

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

**Submission Title: [10 Mbps Visible Light Transmission System]**

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**Abstract: [The overview of 10 Mbps Visible Light Communications System]**

**Purpose: [Contribution to IEEE 802.15 SG-VLC]**

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# 10Mbps Visible Light Transmission System

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Special thanks for

**TAMURA CORPORATION**

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# Features

- **10Mbps-Transmission Speed is realized by using White LEDs(RGB+W).**
- **Bi-directional & Full-duplex Communication is available.**
- **Enable 1 to N Connection**
- **Compliance of a Japanese Standard (ARIB STD-T50)**
- **Enable Direct Connection to Ethernet (IEEE802.3) Devices.**

# System Looking & Presentation



Presentation at IT Pro Expo 2008



Poster Display

STD-T50 is designed to fundamentally meet the ISO/IEC 8802-3:2000. So, Optical Wireless LAN System complying with this standard is able to connect the Ethernet devices.

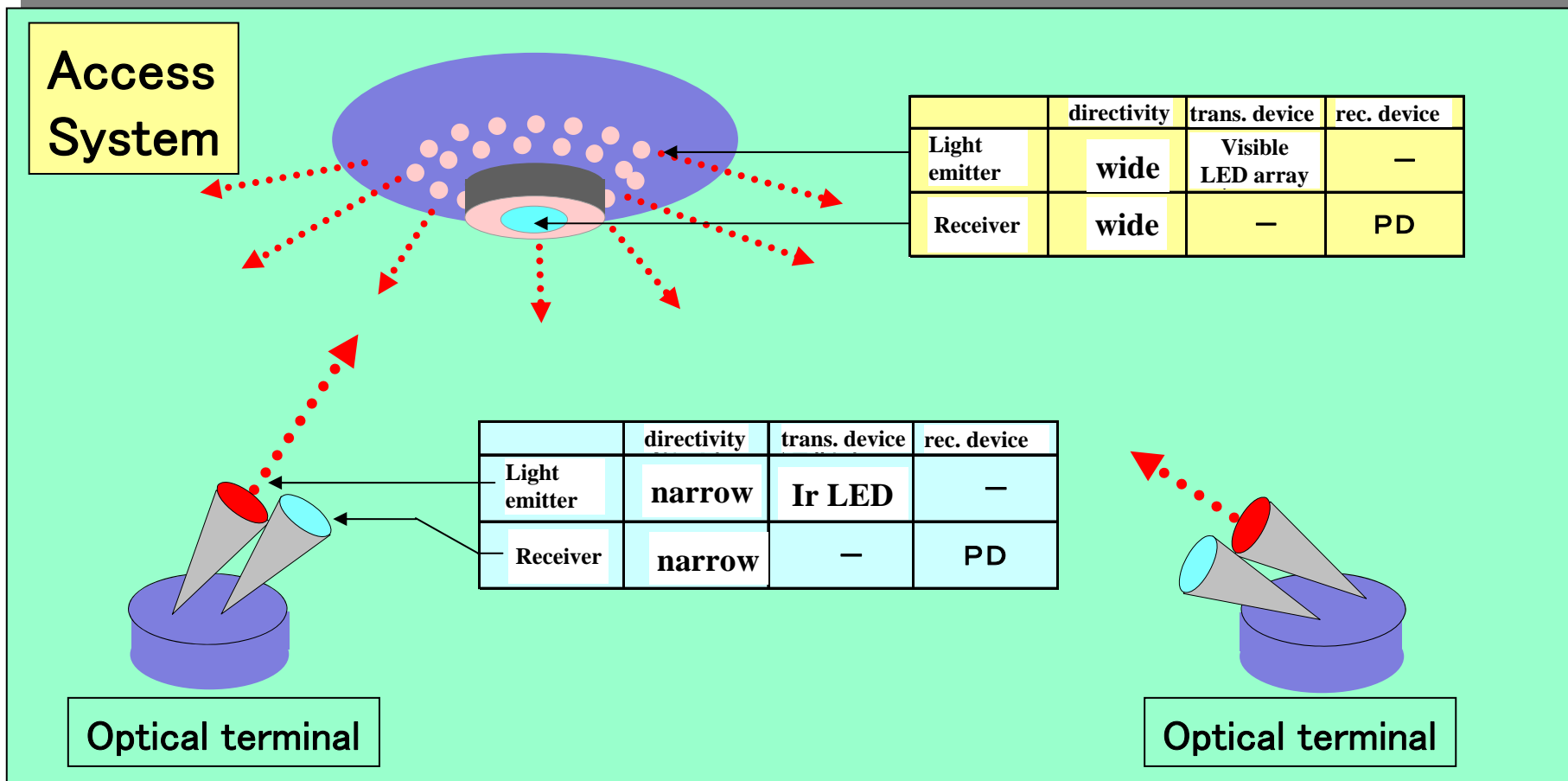
Trans. Speed feature, type	10Mbps	100Mbps	1000Mbps
Transmission Topology	1 to 1, or 1 to N		
Access Control	support CSMA/CD method network configuration		
Data Rate	10Mbps	100Mbps	1000Mbps
Type of Trans. Signal	<b>10BASE-T</b> (Manchester encoding)	100BASE-FX (4B/5B encoding)	1000BASE-X (8B/10B encoding)
Transmitting Function	Transmit predefined signal during signal data available. Otherwise, transmit idling signal or similar signal.		
Receiving Function	Receive predefined signal. Otherwise, idling signal is sent back when not received. Sensitivity is shown by $\mu W/cm^2$ or dBm		
Others	Loop back, collision detection and link confirmation function		

