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

Submission Title: CSK related Comment Resolution Input Summary
Date Submitted: 17. May 2010
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Abstract:
Purpose: addresses comments pending on input from Samsung for comment resolution

Samsung response about CID 877,884,885
17. May 2010

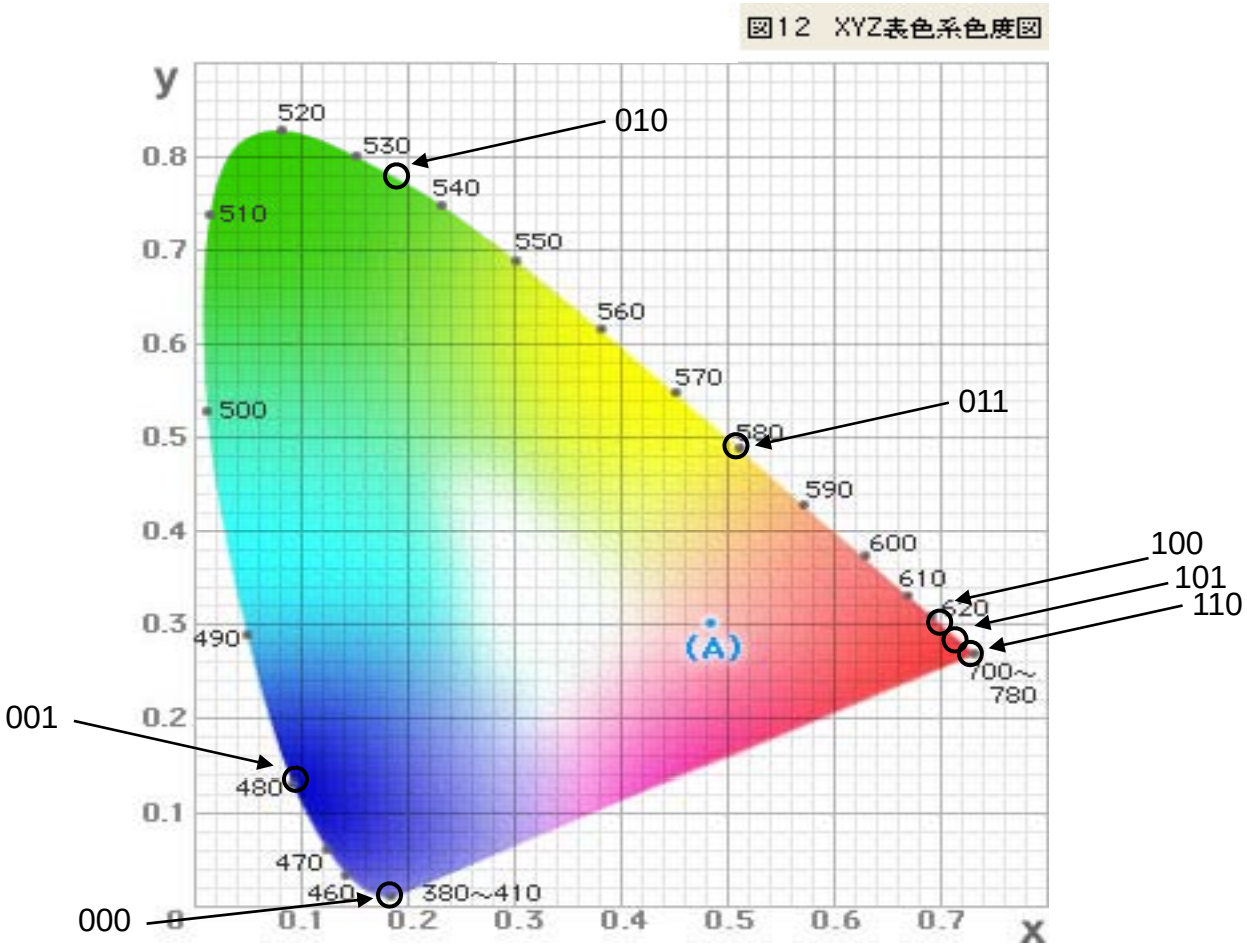
Assumptions

1. CSK signal is generated by 3 color light sources in 7 color bands that are defined in TG7 standard draft.
2. The 3 tops of CSK constellation triangle are decided by the center wave length of the 3 color bands on xy color coordinates. (page 3-4)
3. Symbol points of CSK constellation are defined by the symbol allocation design rules. (page5-7)
4. Data allocations are shown in page 8-10.

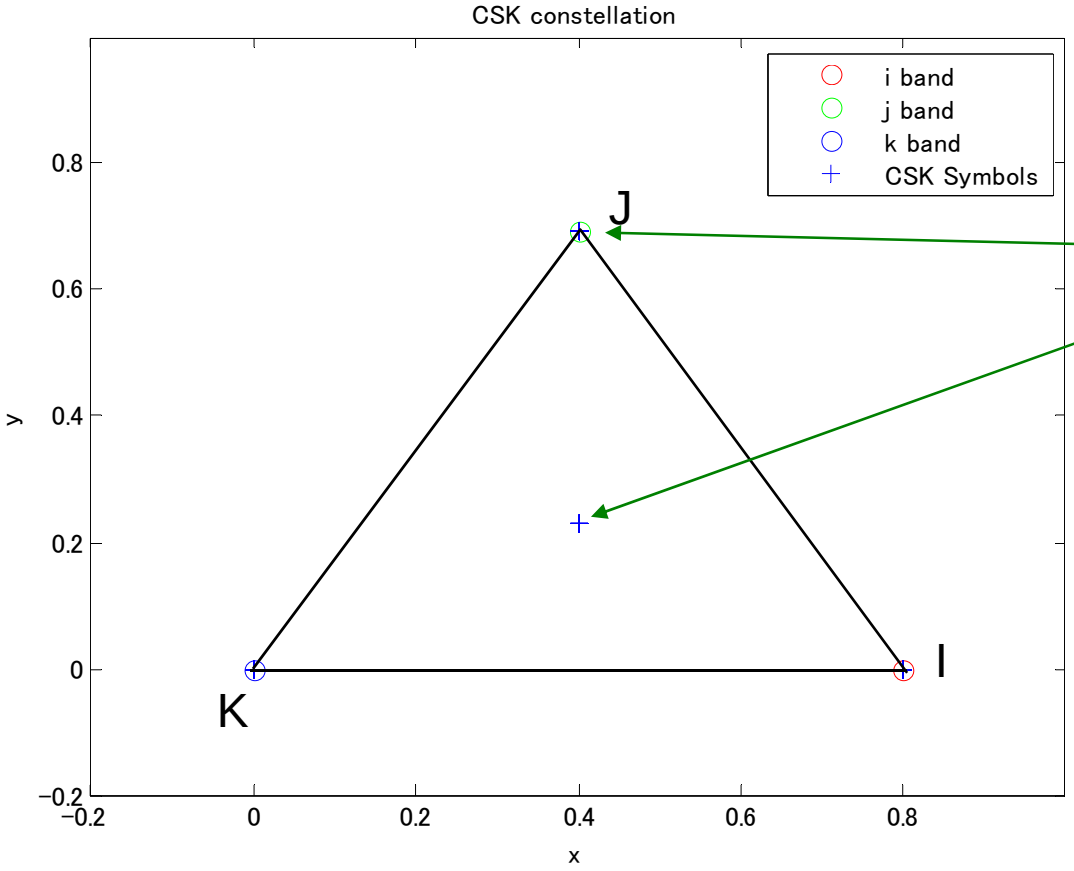
xy color coordinates values for each color band

Color Code	color	Band (nm)	Center (nm)	(x , y)
000	pB	380-450	415	(0.18, 0.01)
001	B,BG	450-510	480	(0.09, 0.13)
010	G	510-560	535	(0.19, 0.78)
011	yG,gY	560-600	580	(0.51, 0.49)
100	rO	600-650	625	(0.70, 0.30)
101	R	650-710	680	(0.72, 0.28)
110	R	710-780	745	(0.73, 0.27)
111	Reserved	-	-	-

