



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.
13/713,804	11/26/2013	8593358	08610010CA	2671

30743 7590 11/06/2013
WHITHAM, CURTIS & CHRISTOFFERSON & COOK, P.C.
11491 SUNSET HILLS ROAD
SUITE 340
RESTON, VA 20190

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

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

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

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

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

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

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

Theodore S. Rappaport, Riner, VA;

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.

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)

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)

30743 7590 08/01/2013
WHITHAM, CURTIS & CHRISTOFFERSON & COOK, P.C.
11491 SUNSET HILLS ROAD
SUITE 340
RESTON, VA 20190

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/713,804	12/13/2012	Theodore S. Rappaport	08610010CA	2671

TITLE OF INVENTION: ACTIVE ANTENNAS FOR MULTIPLE BANDS IN WIRELESS PORTABLE DEVICES

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$890	\$300	\$0	\$1190	11/01/2013

EXAMINER	ART UNIT	CLASS-SUBCLASS
PHAN, THO GIA	2821	343-702000

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, **Whitham Curtis Christofferson & Cook, PC**
 (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
 2 _____
 3 _____

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

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

(A) NAME OF ASSIGNEE

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

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

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

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

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

- ☐ A check is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number **50-2041** (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
- ☐ Applicant asserting small entity status. See 37 CFR 1.27
- ☐ Applicant changing to regular undiscounted fee status.

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

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.

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

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

Authorized Signature _____

Date Oct. 25, 2013

Typed or printed name Michael E. Whitham

Registration No. 32,635

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

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.

Electronic Patent Application Fee Transmittal

Application Number:	13713804			
Filing Date:	13-Dec-2012			
Title of Invention:	ACTIVE ANTENNAS FOR MULTIPLE BANDS IN WIRELESS PORTABLE DEVICES			
First Named Inventor/Applicant Name:	Theodore S. Rappaport			
Filer:	Michael E. Whitham/karen lumpkins			
Attorney Docket Number:	08610010CA			
Filed as Small Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl Issue Fee	2501	1	890	890
Publ. Fee- Early, Voluntary, or Normal	1504	1	300	300

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				1190

Electronic Acknowledgement Receipt

EFS ID:	17226949
Application Number:	13713804
International Application Number:	
Confirmation Number:	2671
Title of Invention:	ACTIVE ANTENNAS FOR MULTIPLE BANDS IN WIRELESS PORTABLE DEVICES
First Named Inventor/Applicant Name:	Theodore S. Rappaport
Customer Number:	30743
Filer:	Michael E. Whitham/karen lumpkins
Filer Authorized By:	Michael E. Whitham
Attorney Docket Number:	08610010CA
Receipt Date:	25-OCT-2013
Filing Date:	13-DEC-2012
Time Stamp:	11:27:11
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$ 1190
RAM confirmation Number	10334
Deposit Account	502041
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part	Pages (if appl.)
		Samsung Ex-1002-Page 6 of 155			

1	Issue Fee Payment (PTO-85B)	08610010CA-payIF.PDF	97490 3c3d0ccd45eeae27df46bc93d9afa2eb323e1fb0	no	2
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	31862 ffa53646ac7cdece1707449ebd2d086b5bb6f76c	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			129352		
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. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					



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.
-----------------	-------------	----------------------	---------------------	------------------

13/713,804

12/13/2012

Theodore S. Rappaport

08610010CA

2671

30743

7590

09/05/2013

WHITHAM, CURTIS & CHRISTOFFERSON & COOK, P.C.

11491 SUNSET HILLS ROAD

SUITE 340

RESTON, VA 20190

EXAMINER

PHAN, THO GIA

ART UNIT

PAPER NUMBER

2821

MAIL DATE

DELIVERY MODE

09/05/2013

PAPER

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.

Response to Rule 312 Communication	Application No. 13/713,804	Applicant(s) RAPPAPORT, THEODORE S.
	Examiner THO G. PHAN	Art Unit 2821

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

1. ☒ The amendment filed on 03 August 2013 under 37 CFR 1.312 has been considered, and has been:

a) ☒ entered.

b) ☐ entered as directed to matters of form not affecting the scope of the invention.

c) ☐ disapproved because the amendment was filed after the payment of the issue fee.

Any amendment filed after the date the issue fee is paid must be accompanied by a petition under 37 CFR 1.313(c)(1) and the required fee to withdraw the application from issue.

d) ☐ disapproved. See explanation below.

e) ☐ entered in part. See explanation below.

	/THO G PHAN/ Primary Examiner, Art Unit 2821
--	---

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re patent application of

Rappaport

Confirmation No. 2671

Serial No. 13/713,804

Group Art Unit 2821

Filed September 13, 2012

Examiner Phan

For ACTIVE ANTENNAS FOR MULTIPLE BANDS IN WIRELESS PORTABLE
DEVICES

Commissioner for Patents

PO Box 1450

Alexandria, Virginia 22313-1450

AMENDMENT UNDER 37 C.F.R. 1.312

Sir:

A notice of allowance was mailed in this application on August 1, 2013. The issue fee has not yet been paid. Prior to issuance of the patent, please amend the above-identified patent application as follows:

Amendments to the Specification: begin on page 2

Remarks: begin on page 3

OK TO ENTER: /TP/ (08/28/2013)



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
13/713,804	12/13/2012	Theodore S. Rappaport	08610010CA

CONFIRMATION NO. 2671

POA ACCEPTANCE LETTER

30743
WHITHAM, CURTIS & CHRISTOFFERSON & COOK, P.C.
11491 SUNSET HILLS ROAD
SUITE 340
RESTON, VA 20190



Date Mailed: 08/22/2013

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 08/14/2013.

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.

/zmoguss/

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

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/AIA/82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number 13/713,804

Filing Date 2012-12-13

First Named Inventor Theodore S. Rappaport

Title Active Antennas for Multiple Bands in Wireless Portable Devices

Art Unit 2821

Examiner Name Tho Gia Phan

Attorney Docket Number 08610010CA

SIGNATURE of Applicant or Patent Practitioner

Signature /Michael E. Whitham/ Date (Optional) 2013-08-14

Name Michael E. Whitham Registration Number 32635

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.**

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:

30743

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 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):

- ☒ 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

Name

Theodore S. Rappaport

Date (Optional)

Title

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. 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 comment on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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

Electronic Acknowledgement Receipt

EFS ID:	16587944
Application Number:	13713804
International Application Number:	
Confirmation Number:	2671
Title of Invention:	ACTIVE ANTENNAS FOR MULTIPLE BANDS IN WIRELESS PORTABLE DEVICES
First Named Inventor/Applicant Name:	Theodore S. Rappaport
Customer Number:	30743
Filer:	Michael E. Whitham/Linda Handler
Filer Authorized By:	Michael E. Whitham
Attorney Docket Number:	08610010CA
Receipt Date:	14-AUG-2013
Filing Date:	13-DEC-2012
Time Stamp:	14:41:23
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	08610010CA_POA_08-14-13.pdf	229021 0240dda712ede5bdf17a5cfa91d8f36b22a83405	no	2

Warnings:

Information:

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

In re patent application of

Rappaport

Confirmation No. 2671

Serial No. 13/713,804

Group Art Unit 2821

Filed September 13, 2012

Examiner Phan

For ACTIVE ANTENNAS FOR MULTIPLE BANDS IN WIRELESS PORTABLE
DEVICES

Commissioner for Patents

PO Box 1450

Alexandria, Virginia 22313-1450

AMENDMENT UNDER 37 C.F.R. 1.312

Sir:

A notice of allowance was mailed in this application on August 1, 2013. The issue fee has not yet been paid. Prior to issuance of the patent, please amend the above-identified patent application as follows:

Amendments to the Specification: begin on page 2

Remarks: begin on page 3

Amendments to the Specification:

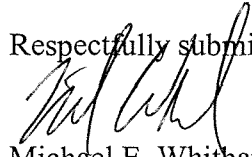
Please amend the application on page 1, at lines 4-7 in the Cross-Reference section, to read as follows:

This application is a continuation application of U.S. Patent Application 12/541,764 filed August 14, 2009, now U.S. Patent 8,350,763, and claims priority to U.S. Provisional Application Serial No. 61/088,829, entitled “Single Active Antenna for Multiple Bands in Wireless Portable Devices”, filed August 14, 2008, and the complete contents thereof is incorporated by reference

REMARKS

The Cross-Reference to Related Applications section has been amended to specifically reference the prior application and its corresponding issued patent. The prior application was referenced in the transmittal papers and was recognized in the official filing receipt. Accordingly, please correct the application prior to issuance of the patent.

Respectfully submitted,



Michael E. Whitham
Reg. No. 32,635

Whitham, Curtis, Christofferson & Cook, P.C.
11491 Sunset Hills Road, Suite 340
Reston, VA 20190

Tel. (703) 787-9400
Fax. (703) 787-7557

Customer No.: 30743

Electronic Acknowledgement Receipt

EFS ID:	16494498
Application Number:	13713804
International Application Number:	
Confirmation Number:	2671
Title of Invention:	ACTIVE ANTENNAS FOR MULTIPLE BANDS IN WIRELESS PORTABLE DEVICES
First Named Inventor/Applicant Name:	Theodore S. Rappaport
Customer Number:	30743
Filer:	Michael E. Whitham
Filer Authorized By:	
Attorney Docket Number:	08610010CA
Receipt Date:	03-AUG-2013
Filing Date:	13-DEC-2012
Time Stamp:	13:25:17
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		08610010cares312.pdf	24497 e68cd39248b0d3b20ba4e92621f768b51871bfef	yes	3

	Multipart Description/PDF files in .zip description		
	Document Description	Start	End
	Amendment after Notice of Allowance (Rule 312)	1	1
	Specification	2	2
	Applicant Arguments/Remarks Made in an Amendment	3	3
Warnings:			
Information:			
Total Files Size (in bytes):		24497	
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. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.			



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

30743 7590 08/01/2013
WHITHAM, CURTIS & CHRISTOFFERSON & COOK, P.C.
11491 SUNSET HILLS ROAD
SUITE 340
RESTON, VA 20190

EXAMINER

PHAN, THO GIA

ART UNIT

PAPER NUMBER

2821

DATE MAILED: 08/01/2013

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

13/713,804

12/13/2012

Theodore S. Rappaport

08610010CA

2671

TITLE OF INVENTION: ACTIVE ANTENNAS FOR MULTIPLE BANDS IN WIRELESS PORTABLE DEVICES

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$890	\$300	\$0	\$1190	11/01/2013

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)

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.

30743 7590 08/01/2013
WHITHAM, CURTIS & CHRISTOFFERSON & COOK, P.C.
11491 SUNSET HILLS ROAD
SUITE 340
RESTON, VA 20190

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.
13/713,804	12/13/2012	Theodore S. Rappaport	08610010CA	2671

TITLE OF INVENTION: ACTIVE ANTENNAS FOR MULTIPLE BANDS IN WIRELESS PORTABLE DEVICES

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$890	\$300	\$0	\$1190	11/01/2013

EXAMINER	ART UNIT	CLASS-SUBCLASS
PHAN, THO GIA	2821	343-702000

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 credit 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

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

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

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.

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

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

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____

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

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.



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.
13/713,804	12/13/2012	Theodore S. Rappaport	08610010CA	2671
30743	7590	08/01/2013	EXAMINER	
WHITHAM, CURTIS & CHRISTOFFERSON & COOK, P.C. 11491 SUNSET HILLS ROAD SUITE 340 RESTON, VA 20190			PHAN, THO GIA	
			ART UNIT	PAPER NUMBER
			2821	

DATE MAILED: 08/01/2013

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

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

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

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

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

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. 13/713,804	Applicant(s) RAPAPORT, THEODORE S.	
	Examiner THO G. PHAN	Art Unit 2821	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 a filing date of 12/13/12.
☐ 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 1,4-10 and 13-35. 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) | 5. ☒ Examiner's Amendment/Comment |
| 2. ☒ Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date <u>12/13/12</u> | 6. ☒ Examiner's Statement of Reasons for Allowance |
| 3. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material | 7. ☐ Other _____. |
| 4. ☐ Interview Summary (PTO-413),
Paper No./Mail Date _____. | |

/THO G PHAN/
Primary Examiner, Art Unit 2821

DETAILED ACTION

EXAMINER'S AMENDMENT

An Examiner's Amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 C.F.R. § 1.312. To ensure consideration of such an amendment, it **MUST** be submitted no later than the payment of the Issue Fee.

The application has been amended as follows:

In the claims:

Claim 4, line 1, "3" has been changed to – 1--.

Allowable Subject Matter

1. The following is a statement of reasons for the indication of allowable subject matter: Claim 1 is allowable over the art of record because the prior art does not teach wherein at least one antenna of the antenna array is used by the plurality of transmitters, receivers or transceivers in a plurality of different bands, wherein the at least one antenna is one or more of a) an actively tuned antenna, and b) is tuned by one or more passive elements which are selected or interconnected using electronic control and in combination with the remaining claimed limitations.

Art Unit: 2821

2. Claim 8 is allowable over the art of record because the prior art does not teach wherein at least one antenna of the antenna array is used by the at least one multiband transmitter, receiver or transceiver in a plurality of different bands, wherein the at least one antenna is one or more of a) an actively tuned antenna, and b) is tuned by one or more passive elements which are selected or interconnected using electronic control and in combination with the remaining claimed limitations.

3. Claim 14 is allowable over the art of record because the prior art does not teach a tuner associated with the at least one multiband transmitter, receiver, or transceiver, the tuner matching the at least one multiband antenna to the at least one multiband transmitter, receiver or transceiver in a plurality of different bands simultaneously and in combination with the remaining claimed limitations.

4. Claim 17 is allowable over the art of record because the prior art does not teach one or more components selected from the group consisting of receivers, transmitters and transceivers, the one or more components connected to the at least one of the one or more antennas, whereby at least one of the one or more components transmits or receives electromagnetic energy simultaneously at two or more of the plurality of particular frequency bands, or two or more components transmit or receive electromagnetic energy at two or more of the plurality of particular frequency bands and in combination with the remaining claimed limitations.

Art Unit: 2821

5. Claim 21 is allowable over the art of record because the prior art does not teach a plurality of transmitters, receivers, or transceivers that operate at one or more frequency bands, wherein the at least one antenna is used by the plurality of transmitters, receivers or transceivers in a plurality of different bands, wherein the at least one antenna is one or more of a) an actively tuned antenna, and b) is tuned by one or more passive elements which are selected or interconnected using electronic control and in combination with the remaining claimed limitations.

6. Claim 32 is allowable over the art of record because the prior art does not teach wherein at least one antenna of the one or more antennas is used by the plurality of transmitters, receivers or transceivers in a plurality of different bands, wherein the at least one antenna is one or more of a) an actively tuned antenna, and b) is tuned by one or more passive elements which are selected or interconnected using electronic control; and one or more mobile, portable, or fixed devices or platforms which communicate with the at least one wireless device and in combination with the remaining claimed limitations.

Conclusion

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The patents to Gray, Robert, Pankinaho, Nallo et al., Poilasne, Friman et al. and Vance are cited as of interested and illustrated a similar structure to a wireless device.

Art Unit: 2821

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tho G. Phan whose telephone number is 571-272-1826. The examiner can normally be reached on M-F, 9:30-6:00.

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).

/Tho G Phan/
Primary Examiner, Art Unit 2821

Notice of References Cited	Application/Control No. 13/713,804		Applicant(s)/Patent Under Reexamination RAPAPORT, THEODORE S.	
	Examiner THO G. PHAN		Art Unit 2821	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-3,381,222 A	04-1968	GRAY JOHN L	455/77
*	B	US-3,689,928 A	09-1972	Robert A. Felsenheld	343/703
*	C	US-6,140,966 A	10-2000	Pankinaho, Ilkka	343/700MS
*	D	US-6,762,723 B2	07-2004	Nallo et al.	343/700MS
*	E	US-7,132,989 B1	11-2006	Poilasne, Gregory	343/745
*	F	US-8,421,695 B2	04-2013	Friman et al.	343/745
*	G	US-8,456,366 B2	06-2013	Vance, Scott LaDell	343/700MS
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

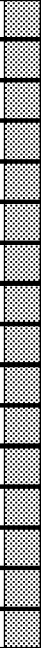
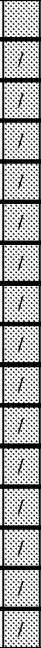
*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

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

Issue Classification 	Application/Control No. 13713804	Applicant(s)/Patent Under Reexamination RAPPAPORT, THEODORE S.	
	Examiner THO G PHAN	Art Unit 2821	

CPC			
Symbol		Type	Version
			

CPC Combination Sets				
Symbol	Type	Set	Ranking	Version
				

NONE		Total Claims Allowed:	
		31	
(Assistant Examiner)	(Date)		
/THO G PHAN/ Primary Examiner.Art Unit 2821	7/27/13	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	2

Issue Classification 	Application/Control No. 13713804	Applicant(s)/Patent Under Reexamination RAPPAPORT, THEODORE S.
	Examiner THO G PHAN	Art Unit 2821

☐ 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	1	19	17	29	33										
	2	20	18	30	34										
	3	21	19	31	35										
2	4	22	20												
3	5	25	21												
4	6	6	22												
5	7	7	23												
8	8	12	24												
9	9	13	25												
10	10	17	26												
	11	18	27												
	12	23	28												
11	13	24	29												
14	14	26	30												
15	15	27	31												
16	16	28	32												

NONE	Total Claims Allowed: 31	
(Assistant Examiner)	(Date)	
/THO G PHAN/ Primary Examiner.Art Unit 2821	7/27/13	O.G. Print Claim(s) 1
(Primary Examiner)	(Date)	O.G. Print Figure 2

Receipt date: 12/13/2012 13713804 - GAU. 2821

INFORMATION DISCLOSURE CITATION

(Use several sheets if necessary)

ATTY DOCKET NO.

08610010CA

APPLICATION NO.

not assigned

APPLICANT(S)

T. Rappaport

FILING DATE

concurrently

GROUP ART UNIT

not assigned

U.S. PATENT DOCUMENTS

*EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	4,499,606	2/1985	Rambo			
	6,693,600	2/2004	Elliot			
	7,088,299	8/2006	Siegler, et al.			

U.S. PATENT APPLICATION PUBLICATIONS

*EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	2003/0151556	8/2003	Cohen			
	2008/0158081	7/2008	Rofougaran			

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION	
							YES	NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

EXAMINER

/Tho Phan/ (07/25/2013)

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.



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

BIB DATA SHEET

CONFIRMATION NO. 2671

SERIAL NUMBER 13/713,804	FILING or 371(c) DATE 12/13/2012 RULE	CLASS 343	GROUP ART UNIT 2821	ATTORNEY DOCKET NO. 08610010CA		
APPLICANTS Theodore S. Rappaport, Riner, VA; ** CONTINUING DATA ***** This application is a CON of 12/541,764 08/14/2009 PAT 8350763 which claims benefit of 61/088,829 08/14/2008 ** FOREIGN APPLICATIONS ***** ** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** ** SMALL ENTITY ** 02/04/2013						
Foreign Priority claimed ☐ Yes ☒ No 35 USC 119(a-d) conditions met ☐ Yes ☒ No Verified and Acknowledged <u>/THO GIA PHAN/</u> Examiner's Signature		☐ Met after Allowance Initials	STATE OR COUNTRY VA	SHEETS DRAWINGS 3	TOTAL CLAIMS 31	INDEPENDENT CLAIMS 6
ADDRESS WHITHAM, CURTIS & CHRISTOFFERSON & COOK, P.C. 11491 SUNSET HILLS ROAD SUITE 340 RESTON, VA 20190 UNITED STATES						
TITLE Active Antennas for Multiple Bands in Wireless Portable Devices						
FILING FEE RECEIVED 1249	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:		☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit			

Search Notes 	Application/Control No. 13713804	Applicant(s)/Patent Under Reexamination RAPPAPORT, THEODORE S.
	Examiner THO G PHAN	Art Unit 2821

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
343	702,722,745	7/25/2013	tp

SEARCH NOTES		
Search Notes	Date	Examiner
search history attached	7/25/2013	tp

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
search history attached	search history attached	7/25/2013	tp

--	--

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	1	"20130141294"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/25 20:32
S2	92	((THEODORE) near2 (RAPPAORT)).INV.	US-PGPUB; USPAT; USOCR	OR	ON	2013/07/25 20:35
S3	11	("20030151556" "20080158081" "4499606" "6693600" "7088299").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/25 20:35
S4	1977728	transmitter or receiver or transceiver	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/25 20:36
S5	440106	frequency with band	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/25 20:36
S6	818998	antenna	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/25 20:37
S7	16054726	used	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/25 20:38
S8	29829	S4 S6 S7	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2013/07/25 20:40
S9	871	S5 S8	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2013/07/25 20:41
S10	2671627	mobile or portable or (wireless adj device)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	WITH	ON	2013/07/25 20:43
S11	117	S9 S10	US-PGPUB; USPAT; USOCR;	SAME	ON	2013/07/25 20:43

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S12	2245	S5 S8	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	SAME	ON	2013/07/25 20:44
S13	470	S12 S10	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	SAME	ON	2013/07/25 20:44
S14	1799	S4 S5 S6 S7 S10	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	SAME	ON	2013/07/25 20:46
S15	59735	tun\$3 with (antenna or passive or parasitic)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	SAME	ON	2013/07/25 20:48
S16	46	S13 S15	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	SAME	ON	2013/07/25 20:48
S17	108	S13 S15	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	ON	2013/07/25 20:48
S18	116	S14 S15	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	SAME	ON	2013/07/25 20:49
S19	13	(wireless and antenna and element and transceiver and used and tuned).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	SAME	ON	2013/07/25 20:51
S20	5	(wireless and antenna and element and transceiver and used and tuner and controller).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	SAME	ON	2013/07/25 20:52
S21	1	(wireless and antenna and element and transceiver and tuner and simultaneously and array).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	SAME	ON	2013/07/25 20:54
S22	3	(wireless and antenna and element and transceiver and tuner and simultaneously and components).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	SAME	ON	2013/07/25 20:55
S23	11615	343/702	US-PGPUB; USPAT; USOCR;	SAME	ON	2013/07/25 20:57

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S24	507	343/722	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	SAME	ON	2013/07/25 20:57
S25	1230	343/745	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	SAME	ON	2013/07/25 20:57

7/ 27/ 2013 9:04:24 AM
C:\ Users\ tphan1\ Documents\ EAST\ Workspaces\ 13-713,804.wsp



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
13/713,804	12/13/2012	Theodore S. Rappaport	08610010CA

CONFIRMATION NO. 2671

PUBLICATION NOTICE



OC000000061738120

30743
WHITHAM, CURTIS & CHRISTOFFERSON & COOK, P.C.
11491 SUNSET HILLS ROAD
SUITE 340
RESTON, VA 20190

Title:Active Antennas for Multiple Bands in Wireless Portable Devices

Publication No.US-2013-0141294-A1

Publication Date:06/06/2013

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 Management, 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

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
13/713,804	12/13/2012	2821	1249	08610010CA	31	6

CONFIRMATION NO. 2671

UPDATED FILING RECEIPT



30743
WHITHAM, CURTIS & CHRISTOFFERSON & COOK, P.C.
11491 SUNSET HILLS ROAD
SUITE 340
RESTON, VA 20190

Date Mailed: 02/26/2013

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)

Theodore S. Rappaport, Riner, VA;

Applicant(s)

Theodore S. Rappaport, Riner, VA;

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 12/541,764 08/14/2009 PAT 8350763
which claims benefit of 61/088,829 08/14/2008

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.

