same carrier (19B-24B) to another coverage area dig a substantially non-overlapping time interval, all in time synchronism with any maximal reuse of that carrier,
whereby the distribution of carriers in adjacent coverage areas approaches parity (8+8+5 ≈ 8+8+3+3) and the minimum channel capacity per coverage area is enhanced (8+8 ⇒ 8+8+3+3; 16 ⇒ 22).

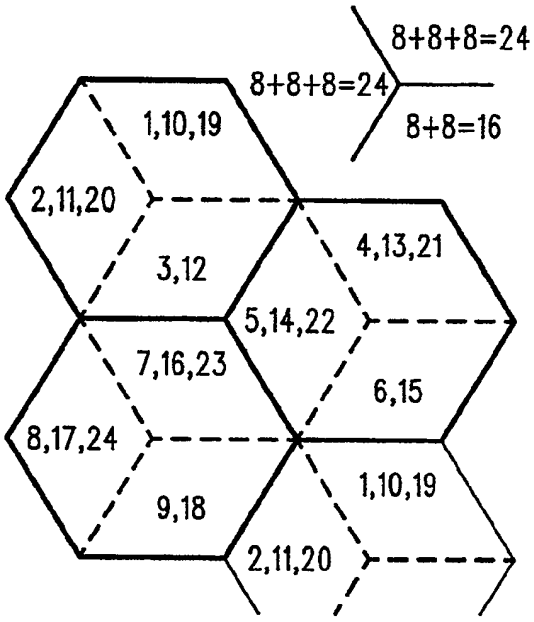


FIG.1

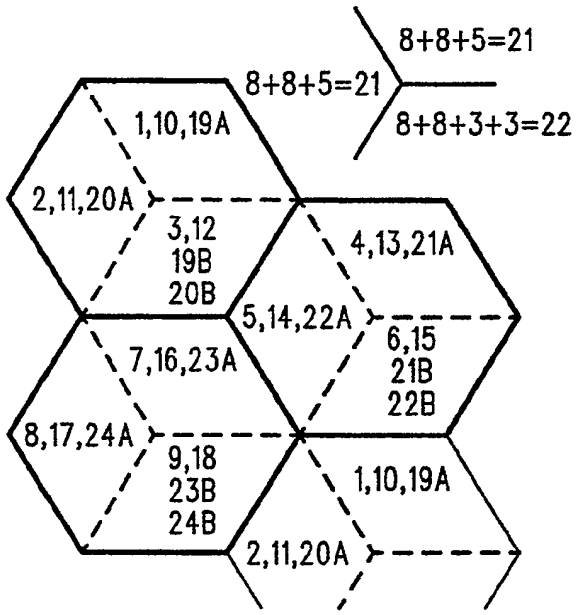
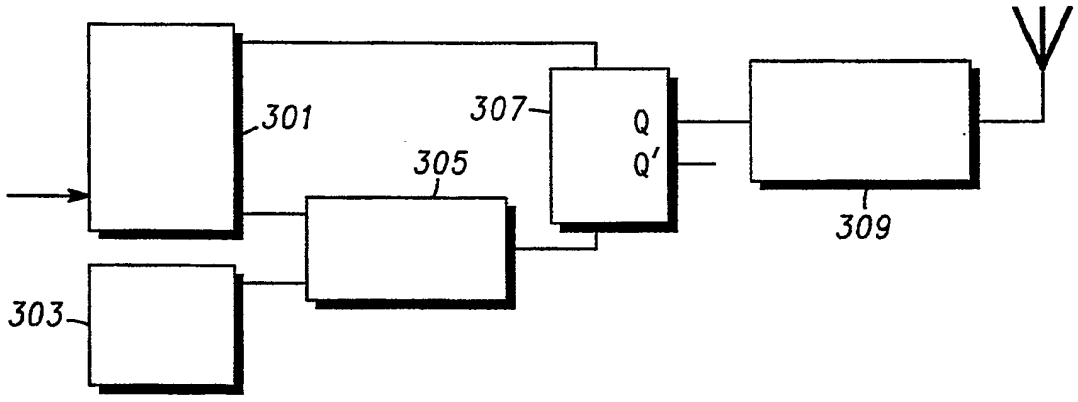


FIG.2

FIG.3



PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : H04Q 7/26 | A1

(11) International Publication Number: WO 98/24254

(43) International Publication Date: 4 June 1998 (04.06.98)

(21) International Application Number: PCT/FI97/00636

(22) International Filing Date: 20 October 1997 (20.10.97)

(30) Priority Data:
964714 26 November 1996 (26.11.96) FI

(71) Applicant *(for all designated States except US)*: NOKIA TELECOMMUNICATIONS OY [FI/FI]; Keilalahdentie 4, FIN–02150 Espoo (FI).

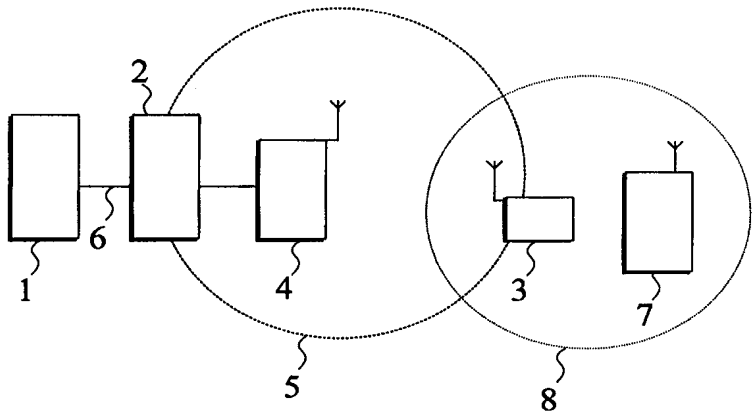
(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: PENTIKÄINEN, Heimo [FI/FI]; Kurjenpolvi 1 J 7, FIN–90580 Oulu (FI). SARPOLA, Jussi [FI/FI]; Torikatu 16 B 14, FIN–90100 Oulu (FI). SUHONEN, Aki [FI/FI]; Tuluskuja 10, FIN–90420 Oulu (FI). VIMPARI, Markku [FI/FI]; Kuovitie 14, FIN–90540 Oulu (FI).

(74) Agent: PAPULA REIN LAHTELA OY; Fredrikinkatu 61 A, P.O. Box 981, FIN–00101 Helsinki (FI).

(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: PROCEDURE AND SYSTEM FOR ENSURING EMERGENCY COMMUNICATION IN A WIRELESS LOCAL LOOP ENVIRONMENT



(57) Abstract

The invention relates to a procedure for ensuring emergency calls in a wireless local loop environnement which is based on technology employed in a mobile telephone system and which comprises a telephone exchange (1), an access node (2) connected to the telephone exchange, a terminal device (3) and a base station (4) connected to the telephone exchange via the access node and serving to transmit call signals between the access node and the terminal device, in which the home network (5) of the terminal device is defined by the base station and the associated access node and in which base stations (7) of other networks are disposed in the environment of the local loop, so that the terminal device receives information signals from the surrounding base stations and, based on said information signals, determines the base station it is communicating with, and the emergency call is set up via any base station compatible with the terminal device. To ensure successful set–up of an emergency call when connection between the terminal device (3) and the telephone exchange (1) of its home network (5) is lost, a dial tone is generated by means of the terminal device, an emergency number dialled via the terminal device is identified and the emergency call function of the mobile telephone system is used for the set–up of the emergency call.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	**ES**	Spain	**LS**	Lesotho	**SI**	Slovenia
AM	Armenia	**FI**	Finland	**LT**	Lithuania	**SK**	Slovakia
AT	Austria	**FR**	France	**LU**	Luxembourg	**SN**	Senegal
AU	Australia	**GA**	Gabon	**LV**	Latvia	**SZ**	Swaziland
AZ	Azerbaijan	**GB**	United Kingdom	**MC**	Monaco	**TD**	Chad
BA	Bosnia and Herzegovina	**GE**	Georgia	**MD**	Republic of Moldova	**TG**	Togo
BB	Barbados	**GH**	Ghana	**MG**	Madagascar	**TJ**	Tajikistan
BE	Belgium	**GN**	Guinea	**MK**	The former Yugoslav Republic of Macedonia	**TM**	Turkmenistan
BF	Burkina Faso	**GR**	Greece			**TR**	Turkey
BG	Bulgaria	**HU**	Hungary	**ML**	Mali	**TT**	Trinidad and Tobago
BJ	Benin	**IE**	Ireland	**MN**	Mongolia	**UA**	Ukraine
BR	Brazil	**IL**	Israel	**MR**	Mauritania	**UG**	Uganda
BY	Belarus	**IS**	Iceland	**MW**	Malawi	**US**	United States of America
CA	Canada	**IT**	Italy	**MX**	Mexico	**UZ**	Uzbekistan
CF	Central African Republic	**JP**	Japan	**NE**	Niger	**VN**	Viet Nam
CG	Congo	**KE**	Kenya	**NL**	Netherlands	**YU**	Yugoslavia
CH	Switzerland	**KG**	Kyrgyzstan	**NO**	Norway	**ZW**	Zimbabwe
CI	Côte d'Ivoire	**KP**	Democratic People's Republic of Korea	**NZ**	New Zealand		
CM	Cameroon			**PL**	Poland		
CN	China	**KR**	Republic of Korea	**PT**	Portugal		
CU	Cuba	**KZ**	Kazakstan	**RO**	Romania		
CZ	Czech Republic	**LC**	Saint Lucia	**RU**	Russian Federation		
DE	Germany	**LI**	Liechtenstein	**SD**	Sudan		
DK	Denmark	**LK**	Sri Lanka	**SE**	Sweden		
EE	Estonia	**LR**	Liberia	**SG**	Singapore		

PROCEDURE AND SYSTEM FOR ENSURING EMERGENCY COMMUNICATION IN A WIRELESS LOCAL LOOP ENVIRONMENT

The present invention relates to a procedure for ensuring an emergency call in a wireless local loop environment, in which a terminal device is connected via a wireless link to a base station and further to an access node and a telephone exchange.

In a wireless local loop (WLL), a terminal device is connected via a wireless link to an access node or a WLL controller. A WLL system may be based e.g. on technology used in a mobile telephone system, such as the GSM/DCS1800 technology (GSM, Group Special Mobile; DCS, Digital Cellular System). Between the terminal device and the access node there is a base station, through which call signals sent by the terminal device over a radio channel are transmitted via the access node to a public telephone network and vice versa. An access node or WLL controller can be connected to the telephone exchange using e.g. the V5.1 or V5.2 protocol.

Open interfaces (V5.1 and V5.2) between an access node and a telephone exchange are defined in the ETSI (European Telecommunications and Standards Institute) standards of the ETS 300 324 and ETS 300 347 series. V5 interfaces enable subscribers belonging to a physically separate access network, which may be either a wired or a wireless network, to be connected to a telephone exchange using a standard interface. A dynamic concentrator interface V5.2 consistent with the standards ETS 300 347-1 and 347-2 consists of one or more (1 - 16) PCM (Pulse Code Modulation) cables. One PCM cable comprises 32 channels, each of which with a transfer rate of 64 kbit/s, i.e. 2048 kbit/s in all. The V5.2 interface supports analogue telephones as used in the public telephone network, digital, such as ISDN (Integrated Services Digital Network) basic

and system subscriptions as well as other analogue or digital terminal equipment based on semi-fixed connections.

In a wireless local loop, emergency calls are only transmitted via the particular network the terminal device belongs to, as is generally done in networks employing the GSM/DCS1800 technology. However, in the event of difficulties, e.g. when the operation of the network of the terminal device has been interrupted for some reason or when there occur other forms of rejection in the system, for instance an insufficiency of radio channels, emergency calls cannot be transmitted. In the event of rejection, calls from the terminal device are inhibited. In this case, no dial tone is generated for the subscriber when the latter tries to initiate a connection, i.e. 'to pick up the headphone'. An example of a rejection situation is the case where the connection between the local exchange and the WLL controller fails. In this case, all calls initiated by the terminal device, including emergency calls, are rejected. Rejection is generally indicated via the terminal device by not giving the subscriber a dial tone. However, it is possible to provide a separate emergency link from the WLL controller to an exchange in a wired network and further to an emergency number. On the other hand, the terminal device may be within the operating range of another functional network, such as a mobile telephone network, in which case this other network could be used for the transmission of an emergency call. However, the problem in prior-art systems is that in either case the terminal device does not even generate a dial tone for the subscriber, which is why the subscriber is likely to give up trying to make an emergency call although this would be technically possible.

The object of the present invention is to eliminate the problem described above. A specific ob-

ject of the present invention is to present a method by which the subscriber can always make an emergency call via a wireless terminal device when there is a radio link to a base station that functionally corresponds to a base station in the home network of the terminal device.

As for the features characteristic of the present invention, reference is made to the claims.

In the procedure of the present invention for ensuring an emergency call in a wireless local loop environment, such as a WLL system, based on a technology employed in a mobile telephone system, such as the GSM/DCS1800 technology, the system comprises a telephone exchange and an access node connected to the telephone exchange e.g. via a V5 interface. Furthermore, the system comprises a base station connected to the access node and further to the telephone exchange, and a terminal device communicating via a radio link with the base station. A home network is defined for the terminal device so that the home network comprises a given base station, a given access node and a subscriber connection defined in the telephone exchange. In addition, base stations of other networks, e.g. base stations of GSM networks, are disposed in the environment of the local loop, and the terminal device receives information signals from the surrounding base stations and, based on these information signals, determines the base station it is communicating with. In a normal situation, the terminal device only communicates with base stations of its home network. Thus, an emergency call can be made using any base station available.

According to the invention, in the event of failure or rejection in the home network, i.e. when connection between the terminal device and the telephone exchange of its home network is lost, a dial tone is generated by the terminal device, so the user

of the terminal device becomes aware that the device is ready for a call. Next, the dialled emergency number, e.g. the generally used string 112, is identified and the emergency call is set up using the emergency call function of the mobile telephone system.

As compared with prior art, the present invention has the advantage that, in a wireless system, the subscriber can always make an emergency call when this is technically possible, i.e. always when the terminal device is able to establish a connection to a base station. A further advantage provided by the invention is that, upon hearing a dial tone, the user can conclude that it is possible to make a call, so he/she can call an emergency number even if connection to the home network telephone exchange should be inhibited for any reason.

In an embodiment, when communication with the home network base station is not possible, an emergency call is set up using a base station of some other network. The other network may be a base station outside the mobility area of the terminal device, a base station in another wireless local loop, a base station maintained by any teleoperator, or some other base station compatible with the terminal device. Compatibility in this context means that the terminal device would be able to use that base station for call setup if it had the right of access to the network to which the base station belongs. The signals between the terminal device and the base station are generally transmitted via a radio channel, which is a given frequency band reserved for the base station.

In a preferred embodiment of the present invention, a string corresponding to the number to be dialled for an emergency call is stored in the terminal device. This can be done e.g. by reading the emergency numbers stored in the subscriber identity module (SIM), e.g. SIM card, of the terminal device. On the

other hand, if the terminal device is based e.g. on the GSM system, the string 112 is always recognised as an emergency number. After this, the string dialled into the terminal device is compared with the strings stored in the terminal device and if this comparison indicates that an emergency number is being called, operation is continued using an emergency call function and the emergency call is set up.

In a preferred embodiment of the procedure of the present invention, the terminal device is sent data indicating that communication with the home network exchange is impossible, and, based on this information, a dial tone is generated in the terminal device when the subscriber is starting a call. The terminal device can also be informed about the communication failure by transmitting via the network a bar code to the terminal device when the latter is attempting a normal call. After this, if an emergency number is dialled via the terminal device, the call is transmitted to the access node of the home network, if the link between the home network base station and the access node is in order and if the terminal device is able to communicate with the base station. Calls attempted to any other numbers except emergency numbers will be rejected. The call is then connected further by using an emergency call function defined in the access node. When the connection to the telephone exchange of the home network of the terminal device fails, the terminal device generates a dial tone that is different from the dial tone heard in a normal situation. Correspondingly, if the connection to the home network access node fails, a dial tone differing from the normal situation can be generated, so the caller will know that the link to the home network is out of order. If the link between the access node and the telephone exchange is overloaded, in other words no free time slots are available for emergency calls, one of

the current calls can be disconnected by the access node. After this, the time slot thus made available can be used for connecting the emergency call further from the access node.

In the following, the invention will be described by the aid of a few examples of its embodiments by referring to the attached drawing, in which

Fig. 1 is a diagram representing a first embodiment of the system of the invention;

Fig. 2 is a diagram representing a second embodiment of the system of the invention;

Fig. 3 is a flow diagram representing a call process in an embodiment of the present invention.

The wireless local loop system presented in Fig. 1 comprises a telephone exchange 1 and an access node 2 connected to it. The access node 2 acts as a concentrating element between the telephone exchange 1 and the terminal device 3, connecting the terminal device to the telephone exchange 1. In this example, the access node 2 is connected via V5.2 interface 6, which comprises 1 - 16 PCM cables (2 Mbit/s), to the exchange terminal (ET) (not shown) of the telephone exchange 1, the exchange terminal being provided with the functions required for the V5 interface. The system illustrated by the figure further comprises a base station 4 with a given coverage area 5, which is also the area of the home network of the terminal device 3 and the mobility area of the terminal device 3. In the system presented in Fig. 1, a connection between the terminal device 3 and the telephone exchange 1 is set up by transmitting signals between the base station 4 and the terminal device 3 by radio and from the base station via a wired, radio or other link to the access node 2 and further via the V5 interface 6 to the telephone exchange 1. Fig. 1 further shows a base station 7 belonging to another network, and the terminal device 3 is also within the coverage area 8 of this

other base station. Thus, in a normal situation, the terminal device 3 receives signals both from base station 4 and from base station 7, but uses only the base station 4 of its home network for call setup.

The system presented in Fig. 2 corresponds to the system in Fig. 1 except that the access node 2 is connected via a second interface, a so-called backup V5 interface 6a to a telephone exchange 1a other than the home network 5 telephone exchange. The purpose of this connection is to guarantee successful emergency communication in the event of a failure in V5 interface 6. Such an arrangement is known in prior art and its various applications are described in e.g. in specifications FI 962465 and FI 962575, submitted by the same applicant as the present application. Therefore, referring to the aforesaid specifications, this arrangement for ensuring emergency communication will not be described in detail in the present application.

Fig. 3 presents a flow chart representing the call setup algorithm in situations exemplified by Fig. 1 and 2. In the following, referring to the drawing, an example of the procedure of the invention for ensuring emergency calls in a wireless local loop environment will be described. First, the subscriber activates the terminal device 3 to start a call, block 21. Next, in block 22, the system checks whether a normal link from the terminal device 3 to the base station 4, to the wireless local loop access node 2 and further to the telephone exchange 1 exists. If the link is in order, the normal call setup procedure is started in block 23. If the link fails, if rejection appears in the wireless network or a failure code or equivalent is received by the terminal device, then the terminal device 3 generates a dial tone (block 24), which may differ from the dial tone used in a normal situation so the user will know that the connection to the home network has failed. Next, the dialled number is recei-

ved in the terminal device 3 and compared in block 25 with numbers stored in the terminal device, and if this comparison indicates that the dialled number is not an emergency number, then the call setup procedure is interrupted, block 26. If the dialled number is an emergency number, operation is continued in block 27, where a check is made to ascertain whether a connection to the home network base station 4 and further to the WLL element 2 is available. If no connection to the home network WLL element can be set up, then the procedure continues in block 29, where the system checks whether a connection to a base station 7 of some other network is available. If not, control is passed to block 26 and the call setup procedure is interrupted. If a connection to a base station of another network is available, then the emergency call is set up via this other network by applying an emergency call setup procedure known in itself, block 31. If, in block 27, the link to the WLL element is in order, then control is passed to block 28, where a check is made to establish whether it is possible in the case of failure of the normal V5 interface 6 to connect the emergency call from the WLL element onwards e.g. via a backup V5 interface 6a. If it is, then the emergency call is set up, block 30.

The invention is not limited to the examples of its embodiments described above, but instead many variations are possible within the framework of the inventive idea defined by the claims.

CLAIMS

1. Procedure for ensuring emergency calls in a wireless local loop environment which is based on technology employed in a mobile telephone system and which comprises a telephone exchange (1), an access node (2) connected to the telephone exchange, a terminal device (3) and a base station (4) connected to the telephone exchange via the access node and serving to transmit call signals between the access node and the terminal device, in which the home network (5) of the terminal device is defined by the base station and the associated access node and in which base stations (7) of other networks are disposed in the environment of the local loop, so that the terminal device receives information signals from the surrounding base stations and, based on said information signals, determines the base station it is communicating with, c h a r a c t e r i z e d in that, when connection between the terminal device (3) and the telephone exchange (1) of its home network (5) is lost, a dial tone is generated by means of the terminal device, an emergency number dialled via the terminal device is identified and the emergency call function of the mobile telephone system is used for the setup of an emergency call.

2. Procedure as defined in claim 1, c h a r a c t e r i z e d in that a base station (7) of another network is used for the setup of an emergency call when the connection to the base station (4) of the home network (5) fails.

3. Procedure as defined in claim 1 or 2, c h a r a c t e r i z e d in that the signals between the terminal device (3) and the base station (4, 7) are transmitted via a radio channel.

4. Procedure as defined in any one of the preceding claims 1 - 3, c h a r a c t e r i z e d in

that a string corresponding to an emergency number is stored in the terminal device (3), the string is compared with the string fed into the terminal device and, based on this comparison, an emergency call is set up.

5. Procedure as defined in claim 4, c h a r a c t e r i z e d in that the string corresponding to an emergency number is read into the terminal device (3) from a subscriber identification unit attached to it.

6. Procedure as defined in any one of the preceding claims 1 - 6, c h a r a c t e r i z e d in that the terminal device (3) is sent information indicating that no connection to the telephone exchange (1) of the home network (5) can be established; a dial tone is generated in the terminal device; a dialled emergency number is received in the terminal device; the call is connected to the access node (2) of the home network; and the call is connected further using an emergency call function defined in the access node.

7. Procedure as defined in any one of the preceding claims 1 - 5, c h a r a c t e r i z e d in that, in the event of an overload on the interface between the access node (2) and the telephone exchange (1), one of the current calls is disconnected by the access node and the capacity thus made available is used for the connection of the emergency call from the access node onwards.

8. Procedure as defined in any one of the preceding claims 1 - 7, c h a r a c t e r i z e d in that, when no connection to the telephone exchange (1) of the home network (5) of the terminal device (3) can be established, a dial tone differing from the dial tone used in a normal situation is generated by means of the terminal device.

9. Procedure as defined in any one of the preceding claims 1 - 8, c h a r a c t e r i z e d in

that the emergency call is set up via any base station compatible with the terminal device with which the terminal device is able to communicate.

10. Procedure as defined in any one of the preceding claims 1 - 9, characterized in that, in a failure situation, calls attempted to other than emergency numbers are rejected.

11. Procedure as defined in any one of the preceding claims 1 - 10, characterized in that the mobile telephone system is based on GSM/DCS1800 technology.

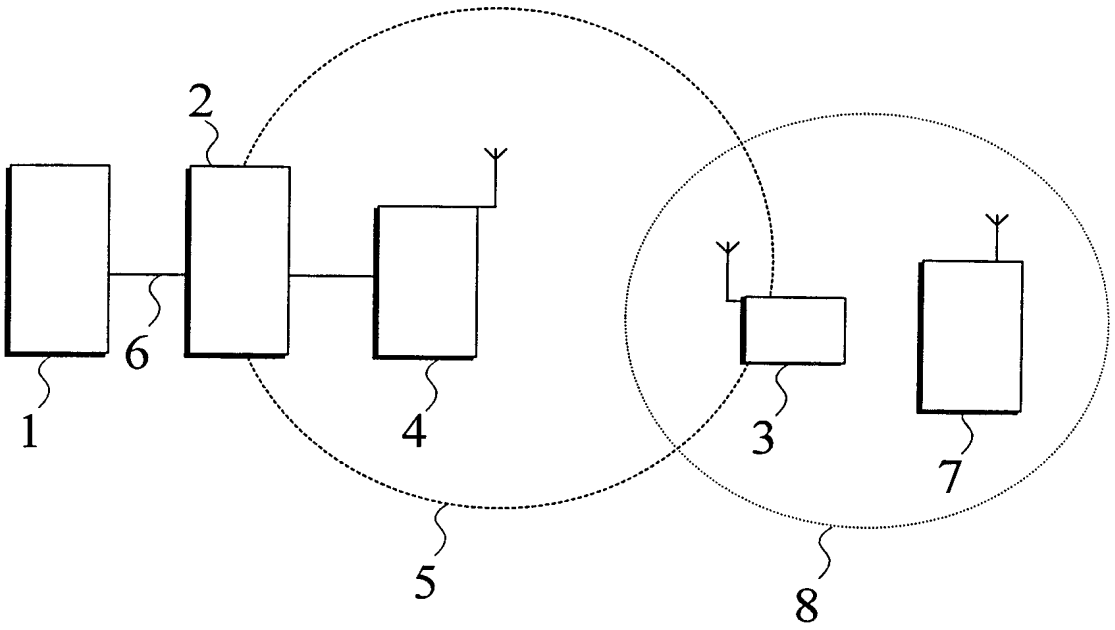


Fig 1

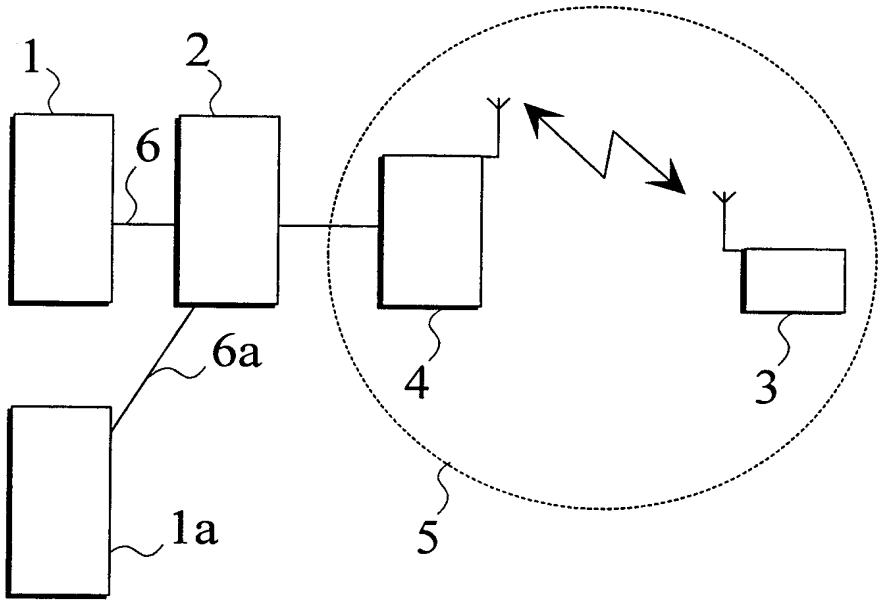


Fig 2

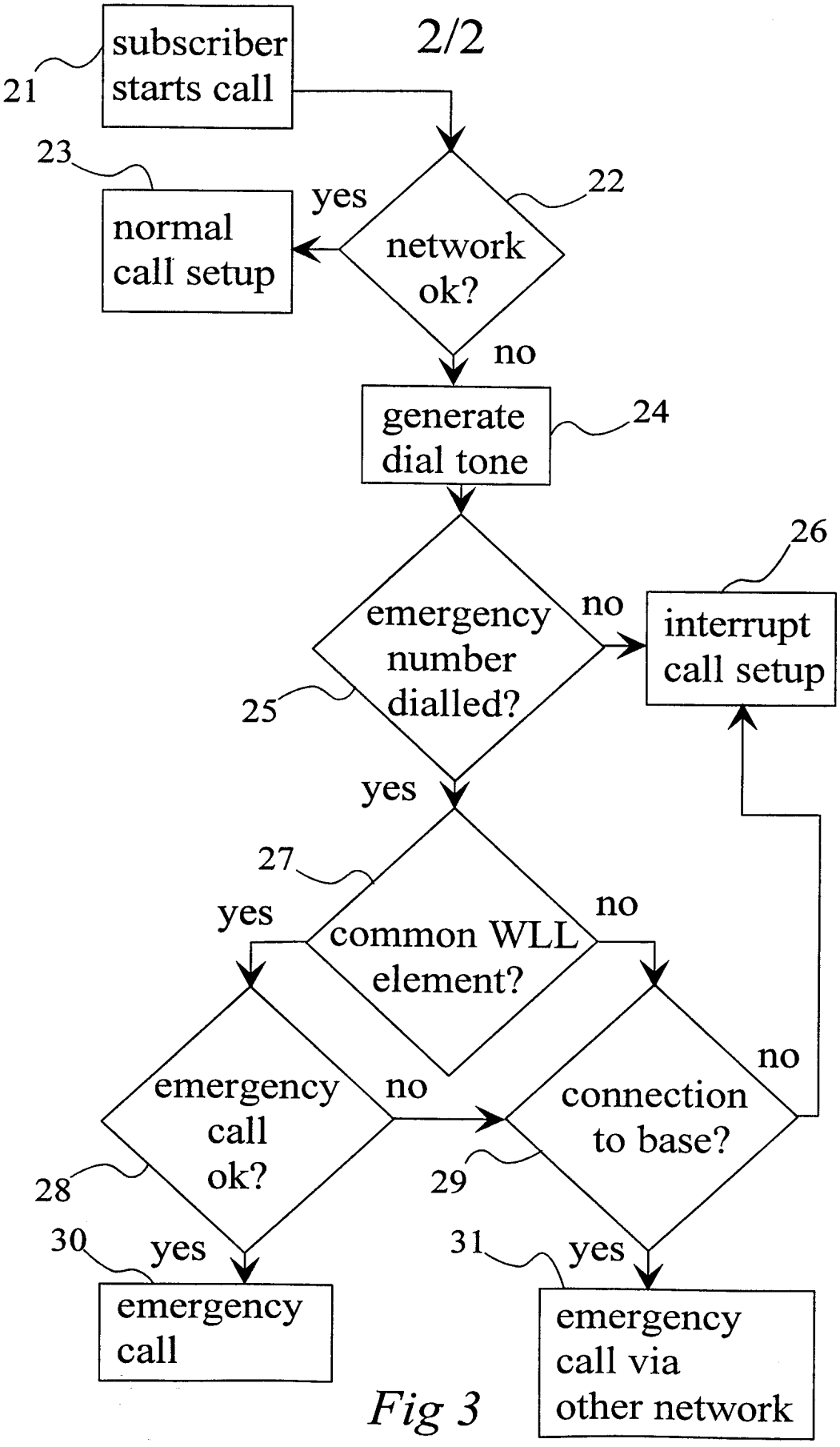

subscriber starts call
21
network ok?
22
yes
normal call setup
23
no
generate dial tone
24
emergency number dialled?
25
no
interrupt call setup
26
yes
common WLL element?
27
yes
no
emergency call ok?
28
no
connection to base?
29
no
yes
emergency call
30
yes
emergency call via other network
31

