PATENT ASSIGNMENT

Electronic Version v1.1
Stylesheet Version v1.1

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	ASSIGNMENT

CONVEYING PARTY DATA

Name	Execution Date
Etenna Corporation	04/01/2004

RECEIVING PARTY DATA

Name:	Titan Aerospace Electronics Division
Street Address:	6404 Ivy Lane
Internal Address:	Suite 300
City:	Greenbelt
State/Country:	MARYLAND
Postal Code:	20770

PROPERTY NUMBERS Total: 11

Property Type	Number
Patent Number:	5777581
Patent Number:	5943016
Patent Number:	6061025
Patent Number:	6075485
Patent Number:	6646605
Application Number:	09845666
Patent Number:	6690327
Application Number:	10246198
Patent Number:	6590531
Application Number:	10152188
Patent Number:	6525695

CH $440.00 5777581

CORRESPONDENCE DATA

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Total Attachments: 7
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INTELLECTUAL PROPERTY ASSIGNMENT AGREEMENT

THIS INTELLECTUAL PROPERTY ASSIGNMENT AGREEMENT ("*Agreement*") is made and entered into this 1 day of April, 2004 ("*Effective Date*"), by and between ETENNA CORPORATION, a Delaware corporation ("*Etenna or Assignor*") and TITAN AEROSPACE ELECTRONICS DIVISION, a Delaware corporation *("TAED or Assignee")* ("*Assignee*" and together with Assignor, each a "*Party*").

RECITALS

A. TAED desires that Etenna assign to TAED all technology, materials and rights identified on ***Exhibit A*** attached hereto, and all intellectual property rights owned by Etenna, if any, that are embodied in the foregoing (the "*Assigned Intellectual Property*").

B. TAED desires that Etenna license to TAED all technology, materials and rights identified on ***Exhibit B*** attached hereto, and all intellectual property rights owned by Assignor, if any, that are embodied in the foregoing (the "*Licensed Intellectual Property*").

C. Etenna is willing to assign and license the Assigned and Licensed Intellectual Property, respectively, to Assignee, subject to the terms and conditions set forth in this Agreement.

AGREEMENT

NOW THEREFORE, in consideration for the mutual covenants set forth below, and for other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the Parties hereby agree as follows:

1. Assignment. Etenna hereby irrevocably assigns, sells, transfers and conveys to TAED all right, title and interest, on a worldwide basis, in and to the Assigned Intellectual Property and all applicable intellectual property rights, moral rights, contractual rights and any other legal rights, on a worldwide basis, related thereto. Etenna hereby waives and releases any rights or claims it may have against TAED, its officers, directors, employees, agents, affiliates, licensees or successors, now or in the future, with respect to any and all Assigned Intellectual Property. Etenna covenants that it shall not undertake any action or assert any claim, whether against TAED or any third party, which action or claim would be adverse to or inconsistent with TAED's (or its successor's, licensee's or assignee's) right, title and interest in and to the Assigned Intellectual Property or (or its successor's, licensee's or assignee's) ability to exercise any such right, title or interest. Etenna acknowledges that from and after the Effective Date of this Agreement, it shall have no further rights in any Assigned Intellectual Property, nor any rights to use any such Assigned Intellectual Property in any matter or for any purpose.

2. License. Etenna hereby grants a paid-up, royalty-free exclusive license to TAED of all right, title and interest in and to the Licensed Intellectual Property for U. S. Government and Department of Defense Purposes and all associated intellectual property rights, moral rights, contractual rights and any other legal rights related thereto owned by Etenna. U. S. Government and Department of Defense Purposes are defined herein is any purpose paid in whole or in part by the U. S. Government directly to TAED in which the Licensed Intellectual Property is used.

Etenna covenants that it shall not undertake any action or assert any claim, whether against TAED or any third party, which action or claim would be adverse to or inconsistent with TAED's (or its successor's, licensee's or assignee's) right, title and interest in and to the Licensed Intellectual Property or (or its successor's, licensee's or assignee's) ability to exercise any such right, title or interest. The parties acknowledge that from and after the Effective Date of this Agreement, Etenna shall have rights to license or further develop the Licensed Intellectual Property, on a worldwide basis, for all purposes other than U. S. Government and Department of Defense Purposes, including, but not limited to, commercial purposes.

3. Payment. Assignee agrees to pay to Assignor the sum of one hundred thousand Dollars (U.S. $100,000), which amount shall be due and payable on the Effective Date.

