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

Submission Title: Why two calibration schemes in contribution 15-10-0089-02-0007?

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Re: N/A

Abstract: We motivate the two calibration schemes suggested in 15-10-0089-02-0007 and outline how the DC response of the LED could be measured with modified Walsh sequences.

Purpose: Helping TG 802.15.7 to assess contribution 15-10-0089-02-0007 towards inclusion into IEEE 802.15.7 D2

Why two calibration schemes in contribution 15-10-0089-02-0007?

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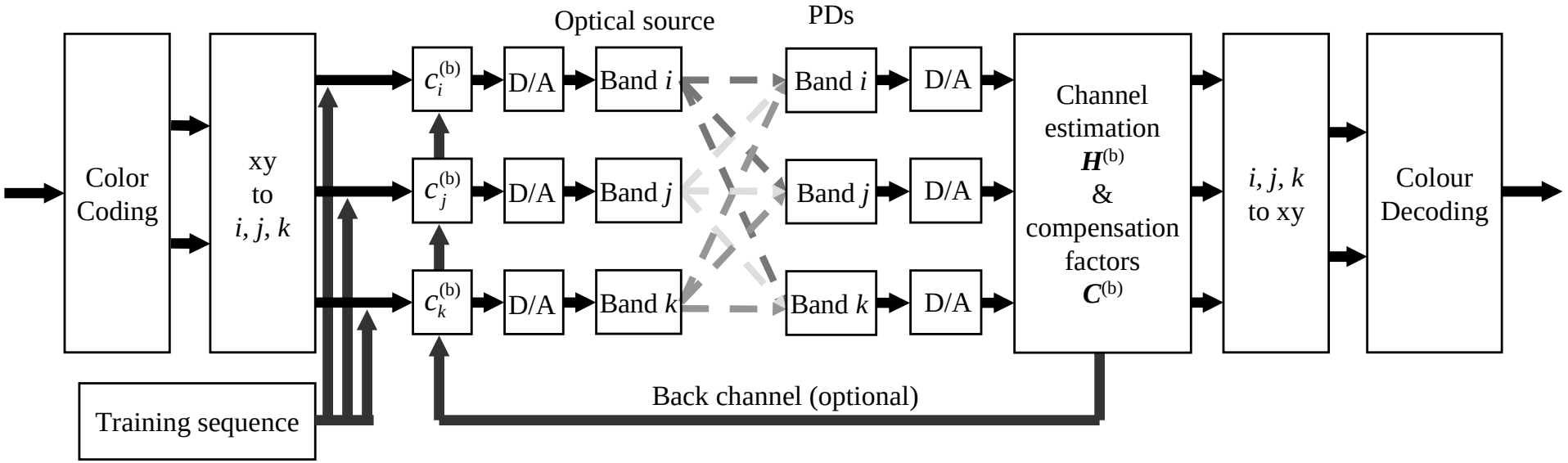
Reminder: proposed compensation scheme