Fig 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 97/00636

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04Q 7/22, H04Q 7/38
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H04Q

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

SE,DK,FI,NO classes as above

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0680230 A1 (ALCATEL STANDARD ELECTRICA S.A.), 2 November 1995 (02.11.95), column 3, line 3 - line 39 --	1-11
A	WO 9721314 A1 (TELEFONAKTIEBOLAGET LM ERICSSON), 12 June 1997 (12.06.97), abstract --	1-11

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 April 1998	20 -04- 1998
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Bengt Romedahl Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

02/04/98

International application No.
PCT/FI 97/00636

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0680230 A1	02/11/95	AU 1763795 A	09/11/95
		CA 2148185 A	30/10/95
		CN 1111892 A	15/11/95
		ES 1027594 U,Y	01/09/94
		ES 2101629 A	01/07/97
		JP 8051667 A	20/02/96
		NZ 270947 A	29/01/97
		PL 308333 A	30/10/95
		US 5680439 A	21/10/97
		ZA 9503411 A	11/01/96
WO 9721314 A1	12/06/97	AU 1044197 A	27/06/97

Best Available Copy

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 304 955 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **88114048.7**

(51) Int. Cl.4: **H04Q 7/04 , H04B 7/24**

(22) Date of filing: **29.08.88**

(30) Priority: **27.08.87 JP 213253/87**
27.08.87 JP 213257/87
27.08.87 JP 213258/87

(43) Date of publication of application:
01.03.89 Bulletin 89/09

(84) Designated Contracting States:
DE GB IT

(71) Applicant: **NEC CORPORATION**
33-1, Shiba 5-chome, Minato-ku
Tokyo 108(JP)

(72) Inventor: **Sasaki, Yasutaka**
c/o NEC Corporation 33-1, Shiba 5-chome
Minato-ku Tokyo(JP)

(74) Representative: **Vossius & Partner**
Siebertstrasse 4 P.O. Box 86 07 67
D-8000 München 86(DE)

(54) Concentrator system capable of completing emergency calls under congested traffic.

(57) In a radio concentrator system found by a central station and remote stations, demand-assigned data channels are constantly monitored to detect when they are congested. When an emergency call is received from a subscriber terminal, a dial tone is sent to the terminal if the emergency call occurs simultaneously with the detection of a congestion. On hearing the dial tone, the subscriber dials an emergency destination address, which is received by a remote station and compared with a list of predetermined addresses and verified if it matches one of the predetermined addresses. The dialled information is sent from that station to the central station, where it is relayed to a switched network. An emergency channel is established to the network for routing the emergency call. This channel may be permanently provided and demand-assigned in response to an emergency channel assignment request, or first selected by a remote station requesting an emergency call and access is granted by the central station if no collision occurs between competing emergency calls. Alternatively, no emergency channel is provided in the system and one of the data channels is cleared when an emergency call is detected simultaneously with the occurrence of a congestion. The cleared channel is used as an emergency channel to complete the emergency call.

FIG. 2

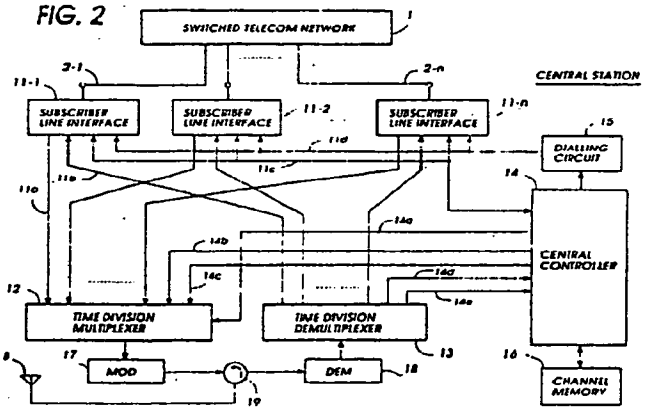
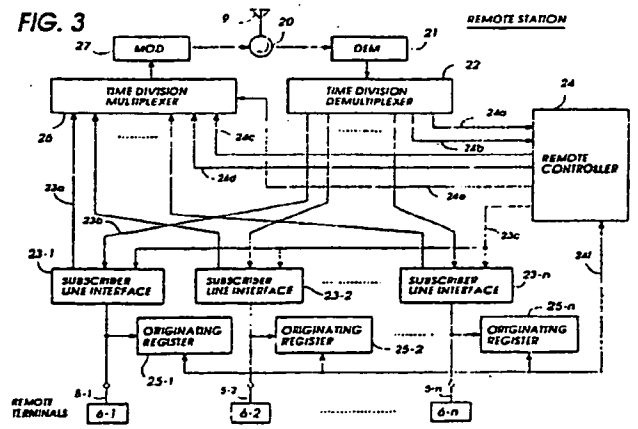


FIG. 3



EP 0 304 955 A2

"Concentrator System Capable of Completing Emergency Calls Under Congested Traffic"

The present invention relates to a concentrator system for connecting geographically scattered subscriber terminals to the public switched telecommunication network through limited channel resources. More specifically, the invention relates to such a concentrator system in which emergency calls to police departments or fire stations are completed through a specially reserved channel.

Radio concentrator systems have been developed as an economic means for connecting remotely located subscriber terminals, such as telephones and data terminals, to an access point of the public switched telephone network through demand-assigned time division access channels. The system comprises a central station located relatively close to the access point of the network and a plurality of remote stations to which the subscriber terminals are connected by groups. Because of the limited number of demand-assigned channels, congestion tends to occur at peak traffic loads. With prior art radio concentrator systems, an emergency call from ordinary subscribers is treated as an ordinary call and routed through one of the demand-assigned channels if it is available. The prior art system is provided with one or more channels which are specially preassigned to special subscribers to allow them to complete an emergency call under congested traffic. However, an emergency call from ordinary subscribers must be abandoned when it encounters a condition indicating that all channels are busy.

It is therefore an object of the present invention to provide a concentrator system which allows an emergency call from any subscriber to be completed when the demand-assigned channels are congested with traffic.

In a concentrator system of the present invention, demand-assigned speech or data channels are constantly monitored by the central station to detect when they are congested. When an emergency call is received from a subscriber terminal, typically in the form of a "hook flash", or momentary depression of the switchhook, a dial tone is sent to the terminal if the emergency call occurs simultaneously with the detection of the channel congestion. On hearing the dial tone, the subscriber dials an emergency destination address, which is received by a remote station and compared with a list of predetermined addresses and verified if it matches one of the predetermined addresses. The dialled information is sent from that remote station to the central station, where it is relayed to an access point of the switched telecommunication network. An emergency channel is then established between the subscriber terminal and the network for routing the emergency call.

The emergency channel may be permanently provided in the transmission link between the central station and remote stations and demand-assigned by the central station to a remote station in response to an emergency channel assignment request therefrom or first selected by the remote station requesting an emergency call and access is granted to it if no collision occurs between competing emergency call attempts. Alternatively, no emergency channel is provided in the system and one of the data channels is cleared when an emergency call is detected simultaneously with the occurrence of a condition indicating all data channels are busy. The cleared channel is used as an emergency channel to complete the emergency call.

In a more specific aspect, the concentrator system of the present invention is made up of a central station and a plurality of remote stations interconnected by a two-way transmission link. The central station comprises a plurality of subscriber line interface circuits associated in a one-to-one correspondence to the subscriber terminals and connected to the switching telecommunication network, and a controller cooperating with the subscriber line interface circuits for selecting a data channel in the transmission link in response to a channel assignment request either from the network and the remote stations and generating a data channel selection signal identifying the selected data channel. The controller detects when all of the data channels are busy and generates an all-busy signal. In the central station, multiplexer/demultiplexer circuitry connects the subscriber line interface circuits to the selected data channels in response to the data channel selection signal, connects one of the subscriber line interface circuits from which an emergency call is requested to the transmission link, connects the data channel selection signal and the all-busy signal to the link for transmission to the remote stations, and applies the channel assignment request, which has been received from the remote stations through the link, to the central station controller. The multiplexer/demultiplexer further detects an emergency destination address transmitted from the remote stations on the link. A dialling circuit is provided in the central station for signalling the detected emergency destination address to the network. Each of the remote stations comprises a plurality of remote subscriber line interface circuits connected respectively to the subscriber terminals and a plurality of registers associated respectively with the subscriber terminals for transmitting a dial tone to the emergency call requesting subscriber

BNSDOCID: <EP___0304955A2_I_>

terminal and receiving the emergency destination address therefrom. A remote controller in each remote station cooperates with the remote subscriber line interface circuits to generate the channel assignment request in response to an outgoing call request from the subscriber terminals and detect a simultaneous occurrence of the all-busy signal from the central station and an emergency call from the emergency requesting subscriber terminal. The remote controller causes one of the registers to send dial tone to the emergency call requesting subscriber terminal in response to the detection of the simultaneous occurrence, and verifies the emergency call by detecting a coincidence between the received destination address with a list of predetermined emergency destination addresses. Remote station multiplexer/demultiplexer circuitry establishes connection of the remote subscriber line interface circuits to the selected data channels in response to the data channel selection signal, connection of one of the remote subscriber line interface circuits which is associated with the emergency call requesting subscriber terminal to the transmission link, connection of the channel assignment request and the emergency destination address of the verified emergency call to the transmission link, and provides connection of the data channel selection signal and the all-busy signal, which have been transmitted from the central station on the lin, to the remote controller.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be described in further detail with reference to the accompanying drawings, in which:

Fig. 1 is a block diagram of a radio concentrator system embodying the present invention;

Fig. 2 is a block diagram of the central station of Fig. 1;

Fig. 3 is a block diagram of each of the remote stations of Fig. 1;

Figs. 4A and 4B are flowcharts describing the operation of the concentrator system according to a first embodiment of the present invention, and Fig. 4C is a data flow diagram useful for understanding the operation of the first embodiment;

Figs. 5A and 5B are flowcharts describing the operation of the concentrator system according to a second embodiment of the present invention, and Fig. 5C is a data flow diagram useful for understanding the operation of the second embodiment;

Figs. 6A and 6B are flowcharts describing the operation of the concentrator system according to a second embodiment of the present invention, and Fig. 6C is a data flow diagram useful for understanding the operation of the third embodiment;

Fig. 7 shows a data format employed in the first and second embodiments of the invention; and

Fig. 8 shows a data format employed in the third embodiment of the present invention.

DETAILED DESCRIPTION

A radio concentrator system of this invention, shown schematically in Fig. 1, is a subscriber connection system for economically connecting geographically scattered remote subscribers over time division multiplex access (TDMA) radio links to a nearby access point, or telephone exchange, of the public switched telecommunication network 1.

The radio concentrator system comprises a central station 3 located relatively close to the telephone exchange and a plurality of remote stations 4. The exchange side of the central station 3 is coupled to subscriber line terminals of the telephone exchange through exchange subscriber lines 2-1 through 2-n, usually of metallic twisted pairs, and the remote-station side of the central station 3 is a radio access point represented by an antenna 8 which is coupled by TDMA radio links 7 to the central-station side of remote stations 4. Subscriber terminals 6-1 through 6-n such as telephones and data terminals are connected by groups to the subscriber side of nearby remote stations 4 through remote subscriber lines 5-1 through 5-n having one-to-one correspondence to the exchange subscriber lines 2-1 through 2-n. The number of subscriber terminals handled by a single radio concentrator system depends on their traffic volume and the number of commonly shared speech or data channels, or time slots, available over the TDMA links 7. Control signals are exchanged between the central station 3 and remote stations 4 over a control channel exclusively reserved for this purpose in the transmission links 7.

Referring to Fig. 2, the central station 3 includes subscriber line interface circuits (SLIC) 11-1 through 11-n connected respectively to the exchange subscriber lines 2-1 through 2-n. Each subscriber line interface circuit 11 is provided with a hybrid which converts the two-wire subscriber line 2 to a four-wire circuit having an outgoing line 11a connected to a respective input of a time division multiplexer 12 and an incoming line 11b connected from a respective output of a time division demultiplexer 13. Subscriber line interface circuits 11 are connected by a respective two-way line 11c to a central controller 14 to exchange control signals with the network 1 and are connected by a line 11d

Page 273 of 755
BNSDOCID: <EP___0304955A2_1_>

to the output of a dialling circuit 16 which operates to dial an emergency call destination address as will be described later. Time division multiplexer 12 is associated with the central controller 14 to multiplex signals from the line interface circuits 11 into a selected idle speech channel in response to a control signal supplied on a control line 14a from the controller 14.

Control signals to be supplied to the remote stations are carried on a line 14b from the controller 14 to an associated input of the multiplexer 12 and emergency call signals are supplied on a line 14c and fed to an associated input of the multiplexer. These control signals are respectively transmitted on control and emergency channels, or time slots, and multiplexed with other speech signals carried on selected speech channels. The multiplexer output is applied to a modulator 17, where it is modulated on a radio frequency carrier and supplied through a duplexer 19 to the antenna 8, where it is transmitted as a TDM down-direction (towards remote stations 4) in a broadcast mode to the remote stations 4.

Incoming signals from the remote stations 4, detected by antenna 8, are supplied through duplexer 19 to a demodulator 18, the output of which is fed to the demultiplexer 13. Demultiplexer 13 examines the control channel to identify the address of the speech channel signals and connects the identified channels through incoming lines 11b to the appropriate line interface circuits 11. Demultiplexer 13 further separates the control channel, the emergency channel or specified speech channel and supplies control signals carried on the control channel on line 14d to the controller 14 and supplies emergency control signals carried on the emergency or specified speech channel on line 14e to the controller 14.

Controller 14 constantly monitors the busy/idle status of all the TDM channels and updates a channel memory 16. This channel memory is called upon by the central controller 15 each time as it assigns a speech channel to a call request from any of the subscriber terminals 6 or from the telephone network 1. When all the speech channels are busy, an "all busy" signal is broadcast to the remote stations.

In Fig. 3, each remote station 4 receives the broadcast TDM signal from the central station 3 via antenna 9 and duplexer 20. A demodulator 21 recovers the baseband TDM signal and feeds a time division demultiplexer 22 where the signal is demultiplexed into respective channel components. The demultiplexed speech channel signals are supplied on lines 23b to subscriber line interface circuits 23-1 through 23-n which are provided in a one-to-one correspondence to the subscriber terminals 6-1 through 6-n. The demultiplexed channel control signal and emergency control signal are supplied on lines 24a, 24b to a remote controller 24. Originating registers 25-1 through 25-n are associated respectively with subscriber line interface circuits 23-a through 23-n. As will be described, each register 25 is designed to detect "on-hook" and "off-hook" and "hook flash" conditions when the associated subscriber goes off-hook for originating a call, or goes on-hook for terminating a call and signals the detect subscriber line conditions to the remote controller 24 on line 24f. If a subscriber desires to place an emergency call, but hears a busy tone indicating that all the speech channels are busy. The subscribers instructed to momentarily depress the switchhook under such conditions to alert the system of an emergency. The register detects the a "hook flash" condition and sends a dial tone to the requesting terminal to urge the subscriber to dial the desired emergency call destination. The emergency destination address is detected by the originating register 25 and fed to the remote controller 24 to be transmitted to central station 3.

Each subscriber line interface circuit 23 has an outgoing line 23a connected to a respective input of a time division multiplexer 26 to which the channel control signal and emergency control signal from the remote controller 24 are also supplied on lines 24c, 24d. Multiplexer 26 is controlled in response to a channel identification signal supplied on line 24e from the remote controller 24. The output of multiplexer 26 is coupled to a modulator 27 where the baseband TDM signal is modulated on a radio frequency carrier and applied through duplexer 20 to antenna 9 and transmitted to the central station as a TDM up-direction signal.

Central controller 14 and remote controller 24 are implemented by microprocessor-based controllers each being programmed according to embodiments of the present invention.

Figs. 4A and 4B are flowcharts describing the operations of remote and central controllers 24 and 14, respectively, according to a first embodiment of the present invention. Each of the TDM up- and down-direction links of the first embodiment is divided into time slots as shown in Fig. 7. Time slot # 0 is exclusively used for the transmission channel control and system management control signals and time slots #1 and #2 are reserved for emergency calls. The other time slots are speech channels for carrying speech signals. In Fig. 4A, the program execution of remote controller 24 starts with a decision block 30 which checks to see if any of the subscriber terminals goes off-hook. If an off-hook condition occurs, an associated originating register 25 issues a call request to the controller 24 and the program control proceeds to a decision block 31 to detect whether the controller 24 has

BNSDOCID: EP 0304955A2 Page 274 of 755

received an "all busy" signal on the control channel from the central station.

If there is an idle speech channel in the transmission link, the answer is negative in block 31, exit is to operations block 41 which directs the sending of a speech channel assignment request (SCAR) to the central station on the control channel to elicit a response from the central station indicating the identification of an assigned speech channel. Control then proceeds to decision block 42 to check for the reception of such a response.

As will be understood as the description proceeds, the central controller 14 receives the speech channel assignment request, selects an idle speech channel by looking up the contents of the channel memory 16 and assigns the selected channel to the requesting subscriber. Central controller 14 proceeds to send the identification number (ID) of the selected speech channel on the control channel to the remote station and establishes a connection between the subscriber line interface circuit (SLIC) 11 concerned with the assigned speech channel. The ID of the selected speech channel is received by the remote controller 24 (block 42), which is followed by operations block 43 to establish a connection between the subscriber line interface circuit 23 of the calling subscriber to the assigned speech channel, thus setting up a dialling connection.

If all the speech channels are busy, the remote controller 24 has received an "all busy" signal from the central station and the answer is affirmative in block 31. Exit then is to operations block 32 which directs the sending of a busy tone from the associated subscriber line interface circuit 23 to the calling subscriber and thence to decision blocks 33 and 34 to check to see if the subscriber goes on-hook or momentarily depresses the switchhook. If the subscriber goes on-hook on hearing the busy tone, control returns to block 30. If the subscriber wants to place an emergency call, he will momentarily depress the switchhook, sending a "hook flash" signal to the remote controller 24. Thus, control exits from block 34 to operations block 35 which directs the removing of the busy tone and sending of a dial tone from the associated originating register 25 to the subscriber terminal to urge the subscriber to dial an emergency destination address.

Exit then is to decision block 36 to receive and store the emergency destination address in memory and verify the emergency call. This is accomplished by detecting a match between the dialled emergency destination address against a list of emergency destination addresses stored in the remote controller 24. If no match occurs, control goes to operations block 44 to send a busy tone to the subscriber. If the call is verified, control proceeds to operations block 37 which directs the sending of an emergency channel assignment request (ECAR) on the control channel to the central station 3 to elicit a response from the central station indicating the identification of an assigned emergency channel, and then exits to decision block 38 to check for the reception of the emergency channel identification number. Exit then is to operations block 39 which directs the switching of the subscriber line interface circuit 23 concerned to the assigned emergency channel and thence to operations block 40 to transmit the stored emergency destination address to the central station on the assigned emergency channel.

As will be described, this emergency call request will be received by the central controller 14 and one of the emergency channels is selected and assigned to the calling subscriber. The ID of the selected emergency channel is returned on the control channel and the reception of this signal is confirmed by the remote station concerned (block 38). If no emergency channels are available, exit is to block 44 to send a busy tone to the subscriber.

In Fig. 4B, the program execution of the central controller 14 begins with operations block 50 which directs the updating of the channel memory 16 with an assigned channel identification number. Exit then is to decision block 51 which checks to see if all the speech channels are busy and proceeds to operations block 56 to send an "all busy" signal on control channel if the answer is affirmative, or proceeds to decision block 52 if the answer is negative. With block 52, the remote controller 24 awaits the arrival of a speech channel assignment request (SCAR) from a remote station requesting an ordinary or emergency call. On receiving a SCAR signal, control exits to operations block 53 which directs the selecting of an idle speech channel using the information stored in the channel memory 16 and the assigning of the selected speech channel to the calling subscriber. Exit then is to operations block 54 to transmit the ID of the assigned speech channel to the remote station on the control channel and advances to operations block 55 to connect the subscriber line interface circuit 11 of the calling subscriber to the assigned speech channel. Thus, control loops through blocks 50 to 55 when a call request is received from any of the remote stations provided that at least one speech channel is available.

With block 56, the central controller 14 sends an "all busy" signal to remote stations 4 and proceeds to block 57 to check for the arrival of an emergency channel assignment request (ECMR). If there is one, control proceeds to operations block 58 to select an idle emergency channel and assign it to the emergency calling subscriber and advances to operations block 59 to send the ID of the

assigned emergency channel on the control channel to the remote station. Exit then is to operations block 60 which directs the connection of the subscriber line interface circuit 11 of the emergency caller to the assigned emergency channel and control proceeds to decision block 61 to receive a dialled emergency destination address from the remote station on the assigned emergency channel. One receiving the emergency destination address, central controller 14 supplies it to the dialling circuit 15, whereupon it dials the received address to the public network 1 through the subscriber line interface circuit 11 of the emergency calling subscriber (block 62).

To summarize the operation of the first embodiment of the invention, Fig. 4C shows a sequence of events that occur when an emergency call is originated from terminal 6-1, for example, under an all-busy condition. A hook-flash signal from the terminal 6-1 is detected by remote station 4-1 (block 34), causing a dial tone to be sent to the terminal 6-1 (block 35) from remote station 4-1 to urge the subscriber to dial a desired emergency destination address. After verifying the dialled information, remote station 4-1 sends an emergency channel assignment request on the control channel to central station 3 (block 37) and received by the central controller 14 (block 57). An idle emergency channel is assigned to the terminal 6-1 (block 58) and the identification of the assigned emergency channel is sent from central station 3 to remote station 4-1 (block 59) on the control channel. The emergency channel ID is received by remote controller 24 (block 38). Subscriber line interface circuits 23-1 and 11-1 of the remote and central stations are connected to the assigned emergency channel (blocks 39,60) and the dialled destination address is sent from remote station 4-1 to central station 3 (block 40) and then relayed to the public network 1 (blocks 61, 62) to establish a connection between the terminal 6-1 and the emergency destination.

A second embodiment of the present invention is shown in Figs. 5A, 5B and 5C. This embodiment differs from the first embodiment in that it includes blocks designated 100 through 107. After verifying the emergency call (block 36) from terminal 6-1, the remote controller 24 of station 4-1 proceeds to operations block 100 which directs the sending of an emergency access grant request (EAGR) signal on one of the emergency channels to central station 3. This EAGR signal is received by central station 3 (block 104). Control proceeds to decision block 105 to check to see if there is a collision with another emergency call. If there is one, control returns to block 50, and if there is none, exit is to operations block 106 which directs the sending of an access grant signal on the emergency channel to the remote station 4-1 and control advances to operations block 107 to connect the subscriber line interface circuit 11-1 to the granted emergency channel. When this grant signal is received by remote station 4-1 (block 101), the remote controller 24 proceeds to block 102 to connect the subscriber line interface circuit 23-1 to the granted emergency channel. Exit then is to operations block 103 which directs the sending of the stored emergency destination address on the granted emergency channel to the central station. Central station 3 receives the emergency destination address (block 61) for transmission to the network 1 through dialling circuit 15 (block 62). It is seen that with the second embodiment of the invention all control signals are sent via one of the emergency channels and the central station operates to grant permission to the use of the emergency channel if no data collision occurs between emergency calls.

A third embodiment of the present invention is shown in Figs. 6A, 6B and 6C. The third embodiment differs from the first embodiment of the invention in that it includes blocks designated 200 through 212. In this embodiment, emergency channels are not provided as shown in Fig. 8 and emergency calls established when an all busy condition exists by forcibly clearing one of the speech channels which may be used by a remote station other than the emergency requesting remote station 4-1. The program starts decision block 200 which checks for the reception of a disconnect signal from central station 3. If there is none, exit is to decision block 30 to perform execution similar to those of Fig. 4A until control proceeds to block 37 in which the remote station, i.e., station 4-1 requesting the emergency call under an all busy condition sends an emergency channel assignment request on the control channel to the central station. On receiving this request (block 57, Fig. 6B), the central station proceeds to operations block 206 to select one of the speech channels and transmits a disconnect signal indicating the channel number of the selected speech channel on the control channel to a remote station associated with the cleared channel (block 207). Exit then is to operations block 208 which directs the clearing of the selected channel and thence to decision block 209 which checks to see if a clear response signal is received.

