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FAKULTI KEJURUTERAAN ELEKTRIK
UNIVERSITI TEKNOLOGI MALAYSIA
JOHOR BAHRU

SEEL 3742

BASIC MICROWAVE LABORATORY

Indoor Wireless Signal Strength Measurement

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Title : **Indoor Wireless Signal Strength Measurement**

Background

The indoor wireless signal strength measurement is important for: Quality of Service (QoS) Assurance – Monitoring signal strength ensures that users receive adequate wireless coverage and reliable connectivity within indoor environments. This is essential for maintaining a high quality of service, especially in settings where seamless wireless communication is critical, such as office buildings, hospitals, and residential homes.

Optimization of Network Performance – By assessing signal strength, network administrators can identify areas with weak or dead zones and take corrective actions to optimize network performance. This may involve adjusting the placement of access points, configuring antenna settings, or implementing signal boosters to enhance coverage and minimize interference.

Troubleshooting Connectivity Issues – Measuring signal strength helps diagnose connectivity problems such as dropped calls, slow data speeds, or intermittent connections. By pinpointing areas of poor signal strength, technicians can troubleshoot issues more effectively and implement targeted solutions to improve overall network reliability and performance.

Capacity Planning – Understanding indoor signal strength is essential for capacity planning, especially in environments with high user density or bandwidth-intensive applications. By analyzing signal strength data, network planners can anticipate future network demands, allocate resources effectively, and scale infrastructure to accommodate growing connectivity needs.

Objective

In this work, students will gain an experience for analysis the signal channel distribution in indoor area. Students are also trained to practically estimate the number of transmitters (access points) and its installation location in order to optimize the signal coverage in the laboratory environment.

Task

Using the available instruments or tools in the Basic Microwave laboratory in order to set up an experiment to measure the signal strength at 2.4 GHz in the laboratory environment.

Instruments

(a) Keysight N9320B Spectrum Analyzer
(b) Coaxial cable
(c)Wide-band double ridge antenna
(d)Antenna holder and tripod
(e)Built-in GPS in the smart phone (**prepared by student**)
(f) PC with installed MATLAB software (**prepared by student**)

Brief Measurement and Data Analysis Guidelines

1 Set the signal generator with power level of -20 dBm at 2.4 GHz.

2 Connect the antenna to spectrum analyser via coaxial cable.

3 Set the measurement frequency range of the spectrum analyser from 2.35 GHz to 2.45 GHz.

4 Determine at least 50 measurement location position in laboratory area and sketch a 2-D plan of the selected area.

5 Determine 'Longitude' and 'Latitude' as well as sea level for each measurement position. or

Label each measurement position as: ($x_1 = 1, y_1 = 1$), ($x_2 = 2, y_1 = 1$), ($x_3 = 3, y_1 = 1$),…

6 Measure received signal strength, P_r of each position in unit **volt** and also unit **dBm**.

7 Repeat the measurement with the antenna height higher than the lab table level (h = 2m). or

Repeat the measurement with different transmitter power level instead of -20 dBm.

8 Draw the contour plot of the signal strength distribution in volt and dBm, respectively using MATLAB software.

9 Analysis the contour plot with respect to factor location and environmental condition.

10 Find the parameter values of α and β in the path loss, PL formulation:

$$PL(\text{dB}) = 10\alpha \log_{10}(d) + \beta$$

where PL is the path loss (in dB) and d is the distance (in meter) between the location 2 and the location 1.

Weekly Schedule

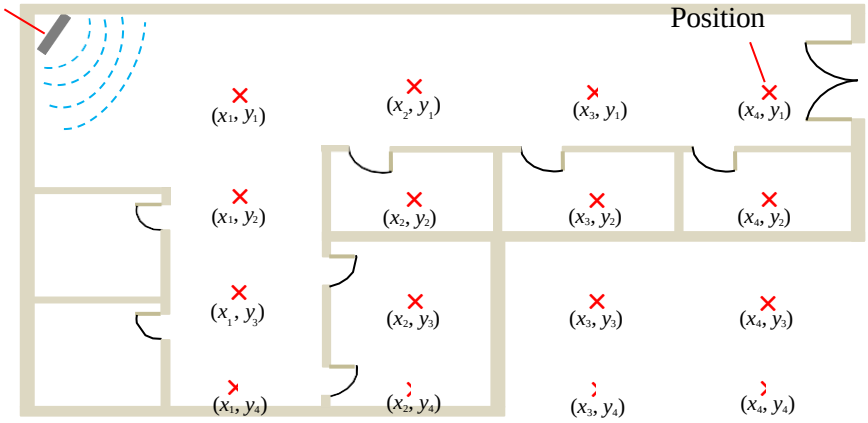
Week 1

Transmit wireless signal at 2.4 GHz with power level of -20 dBm
Determine and label each measurement position as well as the height of the antenna from the floor.

Measure received signal strength, P_r of each position in unit **volt** and also unit **dBm**. Example:

Transmitter (-20 dBm, 2.4 GHz)

(Access Point) Measurement Position



Week 2

Continue to measure received signal strength, P_r. Plot the contour of the signal strength distribution.

Week 3

Path Loss, *PL* modelling of the laboratory.
Discuss and analysis of the measurement data. Complete the writing report.