Introduction

- The tremendous growth of wireless services on hand-held devices has led to an insatiable demand for mobile data.
- MMW spectrum (30 GHz-300 GHz) is a potential solution to keep up with the ever-increasing data traffic growth.
- Dominant line-of-sight (LoS) component, fewer reflection paths and ignorable diffraction and scattering effects are the main properties of the MMW channel. (Differ from microwave band)
- An in-depth understanding of MMW propagation characteristics is vital for the design and operation of future wireless networks.
- Channel modelling for MMW is still an open work.

Channel Modeling Approaches

- **Deterministic (Ray Tracing)**
  - produce precise predictions on radio wave propagation.
  - Needs substantial modeling effort and computational time when a huge network is considered.

- **Stochastic**
  - based on a probability distribution function to model the channel behaviour.
  - use a less number of channel parameters.

System Model

- Consider a communication link with a separation distance \( D \) between the transmitter and receiver.
- The communication link is surrounded by some buildings that are randomly distributed in the communication area.
- All buildings in the surrounding environment have the same shape (rectangle) and orientation but differ in size. (Fig.1)
- Only the first order specular reflections are considered.

Power Delay Profile

- For impenetrable scenario (signal totally blocked), some signal is absorbed and the remaining signal is either reflected, diffracted or scattered (refer as multipath).
- In multipath, the propagating signal is reflected from a number of objects in the physical environment.
- The multiple reflected copies of the transmitted signal arrive at the receiver after travelling over different paths with different time instants and different power levels (Fig.2).
- The characteristic of multipath component is described by Power Delay Profile.

\[
P(\tau) = \rho(\tau) f_{SR}(\tau)
\]

\[
\rho(\tau) = \left( \frac{1}{4\pi\tau} \right)^2 \cdot \sigma
\]

\[
f_{SR}(\tau|\theta) = \int \frac{2\pi}{\lambda} f_{RV}(\tau|\theta) f_{NB}(\tau|\theta) d\theta
\]

Proposed Model

- **Ellipse Model** (Fig.3) – To determine the possible location of reflecting point.
- Density of reflection components at a temporal delay.

\[
\begin{align*}
\text{Parameter} & \quad \text{Value} \\
\text{Distance,} \; D & \quad 100 \; \text{meters} \\
\text{Average Building Length,} \; L & \quad 10 \; \text{meters} \\
\text{Average Building Width,} \; W & \quad 5 \; \text{meters}
\end{align*}
\]

Results

\[
\begin{align*}
\text{Parameter} & \quad \text{Value} \\
\text{Distance,} \; D & \quad 100 \; \text{meters} \\
\text{Density of building} & \quad 7 \times 10^{-5}
\end{align*}
\]