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Has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.

Therefore, this

United States Patent

Grants to the person(s) having title to this patent the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States of America or importing the invention into the United States of America, and if the invention is a process, of the right to exclude others from using, offering for sale or selling throughout the United States of America, or importing into the United States of America, products made by that process, for the term set forth in 35 U.S.C. 154(a)(2) or (c)(1), subject to the payment of maintenance fees as provided by 35 U.S.C. 41(b). See the Maintenance Fee Notice on the inside of the cover.

Michelle K. Lee

Director of the United States Patent and Trademark Office



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(54) **HIGH GAIN AND WIDEBAND
COMPLEMENTARY ANTENNA**

(58) **Field of Classification Search**
USPC 343/700 MS, 795, 846, 725, 730, 821
See application file for complete search history.

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(56) **References Cited**

U.S. PATENT DOCUMENTS

3,594,806	A	7/1971	Black et al.	
4,724,443	A	2/1988	Nysen	
6,317,084	B1	11/2001	Chen et al.	
6,593,887	B2	7/2003	Luk et al.	
7,119,746	B2	10/2006	Luk et al.	
7,236,130	B2 *	6/2007	Voigtlaender	343/700 MS
7,843,389	B2 *	11/2010	Luk et al.	343/700 MS
7,999,744	B2	8/2011	Chin et al.	
2005/0237260	A1 *	10/2005	Bancroft	343/859
2011/0006960	A1 *	1/2011	Edwards et al.	343/730

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FOREIGN PATENT DOCUMENTS

CN 100428564 C 12/2005

* cited by examiner

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(57) **ABSTRACT**

An antenna is disclosed as including at least one dipole connected with at least one shorted patch antenna, and at least two feeding sources.

24 Claims, 11 Drawing Sheets