Center of color bands on xy color coordinates



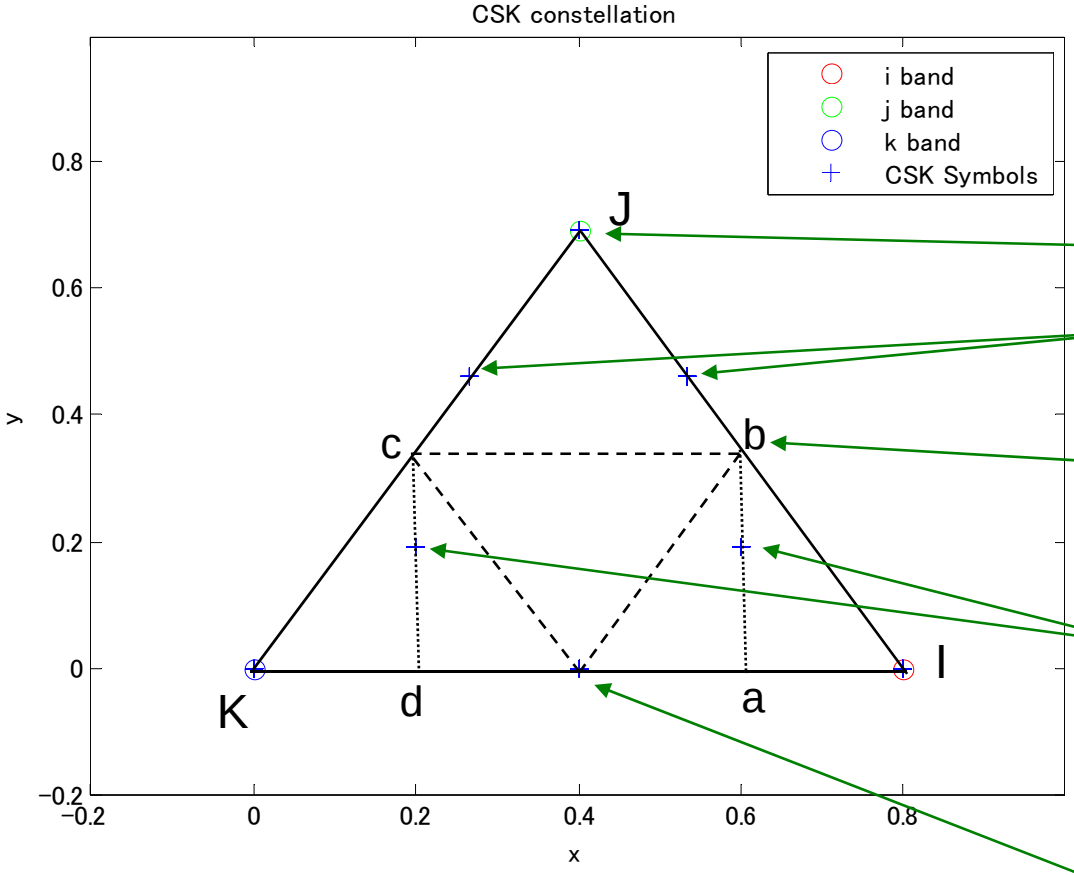
4CSK symbol allocation design rule



3 bands' decide tops of a CSK Triangle (I, J, K).

Gravity center of △IJK

8CSK symbol allocation design rule



3 bands' decide tops of a CSK Triangle (I, J, K).

Points divide sides in the ratio 1:2. (2 points)

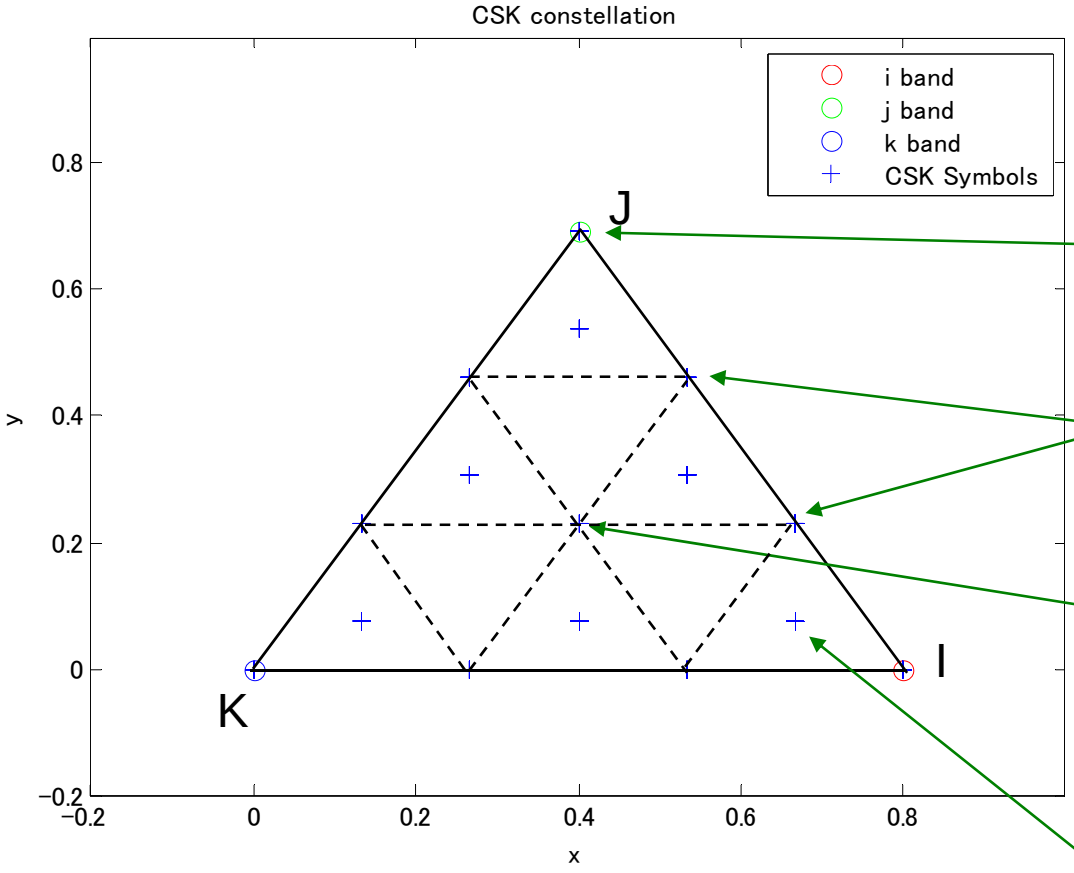
Midpoint of the side IJ

Line ba and line cd meet at right angle s with line KI.

Points divide lines in the ratio 1:2. (2 points)

Midpoint of the side KI

16CSK symbol allocation design rule



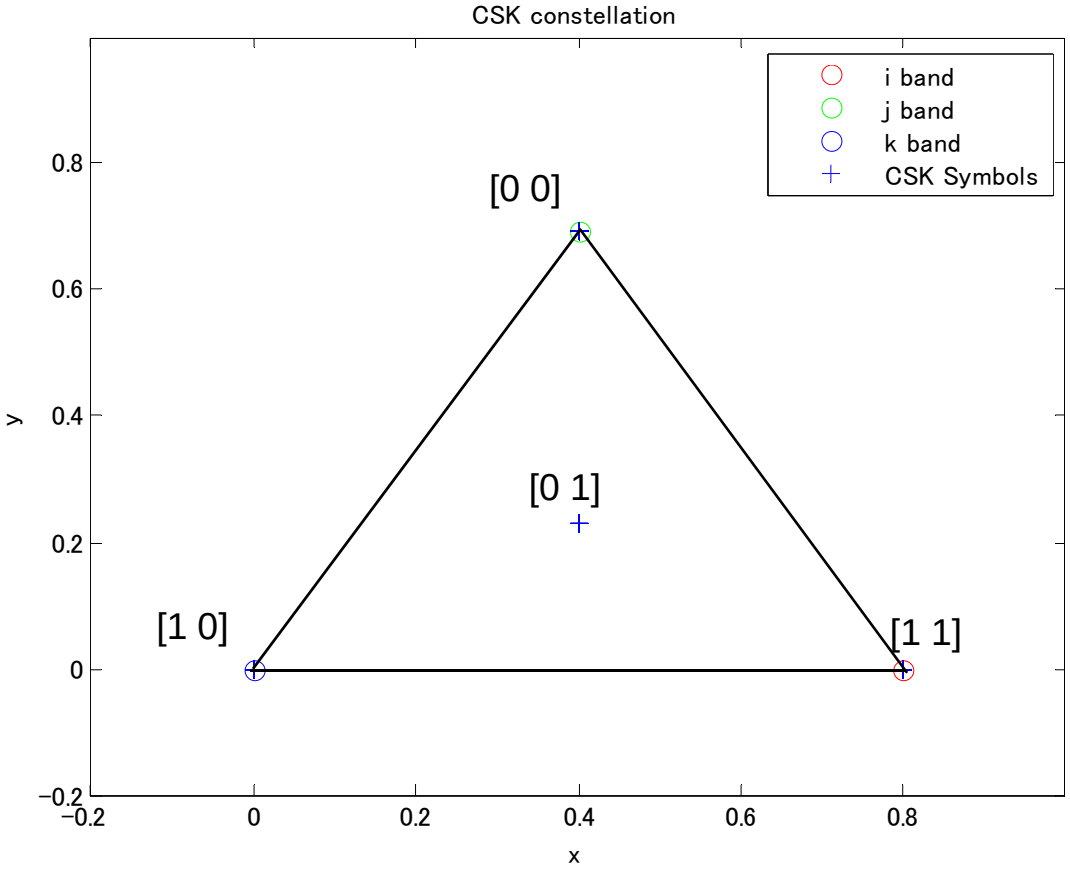
3 bands' decide tops of a CSK Triangle (I, J, K).