The remote station, which is associated with the speech channel to be cleared, receives the disconnect signal addressed to it (block 200, Fig. 6A) and proceeds to operations block 204 which directs the clearing of a speech channel specified by the received disconnect signal. Exit then is to operations block 205 which directs the sending of a clear response signal to central station 3 on the control channel indicating that the specified speech

BNSDOCID<EP 0304955A2>
Page 276 of 755

channel has been cleared. On receiving the clear response signal (block 209, Fig. 6B), the central station proceeds to operations block 210 which directs the sending of the identification number of the cleared speech channel to the emergency call requesting station and thence to operations block 211 which directs the connecting of the subscriber line interface circuit 11-1 to the cleared channel. The cleared channel identification signal is received by remote station 4-1 (block 201) and the latter proceeds to operations block 202 which directs the connecting of the subscriber line interface circuit 23-1 to the cleared speech channel. Exit then is to operations block 203 which directs the sending of the stored emergency destination address on the cleared channel to the central station. On receiving the destination address signal (block 212), the central station advances to operations block 62 to send the emergency destination address through dialling circuit 15 to the network 1.

Claims

1. A concentrator system for connecting subscriber terminals to a switched telecommunication network through a plurality of demand-assigned two-way data channels, comprising:
means for detecting when said data channels are congested;
means for detecting an emergency call from one of said subscriber terminals occurring simultaneously with the detection of said congested channels;
means for sending a dial tone to said one subscriber terminal when said emergency call is detected simultaneously with the detection of the congested channels to allow an emergency destination address to be dialled from said terminal and receiving said dialled emergency destination address;
means for verifying said emergency call by comparing said received address with a list of predetermined addresses; and
means responsive to the verification of said emergency call for transmitting said receiving emergency destination address from said system to said network and establishing an emergency channel between said subscriber terminal and said network.

2. A concentrator system as claimed in claim 1, wherein said emergency call is indicated by hook flash signal generated when said one subscriber terminal momentarily depresses a switchhook.

3. A concentrator system as claimed in claim 1 or 2,further comprising means for clearing one of said data channels when said emergency call is detected simultaneously with said channel all busy and establishing said emergency channel through said cleared data channel.

4. A concentrator system for connecting subscriber terminals to a switched telecommunication network, said system having a central station and a plurality of remote stations to which said subscriber terminals are connected, said central station and said remote stations being interconnected by a two-way transmission link having a plurality of data channels and an auxiliary two-way channel:
wherein said central station comprises:
a plurality of central subscriber line interface circuits associated in a one-to-one correspondence to said subscriber terminals and connected to said switched telecommunication network;
a central controller cooperating with said central subscriber line interface circuits for selecting one of said data channels in response to a channel assignment request either from said network and said remote stations and generating a data channel selection signal identifying the selected data channel, and detecting when all of said data channels are busy and generating an all-busy signal;
central multiplexer/demultiplexer means for coupling said central subscriber line interface circuits to said selected data channels in response to said data channel selection signal, coupling one of said central subscriber line interface circuits which is associated with a subscriber terminal requesting an emergency call to said auxiliary channel, coupling said data channel selection signal and said all-busy signal to said auxiliary channel, coupling said channel assignment request transmitted from said remote stations on said auxiliary channel to said central controller and detecting an emergency destination address transmitted from said remote stations on said auxiliary channel; and
a dialling circuit for signalling said detected emergency destination address to said network,
wherein each of said remote stations comprises:
a plurality of remote subscriber line interface circuits connected respectively to said subscriber terminals;
register means associated respectively with said subscriber terminals for transmitting a dial tone to said emergency call requesting subscriber terminal and receiving said emergency destination address therefrom;
a remote controller cooperating with said remote subscriber line interface circuits for generating said channel assignment request in response to an outgoing call request from said subscriber terminals and detecting a simultaneous occurrence of said all-busy signal from said central station and an emergency call from said emergency requesting subscriber terminal, causing said register means to send dial tone to the emergency call requesting

subscriber terminal in response to the detection of said simultaneous occurrence, and verifying said emergency call by detecting a coincidence between said received destination address with a list of predetermined emergency destination addresses; and

remote multiplexer/demultiplexer means for coupling said remote subscriber line interface circuits to said selected data channels in response to said data channel selection signal, coupling one of said remote subscriber line interface circuits to said auxiliary channel which is associated with said emergency call requesting subscriber terminal, coupling said channel assignment request and said emergency destination address of the verified emergency call to said auxiliary channel, and coupling said data channel selection signal and said all-busy signal transmitted from said central station on said auxiliary channel to said remote controller.

5. A concentrator system for connecting subscriber terminals to a switched telecommunication network, said system having a central station and a plurality of remote stations to which said subscriber terminals are connected, said central station and said remote stations being interconnected by a two-way transmission link having a plurality of commonly shared two-way data channels, a two-way signalling channel and a plurality of two-way emergency channels:

wherein said central station comprises:

a plurality of central subscriber line interface circuits associated in a one-to-one correspondence to said subscriber terminals and connected to said switching telecommunication network;

a central controller cooperating with said central subscriber line interface circuits for selecting one of said data channels in response to a data channel assignment request either from said network and said remote stations and generating a data channel selection signal identifying the selected data channel, selecting one of said emergency channels in response to an emergency channel assignment request from said remote stations and generating an emergency channel selection signal identifying the selected emergency channel, and detecting when all of said data channels are busy and generating an all busy signal;

central multiplexer/demultiplexer means for coupling said central subscriber line interface circuits to said selected data channel in response to said data channel selection signal, coupling one of said central subscriber line interface circuits which is associated with a subscriber terminal requesting an emergency call to said emergency channel, coupling said data channel selection signal, said emergency channel selection signal and said all-busy signal to said signalling channel, coupling said data channel assignment request transmitted from said remote stations on said signalling channel to said central controller and detecting an emergency destination address transmitted from said remote stations on said emergency channel; and

a dialling circuit for signalling said detected emergency destination address to said network,

wherein each of said remote stations comprises:

a plurality of remote subscriber line interface circuits connected respectively to said subscriber terminals;

register means associated respectively with said subscriber terminals for transmitting a dial tone to said emergency call requesting subscriber terminal and receiving said emergency destination address therefrom;

a remote controller cooperating with said remote subscriber line interface circuits for generating said data channel assignment request in response to an outgoing call request from said subscriber terminals and generating said emergency channel assignment request in response to an emergency call from said emergency call requesting subscriber terminal, detecting a simultaneous occurrence of said all-busy signal from said central station and said emergency call, causing said register means to send dial tone to the emergency call requesting subscriber terminal in response to the detection of said simultaneous occurrence, and verifying said emergency call by detecting a coincidence between said received destination address with a list of predetermined emergency destination addresses; and

remote multiplexer/demultiplexer means for coupling said remote subscriber line interface circuits to said selected data channels in response to said data channel selection signal, coupling one of said remote subscriber line interface circuits which is associated with said emergency call requesting subscriber terminal to said emergency channel in response to said emergency channel selection signal, coupling said channel assignment request to said signalling channel, coupling said emergency destination address of the verified emergency call to said emergency channel, and coupling said data channel selection signal and said all-busy signal transmitted from said central station on said signalling channel to said remote controller.

6. A concentrator system for connecting subscriber terminals to a switched telecommunication network, said system having a central station and a plurality of remote stations to which said subscriber terminals are connected, said central station and said remote stations being interconnected by a two-way transmission link having a plurality of commonly shared, demand-assigned two-way data channels, a two-way signalling channel and a two-way emergency channel:

wherein said central station comprises:

BNSDOCID: EP 0304955A2_I_> Page 278 of 755

a plurality of central subscriber line interface circuits associated in a one-to-one correspondence to said subscriber terminals and connected to said switched telecommunication network;

a central controller cooperating with said central subscriber line interface circuits for selecting one of said data channels in response to a channel assignment request either from said network and said remote stations and generating a data channel selection identifying the selected data channel, detecting whether a collision occurs between emergency call requests from said remote stations and generating an access grant signal when no collision is detected, and detecting when all of said data channels are busy and generating an all-busy signal;

central multiplexer/demultiplex means for coupling said central subscriber line interface circuits to said selected data channel in response to said data channel selection signal, coupling one of said central subscriber line interface circuits which is associated with a subscriber terminal requesting an emergency call to said emergency channel, coupling said data channel selection signal and said all-busy signal to said signalling channel, coupling said access grant signal to said emergency channel, coupling said channel assignment request transmitted from said remote stations on said signalling channel to said central controller and detecting an emergency destination address transmitted from said remote stations on said emergency channel; and

a dialling circuit for signalling said detected emergency destination address to said network,

wherein each of said remote stations comprises:

a plurality of remote subscriber line interface circuits connected respectively to said subscriber terminals;

register means associated respectively with said subscriber terminals for transmitting a dial tone to said emergency call requesting subscriber terminal and receiving said emergency destination address therefrom;

a remote controller cooperating with said remote subscriber line interface circuits for generating said channel assignment request in response to an outgoing call request from said subscriber terminals and detecting a simultaneous occurrence of said all-busy signal from said central station and an emergency call from said emergency requesting subscriber terminal, causing said register means to send dial tone to the emergency call requesting subscriber terminal in response to the detection of said simultaneous occurrence, and verifying said emergency call by detecting a coincidence between said received destination address with a list of predetermined emergency destination addresses; and

remote multiplexer/demultiplexer means for coupling said remote subscriber line interface circuits to said selected data channels in response to said data channel selection signal, coupling one of said remote subscriber line interface circuits which is associated with said emergency call requesting subscriber terminal to said emergency channel, coupling said channel assignment request to said signalling channel and said emergency destination address of the verified emergency call to said emergency channel, coupling said access grant signal transmitted from said central station on said emergency channel to said remote controller, and coupling said data channel selection signal and said all-busy signal transmitted from said central station on said signalling channel to said remote controller.

7. A concentrator system for connecting subscriber terminals to a switched telecommunication network, said system having a central station and a plurality of remote stations to which said subscriber terminals are connected, said central station and said remote stations being interconnected by a two-way transmission link having a plurality of commonly shared, demand-assigned two-way data terminals and a two-way signalling channel:

wherein said central station comprises:

a plurality of central subscriber line interface circuits associated in a one-to-one correspondence to said subscriber terminals and connected to said switched telecommunication network;

a central controller cooperating with said central subscriber line interface circuits for selecting one of said data channels in response to a data channel assignment request either from said network and said remote stations and generating a data channel selection signal identifying the selected data channel, detecting when all of said data channels are busy and generating an all-busy signal, and specifying one of said data channels in response to an emergency call request from said remote stations and generating a data channel disconnect signal identifying said specified data channel;

central multiplexer/demultiplexer means for coupling said central subscriber line interface circuits to said selected data channels in response to said data channel selection signal, clearing said specified data channel and coupling one of said central subscriber line interface circuits which is associated with a subscriber terminal requesting an emergency call to said cleared data channel in response to said data channel disconnect signal, coupling said data channel selection signal, said data channel disconnect signal and said all-busy signal to said signalling channel, coupling said data channel assignment request transmitted from said remote stations on said signalling channel to said central controller and detecting an emergency des-

tination address transmitted from said remote stations on signalling channel; and

a dialling circuit for signalling said detected emergency destination address to said network,

wherein each of said remote stations comprises:

a plurality of remote subscriber line interface circuits connected respectively to said subscriber terminals;

register means associated respectively with said subscriber terminals for transmitting a dial tone to said emergency call requesting subscriber terminal and receiving said emergency destination address therefrom;

a remote controller cooperating with said remote subscriber line interface circuits for generating said channel assignment request in response to an outgoing call request from said subscriber terminals and detecting a simultaneous occurrence of said all-busy signal from said central station and an emergency call from said emergency requesting subscriber terminal, causing said register means to send dial tone to the emergency call requesting subscriber terminal in response to the detection of said simultaneous occurrence, and verifying said emergency call by detecting a coincidence between said received destination with a list of predetermined emergency destination addresses; and

remote multiplexer/demultiplexer means for coupling said remote subscriber line interface circuits to said selected data channels in response to said data channel selection signal, clearing said specified data channel and coupling one of said remote subscriber line interface circuits which is associated with said emergency call requesting subscriber terminal to said cleared data channel in response to said data channel disconnect signal, coupling said channel assignment request and said emergency destination address of the verified emergency call to said transmission link, and coupling said data channel selection signal, said data channel disconnect signal and said all-busy signal transmitted from said central station on said signalling channel to said remote controller.

BNSDOCID: <EP __0304955A2_I_>

88114048.7

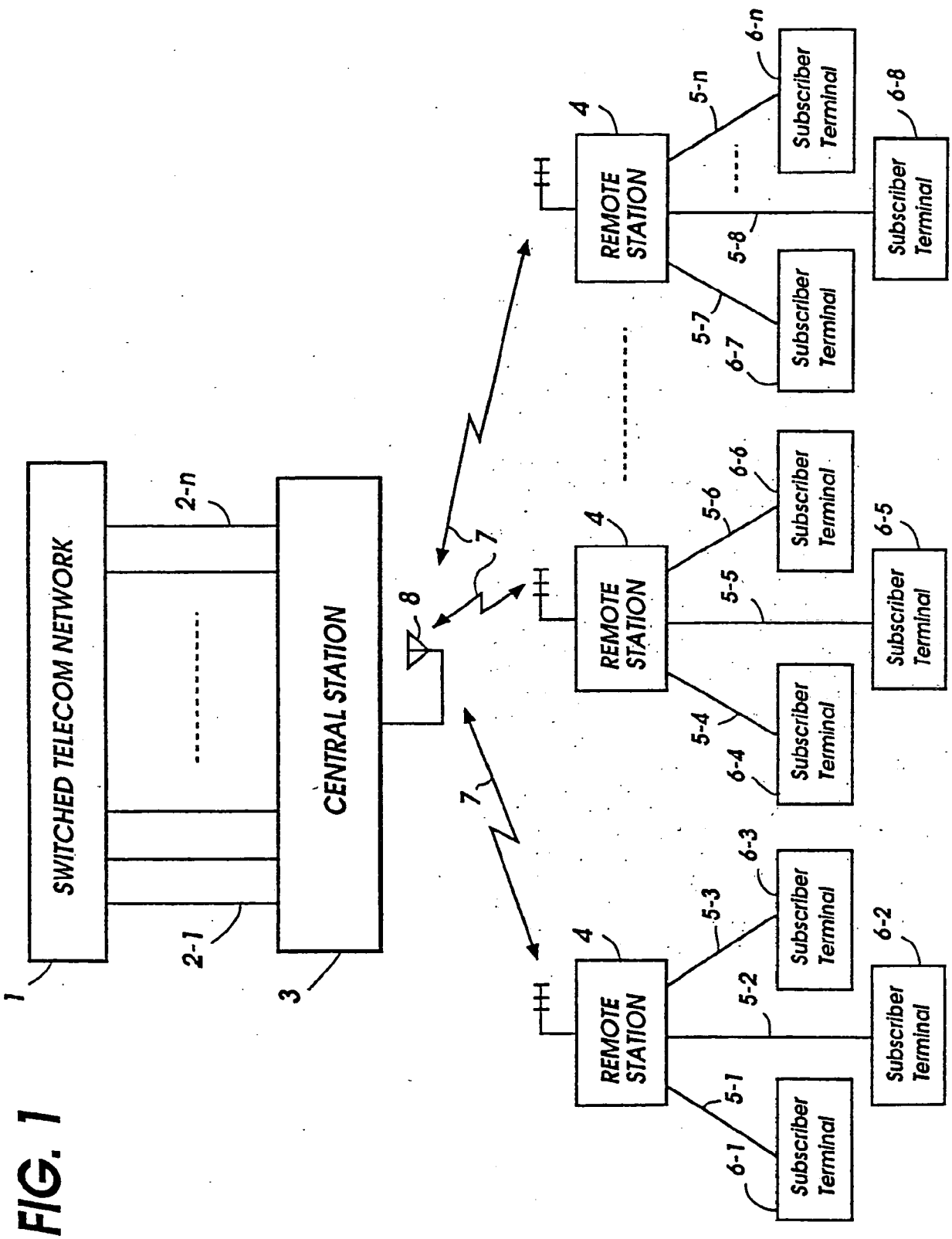


FIG. 1

BNSDOCID: <EP___0304955A2_I_>

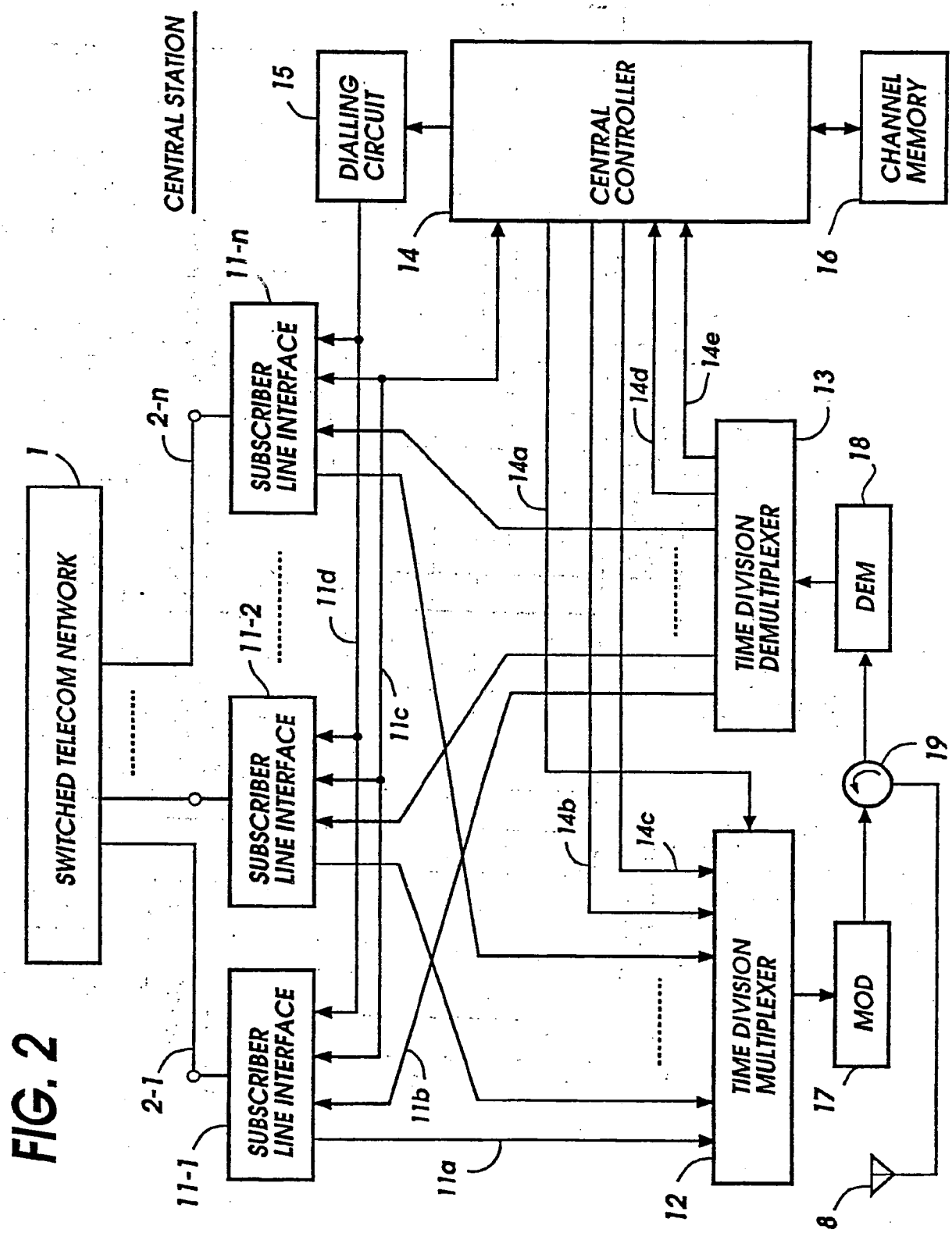


FIG. 2

BNSDOCID: <EP_ _ 0304955A2_I_>

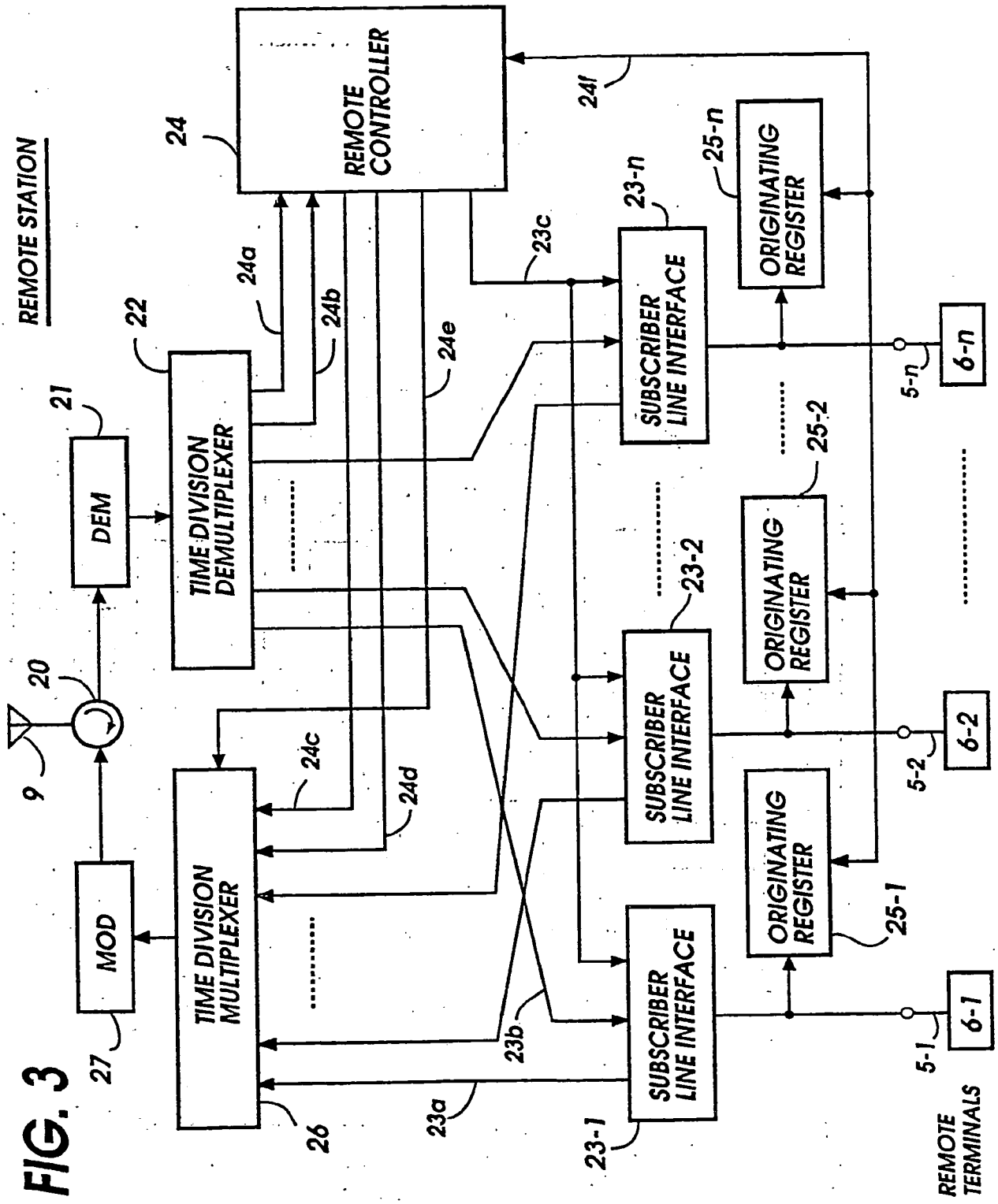
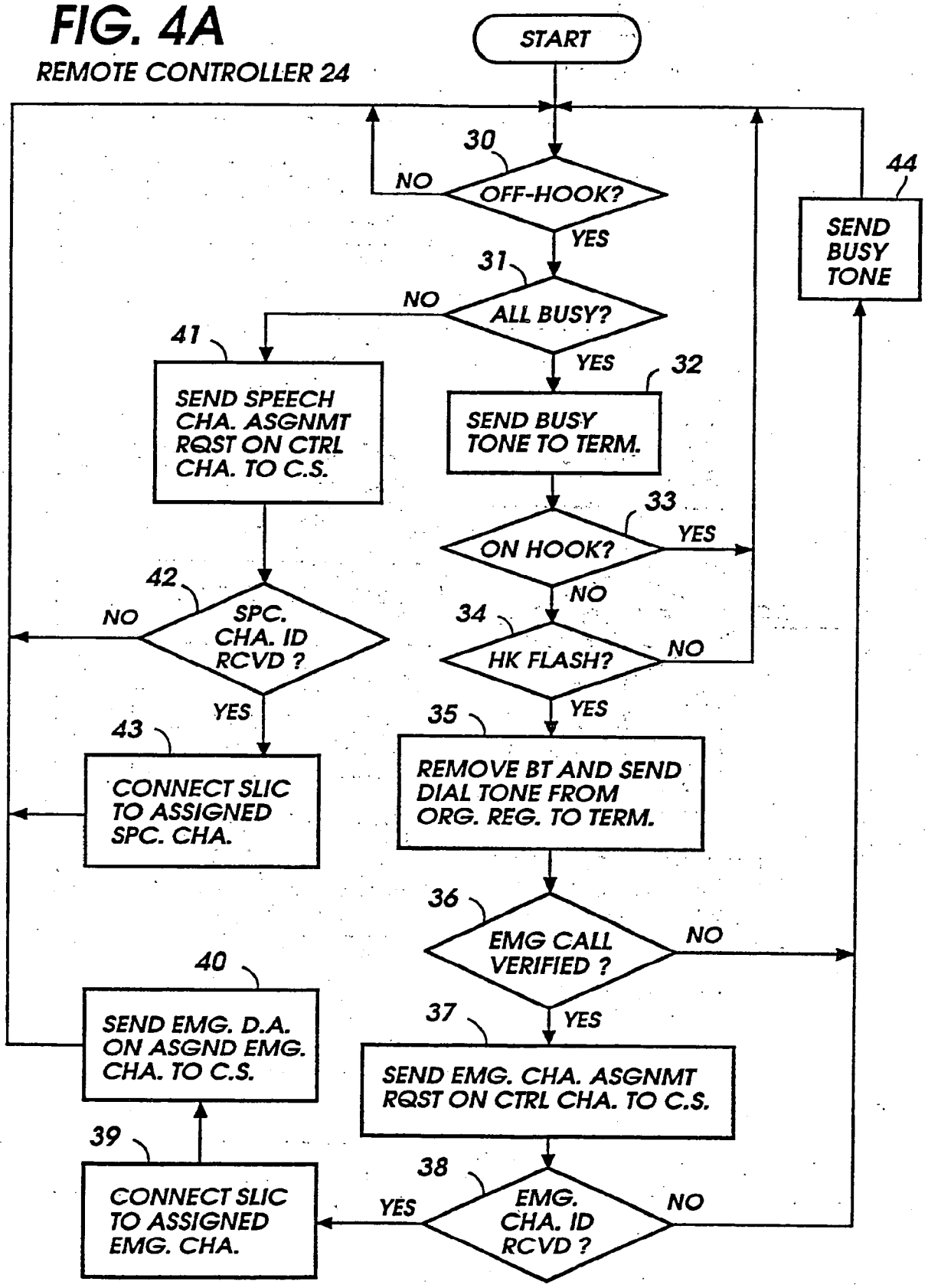