4. Further Assurances. Assignor hereby acknowledges that Assignor retains no rights to use the Assigned Intellectual Property and agrees not to challenge the validity of Assignee's ownership of the Assigned Intellectual Property or undertake any actions inconsistent with Assignee's ownership thereof. Furthermore, Assignor hereby acknowledges that Assignee has limited rights to use the Licensed Intellectual Property and agrees not to challenge the validity of Assignee's license of the Licensed Intellectual Property or undertake any actions inconsistent with Assignee's license thereof. Upon reasonable request by Assignee, Assignor agrees promptly to execute documents and take other acts as Assignee may deem reasonably necessary to procure, maintain, perfect, evidence and enforce the full benefits, enjoyment, rights, title and interest, on a worldwide basis of the Assigned Intellectual Property and the Licensed Intellectual Property and all rights assigned hereunder.

5. Payment of Costs. The parties agree that Assignee shall be solely responsible for all Costs associated with the Assigned Intellectual Property and Assignor shall be solely responsible for all Costs associated with the Licensed Intellectual Property. These Costs include costs of filing any patent applications or necessary documents, costs of prosecution of pending patent applications, including domestic and international official fees and attorney fees, for any pending applications and continuing applications based on the pending applications, costs of granting of the patent applications as issued patents and the costs of annuities, maintenance fees and any other fees necessary to keep issued patents in force in any jurisdiction. The decision to abandon any patent application or issued patent of the Assigned Intellectual Property shall be at the sole discretion of the Assignee and the decision to abandon any patent application or issued patent of the Licensed Intellectual Property shall be at the sole discretion of the Assignor.

6. Delivery. Assignor further agrees to deliver to Assignee upon execution of this Agreement any and all tangible manifestations of the Assigned Intellectual Property, including, without limitation, all notes, records, files and tangible items of any sort in its possession or under its control relating to the Assigned Intellectual Property and the Licensed Intellectual Property.

7. Termination. This agreement shall be continued until the last expiration date of the patents licensed under this agreement, unless sooner terminated by failure of either party to comply with any provision of this agreement excluding entry into bankruptcy by either party. In the event of failure of the breaching party to comply with a provision of this agreement, the non-breaching party may serve written notice of breach of the agreement on the breaching party and,

if such breach is not fully cured within 30 days from the receipt of such notice, the non-breaching party may require the breaching party to pay $500 per day after the 30 days to a total of $20,000 until such breach is fully cured.

8. Bankruptcy. Should Assignor enter bankruptcy or be within 30 days of declaring bankruptcy, it is the intent of both parties that Assignee be afforded an opportunity to purchase the Licensed Intellectual Property for all purposes for a reasonable consideration and be compensated for the lost opportunity should the opportunity be rescinded. To this end, Assignee agrees to pay to Assignor (prior to entry of bankruptcy) or to Trustee of the bankruptcy estate (after entry of Assignor into bankruptcy) or to Receiver (after entry of the Assignor into receivership) $10,000 for assignment of the Licensed Intellectual Property under the same terms as the Assigned Intellectual Property. Should said Assignor refuse to assign the Licensed Intellectual Property to Assignee, said Assignor shall pay the Assignee $10,000 as liquidated damages, or should said Trustee or Receiver rescind such a transfer, said Trustee or Receiver shall pay the Assignee $10,000 from the estate of Assignee as liquidated damages. Should a court of competence find the preceding provision contrary to any bankruptcy law, Assignee shall have the right to purchase the assignment of the Licensed Intellectual Property prior to any third party.

9. Infringement. Should Assignee be notified or sued by any third party for infringement based on the Assigned Intellectual Property or Licensed Intellectual Property, or should litigation arise as to the validity of the Assigned Intellectual Property or Licensed Intellectual Property, Assignee shall bear all costs, expenses including associate legal fees, and related damages related to such litigation and defense of the Assigned Intellectual Property or Licensed Intellectual Property. Assignor does not indemnify the Assignee for any reason related to litigation regarding the Assigned Intellectual Property or Licensed Intellectual Property. Assignor expressly grants Assignee the right to sue a third party for patent infringement of the Licensed Intellectual Property.

10. Warranty. Assignor represents and warrants that it owns, solely or jointly with Assignee, all right, title and interest in and to the Assigned Intellectual Property and the Licensed Intellectual Property, that Assignor has the right and authority to assign, sell, transfer and convey the Assigned Intellectual Property to Assignee and otherwise to perform its obligations under this Agreement, and that this Agreement will be enforceable in accordance with its terms.

11. Entire Agreement. This Agreement and ***Exhibit A*** and ***Exhibit B*** attached hereto constitute the entire, complete, final and exclusive understanding and agreement of the Parties with respect to the subject matter set forth above, and supersedes any other prior or contemporaneous oral understanding or agreement and any other prior written agreement on such subject matter. No modification of or amendment to this Agreement, nor any waiver of any rights under this Agreement, will be effective unless in writing and signed by authorized representatives of both Parties. Failure by either Party to exercise any of its rights hereunder shall not constitute or be deemed a waiver or forfeiture of such rights.