Points divide sides in one third (6 points)

Gravity center of △IJK

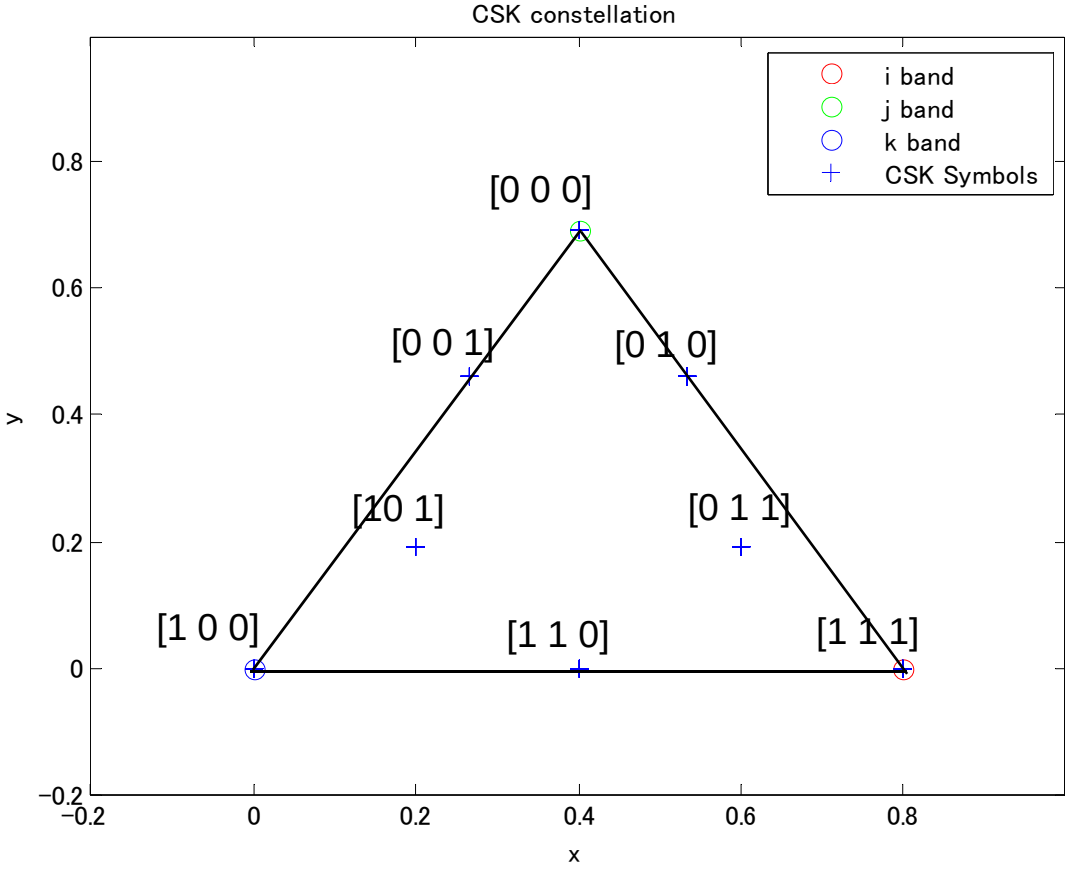
Gravity center of each small △ (6 points)