Permission to Access - A proper **Authorization to Permit Access to Application by Participating Offices** (PTO/SB/39 or its equivalent) has been received by the USPTO.

If Required, Foreign Filing License Granted: 02/04/2013

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/713,804**

Projected Publication Date: 06/06/2013

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

Active Antennas for Multiple Bands in Wireless Portable Devices

Preliminary Class

343

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

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

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

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

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

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

LICENSE FOR FOREIGN FILING UNDER**Title 35, United States Code, Section 184****Title 37, Code of Federal Regulations, 5.11 & 5.15****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 Assets Control, 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.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 13/713,804				
APPLICATION AS FILED - PART I										
(Column 1)		(Column 2)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY				
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)			
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	98		N/A				
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A	310		N/A				
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	125		N/A				
TOTAL CLAIMS (37 CFR 1.16(j))	31 minus 20 =	*	x 31 =	341	OR					
INDEPENDENT CLAIMS (37 CFR 1.16(h))	6 minus 3 =	*	x 125 =	375						
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			0.00						
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00						
			TOTAL	1249		TOTAL				
* If the difference in column 1 is less than zero, enter "0" in column 2.										
APPLICATION AS AMENDED - PART II										
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY		
AMENDMENT A		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))							OR		
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY		
AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))							OR		
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.										

IN THE U.S. PATENT AND TRADEMARK OFFICE

In re Application of
Theodore S. Rappaport

confirmation no. 2671

Serial No.: 13/713,804

Art Unit: 2821

Filed: December 13, 2012

Examiner: not assigned

For: Active Antennas for Multiple Bands in Wireless Portable Devices

RESPONSE TO NOTICE TO FILE
CORRECTED APPLICATION PAPERS

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

Sir:

In response to the Notice to Correct Application Papers mailed February 8, 2013,
attached are the following:

1. A copy of the “notice”;
2. A Marked-Up copy of the specification;
3. A Clean copy of the specification; and
4. A copy of the drawings as filed.

REMARKS

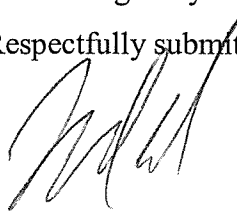
The “notice” required a marked up and clean specification because the specification did not contain a brief description of Figures 6A, 6B and 6C.

Support for Figures 6A thru 6C can be found in the specification on page 11, last paragraph to page 13, line 2.

The “notice” also required replacement drawings because more than one figure is present and each figure is not labeled “fig” with a consecutive Arabic numeral and a capital letter. This requirement is believed to be an error because the only figure in this application that has several views is figure 6 and that drawing is labeled Figure 6A, Figure 6B and Figure 6C at the time of filing; therefore, no “replacement drawings” are required. Submitted herewith are the drawings as originally filed with the application for the convenience of the USPTO.

I, the undersigned, am the attorney of record in this application. I hereby state that the accompanying substitute (clean copy) specification contains no new matter over that contained in the above-identified application as originally filed.

Respectfully submitted,



Michael E. Whitham
Reg. No. 32,635

Date: 2/14/13

Whitham Curtis Christofferson
& Cook, PC
11491 Sunset Hills Road - #340
Reston, VA 20190
703/787-9400
Customer No. 30743



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
13/713,804	12/13/2012	Theodore S. Rappaport	08610010CA

CONFIRMATION NO. 2671

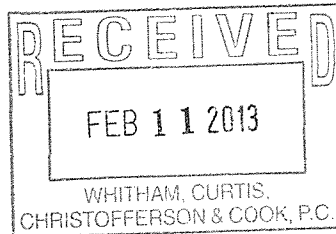
30743

WHITHAM, CURTIS & CHRISTOFFERSON & COOK, P.C.
11491 SUNSET HILLS ROAD
SUITE 340
RESTON, VA 20190

FORMALITIES LETTER



Date Mailed: 02/08/2013



NOTICE TO FILE CORRECTED APPLICATION PAPERS

Filing Date Granted

An application number and filing date have been accorded to this application. The application is informal since it does not comply with the regulations for the reason(s) indicated below. Applicant is given TWO MONTHS from the date of this Notice within which to correct the informalities indicated below. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

The required item(s) identified below must be timely submitted to avoid abandonment:

- A substitute specification in compliance with 37 CFR 1.52, 1.121(b)(3), and 1.125, is required. The substitute specification must be submitted with markings and be accompanied by a clean version (without markings) as set forth in 37 CFR 1.125(c) and a statement that the substitute specification contains no new matter (see 37 CFR 1.125(b)). The specification, claims, and/or abstract page(s) submitted is not acceptable and cannot be scanned or properly stored because:
 - The application contains drawings, but the specification does not contain a brief description of the several views of the drawings as required by 37 CFR 1.74 and 37 CFR 1.77(b)(7).
- Replacement drawings in compliance with 37 CFR 1.84 and 37 CFR 1.121(d) are required. The drawings submitted are not acceptable because:
 - More than one figure is present and each figure is not labeled "Fig." with a consecutive Arabic numeral (1, 2, etc.) or an Arabic numeral and capital letter in the English alphabet (A, B, etc.)(see 37 CFR 1.84(u)(1)). See Figure(s) 6. A brief description of the several views of the drawings (see 37 CFR 1.74) should be added or amended to correspond to the corrected numbering of the figures. See also 37 CFR 1.77(b)(7).

Applicant is cautioned that correction of the above items may cause the specification and drawings page count to exceed 100 pages. If the specification and drawings exceed 100 pages, applicant will need to submit the required application size fee.

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

Replies should be mailed to:

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.

<https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html>

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at <http://www.uspto.gov/ebc>.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

/bnguyen/

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

MARKED UP COPY OF SPECIFICATION

ACTIVE ANTENNAS FOR MULTIPLE BANDS IN WIRELESS PORTABLE DEVICES

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to U.S. Provisional Application Serial No. 61/088,829, entitled “Single Active Antenna for Multiple Bands in Wireless Portable Devices” , filed August 14, 2008, and the complete contents thereof is incorporated by reference

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to wireless portable devices and particularly to improvements in transmitting and receiving electromagnetic signals at multiple frequency bands.

Background of the Invention

Today’s wireless devices, such as laptops and computers that connect wirelessly to the cellphone network or internet must use antennas to transmit and receive wireless energy to and from the device. Today’s cellphones and laptops typically require multiple antennas, each antenna designed for resonance or desired performance at a particular frequency band (such as cellular band, say in the 850 – 950 MHz band, the Bluetooth/WiFi band, say in the 2400 – 2490 MHz band, and so on). Computer makers and cellphone makers have difficulty with the mechanical design of their equipment, and spend a great deal of engineering time, research, and cost in manufacture for the bill of materials for the feedlines and connections between transmitter circuits, transceiver circuits, or receiver circuits and the antennas that are mounted or housed in the wireless device casing. In some cases, antennas must be oriented in the flip up top of a lap top,

placed behind or in the display screen, and tiny coaxial cables run through the case hinges, to the motherboard mounted below the keyboard. Similar problems exist with cellphones, and all devices generally must meet or exceed certain federal or wireless carrier-imposed requirements for radiation efficiency for a wide range of device orientations. It is envisioned that as wireless proliferates, cellphones and laptops will require more and more separate radio frequency bands in order to offer connectivity and competitive services. It is not inconceivable to eventually have wireless portable devices requiring 10 or more separate frequency bands, where the term “band” here means a particular wireless standard or service that is distinct from another. For example, standards such as IEEE 802.11a, 802.11b, 802.11g, 802.15a, 802.15.3.c, Cellular telephone (European, Asian, or US spectrum), Bluetooth, WiMax, PCS, all represent different bands, as they generally have different RF frequency band allocations assigned to them. In the future, RFID tags, vehicles, wireless post it notes, equipment, shipping containers, and even clothing may also suffer the issue of having to provide multiple antennas for different RF bands.

Today, there are many passive antennas solutions that have been published in the literature, such as, for example, the broadband planar antenna developed by Prof. Chen at The University of Texas. Using Fractal programming (genetic algorithms), it is possible to do computer simulations that eventually create an antenna design that offers resonance for several different frequency bands. Such antennas generally are developed by using field solver programs, where the field solver is set to optimize an antenna structure for a particular antenna performance over a specified range of frequencies (for example, the field solver may be set to find an antenna structure that has a low return loss, S_{11} , of less than -13dB over the range of frequencies of 2.4 – 2.9 GHz and 5.1 – 5.8 GHz, in order to accommodate Bluetooth and WiFi 802.11a, 802.11b, and 802.11g). However, planar antennas, when designed by an optimization program or set of algorithms, without the use of active antenna tuning, may result in a larger antenna than what is feasible for a small package (e.g. a small handset).

Recently, there have been some technical advances in active antenna tuning, some of which have been pioneered by Paratek Microwave in Nashua, NH. Using active lumped elements, such as tunable capacitors, it is possible to allow for the active tuning

of an antenna within a cellphone handset. Using electrically tunable capacitors, Paratek has pioneered a way to allow for active tuning of one or more cellphone antennas, as discussed in US patent 7,369,828.

In US patent 7,369,828 by Shamsaifar (owned by Paratek Microwave), the device can tune two different cellphone antennas for use on one of several bands of interest, where each distinct and separate antenna (one for high band and one for low band) has an active element that may be tuned. As described in U.S. Patent 7,369,829, a cellphone antenna is designed specifically for cellphone bands, since today's cellphones generally provide a small Bluetooth antenna, separate and apart from the cellular antenna. In U.S. Patent 7,369,829, there is described a method of transmitting and receiving RF signals from multiple frequency bands utilizing an electronically tunable multiple band antenna, comprising the steps of: providing a high band antenna with at least one voltage tunable varactor associated therewith, the high band antenna providing a first input to a controller; providing a low band antenna with at least one voltage tunable varactor associated therewith, the low band antenna providing a second input to the controller; and inputting control data to the controller and controlling a first bias voltage for biasing the at least one voltage tunable varactor associated with the high band antenna and a second bias voltage for biasing the at least one voltage tunable varactor associated with the low band antenna. By using a controller, the invention enables an antenna to be tuned.

The controller of the method in U.S. Patent 7,369,828 can use a DC voltage supply to provide the DC voltage needed to bias the voltage tunable varactors. The high band antenna of the method taught in U.S. Patent 7,369,828 can further comprise: a substrate; a patch element on the substrate; at least one voltage tunable varactor associated with the patch element; a DC bias point on the patch element; an RF input on the patch element; a temperature sensor; and a ground plane on one side of the substrate.

The low band antenna of the method taught in U.S. Patent 7,369,828 can further comprise: a substrate; a patch element on the substrate; at least one voltage tunable varactor associated with the patch element; a DC bias point on the patch element; an RF input on the patch element; a temperature sensor; and a ground plane on one side of the substrate.

In a more specific embodiment of a preferred method of U.S. Patent 7,369,829, the multiple band antenna is a quad band antenna and covers the following frequency bands and standards which only involve cellular telephone (cellular and PCS): 824-894 MHz; 880-960 MHz; 1710-1880 MHz; 1850-1990 Hz; GSM850; EGSM; GSM1800; and PCS 1900.

Paratek uses BST as a tunable dielectric material that may be used in a tunable dielectric capacitor. *Paratek Microwave, Inc.* has developed and continues to develop tunable dielectric materials that may be utilized in embodiments of the antenna tuners and tunable filters, and the tuners are not necessary limited to using BST material. This family of tunable dielectric materials may be referred to as Parascan by the company.

The term "Parascan" as used herein is a trademarked term indicating a tunable dielectric material developed by Paratek Microwave, the assignee of US patents 7,397,329 and 7,369,828, and the idea of tunable dielectric materials have been described in several patents. Barium strontium titanate ($\text{BaTiO}_3\text{-SrTiO}_3$), also referred to as BSTO, is used for its high dielectric constant (200-6,000) and large change in dielectric constant with applied voltage (25-75 percent with a field of 2 Volts/micron).

Tunable dielectric materials including barium strontium titanate are disclosed in U.S. Pat. No. 5,312,790 to Sengupta, et al. entitled "Ceramic Ferroelectric Material"; U.S. Pat. No. 5,427,988 by Sengupta, et al. entitled "Ceramic Ferroelectric Composite Material-BSTO-MgO"; U.S. Pat. No. 5,486,491 to Sengupta, et al. entitled "Ceramic Ferroelectric Composite Material-BSTO-ZrO₂"; U.S. Pat. No. 5,635,434 by Sengupta, et al. entitled "Ceramic Ferroelectric Composite Material-BSTO-Magnesium Based Compound"; U.S. Pat. No. 5,830,591 by Sengupta, et al. entitled "Multilayered Ferroelectric Composite Waveguides"; U.S. Pat. No. 5,846,893 by Sengupta, et al. entitled "Thin Film Ferroelectric Composites and Method of Making"; U.S. Pat. No. 5,766,697 by Sengupta, et al. entitled "Method of Making Thin Film Composites"; U.S. Pat. No. 5,693,429 by Sengupta, et al. entitled "Electronically Graded Multilayer Ferroelectric Composites"; U.S. Pat. No. 5,635,433 by Sengupta entitled "Ceramic Ferroelectric Composite Material BSTO-ZnO"; U.S. Pat. No. 6,074,971 by Chiu et al. entitled "Ceramic Ferroelectric Composite Materials with Enhanced Electronic Properties BSTO Mg Based Compound-Rare Earth Oxide". These patents are incorporated herein

by reference. The materials described in these patents, especially BSTO-MgO composites, show low dielectric loss and high tunability. Tunability is defined as the fractional change in the dielectric constant with applied voltage.

Using the idea of tunable capacitance, and following on the above listed prior art, Paratek Microwave has developed a technology called Adaptive Impedance Matching Models (AIMM) which it currently demonstrates on its website at worldwide web site paratek.com as able to adaptively tune antennas.

Agile Materials, a company founded in 1999 as a spinoff of University of California, Santa Barbara, has also developed tunable wireless components for multi-band systems. Agile has successfully commercialized its proprietary method to harness the unique properties of a thin-film ferroelectric capacitors, which may be tuned over at least an octave of frequency range. Agile employees produced patent 7,202,747, "Self Tuning Variable Impedance Circuit for Impedance Matching of Power amplifiers," as well a 7,012,483, "Tunable Bridge Circuit", both of which use a BST tunable capacitive material to affect a resonance change in a tuneable circuit.. All of the aforementioned is known from the public prior art of record.

SUMMARY

The current invention uses one or more antennas, at least one of which can be used by multiple transmitters or receivers in different bands, thereby greatly simplifying the antenna structures in a portable wireless device, and greatly reducing the mechanical design complexity, the cost of bill of materials, and the variance in manufacturing of different devices of a particular model.

The current invention exploits the idea of active antenna tuning, but expands it greatly in a non-obvious way by applying the concepts to the situation of where multiple band transmitters, receivers, or transceivers must be used simultaneously in a wireless portable device. In cellphones today, since telephone call need only be made on one band at a time (either on High Band Cellular or Low Band Cellular, or 3G band, but not more than one at a time), US Patent 7,369,829 and other prior art have not contemplated the present invention, which allows a single antenna to be used for simultaneous

transmission (or reception) for multiple bands. The present invention greatly simplifies the mechanical design and layout of wireless portable devices by allowing multiple transmitter (or receiver) bands to simultaneously use one or more antennas for simultaneous multi-purpose use.

This invention allows an antenna, such as a patch or metal fixture or other type of conductive or non/semi-conductive element or elements mounted on or within a mobile or portable device, to be simultaneously fed and used by multiple transmitters, receivers, or transceivers on different bands. It is understood that the terms portable and mobile may be used interchangeably. The invention has application with all wireless devices whether mobile, portable or fixed. This invention exploits active tuning and matching for each of the feedlines to antennas, or may use a single antenna feedline to match a single or multiple antennas from multiple devices, using tunable technologies developed by Paratek Microwave, Agile, or others, as well as techniques described below, or by using signal processing in the RF or IF domains, as well.

DESCRIPTION OF THE DRAWINGS

Figure 1 shows today's typical cellphone or laptop design, where different transceivers are connected to different antennas.

Figure 2 shows an embodiment of the present invention, where multiple transmitters are fed to a single antenna (it is understood that transmitters could also be transceivers, or receivers).

Figure 3 shows a more detailed embodiment of the present invention, where multiple transmitters may be fed to a single antenna using multiple feedlines and active antenna tuners, controlled by a controller, operates on the RF of each signal. (it is understood that transmitters could also be transceivers, or receivers).

Figure 4 shows another embodiment of the present invention, where multiple transmitters may be fed to a single antenna using a single feedline and a single active antenna tuner which is controlled by a controller.

Figure 5 shows yet another alternate embodiment of the present invention, where a multiband tuner provides matching from a single multiband transmitter (or transceiver or receiver) feedline (e.g. a single RF source) to a single multi-use multi-band antenna

Figures 6A, B and C illustrates some of the possible examples and configurations of tuning elements and circuits used within a tuner, with active elements, or in a multiband transceiver.

DETAILED DESCRIPTION

Shown in Figure 1 is an example of how cellphones or laptops or other wireless devices 10 are designed today. In general, different band transceivers (e.g., GSM cellular transceiver 12, Bluetooth transceiver 14, and ultrawideband transceiver 16) are connected to different antennas (e.g., cellular antenna 20, Bluetooth antenna 22, and UWB antenna 24) that must be affixed to, located within the packaging of the device, or included in the printed circuit boards of the device, thereby taking up space, feedline resources (e.g., feedlines 26), increasing the bill of materials, and adding complexity.

Figure 2 illustrates the basic idea of the present invention which can be implemented in fixed or mobile wireless devices 10 such as computers, telephones, portable computing or communication devices, games, wireless post it notes, wireless memory media, personal data assistants and navigation assistants. One potential application of the invention is in the IEEE 802.11ad standard, where very high throughput wireless devices (e.g., 60 GHz carrier transmissions) may use one or more transmitters, receivers or transceivers to simultaneously provide capabilities in the existing 802.11a and 802.11b bands of 2.4 GHz and 5.8 GHz, as well as the 60 GHz spectrum. Instead of requiring different antennas for the different RF bands, the present invention allows for the use of a single antenna 28 for multiple bands (or multiple antennas, at least one of which can be used for multiple bands). By providing the ability to use just a single antenna 28, the problem of mounting, locating, and feeding the antenna can be greatly reduced, so long as a desired antenna efficiency can be maintained for all bands of interest.

Figure 3 shows how the antenna efficiency can be maintained. By using individual RF tuners 30, 32, and 34, that may be based on Paratek's or Agile's technology, or any other active tuning method, such as Microelectrical Mechanical Systems (MEMS), or variable mechanical resonator technologies, or other active or passive methods known now or in the future, it becomes possible to provide a good impedance match for each of the transceivers 36, 38 and 40 shown in Figure 3. The key to proper operation is to also, while providing good matching, provide sufficient RF isolation so that the transmitters in other bands do not overload the front end receiver of a band that is receiving. Fortunately, RF filtering and overload protection is improving in commercially available wireless transceivers in various popular bands, so that overload protection may be offered within the wireless transceiver chip itself through the integrated circuitry. Where more isolation is required, the tuner for a particular band is adjusted to offer very high impedance S22 characteristics at the other bands that differ from the dedicated band of the tuner, so that there is little, if any energy returned to the desired transceiver (or transmitter, or receiver) of the particular band of the tuner. In addition, low cost LC circuits may be etched into and/or added on the circuit board during manufacture or otherwise made a part of the tuner circuitry in order to create an RF Trap for the other bands, at much less cost and reduced engineering than having to use separate antennas for each band.

Furthermore, it is possible to use band transceivers that offer different antenna ports for the transmitter and the receiver within a particular band, whereby the present invention is simply extended to where there are two antennas used – one that is used solely for transmission by the multiple bands, and another multiband shared antenna for the receiver that is located a sufficient distance away within the casing, or which uses polarization diversity, or uses shielding or distributed antenna ideas within the case in order to reduce the RF overload from the transmitting antenna. The receiving antenna, for instance, might be mounted on the other side of the printed circuit board for the cellphone, or laptop, or RFID tag, or wireless post-it, or might be pitched at right angles in the casing, etc. It is also possible to use buffer amplifiers, tuned amplifiers, as well as tuned trap circuits for particular offending bands, that can act as filters to prevent RF from other multi-user band transmitters from leaking into the receiver portion of a

particular band. Also, RF antenna switches, may be made inexpensively in an integrated circuit process in CMOS, GaAs, or other well known semiconductor technologies known now or the future. These capabilities which may be incorporated in the tuner as described below. It should be clear in this disclosure that the term “antenna” is not meant to be limiting to any particular structure, but rather is meant to represent all of the possible ways that a wireless portable device may allow for radiation and reception of electromagnetic energy from particular frequency bands of interest.