FIG. 3

BNSDOCID: <EP___0304955A2_I_>

FIG. 4A

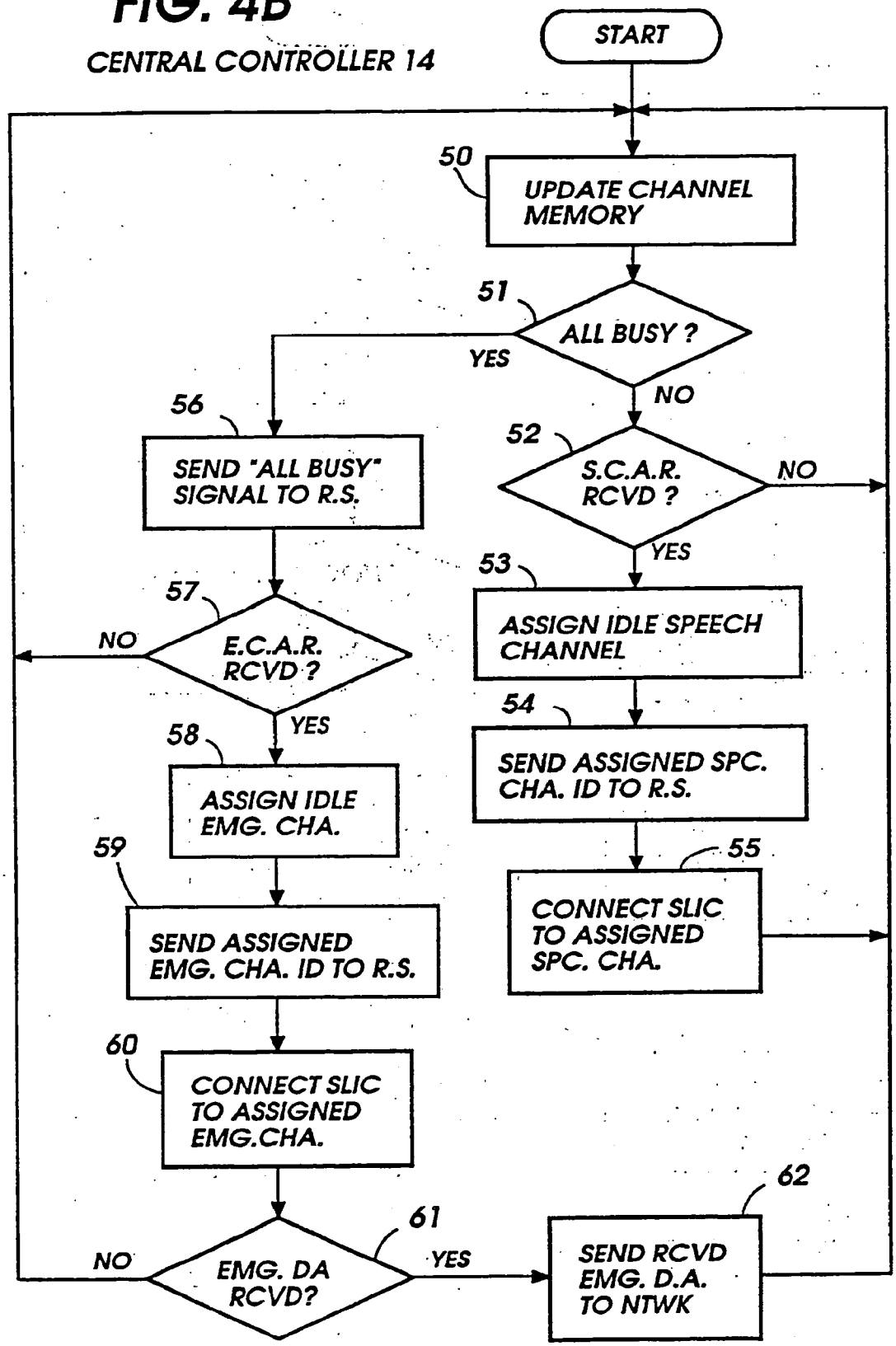
REMOTE CONTROLLER 24



BNSDOCID: <EP___0304955A2_I_>

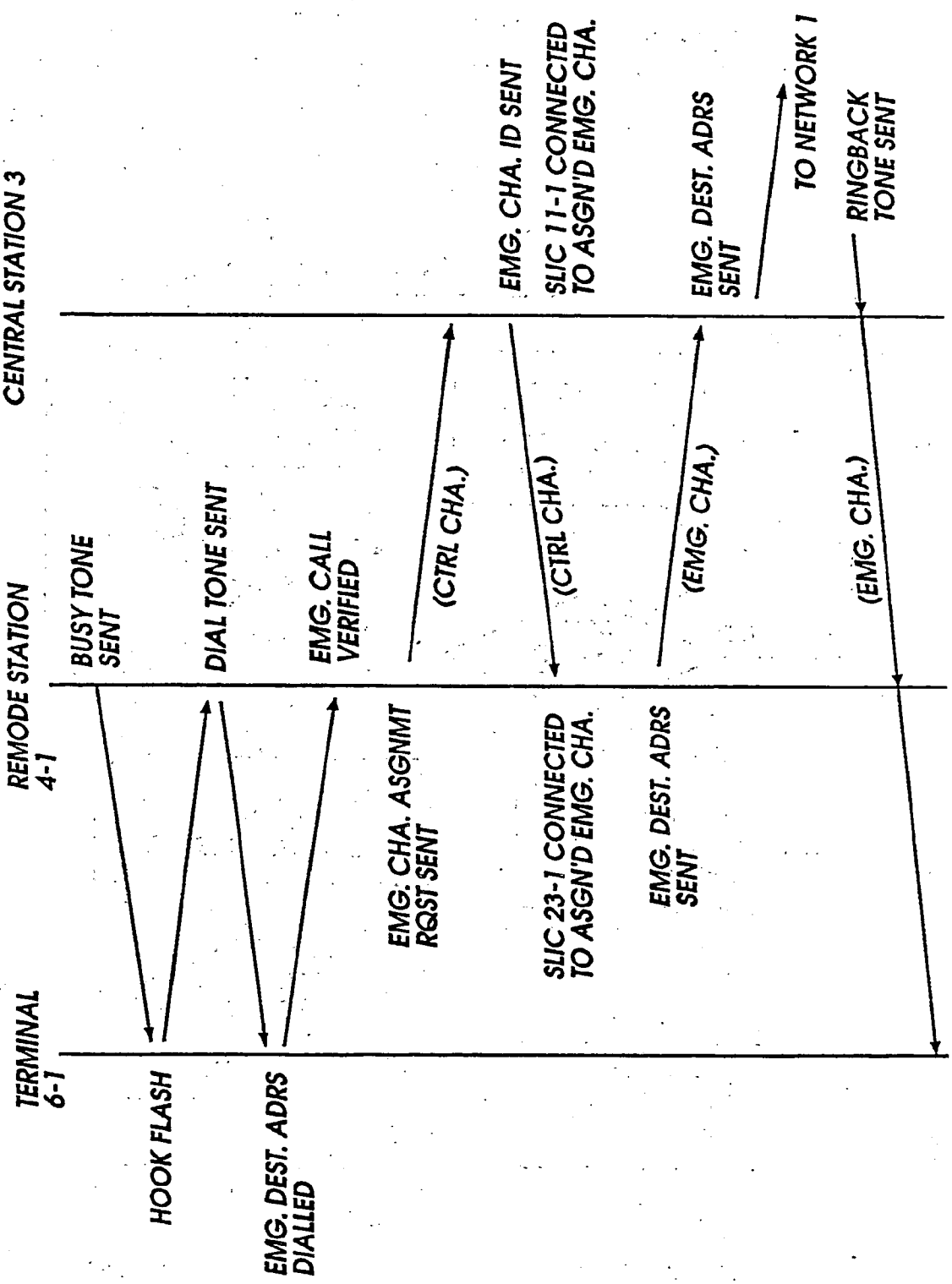
FIG. 4B

CENTRAL CONTROLLER 14



BNSDOCID: <EP__0304955A2_I_>

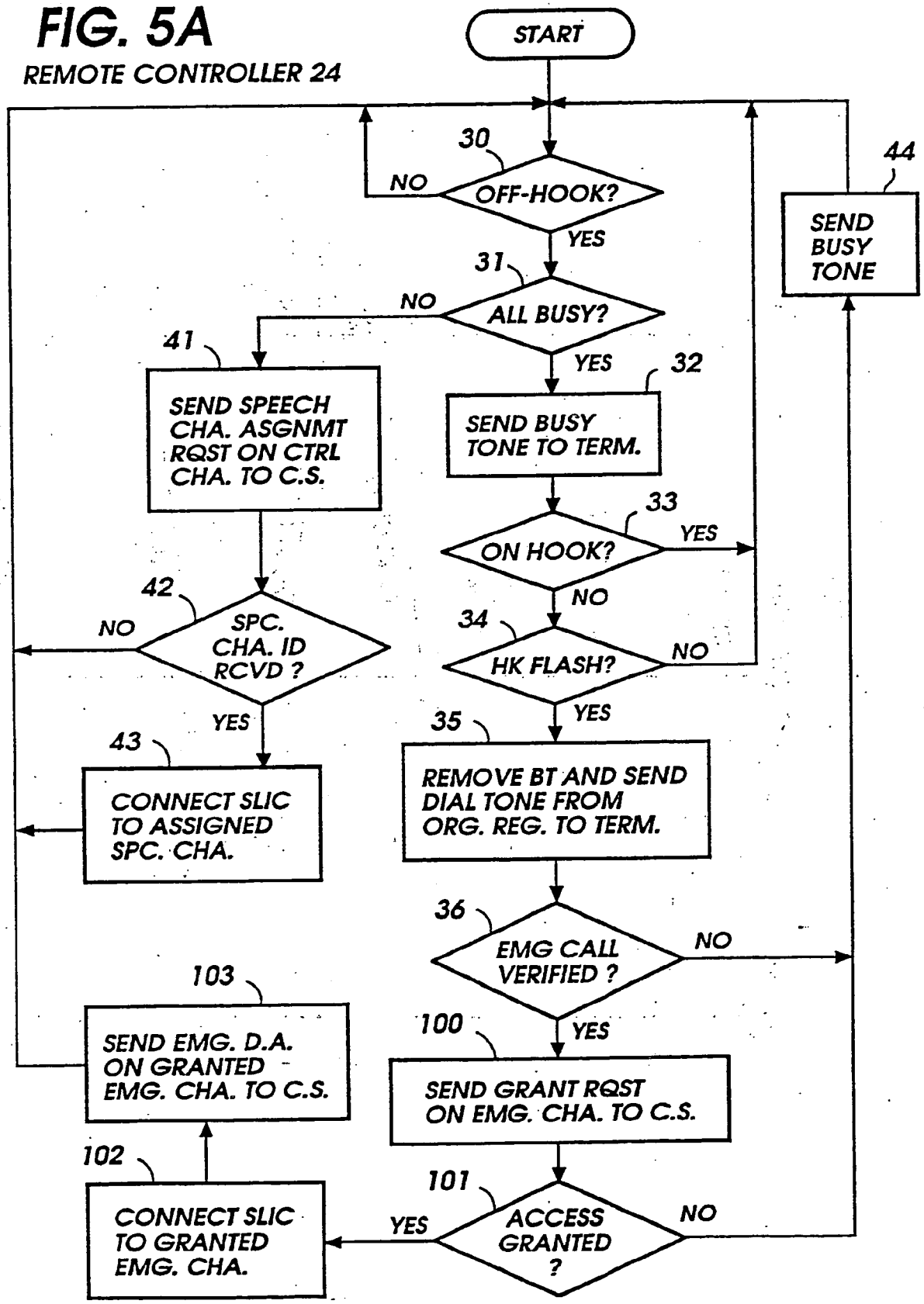
FIG. 4C



BNSDOCID: <EP___0304955A2_I_>

FIG. 5A

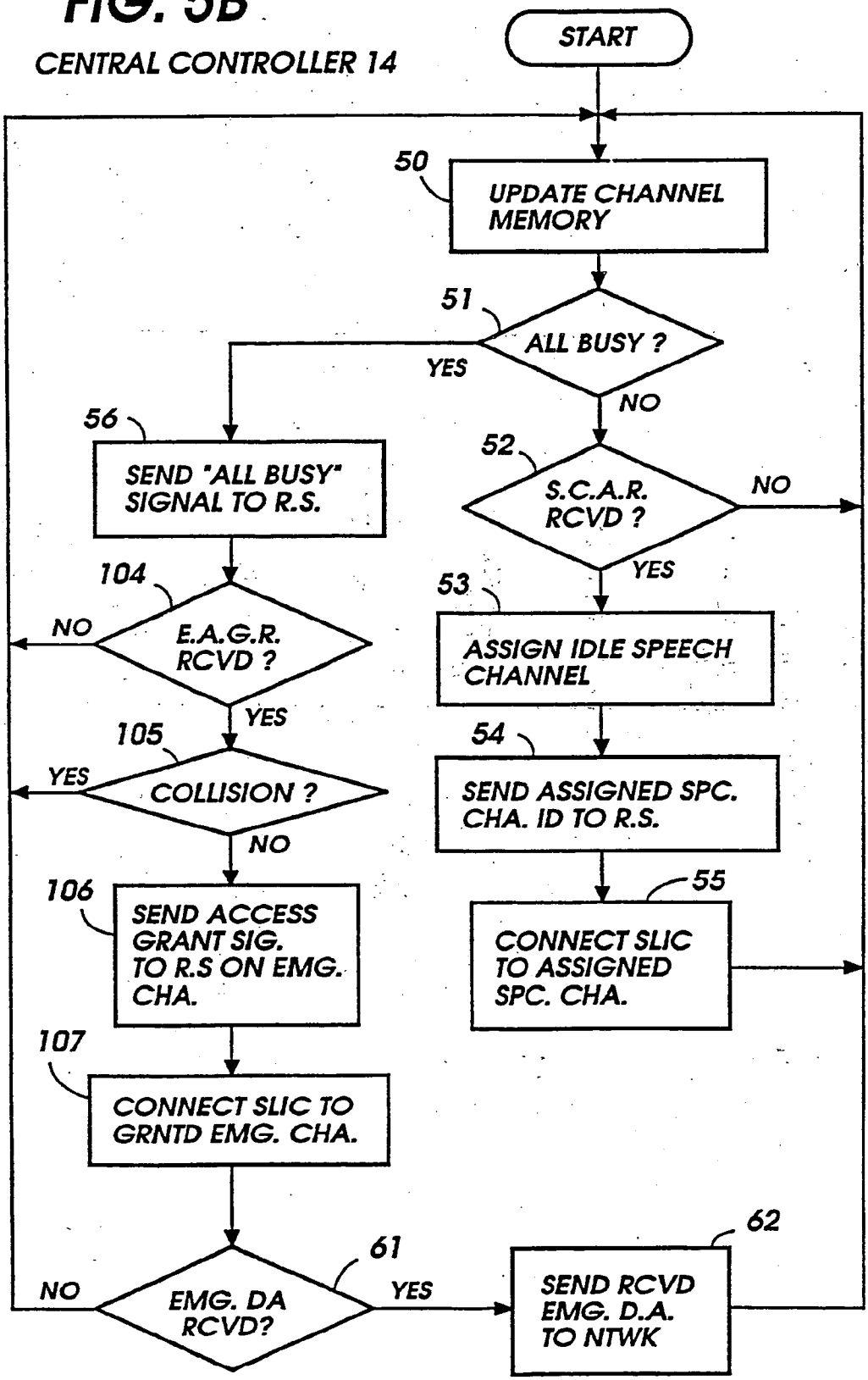
REMOTE CONTROLLER 24



BNSDOCID: <EP__0304955A2_I_>

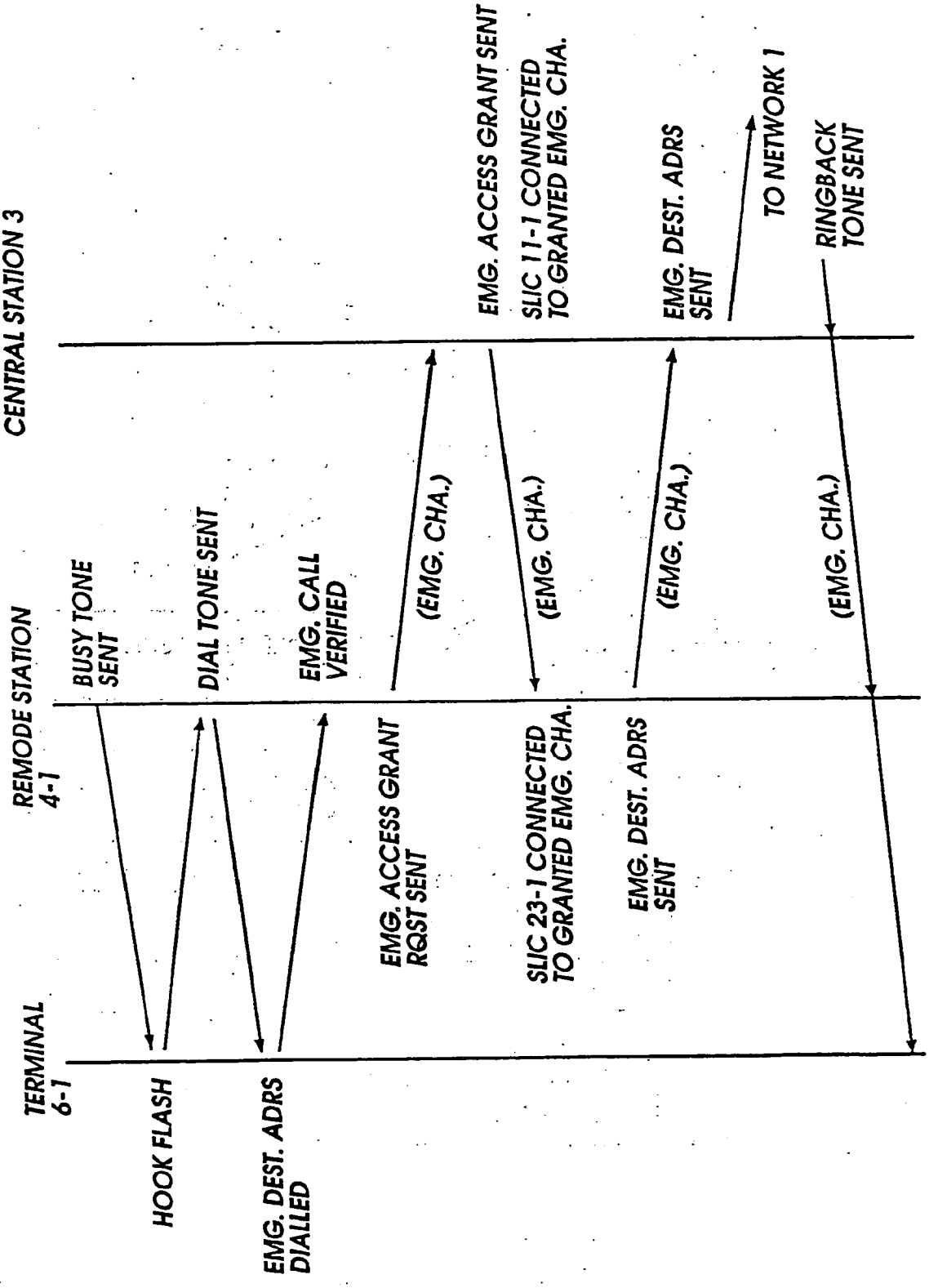
FIG. 5B

CENTRAL CONTROLLER 14



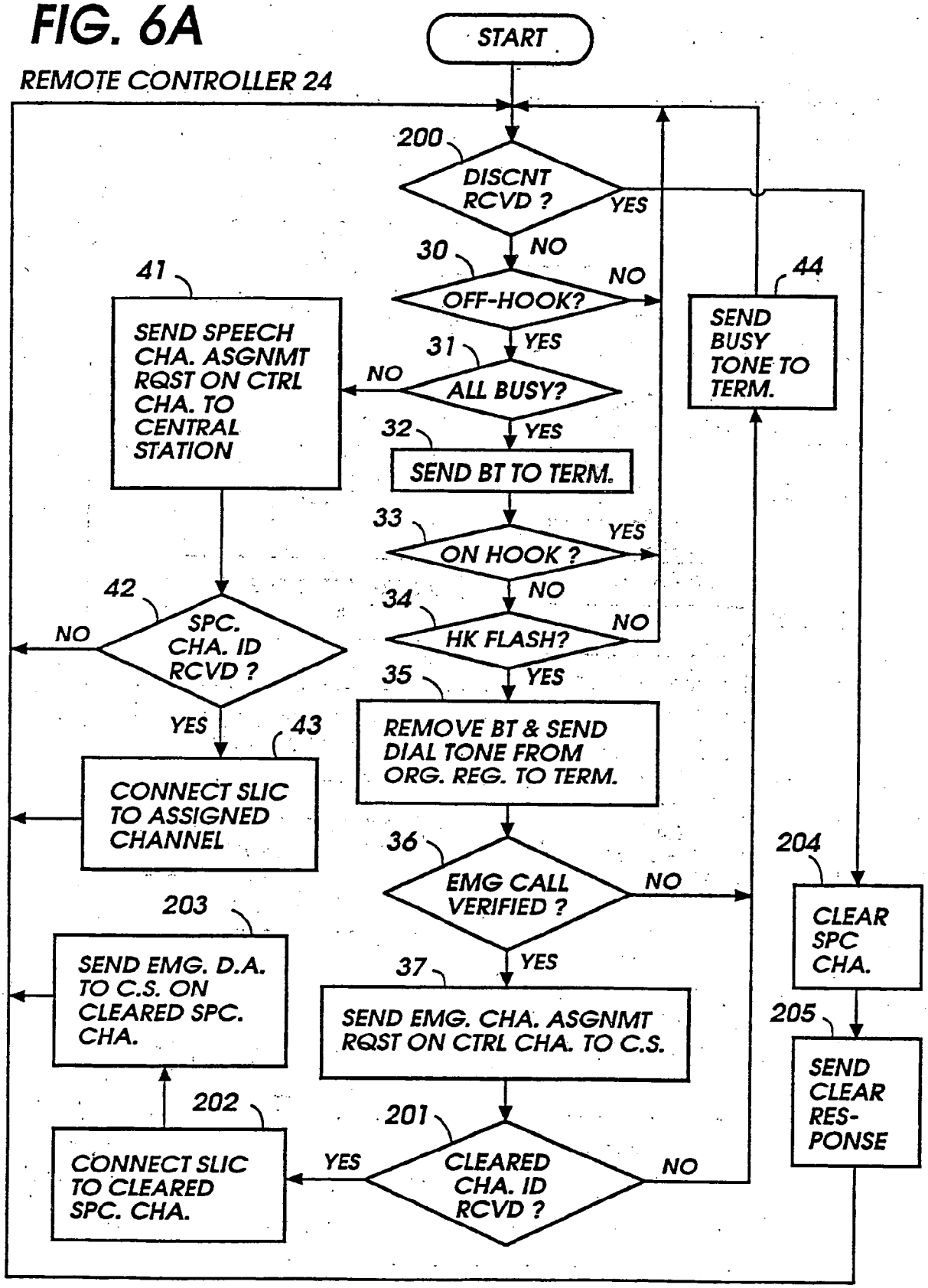
BNSDOCID: <EP___0304955A2_I_>

FIG. 5C



BNSDOCID: <EP___0304955A2_I_>

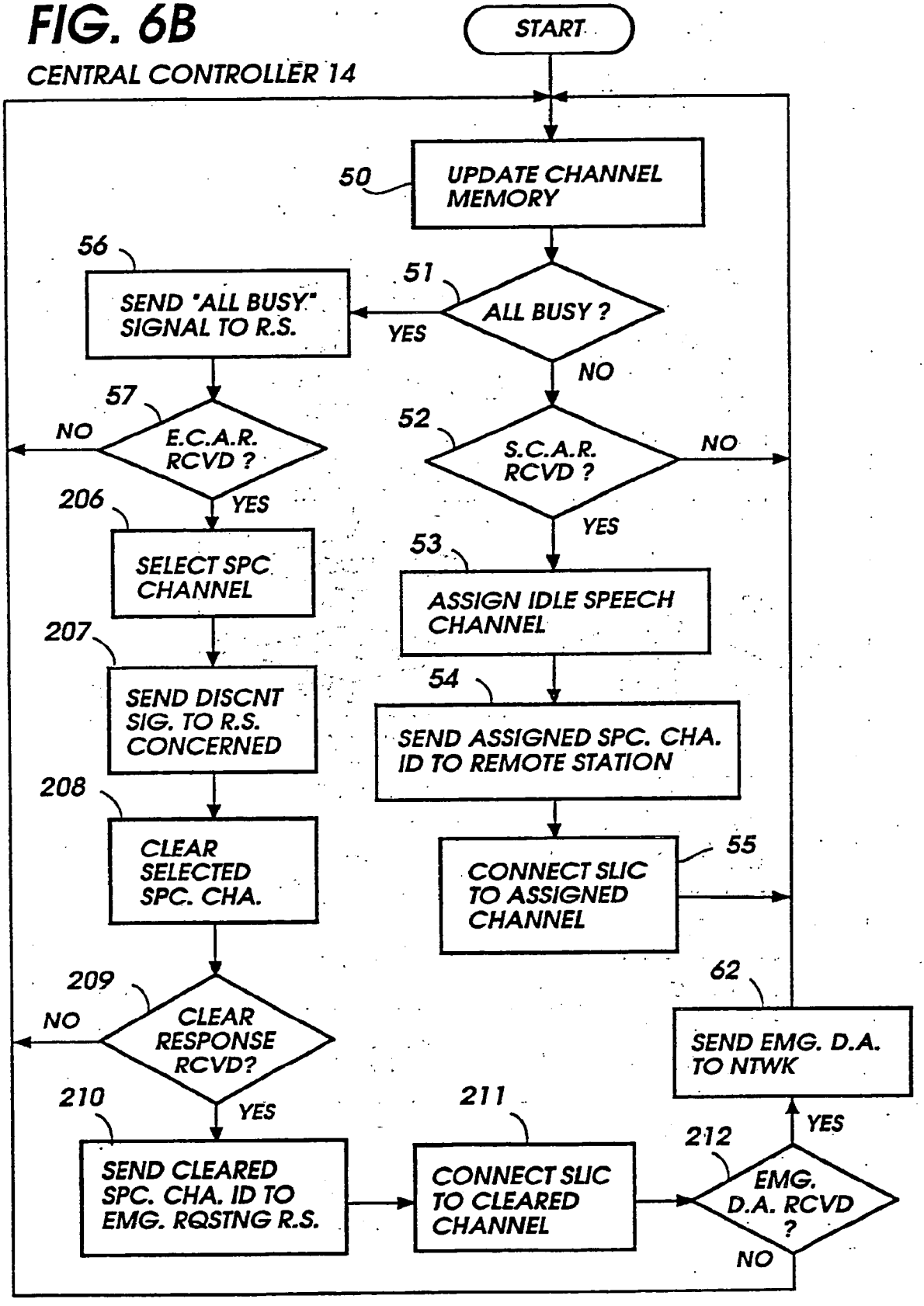
FIG. 6A



BNSDOCID: <EP___0304955A2_I_>

FIG. 6B

CENTRAL CONTROLLER 14



BNSDOCID: <EP___0304955A2_I_>

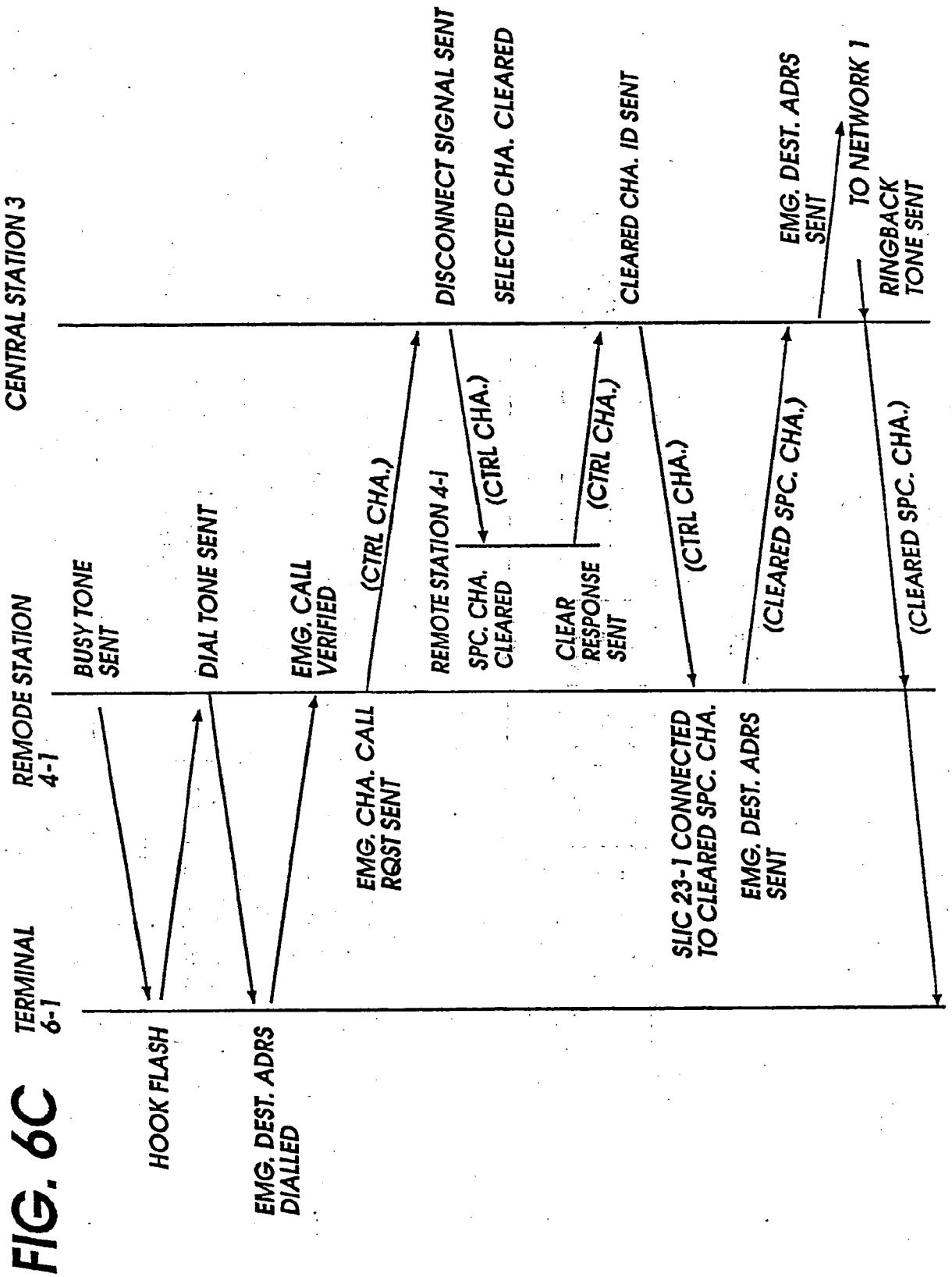


FIG. 6C

BNSDOCID: <EP___0304955A2_I_>

FIG. 7

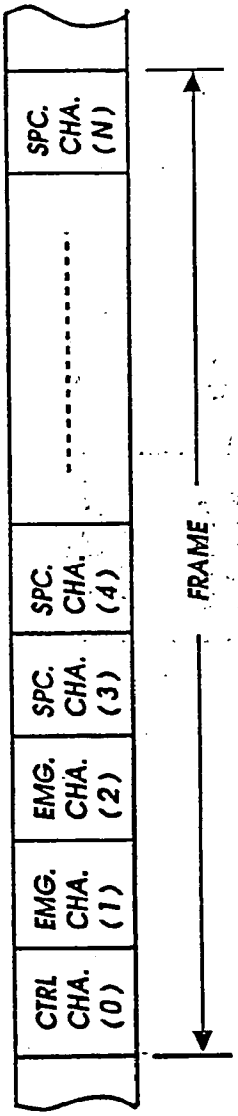
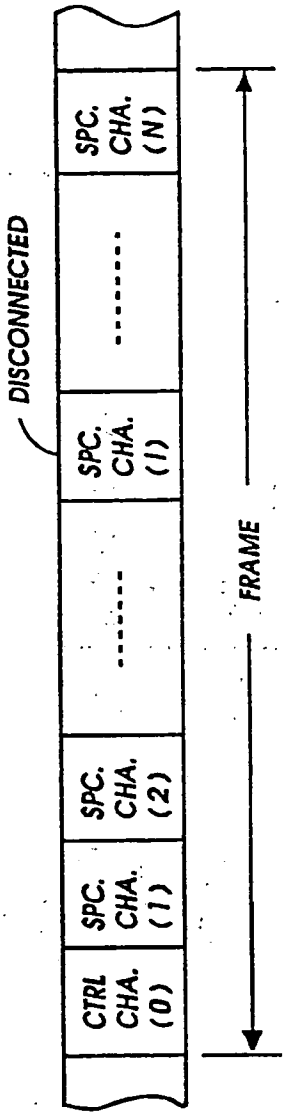


FIG. 8



BNSDOCID: <EP___0304955A2_I_>

THIS PAGE BLANK (USPTO)

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 304 955 A3**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **88114048.7**

(51) Int. Cl.5: **H04Q 7/04, H04B 7/24**

(22) Date of filing: **29.08.88**

(30) Priority: **27.08.87 JP 213253/87**
27.08.87 JP 213257/87
27.08.87 JP 213258/87

(43) Date of publication of application:
01.03.89 Bulletin 89/09

(84) Designated Contracting States:
DE GB IT

(88) Date of deferred publication of the search report:
13.06.90 Bulletin 90/24

(71) Applicant: **NEC CORPORATION**
33-1, Shiba 5-chome, Minato-ku
Tokyo 108(JP)

(72) Inventor: **Sasaki, Yasutaka**
c/o NEC Corporation 33-1, Shiba 5-chome
Minato-ku Tokyo(JP)

(74) Representative: **Vossius & Partner**
Siebertstrasse 4 P.O. Box 86 07 67
D-8000 München 86(DE)

(54) Concentrator system capable of completing emergency calls under congested traffic.

(57) In a radio concentrator system found by a central station (3) and remote stations (4), demand-assigned data channels are constantly monitored to detect when they are congested. When an emergency call is received from a subscriber terminal (6), a dial tone is sent to the terminal if the emergency call occurs simultaneously with the detection of a congestion. On hearing the dial tone, the subscriber dials an emergency destination address, which is received by a remote station and compared with a list of predetermined addresses and verified if it matches one of the predetermined addresses. The dialled information is sent from that station to the central station, where it is relayed to a switched network (1). An emergency channel is established to the network for routing the emergency call. This channel may be permanently provided and demand-assigned in response to an emergency channel assignment request, or first selected by a remote station requesting an emergency call and access is granted by the central station if no collision occurs between competing emergency calls. Alternatively, no emergency channel is provided in the system and one of the data channels is cleared when an emergency call is detected simultaneously with the occurrence of a congestion. The cleared channel is used as an emergency channel to complete the emergency call.

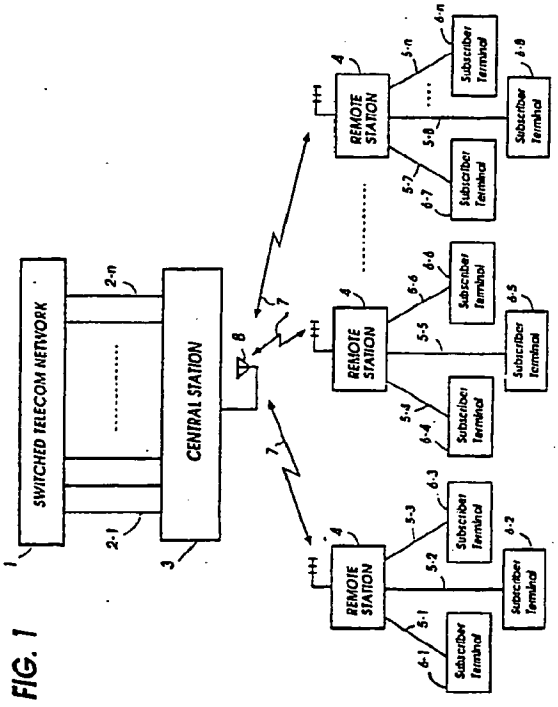


FIG. 1

EP 0 304 955 A3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 88 11 4048

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	PATENT ABSTRACTS OF JAPAN, vol. 8, no. 200 (E-266)[1637], 13th September 1984; & JP-A-59 89 044 (NIPPON DENKI K.K.) 23-05-1984	1	H 04 Q 7/04 H 04 B 7/24
A	IDEM	4-7	
A	DE-A-3 334 886 (LICENTIA) * Page 4, line 1 - page 7, line 17 *	1,3-7	
A	EP-A-0 136 517 (GENERAL ELECTRIC) * Page 5, line 19 - page 7, line 9; page 8, lines 1-19; page 10, line 9 - page 11, line 2; page 17, line 11 - page 18, line 13; page 23, line 7 - page 25, line 18 *	1,4-7	
A	INTERNATIONAL CONFERENCE MOBILE RADIO SYSTEMS AND TECHNIQUES, York, GB, 10th - 13th September 1984, pages 204-208; F. TROSBY: "A new dispatch system for Norwegian users" * Page 204, left-hand column, line 48 - page 206, left-hand column, line 11 *	4-6	TECHNICAL FIELDS SEARCHED (Int. Cl.4) H 04 Q H 04 B
A	N.E.C. RESEARCH AND DEVELOPMENT, no. 76, January 1985, pages 24-35, Tokyo, JP; T. HIYAMA et al.: "Digital Radio Concentrator System (DRCS)"		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	12-03-1990	GERLING J.C.J.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P0401)

BNSDOCID: <EP___0304955A3_I_>

***This Page is Inserted by IFW Indexing and Scanning Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ **BLACK BORDERS**
- ☐ **IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- ☐ **FADED TEXT OR DRAWING**
- ☐ **BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- ☐ **SKEWED/SLANTED IMAGES**
- ☐ **COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- ☐ **GRAY SCALE DOCUMENTS**
- ☐ **LINES OR MARKS ON ORIGINAL DOCUMENT**
- ☑ **REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- ☐ **OTHER:** _____

IMAGES ARE BEST AVAILABLE COPY.
As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.

This Page Blank (uspto)

PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : H04Q 7/20

A1

(11) International Publication Number: WO 99/51043

(43) International Publication Date: 7 October 1999 (07.10.99)

(21) International Application Number: PCT/IL98/00149

(22) International Filing Date: 29 March 1998 (29.03.98)

(71) Applicant *(for all designated States except US)*: ECI TELECOM LTD. [IL/IL]; Hasivim Street 30, 49130 Petach Tikva (IL).

(72) Inventor; and

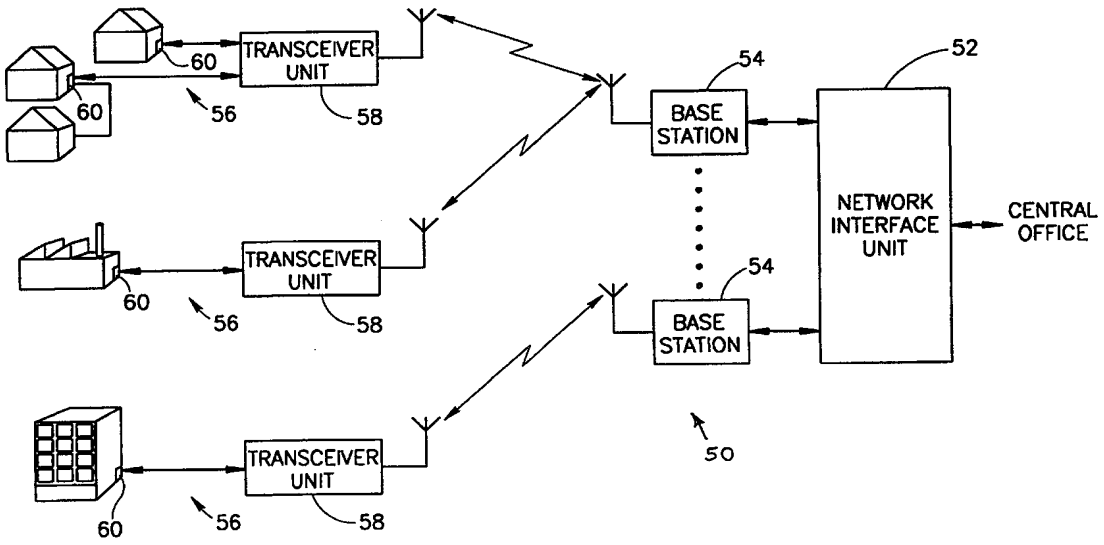
(75) Inventor/Applicant *(for US only)*: ZOHAR, Israel [IL/IL]; Naama Street 26, 75684 Rishon–Lezyyon (IL).

(74) Agents: FENSTER, Paul et al.; Fenster & Company, P.O. Box 2741, 49127 Petach Tikva (IL).

(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, GW, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: WIRELESS LOCAL LOOP SYSTEM



(57) Abstract

A remote terminal for a wireless local loop system comprising: a radio transceiver unit which receives signals from and sends signals to a base station for connection to a telecommunication network; and at least one service unit which receives signals from and sends signals via land lines to a plurality of subscribers, said service unit and said radio transceiver unit being situated at different sites, wherein a particular service unit is connected to a plurality of subscribers and said radio transceiver unit and said particular service unit are electrically connected by only a single pair of wires.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	**ES**	Spain	**LS**	Lesotho	**SI**	Slovenia
AM	Armenia	**FI**	Finland	**LT**	Lithuania	**SK**	Slovakia
AT	Austria	**FR**	France	**LU**	Luxembourg	**SN**	Senegal
AU	Australia	**GA**	Gabon	**LV**	Latvia	**SZ**	Swaziland
AZ	Azerbaijan	**GB**	United Kingdom	**MC**	Monaco	**TD**	Chad
BA	Bosnia and Herzegovina	**GE**	Georgia	**MD**	Republic of Moldova	**TG**	Togo
BB	Barbados	**GH**	Ghana	**MG**	Madagascar	**TJ**	Tajikistan
BE	Belgium	**GN**	Guinea	**MK**	The former Yugoslav Republic of Macedonia	**TM**	Turkmenistan
BF	Burkina Faso	**GR**	Greece			**TR**	Turkey
BG	Bulgaria	**HU**	Hungary	**ML**	Mali	**TT**	Trinidad and Tobago
BJ	Benin	**IE**	Ireland	**MN**	Mongolia	**UA**	Ukraine
BR	Brazil	**IL**	Israel	**MR**	Mauritania	**UG**	Uganda
BY	Belarus	**IS**	Iceland	**MW**	Malawi	**US**	United States of America
CA	Canada	**IT**	Italy	**MX**	Mexico	**UZ**	Uzbekistan
CF	Central African Republic	**JP**	Japan	**NE**	Niger	**VN**	Viet Nam
CG	Congo	**KE**	Kenya	**NL**	Netherlands	**YU**	Yugoslavia
CH	Switzerland	**KG**	Kyrgyzstan	**NO**	Norway	**ZW**	Zimbabwe
CI	Côte d'Ivoire	**KP**	Democratic People's Republic of Korea	**NZ**	New Zealand		
CM	Cameroon			**PL**	Poland		
CN	China	**KR**	Republic of Korea	**PT**	Portugal		
CU	Cuba	**KZ**	Kazakstan	**RO**	Romania		
CZ	Czech Republic	**LC**	Saint Lucia	**RU**	Russian Federation		
DE	Germany	**LI**	Liechtenstein	**SD**	Sudan		
DK	Denmark	**LK**	Sri Lanka	**SE**	Sweden		
EE	Estonia	**LR**	Liberia	**SG**	Singapore		

WIRELESS LOCAL LOOP SYSTEM

FIELD OF THE INVENTION

The present invention is related to wireless local loop telephone systems and in particular to the configuration and installation of such systems.

BACKGROUND OF THE INVENTION

Wireless local loop (WLL) systems are well known in the art. One configuration of such a prior art system 10 is shown in Fig. 1A. In general such systems comprise one or more base station units 12, which are connected to a central office via a network interface unit 14. System 10 also includes one or more remote terminals 16. Remote terminals 16 receive radio transmissions from the base station and distribute messages to subscribers 18 via land lines 19. The remote terminals generally comprise an outdoor unit 20 which receives radio signals from and transmits signals to the base station and an indoor unit 22 which distributes telephone signals to the subscribers based on the radio signals. Indoor unit 22 thus acts as a small switchboard and the transceiver replaces the land lines which would otherwise connect the subscriber to the central office. Where multiple subscribers are supplied by a single remote station, the indoor unit is generally on the premises of one of the subscribers and is powered from the mains at the subscriber.

Installation of such systems is often problematic. As is evident, there are no lines connecting the remote stations to the central office. Thus, the central office cannot supply power to the remote stations. The remote stations must thus be powered directly from the local power lines. Two basic configurations are available for powering such systems, which are generally divided into an indoor unit and an outdoor unit. While these designations are descriptive of normal installation, the indoor unit could be mounted outdoors, if it is sufficiently weatherproofed, and occasionally is mounted on the same roof or telephone pole as the outdoor unit.

Fig. 1B shows the configuration of one such prior art remote terminal 16'. Remote terminal 16' comprises an indoor unit 20' and an outdoor unit 22'. Most of remote terminal 16' is comprised in indoor unit 20'. Indoor unit 20' produces an RF signal which is transported via a coaxial cable 24 to outdoor unit 22'. Optionally, the coaxial cable also carries power to an optional RF amplifier 26, situated in outdoor unit 22'.

While such systems have the advantage that most of the unit is indoors, they have the disadvantage that coaxial cables must be installed between the indoor and the outdoor units, i.e., between the outdoor installation and one of the subscribers. Coaxial cables are relatively

expensive and are more difficult to install than simple two-wire twisted pair lines. The distance between the indoor and the outdoor units is limited by the attenuation of the cable.