4CSK data allocation



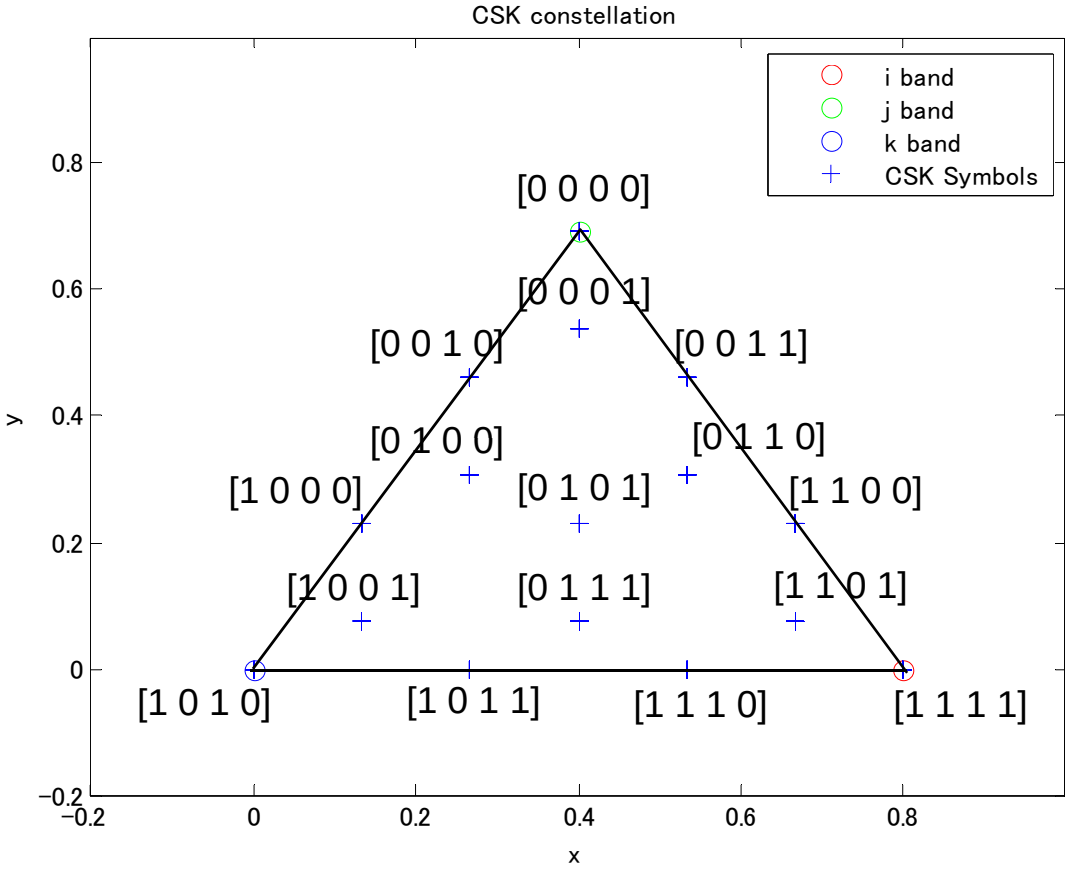
2bits / Symbol

8CSK data allocation



3bits / Symbol

16CSK data allocation



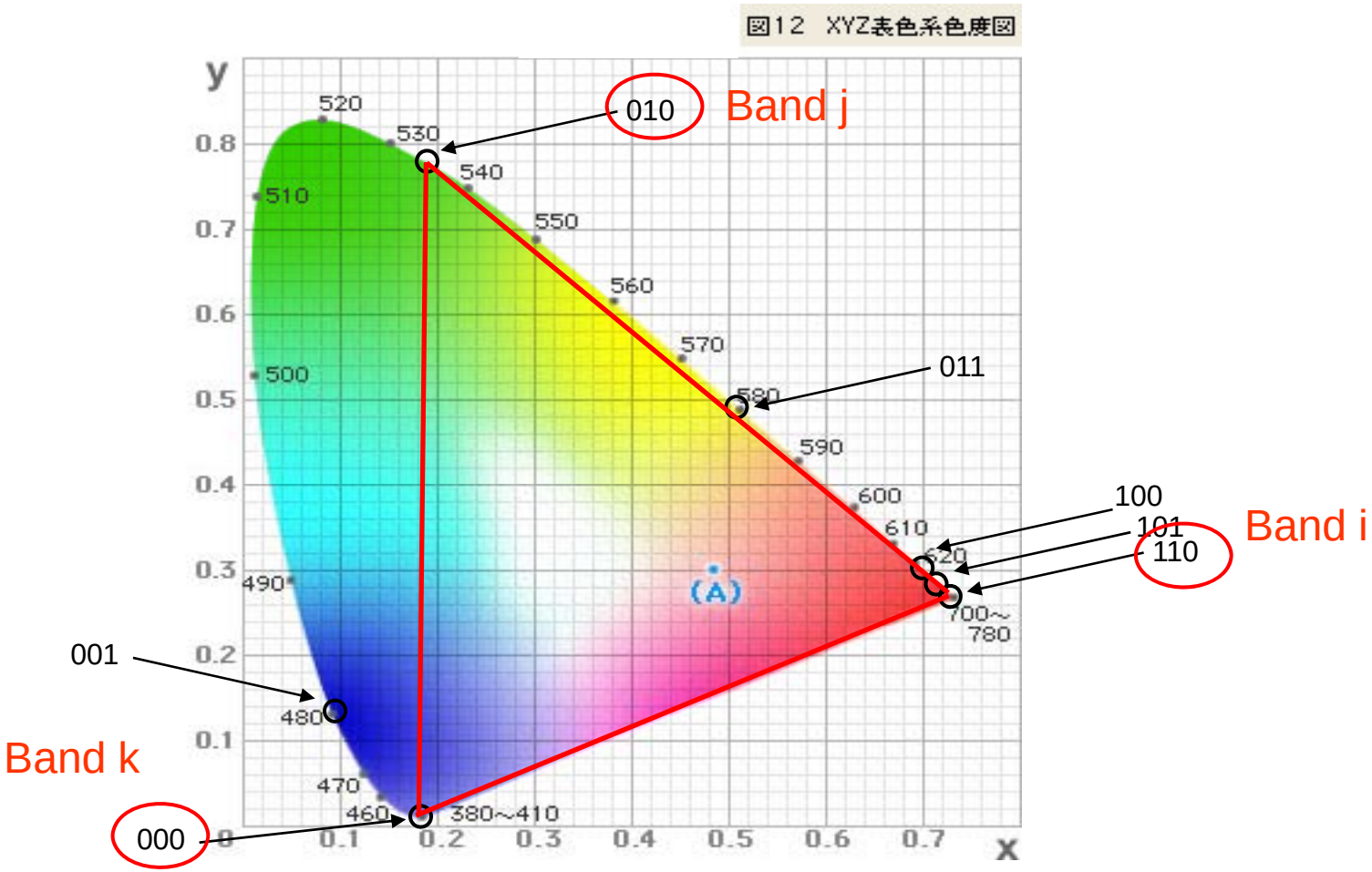
4bits / Symbol

CSK constellations

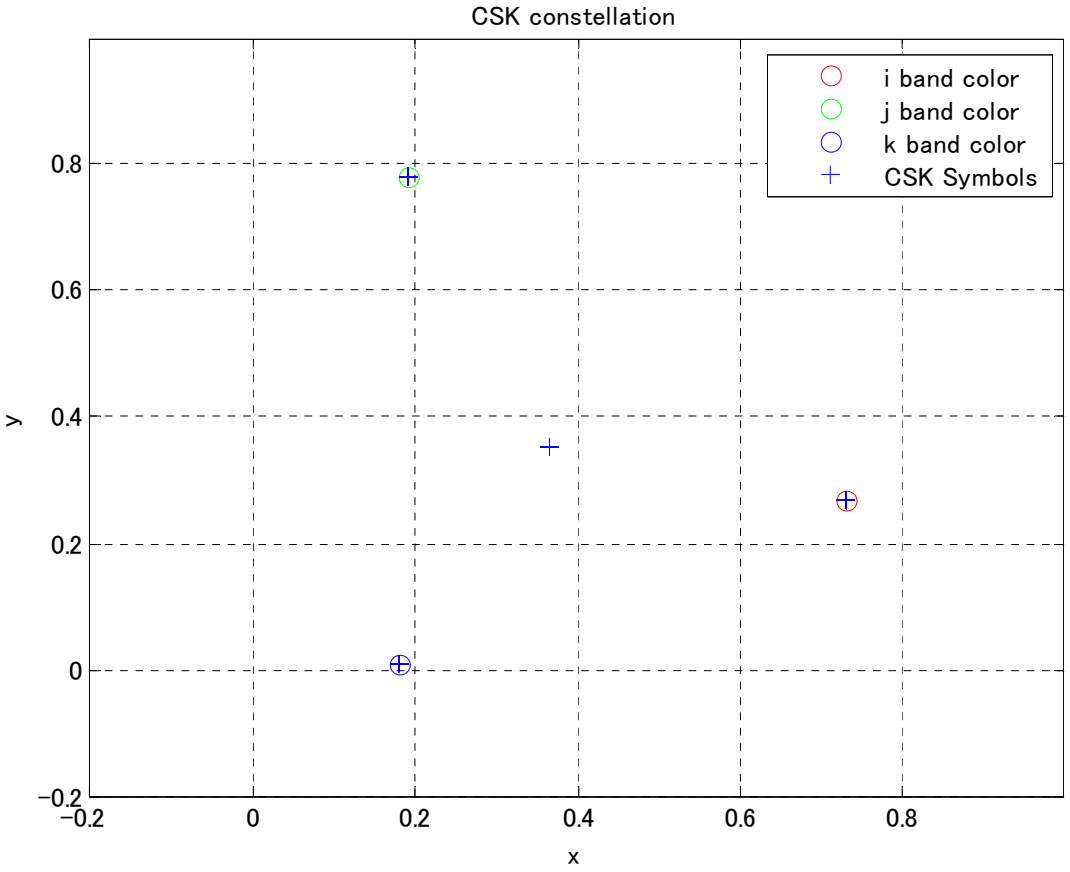
1. CSK constellation is decided by the combination of the 3 color bands.
2. The performance of CSK depends on the form of the CSK constellation triangle.
3. The system can not select the combination which can not make a triangle on the xy color coordinates, like as (110-101-100) or (100-011-010).
4. Some color band combination examples and their xy coordinates' values are shown in page12-23.

Color band combination for CSK (110-010-000)

Color band combination (1)



4CSK xy coordinates values (110-010-000)



*** CSK constellation ***

xy coordinates of color band i, j, k

(xi yi) = (0.730 0.270)

(xj yj) = (0.190 0.780)

(xk yk) = (0.180 0.010)

Symbol data allocation on xy coordinates

[Data] --> (xp yp)

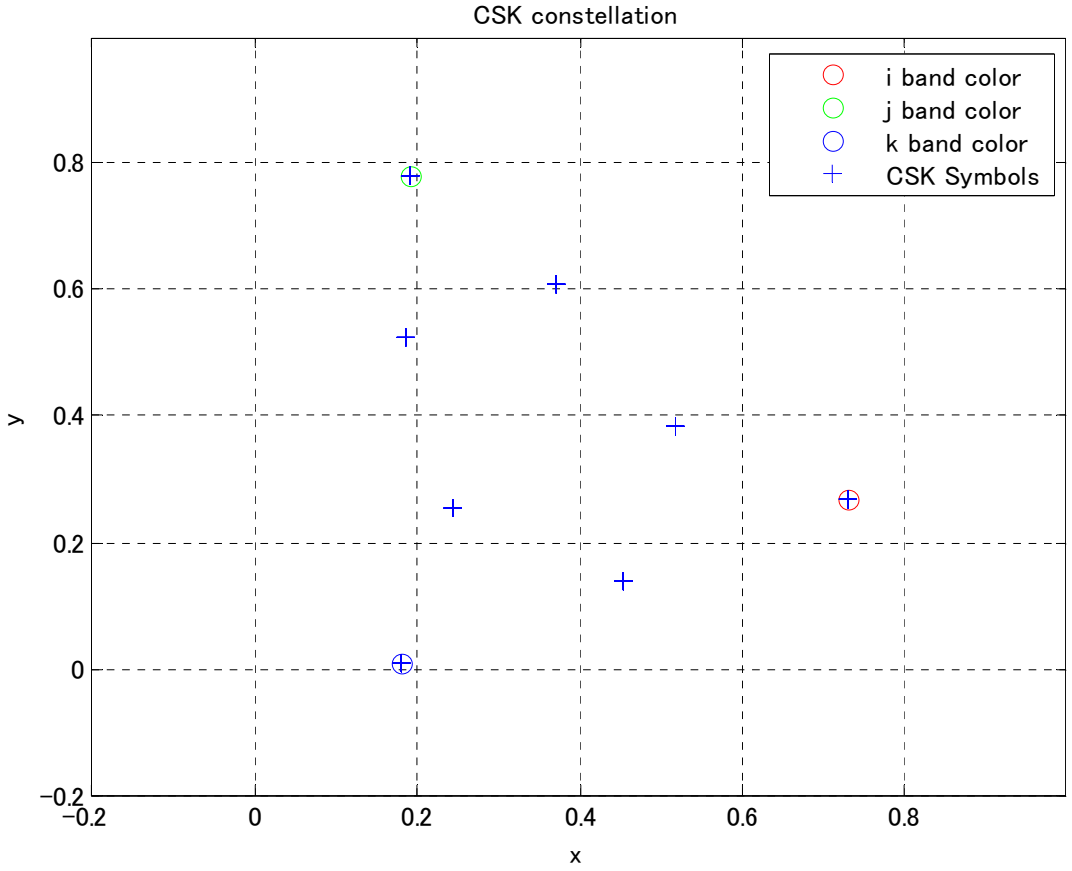
[0 0] --> (0.190 0.780)

[0 1] --> (0.367 0.353)

[1 0] --> (0.180 0.010)

[1 1] --> (0.730 0.270)

8CSK xy coordinates values (110-010-000)



*** CSK constellation ***

xy coordinates of color band i, j, k

(xi yi) = (0.730 0.270)

(xj yj) = (0.190 0.780)

(xk yk) = (0.180 0.010)

Symbol data allocation on xy coordinates

[Data] --> (xp yp)