12. Governing Law. This Agreement will be governed and construed in accordance with the laws of the State of Maryland, as applied to transactions taking place wholly within Maryland between Maryland residents. Each of the Parties hereby expressly consents to the

13. Severability. If any provision of this Agreement is found invalid or unenforceable, in whole or in part, the remaining provisions and partially enforceable provisions will, nevertheless, be binding and enforceable.

14. Applicability. The provisions hereof shall inure to the benefit of, and be binding upon, the successors, assigns, heirs, executors and administrators of the parties hereto.

IN WITNESS WHEREOF, the Parties have caused their duly authorized representatives to execute this Agreement as of the Effective Date.

ASSIGNOR:

ETENNA CORPORATION

By: _____

Printed Name: David T. Auckland

Title: Chief Technical Officer

ASSIGNEE:

TITAN AEROSPACE ELECTRONICS DIVISION

By: _____

Printed Name: Robert S. Cooper

Title: President, Titan AED

EXHIBIT A

Description of Assigned Intellectual Property

1B - Tunable microstrip patch antenna
ABSTRACT: A patch antenna is provided with one or more tuning strips spaced therefrom and RF switches to connect or block RF therebetween. When RF is connected between the tuning strips and the patch, the tuning strips increase the effective length of the patch and lower the antenna's resonant frequency. Thereby allowing the antenna to be frequency tuned electrically over a relatively broadband of frequencies. If the tuning strips are connected to the patch in other than a symmetrical pattern, the antenna pattern of the antenna can be changed.
First TPA patent of Atlantic using diodes or other RF switch mechanisms to adjust resonant frequency.
US Patent number: 5,777,581
Priority date: 7 December 1995
Issued: 7 July 1998
Application Status: US issued patent.

2 - Tunable microstrip patch antenna and feed network therefore
ABSTRACT: A patch antenna is provided with one or more tuning strips spaced therefrom and RF switches to connect or block RF currents therebetween. When a conducting path for RF current is connected between the tuning strips and the patch, the tuning strips increase the effective length of the patch and lower the antenna's resonant frequency, thereby allowing the antenna to be frequency tuned electrically over a relatively broadband of frequencies. If the tuning strips are connected to the patch in other than a symmetrical pattern, the antenna pattern of the antenna can be changed. A feed network couples RF to the antenna and includes two hybrid couplers, one for providing the correct amplitude and phase of excitation at the feed probes, and the second for effectively dissipating reflected power due to antenna impedance mismatch.
US Patent number: 5,943,016
Priority date: 7 December 1995
Issued: 24 August 1999
Application Status: US issued patent.

3 - Tunable microstrip patch antenna and control system therefore
ABSTRACT: A patch antenna is provided with one or more tuning strips spaced therefrom and RF switches to connect or block RF currents therebetween. When a control system for the antenna selectively connects and isolates RF currents between certain of the tuning strips and the patch, the tuning strips change the effective length of the patch and thus the antenna's resonant frequency, thereby frequency tuning the antenna electrically over a relatively broad band of frequencies. The control system includes circuitry for rapidly switching the antenna to a desired frequency with minimal delay and with superior isolation from the antenna, making it suitable for use in DAMA, TDMA, and other frequency hopping applications.
US Patent number: 6,061,025
Priority date: 7 December 1995
Issued: 9 May 2000
Application Status: US issued patent.

4B - Reduced weight artificial dielectric antennas and method for providing the same
ABSTRACT: An artificial dielectric material is used as a microstrip patch antenna substrate and can achieve dramatic antenna weight reduction. The artificial dielectric is composed of a periodic structure of low and high permittivity layers.
US Patent number: 6,075, 485
Priority date: 3 November 1998
Issued: 13 June 2000
Application Status: US issued patent.

71 - **Tunable reduced weight artificial dielectric antennas**
ABSTRACT: A tunable artificial dielectric material achieves the weight reductions made possible in U.S. Pat. No. 6,075,485 and further achieves even higher resonant frequency tuning ratios. In one embodiment of the invention, the artificial dielectric substrate for a patch antenna comprises alternating low and high permittivity layers, with the high permittivity layers each comprised of printed capacitive Frequency Selective Surface (FSS). An example FSS of the invention has a voltage tunable effective sheet capacitance by virtue of varactor diodes integrated into each unit cell. By appropriate adjustment of the bias voltage across the varactor diodes, the amount of the electric field stored in the substrate can be varied, which further varies the resonant frequency of the patch antenna.
US Patent number: 6,646,605
Priority Date: 12 October 2000
Issued: 11/11/2003
Application Status: US issued patent.