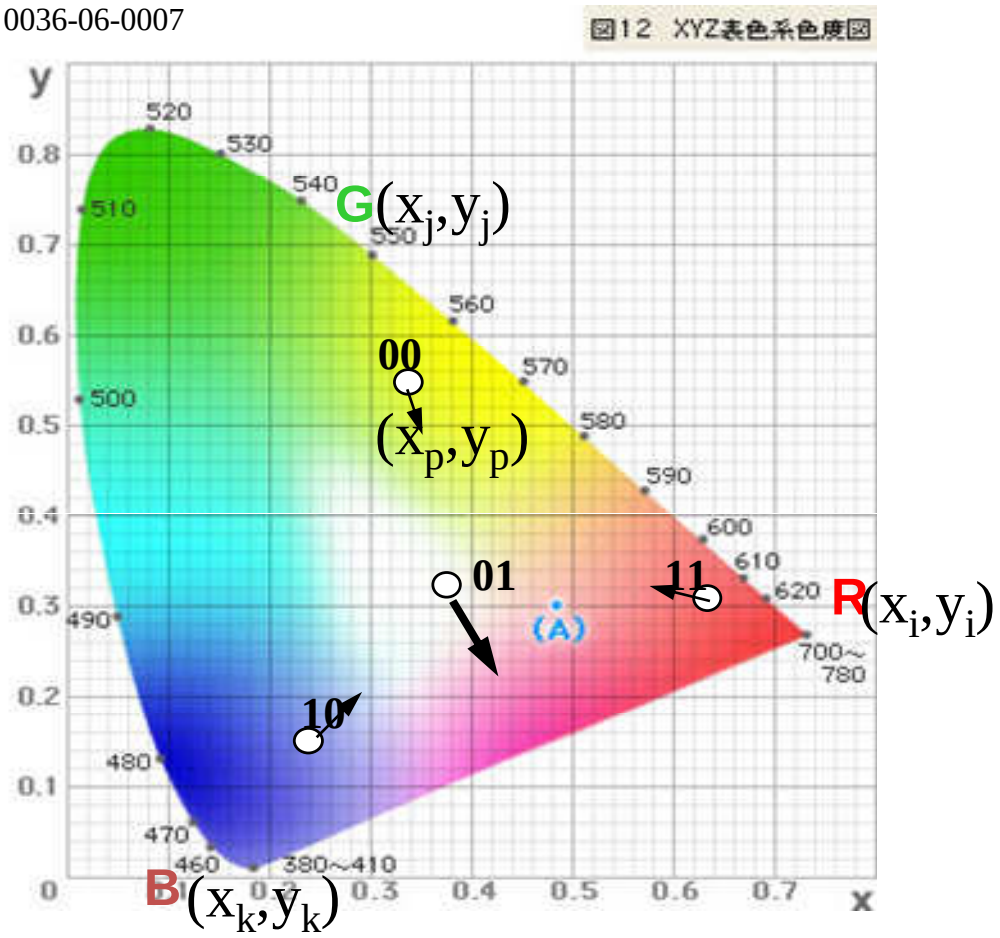
- 15-09-0827-02-0007 advocates two calibration schemes (AC and DC) → two sets of compensation factors

Motivation for this contribution

- 15-09-0827-02-0007 promotes an extension of CSK Rx compensation scheme so that colour centre of gravity of CSK constellation diagram does not drift
- 15-10-0089-02-0007 builds on above contribution and provides more details on PHY and MAC implementation
- Here: we motivate the two calibration schemes in 15-10-0089-02-0007 and explain how the DC case could be covered with modified Walsh sequences
- We also discuss an alternative approach with only one calibration scheme