**Specification of STD-T50 PHY Layer**

Trans. Speed item	10Mbps	100Mbps	1000Mbps
Optical media	assuming 680~1600nm, or other W.L. is available		
Optical device	LED or LD for trans. Device, PD or APD for receiving device		
Safety Regulation	Indoor : Class 1, defined by IEC60825-1Edition1.2		
	Outdoor: recommending Class 1 or Class 1M		

**Specification of STD-T50 Optical Transmission System**

**This System can be established 1toN Multi-Channel Access between the Access System on the ceiling /wall and Several Optical terminal located inside the System Covering Area.**



March 2010 **Specification (VLC Wireless LAN System)** Doc: IEEE 802.15.4r(802.11-01)

	Item	Elements	
1	Trans. Distance	< 2m	
	Trans. Area	Vertical: 9.5 ~ 50° Horizontal: +/-60°	
2	Base Station	W.L. for Transmitter 400 ~ 750 nm White(745nm/680nm) 620 ~ 630 nm Red 525 ~ 530 nm Green 460 ~ 470 nm Blue	
		W.L. for Receiver	680 ~ 1600 nm (Ir)
		Logical I/F	ARIB STD-T50 compliance
		Data Rate	10Mbit/s Max
		Encoding	Manchester encoding
		Lighting Intensity	14 lx (2m)
		Trans. Power	~ 2W (Red), ~ 12W (RGB+W)
		Power Supply	100Vac
		Power Consumption	15W
		Operation Temp.	0 ~ 40°C
		Operation Humidity	20 ~ 85% (no condensation)
		Dimensions	W222 x H185 x D129 mm



# Specification (Optical Terminal)

	Item	Elements	
3	Optical Terminal	W.L. for Transmitter	680 ~ 1600 nm (Ir)
		W.L. for Receiver	350 ~ 750 nm
		Logical I/F	ARIB STD-T50 compliance
		Data Rate	10Mbit/s Max
		Encoding	Manchester encoding
		Power Supply	5Vdc
		Consumption Current	720mA
		Operation Temp.	0 ~ 40 °C
		Operation Humidity	20 ~ 85% (no condensation)
		Dimensions	W60 x H70 x D120 mm
		Weight	150g