Figure 3 also shows a tuner controller 42, preferably digital in nature and which may be part of a computer or microprocessor circuit that also controls one or more of the transceivers (or transmitters or receivers) shown in the figure. The controller 42 provides the proper voltages, or more preferably, the digital control values that are used by the tuner in order to adjust the active elements of the tuner (e.g. the tunable capacitors, inductors, amplifiers, and to toggle switches). The digital decoding circuitry in the tuner is not shown here, but is known to be implemented in a number of ways using standard serial or parallel digital busses that interconnect integrated circuits within cellphones and laptops. Furthermore, the controller receives feedback from the tuner, or from other circuitry (not shown) with respect to VSWR, power, and proper functionality so that the controller may properly adjust, alter, initiate, and end its use of control signals (either voltages or data values sent over a serial data line or a bus) to the tuner. In the case of the tuner receiving digital signals from the controller, it is understood that the tuner would have its own processing that would allow for the digital interpretation of control signals such as to properly determine the necessary analog voltages or other signal adjustments needed to perform impedance tuning through adjustment of the active tunable elements of the tuner, so that it would be possible to sequentially or simultaneously tune one or more of the tuners so that multiple bands may simultaneously transmit (or receive, or both) using the single antenna structure shown in the figure. The controller may be part of the overall portable device computing logic or controlling circuitry, or may be integrated within one or more of a particular band or multiband transceiver, transmitter, or receiver. The controller may be distributed within the portable device, and may even be responsive to over the air signaling that is received by one or more of the transceivers. The controller would have awareness of when particular bands were to be transmitting, receiving, or in

the idle/off mode, so that it could properly control the active elements, and even provide power on/off/sleep instructions to the circuitry within the tuner. Note that nothing here is meant to be limiting in how the controller might be used, as it is conceivable that it could be included in the circuitry of the tuner, or the tuner and controller ideas contemplated here all could be integrated within a single multiband transceiver chip, such as is shown in Figure 4.

Figure 4 shows an alternate embodiment, where the progress in IC design for wireless multiband, multi-mode circuits is contemplated. Indeed, today it is possible to purchase multi-band transceiver chips for popular wireless standards where different antenna ports are provided for various RF output bands. Figure 4 illustrates the use of a combined multiband transceiver 44 which may include, for example, GSM, Bluetooth, UWB, WiMAX all on one chip—eventually software designed radio be a part of the chip). The present idea, shown in Figure 4, using a single RF feedline to a single multiband active controller, would provide an advantage to the wireless industry through simplicity and reduced feedlines, reduced size and weight, and more flexibility in locating the antenna. The multiband tuner 46 would require greater complexity than as shown in Figure 3, as it would require the ability to simultaneously pass desired RF signals at proper low (generally 50 ohm or thereabouts) impedance for each of the bands that are being used, while providing very high impedance to other bands. The tuner is adjusted by the controller in order to indicate when a particular transmitter on a particular band is in the transmit mode or in the receive mode, or, alternatively, the tuner could simply offer matching capabilities to a transmitter to the antenna without consideration for the receiver (for the case where the receiver would be connected to a different antenna). The circuitry of the tuner is described in more detail below, and can exploit buffer amplifiers or tuned RF amplifiers at various RF frequencies to provide isolation, as well as antenna switching, all contained within the tuner, making it possible to create a low cost, high performance antenna tuner chip for the present application. An optional RF switch allows separate transmitter path and receiver path tuning for each of the bands at use. This concept may be included within a single band tuner element for the present invention.

Figure 5 illustrates a more detailed example of the active and passive circuitry of the present invention. To provide a single feedline to a single antenna, the tuner 46 requires controller circuitry that provides instructions as to how the particular active devices may be adjusted. In this case, the term active indicates that RF tuning is possible, such as in the case of tunable capacitors or tunable inductors. Figure 5 shows an example, not in any way meant to be limiting to the type of impedance matching circuits 48 contemplated here, where the capacitors of each of three parallel band tuners are able to be tuned. Tuning methods for capacitors are well known, such as taught in the prior art patents by Paratek, and by researchers throughout the world. Similarly, it is possible to tune inductances, as well. Furthermore, shown in Figure 5, it is noted that RF amplifiers, that may be used to either offer matching impedance at the input (say 50 ohms) and particular desired impedance at the output feedline to the antenna, is shown. It should be clear that RF amplifiers, as shown in Figure 5 and 6, may either be strict buffer amplifiers with a very high output impedance, or alternatively, may be active devices that have a controlled impedance that is adjusted in tandem with the tuned circuit elements shown in the figures. Figure 5 represents an example of how multiband transmitted signals may be applied to a single multiband tuner. The input signals are split and routed to each of the respective tuner circuits, and may use a Wilkinson or simple ohmic splitter, which may be implemented either on a printed circuit board substrate or within an integrated circuit. It is clear to one skilled in the art that tuner circuits and feedlines may be implemented in a myriad of ways depending on the particular physical structure of the circuitry. For example, coplanar waveguides or microstrip lines may be used in integrated circuits or circuit boards, and splitters, combiners, couplers, mixers, and switches may be fabricated to realize the invention using well understood techniques such as taught in D. Pozar's books *Microwave Engineering*, copyright 2004, and *Microwave and RF Design of Wireless Systems*, copyright 2000 which are hereby incorporated by reference, and as presented at various IEEE conferences on antennas, microwave theories, and circuits. While techniques for building both active and passive circuits are taught at various conferences, the use of such technology for the present invention has not been heretofore contemplated. It is well understood that a wide range of active and passive components,

either lumped or distributed, may be combined with various transmission line and active and passive signal coupling techniques to implement the invention.

Figure 6a, b, and c illustrate some of the possible configurations of tuner elements for use in a multiband transceiver. It should be understood that these are representative, and other combinations of lumped or distributed circuits are possible, where the proper choice would depend on the type and structure of single antenna to be used, the electrical specifications and impedance matching/antenna port/isolation capabilities of the transmitter, receiver, or transceiver chips being used in the portable device, as well as cost, bill of materials, and the type of mounting to be used for the tuner circuitry. That is, an integrated circuit tuner might be more likely to pick adjustable capacitors over adjustable inductors in some instances.

Note in Figure 6a, b and c that there are optional RF switches, that may be implemented in integrated circuit form within the tuner circuitry, that can be controlled by the controller to position properly for either transmit or receive operation. The transmitter configuration would exploit the left side of each of the depicted tuners, with a path providing matching to the single antenna structure, where the right side of each depicted tuner would be used for matching provided on the receive path. The switch would be controlled by the controller, or by some other means, such as from a master controller of the wireless device, the transceiver chip, or some other logic that instructs the particular transmitter in the particular band to transmit. Alternatively, the switches could be controlled by RF sensing, whereby the presence of sufficient level of RF from the transmitter (transceiver) chip causes the switches at the top and the bottom of the depictions to throw properly.

The active (tuned) elements shown in Figure 6a, b, and c, suggest that one or more tuned elements may be used in a tuner as disclosed here. For example, one method would only use tunable capacitors, which are available from Paratek Microwave. Other embodiments would use both tunable capacitors and tunable inductors, and still others may use a combination of tunable and fixed elements in order to provide antenna tuning of a particular band to a single antenna while providing sufficient RF isolation/rejection of unwanted bands.

For simplicity, the controller signal in the circuitry shown in Figure 6a, b, and c is omitted, but it should be clear that such signaling capability exists. Other features have also been omitted, such as temperature sensors to determine proper electrical characteristics and calibration of the tuned elements, feedback circuitry (to sense proper VSWR, impedance, or acceptable power transfer, sufficient isolation), but these concepts are well understood by those skilled in the art.

It should also be clear that optimization algorithms that determine the values of multiband tuners so as to properly determine each of the active element positions could be performed by the controller as depicted in this invention disclosure. The optimization could use pre-set or memorized settings from recent or long term histories of proper tuning values, or could determine, on start up of the wireless device, appropriate values for the settings of each tuner elements. Such computation techniques, to determine a matrix of various values in a multidimensional problem, are well known and are varied. The use of memory to remember preset values for various use cases, and to store new or recent or past settings of tuner elements, in order to allow the invention to be used in a power efficient and reliable manner is contemplated here, although memory is not shown in the drawings. These techniques are well understood in the art.

In addition to the active tuned elements shown in Figure 6a, b, and c, it is possible to implement the invention using other frequency selective approaches, such as reasonably high-q passive circuits (with or without amplification), or using metamaterials or transmission line implementations which may be embedded within one or more semiconductor layers or substrates, or implemented in lumped element form, or through active and/or passive circuitry to provide the ability to provide either receiver or transmitter antenna tuning on multiple bands, as described above. Metamaterials are one way to create frequency selective surfaces and can provide good isolation, as described in the paper coauthored by L. Ragan, A. Hassibi, T. S. Rappaport, and C. L. Christianson, entitled "Novel On-Chip Antenna Structures and Frequency Selective Surface (FSS) Approaches for Millimeter Wave Devices," IEEE 66th Vehicular Technology Conference (VTC), Baltimore, MD, Oct. 1 -3, 2007, pp. 2051-2055, and as described in US patent publication 20080238801 by Lawrence Ragan, both of which are fully incorporated here by reference. Such frequency selective structures and implementations, depending upon

the particular implementation, may require amplifiers or may be of sufficiently low loss to obviate the need for amplifiers directly at the antenna tuner junction. The controller would cause various switches, devices, or series or parallel (or both) combinations of connections, or would otherwise support voltages or currents to be established in order to implement or select the desired tunability for these various possible implementations, it being understood that the controller could be designed to work in concert with various semiconductor properties, or with embedded, distributed or lumped circuitry within the RF stage or antenna interconnect stage, in order to affect the ability to use a single antenna on multiple bands.

As wireless devices begin to evolve to millimeter wave (mmWave) carrier frequencies at 60 GHz, and even to frequencies in the 77 to 500 GHz range, and even to Terahertz frequencies, the need to integrate the tuning and interconnection of a single antenna to RF circuitry will become even greater. System on a chip (Soc) implementations of the invention described here will be highly desirable so that a single integrated circuit, with an embedded antenna on the integrated circuit (chip) or package or on the case or circuit board of a consumer device (such as a PC, cellphone, television, vehicle, etc.) may be used for several different frequency bands, or for different portions of a massively wideband spectrum allocation. For example, 60 GHz devices may well work from 58 to 65 GHz, and it will be desirable to implement the current invention across different portions of that band (e.g. the same antenna may need to be tuned for the 58 - 60 GHz portion of the band for one particular application or instance, and the 62-64 GHz portion of the band for a different application or instance, or may also be used to tune to the 77 GHz band or 5.1 - 5.8 GHz band for operations, as well.). Ultrawideband repeaters, such as described in US patent application 10/919,515 to Rappaport, which is fully incorporated here by reference, could make use of this. It is understood that the controller may selectively switch, exit, or cause voltages or currents or switches to be activated in any particular implementation, and that the single antenna may itself be designed to have certain desirable properties or preferential frequency responses at certain different bands, but which are further improved and made to more efficiently transfer power (e.g. reduce the Voltage Standing Wave Ratio, increase efficiency, tune for improved SNR, decrease power or current drain, or improve some other power

transfer metric, all of which are examples of matching the antenna to the other circuitry including without limitation the transmitters, receivers, and transceivers) between the antenna and the transmitter and/or receiver through the disclosed invention.

It should be evident that the invention contemplated here, while described as a single antenna, may itself be implemented with other antennas or antenna elements or sub elements to form an antenna array, including for use in a MiMO system or beam switchable array, and that the disclosed invention with single antenna which may have one or more elements or antennas and which may be implemented in a lumped or distributed or passive or active or hybrid manner, and may be used in conjunction with other antennas in various switching, phasing, or active or passive combining techniques to form a larger or distributed antenna structure that also works over multiple frequencies. The invention extends to components such as the tuner and/or controller for implement the invention. For example, tuners or sets of tuners which are connectable or coupled to multiple transmitters, receivers, or transceivers for allowing the simultaneous transmission or reception at multiple frequency bands or the ability to use a single physical structure (e.g., an antenna) for transmission and reception of many different bands, or controllers or other circuitry for accomplishing the same form a part of this invention.

CLEAN COPY OF SPECIFICATION

CLEAN COPY SPECIFICATION

ACTIVE ANTENNAS FOR MULTIPLE BANDS IN
WIRELESS PORTABLE DEVICES

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to U.S. Provisional Application Serial No. 61/088,829, entitled “Single Active Antenna for Multiple Bands in Wireless Portable Devices” , filed August 14, 2008, and the complete contents thereof is incorporated by reference

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to wireless portable devices and particularly to improvements in transmitting and receiving electromagnetic signals at multiple frequency bands.

Background of the Invention

Today’s wireless devices, such as laptops and computers that connect wirelessly to the cellphone network or internet must use antennas to transmit and receive wireless energy to and from the device. Today’s cellphones and laptops typically require multiple antennas, each antenna designed for resonance or desired performance at a particular frequency band (such as cellular band, say in the 850 – 950 MHz band, the Bluetooth/WiFi band, say in the 2400 – 2490 MHz band, and so on). Computer makers and cellphone makers have difficulty with the mechanical design of their equipment, and spend a great deal of engineering time, research, and cost in manufacture for the bill of materials for the feedlines and connections between transmitter circuits, transceiver circuits, or receiver circuits and the antennas that are mounted or housed in the wireless device casing. In some cases, antennas must be oriented in the flip up top of a lap top,

placed behind or in the display screen, and tiny coaxial cables run through the case hinges, to the motherboard mounted below the keyboard. Similar problems exist with cellphones, and all devices generally must meet or exceed certain federal or wireless carrier-imposed requirements for radiation efficiency for a wide range of device orientations. It is envisioned that as wireless proliferates, cellphones and laptops will require more and more separate radio frequency bands in order to offer connectivity and competitive services. It is not inconceivable to eventually have wireless portable devices requiring 10 or more separate frequency bands, where the term “band” here means a particular wireless standard or service that is distinct from another. For example, standards such as IEEE 802.11a, 802.11b, 802.11g, 802.15a, 802.15.3.c, Cellular telephone (European, Asian, or US spectrum), Bluetooth, WiMax, PCS, all represent different bands, as they generally have different RF frequency band allocations assigned to them. In the future, RFID tags, vehicles, wireless post it notes, equipment, shipping containers, and even clothing may also suffer the issue of having to provide multiple antennas for different RF bands.

Today, there are many passive antennas solutions that have been published in the literature, such as, for example, the broadband planar antenna developed by Prof. Chen at The University of Texas. Using Fractal programming (genetic algorithms), it is possible to do computer simulations that eventually create an antenna design that offers resonance for several different frequency bands. Such antennas generally are developed by using field solver programs, where the field solver is set to optimize an antenna structure for a particular antenna performance over a specified range of frequencies (for example, the field solver may be set to find an antenna structure that has a low return loss, S_{11} , of less than -13dB over the range of frequencies of 2.4 – 2.9 GHz and 5.1 – 5.8 GHz, in order to accommodate Bluetooth and WiFi 802.11a, 802.11b, and 802.11g). However, planar antennas, when designed by an optimization program or set of algorithms, without the use of active antenna tuning, may result in a larger antenna than what is feasible for a small package (e.g. a small handset).

Recently, there have been some technical advances in active antenna tuning, some of which have been pioneered by Paratek Microwave in Nashua, NH. Using active lumped elements, such as tunable capacitors, it is possible to allow for the active tuning

of an antenna within a cellphone handset. Using electrically tunable capacitors, Paratek has pioneered a way to allow for active tuning of one or more cellphone antennas, as discussed in US patent 7,369,828.

In US patent 7,369,828 by Shamsaifar (owned by Paratek Microwave), the device can tune two different cellphone antennas for use on one of several bands of interest, where each distinct and separate antenna (one for high band and one for low band) has an active element that may be tuned. As described in U.S. Patent 7,369,829, a cellphone antenna is designed specifically for cellphone bands, since today's cellphones generally provide a small Bluetooth antenna, separate and apart from the cellular antenna. In U.S. Patent 7,369,829, there is described a method of transmitting and receiving RF signals from multiple frequency bands utilizing an electronically tunable multiple band antenna, comprising the steps of: providing a high band antenna with at least one voltage tunable varactor associated therewith, the high band antenna providing a first input to a controller; providing a low band antenna with at least one voltage tunable varactor associated therewith, the low band antenna providing a second input to the controller; and inputting control data to the controller and controlling a first bias voltage for biasing the at least one voltage tunable varactor associated with the high band antenna and a second bias voltage for biasing the at least one voltage tunable varactor associated with the low band antenna. By using a controller, the invention enables an antenna to be tuned.

The controller of the method in U.S. Patent 7,369,828 can use a DC voltage supply to provide the DC voltage needed to bias the voltage tunable varactors. The high band antenna of the method taught in U.S. Patent 7,369,828 can further comprise: a substrate; a patch element on the substrate; at least one voltage tunable varactor associated with the patch element; a DC bias point on the patch element; an RF input on the patch element; a temperature sensor; and a ground plane on one side of the substrate.

The low band antenna of the method taught in U.S. Patent 7,369,828 can further comprise: a substrate; a patch element on the substrate; at least one voltage tunable varactor associated with the patch element; a DC bias point on the patch element; an RF input on the patch element; a temperature sensor; and a ground plane on one side of the substrate.

In a more specific embodiment of a preferred method of U.S. Patent 7,369,829, the multiple band antenna is a quad band antenna and covers the following frequency bands and standards which only involve cellular telephone (cellular and PCS): 824-894 MHz; 880-960 MHz; 1710-1880 MHz; 1850-1990 Hz; GSM850; EGSM; GSM1800; and PCS 1900.

Paratek uses BST as a tunable dielectric material that may be used in a tunable dielectric capacitor. *Paratek Microwave*, Inc. has developed and continues to develop tunable dielectric materials that may be utilized in embodiments of the antenna tuners and tunable filters, and the tuners are not necessary limited to using BST material. This family of tunable dielectric materials may be referred to as Parascan by the company.

The term "Parascan" as used herein is a trademarked term indicating a tunable dielectric material developed by Paratek Microwave, the assignee of US patents 7,397,329 and 7,369,828, and the idea of tunable dielectric materials have been described in several patents. Barium strontium titanate ($\text{BaTiO}_3\text{-SrTiO}_3$), also referred to as BSTO, is used for its high dielectric constant (200-6,000) and large change in dielectric constant with applied voltage (25-75 percent with a field of 2 Volts/micron).

Tunable dielectric materials including barium strontium titanate are disclosed in U.S. Pat. No. 5,312,790 to Sengupta, et al. entitled "Ceramic Ferroelectric Material"; U.S. Pat. No. 5,427,988 by Sengupta, et al. entitled "Ceramic Ferroelectric Composite Material-BSTO-MgO"; U.S. Pat. No. 5,486,491 to Sengupta, et al. entitled "Ceramic Ferroelectric Composite Material-BSTO-ZrO₂"; U.S. Pat. No. 5,635,434 by Sengupta, et al. entitled "Ceramic Ferroelectric Composite Material-BSTO-Magnesium Based Compound"; U.S. Pat. No. 5,830,591 by Sengupta, et al. entitled "Multilayered Ferroelectric Composite Waveguides"; U.S. Pat. No. 5,846,893 by Sengupta, et al. entitled "Thin Film Ferroelectric Composites and Method of Making"; U.S. Pat. No. 5,766,697 by Sengupta, et al. entitled "Method of Making Thin Film Composites"; U.S. Pat. No. 5,693,429 by Sengupta, et al. entitled "Electronically Graded Multilayer Ferroelectric Composites"; U.S. Pat. No. 5,635,433 by Sengupta entitled "Ceramic Ferroelectric Composite Material BSTO-ZnO"; U.S. Pat. No. 6,074,971 by Chiu et al. entitled "Ceramic Ferroelectric Composite Materials with Enhanced Electronic Properties BSTO Mg Based Compound-Rare Earth Oxide". These patents are incorporated herein

by reference. The materials described in these patents, especially BSTO-MgO composites, show low dielectric loss and high tunability. Tunability is defined as the fractional change in the dielectric constant with applied voltage.

Using the idea of tunable capacitance, and following on the above listed prior art, Paratek Microwave has developed a technology called Adaptive Impedance Matching Models (AIMM) which it currently demonstrates on its website at worldwide web site paratek.com as able to adaptively tune antennas.

Agile Materials, a company founded in 1999 as a spinoff of University of California, Santa Barbara, has also developed tunable wireless components for multi-band systems. Agile has successfully commercialized its proprietary method to harness the unique properties of a thin-film ferroelectric capacitors, which may be tuned over at least an octave of frequency range. Agile employees produced patent 7,202,747, "Self Tuning Variable Impedance Circuit for Impedance Matching of Power amplifiers," as well a 7,012,483, "Tunable Bridge Circuit", both of which use a BST tunable capacitive material to affect a resonance change in a tuneable circuit.. All of the aforementioned is known from the public prior art of record.

SUMMARY

The current invention uses one or more antennas, at least one of which can be used by multiple transmitters or receivers in different bands, thereby greatly simplifying the antenna structures in a portable wireless device, and greatly reducing the mechanical design complexity, the cost of bill of materials, and the variance in manufacturing of different devices of a particular model.

The current invention exploits the idea of active antenna tuning, but expands it greatly in a non-obvious way by applying the concepts to the situation of where multiple band transmitters, receivers, or transceivers must be used simultaneously in a wireless portable device. In cellphones today, since telephone call need only be made on one band at a time (either on High Band Cellular or Low Band Cellular, or 3G band, but not more than one at a time), US Patent 7,369,829 and other prior art have not contemplated the present invention, which allows a single antenna to be used for simultaneous

transmission (or reception) for multiple bands. The present invention greatly simplifies the mechanical design and layout of wireless portable devices by allowing multiple transmitter (or receiver) bands to simultaneously use one or more antennas for simultaneous multi-purpose use.

This invention allows an antenna, such as a patch or metal fixture or other type of conductive or non/semi-conductive element or elements mounted on or within a mobile or portable device, to be simultaneously fed and used by multiple transmitters, receivers, or transceivers on different bands. It is understood that the terms portable and mobile may be used interchangeably. The invention has application with all wireless devices whether mobile, portable or fixed. This invention exploits active tuning and matching for each of the feedlines to antennas, or may use a single antenna feedline to match a single or multiple antennas from multiple devices, using tunable technologies developed by Paratek Microwave, Agile, or others, as well as techniques described below, or by using signal processing in the RF or IF domains, as well.

DESCRIPTION OF THE DRAWINGS

Figure 1 shows today's typical cellphone or laptop design, where different transceivers are connected to different antennas.

Figure 2 shows an embodiment of the present invention, where multiple transmitters are fed to a single antenna (it is understood that transmitters could also be transceivers, or receivers).

Figure 3 shows a more detailed embodiment of the present invention, where multiple transmitters may be fed to a single antenna using multiple feedlines and active antenna tuners, controlled by a controller, operates on the RF of each signal. (it is understood that transmitters could also be transceivers, or receivers).