[0 0 0] --> (0.190 0.780)

[0 0 1] --> (0.187 0.523)

[0 1 0] --> (0.370 0.610)

[0 1 1] --> (0.519 0.383)

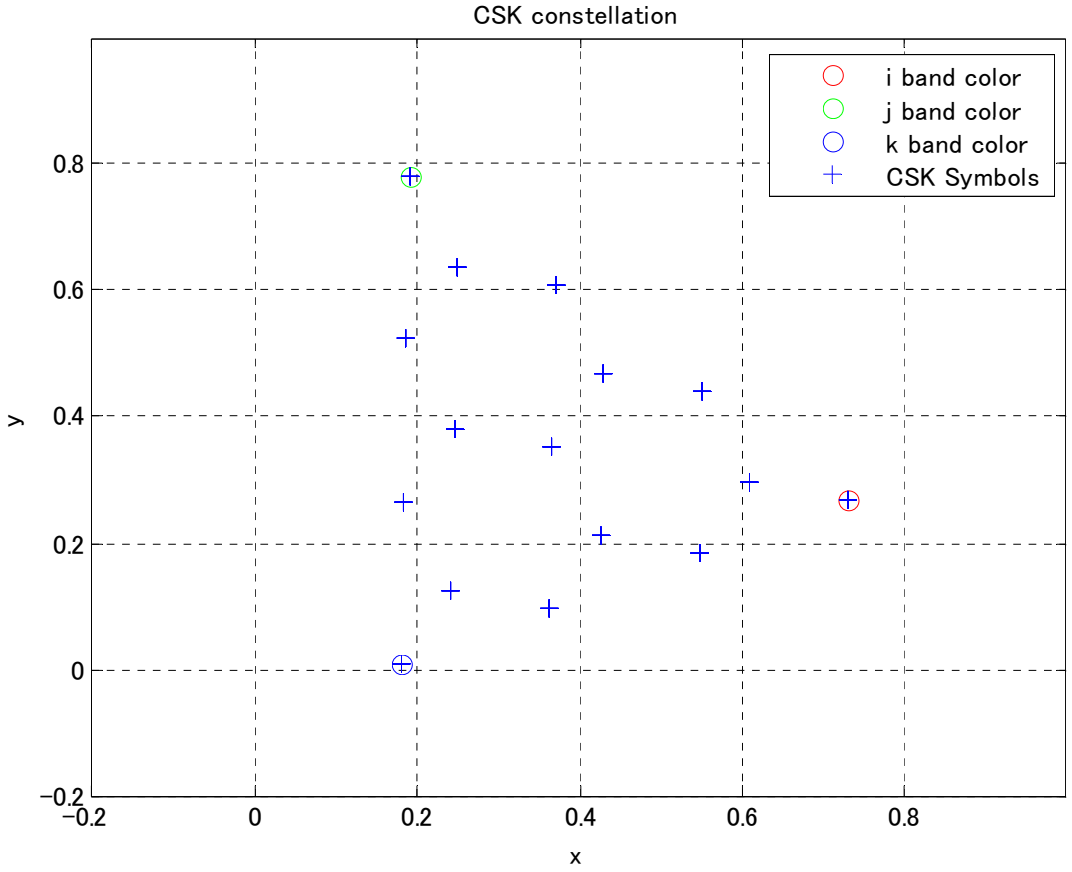
[1 0 0] --> (0.180 0.010)

[1 0 1] --> (0.244 0.253)

[1 1 0] --> (0.455 0.140)

[1 1 1] --> (0.730 0.270)

16CSK xy coordinates values (110-010-000)



*** CSK constellation ***

xy coordinates of color band i, j, k

(xi yi) = (0.730 0.270)

(xj yj) = (0.190 0.780)

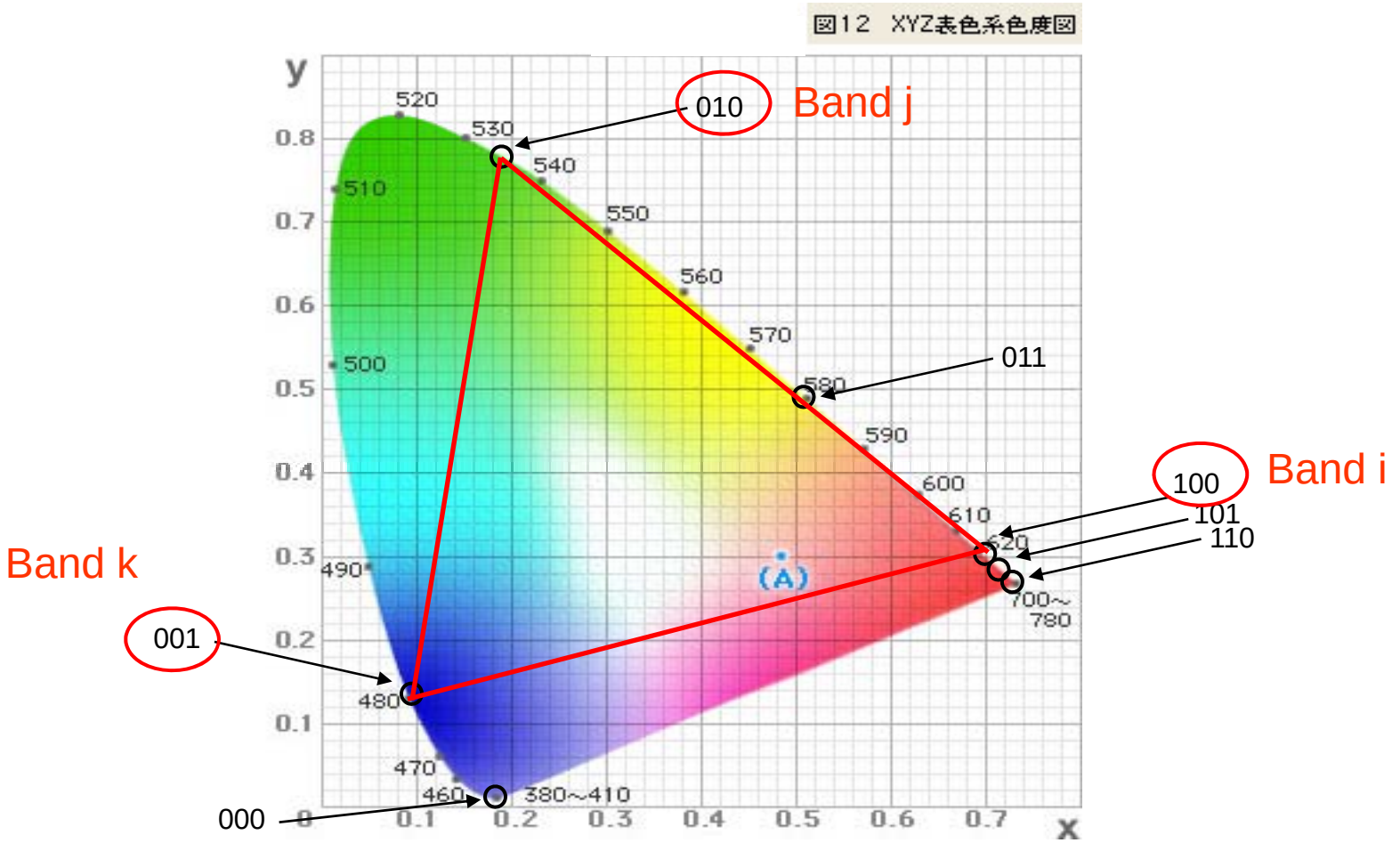
(xk yk) = (0.180 0.010)