**CSMA/CD(Carrier Sense • Multi Channel Access / Collision Detect)  
system is a MUST**



**Conventional wireless system is hard to make CD**



**Issue of receiving signal masking by transmission needs to be  
cleared**



**Break through the issue by employment of Visible light for  
down-link and Ir-light for up-link**

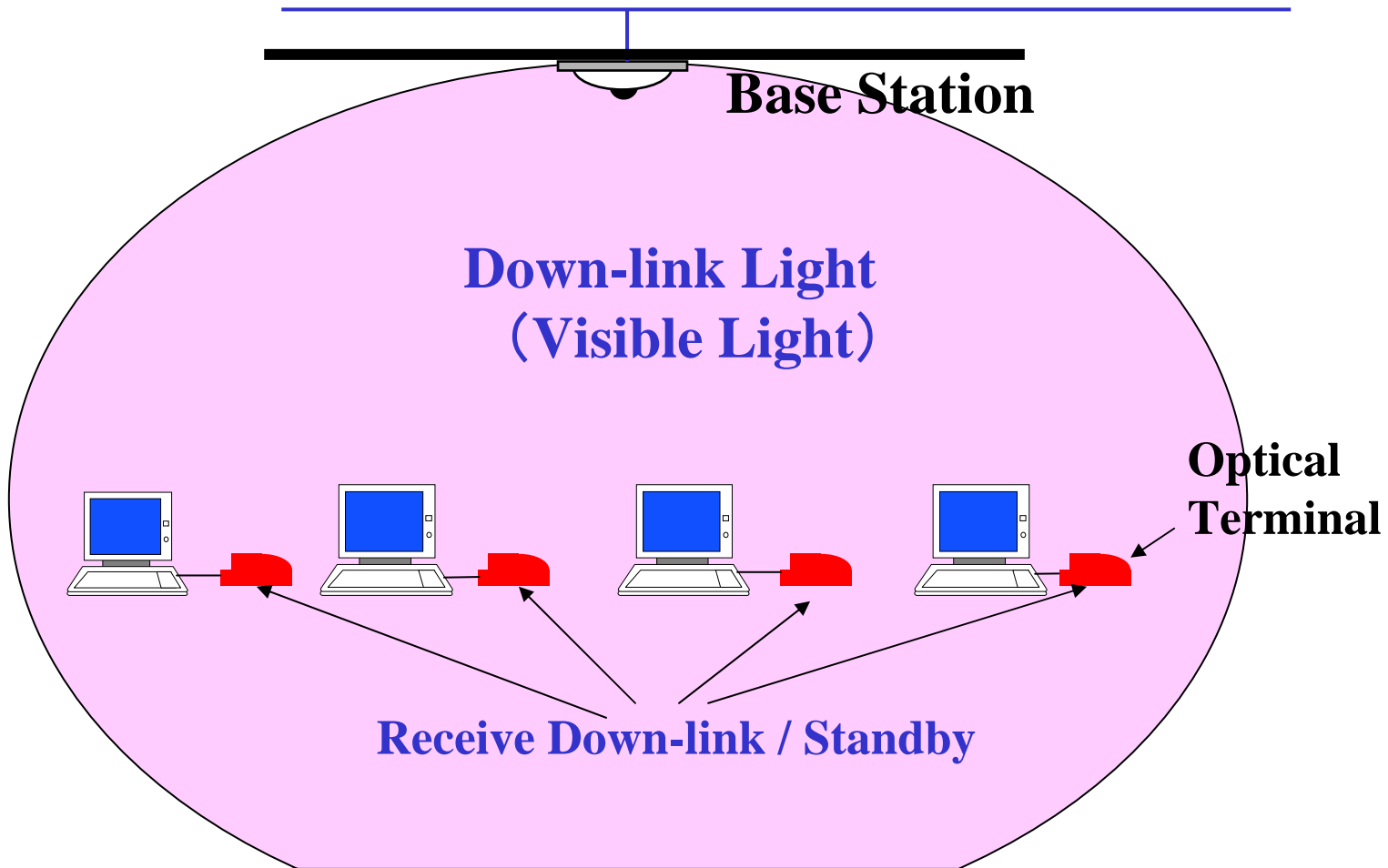


**In addition, to support STD-T50, then established  
CSMA/CD system**

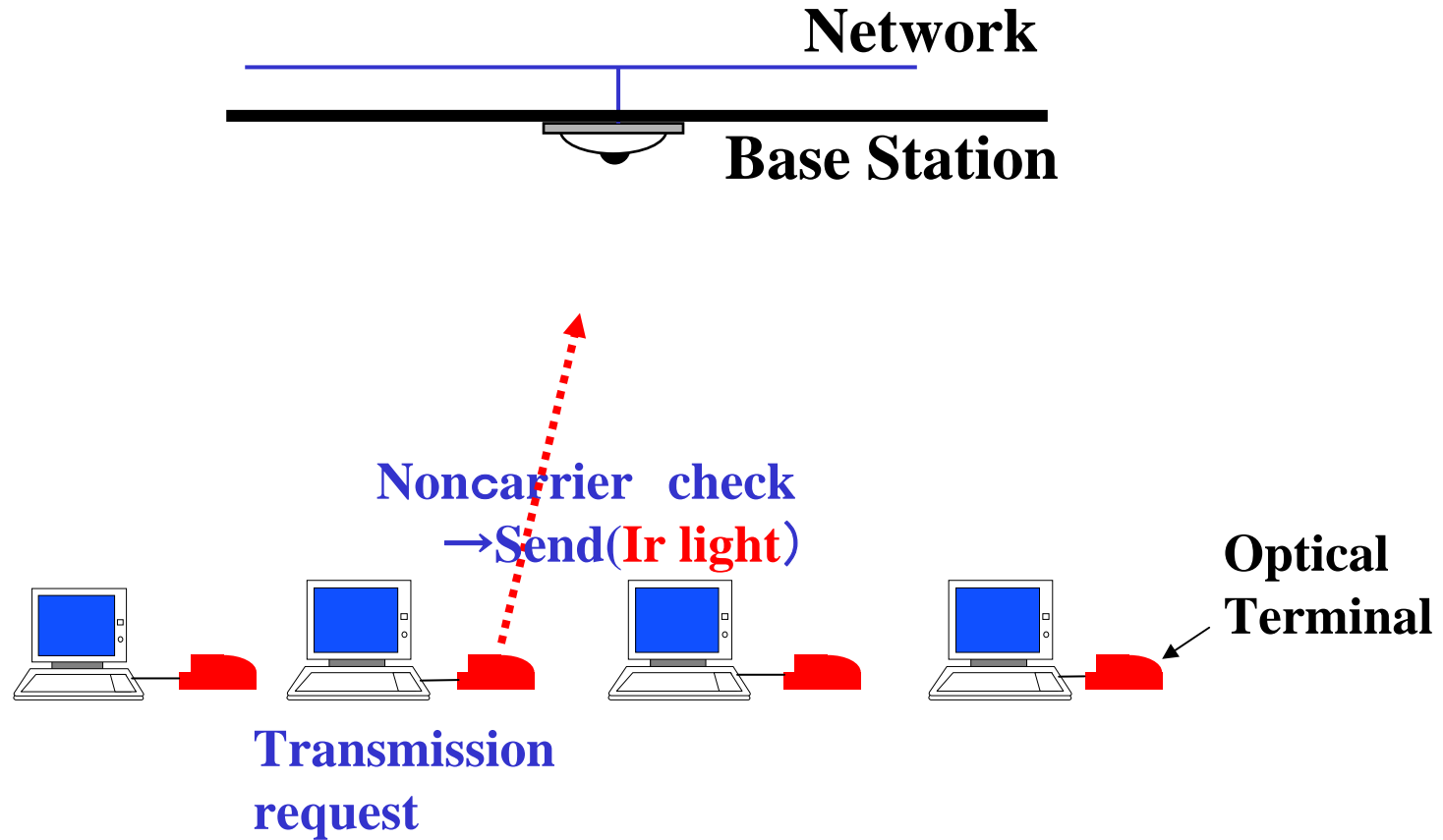
## Initiating packet on Network

→ Check no Up-link, then send packet.

