

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

Submission Title: [ETRI PHY proposal on color channel tolerance of receiver sensitivity]

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Re: [Response to call for proposals]

Abstract: [This document describes a proposal of the color channel tolerance of receiver sensitivity.]

Purpose: [Proposal to IEEE 802.15.7 VLC TG]

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ETRI PHY Proposal on Color Channel Tolerance of Receiver Sensitivity

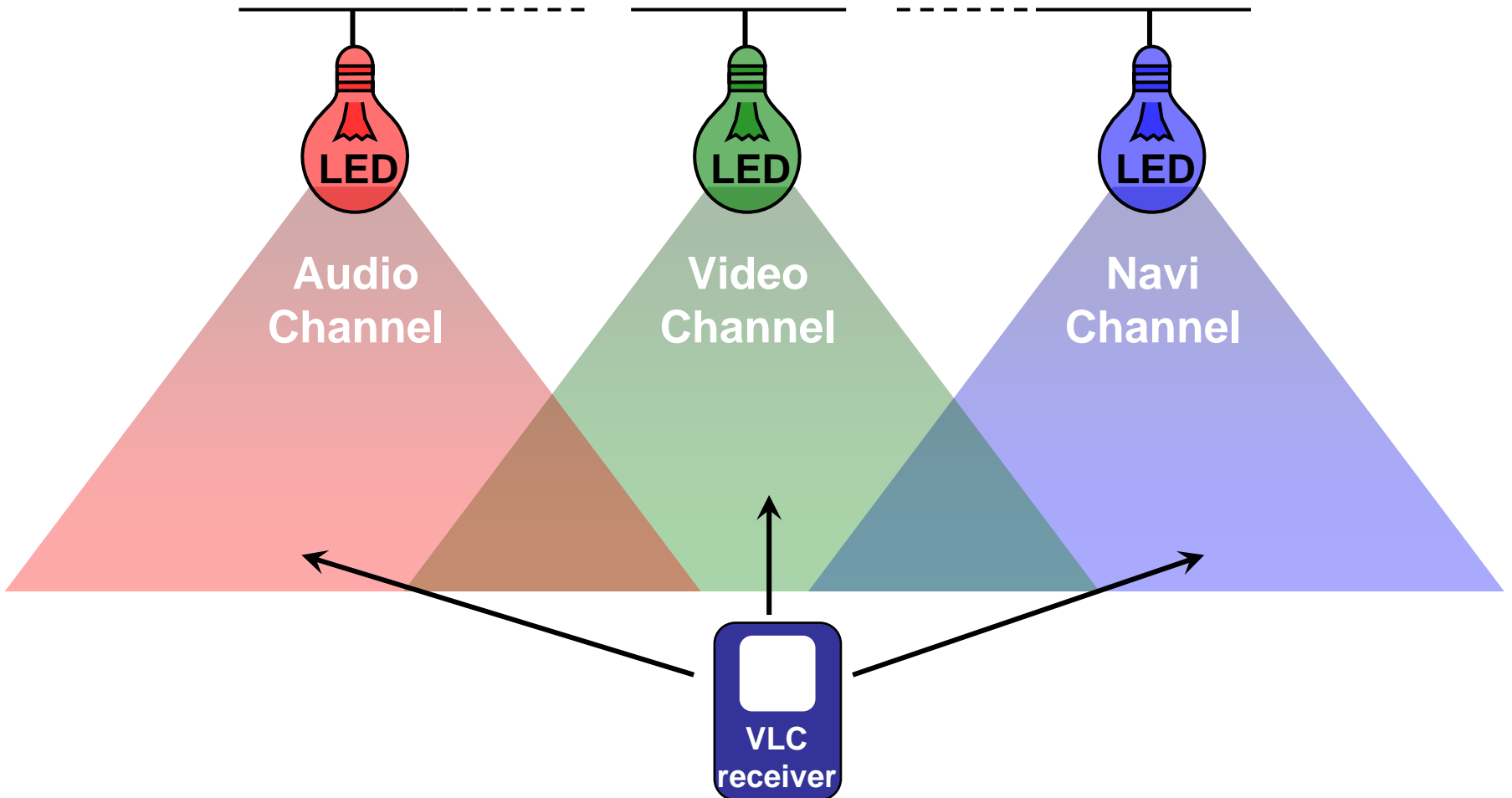
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Outline