Symbol data allocation on xy coordinates

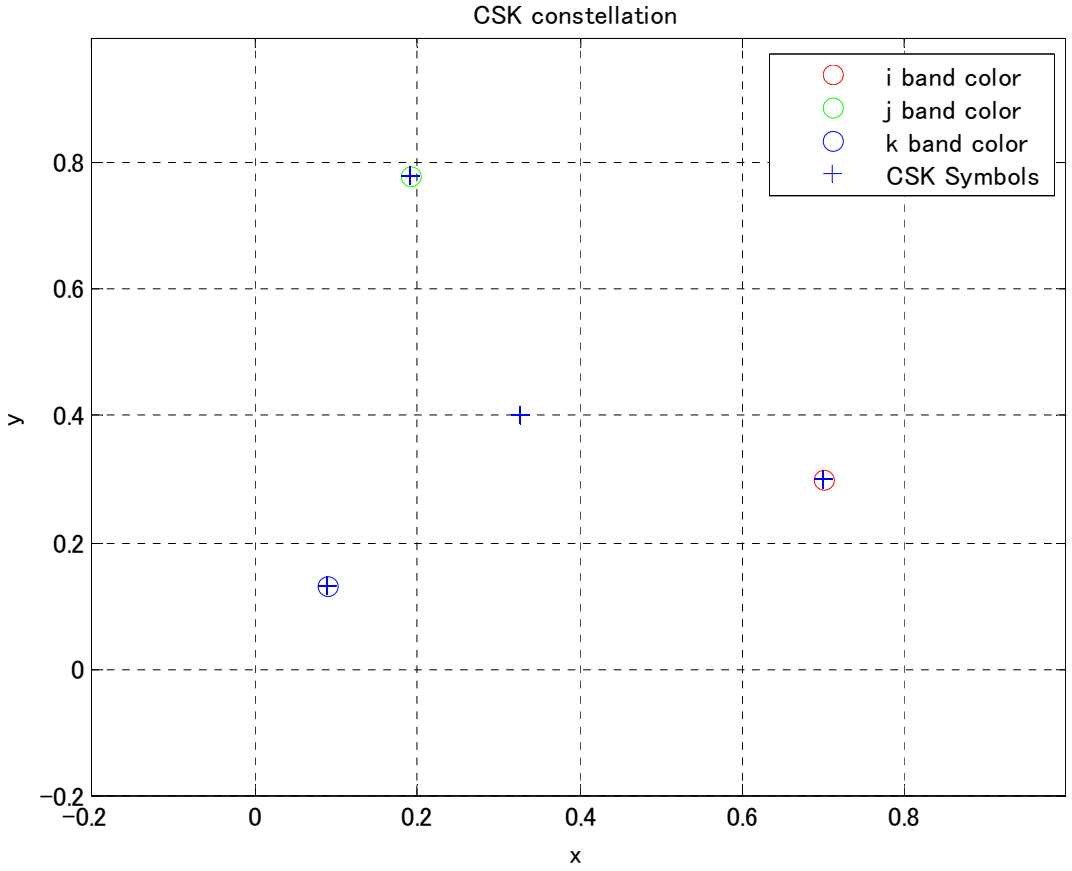
[Data] --> (xp yp)
[0 0 0 0] --> (0.190 0.780)
[0 0 0 1] --> (0.249 0.638)
[0 0 1 0] --> (0.187 0.523)
[0 0 1 1] --> (0.370 0.610)
[0 1 0 0] --> (0.246 0.381)
[0 1 0 1] --> (0.367 0.353)
[0 1 1 0] --> (0.429 0.468)
[0 1 1 1] --> (0.426 0.211)
[1 0 0 0] --> (0.183 0.267)
[1 0 0 1] --> (0.242 0.124)
[1 0 1 0] --> (0.180 0.010)
[1 0 1 1] --> (0.363 0.097)
[1 1 0 0] --> (0.550 0.440)
[1 1 0 1] --> (0.609 0.298)
[1 1 1 0] --> (0.547 0.183)
[1 1 1 1] --> (0.730 0.270)

Color band combination for CSK (100-010-001)

Color band combination (2)



4CSK xy coordinates values (100-010-001)



*** CSK constellation ***

xy coordinates of color band i, j, k

(xi yi) = (0.700 0.300)

(xj yj) = (0.190 0.780)

(xk yk) = (0.090 0.130)

Symbol data allocation on xy coordinates

[Data] --> (xp yp)

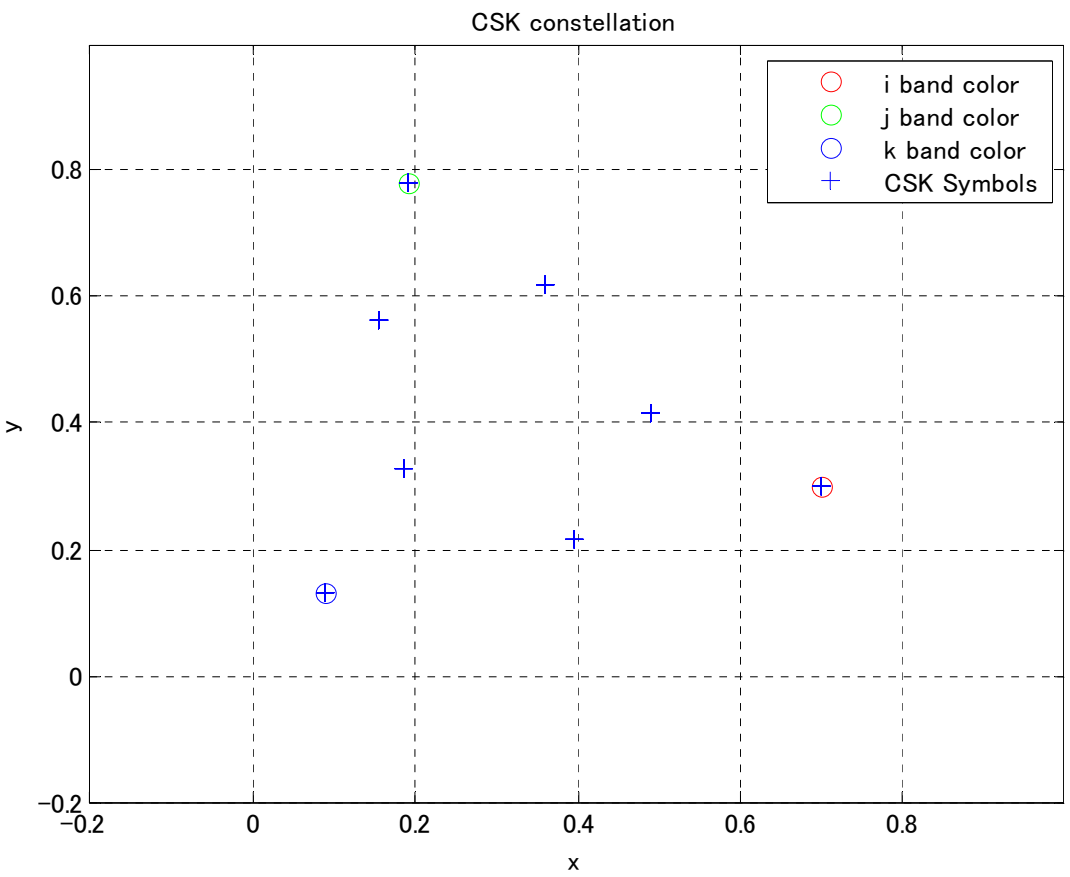
[0 0] --> (0.190 0.780)

[0 1] --> (0.327 0.403)

[1 0] --> (0.090 0.130)

[1 1] --> (0.700 0.300)

8CSK xy coordinates values (100-010-001)



*** CSK constellation ***

xy coordinates of color band i, j, k

(xi yi) = (0.700 0.300)

(xj yj) = (0.190 0.780)

(xk yk) = (0.090 0.130)

Symbol data allocation on xy coordinates

[Data] --> (xp yp)

[0 0 0] --> (0.190 0.780)

[0 0 1] --> (0.157 0.563)

[0 1 0] --> (0.360 0.620)

[0 1 1] --> (0.491 0.414)

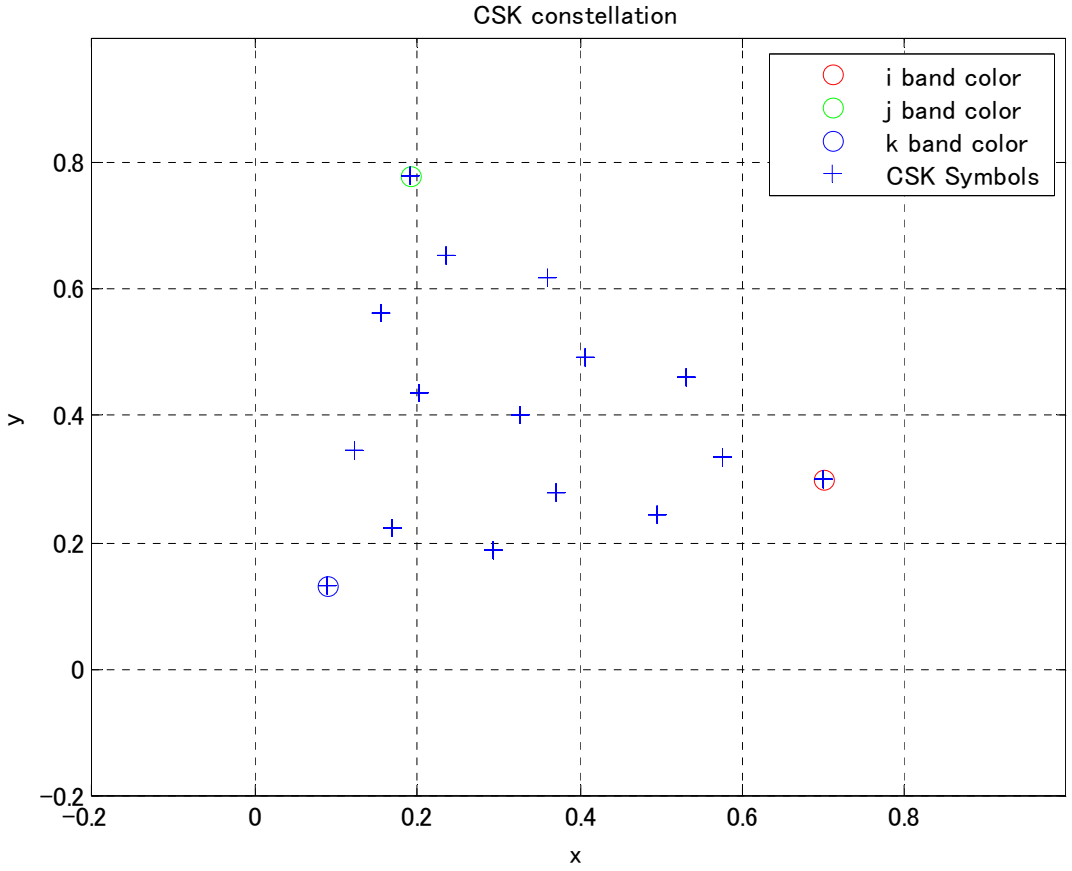
[1 0 0] --> (0.090 0.130)