A second prior art remote terminal 16" is shown in Fig. 1C. Remote terminal 16" is also divided into an indoor unit 20" and an outdoor unit 22". However, indoor unit 20" includes only a power supply and an optional back-up battery. The subscriber connections are individually fed directly to outdoor unit 22" and power is supplied to outdoor unit 22" from indoor unit 20" via a twisted pair of wires. Thus, this installation utilizes easily installed of wire pairs between the outdoor unit and the indoor unit/subscribers. However, multiple sets of wire pairs are required to complete the installation. This is not always convenient, especially if there are a large number of lines being serviced by the remote terminal.

In some systems the power for the outdoor unit is supplied directly from mains to the unit. In other systems, a backup battery is present in the outdoor unit.

For some of such systems, when power is cut off at the subscriber in whose premises the indoor unit is installed, all of the subscribers lose their service.

SUMMARY OF THE INVENTION

One aspect of some embodiments of the present invention is the provision of a remote terminal in which a first unit, generally installed outdoors, is connected to a second unit, not co-located with the first unit and generally installed indoors, utilizing only a single pair of wires which is not a coaxial cable. Such a pair of wires may, for example, be a twisted pair. Such a system provides for easy installation. As used herein the term "pair of wires" excludes a coaxial cable.

Preferably, in accordance with a preferred embodiment of the invention, a remote terminal which services a number of subscribers is powered from the mains or from an external DC power source. In this aspect of the invention, power is supplied to the system from some or all of the subscribers. When power fails at one of the subscribers, the system continues to operate from power supplied by the other subscribers.

In a preferred embodiment of the invention, the remote terminal comprises a radio transceiver unit, which is mounted outdoors, adjacent to an antenna, and a service unit which is generally mounted indoors. A service unit is generally provided for each subscriber or group of subscribers located in a single installation or in nearby installations and is powered by mains power supplied by the subscriber or from a DC power source. A single pair of wires connects the service and radio transceiver units and carries digital or analog telephone signals (which way be multiplexed signals from a plurality of user terminals and/or subscribers) and also

carries power from the service unit to power the radio transceiver. Preferably, each service unit or an associated backup power source supplies power to the radio transceiver unit such that radio transceiver unit remains powered even if one or more of the service units becomes inactive.

In another aspect of the invention, a single pair of wires, preferably a twisted pair of conductors, between the service unit and the radio transceiver supplies at least two and preferably three of the following functions: 1) transfer of telephony signals and associated signaling (in accordance with a recognized protocol), 2) power from the service unit to the radio transceiver unit; and, 3) remote station control information which is not directly related to the telephony signal, for example, a control signal between the units which tests one or the other units or transmits status reports on the "health" of the system or which provides status information, as for example, the ability to monitor the operation of non-subscriber hardware, as desired. As used herein, the term remote station control information shall have the meaning as described in this paragraph.

There is thus provided, in accordance with a preferred embodiment of the invention, a remote terminal for a wireless local loop system comprising:

a radio transceiver unit which receives signals from and sends signals to a base station for connection to a telecommunication network; and

at least one service unit which receives signals from and sends signals via land lines to a plurality of subscribers, said service unit and said radio transceiver unit being situated at different sites, wherein

a particular service unit is connected to a plurality of subscribers and said radio transceiver unit and said particular service unit are electrically connected by only a single pair of wires.

In a preferred embodiment of the invention the service unit is powered by a source of energy and power for the radio transceiver unit is transmitted to the radio transceiver unit from the service unit via the single pair of wires.

Preferably, the at least one service unit comprises a plurality of service units. Preferably, at least two service units are individually powered by energy sources and power for the radio transceiver unit is transmitted thereto from the service units via the single pair of wires from each of a plurality of service units.

Preferably, the transceiver unit comprises circuitry which receives signals from the plurality of service units, multiplexes the signals and sends the multiplexed signals to the base

station. Preferably, the transceiver unit comprises circuitry which receives multiplexed signals from the base station and at least partially demultiplexes the signals prior to sending the at least partially demultiplexed signals to the service units.

Preferably, the service unit includes circuitry which receives signals from said plurality of subscribers and multiplexes said signals prior to sending the multiplexed signals to the radio transceiver unit.

Preferably, the service unit includes circuitry which receives multiplexed signals from the radio transceiver unit and demultiplexes the signals prior to distributing signals to the plurality of subscribers.

In a preferred embodiment of the invention, at least one service unit supplies ISDN service to a subscriber. Alternatively, or additionally, at least one service unit provides data services and/or other telephony services to a subscriber.

There is further provided, in accordance with a preferred embodiment of the invention a remote terminal for a wireless local loop system comprising:

a radio transceiver unit which receives signals from and sends signals to a base station for connection to a telecommunication network; and

at least one service unit which receives signals from and sends signals via land lines to at least one subscriber, said service unit and said radio transceiver unit being situated at different sites, wherein

said radio transceiver unit and a particular service unit are electrically connected by a single pair of wires which carries at least two of:

(1) telephony signals and signaling in accordance with a standard protocol;

(2) power from the service unit to the radio transceiver unit; and

(3) control and management information indicating at least the status of non-subscriber equipment.

In a preferred embodiment of the invention, the pair of wires carries at least (1) and (2).

In a preferred embodiment of the invention, the pair of wires carries at least (1) and (3).

In a preferred embodiment of the invention, the pair of wires carries at least (2) and (3).

In a preferred embodiment of the invention, the pair of wires carries (1), (2) and (3).

Preferably, the radio transceiver unit and a particular service unit are electrically connected by only a single pair of wires.

In a preferred embodiment of the invention, the at least one service unit comprises a plurality of service units. Preferably, at least two service units are individually powered by

energy sources and wherein power for the radio transceiver unit is transmitted to the radio transceiver unit from the service units via a pair of wires from each of a plurality of service units.

Preferably, the pair of wires is a twisted pair.

There is further provided, in accordance with a preferred embodiment of the invention, a wireless local loop system comprising:

at least one remote station according to the invention; and

a base station which receives signals from the at least one remote station and passes the signals on to the telecommunication network.

Preferably, the at least one remote station comprises a plurality of said remote stations.

SHORT DESCRIPTION OF THE DRAWINGS

The invention will be more clearly understood from the following preferred embodiments thereof, taken together with the following drawings in which:

Fig. 1A is a schematic representation of a configuration of a wireless local loop (WLL) system of the prior art;

Fig. 1B is a schematic representation of a configuration of a prior art WLL remote terminal;

Fig. 1C is a schematic representation of a configuration of a second prior art WLL remote terminal;

Fig. 2 is a schematic representation of a configuration of a WLL system according to a preferred embodiment of the present invention;

Figs. 3A and 3B is a schematic representation of a configuration of a WLL remote terminal in accordance with a preferred embodiment of the present invention;

Fig. 4 is a schematic representations of circuitry for the juxtapositioning of digital signals and power, at a service unit, for transfer over a pair or wires, in accordance with a preferred embodiment of the invention.; and

Fig. 5 is a schematic representation of a system for powering a radio transceiver unit of a WLL remote terminal, in accordance with a preferred embodiment of the invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Fig. 2 is a schematic representation of a wireless local loop (WLL) telecommunication system 50 in accordance with a preferred embodiment of the present invention. System 50 comprises a network interface unit 52 which is connected to a telecommunications network (not shown). Interface unit 52 serves to connect at least one base station 54 to the network. Base

station 54 and network interface unit 52 are generally conventional and may be of any construction as is known in the art. They interface with the telecommunications network and with remote terminals (described below in detail) in a purely conventional manner. No further description of base stations 52 and interface unit 54 (which are sometimes packaged together and sometimes separately) is necessary for an understanding of the invention.

WLL system 50 also includes at least one and generally a plurality of remote terminals 56. Each base station 54 services one or more remote terminals 56 as shown in Fig. 2.

In a preferred embodiment of the invention, each remote terminal 56 includes a radio transceiver unit 58 and one or more service units 60. The number of service units 60 associated with a given remote station will depend on the particular mix of subscribers being serviced by the remote station. Typically, a service unit can service a number of separate subscribers in an apartment house, a single residence or two or more relatively nearby residences, a factory or office building, etc., depending on the number of lines required and the distance between the subscribers.

