CO-CHANNEL INTERFERENCE STUDIES BETWEEN HIGH ALTITUDE PLATFORM AND TERRESTRIAL SYSTEM IN MALAYSIA

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To my beloved mother and father

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In the name of Allah the Most Gracious and the Most Merciful

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INTRODUCTION

1.1 Overview

High Altitude Platform Station (HAPS) technology is a new technology that can perform the tasks currently handled terrestrial and satellite systems. The tasks include telecommunication, broadcasting services, surveillance of persons and goods, areas and weather monitoring, mapping, data collection, remote sensing and so on. The high altitude platform station is situated from 17 km to 22 km above ground in the stratosphere [1].

In Malaysia, QucomHaps is the telecommunication operator that manages about HAPS. A piloted M-55GN stratospheric aircraft is proposed to be used as the high altitude platform in Malaysia. It can fly up to five hours in a circular corridor at an altitude of approximately 20 km to provide wireless access over a 400km radius of footprint. HAPS is interconnected with terrestrial wireless technologies through radio links. It has small latency and the bandwidth of HAPS is allocated to some other transmission technologies on the same platform [1]. Figure 1.1 shows the architecture of multiple HAPS [2]. The coverage area of single HAPS depends on the elevation angle

and the altitude. A multibeam antenna is used for the purpose to cover many subscriber ground stations by single HAPS with high frequency reuse efficiency. Gateway stations are provided to allow user access to the existing public networks, such as PSTN and Internet [3].

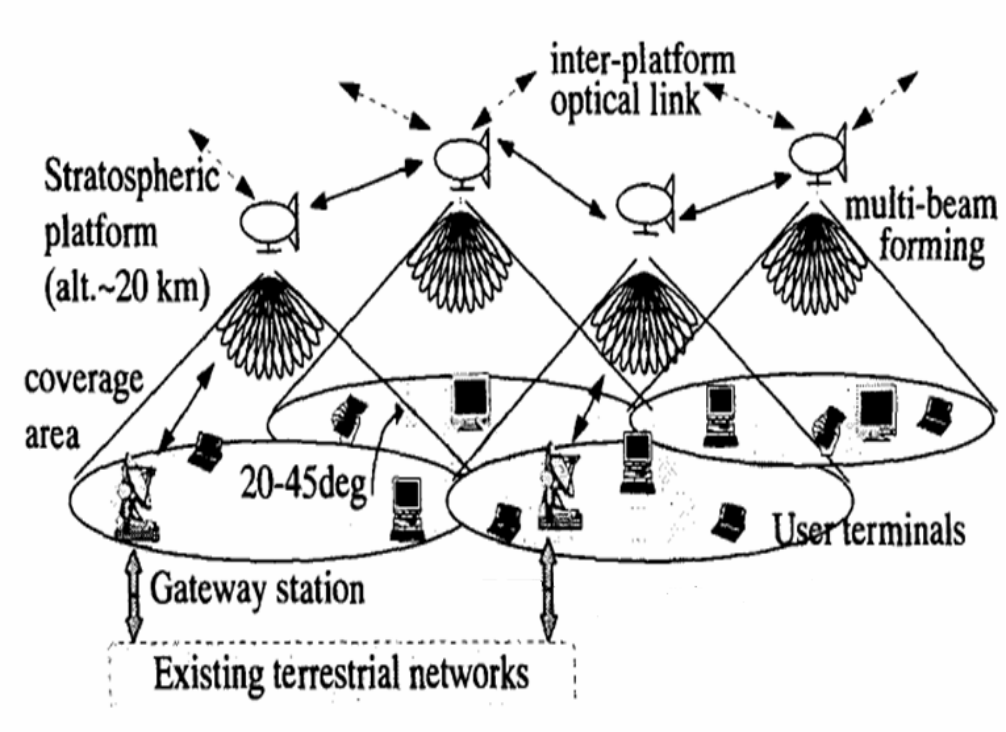

Figure 1.1 Overview of HAPS [2]

1.2 Problem Statement

Resolution 734 (Rev.WRC-03) invites ITU-R to conduct regulatory and technical studies to determine the feasibility of use by HAPS and encourages administrations to contribute actively to the sharing studies in the frequency bands above 3 GHz allocated exclusively for terrestrial radio communication [4].

In response to the technical study stated, interference situation from HAPS system has to be evaluated to ensure non-harmful interference from HAPS system to other stations of services exists. Figure 1.2 illustrates the possible interference situations from HAPS ground station to a radio-relay station [4].

