Compact Asymmetric Coplanar Waveguide Fed Monopole Antenna for DVB-H Applications

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ABSTRACT

The purpose of this thesis is to design and manufacture the miniaturized antenna for digital video broadcasting-handheld (DVB-H) application. The miniaturized DVB-H antenna has become very attractive for applications in mobile communication devices such as laptop computers, mobile phones and automobiles. Because the volume reserved for an antenna inside these devices is limited, a DVB-H antenna should be electrically small, and broadband operation has the challenging. In this thesis, the printed monopole antenna which utilizes the coplanar waveguide line is designed. The proposed antenna comprises a P-shape patch and a L-shaped ground plane. By the use of the different length of asymmetric ground plane, an additional resonant mode (0.75-wavelenght) adjacent to the antenna ’ s fundamental (0.25-wavelength) resonant mode can be excited. In addition, the use of coplanar waveguide fed structure has advantages like single metallic layer structure, lightweight, low cost and easy integration to monolithic microwave integrated circuits (MMICs). Based on the simulations of radiation patterns, return loss, and other antenna parameters from Ansoft High Frequency Structure Simulator (HFSS), the prototype antenna is designed. The proposed antenna can operate in the 439 – 937 MHz frequency range below -6 dB and cover the DVB-H operating bandwidth (470 - 862 MHz). The antenna has an approximately omni-directional radiation pattern in XZ-plane over the entire frequency band.

Keywords : digital video broadcasting-handheld (DVB-H)、printed monopole antenna、coplanar waveguide

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REFERENCES

[1] DVB Timeline – History of DVB http://www.dvb.org/about_dvb/history/dvb_timeline/.

[2] DVB – History of the DVB Project http://www.dvb.org/.

[3] Arjona Andres - Internet Protocol Datacasting Telecommunications Software and Multimedia Laboratory, Espoo, 2005.

[4] Broadcasting to Handhelds - Digital Terrestrial Mobile TV, May 2011. http://www.dvb.org/technology/fact_sheets/DVB-H_Factsheet.pdf

[5] DVB-H: Digital Broadcast Services to Handheld Devices http://www.dvb-h.org/PDF/01566629_DVB-H.pdf [6] Herrero, Carlos and Vuorimaa, Petri - Delivery of Digital Television to Handheld Devices, Telecommunications Software and Multimedia Laboratory, Helsinki University of technology.

[7] Kornfeld, Michael - DVB-H - The emerging standard for mobile data communication.

[8] Reimers, Ulrich – DVB - The Family of International Standards for Digital Video Broadcasting, Springer-Verlag Berlin Heidelberg, 2005.

[9] Amitabh Kumar , " Mobile TV DVB-H, DMB, 3G Systems and Rich Media applications " , 2007.

[10] DVB Document A080, Apr 2004.

[11] Pekowsky, Stuart and Maalej, Khaled - DVB-H architecture for mobile communications systems, Apr 2005.

[12] ETSI EN 301 192: " Digital Video Broadcasting (DVB) and DVB specification for broadcasting " .

[13] EICTA: Mobile and Portable DVB-T/H Radio Access - Interface Specification, version 2.0, 2007.

[14] DVB Project, DVB-H Implementation Guidelines, DVB Document A092 Rev. 2 May 2007, http://www.dvb.org -> Standards & Technology.

[15] Compact Integrated Antennas, Freescale semiconductor, Nov 2004.

[16] Constantine A. Balanis - Antenna theory, John Wiley & Sons, Inc., 2005.

[17] W. L. Stutzman and G.A. Thiele, Antenna Theory and Design. New York: John Wiley & Sons Inc., 1998.

[18] K. Fujimoto, J.R. James - Mobile Antenna Systems Handbook, Artech house, INC, 2001.

[19] Gardiol, Fred – Microstrip circuits, John Wiley & Sons Inc, 1994.

[20] Y. W. Chi, K. L. Wong, and S. W. Su, " Broadband printed dipole antenna with a step-shaped feed gap for DTV signal reception, " IEEE Trans. Antennas Propag., vol. 55, no. 11, pp. 3353 – 3356, Nov. 2007.

[21] Y. W. Chi, K. L.Wong, and S. H. Yeh, " End-fed modified planar dipole antenna for DTV signal reception, " Microw. Opt. Technol. Lett., vol. 49, no. 3, pp. 676 – 680, Mar. 2007.

[22] C. Y. Huang, B. M. Jeng, and J. S. Kuo, " Grating monopole antenna for DVB-T applications, " IEEE Trans. Antennas Propag., vol. 56, no. 6, pp. 1175 – 1176, Jun. 2008.

[23] B.-M. Jeng, C.-M. Lee, and C.-H. Luo, " Multiple-ring monopole antenna with sleeve-shaped ground for DVB-T applications, " Progress In Electromagnetics Research C, vol. 14, 155-161, 2010.

[24] Mau-Phon Houng, Yu-Jen Chou, Ding-Bing Lin, and I-Tseng Tang, " A Monopole Antenna with CPW-fed for Digital Video Broadcasting Applications, " PIERS Proceedings, Marrakesh, MOROCCO, March 20-23, 2011.

[25] Rainee N. Simons - Coplanar Waveguide Circuits, Components, and Systems. John Wiley & Sons, Inc., 2001.

[26] DVB-H implemented Guidelines: ETSI: TR 102 337 V1.1.1 (2005 – 02), European Telecommunications Standards Institute.