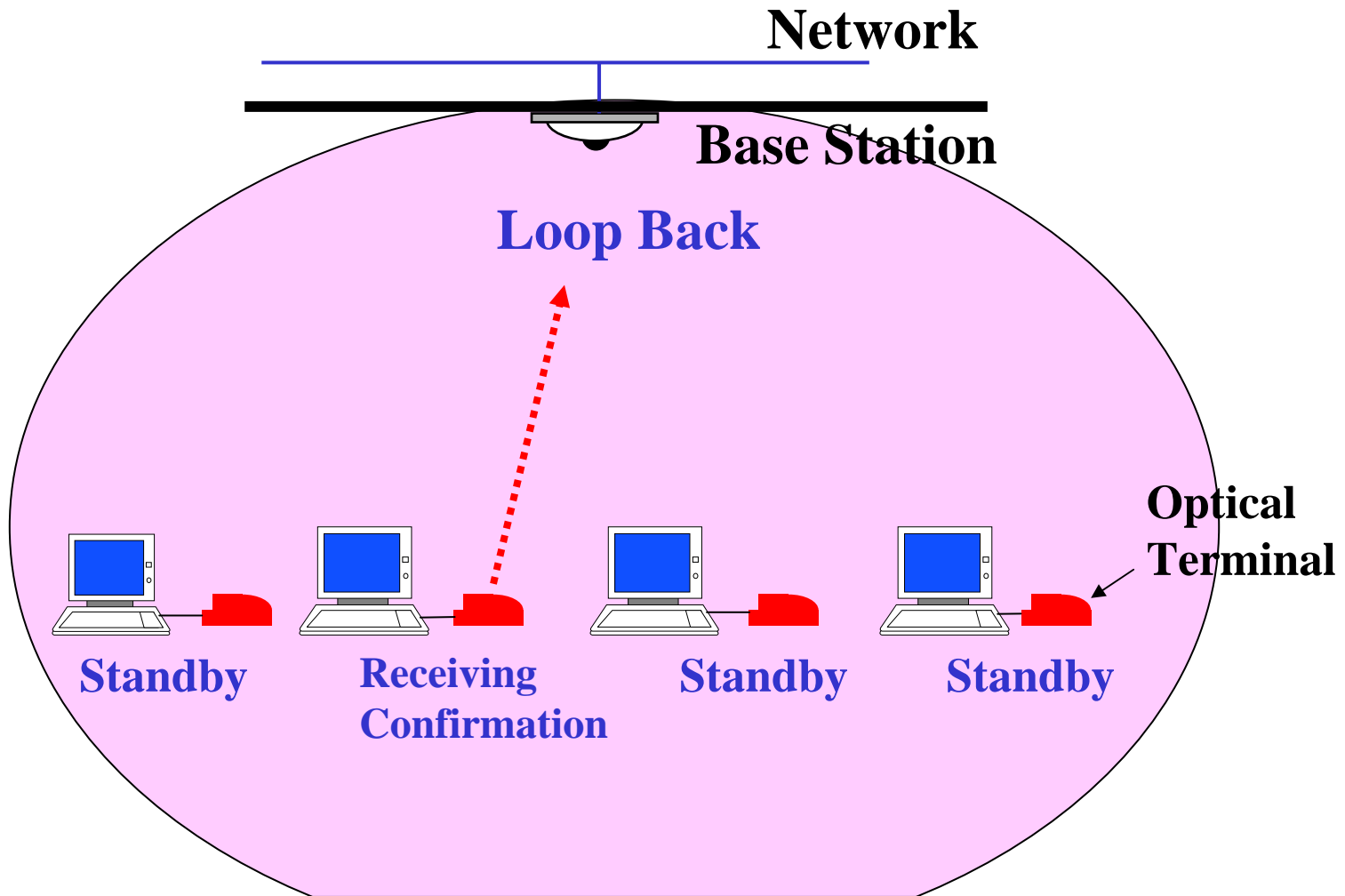
**Network**



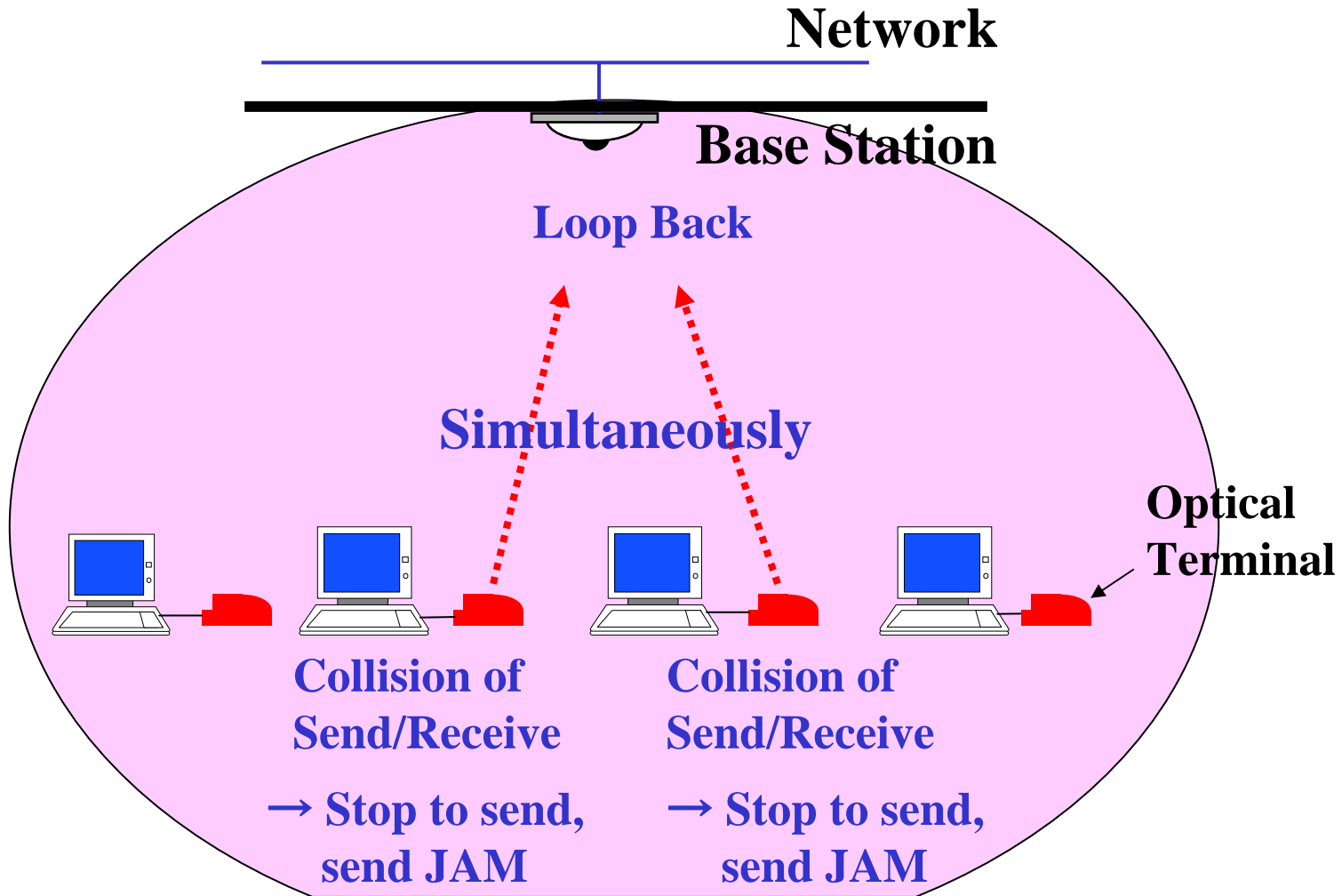
# Up-link 1



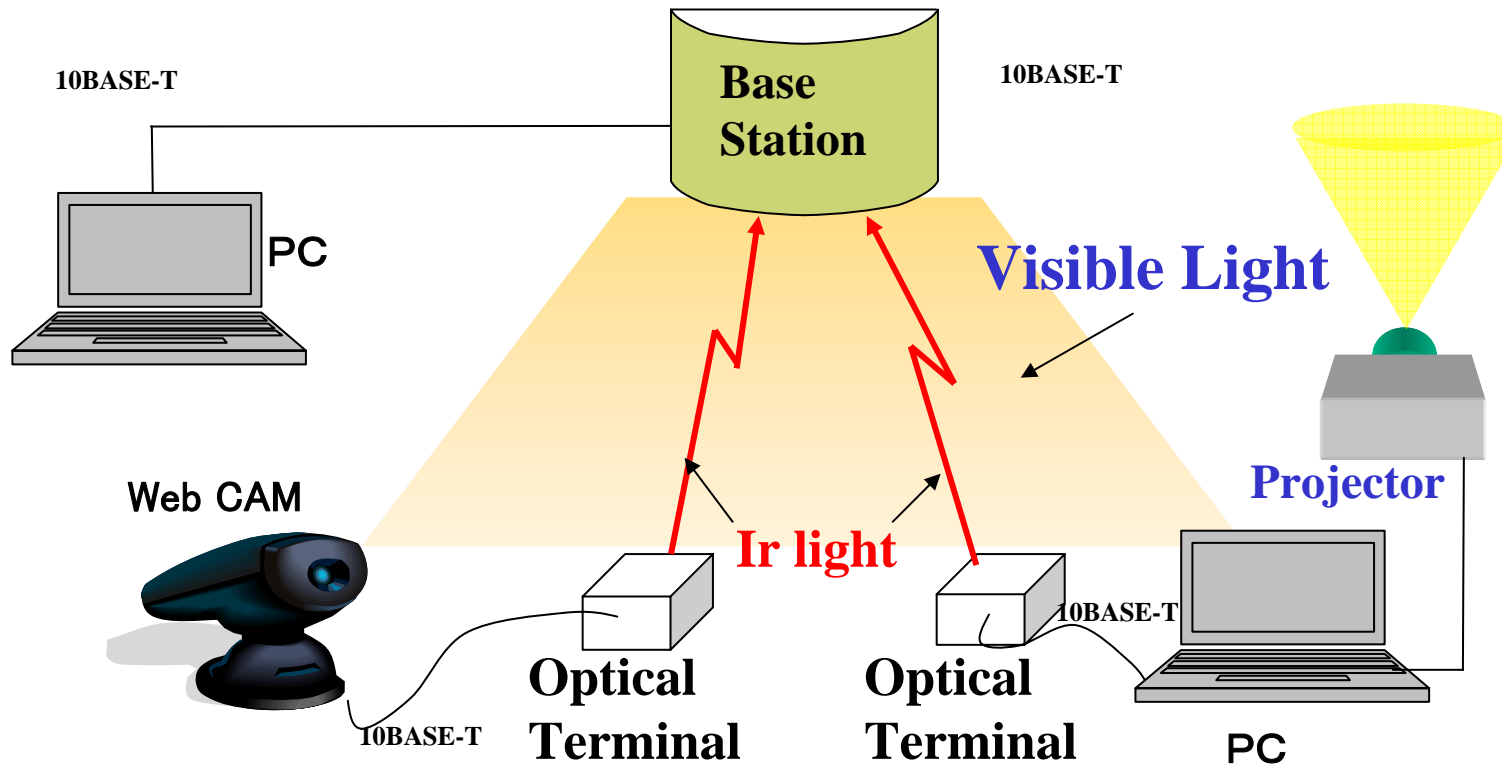
# Up-link 2



# Collision Case



# Demo System



- Confirmed the capability of establishment of 10Mbps wireless LAN using White LEDs(RGB+W).
- Utilizing the lighting system for down-link and Ir light for up-link makes 1toN wireless LAN configuration.
- Direct Ethernet connection is available by supporting ARIB STD-T50. That application, on conventional wireless LAN disabled environment, has potential for office use, which needs care for compromise, or for medical institution, which requires high-level safety.