A schematic of a typical remote terminal is shown in Figs. 3A and 3B. The remote terminal, includes radio transceiver unit 58 (Fig. 3B) and a plurality of service units 60 (Fig. 3A). Each service unit 60 comprises one or more terminal interfaces 62 which connect directly to telephones or other subscriber equipment. Generally, each interface 62 is associated with a unique telephone number. In preferred embodiments of the invention, terminal interfaces 62 supply ISDN service to subscribers, and a plurality of telephone numbers are associated with each terminal interface. Alternatively or additionally, data services may be provided.

Additionally, each service unit 60 has a preferably digital interface 64 which connects, via a pair of wires, preferably a twisted pair 66, to a transceiver 67 in its associated radio transceiver unit 58. As described below, power is also supplied from one or more of service units 60 to radio transceiver unit 58 via twisted pair 66.

Figs. 3A and 3B show a typical configuration of a division of functions in a remote terminal 56 which allows for an especially simple connection between service units 60 and radio transceiver 58. However, other configurations and functional divisions allowing for this simple connection between the two units will occur to persons of skill in the art.

As shown in the particular configuration of Figs. 3A and 3B, each service unit 60 comprises, in addition to a plurality of terminal interfaces 62, an information decoding and encoding module 68 which receives signals from, and sends signals to the terminal interfaces, under control of a control unit 70. Module 68 sends signals to and receives signals from digital

interface 64 for interaction with radio transceiver unit 58. Generally module 68 receives multiplexed signals from digital interface 64, demultiplexes them and sends the individual telephone signals to the subscribers via terminal interfaces 62. It receives signals from the individual subscribers, again, via terminal interfaces 62, and multiplexes them for transmission, via digital interface 64 and twisted pair 66 to radio transceiver unit 58. This transmission may be by any high speed transmission known in the art such as 2B1Q, 4B3T, TCM (Time Compression Multiplexing) or other HDSL modem technology. Timing, control and management signals are also preferably sent, multiplexed with the telephony signals, on the pair of wires.

The design of the various units within service unit 60 may take any number of forms and may be purely conventional in nature. Alternatively, the form of the connection between the subscriber units and the pair of wires which carries the digital telephone information to and from the radio transceiver unit may differ from that shown and may, for example, be embodied in a computer and associated software and firmware. In preferred embodiments of the invention, however, the interface between the service unit and its associated radio transceiver unit is a single pair of wires.

Service unit 60 also preferably includes a power supply 72, which is mains supplied and optionally, a backup battery 74 which supplies power to the system when the mains power is not available. Power from power supply 72 preferably supplies power to the other elements of service unit 60 as well as delivering power to unit 58 via pair 66.

Alternatively or additionally, pair 66 also carries signaling, control and management information. For example such information may include information regarding the status of non-subscriber equipment, control and management of that equipment and other signals not normally part of the established telephony protocols. Preferably, the components of units 58 and 60 are designed and configured to provide such information. The design of equipment which provides status information is well known in the art.

Referring additionally to Fig. 4 shows a circuit 71 for the juxtaposition of the power with the digital signal outputs of digital interface 64. In this system power supply 72 provides an AC or DC power voltage to pair 66. This power voltage is superimposed on digital signals received from digital interface 64 in a transformer 76. A capacitor 78 assures that the transfer of information between service unit 60 and radio transceiver unit 58 is not effected by the presence or absence of power supply 72. It also assures that power supply 72 is undisturbed by signals transmitted on pair 66. Additional elements, such as inductors, may be provided, for example

between capacitor 78 and power supply 72 to provide cleaner DC power and/or better isolation of the power supply from pair 66.

Returning again to Fig. 3, Radio transceiver unit 58 preferably includes an antenna 80 which sends and receives radio frequency signals to and from its associated base station. When signals are to be sent, logic circuitry 81 assembles (multiplexes) signals received from transceivers 67 and sends them to the antenna via TX signal processing circuitry 82, TX RF modulating circuitry 84, T/R switch 86 and optional RF amplifier 88. When signals are to be received, logic circuitry 81 receives signals from the antenna via optional amplifier 88, T/R switch 86, RX demodulating circuitry 90, RX signal processing circuitry 92. After receipt of signals from circuitry 92, logic circuitry 81 distributes such signals after demultiplexing, to transceivers 67 for transmission to the various service units 60.

The design of the various units within radio transceiver unit 58 may take any number of forms and may be purely conventional in nature. Alternatively, logic circuitry 81 and/or portions of transceiver unit 58 that form of the connection between the subscriber units and the pair of wires which carries the digital telephone information to and from the radio transceiver unit may differ from that shown and may, for example, be embodied in a computer and associated software and firmware.

Radio transceiver unit 58 also includes a power supply or distribution unit 94 which provides power to the various units of radio transceiver unit 58. In a preferred embodiment of the invention, power supply or distribution unit 94 receives its energy via pair 66 from at least one of service units 60.

Fig. 5 shows one embodiment of circuitry 95 for separating the information signals and the power which were imposed on pair 66 by the circuitry shown in Fig. 4. In the circuitry of Fig. 5, a transformer 96 receives both the information signals and the power signals via pair 66. A power output 98 conducts the power voltage from transformer 96 to power supply or distribution unit 94. A capacitor 100 serves the same function as capacitor 78 in Fig. 4. A diode bridge 75 is preferably added to avoid problems which may result if the polarity of the DC power voltage is reversed. If AC power input is used, the bridge may be omitted or it may be used to rectify the power for use by supply 94. Where power is supplied by more than one set of pairs 66, unit 94 takes power from one or more of the pairs of wires. However, when one or more of the service units 58 loses power, radio transceiver unit 60 continues to operate and serve the other service units.

It should be understood that the arrangements of Figs. 4 and 5 are exemplary in nature and that many different ways of transferring power on pairs of wires 66 are useful in various aspects and embodiments of the invention.

The present invention has been described with reference to a preferred, non-limiting embodiment thereof. Variations of this embodiment, within the scope of the claims, which define the invention, will occur to persons of skill in the art.

CLAIMS

1. A remote terminal for a wireless local loop system comprising:

a radio transceiver unit which receives signals from and sends signals to a base station for connection to a telecommunication network; and

at least one service unit which receives signals from and sends signals via land lines to a plurality of subscribers, said service unit and said radio transceiver unit being situated at different sites, wherein

a particular service unit is connected to a plurality of subscribers and wherein said radio transceiver unit and said particular service unit are electrically connected by only a single pair of wires.

2. A remote terminal according to claim 1 wherein the service unit is powered by a source of energy and wherein power for the radio transceiver unit is transmitted to the radio transceiver unit from the service unit via said single pair of wires.

3. A remote terminal according to claim 1 or claim 2 wherein the at least one service unit comprises a plurality of service units.

4. A remote terminal according to claim 1 wherein the at least one service unit comprises a plurality of service units and wherein at least two service units are individually powered by energy sources and wherein power for the radio transceiver unit is transmitted to the radio transceiver unit from the service units via said single pair of wires from each of a plurality of service units.

5. A remote terminal according to claim 3 or claim 4 wherein the transceiver unit comprises circuitry which receives signals from the plurality of service units, multiplexes the signals and sends the multiplexed signals to the base station.

6. A remote terminal according to any of claims 3-5 wherein the transceiver unit comprises circuitry which receives multiplexed signals from the base station and at least partially demultiplexes the signals prior to sending at least partially demultiplexed signals to the service units.

7. A remote terminal according to any of the preceding claims wherein said service unit includes circuitry which receives signals from said plurality of subscribers and multiplexes said signals prior to sending said multiplexed signals to said radio transceiver unit.

8. A remote terminal according to any of the preceding claims wherein said service unit includes circuitry which receives multiplexed signals from the radio transceiver unit and wherein the circuitry demultiplexes the signals prior to distributing signals to the plurality of subscribers.

9. A remote terminal according to any of the preceding claims wherein at least one service unit supplies ISDN service to a subscriber.

10. A remote terminal according to any of the preceding claims wherein the at least one service unit supplies data services to a subscriber.

11. A remote terminal for a wireless local loop system comprising:

a radio transceiver unit which receives signals from and sends signals to a base station for connection to a telecommunication network; and

at least one service unit which receives signals from and sends signals via land lines to at least one subscriber, said service unit and said radio transceiver unit being situated at different sites, wherein

said radio transceiver unit and a particular service unit are electrically connected by a single pair of wires which carries at least two of:

(1) telephony signals and signaling in accordance with a standard protocol;

(2) power from the service unit to the radio transceiver unit; and

(3) control and management information indicating at least the status of non-subscriber equipment.

12. A remote terminal according to claim 11 wherein said pair of wires carries at least (1) and (2).

13. A remote terminal according to claim 11 or claim 12 wherein said pair of wires carries at least (1) and (3).

14. A remote terminal according to claim 11 wherein said pair of wires carries at least (2) and (3).

15. A remote terminal according to any of claims 11-14 wherein said radio transceiver unit and a particular service unit are electrically connected by only a single pair of wires.

16. A remote terminal according to any of claim 11-15 wherein the at least one service unit comprises a plurality of service units.

17. A remote terminal according to claim 16 wherein at least two service units are individually powered by energy sources and wherein power for the radio transceiver unit is transmitted to the radio transceiver unit from the service units via a pair of wires from each of a plurality of service units.

18. A remote terminal according to any of the preceding claims wherein the pair of wires is a twisted pair.

19. A wireless local loop system comprising:

at least one remote station according to any of claims 1-18; and

a base station which receives signals from the at least one remote station and passes the signals on to the telecommunication network.

20. A wireless local loop system according to claim 19 wherein the at least one remote station comprises a plurality of said remote stations.

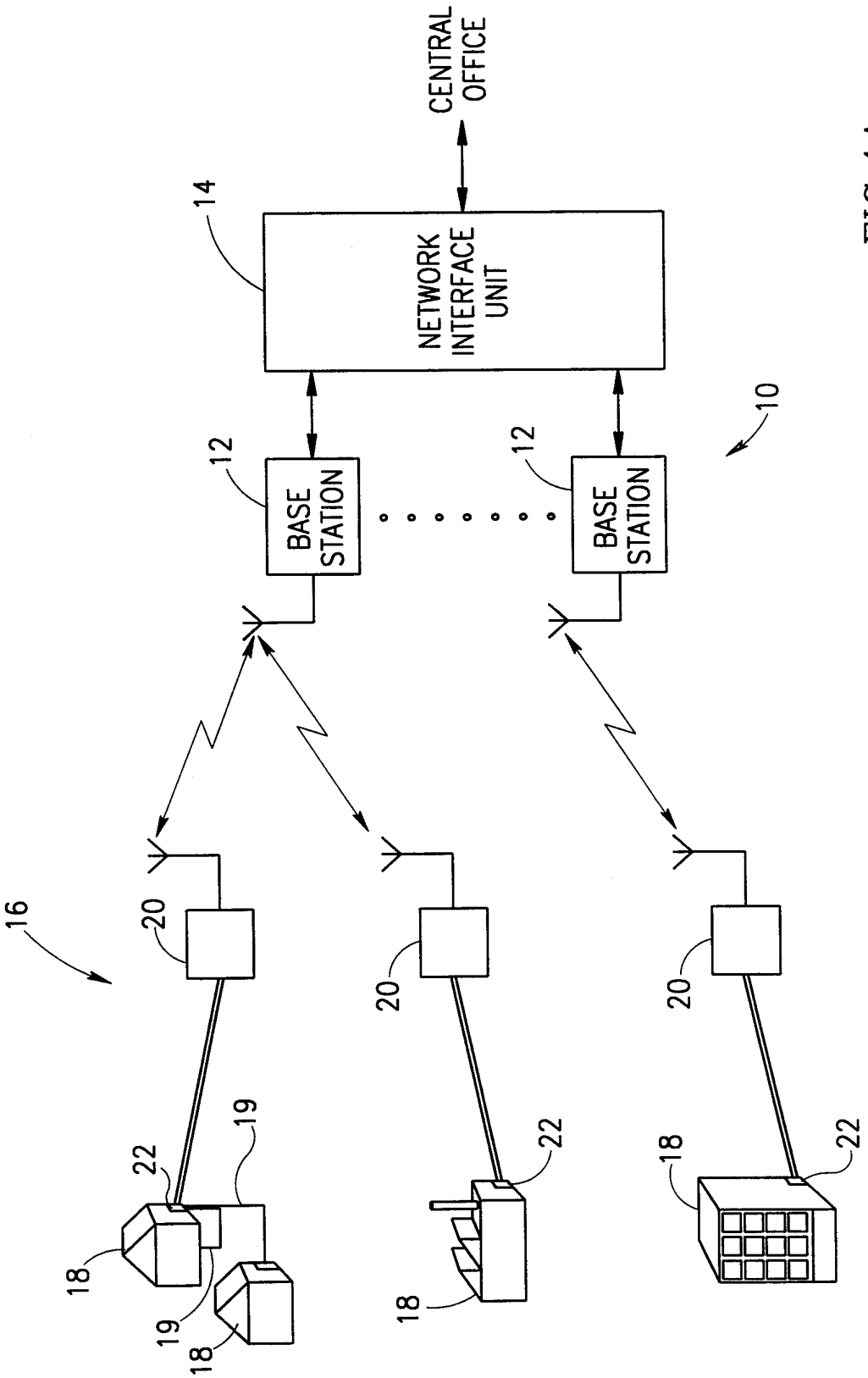


FIG. 1A
PRIOR ART

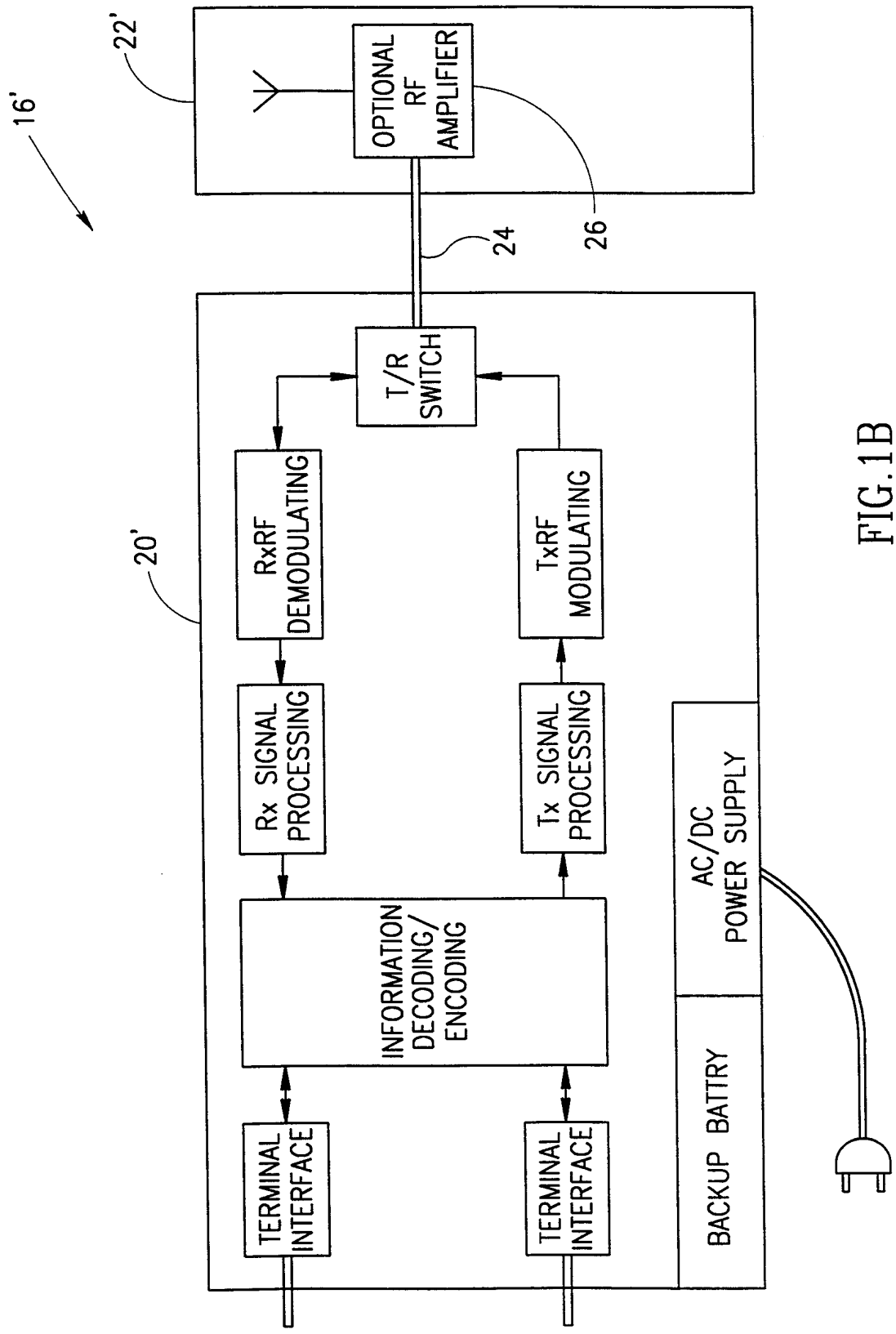


FIG. 1B
PRIOR ART

3/8

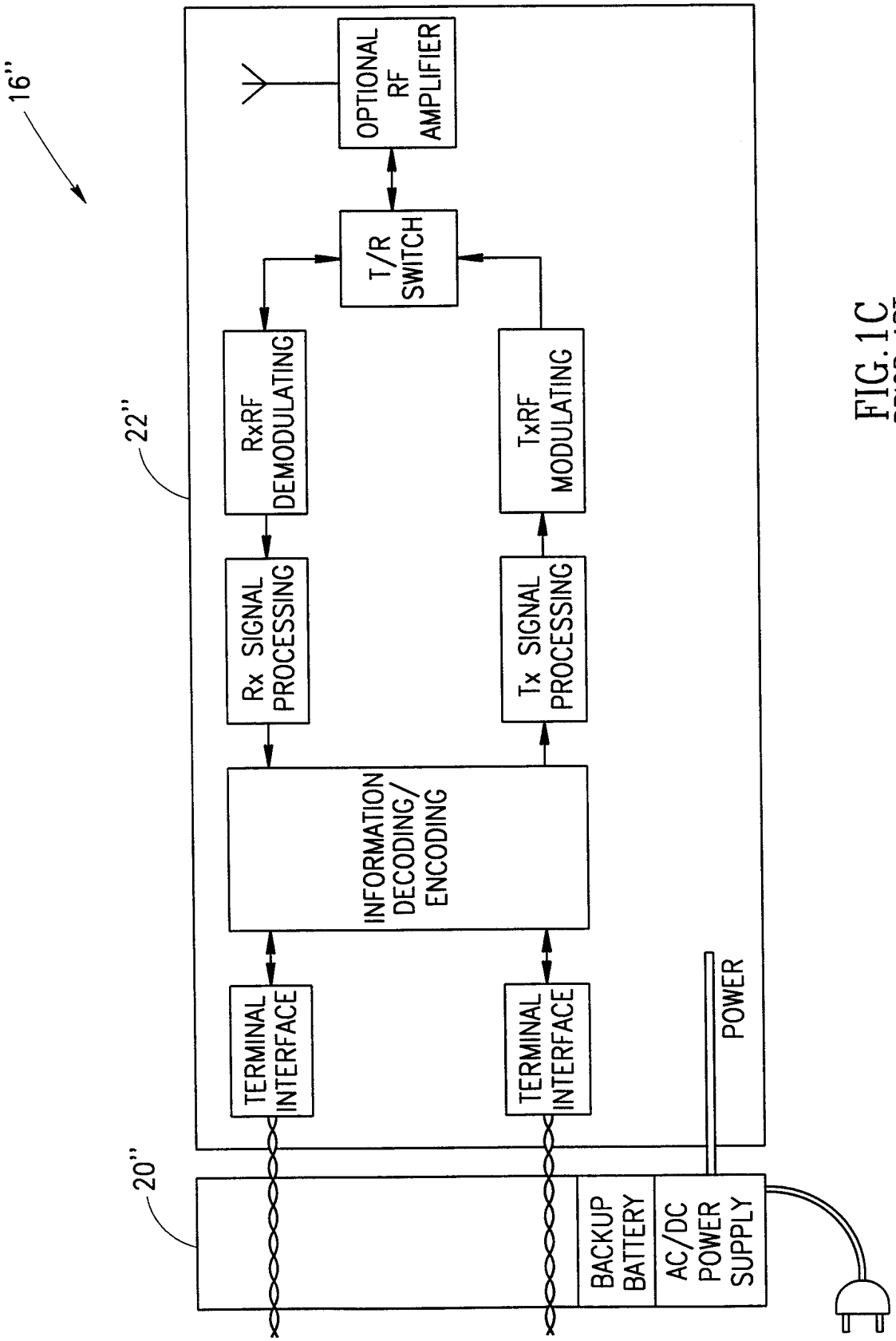


FIG. 1C
PRIOR ART

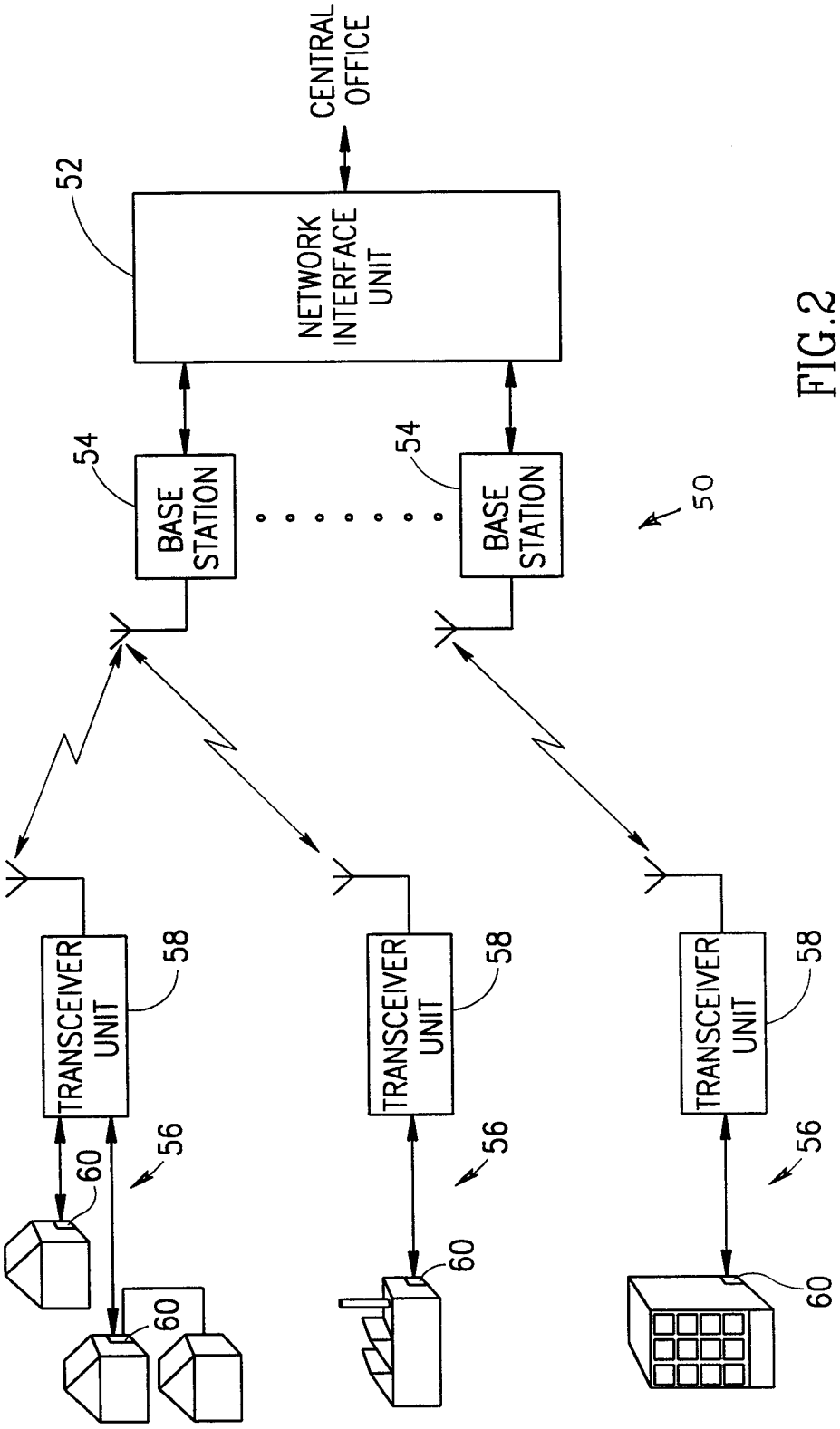

CENTRAL OFFICE
52
NETWORK INTERFACE UNIT
54
BASE STATION
54
BASE STATION
50
TRANSCEIVER UNIT
58
TRANSCEIVER UNIT
58
TRANSCEIVER UNIT
58
56
56
56
60
60
60
60

FIG.2

5/8

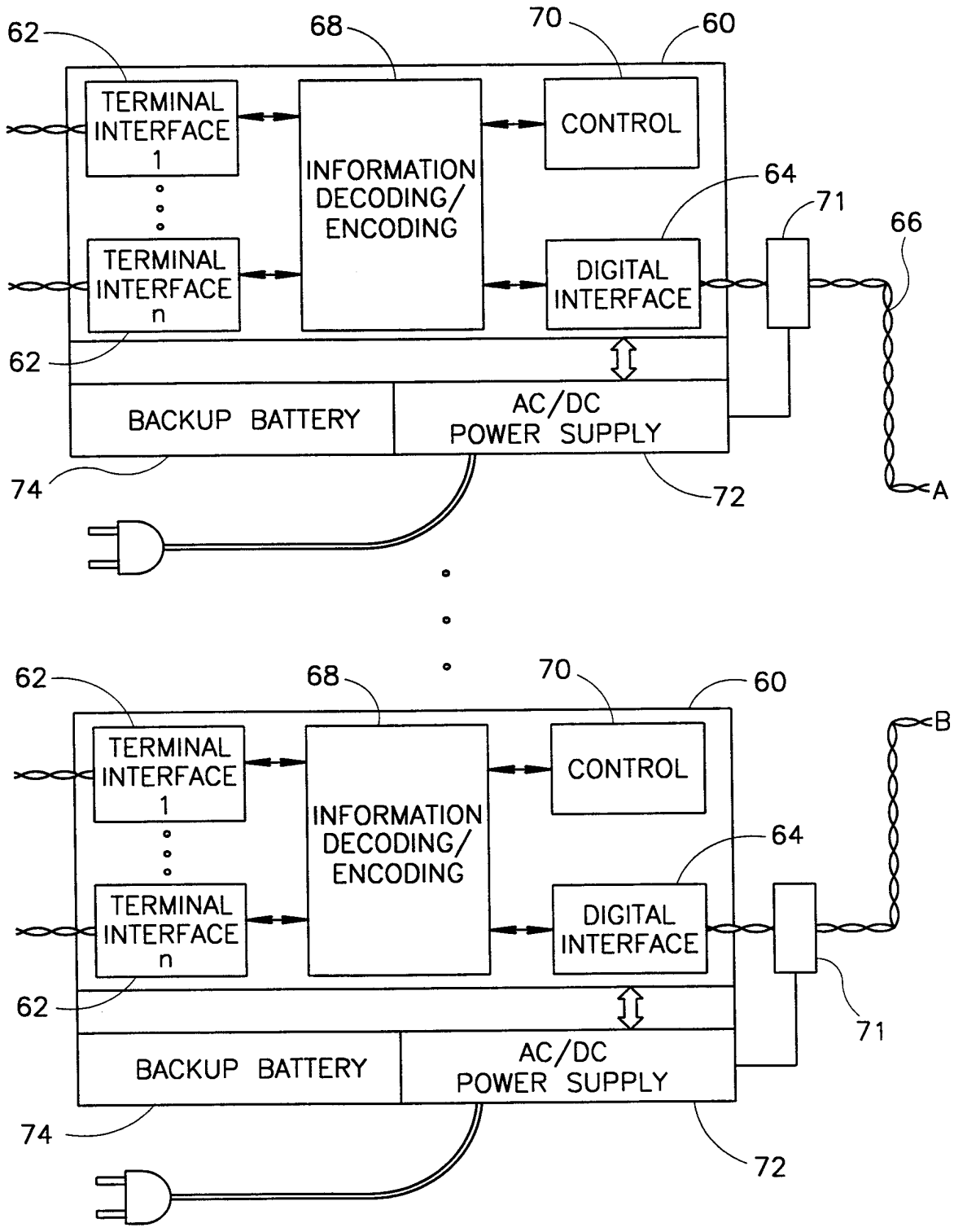

62
68
70
60
TERMINAL INTERFACE 1
TERMINAL INTERFACE n
INFORMATION DECODING/ ENCODING
CONTROL
DIGITAL INTERFACE
64
71
66
62
BACKUP BATTERY
AC/DC POWER SUPPLY
74
72
A
62
68
70
60
TERMINAL INTERFACE 1
TERMINAL INTERFACE n
INFORMATION DECODING/ ENCODING
CONTROL
DIGITAL INTERFACE
64
B
62
71
BACKUP BATTERY
AC/DC POWER SUPPLY
74
72