Figure 4 shows another embodiment of the present invention, where multiple transmitters may be fed to a single antenna using a single feedline and a single active antenna tuner which is controlled by a controller.

Figure 5 shows yet another alternate embodiment of the present invention, where a multiband tuner provides matching from a single multiband transmitter (or transceiver or receiver) feedline (e.g. a single RF source) to a single multi-use multi-band antenna

Figures 6A, B, and C illustrates some of the possible examples and configurations of tuning elements and circuits used within a tuner, with active elements, or in a multiband transceiver.

DETAILED DESCRIPTION

Shown in Figure 1 is an example of how cellphones or laptops or other wireless devices 10 are designed today. In general, different band transceivers (e.g., GSM cellular transceiver 12, Bluetooth transceiver 14, and ultrawideband transceiver 16) are connected to different antennas (e.g., cellular antenna 20, Bluetooth antenna 22, and UWB antenna 24) that must be affixed to, located within the packaging of the device, or included in the printed circuit boards of the device, thereby taking up space, feedline resources (e.g., feedlines 26), increasing the bill of materials, and adding complexity.

Figure 2 illustrates the basic idea of the present invention which can be implemented in fixed or mobile wireless devices 10 such as computers, telephones, portable computing or communication devices, games, wireless post it notes, wireless memory media, personal data assistants and navigation assistants. One potential application of the invention is in the IEEE 802.11ad standard, where very high throughput wireless devices (e.g., 60 GHz carrier transmissions) may use one or more transmitters, receivers or transceivers to simultaneously provide capabilities in the existing 802.11a and 802.11b bands of 2.4 GHz and 5.8 GHz, as well as the 60 GHz spectrum. Instead of requiring different antennas for the different RF bands, the present invention allows for the use of a single antenna 28 for multiple bands (or multiple antennas, at least one of which can be used for multiple bands). By providing the ability to use just a single antenna 28, the problem of mounting, locating, and feeding the antenna can be greatly reduced, so long as a desired antenna efficiency can be maintained for all bands of interest.

Figure 3 shows how the antenna efficiency can be maintained. By using individual RF tuners 30, 32, and 34, that may be based on Paratek's or Agile's technology, or any other active tuning method, such as Microelectrical Mechanical Systems (MEMS), or variable mechanical resonator technologies, or other active or passive methods known now or in the future, it becomes possible to provide a good impedance match for each of the transceivers 36, 38 and 40 shown in Figure 3. The key to proper operation is to also, while providing good matching, provide sufficient RF isolation so that the transmitters in other bands do not overload the front end receiver of a band that is receiving. Fortunately, RF filtering and overload protection is improving in commercially available wireless transceivers in various popular bands, so that overload protection may be offered within the wireless transceiver chip itself through the integrated circuitry. Where more isolation is required, the tuner for a particular band is adjusted to offer very high impedance S22 characteristics at the other bands that differ from the dedicated band of the tuner, so that there is little, if any energy returned to the desired transceiver (or transmitter, or receiver) of the particular band of the tuner. In addition, low cost LC circuits may be etched into and/or added on the circuit board during manufacture or otherwise made a part of the tuner circuitry in order to create an RF Trap for the other bands, at much less cost and reduced engineering than having to use separate antennas for each band.

Furthermore, it is possible to use band transceivers that offer different antenna ports for the transmitter and the receiver within a particular band, whereby the present invention is simply extended to where there are two antennas used – one that is used solely for transmission by the multiple bands, and another multiband shared antenna for the receiver that is located a sufficient distance away within the casing, or which uses polarization diversity, or uses shielding or distributed antenna ideas within the case in order to reduce the RF overload from the transmitting antenna. The receiving antenna, for instance, might be mounted on the other side of the printed circuit board for the cellphone, or laptop, or RFID tag, or wireless post-it, or might be pitched at right angles in the casing, etc. It is also possible to use buffer amplifiers, tuned amplifiers, as well as tuned trap circuits for particular offending bands, that can act as filters to prevent RF from other multi-user band transmitters from leaking into the receiver portion of a

particular band. Also, RF antenna switches, may be made inexpensively in an integrated circuit process in CMOS, GaAs, or other well known semiconductor technologies known now or the future. These capabilities which may be incorporated in the tuner as described below. It should be clear in this disclosure that the term “antenna” is not meant to be limiting to any particular structure, but rather is meant to represent all of the possible ways that a wireless portable device may allow for radiation and reception of electromagnetic energy from particular frequency bands of interest.

Figure 3 also shows a tuner controller 42, preferably digital in nature and which may be part of a computer or microprocessor circuit that also controls one or more of the transceivers (or transmitters or receivers) shown in the figure. The controller 42 provides the proper voltages, or more preferably, the digital control values that are used by the tuner in order to adjust the active elements of the tuner (e.g. the tunable capacitors, inductors, amplifiers, and to toggle switches). The digital decoding circuitry in the tuner is not shown here, but is known to be implemented in a number of ways using standard serial or parallel digital busses that interconnect integrated circuits within cellphones and laptops. Furthermore, the controller receives feedback from the tuner, or from other circuitry (not shown) with respect to VSWR, power, and proper functionality so that the controller may properly adjust, alter, initiate, and end its use of control signals (either voltages or data values sent over a serial data line or a bus) to the tuner. In the case of the tuner receiving digital signals from the controller, it is understood that the tuner would have its own processing that would allow for the digital interpretation of control signals such as to properly determine the necessary analog voltages or other signal adjustments needed to perform impedance tuning through adjustment of the active tunable elements of the tuner, so that it would be possible to sequentially or simultaneously tune one or more of the tuners so that multiple bands may simultaneously transmit (or receive, or both) using the single antenna structure shown in the figure. The controller may be part of the overall portable device computing logic or controlling circuitry, or may be integrated within one or more of a particular band or multiband transceiver, transmitter, or receiver. The controller may be distributed within the portable device, and may even be responsive to over the air signaling that is received by one or more of the transceivers. The controller would have awareness of when particular bands were to be transmitting, receiving, or in

the idle/off mode, so that it could properly control the active elements, and even provide power on/off/sleep instructions to the circuitry within the tuner. Note that nothing here is meant to be limiting in how the controller might be used, as it is conceivable that it could be included in the circuitry of the tuner, or the tuner and controller ideas contemplated here all could be integrated within a single multiband transceiver chip, such as is shown in Figure 4.

Figure 4 shows an alternate embodiment, where the progress in IC design for wireless multiband, multi-mode circuits is contemplated. Indeed, today it is possible to purchase multi-band transceiver chips for popular wireless standards where different antenna ports are provided for various RF output bands. Figure 4 illustrates the use of a combined multiband transceiver 44 which may include, for example, GSM, Bluetooth, UWB, WiMAX all on one chip—eventually software designed radio be a part of the chip). The present idea, shown in Figure 4, using a single RF feedline to a single multiband active controller, would provide an advantage to the wireless industry through simplicity and reduced feedlines, reduced size and weight, and more flexibility in locating the antenna. The multiband tuner 46 would require greater complexity than as shown in Figure 3, as it would require the ability to simultaneously pass desired RF signals at proper low (generally 50 ohm or thereabouts) impedance for each of the bands that are being used, while providing very high impedance to other bands. The tuner is adjusted by the controller in order to indicate when a particular transmitter on a particular band is in the transmit mode or in the receive mode, or, alternatively, the tuner could simply offer matching capabilities to a transmitter to the antenna without consideration for the receiver (for the case where the receiver would be connected to a different antenna). The circuitry of the tuner is described in more detail below, and can exploit buffer amplifiers or tuned RF amplifiers at various RF frequencies to provide isolation, as well as antenna switching, all contained within the tuner, making it possible to create a low cost, high performance antenna tuner chip for the present application. An optional RF switch allows separate transmitter path and receiver path tuning for each of the bands at use. This concept may be included within a single band tuner element for the present invention.

Figure 5 illustrates a more detailed example of the active and passive circuitry of the present invention. To provide a single feedline to a single antenna, the tuner 46 requires controller circuitry that provides instructions as to how the particular active devices may be adjusted. In this case, the term active indicates that RF tuning is possible, such as in the case of tunable capacitors or tunable inductors. Figure 5 shows an example, not in any way meant to be limiting to the type of impedance matching circuits 48 contemplated here, where the capacitors of each of three parallel band tuners are able to be tuned. Tuning methods for capacitors are well known, such as taught in the prior art patents by Paratek, and by researchers throughout the world. Similarly, it is possible to tune inductances, as well. Furthermore, shown in Figure 5, it is noted that RF amplifiers, that may be used to either offer matching impedance at the input (say 50 ohms) and particular desired impedance at the output feedline to the antenna, is shown. It should be clear that RF amplifiers, as shown in Figure 5 and 6, may either be strict buffer amplifiers with a very high output impedance, or alternatively, may be active devices that have a controlled impedance that is adjusted in tandem with the tuned circuit elements shown in the figures. Figure 5 represents an example of how multiband transmitted signals may be applied to a single multiband tuner. The input signals are split and routed to each of the respective tuner circuits, and may use a Wilkinson or simple ohmic splitter, which may be implemented either on a printed circuit board substrate or within an integrated circuit. It is clear to one skilled in the art that tuner circuits and feedlines may be implemented in a myriad of ways depending on the particular physical structure of the circuitry. For example, coplanar waveguides or microstrip lines may be used in integrated circuits or circuit boards, and splitters, combiners, couplers, mixers, and switches may be fabricated to realize the invention using well understood techniques such as taught in D. Pozar's books Microwave Engineering, copyright 2004, and Microwave and RF Design of Wireless Systems, copyright 2000 which are hereby incorporated by reference, and as presented at various IEEE conferences on antennas, microwave theories, and circuits. While techniques for building both active and passive circuits are taught at various conferences, the use of such technology for the present invention has not been heretofore contemplated. It is well understood that a wide range of active and passive components,

either lumped or distributed, may be combined with various transmission line and active and passive signal coupling techniques to implement the invention.

Figure 6a, b, and c illustrate some of the possible configurations of tuner elements for use in a multiband transceiver. It should be understood that these are representative, and other combinations of lumped or distributed circuits are possible, where the proper choice would depend on the type and structure of single antenna to be used, the electrical specifications and impedance matching/antenna port/isolation capabilities of the transmitter, receiver, or transceiver chips being used in the portable device, as well as cost, bill of materials, and the type of mounting to be used for the tuner circuitry. That is, an integrated circuit tuner might be more likely to pick adjustable capacitors over adjustable inductors in some instances.

Note in Figure 6a, b and c that there are optional RF switches, that may be implemented in integrated circuit form within the tuner circuitry, that can be controlled by the controller to position properly for either transmit or receive operation. The transmitter configuration would exploit the left side of each of the depicted tuners, with a path providing matching to the single antenna structure, where the right side of each depicted tuner would be used for matching provided on the receive path. The switch would be controlled by the controller, or by some other means, such as from a master controller of the wireless device, the transceiver chip, or some other logic that instructs the particular transmitter in the particular band to transmit. Alternatively, the switches could be controlled by RF sensing, whereby the presence of sufficient level of RF from the transmitter (transceiver) chip causes the switches at the top and the bottom of the depictions to throw properly.

The active (tuned) elements shown in Figure 6a, b, and c, suggest that one or more tuned elements may be used in a tuner as disclosed here. For example, one method would only use tunable capacitors, which are available from Paratek Microwave. Other embodiments would use both tunable capacitors and tunable inductors, and still others may use a combination of tunable and fixed elements in order to provide antenna tuning of a particular band to a single antenna while providing sufficient RF isolation/rejection of unwanted bands.

For simplicity, the controller signal in the circuitry shown in Figure 6a, b, and c is omitted, but it should be clear that such signaling capability exists. Other features have also been omitted, such as temperature sensors to determine proper electrical characteristics and calibration of the tuned elements, feedback circuitry (to sense proper VSWR, impedance, or acceptable power transfer, sufficient isolation), but these concepts are well understood by those skilled in the art.

It should also be clear that optimization algorithms that determine the values of multiband tuners so as to properly determine each of the active element positions could be performed by the controller as depicted in this invention disclosure. The optimization could use pre-set or memorized settings from recent or long term histories of proper tuning values, or could determine, on start up of the wireless device, appropriate values for the settings of each tuner elements. Such computation techniques, to determine a matrix of various values in a multidimensional problem, are well known and are varied. The use of memory to remember preset values for various use cases, and to store new or recent or past settings of tuner elements, in order to allow the invention to be used in a power efficient and reliable manner is contemplated here, although memory is not shown in the drawings. These techniques are well understood in the art.

In addition to the active tuned elements shown in Figure 6a, b, and c, it is possible to implement the invention using other frequency selective approaches, such as reasonably high-q passive circuits (with or without amplification), or using metamaterials or transmission line implementations which may be embedded within one or more semiconductor layers or substrates, or implemented in lumped element form, or through active and/or passive circuitry to provide the ability to provide either receiver or transmitter antenna tuning on multiple bands, as described above. Metamaterials are one way to create frequency selective surfaces and can provide good isolation, as described in the paper coauthored by L. Ragan, A. Hassibi, T. S. Rappaport, and C. L. Christianson, entitled "Novel On-Chip Antenna Structures and Frequency Selective Surface (FSS) Approaches for Millimeter Wave Devices," IEEE 66th Vehicular Technology Conference (VTC), Baltimore, MD, Oct. 1 -3, 2007, pp. 2051-2055, and as described in US patent publication 20080238801 by Lawrence Ragan, both of which are fully incorporated here by reference. Such frequency selective structures and implementations, depending upon

the particular implementation, may require amplifiers or may be of sufficiently low loss to obviate the need for amplifiers directly at the antenna tuner junction. The controller would cause various switches, devices, or series or parallel (or both) combinations of connections, or would otherwise support voltages or currents to be established in order to implement or select the desired tunability for these various possible implementations, it being understood that the controller could be designed to work in concert with various semiconductor properties, or with embedded, distributed or lumped circuitry within the RF stage or antenna interconnect stage, in order to affect the ability to use a single antenna on multiple bands.

As wireless devices begin to evolve to millimeter wave (mmWave) carrier frequencies at 60 GHz, and even to frequencies in the 77 to 500 GHz range, and even to Terahertz frequencies, the need to integrate the tuning and interconnection of a single antenna to RF circuitry will become even greater. System on a chip (Soc) implementations of the invention described here will be highly desirable so that a single integrated circuit, with an embedded antenna on the integrated circuit (chip) or package or on the case or circuit board of a consumer device (such as a PC, cellphone, television, vehicle, etc.) may be used for several different frequency bands, or for different portions of a massively wideband spectrum allocation. For example, 60 GHz devices may well work from 58 to 65 GHz, and it will be desirable to implement the current invention across different portions of that band (e.g. the same antenna may need to be tuned for the 58 - 60 GHz portion of the band for one particular application or instance, and the 62-64 GHz portion of the band for a different application or instance, or may also be used to tune to the 77 GHz band or 5.1 - 5.8 GHz band for operations, as well.). Ultrawideband repeaters, such as described in US patent application 10/919,515 to Rappaport, which is fully incorporated here by reference, could make use of this. It is understood that the controller may selectively switch, exit, or cause voltages or currents or switches to be activated in any particular implementation, and that the single antenna may itself be designed to have certain desirable properties or preferential frequency responses at certain different bands, but which are further improved and made to more efficiently transfer power (e.g. reduce the Voltage Standing Wave Ratio, increase efficiency, tune for improved SNR, decrease power or current drain, or improve some other power

transfer metric, all of which are examples of matching the antenna to the other circuitry including without limitation the transmitters, receivers, and transceivers) between the antenna and the transmitter and/or receiver through the disclosed invention.

It should be evident that the invention contemplated here, while described as a single antenna, may itself be implemented with other antennas or antenna elements or sub elements to form an antenna array, including for use in a MiMO system or beam switchable array, and that the disclosed invention with single antenna which may have one or more elements or antennas and which may be implemented in a lumped or distributed or passive or active or hybrid manner, and may be used in conjunction with other antennas in various switching, phasing, or active or passive combining techniques to form a larger or distributed antenna structure that also works over multiple frequencies. The invention extends to components such as the tuner and/or controller for implement the invention. For example, tuners or sets of tuners which are connectable or coupled to multiple transmitters, receivers, or transceivers for allowing the simultaneous transmission or reception at multiple frequency bands or the ability to use a single physical structure (e.g., an antenna) for transmission and reception of many different bands, or controllers or other circuitry for accomplishing the same form a part of this invention.

