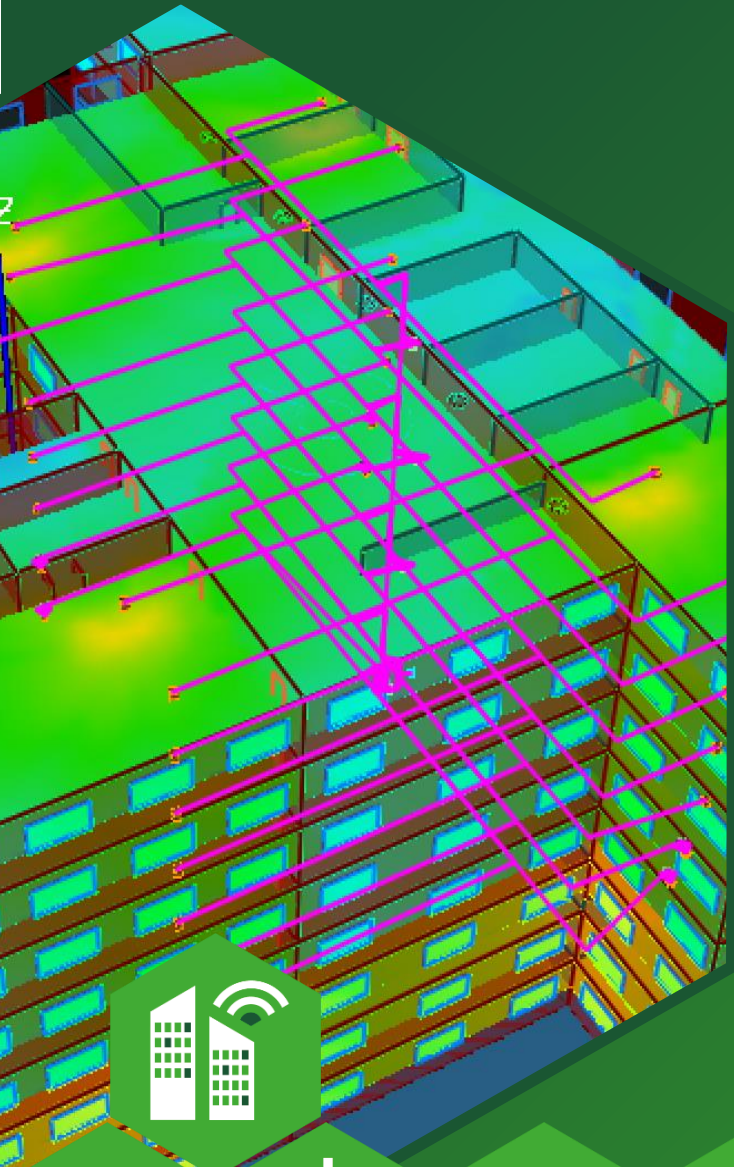


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WHITE PAPER

VENDOR ANALYSIS FOR
NETWORK OPTIMISATION

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Date: July 2023



Introduction

This white paper presents a comprehensive analysis of wireless network system equipment through the utilization of Ranplan’s network planning software. With the ever-increasing demand for reliable and high-performing wireless networks, it is crucial to evaluate and compare different equipment options to ensure optimal network performance. By leveraging advanced network planning software, this project aims to provide valuable insights for network planners and decision-makers in selecting the most suitable equipment for their wireless network deployments.

Ranplan Professional is a powerful indoor and outdoor network planning platform with intelligent algorithms to simplify, expedite, and automate the design process for in-building wireless network systems. Its advanced features include a true 3D ray-tracing propagation engine and Monte Carlo capacity simulator that generate precise 3D coverage and capacity heatmaps, facilitating the rapid identification and resolution of network issues. Furthermore, the platform offers a range of optimization modules that automate network adjustments, enabling the attainment of desired key performance indicators (KPIs) efficiently.

Project brief:

The aim of this project is to design an indoor multi-system deployment for an exhibition hall with high capacity requirements when a large event is taking place.

Case 1: Model and simulate the antenna placement and signal propagation throughout the venue, comparing the coverage performance of 4 manufacturers’ equipment. The analysis will consider the current thresholds for coverage and the signal interference from the system. This scenario is purely focused on the in-building system and not the coverage generated by the Macro system.

Case 2: Expanding the case scenario above to include Macro coverage and assigning users and dominance to Small Cells. This scenario considers the targeted throughput, coverage heat maps for uplink transmission power and the method of aggregating more Small Cells when needed for dominance.

Parameters and Technology:

Expected No. of Users: 250 (5th floor)

LTE(MIMO) AWS 1700MHz (1 available carrier)

Bandwidth: 10 MHz

Uplink (UL): 1710-1720 MHz

Downlink (DL): 2110-2120 MHz

Coverage requirement:

- 95% coverage with RSRP \geq - 85 dBm
- 95% of DL SINR \geq 0 dBm

Capacity requirement:

- DL Throughput average per user \geq 2 Mbps
- UL Throughput average per user \geq 512 kbps

The antenna and power configuration are shown in Table 1 below.