11 -**Reconfigurable artificial magnetic conductor**
ABSTRACT: An electronically reconfigurable artificial magnetic conductor (RAMC) includes a frequency selective surface (FSS) having an effective sheet capacitance which is variable to control resonant frequency of the RAMC. In one embodiment, the RAMC further includes a conductive backplane structure and a spacer layer separating the conductive backplane structure and the FSS. The spacer layer includes conductive vias extending between the conductive backplane structure and the FSS, and voltage variable capacitive circuit elements coupled with the FSS and responsive to bias voltages applied on one or more bias signal lines routed through the conductive backplane structure and the conductive vias.
US Patent application serial number 09/845,666, filed 30 April 2001
US Patent publication number US 2002-0167457 A1 PCT: US02/13542 (filed 4/30/02)
PCT Publication number: WO02/089256
Application Status: Response to Office action filed 3/17/2004. Patent should issue within 6 months.

12 - **Reconfigurable artificial magnetic conductor using voltage controlled capacitors with coplanar resistive biasing networks**
ABSTRACT: A frequency reconfigurable artificial magnetic conductor (AMC) includes a ground plane, a spacer layer disposed adjacent to the ground plane and a plurality of vias in electrical contact with the ground plane in direction of the spacer layer. The AMC further includes a frequency selective surface (FSS) disposed on the spacer layer and including a periodic pattern of bias node patches alternating with ground node patches, the ground node patches being in electrical contact with respective vias of the plurality of vias, and components between selected bias node patches and ground node patches, the components having a capacitance which is variable in response to a bias voltage. A network of bias resistors between adjacent bias node patches provides the tuning voltage.
US Patent number 6,525,695
Priority date: 30 April 2001
Issued 25 February 2003
Application Status: US issued patent.

17 - **Artificial magnetic conductor surfaces loaded with ferrite-based artificial magnetic materials**
ABSTRACT: A magnetically-loaded AMC surface provides enhanced bandwidth. The structure includes in one embodiment a thumbtack structure with a spacer layer that is loaded with a barium-cobalt hexaferrite based artificial magnetic material. Specifically, the geometry consists of a ground plane covered with thinly sliced ferrite tiles that are metallized and stacked. Each tile has a metal via running through its center that is electrically connected to the plated matallized surfaces. A foam spacer layer resides above the ferrite tiles. Atop the foam spacer layer rests a capacitive surface, which can be realized as a single layer array of metal patches, a multiple layer array of overlapping patches or other planar capacitive geometry.
US provisional application serial number 60/480,098, filed 6/20/2003
Application Status: Non-provisional and foreign filing deadline 6/20/2004.

34 - **Mechanically reconfigurable artificial magnetic conductor**

ABSTRACT: In an artificial magnetic conductor, the distance between the frequency selective surface and the ground plane is mechanically varied to adjust the effective inductance of the structure and thus the resonant frequency of the device.
US Patent number 6,690,327
Priority date: 19 September 2001
Issued: 10 February 2004
Application Status: US issued patent.

35 - **Broadband antennas over electronically reconfigurable artificial magnetic conductor surfaces**
ABSTRACT: An antenna system includes a frequency selective surface (FSS) having an effective sheet capacitance which is variable to control resonant frequency of the AMC and an antenna element positioned adjacent to the FSS.
US Patent application serial number 10/246,198, filed 17 September 2002
US Patent publication number: US 2003-0112186 A1
Priority date: 19 September 2001
Application Status: Response to office action filed 17 March 2004. Patent should issue within 6 months.

20 - **Planar, fractal, time-delay beamformer**
ABSTRACT: An antenna beamformer is disclosed that uses controllable time delay elements distributed in a planar fractal feed network between the input port and multiple output ports. The use of time delay elements, rather than phase shifting elements, allows the beamformer to maintain a constant steering angle independent of frequencies over a broad range of frequencies.
US Patent number: 6,590,531
Priority date: 20 April 2001
Issued: 8 June 2003
Application Status: US issued patent.

43 - **Low cost trombone line beamformer**
ABSTRACT: Microstrip trombone lines are used to provide a low cost, linear beamformer. The beamformer may form an array that scans signals in one or more dimensions. Each microstrip trombone line includes printed traces on a fixed substrate and a trombone line on a movable superstrate. The microstrip trombone line may have different dimensions to vary the characteristic impedance at either end and decrease the insertion losses. Beamformers operating in multiple dimensions require few movable parts and linear actuators.
US Patent application serial number 10/152,188, filed 21 May 2002
Priority date: 5 April 2002
US Patent publication number: US 2003-0016097 A1
PCT: US03/08655 (filed 3/2/2003)
PCT Publication number: WO03/088413
Application Status: Issue fee paid 30 March 2004. Should issue by Jun 2004.