DRAWING AS FILED WITH APPLICATION

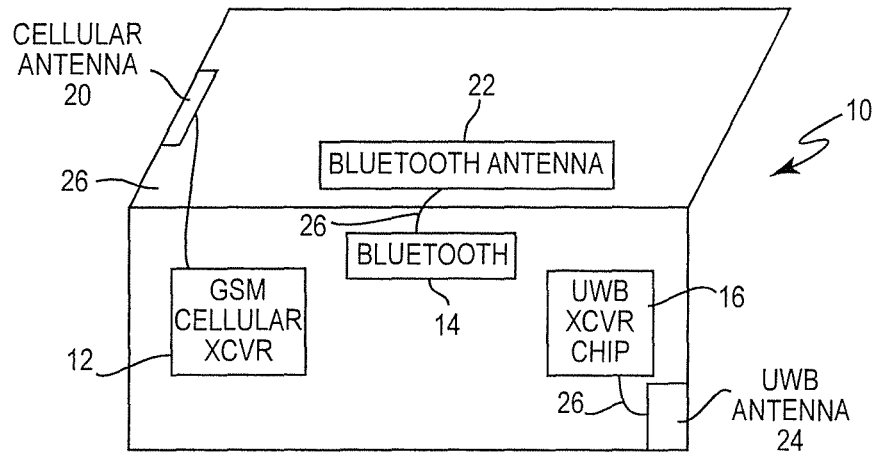


Figure 1

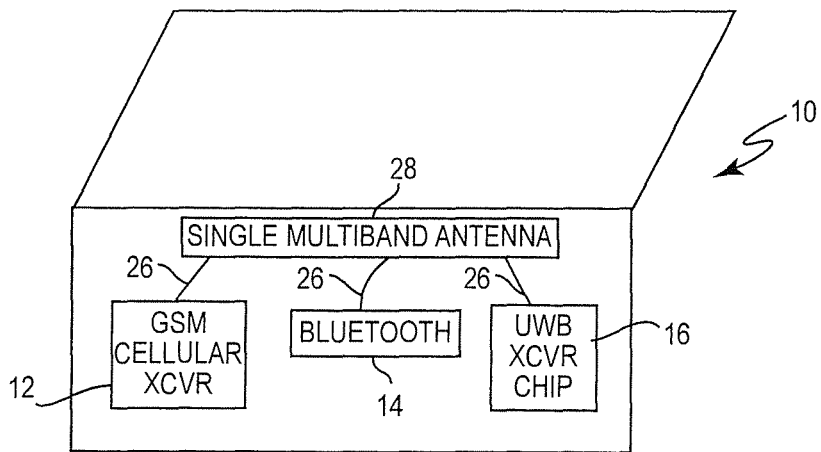


Figure 2

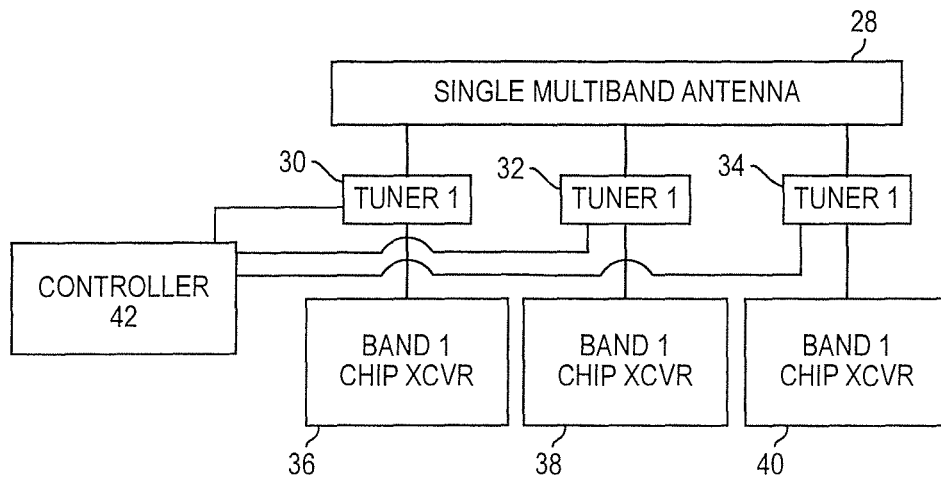


Figure 3

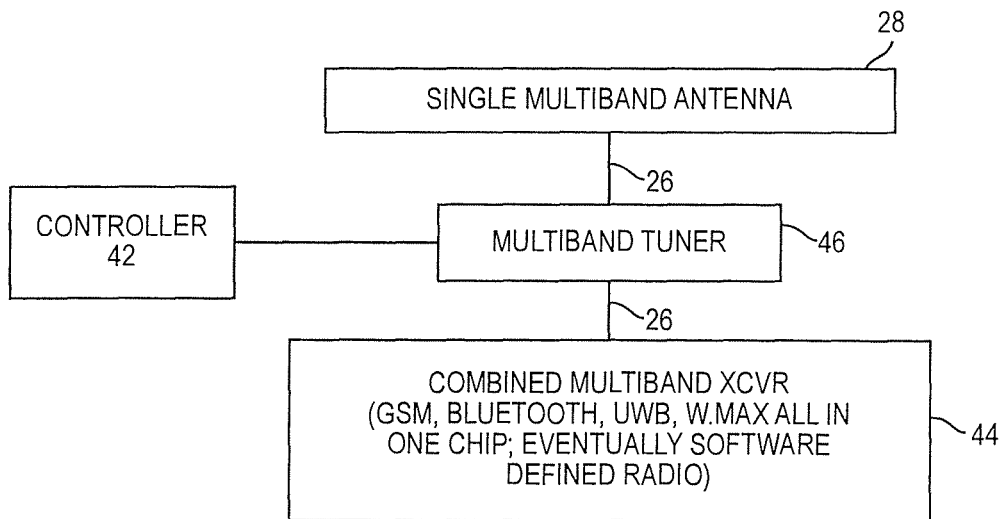


Figure 4

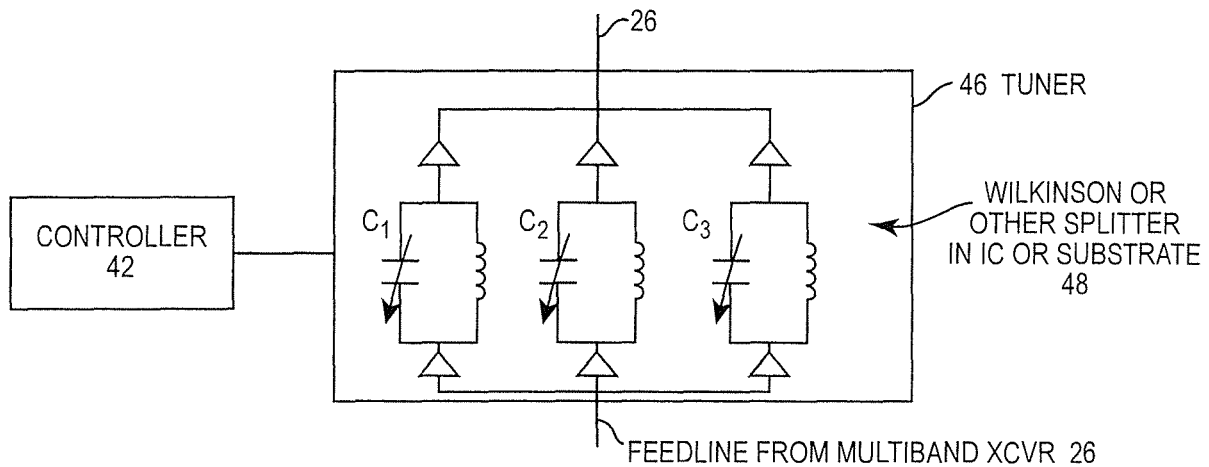


Figure 5

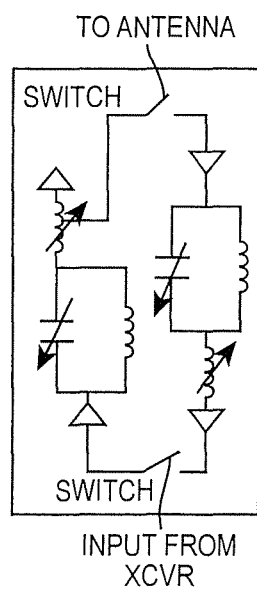


Figure 6A

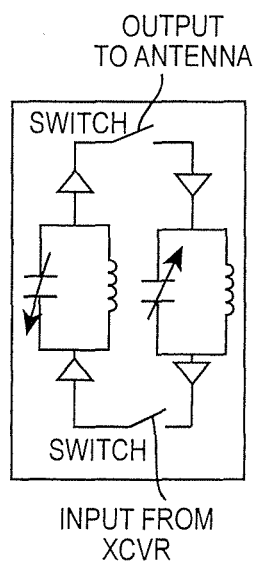


Figure 6B

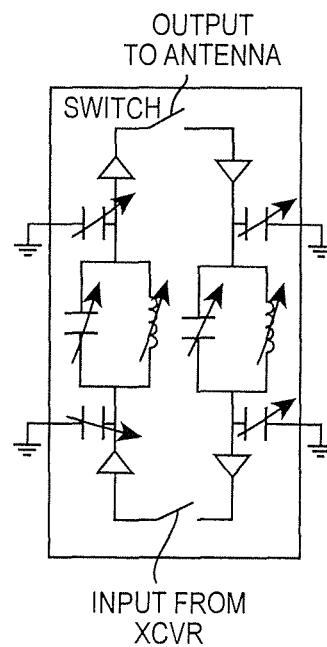


Figure 6C

Electronic Acknowledgement Receipt

EFS ID:	14961140
Application Number:	13713804
International Application Number:	
Confirmation Number:	2671
Title of Invention:	Active Antennas for Multiple Bands in Wireless Portable Devices
First Named Inventor/Applicant Name:	Theodore S. Rappaport
Customer Number:	30743
Filer:	Michael E. Whitham/karen lumpkins
Filer Authorized By:	Michael E. Whitham
Attorney Docket Number:	08610010CA
Receipt Date:	14-FEB-2013
Filing Date:	13-DEC-2012
Time Stamp:	14:55:54
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	Request for Corrected Filing Receipt	08610010CA-resq_corr_ofr.PDF	219008 a956b6762841f489a45054394e7db0edbc5f5426	no	9

Warnings:

Information:

2	Applicant Response to Pre-Exam Formalities Notice	08610010CA-resp_corr_appln. PDF	487760 d5b53e03c2c9015f4aefb6d47ec992fa7857db0c	no	40
Warnings:					
Information:					
Total Files Size (in bytes):				706768	
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. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

IN THE U.S. PATENT AND TRADEMARK OFFICE

In re Application of:

T. S. Rappaport

Confirmation No.: 2671

Ser. No. 13/713,804

Group Art Unit: 2821

Filed: Dec. 13, 2012

Examiner: unknown

For: Active Antennas for Multiple Bands in Wireless Portable Devices

REQUEST FOR CORRECTED FILING RECEIPT

Commissioner of Patents

P.O. Box 1450

Alexandria, VA 22313-1450

Sir:

Attached is a copy of the Official Filing Receipt in which the residence is incorrect. Please delete "New York, NY and insert -- Riner, VA --. A copy of the filing receipt with correction is attached along with an updated ADS. Please forward to the undersigned a Corrected Filing Receipt.

If any fees are due by the filing of this paper, please charge Deposit Account 50-2041.

Respectfully submitted,



Michael E. Whitham/Reg. No. 32,635

Date: 2/14/13

Whitham, Curtis & Christofferson, PC

11491 Sunset Hills Road - #340

Reston, VA 20190

703/787-9400

Customer No. 30743



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
13/713,804	12/13/2012	2821	1249	08610010CA	31	6

CONFIRMATION NO. 2671

FILING RECEIPT

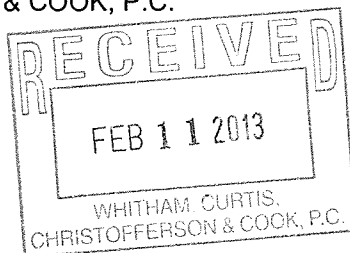
30743

WHITHAM, CURTIS & CHRISTOFFERSON & COOK, P.C.

11491 SUNSET HILLS ROAD

SUITE 340

RESTON, VA 20190



Date Mailed: 02/08/2013

COPY

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)

Theodore S. Rappaport, ~~New York, NY~~, *Riner, VA*

Applicant(s)

Theodore S. Rappaport, ~~New York, NY~~, *Riner, VA*

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 12/541,764 08/14/2009 PAT 8350763 *
which claims benefit of 61/088,829 08/14/2008

(*)Data provided by applicant is not consistent with PTO records.

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.

Permission to Access - A proper **Authorization to Permit Access to Application by Participating Offices** (PTO/SB/39 or its equivalent) has been received by the USPTO.

If Required, Foreign Filing License Granted: 02/04/2013

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/713,804**

Projected Publication Date: To Be Determined - pending completion of Corrected Papers

Non-Publication Request: No

Early Publication Request: No

COPY

**** SMALL ENTITY ****

Title

Active Antennas for Multiple Bands in Wireless Portable Devices

Preliminary Class

343

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

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

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

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

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

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

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

COPY

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

COPY

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 Assets Control, 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.

COPY

UPDATED ADS

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.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	08610010CA	
		Application Number		
Title of Invention	Active Antennas for Multiple Bands in Wireless Portable Devices			
The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.				

Secrecy Order 37 CFR 5.2

☐	Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)
--------------------------	---

Inventor Information:

Inventor 1 Remove				
Legal Name				
Prefix	Given Name	Middle Name	Family Name	Suffix
	Theodore	S.	Rappaport	
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service				
City	Riner	State/Province	VA	Country of Residence US
Mailing Address of Inventor:				
Address 1		P.O. Box 888		
Address 2				
City	Riner	State/Province	VA	
Postal Code	24149	Country	US	
All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the Add button. Add				

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).	
☐ An Address is being provided for the correspondence information of this application.	
Customer Number	30743
Email Address	 Add Email Remove Email

Application Information:

Title of the Invention	Active Antennas for Multiple Bands in Wireless Portable Devices		
Attorney Docket Number	08610010CA	Small Entity Status Claimed ☒	
Application Type	Nonprovisional		
Subject Matter	Utility		
Suggested Class (if any)		Sub Class (if any)	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	3	Suggested Filing Date: 10/2/2012, Page 93 of 155	

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	08610010CA
		Application Number	
Title of Invention	Active Antennas for Multiple Bands in Wireless Portable Devices		

Publication Information:

☐	Request Early Publication (Fee required at time of Request 37 CFR 1.219)
☐	Request Not to Publish. I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application has not and will not be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.			
Please Select One:	☒ Customer Number	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number	30743		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.			
Prior Application Status	Pending	Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	Continuation of	12541764	2009-08-14
Prior Application Status	Expired	Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
12541764	non provisional of	61088829	2008-08-14
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.			

Foreign Priority Information:

This section allows for the applicant to claim benefit of foreign priority and to identify any prior foreign application for which priority is not claimed. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(a).			
Remove			
Application Number	Country ¹	Filing Date (YYYY-MM-DD)	Priority Claimed
			☒ Yes ☐ No
Additional Foreign Priority Data may be generated within this form by selecting the Add button.			

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	08610010CA
		Application Number	
Title of Invention	Active Antennas for Multiple Bands in Wireless Portable Devices		

Authorization to Permit Access:

☒ Authorization to Permit Access to the Instant Application by the Participating Offices
If checked, the undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the instant patent application is filed access to the instant patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the instant patent application is filed to have access to the instant patent application. In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the instant patent application with respect to: 1) the instant patent application-as-filed; 2) any foreign application to which the instant patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the instant patent application; and 3) any U.S. application-as-filed from which benefit is sought in the instant patent application. In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing this Authorization.

Applicant Information:

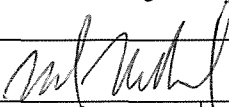
Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.				
Applicant 1				
If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.				
☐ Assignee		☐ Legal Representative under 35 U.S.C. 117		
☐ Person to whom the inventor is obligated to assign.		☐ Person who shows sufficient proprietary interest		
If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:				
Name of the Deceased or Legally Incapacitated Inventor :				
If the Assignee is an Organization check here. ☐				
Prefix	Given Name	Middle Name	Family Name	Suffix

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.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	08610010CA
		Application Number	
Title of Invention	Active Antennas for Multiple Bands in Wireless Portable Devices		

Mailing Address Information:			
Address 1			
Address 2			
City		State/Province	
Country		Postal Code	
Phone Number		Fax Number	
Email Address			
Additional Applicant Data may be generated within this form by selecting the Add button.			

Signature:

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications					
Signature				Date (YYYY-MM-DD)	2013-2-14
First Name	Michael E.	Last Name	Whitham	Registration Number	32635
Additional Signature may be generated within this form by selecting the Add button.					

This collection of information is required by 37 CFR 1.76. 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 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet 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.**



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
13/713,804	12/13/2012	Theodore S. Rappaport	08610010CA

CONFIRMATION NO. 2671

FORMALITIES LETTER



30743
WHITHAM, CURTIS & CHRISTOFFERSON & COOK, P.C.
11491 SUNSET HILLS ROAD
SUITE 340
RESTON, VA 20190

Date Mailed: 02/08/2013

NOTICE TO FILE CORRECTED APPLICATION PAPERS

Filing Date Granted

An application number and filing date have been accorded to this application. The application is informal since it does not comply with the regulations for the reason(s) indicated below. Applicant is given TWO MONTHS from the date of this Notice within which to correct the informalities indicated below. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

The required item(s) identified below must be timely submitted to avoid abandonment:

- A substitute specification in compliance with 37 CFR 1.52, 1.121(b)(3), and 1.125, is required. The substitute specification must be submitted with markings and be accompanied by a clean version (without markings) as set forth in 37 CFR 1.125(c) and a statement that the substitute specification contains no new matter (see 37 CFR 1.125(b)). The specification, claims, and/or abstract page(s) submitted is not acceptable and cannot be scanned or properly stored because:
 - The application contains drawings, but the specification does not contain a brief description of the several views of the drawings as required by 37 CFR 1.74 and 37 CFR 1.77(b)(7).
- Replacement drawings in compliance with 37 CFR 1.84 and 37 CFR 1.121(d) are required. The drawings submitted are not acceptable because:
 - More than one figure is present and each figure is not labeled "Fig." with a consecutive Arabic numeral (1, 2, etc.) or an Arabic numeral and capital letter in the English alphabet (A, B, etc.)(see 37 CFR 1.84(u)(1)). See Figure(s) 6. A brief description of the several views of the drawings (see 37 CFR 1.74) should be added or amended to correspond to the corrected numbering of the figures. See also 37 CFR 1.77(b)(7).

Applicant is cautioned that correction of the above items may cause the specification and drawings page count to exceed 100 pages. If the specification and drawings exceed 100 pages, applicant will need to submit the required application size fee.

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

Replies should be mailed to:

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.

<https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html>

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at <http://www.uspto.gov/ebc>.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

/bnguyen/

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

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 13/713,804				
APPLICATION AS FILED - PART I										
(Column 1)		(Column 2)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY				
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)			
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	98		N/A				
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A	310		N/A				
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	125		N/A				
TOTAL CLAIMS (37 CFR 1.16(j))	31 minus 20 =	*	x 31 =	11	341					
INDEPENDENT CLAIMS (37 CFR 1.16(h))	6 minus 3 =	*	x 125 =	3	375					
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			0.00						
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00						
			TOTAL	1249		TOTAL				
* If the difference in column 1 is less than zero, enter "0" in column 2.										
APPLICATION AS AMENDED - PART II										
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY		
AMENDMENT A		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))							OR		
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY		
AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))							OR		
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.										



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
13/713,804	12/13/2012	2821	1249	08610010CA	31	6

CONFIRMATION NO. 2671

30743

WHITHAM, CURTIS & CHRISTOFFERSON & COOK, P.C.
11491 SUNSET HILLS ROAD
SUITE 340
RESTON, VA 20190

FILING RECEIPT



OC000000059080175

Date Mailed: 02/08/2013

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)

Theodore S. Rappaport, New York, NY;

Applicant(s)

Theodore S. Rappaport, New York, NY;

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 12/541,764 08/14/2009 PAT 8350763 *
which claims benefit of 61/088,829 08/14/2008

(*)Data provided by applicant is not consistent with PTO records.

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.

Permission to Access - A proper **Authorization to Permit Access to Application by Participating Offices** (PTO/SB/39 or its equivalent) has been received by the USPTO.

If Required, Foreign Filing License Granted: 02/04/2013

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/713,804**

Projected Publication Date: To Be Determined - pending completion of Corrected Papers

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

Active Antennas for Multiple Bands in Wireless Portable Devices

Preliminary Class

343

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

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

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

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

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

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

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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 Assets Control, 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.

Utility Patent Application Transmittal

Docket Number

08610010CA

Address To
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

First Named Inventor

Name	Theodore S. Rappaport		
Mailing Address			
City		State	
Country		Postal Code	
City of Residence		State of Residence	
Country of Residence		Citizenship	

Title of Invention

Active Antennas for Multiple Bands in Wireless Portable Devices

Assignee Information*

Name			
Company			
Address			
City		State	
Country		Postal Code	

*Complete this section if applicant wants the patent application publication to include assignee information. Providing this information does not substitute for compliance with any requirement of Part 3 of 37 CFR to have an assignment recorded by the Patent Office.

Application Elements

See MPEP chapter 600 concerning utility patent application contents.

- | | |
|---|---|
| <p>1. ☒ USPTO Filing Fee (as calculated <i>infra</i>)</p> <p>2. ☒ Applicant claims small entity status
See 37 CFR 1.27</p> <p>3. ☒ Specification
Total number of pages <u>20</u>
Both the claims and abstract must start on a new page
(For information on the preferred arrangement, see MPEP 608.01(a))</p> <p>4. ☒ Drawing(s) (35 U.S.C. 113)
Total number of sheets <u>3</u></p> <p>5. ☒ Oath or Declaration
a. ☒ Newly executed (original or copy), or ☐ Unexecuted
b. ☐ A copy from a prior application (37 CFR 1.63(d))
(for Continuation or Divisional Application)
i. ☐ DELETION OF INVENTOR(S)
Signed statement attached deleting inventor(s)
named in the prior application (see 37 CFR
1.63(d) and 1.33(b).)</p> | <p>6. ☐ Application Data Sheet (37 CFR 1.76)</p> <p>7. ☐ CD-ROM or CD-R in duplicate, large table or
Computer Program (<i>Appendix</i>)
☐ Landscape Table on CD</p> <p>8. ☐ Nucleotide and/or Amino Acid Sequence Submission
(if applicable, items a. - c. are required)
a. ☐ Computer Readable Form (CRF)
b. Specification Sequence listing on:
i. ☐ CD-ROM or CD-R (2 copies), or
ii. ☐ Paper
c. ☐ Statements verifying identity of above copies</p> |
|---|---|

Utility Patent Application Transmittal

Docket Number

08610010CA

Accompanying Application Parts

9. ☐ Assignment
a. ☐ Recordation Form Cover Sheet
10. ☐ 37 CFR 3.73(b) Statement (when there is an assignee)
11. ☐ Power of Attorney ☐ No Power of Attorney
12. ☐ English Translation Document (if applicable)
13. ☒ Information Disclosure Statement
a. ☐ Copies of citations attached
14. ☒ Preliminary Amendment
15. ☐ Return Receipt Postcard (MPEP 503)
(Should be specifically itemized)
16. ☐ Certified Copy of Priority Document(s)
(if foreign priority is claimed)
17. ☐ Nonpublication Request under 35 USC 122(b)(2)(B)(i)

18. ☐ Certificate of Mailing
a. ☐ First Class Mail, or
b. ☐ Express Mail
Label Number _____

19. ☐ Other:

20. If a **CONTINUING APPLICATION**, check appropriate box, and supply the requisite information below and in the first sentence of the specification following the title, or in an Application Data Sheet under 37 CFR 1.76:

☒ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No. 12/541,764
(XX/YYY,YYY)

Prior application information: Examiner Phan, T. G. Art Unit: 2821

Request Not To Publish*

21. ☐ Applicant hereby requests that the attached application not be published under 35 U.S.C. 122(b).

Applicant hereby certifies that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

*Warning

This request must be signed in compliance with 37 CFR 1.33(b) and submitted with the application upon filing.

Applicant may rescind this nonpublication request at any time. If applicant rescinds a request that an application not be published under 35 U.S.C. 122(b), the application will be scheduled for publication at eighteen months from the earliest claimed filing date for which a benefit is claimed.

If applicant subsequently files an application directed to the invention disclosed in the attached application in another country, or under a multilateral international agreement, that requires publication of applications eighteen months after filing, the applicant must notify the United States Patent and Trademark Office of such filing within forty-five (45) days after the date of the filing of such foreign or international application. Failure to do so will result in abandonment of this application (35 U.S.C. 122(b)(2)(B)(iii)).

Request To Publish Early

22. ☐ Applicant hereby requests the publication of this patent application earlier than as set forth in 37 CFR 1.211(a) pursuant to 37 CFR 1.219 as provided in 37 CFR 1.215(c).

Utility Patent Application Transmittal

Docket Number

08610010CA

Fee Calculation

Utility Patent Application Fee

Claims as Filed

For	#Filed	#Allowed	#Extra	Rate	Fee
Total Claims	31	- 20 =	11	x 31 =	\$341
Total Indep. Claims	6	- 3 =	3	x 125 =	\$375
Multiple Dependent Claims (check if applicable) ☐					
☒ E-Filing (small entity must be selected to get Filing Fee discount)				Basic Filing Fee	\$98
Number of Specification Pages	20	Number of Drawing Sheets	3		
Total Pages	23	Application Size Fee			\$ 0

Pre-Grant Publication Fee

Early publication fee as set forth in 37 CFR 1.18(d)	☐	
Processing fee for publication or republication as set forth in 37 CFR 1.17(i)	☐	

Assignment Recordal Fee

Enter Number of Properties Affected by Recordal	x 40 =	
---	--------	--

Examination Fee

Examination Fee	\$125
-----------------	-------

Search Fee

Search Fee	\$310
------------	-------

TOTAL \$1249

Method of Payment

☒ Deposit Account ☐ Credit Card ☐ Check ☐ Money Order ☐ Other: _____

Deposit Account Number **50-2041**

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

- ☒ Charge the fee(s) set forth above
☒ Charge any additional fee(s) or underpayments of fee(s) under 37 CFR 1.16 and 1.17
☐ Charge fee(s) indicated above, **except for the filing fee**
☒ Credit any overpayments

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on form PTO-2038.

Amount Grand Total \$1249

Utility Patent Application Transmittal

Docket Number

08610010CA

Correspondence Address

Customer Number 30743

-OR-

Name

Address

City

State

Country

Postal Code

Phone Number

E-mail Address

Certificate of Mailing by Express Mail

I hereby certify that this Patent Application, accompanying documents, and fee are being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 in an envelope addressed to Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450 on the date indicated below:

(Date of Mailing)

(Typed or Printed Name of Person Mailing Correspondence)

(Signature of Person Mailing Correspondence)

("Express Mail" Mailing Label Number)

Certificate of Mailing by First Class Mail

I hereby certify that this Patent Application, accompanying documents, and fee are being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450 on the date indicated below:

(Date of Mailing)

(Name of Person Mailing Correspondence)

(Signature of Person Mailing Correspondence)

Certificate of Transmission

I hereby certify that this Patent Application, accompanying documents, and fee authorization are being facsimile transmitted to the United States Patent and Trademark Office on the date indicated below:

(Date of Transmission)

(Name of Person Transmitting Correspondence)

(Signature of Person Transmitting Correspondence)

Signature Instructions

Select the name of the person who will electronically sign the Patent Application from the drop-down box below.

If a practitioner is not present in the drop-down list, you must close this form and select 'Add Practitioner...' in the Form Manager's Utility menu.

Verify that the signatory information is correct and press the 'eSign' button to electronically sign the submission. If you prefer to sign the form manually, simply do not click the 'eSign' button; just print and manually sign.

