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US 12/888,208 (CON)  
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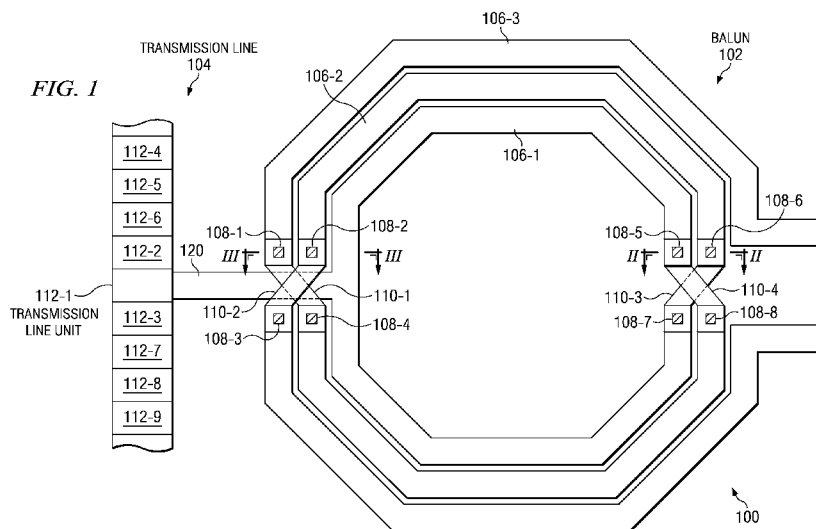
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Declarations under Rule 4.17:

— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))

[Continued on next page]

(54) Title: LOW IMPEDANCE TRANSMISSION LINE



(57) Abstract: A system (100) has a transmission line (104) coupled to a balun (102) at its center tap (120). Typically, transmission line (104) carries signals in the frequency range of about 160GHz (for example) and can have a length of about 20µm. To adjust the impedance applied at the center tap (120), the transmission line units (112-1 to 112-9) of transmission line (104) are varied around the center tap (120). Transmission line units near (i.e., 112-1 to 112-3) the center tap 120 cascade in decreasing height. Each of these transmission line units (112-1 to 112-9) generally comprises a MOS capacitor, a metal capacitor, and a coplanar waveguide.





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— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

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**A. CLASSIFICATION OF SUBJECT MATTER***H01L 27/04(2006.01)i, H01L 21/768(2006.01)i, H01L 29/92(2006.01)i, H01L 21/3205(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)

H01L 27/04; H03K 19/0175; H03K 17/04; H04B 3/30; H01L 21/822; H01L 21/44; H01L 21/48

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) &amp; Keywords: transmission line, MOS capacitor, coplanar waveguide, impedance

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	JP 2007-115737 A (TAMA TLO KK) 10 May 2007 See bstract, claims 1-15, figures 1-23.	1-2,7 3-6,8-20
A	JP 2001-111408 A (HITACHI LTD.) 20 April 2001 See abstract, claims 1-4, figures 1-7.	1-20
A	JP 2005-027005 A (MATSUSHITA ELECTRIC IND. CO., LTD.) 27 January 2005 See abstract, claims 1-5, figures 1-7.	1-20
A	US 05639686 A (HIRANO, M. et al.) 17 June 1997 See abstract, claims 1-26, figures 1-50.	1-20

 Further documents are listed in the continuation of Box C. See patent family annex.

\* Special categories of cited documents:

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

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

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

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

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

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

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

"&amp;" document member of the same patent family

Date of the actual completion of the international search

30 APRIL 2012 (30.04.2012)

Date of mailing of the international search report

**03 MAY 2012 (03.05.2012)**

Name and mailing address of the ISA/KR

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**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/US2011/052767**

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2007-115737 A	10.05.2007	JP 04-799992 B2 US 2009-0108955 A1 US 7804111 B2 WO 2007-046268 A1	12.08.2011 30.04.2009 28.09.2010 26.04.2007
JP 2001-111408 A	20.04.2001	None	
JP 2005-027005 A	27.01.2005	None	
US 05639686 A	17.06.1997	JP 04-171823 A JP 04-262514 A JP 04-262536 A JP 04-269829 A JP 04-276608 A JP 05-022004 A JP 05-041322 A JP 2784360 B2 JP 2962490 B2 US 05281769A A US 05550068A A US 05652157A A	19.06.1992 17.09.1992 17.09.1992 25.09.1992 01.10.1992 29.01.1993 19.02.1993 06.08.1998 12.10.1999 25.01.1994 27.08.1996 29.07.1997