

**UNIVERSITI TEKNOLOGI MARA**

**HYBRID COMBINER CIRCUIT OF  
MULTI NETWORK OPERATOR FOR  
CAPACITY ENHANCEMENT  
SOLUTION IN INDOOR  
ENVIRONMENT**

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**MSc**

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## AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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## ABSTRACT

This research focuses on providing a solution for a mobile service provider with Multi Network Operators (MNOs) using a single multi-beam antenna via a hybrid circuit to provide an excellent service attended by thousands of Mobile Subscribers (MS) at Nasional Bukit Jalil Kuala Lumpur Stadium. The combination circuit design using the Hybrid Combiner (HC) is the solution used to combine multiple MNOs towards minimising space and cost besides ensuring the aesthetical value of the national stadium. During a significant incident, MS users may have trouble accessing the service due to unavailability of the service due to network congestion. In this situation, the MNOs must have additional capacity to meet the demand for data transmission and voice call transactions. Improving the output of the network and the quality of service should reflect customer loyalty as it automatically produces. In the current scenario, MS users experienced bad services as they are unable to access to the internet as well as make a call while they are in the stadium attending a major event. The implementation of the proposed solution, MS users will be able to access the network and will also enjoy live feeds via Facebook (FB) and other software applications without delay and interruption as well as voice call congestion. Restriction by the stadium management due to the National interest, the concept of integrating multi-operators is critical, and in this study, the MNOs will share the same Radio Frequency Antenna to ensure the site's tidiness and better look at the Base Station location. The results of the suggested solution will be compared with the Walk Test results and the coverage simulation analysis using the Planning Methods. Data Statistics taken from MNOs will explain the effectiveness of the solution in term of Signal quality level where the Signal to Noise Ratio (SINR) recorded at -95 dBm below the threshold of -85 dBm to prevent interference with MS users. The Resource Block (RB) Utilization shows the utilization of all sectors are at below 70% of total available capacity which means that the congestion level is manageable and MS user able to access the network without interruption. Economically, the solution proposed is more effective and simpler compared to other solutions such as IBC, Wi-Fi and Small Cells, and the combination of multi-MNOs would be more economical. In addition, the use of the Mobile BTS (MBTS) solution is 2-fold higher in costs with low service efficiency. Fast deployment, less maintenance and a shared solution between MNOs is a key factor in the proposed study and is known as Hybrid Combiner Circuit of Multi Network Operator for Capacity Enhancement Solution in Indoor Environment.

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