Signatory Drop-Down Box

Michael E. Whitham

Name

Michael E. Whitham

Registration Number

32,635

Signatory Capacity

Attorney for Applicant(s)

E-mail Address

action@wcc-ip.com

eSign

Date Signed

12/13/12

ACTIVE ANTENNAS FOR MULTIPLE BANDS IN WIRELESS PORTABLE DEVICES

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to U.S. Provisional Application Serial No. 61/088,829, entitled "Single Active Antenna for Multiple Bands in Wireless Portable Devices", filed August 14, 2008, and the complete contents thereof is incorporated by reference

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to wireless portable devices and particularly to improvements in transmitting and receiving electromagnetic signals at multiple frequency bands.

Background of the Invention

Today's wireless devices, such as laptops and computers that connect wirelessly to the cellphone network or internet must use antennas to transmit and receive wireless energy to and from the device. Today's cellphones and laptops typically require multiple antennas, each antenna designed for resonance or desired performance at a particular frequency band (such as cellular band, say in the 850 – 950 MHz band, the Bluetooth/WiFi band, say in the 2400 – 2490 MHz band, and so on). Computer makers and cellphone makers have difficulty with the mechanical design of their equipment, and spend a great deal of engineering time, research, and cost in manufacture for the bill of materials for the feedlines and connections between transmitter circuits, transceiver circuits, or receiver circuits and the antennas that are mounted or housed in the wireless

device casing. In some cases, antennas must be oriented in the flip up top of a lap top, placed behind or in the display screen, and tiny coaxial cables run through the case hinges, to the motherboard mounted below the keyboard. Similar problems exist with cellphones, and all devices generally must meet or exceed certain federal or wireless carrier-imposed requirements for radiation efficiency for a wide range of device orientations. It is envisioned that as wireless proliferates, cellphones and laptops will require more and more separate radio frequency bands in order to offer connectivity and competitive services. It is not inconceivable to eventually have wireless portable devices requiring 10 or more separate frequency bands, where the term “band” here means a particular wireless standard or service that is distinct from another. For example, standards such as IEEE 802.11a, 802.11b, 802.11g, 802.15a, 802.15.3.c, Cellular telephone (European, Asian, or US spectrum), Bluetooth, WiMax, PCS, all represent different bands, as they generally have different RF frequency band allocations assigned to them. In the future, RFID tags, vehicles, wireless post it notes, equipment, shipping containers, and even clothing may also suffer the issue of having to provide multiple antennas for different RF bands.

Today, there are many passive antennas solutions that have been published in the literature, such as, for example, the broadband planar antenna developed by Prof. Chen at The University of Texas. Using Fractal programming (genetic algorithms), it is possible to do computer simulations that eventually create an antenna design that offers resonance for several different frequency bands. Such antennas generally are developed by using field solver programs, where the field solver is set to optimize an antenna structure for a particular antenna performance over a specified range of frequencies (for example, the field solver may be set to find an antenna structure that has a low return loss, S_{11} , of less than -13dB over the range of frequencies of 2.4 – 2.9 GHz and 5.1 – 5.8 GHz, in order to accommodate Bluetooth and WiFi 802.11a, 802.11b, and 802.11g). However, planar antennas, when designed by an optimization program or set of algorithms, without the use of active antenna tuning, may result in a larger antenna than what is feasible for a small package (e.g. a small handset).

Recently, there have been some technical advances in active antenna tuning, some of which have been pioneered by Paratek Microwave in Nashua, NH. Using active

lumped elements, such as tunable capacitors, it is possible to allow for the active tuning of an antenna within a cellphone handset. Using electrically tunable capacitors, Paratek has pioneered a way to allow for active tuning of one or more cellphone antennas, as discussed in US patent 7,369,828.

In US patent 7,369,828 by Shamsaifar (owned by Paratek Microwave), the device can tune two different cellphone antennas for use on one of several bands of interest, where each distinct and separate antenna (one for high band and one for low band) has an active element that may be tuned. As described in U.S. Patent 7,369,829, a cellphone antenna is designed specifically for cellphone bands, since today's cellphones generally provide a small Bluetooth antenna, separate and apart from the cellular antenna. In U.S. Patent 7,369,829, there is described a method of transmitting and receiving RF signals from multiple frequency bands utilizing an electronically tunable multiple band antenna, comprising the steps of: providing a high band antenna with at least one voltage tunable varactor associated therewith, the high band antenna providing a first input to a controller; providing a low band antenna with at least one voltage tunable varactor associated therewith, the low band antenna providing a second input to the controller; and inputting control data to the controller and controlling a first bias voltage for biasing the at least one voltage tunable varactor associated with the high band antenna and a second bias voltage for biasing the at least one voltage tunable varactor associated with the low band antenna. By using a controller, the invention enables an antenna to be tuned.

The controller of the method in U.S. Patent 7,369,828 can use a DC voltage supply to provide the DC voltage needed to bias the voltage tunable varactors. The high band antenna of the method taught in U.S. Patent 7,369,828 can further comprise: a substrate; a patch element on the substrate; at least one voltage tunable varactor associated with the patch element; a DC bias point on the patch element; an RF input on the patch element; a temperature sensor; and a ground plane on one side of the substrate.

The low band antenna of the method taught in U.S. Patent 7,369,828 can further comprise: a substrate; a patch element on the substrate; at least one voltage tunable varactor associated with the patch element; a DC bias point on the patch element; an RF input on the patch element; a temperature sensor; and a ground plane on one side of the

substrate.

In a more specific embodiment of a preferred method of U.S. Patent 7,369,829, the multiple band antenna is a quad band antenna and covers the following frequency bands and standards which only involve cellular telephone (cellular and PCS): 824-894 MHz; 880-960 MHz; 1710-1880 MHz; 1850-1990 Hz; GSM850; EGSM; GSM1800; and PCS 1900.

Paratek uses BST as a tunable dielectric material that may be used in a tunable dielectric capacitor. *Paratek Microwave*, Inc. has developed and continues to develop tunable dielectric materials that may be utilized in embodiments of the antenna tuners and tunable filters, and the tuners are not necessary limited to using BST material. This family of tunable dielectric materials may be referred to as Parascan by the company.

The term "Parascan" as used herein is a trademarked term indicating a tunable dielectric material developed by Paratek Microwave, the assignee of US patents 7,397,329 and 7,369,828, and the idea of tunable dielectric materials have been described in several patents. Barium strontium titanate ($\text{BaTiO}_3\text{-SrTiO}_3$), also referred to as BSTO, is used for its high dielectric constant (200-6,000) and large change in dielectric constant with applied voltage (25-75 percent with a field of 2 Volts/micron).

Tunable dielectric materials including barium strontium titanate are disclosed in U.S. Pat. No. 5,312,790 to Sengupta, et al. entitled "Ceramic Ferroelectric Material"; U.S. Pat. No. 5,427,988 by Sengupta, et al. entitled "Ceramic Ferroelectric Composite Material-BSTO-MgO"; U.S. Pat. No. 5,486,491 to Sengupta, et al. entitled "Ceramic Ferroelectric Composite Material-BSTO-ZrO₂"; U.S. Pat. No. 5,635,434 by Sengupta, et al. entitled "Ceramic Ferroelectric Composite Material-BSTO-Magnesium Based Compound"; U.S. Pat. No. 5,830,591 by Sengupta, et al. entitled "Multilayered Ferroelectric Composite Waveguides"; U.S. Pat. No. 5,846,893 by Sengupta, et al. entitled "Thin Film Ferroelectric Composites and Method of Making"; U.S. Pat. No. 5,766,697 by Sengupta, et al. entitled "Method of Making Thin Film Composites"; U.S. Pat. No. 5,693,429 by Sengupta, et al. entitled "Electronically Graded Multilayer Ferroelectric Composites"; U.S. Pat. No. 5,635,433 by Sengupta entitled "Ceramic Ferroelectric Composite Material BSTO-ZnO"; U.S. Pat. No. 6,074,971 by Chiu et al.

entitled "Ceramic Ferroelectric Composite Materials with Enhanced Electronic Properties BSTO Mg Based Compound-Rare Earth Oxide". These patents are incorporated herein by reference. The materials described in these patents, especially BSTO-MgO composites, show low dielectric loss and high tunability. Tunability is defined as the fractional change in the dielectric constant with applied voltage.

Using the idea of tunable capacitance, and following on the above listed prior art, Paratek Microwave has developed a technology called Adaptive Impedance Matching Models (AIMM) which it currently demonstrates on its website at worldwide web site paratek.com as able to adaptively tune antennas.

Agile Materials, a company founded in 1999 as a spinoff of University of California, Santa Barbara, has also developed tunable wireless components for multi-band systems. Agile has successfully commercialized its proprietary method to harness the unique properties of a thin-film ferroelectric capacitors, which may be tuned over at least an octave of frequency range. Agile employees produced patent 7,202,747, "Self Tuning Variable Impedance Circuit for Impedance Matching of Power amplifiers," as well a 7,012,483, "Tunable Bridge Circuit", both of which use a BST tunable capacitive material to affect a resonance change in a tuneable circuit.. All of the aforementioned is known from the public prior art of record.

SUMMARY

The current invention uses one or more antennas, at least one of which can be used by multiple transmitters or receivers in different bands, thereby greatly simplifying the antenna structures in a portable wireless device, and greatly reducing the mechanical design complexity, the cost of bill of materials, and the variance in manufacturing of different devices of a particular model.

The current invention exploits the idea of active antenna tuning, but expands it greatly in a non-obvious way by applying the concepts to the situation of where multiple band transmitters, receivers, or transceivers must be used simultaneously in a wireless portable device. In cellphones today, since telephone call need only be made on one band at a time (either on High Band Cellular or Low Band Cellular, or 3G band, but not

more than one at a time), US Patent 7,369,829 and other prior art have not contemplated the present invention, which allows a single antenna to be used for simultaneous transmission (or reception) for multiple bands. The present invention greatly simplifies the mechanical design and layout of wireless portable devices by allowing multiple transmitter (or receiver) bands to simultaneously use one or more antennas for simultaneous multi-purpose use.

This invention allows an antenna, such as a patch or metal fixture or other type of conductive or non/semi-conductive element or elements mounted on or within a mobile or portable device, to be simultaneously fed and used by multiple transmitters, receivers, or transceivers on different bands. It is understood that the terms portable and mobile may be used interchangeably. The invention has application with all wireless devices whether mobile, portable or fixed. This invention exploits active tuning and matching for each of the feedlines to antennas, or may use a single antenna feedline to match a single or multiple antennas from multiple devices, using tunable technologies developed by Paratek Microwave, Agile, or others, as well as techniques described below, or by using signal processing in the RF or IF domains, as well.

DESCRIPTION OF THE DRAWINGS

Figure 1 shows today's typical cellphone or laptop design, where different transceivers are connected to different antennas.

Figure 2 shows an embodiment of the present invention, where multiple transmitters are fed to a single antenna (it is understood that transmitters could also be transceivers, or receivers).

Figure 3 shows a more detailed embodiment of the present invention, where multiple transmitters may be fed to a single antenna using multiple feedlines and active antenna tuners, controlled by a controller, operates on the RF of each signal. (it is understood that transmitters could also be transceivers, or receivers).

Figure 4 shows another embodiment of the present invention, where multiple transmitters may be fed to a single antenna using a single feedline and a single active antenna tuner which is controlled by a controller.

Figure 5 shows yet another alternate embodiment of the present invention, where a multiband tuner provides matching from a single multiband transmitter (or transceiver or receiver) feedline (e.g. a single RF source) to a single multi-use multi-band antenna

Figure 6 illustrates some examples of tuning circuits used within a tuner, with active elements.

DETAILED DESCRIPTION

Shown in Figure 1 is an example of how cellphones or laptops or other wireless devices 10 are designed today. In general, different band transceivers (e.g., GSM cellular transceiver 12, Bluetooth transceiver 14, and ultrawideband transceiver 16) are connected to different antennas (e.g., cellular antenna 20, Bluetooth antenna 22, and UWB antenna 24) that must be affixed to, located within the packaging of the device, or included in the printed circuit boards of the device, thereby taking up space, feedline resources (e.g., feedlines 26), increasing the bill of materials, and adding complexity.

Figure 2 illustrates the basic idea of the present invention which can be implemented in fixed or mobile wireless devices 10 such as computers, telephones, portable computing or communication devices, games, wireless post it notes, wireless memory media, personal data assistants and navigation assistants. One potential application of the invention is in the IEEE 802.11ad standard, where very high throughput wireless devices (e.g., 60 GHz carrier transmissions) may use one or more transmitters, receivers or transceivers to simultaneously provide capabilities in the existing 802.11a and 802.11b bands of 2.4 GHz and 5.8 GHz, as well as the 60 GHz spectrum. Instead of requiring different antennas for the different RF bands, the present invention allows for the use of a single antenna 28 for multiple bands (or multiple antennas, at least one of which can be used for multiple bands). By providing the ability to use just a single antenna 28, the problem of mounting, locating, and feeding the antenna can be greatly reduced, so long as a desired antenna efficiency can be maintained for all bands of interest.

Figure 3 shows how the antenna efficiency can be maintained. By using individual RF tuners 30, 32, and 34, that may be based on Paratek's or Agile's

technology, or any other active tuning method, such as Microelectrical Mechanical Systems (MEMS), or variable mechanical resonator technologies, or other active or passive methods known now or in the future, it becomes possible to provide a good impedance match for each of the transceivers 36, 38 and 40 shown in Figure 3. The key to proper operation is to also, while providing good matching, provide sufficient RF isolation so that the transmitters in other bands do not overload the front end receiver of a band that is receiving. Fortunately, RF filtering and overload protection is improving in commercially available wireless transceivers in various popular bands, so that overload protection may be offered within the wireless transceiver chip itself through the integrated circuitry. Where more isolation is required, the tuner for a particular band is adjusted to offer very high impedance S22 characteristics at the other bands that differ from the dedicated band of the tuner, so that there is little, if any energy returned to the desired transceiver (or transmitter, or receiver) of the particular band of the tuner. In addition, low cost LC circuits may be etched into and/or added on the circuit board during manufacture or otherwise made a part of the tuner circuitry in order to create an RF Trap for the other bands, at much less cost and reduced engineering than having to use separate antennas for each band.

Furthermore, it is possible to use band transceivers that offer different antenna ports for the transmitter and the receiver within a particular band, whereby the present invention is simply extended to where there are two antennas used – one that is used solely for transmission by the multiple bands, and another multiband shared antenna for the receiver that is located a sufficient distance away within the casing, or which uses polarization diversity, or uses shielding or distributed antenna ideas within the case in order to reduce the RF overload from the transmitting antenna. The receiving antenna, for instance, might be mounted on the other side of the printed circuit board for the cellphone, or laptop, or RFID tag, or wireless post-it, or might be pitched at right angles in the casing, etc. It is also possible to use buffer amplifiers, tuned amplifiers, as well as tuned trap circuits for particular offending bands, that can act as filters to prevent RF from other multi-user band transmitters from leaking into the receiver portion of a particular band. Also, RF antenna switches, may be made inexpensively in an integrated circuit process in CMOS, GaAs, or other well known semiconductor technologies known

now or the future. These capabilities which may be incorporated in the tuner as described below. It should be clear in this disclosure that the term “antenna” is not meant to be limiting to any particular structure, but rather is meant to represent all of the possible ways that a wireless portable device may allow for radiation and reception of electromagnetic energy from particular frequency bands of interest.

Figure 3 also shows a tuner controller 42, preferably digital in nature and which may be part of a computer or microprocessor circuit that also controls one or more of the transceivers (or transmitters or receivers) shown in the figure. The controller 42 provides the proper voltages, or more preferably, the digital control values that are used by the tuner in order to adjust the active elements of the tuner (e.g. the tunable capacitors, inductors, amplifiers, and to toggle switches). The digital decoding circuitry in the tuner is not shown here, but is known to be implemented in a number of ways using standard serial or parallel digital busses that interconnect integrated circuits within cellphones and laptops. Furthermore, the controller receives feedback from the tuner, or from other circuitry (not shown) with respect to VSWR, power, and proper functionality so that the controller may properly adjust, alter, initiate, and end its use of control signals (either voltages or data values sent over a serial data line or a bus) to the tuner. In the case of the tuner receiving digital signals from the controller, it is understood that the tuner would have its own processing that would allow for the digital interpretation of control signals such as to properly determine the necessary analog voltages or other signal adjustments needed to perform impedance tuning through adjustment of the active tunable elements of the tuner, so that it would be possible to sequentially or simultaneously tune one or more of the tuners so that multiple bands may simultaneously transmit (or receive, or both) using the single antenna structure shown in the figure. The controller may be part of the overall portable device computing logic or controlling circuitry, or may be integrated within one or more of a particular band or multiband transceiver, transmitter, or receiver. The controller may be distributed within the portable device, and may even be responsive to over the air signaling that is received by one or more of the transceivers. The controller would have awareness of when particular bands were to be transmitting, receiving, or in the idle/off mode, so that it could properly control the active elements, and even provide power on/off/sleep instructions to the circuitry within the tuner. Note that nothing here is

meant to be limiting in how the controller might be used, as it is conceivable that it could be included in the circuitry of the tuner, or the tuner and controller ideas contemplated here all could be integrated within a single multiband transceiver chip, such as is shown in Figure 4.

Figure 4 shows an alternate embodiment, where the progress in IC design for wireless multiband, multi-mode circuits is contemplated. Indeed, today it is possible to purchase multi-band transceiver chips for popular wireless standards where different antenna ports are provided for various RF output bands. Figure 4 illustrates the use of a combined multiband transceiver 44 which may include, for example, GSM, Bluetooth, UWB, WiMAX all on one chip—eventually software designed radio be a part of the chip). The present idea, shown in Figure 4, using a single RF feedline to a single multiband active controller, would provide an advantage to the wireless industry through simplicity and reduced feedlines, reduced size and weight, and more flexibility in locating the antenna. The multiband tuner 46 would require greater complexity than as shown in Figure 3, as it would require the ability to simultaneously pass desired RF signals at proper low (generally 50 ohm or thereabouts) impedance for each of the bands that are being used, while providing very high impedance to other bands. The tuner is adjusted by the controller in order to indicate when a particular transmitter on a particular band is in the transmit mode or in the receive mode, or, alternatively, the tuner could simply offer matching capabilities to a transmitter to the antenna without consideration for the receiver (for the case where the receiver would be connected to a different antenna). The circuitry of the tuner is described in more detail below, and can exploit buffer amplifiers or tuned RF amplifiers at various RF frequencies to provide isolation, as well as antenna switching, all contained within the tuner, making it possible to create a low cost, high performance antenna tuner chip for the present application. An optional RF switch allows separate transmitter path and receiver path tuning for each of the bands at use. This concept may be included within a single band tuner element for the present invention.

Figure 5 illustrates a more detailed example of the active and passive circuitry of the present invention. To provide a single feedline to a single antenna, the tuner 46 requires controller circuitry that provides instructions as to how the particular active

devices may be adjusted. In this case, the term active indicates that RF tuning is possible, such as in the case of tunable capacitors or tunable inductors. Figure 5 shows an example, not in any way meant to be limiting to the type of impedance matching circuits 48 contemplated here, where the capacitors of each of three parallel band tuners are able to be tuned. Tuning methods for capacitors are well known, such as taught in the prior art patents by Paratek, and by researchers throughout the world. Similarly, it is possible to tune inductances, as well. Furthermore, shown in Figure 5, it is noted that RF amplifiers, that may be used to either offer matching impedance at the input (say 50 ohms) and particular desired impedance at the output feedline to the antenna, is shown. It should be clear that RF amplifiers, as shown in Figure 5 and 6, may either be strict buffer amplifiers with a very high output impedance, or alternatively, may be active devices that have a controlled impedance that is adjusted in tandem with the tuned circuit elements shown in the figures. Figure 5 represents an example of how multiband transmitted signals may be applied to a single multiband tuner. The input signals are split and routed to each of the respective tuner circuits, and may use a Wilkinson or simple ohmic splitter, which may be implemented either on a printed circuit board substrate or within an integrated circuit. It is clear to one skilled in the art that tuner circuits and feedlines may be implemented in a myriad of ways depending on the particular physical structure of the circuitry. For example, coplanar waveguides or microstrip lines may be used in integrated circuits or circuit boards, and splitters, combiners, couplers, mixers, and switches may be fabricated to realize the invention using well understood techniques such as taught in D. Pozar's books *Microwave Engineering*, copyright 2004, and *Microwave and RF Design of Wireless Systems*, copyright 2000 which are hereby incorporated by reference, and as presented at various IEEE conferences on antennas, microwave theories, and circuits. While techniques for building both active and passive circuits are taught at various conferences, the use of such technology for the present invention has not been heretofore contemplated. It is well understood that a wide range of active and passive components, either lumped or distributed, may be combined with various transmission line and active and passive signal coupling techniques to implement the invention.

Figure 6a, b, and c illustrate some of the possible configurations of tuner elements for use in a multiband transceiver. It should be understood that these are representative,

and other combinations of lumped or distributed circuits are possible, where the proper choice would depend on the type and structure of single antenna to be used, the electrical specifications and impedance matching/antenna port/isolation capabilities of the transmitter, receiver, or transceiver chips being used in the portable device, as well as cost, bill of materials, and the type of mounting to be used for the tuner circuitry. That is, an integrated circuit tuner might be more likely to pick adjustable capacitors over adjustable inductors in some instances.

Note in Figure 6a, b and c that there are optional RF switches, that may be implemented in integrated circuit form within the tuner circuitry, that can be controlled by the controller to position properly for either transmit or receive operation. The transmitter configuration would exploit the left side of each of the depicted tuners, with a path providing matching to the single antenna structure, where the right side of each depicted tuner would be used for matching provided on the receive path. The switch would be controlled by the controller, or by some other means, such as from a master controller of the wireless device, the transceiver chip, or some other logic that instructs the particular transmitter in the particular band to transmit. Alternatively, the switches could be controlled by RF sensing, whereby the presence of sufficient level of RF from the transmitter (transceiver) chip causes the switches at the top and the bottom of the depictions to throw properly.

The active (tuned) elements shown in Figure 6a, b, and c, suggest that one or more tuned elements may be used in a tuner as disclosed here. For example, one method would only use tunable capacitors, which are available from Paratek Microwave. Other embodiments would use both tunable capacitors and tunable inductors, and still others may use a combination of tunable and fixed elements in order to provide antenna tuning of a particular band to a single antenna while providing sufficient RF isolation/rejection of unwanted bands.

For simplicity, the controller signal in the circuitry shown in Figure 6a, b, and c is omitted, but it should be clear that such signaling capability exists. Other features have also been omitted, such as temperature sensors to determine proper electrical characteristics and calibration of the tuned elements, feedback circuitry (to sense proper

VSWR, impedance, or acceptable power transfer, sufficient isolation), but these concepts are well understood by those skilled in the art.