[1 0 1] --> (0.186 0.329)

[1 1 0] --> (0.395 0.215)

[1 1 1] --> (0.700 0.300)

16CSK xy coordinates values (100-010-001)



*** CSK constellation ***

xy coordinates of color band i, j, k

(xi yi) = (0.700 0.300)

(xj yj) = (0.190 0.780)

(xk yk) = (0.090 0.130)

Symbol data allocation on xy coordinates

[Data] --> (xp yp)

[0 0 0 0] --> (0.190 0.780)

[0 0 0 1] --> (0.236 0.654)

[0 0 1 0] --> (0.157 0.563)

[0 0 1 1] --> (0.360 0.620)

[0 1 0 0] --> (0.202 0.438)

[0 1 0 1] --> (0.327 0.403)

[0 1 1 0] --> (0.406 0.494)

[0 1 1 1] --> (0.372 0.278)

[1 0 0 0] --> (0.123 0.347)

[1 0 0 1] --> (0.169 0.221)

[1 0 1 0] --> (0.090 0.130)

[1 0 1 1] --> (0.293 0.187)

[1 1 0 0] --> (0.530 0.460)

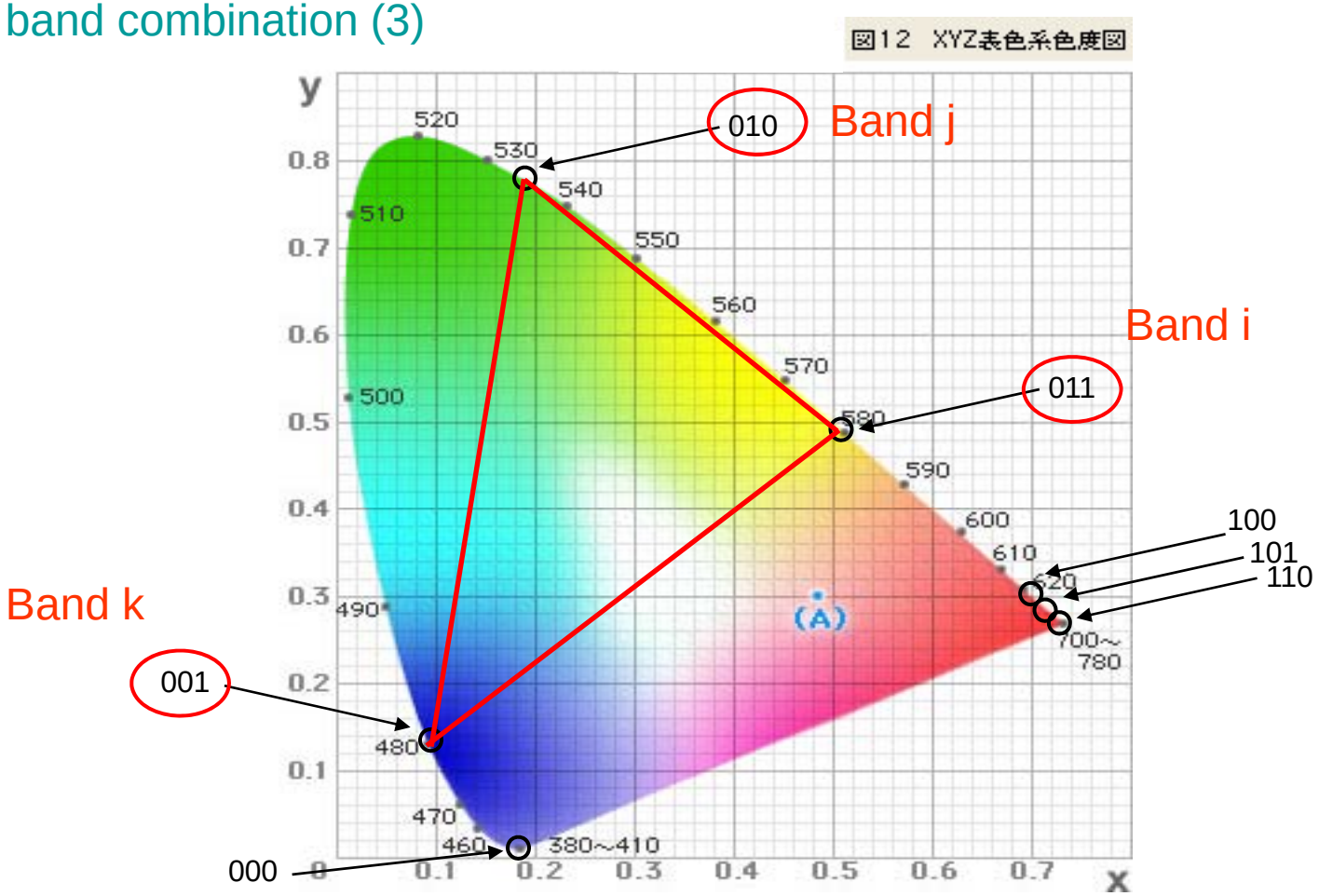
[1 1 0 1] --> (0.576 0.334)

[1 1 1 0] --> (0.497 0.243)

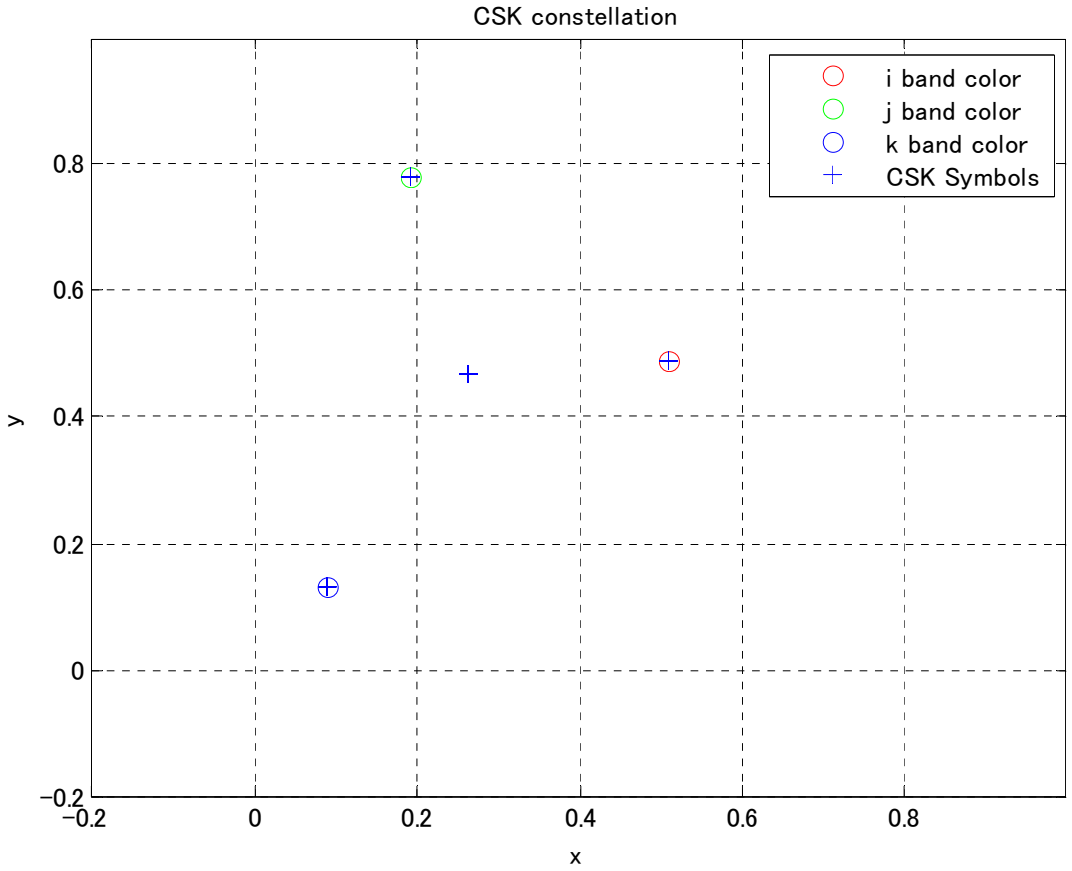
[1 1 1 1] --> (0.700 0.300)

