Project: IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)

Submission Title: [VLC Channel Model considerations in terms of LED application]
Date Submitted: [20 January, 2009]
Source: [Kang Tae-Gyu, Sang-Kyu Lim, Dae Ho Kim, Kwonhyung Lee, Tae-Wan Kim, Chung Myung-Ae, SungWon Sohn] Company [ETRI]
Address [138 Gajeongno, Yuseong-Gu, Daejeon, Korea]
Voice:[+82-42-860-5232], FAX: [+82-42-860-5611], E-Mail:[tgkang@etri.re.kr]

Re: [To develop VLC Channel Model]

Abstract: [This document presents VLC Channel Model considerations in terms of LED application]

Purpose: [For discussion on VLC Channel Model considerations in terms of LED application]

VLC Channel Model considerations in terms of LED application
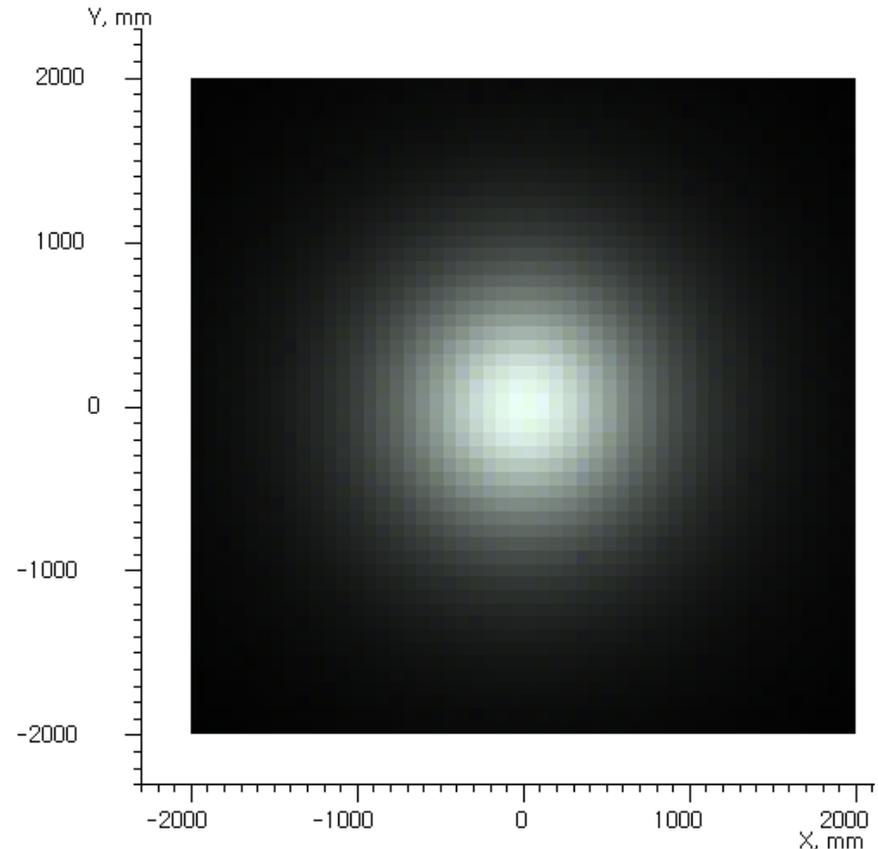
Tae-Gyu Kang
tgkang@etri.re.kr
ETRI

Contents

- ## Light Characteristic
  - – LED application
  - – VLC use cases
- ## VLC Channel Model considerations
  - – Lighting, Communication, Relationship
- ## VLC Requirement

Light Simulation Example

- Not even lighting
- Relation between Lightings
- Different dispersion depending on a lighting application and the reflection indexes

