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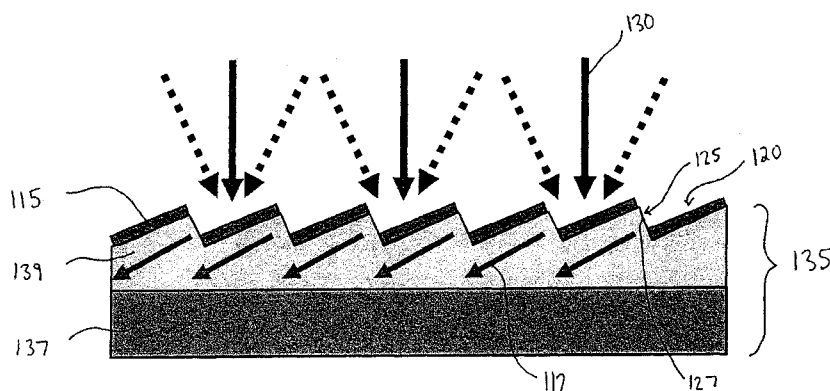


Fig. 6a

(57) Abstract: A vertical dipole array structure includes a substrate that supports a film, which is not comprised of a negative-index metamaterial. The film includes a plurality of tilt-oriented portions and apertures. At least two of the tilt-oriented portions are separated by an aperture, and the tilt-oriented portions are configured such that incident radiation is redirected into a negative or positive refraction direction.



A. CLASSIFICATION OF SUBJECT MATTER**G02B 27/12(2006.01)i**

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G02B 27/12; H01J 3/14; H01L 21/44

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords: vertical, nano, aperture, negative refraction

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2005-0161589 A1 (HONG KOO KIM et al.) 28 July 2005 See Abstract; Figure 3A; Claim 1	1-31
A	Orbons, S. M. et al., Nanoscale annular array metamaterials, ICONN 2006, pp. 466-469, 3-7 July 2006 See Abstract; Figure 1	1-31
A	Lheurette, E. et al., Negative index subwavelength arrays operating at 0.5 THz, The Forth EuCAP 2010, pp. 1-4, 12-16 April 2010 See Abstract; Figure 2	1-31



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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

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US 2005-0161589 A1

28.07.2005

US 2008-0024873 A1

31.01.2008

US 7315426 B2

01.01.2008

US 7492530 B2

17.02.2009