Product	Power	Noise figure	Antenna Gain	Patterns
Vendor A	L: 2 x 125 mW U: 1 x 250 mW	8 dB	Omni 2 dBi	Pre-loaded in Ranplan Professional
Vendor B	L: 2 x 100 mW U: 1 x 200 mW	12 dB	Omni @ 2 dBi	
Vendor C	L: 2 x 50 mW U: 1 x 100 mW	16 dB	Omni @ 0dBi	
Vendor D	L: 2 x 250 mW U: 1 x 500 mW	13 dB	Omni @ 2 dBi	

Project Report

Building Modelling

The building and environment have been modelled using the Smart Exact tool in Ranplan Professional which imports CAD floorplans to generate 3D and 2D structures as shown in Figure 1. The building consists of open spaces and closed offices. The attributed materials are table rock, wood and glass and there is a central concrete structure. The height between floors is 3.5 meters. The system configuration is shown in Figure 2.

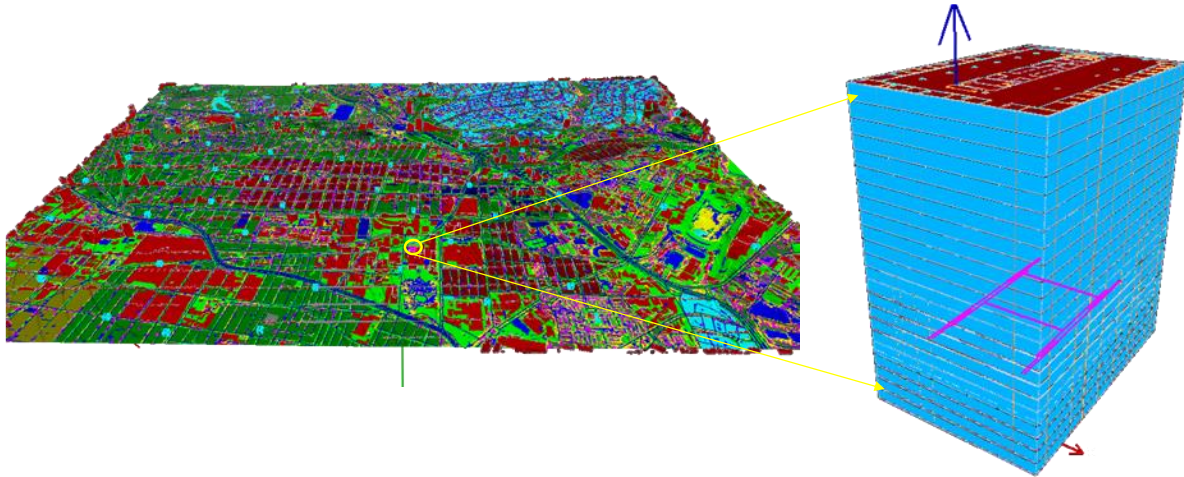


Figure 1 Building modelling

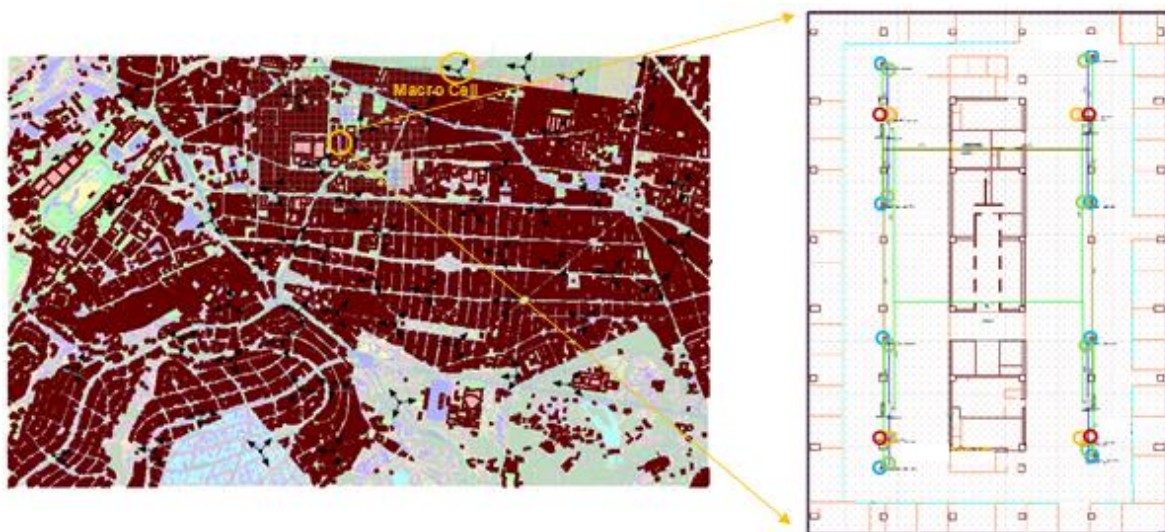


Figure 2 System configuration

Capacity Calculations

Based on the expected number of users, 250 users will be modelled in this simulation. For LTE, the DL throughput should reach 2 Mbps and the UL throughput per user should reach 512 Kbps.