- ❑ ***VLC Applications using Color Channels***
- ❑ ***Receiver Requirements for VLC Applications using Color Channels***
- ❑ ***Sources and Mechanism of Color Channel Difference in Receiver Sensitivity***
- ❑ ***Our proposal on Color Channel Tolerance***

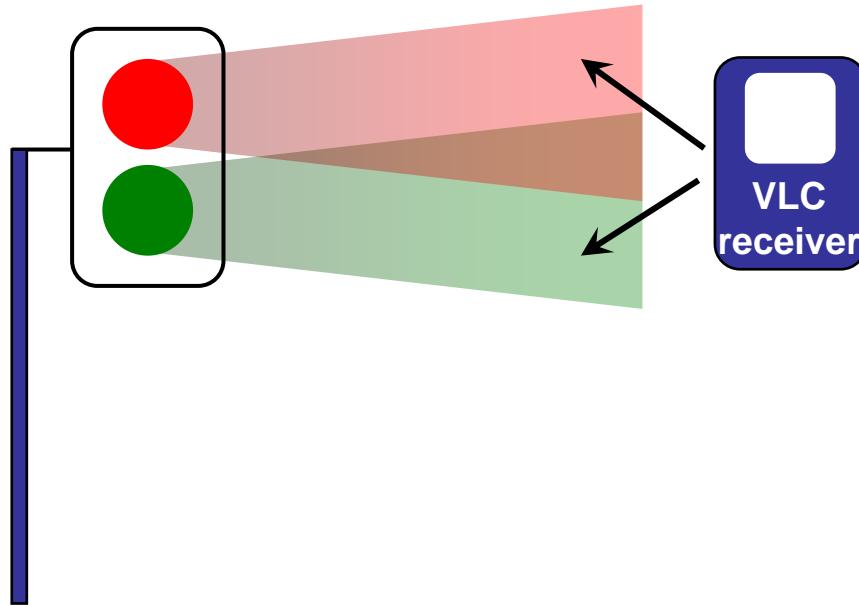
VLC Application using Color Channels (1)

VLC Light Sources

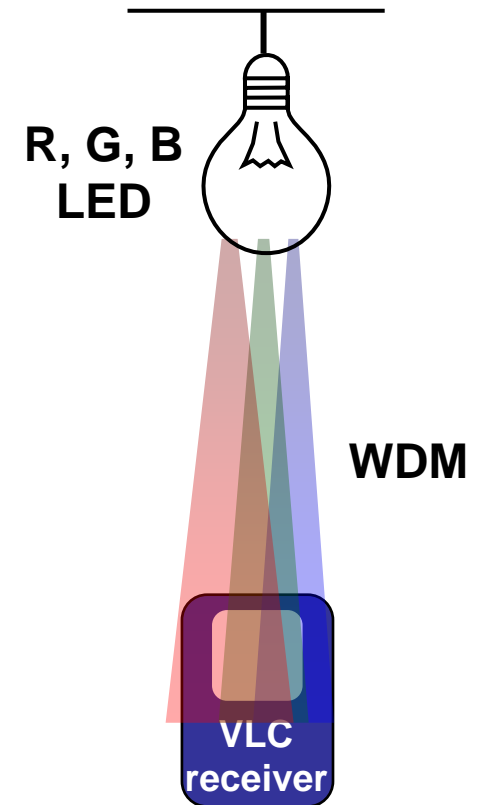


VLC Applications using Color Channels (2)

VLC Traffic Signal Light Sources



VLC WDM Light Source



Receiver Requirements for VLC Applications Using Color Channels

- ❑ A VLC receiver must support the various color channels according to VLC band plan.
- ❑ A VLC receiver must have constant receiver sensitivities in a tolerance range for the respective color channels.
- ❑ The Concept of **color channel tolerance of receiver sensitivity**.