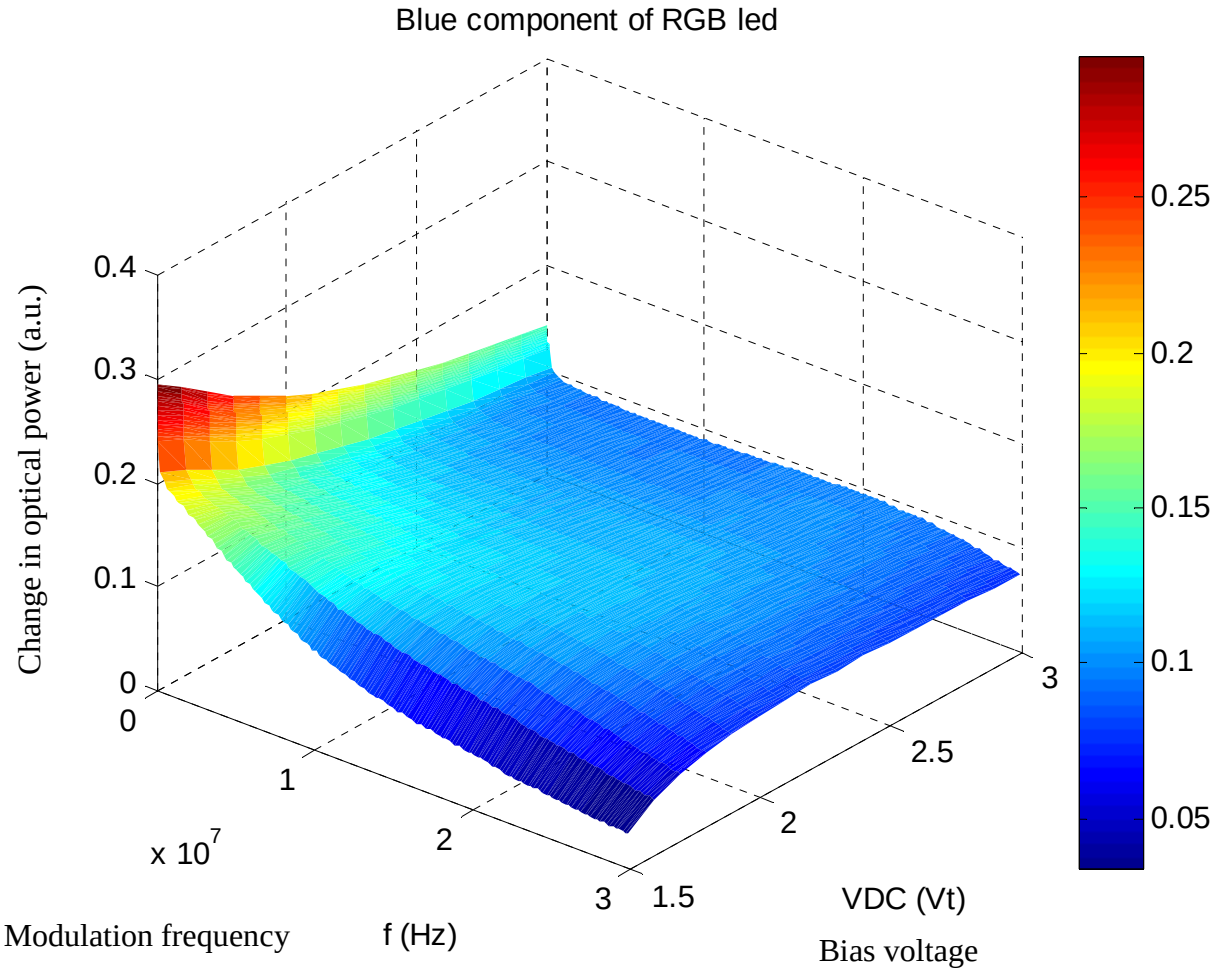
Significance of AC and DC component

Source: 15-10-0036-06-0007



- Large arrow: wander of centre of gravity due to drift of slow response of LED (“DC quantum efficiency”)
- Small arrows: wander of off-centre constellation points due to drift of “AC quantum efficiency”

Is there really an DC and AC quantum efficiency?



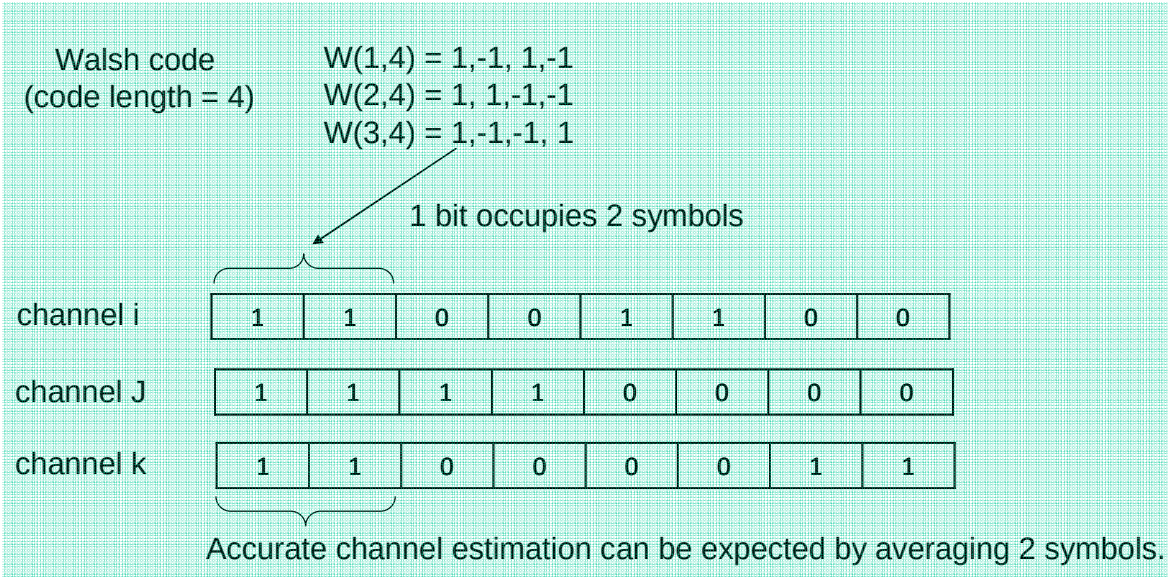
Conclusions drawn from small-signal measurement

- Strong dependence on frequency for modulation frequencies << 1 MHz (thermal regime)
- Defines DC behaviour of LED and how centre of gravity of CSK constellation scheme reacts to changes in bias current
- Response to stimuli > 1 MHz: separation of CSK constellation points
- Notice: different magnitude and dependence on bias current!