FIG.3A

6/8

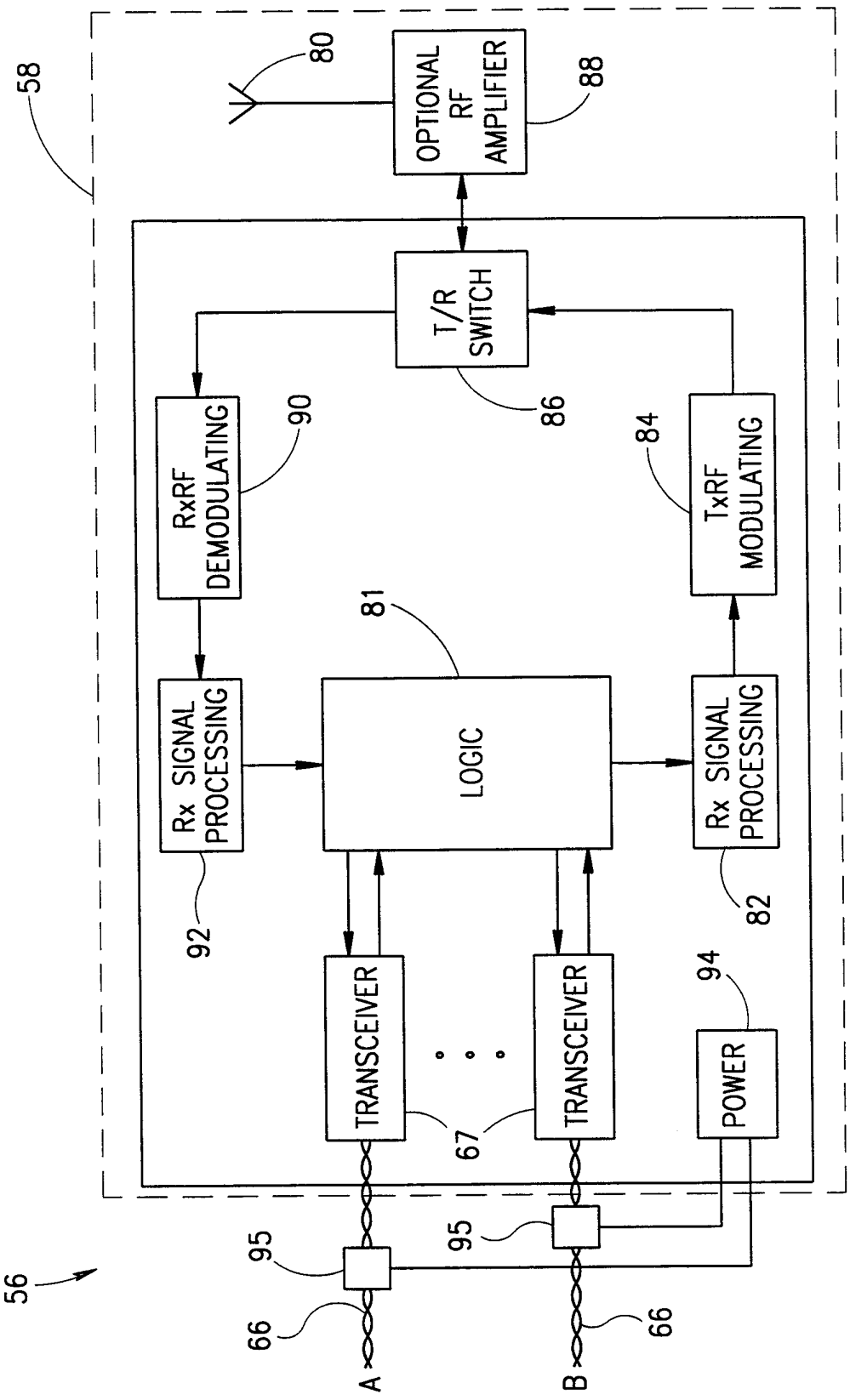

58
80
OPTIONAL RF AMPLIFIER
88
T/R SWITCH
86
RxRF DEMODULATING
90
TxRF MODULATING
84
81
Rx SIGNAL PROCESSING
LOGIC
Rx SIGNAL PROCESSING
92
82
TRANSCEIVER
TRANSCEIVER
67
94
POWER
95
95
56
66
66
A
B

FIG.3B

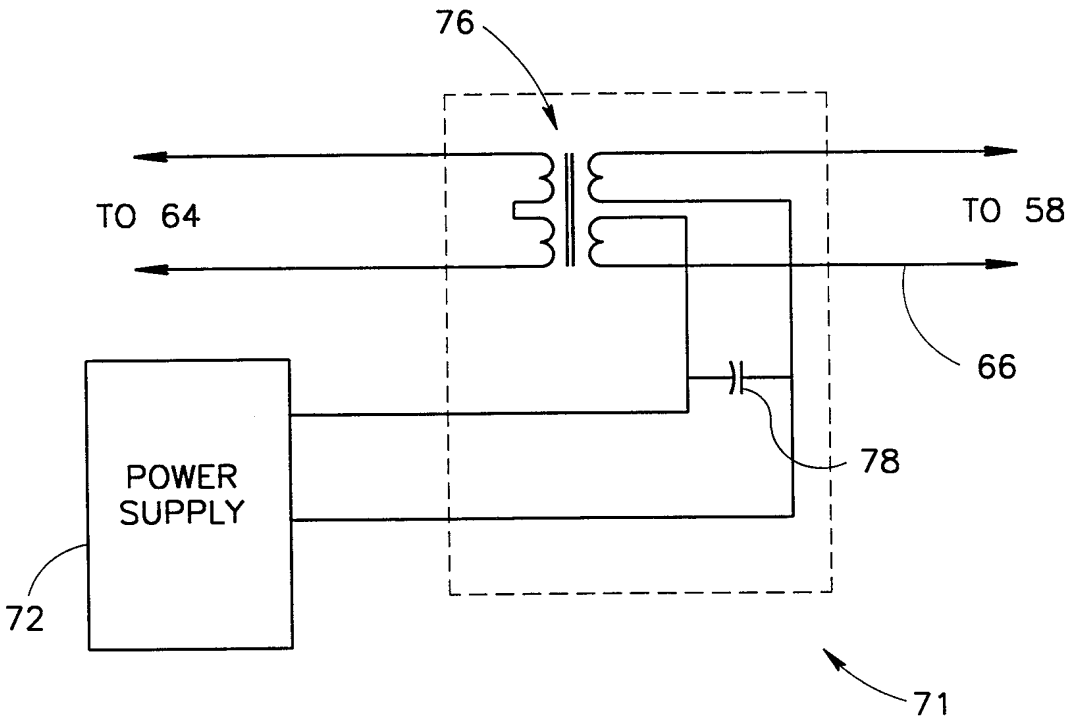


FIG.4

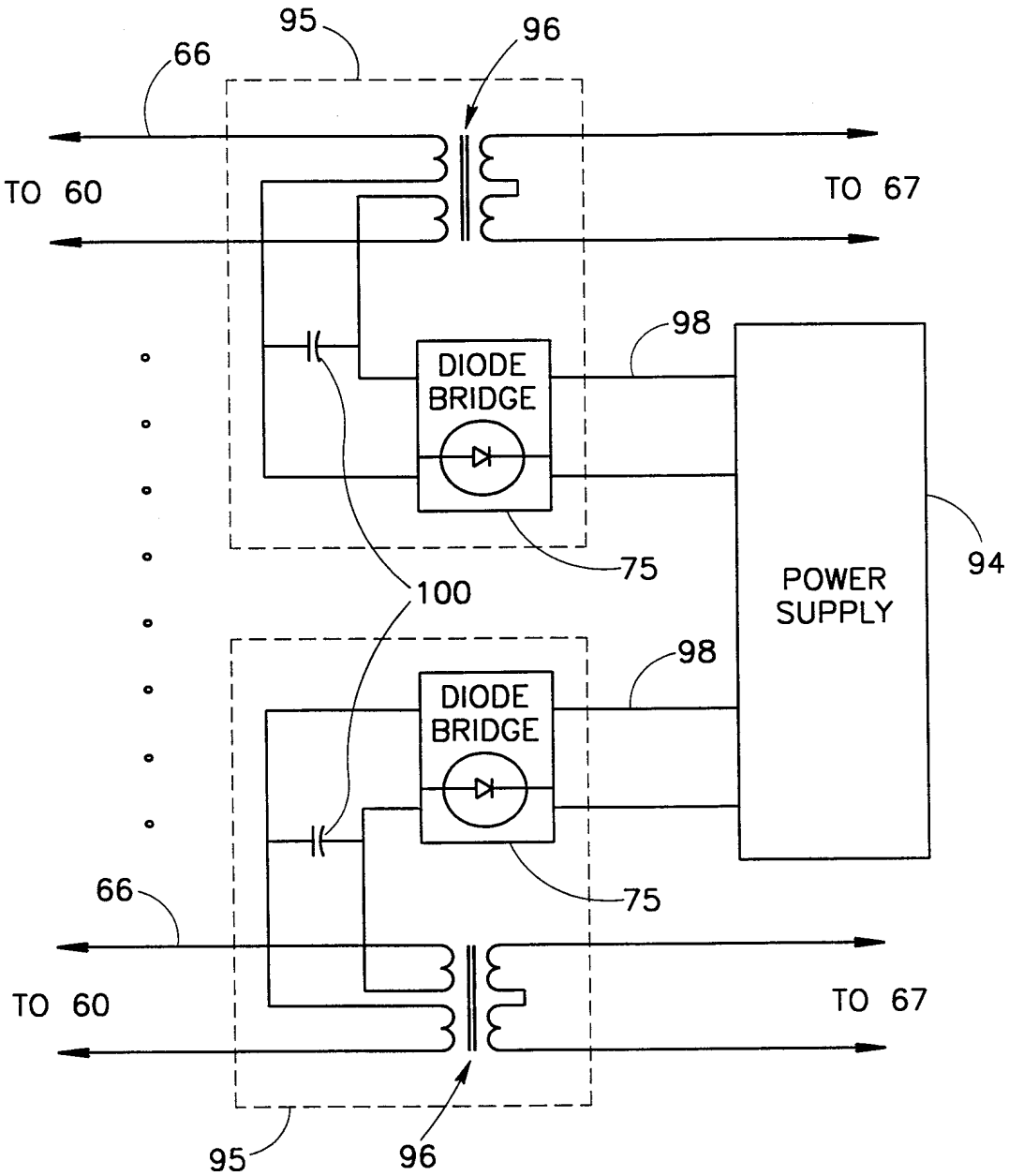

95
96
66
TO 60
TO 67
98
DIODE BRIDGE
75
100
POWER SUPPLY
94
98
DIODE BRIDGE
75
66
TO 60
TO 67
95
96

FIG.5

INTERNATIONAL SEARCH REPORT

Inter onal Application No
PCT/IL 98/00149

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04Q7/20

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04Q

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0 251 986 A (ECI TELECOM LTD) 7 January 1988	1-15, 18-20
A	see the whole document	16,17

Y	WO 97 41699 A (RADIO DESIGN INNOVATION AB ;JOHNSON TORBJOERN (SE); STROEM MARTIN) 6 November 1997	1-15, 18-20
A	see page 3, line 25 - page 7, line 4	16,17

A	WO 95 29565 A (NORTHERN TELECOM LTD) 2 November 1995 see page 2, line 3-23 see page 4, line 17-38 see page 6, line 5 - page 9, line 2	1-20

	-/--	

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

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

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

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

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

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

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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
9 February 1999	16/02/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Roberti, V

1

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Inter ›nal Application No
PCT/IL 98/00149

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	WO 96 01543 A (GENDO LIE ;KARMARGA HARDIENTO (ID); NOLLER COMMUNICATIONS INC (US)) 18 January 1996 see page 25, line 18 - page 29, line 29	1-20

1

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

..iformation on patent family members

Inter ›nal Application No
PCT/IL 98/00149

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0251986 A	07-01-1988	AU 7464687 A	07-01-1988
WO 9741699 A	06-11-1997	AU 2313997 A	19-11-1997
WO 9529565 A	02-11-1995	US 5787355 A	28-07-1998
		CN 1146844 A	02-04-1997
		DE 69503621 D	27-08-1998
		DE 69503621 T	26-11-1998
		EP 0757879 A	12-02-1997
		JP 9512154 T	02-12-1997
WO 9601543 A	18-01-1996	US 5845201 A	01-12-1998
		PL 317852 A	28-04-1997

Form PCT/ISA/210 (patent family annex) (July 1992)

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/488,374	06/04/2012	Paul F. Struhsaker	9030101.141-US0

CONFIRMATION NO. 2192

70763
Byrne Poh LLP
11 Broadway, Ste 1115
New York, NY 10004

PUBLICATION NOTICE

OC000000080340424

Title:WIRELESS COMMUNICATION SYSTEM AND DEVICE FOR COUPLING A BASE STATION AND MOBILE STATIONS

Publication No.US-2016-0037489-A9
Publication Date:02/04/2016

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 publically available Searchable Databases via the Internet at 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 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.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

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

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

70763 7590 01/26/2016

Byrne Poh LLP
11 Broadway, Ste 1115
New York, NY 10004

EXAMINER
CAI, WAYNE HUU

ART UNIT	PAPER NUMBER
2644	

DATE MAILED: 01/26/2016

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/488,374	06/04/2012	Paul F. Struhsaker	9030101.141-US0	2192

TITLE OF INVENTION: WIRELESS COMMUNICATION SYSTEM AND DEVICE FOR COUPLING A BASE STATION AND MOBILE STATIONS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$480	$0	$0	$480	04/26/2016

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.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

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
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

70763 7590 01/26/2016
Byrne Poh LLP
11 Broadway, Ste 1115
New York, NY 10004

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission
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.
13/488,374	06/04/2012	Paul F. Struhsaker	9030101.141-US0	2192

TITLE OF INVENTION: WIRELESS COMMUNICATION SYSTEM AND DEVICE FOR COUPLING A BASE STATION AND MOBILE STATIONS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$480	$0	$0	$480	04/26/2016

EXAMINER	ART UNIT	CLASS-SUBCLASS
CAI, WAYNE HUU	2644	455-443000

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 _____
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:
- ❑ 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 credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ❑ Applicant certifying micro entity status. See 37 CFR 1.29 — NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
- ❑ Applicant asserting small entity status. See 37 CFR 1.27 — NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
- ❑ Applicant changing to regular undiscounted fee status. — NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/488,374	06/04/2012	Paul F. Struhsaker	9030101.141-US0	2192

70763 7590 01/26/2016

Byrne Poh LLP
11 Broadway, Ste 1115
New York, NY 10004

EXAMINER	
CAI, WAYNE HUU	

ART UNIT	PAPER NUMBER
2644	

DATE MAILED: 01/26/2016

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

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

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.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B 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. 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.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
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 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.

Notice of Allowability	Application No. 13/488,374	Applicant(s) STRUHSAKER, PAUL F.	
	Examiner WAYNE CAI	Art Unit 2644	AIA (First Inventor to File) Status No

-- 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 *01/21/2015*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on_____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *1-6*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov .
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   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.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ 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. ☐ Notice of References Cited (PTO-892)
2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☐ Examiner's Amendment/Comment
6. ☒ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/WAYNE CAI/
Primary Examiner, Art Unit 2644

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after allowance or after an Office action under *Ex Parte Quayle*, 25 USPQ 74, 453 O.G. 213 (Comm'r Pat. 1935). Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, prosecution in this application has been reopened pursuant to 37 CFR 1.114. Applicant's submission filed on June 20, 2014 has been entered.

Information Disclosure Statement

2. The information disclosure statement (IDS) submitted on January 21, 2015 is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Allowable Subject Matter

3. Claims 1-6 are allowed for the same reasons discussed in previous Notice of Allowance dated October 21, 2014.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to WAYNE CAI whose telephone number is (571)272-7798. The examiner can normally be reached on Monday-Thursday, from 8:00 a.m. to 6:00 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Edouard can be reached on (571) 272-7603. 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.

/WAYNE CAI/
Primary Examiner, Art Unit 2644

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	2	13/488374	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/01/19 10:39
L2	83	struhsaker-paul-f.in.	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/01/19 10:52
L3	1	struhsaker-paul-f.in. and ((wan wide adj area) and (lan or local adj area$2) and (downlink forward) and (signal$5 near5 (strengh characteristic$2 qualit$5 signature$2))).clm.	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/01/19 10:53
L4	3	11/982424	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/01/19 10:54
L5	2	("6374078").PN.	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/01/19 11:06
L6	22	((relay$5 re-transmit$5 re-transmission$2 re-send$5) and (local adj area wlan wireless adj lan) and (wan wide adj area$2) and (track$5 monitor$5 detect$5 determin$5) near3 (characteristic$2 parameter$2 qualit$5)).clm.	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/01/19 11:11
L7	16573	H04W84/12,14.cpc.	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/01/19 11:26
L8	4	((relay$5 re-transmit$5 re-transmission$2 re-send$5) and (local adj area wlan wireless adj lan) and (wan wide adj area$2) and (track$5 monitor$5 detect$5 determin$5) near3 (characteristic$2 parameter$2 qualit$5) and (forward$5 adj link$2 downlink$2)).clm.	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/01/19 11:27
L9	2321	((relay$5 re-transmit$5 re-transmission$2 re-send$5) and (local adj area wlan wireless adj lan) and (wan wide adj area$2) and (track$5 monitor$5 detect$5 determin$5) near3 (characteristic$2 parameter$2 qualit$5) and (forward$5 adj link$2 downlink$2))	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/01/19 11:28

L10	78	7 and 9	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/01/19 11:30
L11	34	@ad<"20071031" and 10	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/01/19 11:30
L12	2188	455/443,426.2,444,448.ccls. and @ad<"20071031"	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/01/19 11:36
L13	5	9 and 12	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/01/19 11:36
L14	2850	((relay$5 re-transmit$5 re-transmission$2 re-send$5) and (local adj area wlan wireless adj lan micro adj3 cell$2) and (wan wide adj area$2 macro adj3 cell$2) and (track$5 monitor$5 detect$5 determin$5) near3 (characteristic$2 parameter$2 qualit$5) and (forward$5 adj link$2 downlink$2))	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/01/19 11:38
L15	253	((relay$5 re-transmit$5 re-transmission$2 re-send$5) same (local adj area wlan wireless adj lan micro adj3 cell$2) same (wan wide adj area$2 macro adj3 cell$2) and (track$5 monitor$5 detect$5 determin$5) near3 (characteristic$2 parameter$2 qualit$5) and (forward$5 adj link$2 downlink$2))	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/01/19 11:41
L16	34	(("6839333") or ("6954432") or ("7292844") or ("7764228") or ("6925072") or ("20050048985") or ("7218890") or ("20060233161") or ("7606189") or ("7061886") or ("20010033561") or ("20020152053") or ("6697606") or ("7099339")).PN.	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/01/19 11:42
L17	25679	(forward$5 relay$5 re-transmit$5) near5 (transmission$5 signal$5 transmit$5) same (identif$9 determin$5 detect$5) near5 (characteristic$2 parameter$2 device$2 terminal$2 phone$2 equipment$2)	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/01/19 11:46
L18	9772	(forward$5 relay$5 re-transmit$5) near5 (transmission$5 signal$5 transmit$5) near7 (identif$9 determin$5 detect$5) near5 (characteristic$2 parameter$2 device$2 terminal$2 phone$2 equipment$2)	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/01/19 11:46
L19	7398	H04W84/12,14.cpc. and @ad<"20071031"	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/01/19 11:48

L20	0	(forward$5 relay$5 re-transmit$5) near5 (transmission$5 signal$5 transmit$5) near7 (identif$9 determin$5 detect$5) near5 (characteristic$2 parameter$2 device$2 terminal$2 phone$2 equipment$2) same (micro adj3 cell$2 same macro adj3 cell$2)	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/01/19 11:48
L21	2	(forward$5 relay$5 re-transmit$5) near5 (transmission$5 signal$5 transmit$5) near7 (identif$9 determin$5 detect$5) near5 (characteristic$2 parameter$2 device$2 terminal$2 phone$2 equipment$2) same (wan wide adj area$2) same (wlan wireless adj lan$2 wireless adj local adj area$2)	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/01/19 11:50
L22	9731	(identif$9 determin$5 detect$5) near5 (parameter$2 characteristic$2) same (relay$5 forward$5) same (equipment$2 device$2 terminal$2 phone$2)	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/01/19 11:55
L23	9917	(identif$9 determin$5 detect$5) near5 (parameter$2 characteristic$2) same (relay$5 forward$5 re-rout$5) same (equipment$2 device$2 terminal$2 phone$2)	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/01/19 11:55
L24	1234	(identif$9 determin$5 detect$5) near5 (parameter$2 characteristic$2) near10 (relay$5 forward$5 re-rout$5) near10 (equipment$2 device$2 terminal$2 phone$2)	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/01/19 11:56
L25	509	@ad<"20071031" and 24	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/01/19 11:56
L26	0	12 and 25	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/01/19 11:58
L27	5	7 and 25	US-PGPUB; USPAT; JPO; DERWENT	OR	OFF	2016/01/19 11:59

1/19/2016 12:25:12 PM
C:\Users\wcai1\Documents\EAST\Workspaces\13488374.wsp

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /WHC/

PTO/SB/08a (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 2

Complete if Known	
Application Number	13/488,374
Filing Date	06-04-2012
First Named Inventor	Paul F. Struhsaker
Art Unit	2644
Examiner Name	Huy C. Ho
Attorney Docket Number	9030101.141-US0

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] *(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
		US- 6839333	01-04-2005	Akerberg, Dag E:son	
		US- 6954432	10-11-2005	Bychowsky et al.	
		US- 7292844	11-06-2007	Dowling et al.	
		US- 7764228	07-27-2010	Durst et al.	
		US- 6925072	08-02-2005	Grohn, Ossi Ilari	
		US- 20050048985	03-03-2005	Haartsen, Jacobus Cornelis	
		US- 7218890	05-15-2007	Iseli et al.	
		US- 20060233161	10-19-2006	Koenck et al.	
		US- 7606189	10-20-2009	Lee et al.	
		US- 7061886	06-13-2006	Moon et al.	
		US- 20010033561	10-25-2001	Rodin, Gunnar	
		US- 20020152053	10-17-2002	Roy et al.	
		US- 6697606	02-24-2004	Wagemans et al.	
		US- 7099339	08-29-2006	Wang et al.	
		US-			
		US-			
		US-			
		US-			
		US-			

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]–Number[4]–Kind Code[5] *(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[6]

Examiner Signature	/Wayne H Cai/	Date Considered	01/19/2016

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.97 and 1.98. 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 2 hours 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, 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 (1-800-786-9199) and select option 2.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /WHC/

PTO/SB/08b (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 2

Complete if Known	
Application Number	13/488,374
Filing Date	06-04-2012
First Named Inventor	Paul F. Struhsaker
Art Unit	2644
Examiner Name	Huy C. Ho
Attorney Docket Number	9030101.141-US0

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
		Notice of Allowance dated 9/30/2014 in U.S. Patent Application No. 13/567,978.	
		Office Action dated 7/1/2013 in U.S. Patent Application No. 13/488,374.	
		Office Action dated 9/24/2014 in U.S. Patent Application No. 13/532,650.	
		Office Action dated 10/17/2012 in U.S. Patent Application No. 13/488,374.	

Examiner Signature	/Wayne H Cai/	Date Considered	01/19/2016

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.98. 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 2 hours 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, 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 (1-800-786-9199) and select option 2.

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13488374	STRUHSAKER, PAUL F.
	Examiner	**Art Unit**
	HUY C HO	2644

CPC						
Symbol					**Type**	**Version**
H04W		84	/	14	F	2013-01-01
H04W		84	/	12	A	2013-01-01
			/			
			/			
			/			
			/			
			/			
			/			
			/			
			/			
			/			
			/			
			/			
			/			

CPC Combination Sets							
Symbol					**Type**	**Set**	**Ranking**	**Version**
			/					
			/					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	6	
/WAYNE CAI/ Primary Examiner.Art Unit 2644	01/19/2016	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13488374	STRUHSAKER, PAUL F.
	Examiner	**Art Unit**
	HUY C HO	2644

US ORIGINAL CLASSIFICATION		INTERNATIONAL CLASSIFICATION										
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED				
455	443	H	0	4	W	36 / 00 (2009.01.01)	H	0	4	W	4 / 00 (2009.01.01)
CROSS REFERENCE(S)							H	0	4	W	36 / 00 (2009.01.01)
							H	0	4	W	40 / 00 (2009.01.01)
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)						H	0	4	B	1 / 56 (2006.01.01)
455	426.2	444	448				H	0	4	L	12 / 56
370	274	401									

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	6	
/WAYNE CAI/ Primary Examiner.Art Unit 2644	01/19/2016	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13488374	STRUHSAKER, PAUL F.
	Examiner	**Art Unit**
	HUY C HO	2644

☒ **Claims renumbered in the same order as presented by applicant** ☐ **CPA** ☐ **T.D.** ☐ **R.1.47**

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1														
	2														
	3														
	4														
	5														
	6														

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	6	
/WAYNE CAI/ Primary Examiner.Art Unit 2644	01/19/2016	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13488374	STRUHSAKER, PAUL F.
	Examiner	Art Unit
	HUY C HO	2644

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

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	10/08/2012	06/26/2013	01/19/2016						
	1	✓	✓	=						
	2	✓	✓	=						
	3	✓	✓	=						
	4	✓	✓	=						
	5	✓	✓	=						
	6			=						

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13488374	STRUHSAKER, PAUL F.
	Examiner	Art Unit
	HUY C HO	2644

CPC- SEARCHED		
Symbol	Date	Examiner
H04W 84/045	2/24/2014	HH
H04W 84/14,12	01/19/16	WHC

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner
H04W 88/06	2/24/2014	HH

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
455	443	10/8/2012	HH
455	443,426.2,444,448	01/19/16	WHC

SEARCH NOTES		
Search Notes	Date	Examiner
EAST Database Search	10/8/2012	HH
Inventor Search complete	10/8/2012	HH
Search update	6/26/2013	HH
Search update	2/24/2014	HH
Information Disclosure Statement (IDS) filed on 06/10/2014 is considered by the examiner.	6/13/2014	HH
Search update	10/15/2014	HH
Inventor Update Search	01/19/16	WHC
See Update Search History	01/19/16	WHC

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
455	444, 554.2	10/8/2012	HH
370	274, 401	10/8/2012	HH

INTERFERENCE SEARCH			
US Class/ CPC Symbol	**US Subclass / CPC Group**	**Date**	**Examiner**
	Same As Above	01/19/16	WHC

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/488,374	06/04/2012	Paul F. Struhsaker	9030101.141-US0

CONFIRMATION NO. 2192

70763
Byrne Poh LLP
11 Broadway, Ste 1115
New York, NY 10004

PUB REQUEST ACCEPTANCE LETTER

OC000000078301943

Date Mailed: 10/28/2015

NOTICE OF ACCEPTANCE OF PUBLICATION REQUEST

The request for voluntary publication, amended publication, early publication, redacted publication, republication, corrected publication or revised publication has been received for this application. The request, including payment of any necessary fee(s), is in compliance with 37 CFR 1.215, 1.217, 1.219 or 1.221.

