EMPIRICAL APPROACH FOR 5G NR 3.5 GHZ DENSE URBAN PROPAGATION MODEL TUNING

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Degree of Master of Science

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DECLARATION

I declare that this is my own work and this Dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or Institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text. I retain the right to use this content in whole or part in future works (such as articles or books).

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The supervisor should certify the Dissertation with the following declaration.

The above candidate has carried out research for the Degree of Master of Science Dissertation under my supervision. I confirm that the declaration made above by the student is true and correct.

Name of Supervisor: Dr. Kasun T. Hemachandra

Signature of the Supervisor: Date:

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ABSTRACT

With the increasing demand for wireless networks and rapid growth in wireless access technologies, there are numerous technical and economic problems during the planning, deployment and optimization phases of radio networks from the operator's point of view. Wireless signal prediction is one of the major approaches to minimize those problems by pre-analyzing coverage, capacity and interference through specific propagation modelling. With the introduction of fifth generation (5G) wireless systems in the last decade, several new technical aspects such as higher operating frequency, larger bandwidth, massive multiple-input and multiple-output (MIMO) and beamforming features have been incorporated into 5G wireless networks. However, these new technical aspects are not properly addressed in legacy propagation modelling. Hence, telecommunication operators find it difficult to have accurate propagation models which minimize the gap between simulation results and actual field measurements. This thesis presents a novel approach of propagation modelling for 3.5 GHz 5G network in urban environment.

The proposed methodology first provides a method for purifying field-collected signal strength samples by new filtering and averaging approaches. The purified samples are then used to accommodate 5G features in different scenarios in the Planet tool, which is the most popular engineering tool among wireless network operators for network coverage simulation. Furthermore, this thesis compares the accuracy of the proposed universal model with the basic universal model and other legacy models, which do not capture the main characteristics of 5G wireless access technology.

Keywords: 5G, beamforming, high bandwidth communications, propagation modelling.

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LIST OF ABBREVIATIONS

Abbreviation	Description
3D	three dimensional
3GPP	third generation partnership project
4D	four dimensional
5G	fifth generation
AAU	active antenna unit
BW	bandwidth
EIRP	isotropic radiated power
GPS	global positioning system
GSCM	geometry based stochastic channel
LOS	line of sight
LTE	long-term evolution
MDT	minimizing of drive test
MIMO	multiple-input and multiple-output
mm Wave	millimeter wave
MSE	mean square error
NR	new radio
PA	power amplifier
RSSI	received signal strength indicator