

論文 / 著書情報
Article / Book Information

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Title(English)	Study on Propagation Delay Characteristics for VHF Band Broadband Mobile Communication Systems
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Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

(博士課程)
Doctoral Program

論文要旨

THESIS SUMMARY

専攻：	国際開発工学	専攻
Department of		
学生氏名：	小原 宏貴	
Student's Name		

申請学位 (専攻分野)：	博士	(工学)
Academic Degree Requested	Doctor of	
指導教員 (主)：	高田 潤一	教授
Academic Supervisor(main)		
指導教員 (副)：		
Academic Supervisor(sub)		

要旨 (英文 800 語程度)
Thesis Summary (approx.800 English Words)

The thesis is entitled "Study on Propagation Delay Characteristics for VHF Band Broadband Mobile Communication Systems" and comprises six chapters.

Chapter 1 presents the background of this study and research motivation in detail. The current status of the VHF and UHF band is described because the VHF-high band from 170 MHz to 202.5 MHz is now available for the public broadband mobile communication (PBB) system for private communication networks by public organizations, which is one example of broadband mobile communication systems in the VHF band. In order to perform the PBB system in harsh environments, the ARIB STD T-103 which is a standard for the PBB system is standardized by employing strict condition. Also, the influence of propagation delay characteristics on broadband mobile communications as well as several issues such as inter-symbol interference and frequency selective fading due to multipaths are summarized here. Then, the main objective of this study is described to clarify the propagation delay characteristics for the VHF band broadband mobile communication systems in an urban environment.

Chapter 2 presents the issues of existing channel models which might be suitable for the VHF band broadband mobile communication systems, and a proposed channel modeling approach based on the Saleh-Valenzuela (S-V) model is introduced here. Conventionally, the VHF bands have been widely utilized by wireless communication systems such as analog TV broadcasting services. Thus, there exist few channel models for the VHF band broadband mobile communication systems. In this study, three channel models such as COST 207 channel model, IEEE 802.22 channel model and PBB channel model are selected to discuss the issues of the existing channel models. Since the proposed channel model is based on the S-V model, an overview of modeling approach is also described in detail here. By adopting the proposed channel modeling approach, it is expected that the propagation delay characteristics for the VHF band mobile communication systems are able to be expressed more accurately by statistical analysis.

Chapter 3 proposes the propagation measurement and analysis method of channel impulse responses (CIRs) to obtain the propagation delay characteristics for the VHF band broadband mobile communication systems more easily and rigorously. Currently, there are few reports on radio wave propagation characteristics for the VHF band broadband mobile communication systems. In particular, the previous propagation measurement results included the signal contamination from analog terrestrial TV broadcasting services because it has not been terminated in those days. In this study, a rigorous CIR measurement is conducted in an environment without signal contamination from analog terrestrial TV broadcasting services for the VHF band broadband mobile communication systems. A PBB device which is compliant with the ARIB STD

T-103 is utilized with a commercial signal analyzer to measure the CIRs. In this chapter, details of the CIR measurement system, transmitted signal, measurement environment are explained, and the influence of propagation delay on the measured CIRs and fading characteristics in VHF band broadband mobile communications systems are shown.

Chapter 4 shows the detailed analysis of propagation delay characteristics for the VHF band broadband mobile communication systems. Delay paths due to buildings or obstacles are extracted by successive interference cancellation (SIC). SIC detects the peak of CIR successively by subtraction processing, using a template CIR which is obtained by autocorrelation of the reference signal. For the extracted delay paths, the K-power-means algorithm is adopted to classify them into clusters. Detailed descriptions of SIC and K-power-means algorithm are explained with some analysis examples. These analyses are necessary to conduct the channel modeling based on the S-V model to extract the channel model parameters. In addition, the number of arrival clusters is also investigated, and the distribution for the VHF band broadband mobile communication in this environment is discussed for better fitting.

Chapter 5 proposes a statistical channel model for the VHF band broadband mobile communication systems to clarify the propagation delay characteristics more accurately. Channel model parameters for the VHF band broadband mobile communication systems are extracted by statistical analysis based on the modified S-V model. Since the regression analysis is employed to obtain the decay factor and arrival rate for clusters and rays, a statistical test is introduced for validation of the decay factor and arrival rate. For fluctuation of path power gain, the usage of the Generalized Extreme Value distribution is proposed for better fitting. The CIRs are reconstructed by using the extracted channel model parameters and compared with the measured CIRs. Also, the CDFs of RMS delay spread and maximum excess delay are calculated for the measured and simulated CIRs to characterize the propagation delay for the VHF broadband mobile communication systems, and the two-sample Kolmogorov-Smirnov test is used in the validation of the measurement and simulated result for the RMS delay spread and maximum excess delay, respectively.

Chapter 6 concludes the thesis with some contributions in terms of the clarification of propagation delay characteristics for the VHF band broadband mobile communication systems.

備考：論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。

Note: Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1 copy of 800 Words (English).

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