In Ranplan Professional, simulation traffic configuration is based on the concurrent number of users, i.e. users actively using the service. In order to calculate the active users, we will need to assume 250 LTE users in the region, and the active rate is about 20% respectively in the high-capacity region. So the number of active users is 50, respectively.

Parameters Configuration

In the network design, prediction and simulation are used to evaluate the coverage and capacity. Therefore, the project parameters configuration is shown in Table 2 to Table 5 for the different wireless systems.

Table 2: LTE system simulation parameters in Vendor A solution

Parameter	Assumption
Wireless system	FDD-LTE system with 1 channel (LTE AWS)
Carrier frequency	1.7GHz
Bandwidth	10MHz
Cell Tx power	20dBm
Cell load	90%
Channel model	Ranplan Radio Propagation Simulator (RRPS)
No. of active UE	50
Traffic model	Table 10
Scheduler algorithm	Proportional Fair
MIMO mode	CLSM 2x2 (DL), SIMO 1x2 (UL)
Antenna height	3m
Antenna gain	2dBi
Antenna coverage radius	50m
Cell No.	2
Radio Units	8

Table 3: LTE system simulation parameters in Vendor B solution

Parameter	Assumption
Wireless system	FDD-LTE system with 1 channel(LTE AWS)
Carrier frequency	1.7GHz
Bandwidth	10MHz
Cell Tx power	17dBm
Cell load	90%
Channel model	Ranplan Radio Propagation Simulator (RRPS)
No. of active UE	50
Traffic model	Table 10
Scheduler algorithm	Proportional Fair
MIMO mode	CLSM 2x2 (DL), SIMO 1x2 (UL)
Antenna height	3m
Antenna gain	0dBi
Antenna coverage radius	50m
Cell No.	2
Radio Units	8

Table 4: LTE system simulation parameters in Vendor C solution

Parameter	Assumption
Wireless system	FDD-LTE system with 1 channel(LTE AWS)
Carrier frequency	1.7GHz
Bandwidth	10MHz
Cell Tx power	21dBm
Cell load	90%
Channel model	Ranplan Radio Propagation Simulator (RRPS)
No. of active UE	50
Traffic model	Table 10
Scheduler algorithm	Proportional Fair
MIMO mode	CLSM 2x2 (DL), SIMO 1x2 (UL)

Antenna height	3m
Antenna gain	2dBi
Antenna coverage radius	50m
Cell No.	4

Table 5: LTE system simulation parameters in Vendor D solution

Parameter	Assumption
Wireless system	FDD-LTE system with 1 channel(LTE AWS)
Carrier frequency	1.7GHz
Bandwidth	10MHz
Cell Tx power	24dBm
Cell load	90%
Channel model	Ranplan Radio Propagation Simulator (RRPS)
No. of active UE	50
Traffic model	Table 10
Scheduler algorithm	Proportional Fair
MIMO mode	CLSM 2x2 (DL), SIMO 1x2 (UL)
Antenna height	3m
Antenna gain	2dBi
Antenna coverage radius	50m
Cell No.	4

Traffic

In the simulation, we have assumed all users are active with a fixed traffic model from the beginning of the simulation. The traffic mix consists of different traffic models as shown in Table 6.

Table 6 UE traffic mix of LTE

Traffic Model	Number of UEs
Full buffer	50

Scenario Results

Figure 3 shows the outdoor signal propagation results. From the figure, the RSRP in range [-80dbm, -90dBm] is about 2.69%. Considering the macro cell interference and dominance, if 95% RSRP is larger than -85dBm, the design can meet the coverage requirement.

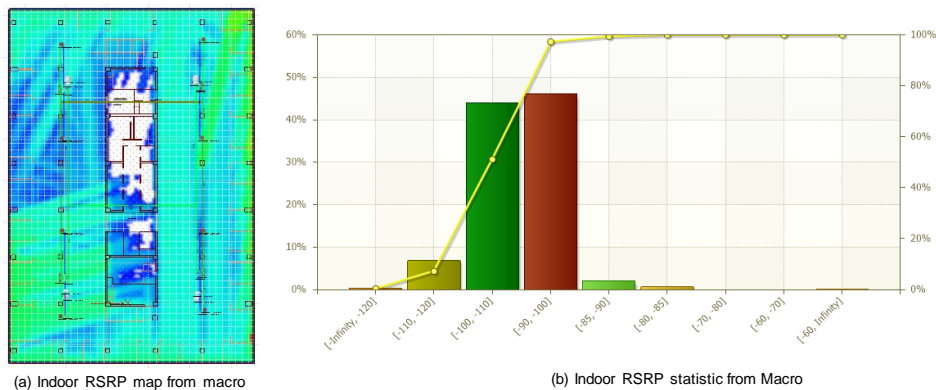


Figure 3 Outdoor to Indoor RSRP

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