The projected publication date is 02/04/2016.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/dterry/

Office of Petitions: Routing Sheet



Application No. 13/488,374

This application is being forwarded to your office for further processing. A decision has been rendered on a petition filed in this application.

- [X] **GRANTED**
- [ ] **DISMISSED**
- [ ] **DENIED**

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
13/488,374	06/04/2012	2644	530	9030101.141-US0	5	1

CONFIRMATION NO. 2192

CORRECTED FILING RECEIPT

70763
Byrne Poh LLP
11 Broadway, Ste 1115
New York, NY 10004

OC000000078260271

Date Mailed: 10/26/2015

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**

Inventor(s)

Paul F. Struhsaker, Plano, TX;

Applicant(s)

Paul F. Struhsaker, Plano, TX;

Power of Attorney: The patent practitioners associated with Customer Number 70763

Domestic Priority data as claimed by applicant

This application is a CON of 11/982,424 10/31/2007 ABN
which is a CON of 09/839,499 04/20/2001 PAT 7346347
which claims benefit of 60/262,708 01/19/2001
and claims benefit of 60/262,712 01/19/2001
and claims benefit of 60/262,825 01/19/2001
and claims benefit of 60/262,698 01/19/2001
and claims benefit of 60/262,827 01/19/2001
and claims benefit of 60/262,826 01/19/2001
and claims benefit of 60/262,951 01/19/2001
and claims benefit of 60/262,824 01/19/2001
and claims benefit of 60/263,101 01/19/2001
and claims benefit of 60/263,097 01/19/2001
and claims benefit of 60/273,579 03/05/2001
and claims benefit of 60/262,955 01/19/2001
and claims benefit of 60/273,689 03/05/2001
and claims benefit of 60/273,757 03/05/2001
and claims benefit of 60/270,378 02/21/2001
and claims benefit of 60/270,385 02/21/2001
and claims benefit of 60/270,430 02/21/2001

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

If Required, Foreign Filing License Granted: 06/13/2012

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/488,374**

Projected Publication Date: Not Applicable

Non-Publication Request: No

Early Publication Request: No
** **SMALL ENTITY** **
Title

WIRELESS COMMUNICATION SYSTEM AND DEVICE FOR COUPLING A BASE STATION AND MOBILE STATIONS

Preliminary Class

455

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications:

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 (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor

community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/488,374	06/04/2012	Paul F. Struhsaker	9030101.141-US0	2192

70763 7590 10/27/2015

Byrne Poh LLP
11 Broadway, Ste 1115
New York, NY 10004

EXAMINER
CAI, WAYNE HUU

ART UNIT	PAPER NUMBER
2644	

NOTIFICATION DATE	DELIVERY MODE
10/27/2015	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

info@byrnepoh.com

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

In re Application of	:	
Struhsaker	:	
Application No. 13/488,374	:	ON PETITION
Filed: June 4, 2012	:	
Attorney Docket No. 9030101.141-US0	:	

This is a decision on the petition under 37 CFR 1.78(e) filed March 20, 2015, to accept an unintentionally delayed claim for the benefit of priority to the prior-filed non-provisional applications set forth in the Application Data Sheet filed concurrently with the instant petition. The petition will also be treated as a petition under 37 CFR 1.78(c) to accept the unintentionally delayed claim for the benefit of priority of the prior-filed provisional applications set forth in the Application Data Sheet filed concurrently with the instant petition.

The petition under 37 CFR 1.78(e) is **GRANTED**.

The petition under 37 CFR 1.78(c) is also **GRANTED**.

TREATMENT UNDER 37 CFR 1.78(e)

A petition for acceptance of a claim for late priority under 37 CFR 1.78(d) is only applicable to those applications filed on, or after, November 29, 2000. Further, the petition is appropriate only after the expiration of the period specified in 37 CFR 1.78(d). In addition, the petition under 37 CFR 1.78(e) must be accompanied by:

1. the reference required by 35 U.S.C § 120 and paragraph (d)(2) to the prior-filed application, unless previously submitted;

2. the surcharge set forth in § 1.17(m), and

3. a statement that the entire delay between the date the claim was due under 37 CFR 1.78(d)(3) and the date the benefit claim was filed was unintentional. The Director may require additional information where there is a question whether the delay was unintentional.

The instant nonprovisional application was filed after November 29, 2000, and the claim herein for the benefit of priority to the prior-filed applications is submitted after the expiration of the period specified in 37 CFR 1.78(d). Also, the reference to the prior filed applications was submitted during the pendency of the instant nonprovisional application for which the claim for benefit of priority is sought. See 35 U.S.C. § 120. Accordingly, having found that the instant petition for acceptance of an unintentionally delayed claim for benefit of priority under 35 U.S.C. § 120 to the prior-filed non-provisional applications satisfies the conditions of 37 CFR 1.78(e), the petition is granted.

TREATMENT UNDER 37 CFR 1.78(c)

A petition for acceptance of a claim for late priority under 37 CFR 1.78(c) is only applicable to those applications filed on, or after, November 29, 2000. Further, the petition is appropriate only after the expiration of the period specified in 37 CFR 1.78(a)(4). In addition, the petition under 37 CFR 1.78(c) must be accompanied by:

1. the reference required by 35 USC 119(e) and paragraph (a)(3) of this section to the prior-filed provisional application, unless previously submitted.

2. the surcharge set forth in 1.17(m), and

3. a statement that the entire delay between the date the claim was due under paragraph (a)(4) of this section and the date the claim was filed was unintentional.

The instant non-provisional application was filed after November 29, 2000, and the claim herein for the benefit of priority to the prior-filed provisional application is submitted after the expiration of the period specified in 37 CFR 1.78(a). Also, the reference to the prior filed application, found in the Application Data Sheet was submitted during the pendency of the instant nonprovisional application for which the claim for benefit of priority is sought. See 35 U.S.C. § 119(e). Accordingly, having found that the instant petition for acceptance of an unintentionally delayed claim for benefit of priority under 35 U.S.C. § 119 to the prior-filed provisional applications satisfies the conditions of 37 CFR 1.78(c) the petition is granted.

The granting of the petition to accept the delayed benefit claim to the prior-filed applications under 37 CFR 1.78(c) and 37 CFR 1.78(e) should not be construed as meaning the instant application is entitled to the benefit of the prior-filed applications. In order for the instant application to be entitled to the benefit of the prior-filed applications, all other requirements under 35 U.S.C. § 120, 35 U.S.C.§ 119, 37 CFR 1.78 and must be met. Similarly, the fact that the corrected Filing Receipt accompanying this decision on petition includes the prior-filed applications should not be construed as meaning that applicant is entitled to the claim for benefit of priority to the prior-filed applications noted thereon. Accordingly, the examiner will, in due course, consider this benefit claim and determine whether the instant application is entitled to the benefit of the earlier filing date.

A corrected Filing Receipt, which includes the priority claim to the prior-filed nonprovisional application and provisional applications, accompanies this decision on petition.

Any inquiries concerning this decision may be directed to Kenya A. McLaughlin, Attorney Advisor, at (571) 272-3222.

This matter is being referred to Technology Center GAU 2644 for further processing.

/Kenya A. McLaughlin/

Kenya A. McLaughlin
Attorney Advisor
Office of Petitions

Enclosure: Corrected Filing Receipt

Office of Petitions: Decision Count Sheet

Mailing Month 10

Application No. 13488374

13488374

For US serial numbers: enter number only, no slashes or commas. Ex: 10123456

For PCT: enter "51+single digit of year of filing+last 5 numbers", Ex. for PCT/US05/12345, enter 51512345

Deciding Official: Thornton-McLaughlin, Kenya

Count (1) - Palm Credit 13/488,374

Decision: GRANT

FINANCE WORK NEEDED ☐ Select Check Box for YES

GRANT

Decision Type: 535 - 37 CFR 1.78(a)(3) & (a)(6) UNINTENTIONAL DELAY

535

Notes:

Count (2)

Decision: n/a

FINANCE WORK NEEDED ☐ Select Check Box for YES

Decision Type: NONE

FALSE

Notes:

Count (3)

Decision: n/a

FINANCE WORK NEEDED ☐ Select Check Box for YES

Decision Type: NONE

Notes:

Initials of Approving Official (if required)

If more than 3 decisions, attach 2nd count sheet & mark this box ☐

Printed on: *10/23/2015*

Office of Petitions Internal Document - Ver. 5.0

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/488,374	06/04/2012	Paul F. Struhsaker	9030101.141-US0

CONFIRMATION NO. 2192

POWER OF ATTORNEY NOTICE

70763
Byrne Poh LLP
11 Broadway, Ste 1115
New York, NY 10004

OC00000078243797

Date Mailed: 10/26/2015

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 10/14/2015.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/sleutchit/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/488,374	06/04/2012	Paul F. Struhsaker	9030101.141-US0

CONFIRMATION NO. 2192

70763
Byrne Poh LLP
11 Broadway, Ste 1115
New York, NY 10004

POA ACCEPTANCE LETTER



Date Mailed: 10/26/2015

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 10/14/2015.

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.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/sleutchit/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
13/488,374	06/04/2012	2644	530	9030101.141-US0	5	1

CONFIRMATION NO. 2192

CORRECTED FILING RECEIPT

70763
Byrne Poh LLP
11 Broadway, Ste 1115
New York, NY 10004

OC000000078260271

Date Mailed: 10/26/2015

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**

Inventor(s)

Paul F. Struhsaker, Plano, TX;

Applicant(s)

Paul F. Struhsaker, Plano, TX;

Power of Attorney: The patent practitioners associated with Customer Number 70763

Domestic Priority data as claimed by applicant

This application is a CON of 11/982,424 10/31/2007 ABN
which is a CON of 09/839,499 04/20/2001 PAT 7346347
which claims benefit of 60/262,708 01/19/2001
and claims benefit of 60/262,712 01/19/2001
and claims benefit of 60/262,825 01/19/2001
and claims benefit of 60/262,698 01/19/2001
and claims benefit of 60/262,827 01/19/2001
and claims benefit of 60/262,826 01/19/2001
and claims benefit of 60/262,951 01/19/2001
and claims benefit of 60/262,824 01/19/2001
and claims benefit of 60/263,101 01/19/2001
and claims benefit of 60/263,097 01/19/2001
and claims benefit of 60/273,579 03/05/2001
and claims benefit of 60/262,955 01/19/2001
and claims benefit of 60/273,689 03/05/2001
and claims benefit of 60/273,757 03/05/2001
and claims benefit of 60/270,378 02/21/2001
and claims benefit of 60/270,385 02/21/2001
and claims benefit of 60/270,430 02/21/2001

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

If Required, Foreign Filing License Granted: 06/13/2012

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/488,374**

Projected Publication Date: Not Applicable

Non-Publication Request: No

Early Publication Request: No
** **SMALL ENTITY** **
Title

WIRELESS COMMUNICATION SYSTEM AND DEVICE FOR COUPLING A BASE STATION AND MOBILE STATIONS

Preliminary Class

455

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications:

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 (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor

community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

PTO/AIA/82A (07-13)
Approved for use through 11/30/2014. OMB 0651-0051
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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.

TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	13/488,374
Filing Date	06/04/2012
First Named Inventor	Paul F. Struhsaker
Title	WIRELESS COMMUNICATION SYSTEM AND DEVICE FOR COUPLING A BASE STATION AND MOBILE STATIONS
Art Unit	2644
Examiner Name	Wayne Huu Cai
Attorney Docket Number	9030101.141-US0

SIGNATURE of Applicant or Patent Practitioner

Signature	/Matthew T Byrne/	Date (Optional)	10/14/2015
Name	Matthew T. Byrne	Registration Number	40,934
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☑ *Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.131, 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.

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82B (07-13)
Approved for use through 11/30/2014. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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 BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☑ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 70763

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

☑ The address associated with the above-mentioned Customer Number

OR

☐ The address associated with Customer Number:

OR

Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

Access Solutions, Ltd.

☐ Inventor or Joint Inventor (title not required below)

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☑ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature	/Michael S. Hynek/	Date (Optional)	
Name	Michael S. Hynek, Manager of General Access, LLC which is general partner of General Access Solutions, Ltd		
Title	formerly known as Access Solutions, Ltd.		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☑ Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. This 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.

PTO/SB/96 (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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(b)

Applicant/Patent Owner: Paul F. Struhsaker

Application No./Patent No.: 13/488,374 Filed/Issue Date: 06/04/2012

Titled: WIRELESS COMMUNICATION SYSTEM AND DEVICE FOR COUPLING A BASE STATION AND MOBILE STATIONS

Access Solutions, Ltd. , 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 _____, Frame _____, 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: Paul F. Struhsaker To: Raze Technologies, Inc.

The document was recorded in the United States Patent and Trademark Office at
Reel 011734 , Frame 0553 , or for which a copy thereof is attached.

2. From: Raze Technologies, Inc. To: Access Solutions, Ltd.

The document was recorded in the United States Patent and Trademark Office at
Reel 012449 , Frame 0730 , 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.

/Matthew T Byrne/ 10/14/2015

Signature Date

Matthew T. Byrne Attorney - 40,934

Printed or Typed Name 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.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
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 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:	23780963
Application Number:	13488374
International Application Number:	
Confirmation Number:	2192
Title of Invention:	WIRELESS COMMUNICATION SYSTEM AND DEVICE FOR COUPLING A BASE STATION AND MOBILE STATIONS
First Named Inventor/Applicant Name:	Paul F. Struhsaker
Customer Number:	70763
Filer:	Matthew T. Byrne/Nicole Beverly
Filer Authorized By:	Matthew T. Byrne
Attorney Docket Number:	9030101.141-US0
Receipt Date:	14-OCT-2015
Filing Date:	04-JUN-2012
Time Stamp:	17:18:55
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	9030101_141_US0_POATransmittal.pdf	156961 b786b23727ac3f6c3b47b2eeabe616ab32a845bf	no	1

Warnings:	
Information:	

2	Power of Attorney	9030101_141_US0_POA.pdf	1695562 61a33e6d0da84619c451cb281c7e66fd146dad50	no	1
Warnings:					
Information:					
3	Assignee showing of ownership per 37 CFR 3.73	9030101_141_US0_373B.pdf	427491 6593ced9bbb4827bdcb17550739f933282977306	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	2280014	

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.

New Applications Under 35 U.S.C. 111
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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Paul F. Struhsaker	Examiner:	Huy C. Ho
Application No.:	13/488,374	Confirmation No.:	2192
Filing Date:	June 4, 2012	Art Unit:	2644
For:	Wireless Communication System and Device for Coupling a Base Station to Mobile Stations		

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

PETITION TO ACCEPT
UNINTENTIONALLY DELAYED PRIORITY CLAIM

Dear Examiner:

Applicant respectfully petitions the USPTO to accept an unintentionally delayed priority claim in the above-referenced patent application. As required by 37 C.F.R. 1.78(b)&(d) (Post-AIA) and 37 C.F.R. 1.78(a)(3)&(a)(6) (Pre-AIA):

1) An Application Data Sheet (in marked-up form) is submitted herewith showing the desired priority claim;

2) The Director is hereby authorized to charge the surcharge(s) under 37 C.F.R. 1.17(t) or 1.17(m) (and any other fees that may be required) for a Small Entity to Deposit Account No. 50-4207; and

3) The undersigned hereby states that the entire delay between the date the benefit claim was due under paragraph 37 C.F.R. 1.78 and the date the benefit claim was filed was unintentional.

In the event that a Request for Continued Examination under 37 C.F.R. 1.114 is required to make this paper timely, this paper should be construed as being a Request for Continued Examination and the Director is hereby authorized to charge any RCE Fees for a Small Entity to Deposit Account No. 50-4207.

In the event that there are any questions regarding this petition, the undersigned respectfully requests that the Office contact the undersigned at the number below.

Respectfully submitted,

Date: March 20, 2015

/Matthew T. Byrne/
Matthew T. Byrne
Registration No. 40,934
Attorney for Applicants

Byrne Poh LLP
11 Broadway, Suite 1115
New York, NY 10004
Telephone: (212) 509-8870
Facsimile: (212) 931-8521

Application Data Sheet

Under 37 C.F.R. 1.76(c)(2)

Application No.: 13/488,374

Filed: June 4, 2012

Title of Invention: Wireless Communication System and Device for Coupling a Base Station to Mobile Stations

Domestic Benefit/National Stage Information:

Prior Application Status	Abandoned		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing Date (YYYY-MM-DD)**
13/488,374	Continuation	11/982,424	2007-10-31

Prior Application Status		Patented			
Application Number	**Continuity Type**	**Prior Application Number**	**Filing Date (YYYY-MM-DD)**	**Patent Number**	**Issue Date (YYYY-MM-DD)**
11/982,424	Continuation	09/839,499	2001-04-20	7,346,347	2008-03-18

Prior Application Status	Expired		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing Date (YYYY-MM-DD)**
09/839,499	Non provisional of	60/262,712	2001-01-19
Prior Application Status	Expired		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing Date (YYYY-MM-DD)**
09/839,499	Non provisional of	60/262,825	2001-01-19
Prior Application Status	Expired		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing Date (YYYY-MM-DD)**
09/839,499	Non provisional of	60/262,698	2001-01-19
Prior Application Status	Expired		

Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
09/839,499	Non provisional of	60/262,827	2001-01-19
Prior Application Status	Expired		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing Date (YYYY-MM-DD)**
09/839,499	Non provisional of	60/262,826	2001-01-19
Prior Application Status	Expired		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing Date (YYYY-MM-DD)**
09/839,499	Non provisional of	60/262,951	2001-01-19
Prior Application Status	Expired		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing Date (YYYY-MM-DD)**
09/839,499	Non provisional of	60/262,824	2001-01-19
Prior Application Status	Expired		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing Date (YYYY-MM-DD)**
09/839,499	Non provisional of	60/263,101	2001-01-19
Prior Application Status	Expired		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing Date (YYYY-MM-DD)**
09/839,499	Non provisional of	60/263,097	2001-01-19
Prior Application Status	Expired		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing Date (YYYY-MM-DD)**
09/839,499	Non provisional of	60/273,579	2001-03-05
Prior Application Status	Expired		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing Date (YYYY-MM-DD)**
09/839,499	Non provisional of	60/262,955	2001-01-19
Prior Application Status	Expired		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing Date (YYYY-MM-DD)**
09/839,499	Non provisional of	60/273,689	2001-03-05

Prior Application Status	Expired		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing Date (YYYY-MM-DD)**
09/839,499	Non provisional of	60/273,757	2001-03-05
Prior Application Status	Expired		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing Date (YYYY-MM-DD)**
09/839,499	Non provisional of	60/270,378	2001-02-21
Prior Application Status	Expired		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing Date (YYYY-MM-DD)**
09/839,499	Non provisional of	60/270,385	2001-02-21
Prior Application Status	Expired		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing Date (YYYY-MM-DD)**
09/839,499	Non provisional of	60/270,430	2001-02-21
Prior Application Status	Expired		
Application Number	**Continuity Type**	**Prior Application Number**	**Filing Date (YYYY-MM-DD)**
09/839,499	Non provisional of	60/262,708	2001-01-19

Date: March 20, 2015

Respectfully submitted,
/Matthew T Byrne/
Matthew T. Byrne
Attorney for Applicants
Reg. No. 40,934

Electronic Acknowledgement Receipt

EFS ID:	21840111
Application Number:	13488374
International Application Number:	
Confirmation Number:	2192
Title of Invention:	WIRELESS COMMUNICATION SYSTEM AND DEVICE FOR COUPLING A BASE STATION AND MOBILE STATIONS
First Named Inventor/Applicant Name:	Paul F. Struhsaker
Customer Number:	70763
Filer:	Matthew T. Byrne
Filer Authorized By:	
Attorney Docket Number:	9030101.141-US0
Receipt Date:	20-MAR-2015
Filing Date:	04-JUN-2012
Time Stamp:	19:59:54
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Petition for review by the Office of Petitions.	00077494.PDF	138869 90fe8b7d99770e8b16f6808816eace2dc28b389d	no	2

Warnings:	
Information:	

2	Application Data Sheet	00077492.PDF	208772 0a30e827a1d76b91081c1968e200c90e9a0a0a42	no	3

Warnings:	
Information:	
This is not an USPTO supplied ADS fillable form	
Total Files Size (in bytes):	347641

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.

New Applications Under 35 U.S.C. 111
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.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/488,374	06/04/2012	Paul F. Struhsaker	9030101.141-US0	2192

70763 7590 02/11/2015

Byrne Poh LLP
11 Broadway, Ste 1115
New York, NY 10004

EXAMINER
EDOUARD, PATRICK NESTOR

ART UNIT	PAPER NUMBER
2644	

NOTIFICATION DATE	DELIVERY MODE
02/11/2015	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

info@byrnepoh.com

UNITED STATES PATENT AND TRADEMARK OFFICE

COMMISSIONER FOR PATENTS
UNITED STATES PATENT AND TRADEMARK OFFICE
P.O. BOX 1450
ALEXANDRIA, VA 22313-1450
www.uspto.gov

Byrne Poh LLP
11 Broadway, Ste 1115
New York NY 10004

In re Application of	:	
STRUHSAKER, PAUL F.	:	NOTICE OF WITHDRAWAL
Application No. 13/488374	:	FROM ISSUE
Filed: 06/04/2012	:	UNDER 37 CFR 1.313
Attorney Docket No. 9030101.141-US0		

The purpose of this communication is to inform you that the above identified application is being withdrawn from issue pursuant to 37 C.F.R. 1.313.

The application is being withdrawn to permit reopening of prosecution. The reasons therefor will be communicated to you by the examiner.

Patent and Trademark Office records reveal that the issue fee has not been paid. If the issue fee has been submitted, the applicant may request a refund, or may request that the fee be credited to a deposit account. However, applicant may wait until the application is either again found allowable or held abandoned. If the application is allowed, upon receipt of a new Notice of Allowance and Issue Fee Due, applicant may request that the previously submitted issue fee be applied toward payment of the issue fee in the amount identified on the new Notice of Allowance and Issue Fee Due. If the application is abandoned, applicant may request either a refund or a credit to a deposit account.

Telephone inquiries should be directed to Patrick Edouard at (571) 272-7603

The above-identified application is being forwarded to the examiner for prompt appropriate action, including notifying applicant of the new status of this application.

David Wiley, Director
Technology Center 2600

PTO/SB/08a (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 2

Complete if Known	
Application Number	13/488,374
Filing Date	06-04-2012
First Named Inventor	Paul F. Struhsaker
Art Unit	2644
Examiner Name	Huy C. Ho
Attorney Docket Number	9030101.141-US0

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] *(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
		US- 6839333	01-04-2005	Akerberg, Dag E:son	
		US- 6954432	10-11-2005	Bychowsky et al.	
		US- 7292844	11-06-2007	Dowling et al.	
		US- 7764228	07-27-2010	Durst et al.	
		US- 6925072	08-02-2005	Grohn, Ossi Ilari	
		US- 20050048985	03-03-2005	Haartsen, Jacobus Cornelis	
		US- 7218890	05-15-2007	Iseli et al.	
		US- 20060233161	10-19-2006	Koenck et al.	
		US- 7606189	10-20-2009	Lee et al.	
		US- 7061886	06-13-2006	Moon et al.	
		US- 20010033561	10-25-2001	Rodin, Gunnar	
		US- 20020152053	10-17-2002	Roy et al.	
		US- 6697606	02-24-2004	Wagemans et al.	
		US- 7099339	08-29-2006	Wang et al.	
		US-			
		US-			
		US-			
		US-			
		US-			

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]–Number[4]–Kind Code[5] *(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[6]

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.97 and 1.98. 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 2 hours 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, 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 (1-800-786-9199) and select option 2.

PTO/SB/08b (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 2

Complete if Known	
Application Number	13/488,374
Filing Date	06-04-2012
First Named Inventor	Paul F. Struhsaker
Art Unit	2644
Examiner Name	Huy C. Ho
Attorney Docket Number	9030101.141-US0

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
		Notice of Allowance dated 9/30/2014 in U.S. Patent Application No. 13/567,978.	
		Office Action dated 7/1/2013 in U.S. Patent Application No. 13/488,374.	
		Office Action dated 9/24/2014 in U.S. Patent Application No. 13/532,650.	
		Office Action dated 10/17/2012 in U.S. Patent Application No. 13/488,374.	

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.98. 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 2 hours 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, 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 (1-800-786-9199) and select option 2.

Attorney Docket No. 9030101.141-US0
PATENTS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Paul F. Struhsaker	Conf. No.:	2192
Application No.:	13/488,374	Examiner:	Huy C. Ho
Filing Date:	June 4, 2012	Art Unit:	2644
For:	WIRELESS COMMUNICATION SYSTEM AND DEVICE FOR COUPLING A BASE STATION AND MOBILE STATIONS		

INFORMATION DISCLOSURE STATEMENT (IDS)
AND POSSIBLE REQUEST FOR CONTINUED EXAMINATION

Dear Examiner:

Attached hereto are two sheets of SB08a identifying references in accordance with 37 CFR 1.56. No aspect of these submissions constitute a disclaimer of claim scope.

As set forth in the Interview Summary filed concurrently herewith, the Notice of Allowance mailed in this case on October 21, 2014 is to be vacated by the Examiner (or Examiner's Supervisor). Accordingly, the filing of this IDS is believed to be timely.

In the event that the Notice of Allowance was not vacated by January 21, 2015, this paper should also serve as a Request for Continued Examination (RCE) under 37 CFR 1.114 in this application, and this IDS should be considered the RCE Submission.

The Director is hereby authorized to charge any fees that may be due (**including the RCE fee under 37 CFR 1.17(e) as required by 37 CFR 1.114 should it be determined that the Notice of Allowance dated October 21, 2014 was NOT vacated**), or credit any overpayment of fees, to Deposit Account No. 50-4207.

Respectfully submitted,

Date: January 21, 2015

/Matthew T Byrne/
Matthew T. Byrne
Registration No. 40,934
Attorney for Applicant

Byrne Poh LLP
11 Broadway, Suite 1115
New York, NY 10004
Telephone: (212) 509-8870
Facsimile: (212) 931-8521