Visible Light Characteristics
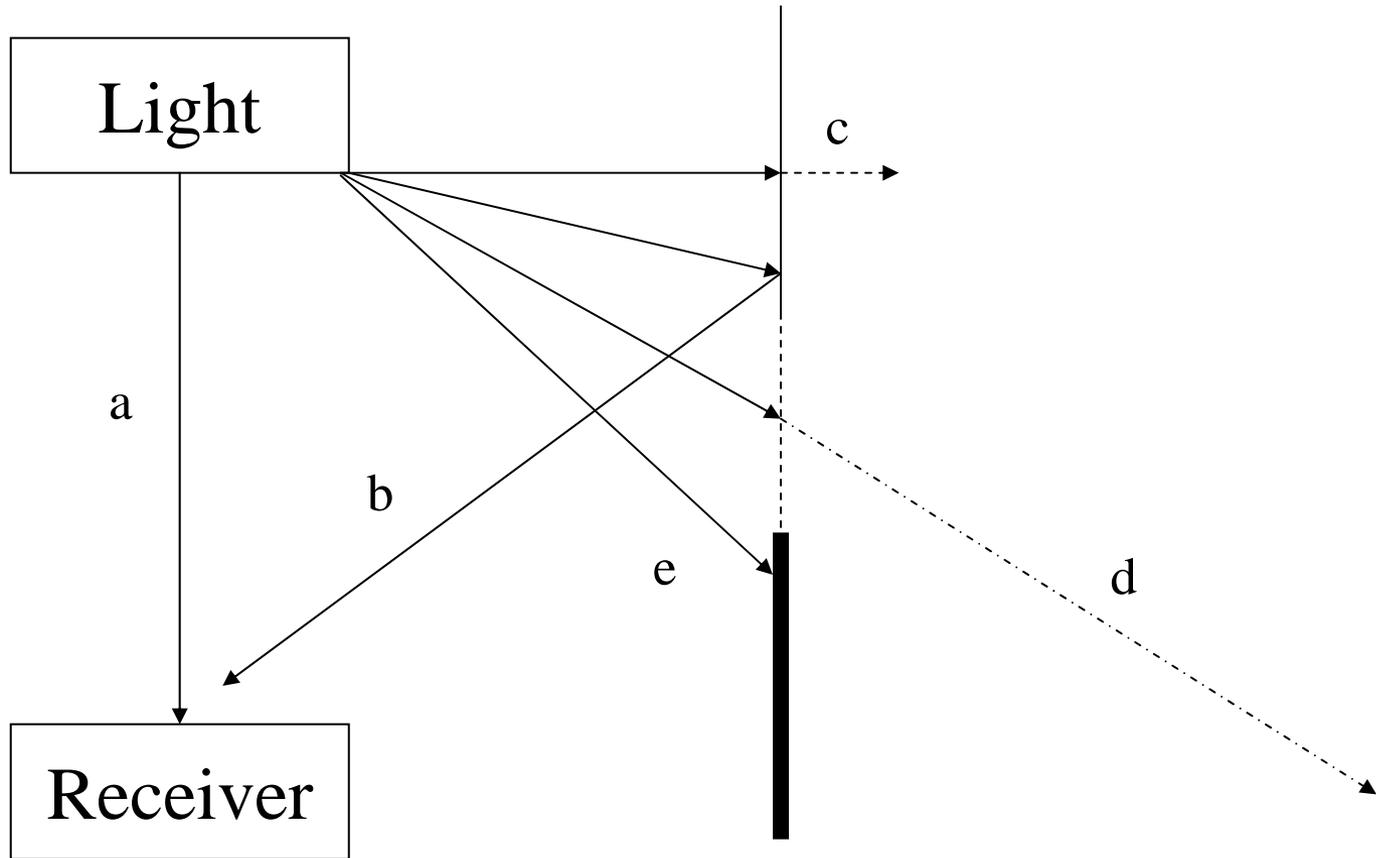
Light characteristic on VLC Application

- LED Display → Short Distance
  - Mobile handset/Notebook/TV display with BLU
  - Signboard

- Inter Vehicles → Focusing with small angle
  - Taillight, Headlight, On-and-off light
  - Traffic signal, Route beacon

- Lamp Lighting
  - Indoor illumination → Wide Angle

FOV Consideration

- ## Small FOV-Long Distance
  - – Focusing
  - – Optical Lens
- ## Large FOV-Wide Area
  - – Less distance coverage

What is a channel for each VLC use cases ?

- LED illumination use case → Dispersion
- Vehicle use case → Focusing
- LBS use case → Coverage
- Optical ID use case → ID selection
- Broadcasting use case → Channel discrimination
- Machine-to-machine use case→ Handshaking
- Security use case → Reach ability

Lighting Considerations

- ## Color Considerations
  - R(Red)
  - G(Green)
  - B(Blue)

- ## Light Interference Considerations
  - Sun light
  - Illumination from others
  - Reflection light

Communication Considerations

- ## Light Reach ability
  - Communication ability
  - Secure Communication

- ## Light Intensity
  - Communication Speed
  - Noise Robustness

- ## Light Color discrimination
  - Multi Channel
  - Visible Sensibility

Relationship Consideration

- **Dimming consideration**
  - Modulation : Dimming
  - Some modulations make a side effect to the illumination due to off time

- **Relationship considerations**
  - Speed
  - BER
  - Illumination

- **Error Recovery Consideration**
  - Long distance
  - Fog/heavy rain
  - LOS(Line of Sight) swing

VLC Requirements

- **LED illumination Requirement**
  - Sharing the lighting for illumination and wireless communication
  - MUST do not darkening
  - MUST do not change the color

- **Channel Management Requirement**
  - Mobile tracking
  - Streaming control

- **Fault identification Requirement**
  - ID lighting information hiding on space
  - Error detection and recovery

Next is … ?

- Define or select the best use case
- Define a requirement document
- Any other next step