It should also be clear that optimization algorithms that determine the values of multiband tuners so as to properly determine each of the active element positions could be performed by the controller as depicted in this invention disclosure. The optimization could use pre-set or memorized settings from recent or long term histories of proper tuning values, or could determine, on start up of the wireless device, appropriate values for the settings of each tuner elements. Such computation techniques, to determine a matrix of various values in a multidimensional problem, are well known and are varied. The use of memory to remember preset values for various use cases, and to store new or recent or past settings of tuner elements, in order to allow the invention to be used in a power efficient and reliable manner is contemplated here, although memory is not shown in the drawings. These techniques are well understood in the art.

In addition to the active tuned elements shown in Figure 6a, b, and c, it is possible to implement the invention using other frequency selective approaches, such as reasonably high-q passive circuits (with or without amplification), or using metamaterials or transmission line implementations which may be embedded within one or more semiconductor layers or substrates, or implemented in lumped element form, or through active and/or passive circuitry to provide the ability to provide either receiver or transmitter antenna tuning on multiple bands, as described above. Metamaterials are one way to create frequency selective surfaces and can provide good isolation, as described in the paper coauthored by L. Ragan, A. Hassibi, T. S. Rappaport, and C. L. Christianson, entitled "Novel On-Chip Antenna Structures and Frequency Selective Surface (FSS) Approaches for Millimeter Wave Devices," IEEE 66th Vehicular Technology Conference (VTC), Baltimore, MD, Oct. 1 -3, 2007, pp. 2051-2055, and as described in US patent publication 20080238801 by Lawrence Ragan, both of which are fully incorporated here by reference. Such frequency selective structures and implementations, depending upon the particular implementation, may require amplifiers or may be of sufficiently low loss to obviate the need for amplifiers directly at the antenna tuner junction. The controller would cause various switches, devices, or series or parallel (or both) combinations of connections, or would otherwise support voltages or currents to be established in order to

implement or select the desired tunability for these various possible implementations, it being understood that the controller could be designed to work in concert with various semiconductor properties, or with embedded, distributed or lumped circuitry within the RF stage or antenna interconnect stage, in order to affect the ability to use a single antenna on multiple bands.

As wireless devices begin to evolve to millimeter wave (mmWave) carrier frequencies at 60 GHz, and even to frequencies in the 77 to 500 GHz range, and even to Terahertz frequencies, the need to integrate the tuning and interconnection of a single antenna to RF circuitry will become even greater. System on a chip (Soc) implementations of the invention described here will be highly desirable so that a single integrated circuit, with an embedded antenna on the integrated circuit (chip) or package or on the case or circuit board of a consumer device (such as a PC, cellphone, television, vehicle, etc.) may be used for several different frequency bands, or for different portions of a massively wideband spectrum allocation. For example, 60 GHz devices may well work from 58 to 65 GHz, and it will be desirable to implement the current invention across different portions of that band (e.g. the same antenna may need to be tuned for the 58 - 60 GHz portion of the band for one particular application or instance, and the 62-64 GHz portion of the band for a different application or instance, or may also be used to tune to the 77 GHz band or 5.1 - 5.8 GHz band for operations, as well.). Ultrawideband repeaters, such as described in US patent application 10/919,515 to Rappaport, which is fully incorporated here by reference, could make use of this. It is understood that the controller may selectively switch, exit, or cause voltages or currents or switches to be activated in any particular implementation, and that the single antenna may itself be designed to have certain desirable properties or preferential frequency responses at certain different bands, but which are further improved and made to more efficiently transfer power (e.g. reduce the Voltage Standing Wave Ratio, increase efficiency, tune for improved SNR, decrease power or current drain, or improve some other power transfer metric, all of which are examples of matching the antenna to the other circuitry including without limitation the transmitters, receivers, and transceivers) between the antenna and the transmitter and/or receiver through the disclosed invention.

It should be evident that the invention contemplated here, while described as a single antenna, may itself be implemented with other antennas or antenna elements or sub elements to form an antenna array, including for use in a MiMO system or beam switchable array, and that the disclosed invention with single antenna which may have one or more elements or antennas and which may be implemented in a lumped or distributed or passive or active or hybrid manner, and may be used in conjunction with other antennas in various switching, phasing, or active or passive combining techniques to form a larger or distributed antenna structure that also works over multiple frequencies. The invention extends to components such as the tuner and/or controller for implement the invention. For example, tuners or sets of tuners which are connectable or coupled to multiple transmitters, receivers, or transceivers for allowing the simultaneous transmission or reception at multiple frequency bands or the ability to use a single physical structure (e.g., an antenna) for transmission and reception of many different bands, or controllers or other circuitry for accomplishing the same form a part of this invention.

CLAIMS

I claim:

1. A wireless device, comprising:
 - one or more antennas; and
 - a plurality of transmitters, receivers or transceivers that operate in one or more frequency bands,wherein at least one antenna of said one or more antennas is used by said plurality of transmitters, receivers or transceivers in a plurality of different bands.
2. The wireless device of claim 1 wherein said at least one antenna is an actively tuned antenna.
3. The wireless device of claim 1 wherein said at least one antenna is tuned by one or more passive elements which are selected or interconnected using electronic control.
4. The wireless device of claim 3 wherein said passive elements are comprised of either or both lumped or distributed elements.
5. The wireless device of claim 1 wherein said at least one antenna is used for transmitting, receiving, or transmitting and receiving simultaneously in said plurality of different bands.
6. The wireless device of claim 1 further comprising
 - one or more tuners associated with one or more transmitters, receivers or transceivers of said plurality of transmitters, receivers or transceivers; and
 - a controller for controlling tuning of the tuner for said at least one antenna to operate in said plurality of different bands.

7. The wireless device of claim 1 wherein said mobile device is selected from the group consisting of computers, telephones, portable computing or communication devices, games, wireless post it notes, wireless memory media, RFID tags, vehicles, clothing, personal data assistants and navigation assistants.

8. A wireless device, comprising:

one or more antennas; and

at least one multiband transmitter, receiver or transceiver;

a tuner associated with said at least one multiband transmitter, receiver, or transceiver; and

a controller for controlling tuning of the tuner to a plurality of different bands

wherein at least one antenna of said one or more antennas is used by said at least one multiband transmitter, receiver or transceiver in a plurality of different bands.

9. The wireless device of claim 8 said at least one antenna is used for transmitting, receiving, or transmitting and receiving simultaneously in said plurality of different bands.

10. The wireless device of claim 8 wherein said mobile device is selected from the group consisting of computers, telephones, portable computing or communication devices, games, wireless post it notes, wireless memory media, RFID tags, vehicles, clothing, personal data assistants and navigation assistants.

11. The wireless device of claim 8 wherein said at least one antenna is an actively tuned antenna.

12. The wireless device of claim 8 wherein said at least one antenna is tuned by one or more passive elements which are selected or interconnected using electronic control.

13. The wireless device of claim 12 wherein said passive elements are comprised of either or both lumped or distributed elements.

14. A wireless device, comprising:

at least one multiband antenna;

at least one multiband transmitter, receiver or transceiver; and

a tuner associated with said at least one multiband transmitter, receiver, or transceiver, said tuner matching said at least one multiband antenna to said at least one multiband transmitter, receiver or transceiver in a plurality of different bands.

15. The mobile device of claim 14 wherein said at least one antenna is used for transmitting, receiving, or transmitting and receiving simultaneously in said plurality of different bands.

16. The wireless device of claim 14 wherein said mobile device is selected from the group consisting of computers, telephones, portable computing or communication devices, games, wireless post it notes, wireless memory media, RFID tags, vehicles, clothing, personal data assistants and navigation assistants.

17. A wireless portable device, comprising:

one or more antennas radiating or receiving electromagnetic energy at particular frequency bands, at least one of said one or more antennas radiating or receiving electromagnetic energy at a plurality of particular frequency bands;

one or more components selected from the group consisting of receivers, transmitters and transceivers, said one or more components connected to said at least one of said one or more antennas, whereby

at least one of said one or more components transmits or receives electromagnetic energy at two or more of said plurality of particular frequency bands, or

two or more components transmit or receive electromagnetic energy at two or more of said plurality of particular frequency bands.

18. The wireless portable device of claim 17 wherein said wireless portable device is selected from the group consisting of computers, telephones, personal data assistants, and navigation assistants.

19. The wireless portable device of claim 17 further comprising one or more tuners which match electromagnetic energy at a particular frequency band to only one of said one or more components.

20. The wireless portable device of claim 17 further comprising isolation means for isolating said one or more components from more than one particular frequency band of said plurality of frequency bands.

21. A wireless device component, comprising a tuner or a set of tuners or controller or other circuitry configurable to be coupled to at least one antenna and a plurality of transmitters, receivers, or transceivers that operate at one or more frequency bands, wherein said at least one antenna is used by said plurality of transmitters, receivers or transceivers in a plurality of different bands.

ABSTRACT OF THE DISCLOSURE

Wireless devices, and particularly mobile devices such as cellphones, PDAs, computers, navigation devices, etc., as well as other devices which transmit or receive data or other signals at multiple frequency bands utilize at least one antenna to transmit and receive and a plurality of different bands (e.g., GSM cellular communication band; Bluetooth short range communication band; ultrawideband (UWB) communications, etc.). These wireless devices can simultaneously transmit or receive at a plurality of different bands, or simultaneously transmit and receive at different bands. The wireless devices have the ability to use a single physical structure (e.g., an antenna) for transmission and reception of many different bands. The antenna can be either actively tuned or passively tuned using one or more elements.

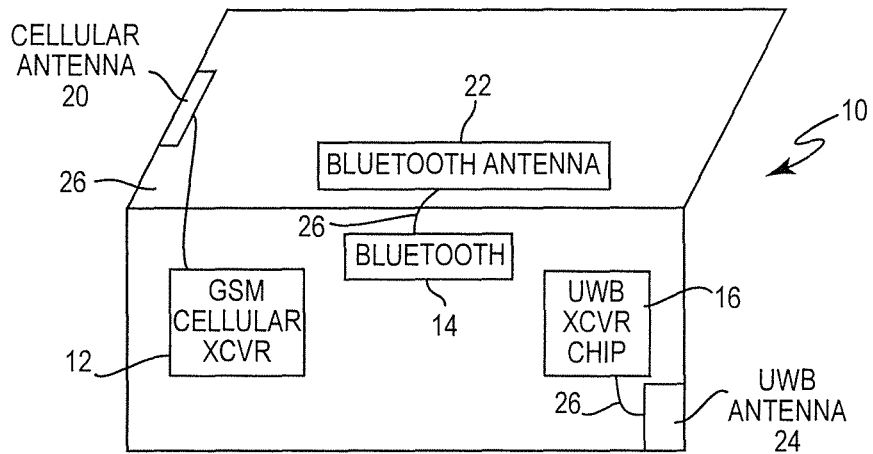


Figure 1

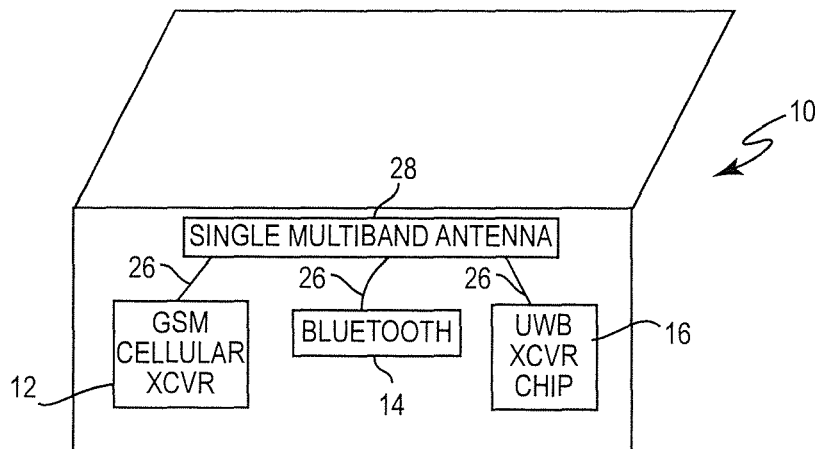


Figure 2

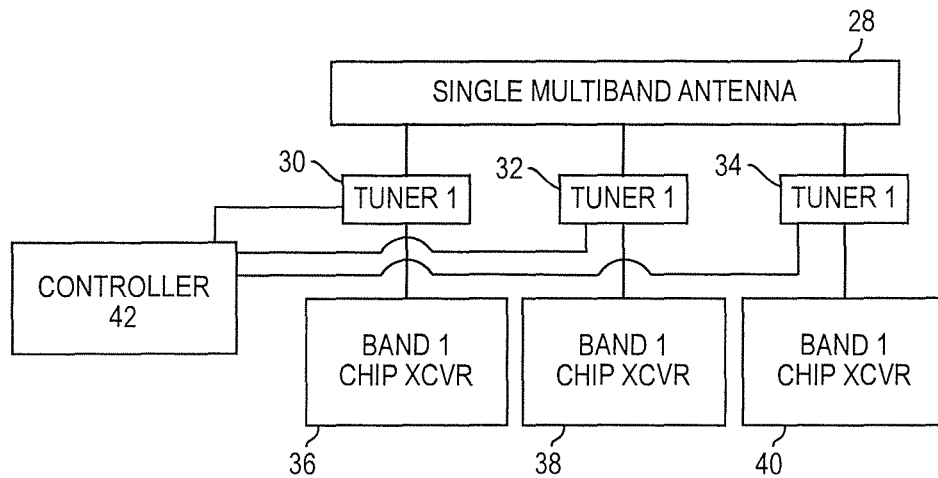


Figure 3

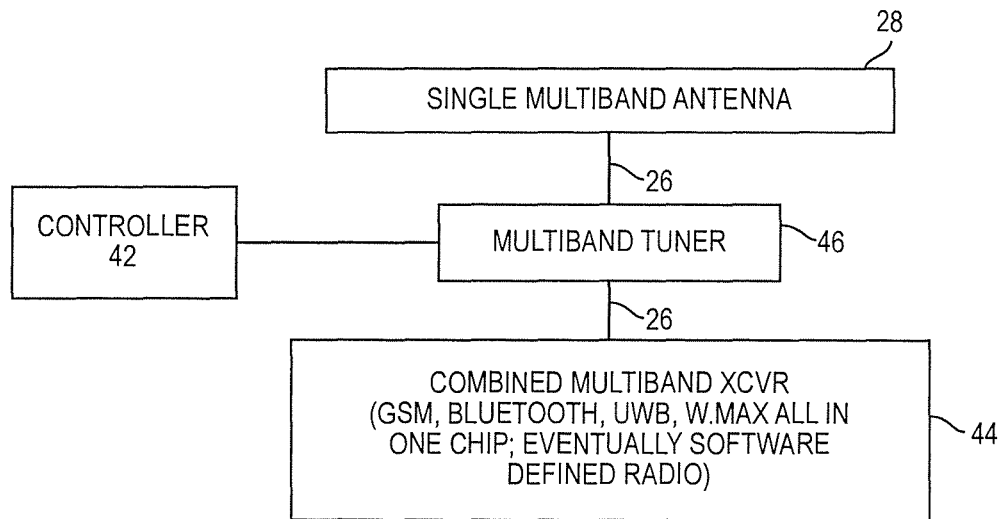


Figure 4

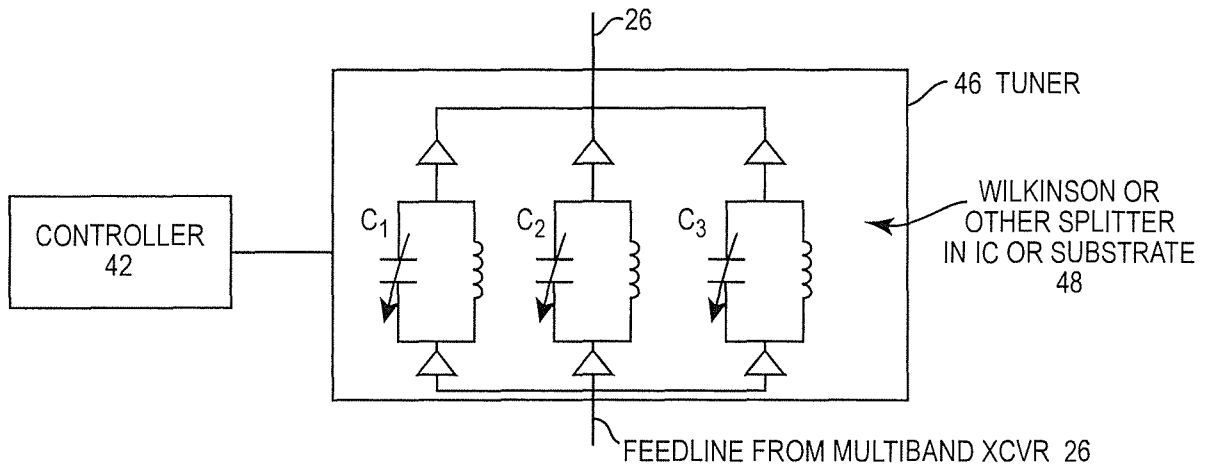


Figure 5

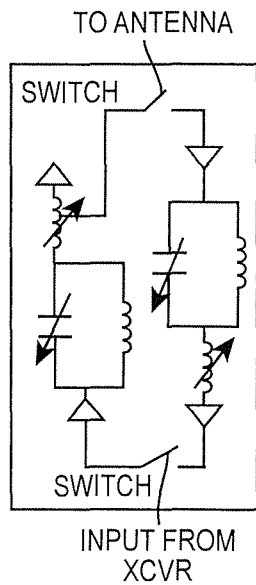


Figure 6A

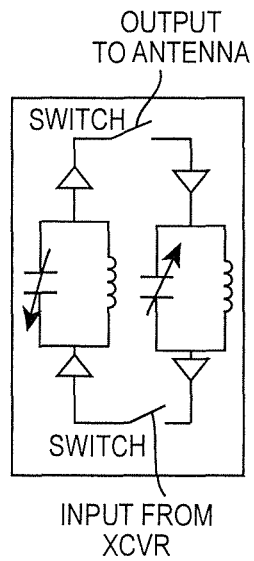


Figure 6B

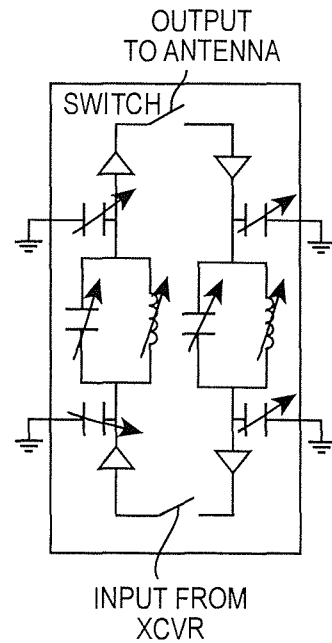


Figure 6C

Utility Patent Application Transmittal

Docket Number

08610010CA

Address To
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

First Named Inventor

Name	Theodore S. Rappaport		
Mailing Address			
City		State	
Country		Postal Code	
City of Residence		State of Residence	
Country of Residence		Citizenship	

Title of Invention

Active Antennas for Multiple Bands in Wireless Portable Devices

Assignee Information*

Name			
Company			
Address			
City		State	
Country		Postal Code	

*Complete this section if applicant wants the patent application publication to include assignee information. Providing this information does not substitute for compliance with any requirement of Part 3 of 37 CFR to have an assignment recorded by the Patent Office.

Application Elements

See MPEP chapter 600 concerning utility patent application contents.

- | | |
|--|---|
| 1. ☒ USPTO Filing Fee (as calculated <i>infra</i>) | 6. ☐ Application Data Sheet (37 CFR 1.76) |
| 2. ☒ Applicant claims small entity status
See 37 CFR 1.27 | 7. ☐ CD-ROM or CD-R in duplicate, large table or Computer Program (<i>Appendix</i>)
☐ Landscape Table on CD |
| 3. ☒ Specification
Total number of pages <u>20</u>
Both the claims and abstract must start on a new page
(For information on the preferred arrangement, see MPEP 608.01(a)) | 8. ☐ Nucleotide and/or Amino Acid Sequence Submission
(if applicable, items a. - c. are required)
a. ☐ Computer Readable Form (CRF)
b. Specification Sequence listing on:
i. ☐ CD-ROM or CD-R (2 copies), or
ii. ☐ Paper
c. ☐ Statements verifying identity of above copies |
| 4. ☒ Drawing(s) (35 U.S.C. 113)
Total number of sheets <u>3</u> | |
| 5. ☒ Oath or Declaration
a. ☒ Newly executed (original or copy), or ☐ Unexecuted
b. ☐ A copy from a prior application (37 CFR 1.63(d))
(for Continuation or Divisional Application)
i. ☐ DELETION OF INVENTOR(S)
Signed statement attached deleting inventor(s) named in the prior application (see 37 CFR 1.63(d) and 1.33(b).) | |

Utility Patent Application Transmittal

Docket Number

08610010CA

Accompanying Application Parts

9. ☐ Assignment
a. ☐ Recordation Form Cover Sheet
10. ☐ 37 CFR 3.73(b) Statement (when there is an assignee)
11. ☐ Power of Attorney ☐ No Power of Attorney
12. ☐ English Translation Document (if applicable)
13. ☒ Information Disclosure Statement
a. ☐ Copies of citations attached
14. ☒ Preliminary Amendment
15. ☐ Return Receipt Postcard (MPEP 503)
(Should be specifically itemized)
16. ☐ Certified Copy of Priority Document(s)
(if foreign priority is claimed)
17. ☐ Nonpublication Request under 35 USC 122(b)(2)(B)(i)

18. ☐ Certificate of Mailing
a. ☐ First Class Mail, or
b. ☐ Express Mail
Label Number _____

19. ☐ Other:

20. If a **CONTINUING APPLICATION**, check appropriate box, and supply the requisite information below and in the first sentence of the specification following the title, or in an Application Data Sheet under 37 CFR 1.76:

☒ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No. 12/541,764
(XX/YYY,YYY)

Prior application information: Examiner Phan, T. G. Art Unit: 2821

Request Not To Publish*

21. ☐ Applicant hereby requests that the attached application not be published under 35 U.S.C. 122(b).

Applicant hereby certifies that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

*Warning

This request must be signed in compliance with 37 CFR 1.33(b) and submitted with the application upon filing.