Remedy of this issue as per 15-10-0089-02-0007

- Measure AC response as outlined in 15-09-0827-02-0007, i.e. with channel matrix ***H*** as defined in D1
- Measure DC response with modified Walsh sequences …

Recap of AC scheme



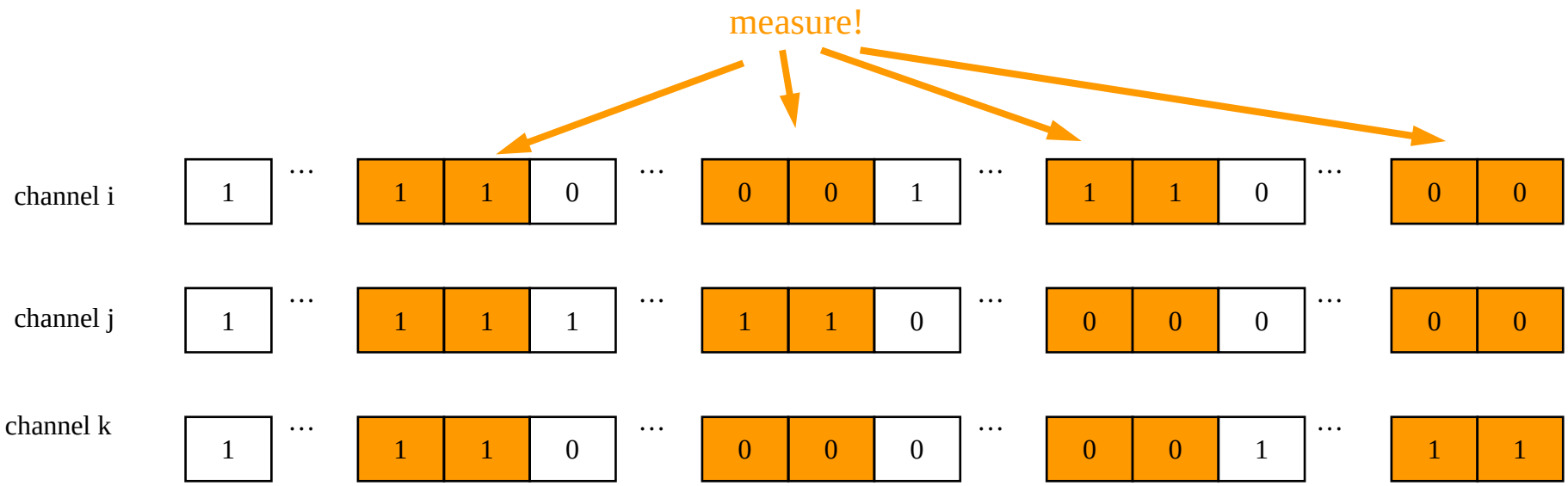
Source: 15-10-0036-06-0007

Source: IEEE 802.15.7 D0

Thus: Small-signal modulation
@ 12 or 24 MHz

	Optical rate	Modulation	FEC	Data rate
CCM	12 MHz	4 CCM	1/2	12 Mbps
	12 MHz	8 CCM	1/2	18 Mbps
	24 MHz	4 CCM	1/2	24 Mbps
	24 MHz	8 CCM	1/2	36 Mbps
	24 MHz	16 CCM	1/2	48 Mbps
	24 MHz	8 CCM	1	72 Mbps
	24 MHz	16 CCM	1	96 Mbps

Alternative DC Walsh sequence



- Repeat Walsh sequences so often that LED enters thermal regime (> ~ 10^3 times)
- Issue: need to introduce new PHY sequences

Can we get along with only one scheme?

- Diagram on slide 5: Fixed relationship between AC and DC dependence
- Our experience: Aging and temperature do only weakly change this relationship
- Thus: Calibrate AC behaviour and extrapolate DC behaviour from known relationship between both?
- Notice: Has to be done in Tx

Summary

- Motivated the necessity of two calibration regimes (AC and DC) in 15-10-0089-02-0007
- Outlined DC measurement procedure based on long Walsh sequences
- Discussed potential of extrapolating AC compensation factors to DC regime
- Will submit a comment advocating integration of 15-10-0089-02-0007 into D2 before end of letter ballot

Acknowledgment

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