Sources of Color Channel Differences in Receiver Sensitivity

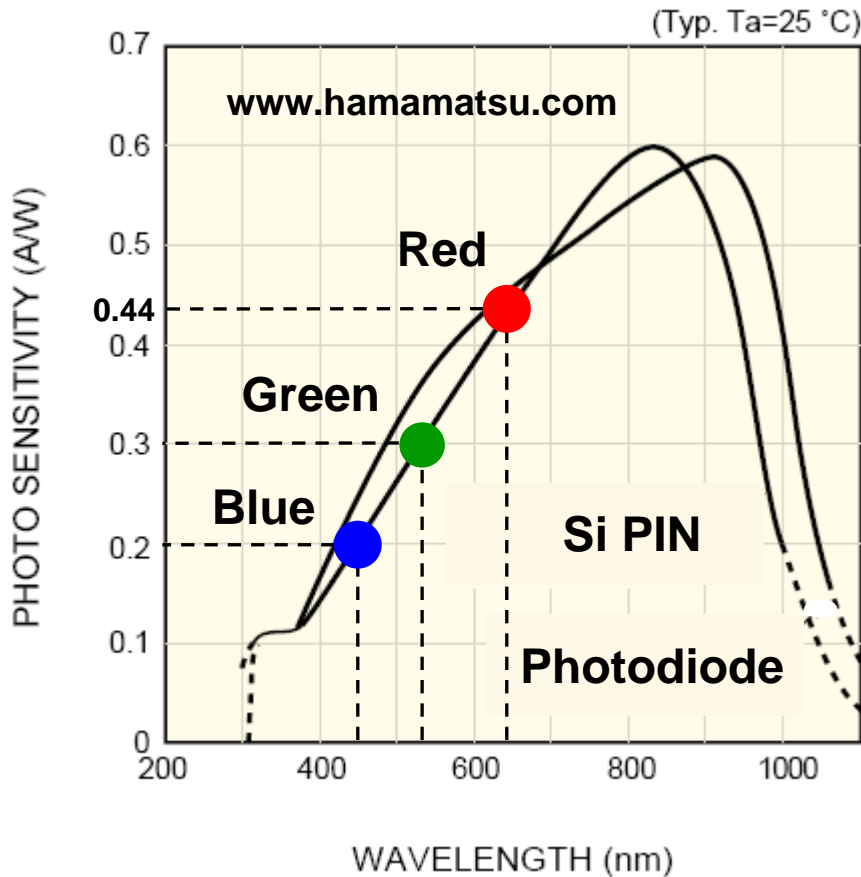
- ❑ The relations of radiometry and photometry.
- ❑ Remember that a green color channel has less radiant flux (Watt) than a red or blue channel at the same brightness (lumen).
- ❑ Si-photodetectors sensitivities depending on the visible wavelength region.

Calculated Color Channel Difference Table @ Receiver Input

Wavelength Band (nm)		Center Wavelength (nm)	$V(\lambda)$ at C.W.	Receiver input power (Watt) @ 1 lm
380	400	390	0.0008	1.8302
400	500	450	0.0468	0.0313
500	560	530	0.8620	0.0017
560	620	590	0.7570	0.0019
620	660	640	0.1750	0.0084
660	720	690	0.0082	0.1786
720	780	750	0.0001	14.6413

$V(\lambda)$: Human eye sensitivity function, C.W. : Center Wavelength
Ref. : E. Fred Schubert, *Light-Emitting Diodes*. Cambridge University Press, 2003.

Calculated Color Channel Difference Table @ Photodetector Output



Center Wavelength (nm)	Receiver input power (Watt) @ 1 lm	PD output current (mA) @ 1 lm
450	0.0313	6.3
530	0.0017	0.5
640	0.0084	3.7

Proposal on Color Channel Tolerance (1)

- ❑ **VLC using color channels basically has the color channel difference in receiver sensitivity because of the relation between the radiometric and photometric units and the wavelength dependence of a VLC receiver.**
- ❑ **We propose we need to make the concept of the color channel tolerance of a receiver sensitivity.**

Proposal on Color Channel Tolerance (2)

Wavelength Band (nm)		Spectral Width (nm)	Color Channel Tolerance of Receiver Sensitivity (%)
380	400	20	<p style="text-align: center;">$\pm 5\%$</p> <p style="text-align: center;">@ receiver sensitivity mean value</p>
400	500	100	
500	560	60	
560	620	60	
620	660	40	
660	720	60	
720	780	60	