Color band combination for CSK (011-010-001)

Color band combination (3)



4CSK xy coordinates values (011-010-001)



*** CSK constellation ***

xy coordinates of color band i, j, k

(xi yi) = (0.510 0.490)

(xj yj) = (0.190 0.780)

(xk yk) = (0.090 0.130)

Symbol data allocation on xy coordinates

[Data] --> (xp yp)

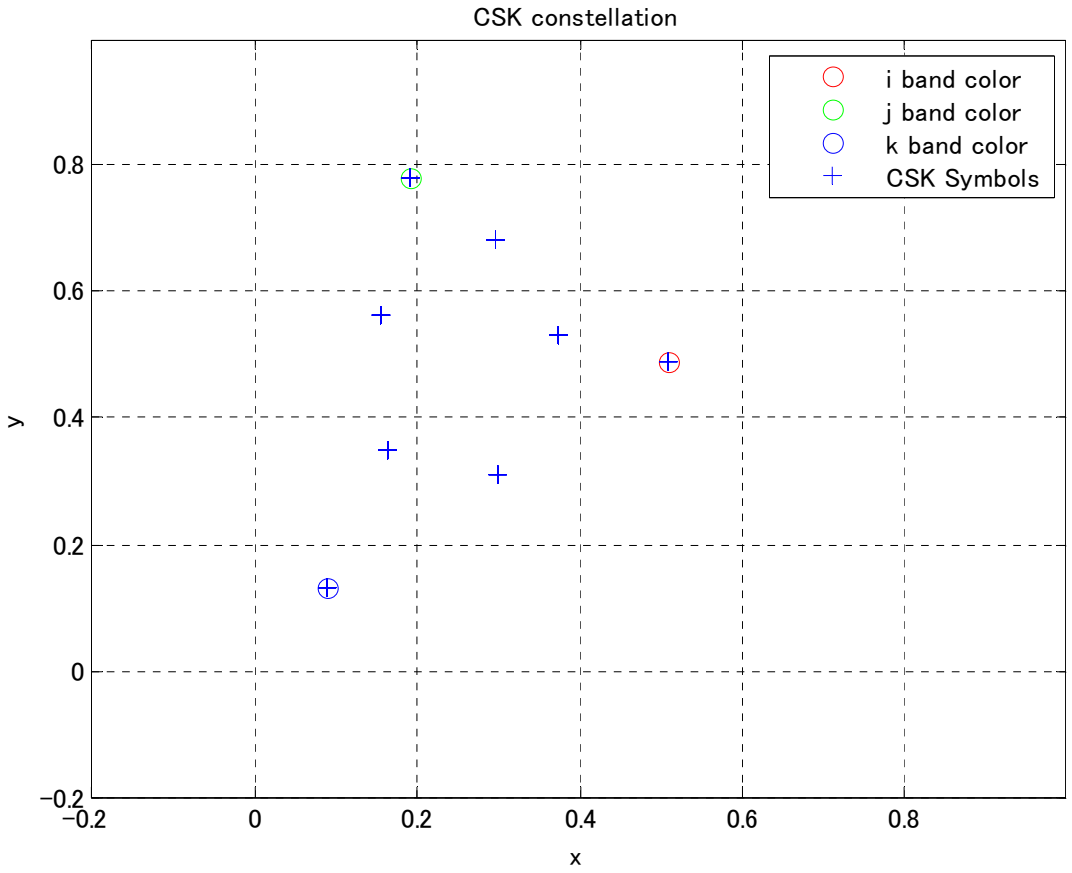
[0 0] --> (0.190 0.780)

[0 1] --> (0.263 0.467)

[1 0] --> (0.090 0.130)

[1 1] --> (0.510 0.490)

8CSK xy coordinates values (011-010-001)



*** CSK constellation ***

xy coordinates of color band i, j, k

(xi yi) = (0.510 0.490)

(xj yj) = (0.190 0.780)

(xk yk) = (0.090 0.130)

Symbol data allocation on xy coordinates

[Data] --> (xp yp)

[0 0 0] --> (0.190 0.780)

[0 0 1] --> (0.157 0.563)

[0 1 0] --> (0.297 0.683)

[0 1 1] --> (0.374 0.531)

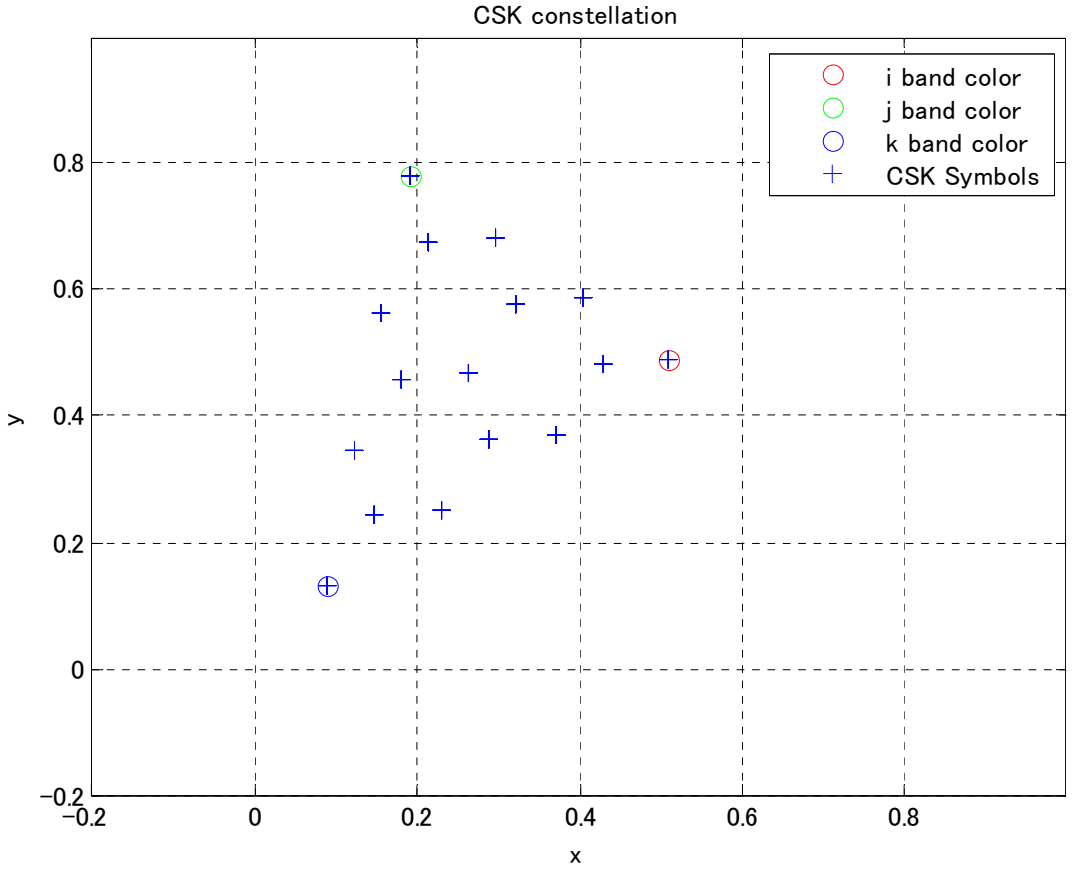
[1 0 0] --> (0.090 0.130)

[1 0 1] --> (0.164 0.351)

[1 1 0] --> (0.300 0.310)

[1 1 1] --> (0.510 0.490)

16CSK xy coordinates values (011-010-001)



*** CSK constellation ***

xy coordinates of color band i, j, k

(xi yi) = (0.510 0.490)

(xj yj) = (0.190 0.780)

(xk yk) = (0.090 0.130)

Symbol data allocation on xy coordinates

[Data] --> (xp yp)

[0 0 0 0] --> (0.190 0.780)

[0 0 0 1] --> (0.214 0.676)

[0 0 1 0] --> (0.157 0.563)

[0 0 1 1] --> (0.297 0.683)

[0 1 0 0] --> (0.181 0.459)

[0 1 0 1] --> (0.263 0.467)

[0 1 1 0] --> (0.321 0.579)

[0 1 1 1] --> (0.288 0.362)

[1 0 0 0] --> (0.123 0.347)

[1 0 0 1] --> (0.148 0.242)

[1 0 1 0] --> (0.090 0.130)

[1 0 1 1] --> (0.230 0.250)

[1 1 0 0] --> (0.403 0.587)

[1 1 0 1] --> (0.428 0.482)

[1 1 1 0] --> (0.370 0.370)

[1 1 1 1] --> (0.510 0.490)