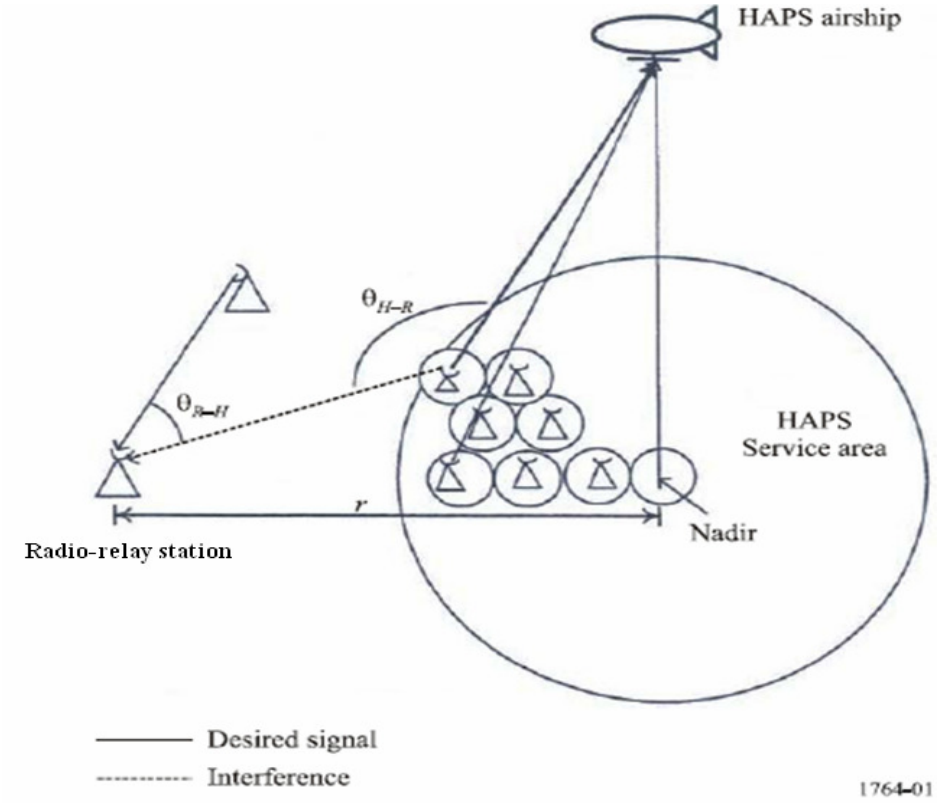

Figure 1.2 Interference situations of HAPS ground station and a radio-relay station [4]

1.3 Objective

The objective of this project is to perform the co-channel interference studies between High altitude platform stations and current wireless terrestrial system in Malaysia. To analyze interference between HAPS and terrestrial microwave links .The scope of evaluating the fractional degradation in performance of the terrestrial links at several locations in Malaysia. Studies taking into account parameters such as propagation condition & interference geometry.

1.4 Scope

Only one high altitude platform station and one HAPS ground station is considered in this project. The elevation angle of HAPS ground station used is 20° which is the elevation angle for worst case. The radio-relay station taken into account is a fixed wireless access (FWA) base station. The evaluation of interference is carried out in both clear-sky and rainy conditions.

1.5 Methodology

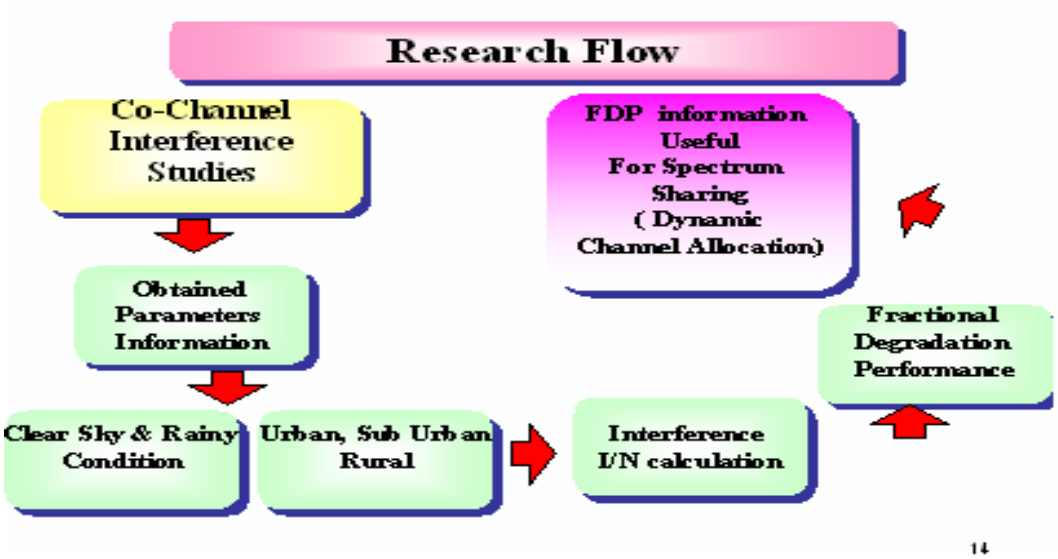

Figure 1.3 Flow chart of Methodology

Figure 1.3 gives a general idea of the methodology for conducting this project. The first step in methodology is to do literature review on the title of project, which is, co channel interference between the high altitude platform to terrestrial system. In the Spectrum sharing between High altitude platform networks and terrestrial system involves time varying phenomena such as interference geometry, Real location of terrestrial system and propagation condition. After that used the parameter information to obtained the impact of interference for two condition when clear sky and rainy condition and for urban, suburban and rural area.

The nature of this project is calculation work and all calculations are done using the MATLAB software. After determining all the equations needed to evaluate the interference by using I/N equation, effort of finding the values for every parameter in the equations has to be done. All the parameters of HAPS ground station are adopted from ITU-R F.1569 whereas ITU-R F.1609-1 is used to obtain the parameters of FWA station. Calculations involving rain attenuation is referred to ITU-R P.530-12 and ITU-R P.838-3. Before computing the calculations work, knowledge of using MATLAB has to

be acquired. After obtaining all the desired results, analysis of results is required. Finally, conclusion is drawn from the results and analysis.

1.6 Thesis Outline

This thesis is divided into five chapters. Each chapter will discuss on different issues related to the project.

Chapter one discusses on the overview of the project background, problem statement, objective, scope of work and the methodology to carry out the work. Meanwhile, Chapter two focuses on the literature review used to assist the project. It discusses the development of HAPS, types of high altitude platform station, antenna pattern used, advantages of HAPS and also all the equations related in evaluating the interference.

Chapter three on the other hand will show all the procedures in computing the calculations. The values of parameters used will be shown as well. The result and discussion will be presented in Chapter four. Last but not least, Chapter 5 discusses the conclusion of this project and future work that can be done.