Applicant may rescind this nonpublication request at any time. If applicant rescinds a request that an application not be published under 35 U.S.C. 122(b), the application will be scheduled for publication at eighteen months from the earliest claimed filing date for which a benefit is claimed.

If applicant subsequently files an application directed to the invention disclosed in the attached application in another country, or under a multilateral international agreement, that requires publication of applications eighteen months after filing, the applicant must notify the United States Patent and Trademark Office of such filing within forty-five (45) days after the date of the filing of such foreign or international application. Failure to do so will result in abandonment of this application (35 U.S.C. 122(b)(2)(B)(iii)).

Request To Publish Early

22. ☐ Applicant hereby requests the publication of this patent application earlier than as set forth in 37 CFR 1.211(a) pursuant to 37 CFR 1.219 as provided in 37 CFR 1.215(c).

Utility Patent Application Transmittal

Docket Number

08610010CA

Fee Calculation

Utility Patent Application Fee

Claims as Filed

For	#Filed	#Allowed	#Extra	Rate	Fee
Total Claims	31	- 20 =	11	x 31 =	\$341
Total Indep. Claims	6	- 3 =	3	x 125 =	\$375
Multiple Dependent Claims (check if applicable) ☐					
☒ E-Filing (small entity must be selected to get Filing Fee discount)				Basic Filing Fee	\$98
Number of Specification Pages	20	Number of Drawing Sheets	3		
Total Pages	23	Application Size Fee			\$ 0

Pre-Grant Publication Fee

Early publication fee as set forth in 37 CFR 1.18(d)	☐	
Processing fee for publication or republication as set forth in 37 CFR 1.17(i)	☐	

Assignment Recordal Fee

Enter Number of Properties Affected by Recordal	x 40 =	
---	--------	--

Examination Fee

Examination Fee	\$125
-----------------	-------

Search Fee

Search Fee	\$310
------------	-------

TOTAL \$1249

Method of Payment

☒ Deposit Account ☐ Credit Card ☐ Check ☐ Money Order ☐ Other: _____

Deposit Account Number **50-2041**

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

- ☒ Charge the fee(s) set forth above
☒ Charge any additional fee(s) or underpayments of fee(s) under 37 CFR 1.16 and 1.17
☐ Charge fee(s) indicated above, **except for the filing fee**
☒ Credit any overpayments

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on form PTO-2038.

Amount Grand Total \$1249

Utility Patent Application Transmittal

Docket Number

08610010CA

Correspondence Address

Customer Number 30743

-OR-

Name

Address

City

State

Country

Postal Code

Phone Number

E-mail Address

Certificate of Mailing by Express Mail

I hereby certify that this Patent Application, accompanying documents, and fee are being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 in an envelope addressed to Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450 on the date indicated below:

(Date of Mailing)

(Typed or Printed Name of Person Mailing Correspondence)

(Signature of Person Mailing Correspondence)

("Express Mail" Mailing Label Number)

Certificate of Mailing by First Class Mail

I hereby certify that this Patent Application, accompanying documents, and fee are being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450 on the date indicated below:

(Date of Mailing)

(Name of Person Mailing Correspondence)

(Signature of Person Mailing Correspondence)

Certificate of Transmission

I hereby certify that this Patent Application, accompanying documents, and fee authorization are being facsimile transmitted to the United States Patent and Trademark Office on the date indicated below:

(Date of Transmission)

(Name of Person Transmitting Correspondence)

(Signature of Person Transmitting Correspondence)

Signature Instructions

Select the name of the person who will electronically sign the Patent Application from the drop-down box below.

If a practitioner is not present in the drop-down list, you must close this form and select 'Add Practitioner...' in the Form Manager's Utility menu.

Verify that the signatory information is correct and press the 'eSign' button to electronically sign the submission. If you prefer to sign the form manually, simply do not click the 'eSign' button; just print and manually sign.

Signatory Drop-Down Box

Michael E. Whitham

Name

Michael E. Whitham

Registration Number

32,635

Signatory Capacity

Attorney for Applicant(s)

E-mail Address

action@wcc-ip.com

eSign

Date Signed

12/13/12

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	Active Antennas for Multiple Bands in Wireless Portable Devices
--------------------	---

As the below named inventor, I hereby declare that:

This declaration is directed to: ☒ The attached application, or
☐ United States application or PCT international application number _____
 filed on _____

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

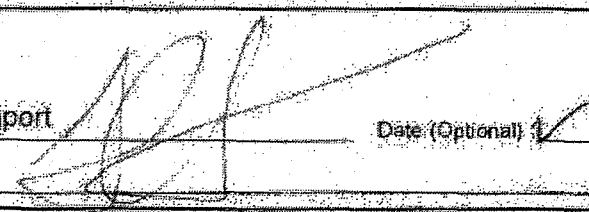
I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: Theodore S. Rappaport

Date (Optional):  _____

Signature:  _____

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 116 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public, which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-5199 and select option 2.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re patent application of

Rappaport

Confirmation No. (not assigned)

Serial No. (not assigned)

Group Art Unit (not assigned)

Filed Concurrently Herewith

Examiner (not assigned)

For ACTIVE ANTENNAS FOR MULTIPLE BANDS IN WIRELESS
PORTABLE DEVICES

This application is a continuation patent application of

Rappaport

Confirmation No. 4056

Serial No. 12/541,764

Group Art Unit 2821

Filed August 14, 2009

Examiner Phan

For ACTIVE ANTENNAS FOR MULTIPLE BANDS IN WIRELESS
PORTABLE DEVICES

Commissioner for Patents

PO Box 1450

Alexandria, Virginia 22313-1450

PRELIMINARY AMENDMENT

Sir:

Prior to calculation of the filing fee and examination on the merits, please
amend the application as follows:

Listing of the Claims: begin on page 2

Remarks: begin on page 8

Listing of the Claims:

The following is a complete listing of all the claims in the application, with an indication of the status of each:

1. (Currently amended) A wireless device, comprising:

one or more antennas wherein at least one of said one or more antennas includes one or more elements or sub-elements, said one or more antennas forming an antenna array; and

a plurality of transmitters, receivers or transceivers that operate in one or more frequency bands,

wherein at least one antenna of said antenna array ~~one or more antennas~~ is used by said plurality of transmitters, receivers or transceivers in a plurality of different bands,

wherein said at least one antenna is one or more of

a) an actively tuned antenna, and

b) is tuned by one or more passive elements which are selected or interconnected using electronic control.

2-3. (Canceled)

4. (Original) The wireless device of claim 3 wherein said passive elements are comprised of either or both lumped or distributed elements.

5. (Original) The wireless device of claim 1 wherein said at least one antenna is used for transmitting, receiving, or transmitting and receiving simultaneously in said plurality of different bands.

6. (Original) The wireless device of claim 1 further comprising

one or more tuners associated with one or more transmitters, receivers or transceivers of said plurality of transmitters, receivers or transceivers; and

a controller for controlling tuning of the tuner for said at least one antenna to operate in said plurality of different bands.

7. (Original) The wireless device of claim 1 wherein said mobile device is selected from the group consisting of computers, telephones, portable computing or communication devices, games, wireless post it notes, wireless memory media, RFID tags, vehicles, clothing, personal data assistants and navigation assistants.

8. (Currently amended) A wireless device, comprising:

one or more antennas wherein at least one of said one or more antennas includes one or more elements or sub-elements, said one or more antennas forming an antenna array; and

at least one multiband transmitter, receiver or transceiver;

a tuner associated with said at least one multiband transmitter, receiver, or transceiver; and

a controller for controlling tuning of the tuner to a plurality of different bands,

wherein at least one antenna of said antenna array ~~one or more antennas~~ is used by said at least one multiband transmitter, receiver or transceiver in a plurality of different bands,

wherein said at least one antenna is one or more of

a) an actively tuned antenna, and

b) is tuned by one or more passive elements which are selected or interconnected using electronic control.

9. (Original) The wireless device of claim 8 said at least one antenna is used for transmitting, receiving, or transmitting and receiving simultaneously in said plurality of different bands.

10. (Original) The wireless device of claim 8 wherein said mobile device is selected from the group consisting of computers, telephones, portable computing or communication devices, games, wireless post it notes, wireless memory media, RFID tags, vehicles, clothing, personal data assistants and navigation assistants.

11-12. (Cancelled)

13. (Currently amended) The wireless device of claim 8 ~~12~~ wherein said passive elements are comprised of either or both lumped or distributed elements.

14. (currently amended) A wireless device, comprising:

at least one multiband antenna which includes one or more elements or sub-elements and which is configured to form an antenna array;

at least one multiband transmitter, receiver or transceiver; and

a tuner associated with said at least one multiband transmitter, receiver, or transceiver, said tuner matching said at least one multiband antenna to said at least one multiband transmitter, receiver or transceiver in a plurality of different bands simultaneously.

15. (Original) The mobile device of claim 14 wherein said at least one antenna is used for transmitting, receiving, or transmitting and receiving simultaneously in said plurality of different bands.

16. (Original) The wireless device of claim 14 wherein said mobile device is selected from the group consisting of computers, telephones, portable computing or communication devices, games, wireless post it notes, wireless memory media, RFID tags, vehicles, clothing, personal data assistants and navigation assistants.

17. (currently amended) A wireless portable device, comprising:

one or more antennas wherein at least one of said one or more antennas includes one or more elements or sub-elements, said one or more antennas forming an antenna array, said one or more antennas radiating or receiving electromagnetic energy at particular frequency bands, at least one of said one or more antennas radiating or receiving electromagnetic energy at a plurality of particular frequency bands;

one or more components selected from the group consisting of receivers, transmitters and transceivers, said one or more components connected to said at least one of said one or more antennas, whereby

at least one of said one or more components transmits or receives electromagnetic energy simultaneously at two or more of said plurality of particular frequency bands, or

two or more components transmit or receive electromagnetic energy at two or more of said plurality of particular frequency bands.

18. (Original) The wireless portable device of claim 17 wherein said wireless portable device is selected from the group consisting of computers, telephones, personal data assistants, and navigation assistants.

19. (Original) The wireless portable device of claim 17 further comprising one or more tuners which match electromagnetic energy at a particular frequency band to only one of said one or more components.

20. (Original) The wireless portable device of claim 17 further comprising isolation means for isolating said one or more components from more than one particular frequency band of said plurality of frequency bands.

21. (Currently amended) A wireless device component, comprising a tuner or a set of tuners or controller or other circuitry configurable to be coupled to at least one antenna of one or more antennas wherein at least one of said one or more antennas includes one or more elements or sub-elements, said one or more antennas forming an antenna array, and a plurality of transmitters, receivers, or transceivers that operate at one or more frequency bands, wherein said at least one antenna is used by said plurality of transmitters, receivers or transceivers in a plurality of different bands,

wherein said at least one antenna is one or more of

a) an actively tuned antenna, and

b) is tuned by one or more passive elements which are selected or interconnected using electronic control.

22. (New) The wireless device of claim 1 wherein said antenna array is configured for use and implemented in a multiple input multiple output (MIMO) system.

23. (New) The wireless device of claim 1 wherein said antenna array is configured for use and implemented in a beam switchable array.

24. (New) The wireless device of claim 8 wherein said antenna array is configured for use and implemented in a multiple input multiple output (MIMO) system.

25. (New) The wireless device of claim 8 wherein said antenna array is configured for use and implemented in a beam switchable array.

26. (New) The wireless device of claim 14 wherein said antenna array is configured for use and implemented in a multiple input multiple output (MIMO) system.

27. (New) The wireless device of claim 14 wherein said antenna array is configured for use and implemented in a beam switchable array.

28. (New) The wireless portable device of claim 17 wherein said antenna array is configured for use and implemented in a multiple input multiple output (MIMO) system.

29. (New) The wireless portable device of claim 17 wherein said antenna array is configured for use and implemented in a beam switchable array.

30. (New) The wireless device component of claim 21 wherein said antenna array is configured for use and implemented in a multiple input multiple output (MIMO) system.

31. (New) The wireless device component of claim 21 wherein said antenna array is configured for use and implemented in a beam switchable array.

32. (New) A wireless communication system, comprising
at least one wireless device, comprising:
one or more antennas; and
a plurality of transmitters, receivers or transceivers that operate in
one or more frequency bands,
wherein at least one antenna of said one or more antennas is used
by said plurality of transmitters, receivers or transceivers in a plurality of different
bands,
wherein said at least one antenna is one or more of
a) an actively tuned antenna, and
b) is tuned by one or more passive elements which are
selected or interconnected using electronic control; and
one or more mobile, portable, or fixed devices or platforms which
communicate with said at least one wireless device.

33. (New) The wireless communication system of claim 32 wherein said at least one wireless device has at least one of said one or more antennas which includes one or more elements or sub-elements, said one or more antennas forming an antenna array.

34. (New) The wireless communication system of claim 33 wherein said antenna array of at least one wireless device is configured for use and implemented in a multiple input multiple output (MIMO) system.

35. (New) The wireless communication system of claim 33 wherein said antenna array of said at least one wireless device is configured for use and implemented in a beam switchable array.

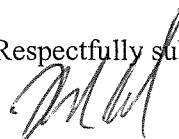
REMARKS

U.S. Patent Application 12/541,764 has proceeded to allowance.

This amendment amends claims 1, 8, 14 and 17, and adds new claim 34, at least one of the antennas include elements and sub elements, and configuring as an array, as discussed on page 15 of the application. Claims 22-31 and 34-35 require the MIMO system or beam steerable array as discussed on page 15 of the application. New claim 35 specifies a system which includes one or more mobile, portable or fixed devices or platforms which communicate with at least one of the wireless devices as discussed on page 6 of the application. The application now includes claims 1, 4-10, and 13-35.

Please proceed to examination on the merits.

Respectfully submitted,



Michael E. Whitham
Reg. No. 32,635

Whitham, Curtis, Christofferson & Whitham, P.C.
11491 Sunset Hills Road, Suite 340
Reston, VA 20190

Tel. (703) 787-9400
Fax. (703) 787-7557

Customer No.: 30743

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re patent application of

T. Rappaport

Confirmation No.: not assigned

Serial No.: not assigned

(CON of USSN 12/541,764)

Group Art Unit: not assigned

Filed: Concurrently

Examiner: not assigned

For: Active Antennas for Multiple Bands in Wireless Portable Devices

INFORMATION DISCLOSURE STATEMENT

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

Sir:

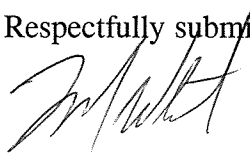
Under the provisions of 37 C.F.R. 1.97 through 1.99 and pursuant to applicant's duty of disclosure under 37 C.F.R. 1.56, applicant respectfully brings the following documents, listed on the attached form PTO-1449 (3 pages), to the attention of the Examiner in charge of the above-identified application. The references cited in the attached PTO-1449 (1 page) are readily available to the Examiner in co-pending U.S. Application Ser. No: 12/541,764 filed on Aug. 14, 2009.

Thus, according to the rules of practice, these references are not provided herein, but are listed on the PTO-1449 form and should be considered by the Examiner. If the Examiner is unable to obtain the listed references, applicant will gladly provide such references upon notification by the Examiner in charge of the examination of the above-identified application.

These citations do not constitute an admission that the references are relevant or material to the claims. They are only cited as constituting related art of which the applicant is aware.

It is respectfully requested that the listed references be considered by the Examiner and formally made of record in this application.

Respectfully submitted,



Michael E. Whitham

Registration No.: 32,635

Date:

12-13-12

Whitham, Curtis, Christofferson & Cook, PC

11491 Sunset Hills Road - #340

Reston, VA 20190

703/787-94000

Customer No. 30743

INFORMATION DISCLOSURE CITATION <i>(Use several sheets if necessary)</i>				ATTY DOCKET NO. 08610010CA		APPLICATION NO. not assigned	
				APPLICANT(S) T. Rappaport			
				FILING DATE concurrently		GROUP ART UNIT not assigned	
U.S. PATENT DOCUMENTS							
*EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
		4,499,606	2/1985	Rambo			
		6,693,600	2/2004	Elliot			
		7,088,299	8/2006	Siegler, et al.			
U.S. PATENT APPLICATION PUBLICATIONS							
*EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
		2003/0151556	8/2003	Cohen			
		2008/0158081	7/2008	Rofougaran			
FOREIGN PATENT DOCUMENTS							
		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION
							YES NO
OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)							
EXAMINER				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.

Electronic Patent Application Fee Transmittal

Application Number:				
Filing Date:				
Title of Invention:	Active Antennas for Multiple Bands in Wireless Portable Devices			
First Named Inventor/Applicant Name:	Theodore S. Rappaport			
Filer:	Michael E. Whitham/karen lumpkins			
Attorney Docket Number:	08610010CA			
Filed as Small Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Utility filing Fee (Electronic filing)	4011	1	98	98
Utility Search Fee	2111	1	310	310
Utility Examination Fee	2311	1	125	125
Pages:				
Claims:				
Claims in excess of 20	2202	11	31	341
Independent claims in excess of 3	2201	3	125	375
Miscellaneous-Filing:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				1249

Electronic Acknowledgement Receipt

EFS ID:	14463686
Application Number:	13713804
International Application Number:	
Confirmation Number:	2671
Title of Invention:	Active Antennas for Multiple Bands in Wireless Portable Devices
First Named Inventor/Applicant Name:	Theodore S. Rappaport
Customer Number:	30743
Filer:	Michael E. Whitham/karen lumpkins
Filer Authorized By:	Michael E. Whitham
Attorney Docket Number:	08610010CA
Receipt Date:	13-DEC-2012
Filing Date:	
Time Stamp:	16:34:53
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$ 1249
RAM confirmation Number	3809
Deposit Account	502041
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Page	Multi Part File	Pages (if appl.)
		Samsung Ex-1002	148 of 155		

1	Application Data Sheet	ADS.pdf	998391	no	5
			7226053285fbae816870d111d80c500a7efa0516		
Warnings:					
Information:					
2		08610010CA-appln.PDF	550041	yes	28
			8bce586e0209ba416fa90d326eb8a75d1d8d8298		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Transmittal of New Application		1	4	
	Specification		5	19	
	Claims		20	23	
	Abstract		24	24	
	Drawings-only black and white line drawings		25	27	
	Oath or Declaration filed		28	28	
Warnings:					
Information:					
3		08610010CA-prel_amdt_IDS.PDF	123786	yes	11
			397c92f7678726d58488f29c1a3216b28b7b02fb		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Preliminary Amendment		1	8	
	Transmittal Letter		9	11	
Warnings:					
Information:					
4	Fee Worksheet (SB06)	fee-info.pdf	38161	no	2
			3e1a6e812de338824fd0c8c38d9327decf0779a2		
Warnings:					
Information:					
Total Files Size (in bytes):			1710379		

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.

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.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	08610010CA
		Application Number	
Title of Invention	Active Antennas for Multiple Bands in Wireless Portable Devices		
The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.			

Secrecy Order 37 CFR 5.2

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)
--

Inventor Information:

Inventor 1					Remove	
Legal Name						
Prefix	Given Name	Middle Name	Family Name	Suffix		
	Theodore	S.	Rappaport			
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service						
City	New York	State/Province	NY	Country of Residence ⁱ	US	
Mailing Address of Inventor:						
Address 1		120 W. 15th Street				
Address 2						
City	New York	State/Province	NY			
Postal Code	10011	Country ⁱ	US			
All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the Add button.						
Add						

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).		
☐ An Address is being provided for the correspondence information of this application.		
Customer Number	30743	
Email Address		Add Email Remove Email

Application Information:

Title of the Invention	Active Antennas for Multiple Bands in Wireless Portable Devices		
Attorney Docket Number	08610010CA	Small Entity Status Claimed	☒
Application Type	Nonprovisional		
Subject Matter	Utility		
Suggested Class (if any)		Sub Class (if any)	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	3	Suggested Figure for Publication (if any)	5

Samsung Ex. 1002, Page 151 of 155

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	08610010CA
		Application Number	
Title of Invention	Active Antennas for Multiple Bands in Wireless Portable Devices		

Publication Information:

☐	Request Early Publication (Fee required at time of Request 37 CFR 1.219)
☐	Request Not to Publish. I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application has not and will not be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.			
Please Select One:	☒ Customer Number	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number	30743		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.			
Prior Application Status	Pending	Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	Continuation of	12541764	2009-08-14
Prior Application Status	Expired	Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
12541764	non provisional of	61088829	2008-08-14
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.			Add

Foreign Priority Information:

This section allows for the applicant to claim benefit of foreign priority and to identify any prior foreign application for which priority is not claimed. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(a).			
Remove			
Application Number	Country i	Filing Date (YYYY-MM-DD)	Priority Claimed
			☒ Yes ☐ No
Additional Foreign Priority Data may be generated within this form by selecting the Add button.			Add

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	08610010CA
	Application Number	
Title of Invention	Active Antennas for Multiple Bands in Wireless Portable Devices	

Authorization to Permit Access:

☒	Authorization to Permit Access to the Instant Application by the Participating Offices
If checked, the undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the instant patent application is filed access to the instant patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the instant patent application is filed to have access to the instant patent application. In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the instant patent application with respect to: 1) the instant patent application-as-filed; 2) any foreign application to which the instant patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the instant patent application; and 3) any U.S. application-as-filed from which benefit is sought in the instant patent application. In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing this Authorization.	

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.				
Applicant 1				
If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.				
Remove				
☐ Assignee	☐ Legal Representative under 35 U.S.C. 117			
☐ Person to whom the inventor is obligated to assign.	☐ Person who shows sufficient proprietary interest			
If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:				
Name of the Deceased or Legally Incapacitated Inventor :				
If the Assignee is an Organization check here. ☐				
Prefix	Given Name	Middle Name	Family Name	Suffix
			Samsung Ex. 1002, Page 153 of 155	

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	08610010CA
		Application Number	
Title of Invention	Active Antennas for Multiple Bands in Wireless Portable Devices		

Mailing Address Information:			
Address 1			
Address 2			
City		State/Province	
Country i		Postal Code	
Phone Number		Fax Number	
Email Address			
Additional Applicant Data may be generated within this form by selecting the Add button. Add			

Signature:				Remove
NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications				
Signature	/Michael E. Whitham/		Date (YYYY-MM-DD)	2012-12-13
First Name	Michael E.	Last Name	Whitham	Registration Number 32635
Additional Signature may be generated within this form by selecting the Add button. Add				

This collection of information is required by 37 CFR 1.76. 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 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet 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 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.