



- (51) **International Patent Classification:**
H04N 19/00 (2014.01)
- (21) **International Application Number:**
PCT/US2013/048707
- (22) **International Filing Date:**
28 June 2013 (28.06.2013)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
61/666,617 29 June 2012 (29.06.2012) US
13/841,253 15 March 2013 (15.03.2013) US
- (71) **Applicant:** QUALCOMM INCORPORATED [US/US];
ATTN: International IP Administration, 5775 Morehouse
Drive, San Diego, California 92121-1714 (US).
- (72) **Inventors:** COBAN, Muhammed Zeyd; 5775 Morehouse
Drive, San Diego, California 92121-1714 (US). WANG,
Ye-Kui; 5775 Morehouse Drive, San Diego, California
92121-1714 (US).
- (74) **Agent:** FITZGERALD, Kelly Patrick; Shumaker & Sief-
fert, P.A., 1625 Radio Drive, Suite 300, Woodbury, Min-
nesota 55125 (US).
- (81) **Designated States** (*unless otherwise indicated, for every
kind of national protection available*): AE, AG, AL, AM,

AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME,
MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ,
OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC,
SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN,
TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

- (84) **Designated States** (*unless otherwise indicated, for every
kind of regional protection available*): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ,
UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ,
TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,
EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV,
MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,
KM, ML, MR, NE, SN, TD, TG).

Published:

- *with international search report (Art. 21(3))*
- *before the expiration of the time limit for amending the
claims and to be republished in the event of receipt of
amendments (Rule 48.2(h))*

- (88) **Date of publication of the international search report:**
3 July 2014



WO 2014/005087 A3

(54) **Title:** TILES AND WAVEFRONT PARALLEL PROCESSING

(57) **Abstract:** This disclosure describes techniques that may enable a video coder to simultaneously implement multiple parallel processing mechanisms, including two or more of wavefront parallel processing (WPP), tiles, and entropy slices. This disclosure describes signaling techniques that are compatible both with coding standards that only allow one parallel processing mechanism to be implemented at a time, but that are also compatible with potential future coding standards that may allow for more than one parallel processing mechanism to be implemented simultaneously. This disclosure also describes restrictions that may enable WPP and tiles to be implemented simultaneously.

INTERNATIONAL SEARCH REPORT

International application No PCT/US2013/048707
--

A. CLASSIFICATION OF SUBJECT MATTER INV. H04N19/00 ADD.		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) H04N		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	COBAN M ET AL: "AHG4: On tiles and wavefronts", 10. JCT-VC MEETING; 101. MPEG MEETING; 11-7-2012 - 20-7-2012; STOCKHOLM; (JOINT COLLABORATIVE TEAM ON VIDEO CODING OF ISO/IEC JTC1/SC29/WG11 AND ITU-T SG.16); URL: HTTP://WFTP3.ITU.INT/AV-ARCH/JCTVC-SITE/, , no. JCTVC-J0123, 3 July 2012 (2012-07-03), XP030112485, the whole document <div style="text-align: center;">----- -/--</div>	1-52
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
* Special categories of cited documents :		
"A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family	
Date of the actual completion of the international search	Date of mailing of the international search report	
13 May 2014	21/05/2014	
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Raeymaekers, Peter	

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2013/048707

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	SULLIVAN G J ET AL: "Meeting Report of the 8th JCT-VC Meeting", 8. JCT-VC MEETING; 99. MPEG MEETING; 1-2-2012 - 10-2-2012; SAN JOSE; (JOINT COLLABORATIVE TEAM ON VIDEO CODING OF ISO/IEC JTC1/SC29/WG11 AND ITU-T SG.16); URL: HTTP://WFTP3.ITU.INT/AV-ARCH/JCTVC-SITE/, , no. JCTVC-H1000, 23 April 2012 (2012-04-23), XP030111766, page 124	1,2,5,9, 10,13, 17,18, 22,23, 26,30, 31,34, 38,39, 42,46, 50-52
Y		3,4,6-8, 11,12, 14,20, 21,23, 28,29, 31,36, 37,39, 44,45,47
Y	----- LEE T ET AL: "Simplification on tiles and slices", 8. JCT-VC MEETING; 99. MPEG MEETING; 1-2-2012 - 10-2-2012; SAN JOSE; (JOINT COLLABORATIVE TEAM ON VIDEO CODING OF ISO/IEC JTC1/SC29/WG11 AND ITU-T SG.16); URL: HTTP://WFTP3.ITU.INT/AV-ARCH/JCTVC-SITE/, , no. JCTVC-H0348, 20 January 2012 (2012-01-20), XP030111375, the whole document	3,4,6, 11,12, 14,20, 21,23, 28,29, 31,36, 37,39, 44,45,47
Y	----- SASAI H ET AL: "Constrained Tile for parallel decoding", 8. JCT-VC MEETING; 99. MPEG MEETING; 1-2-2012 - 10-2-2012; SAN JOSE; (JOINT COLLABORATIVE TEAM ON VIDEO CODING OF ISO/IEC JTC1/SC29/WG11 AND ITU-T SG.16); URL: HTTP://WFTP3.ITU.INT/AV-ARCH/JCTVC-SITE/, , no. JCTVC-H0345, 20 January 2012 (2012-01-20), XP030111372, the whole document	3,4,6, 11,12, 14,20, 21,23, 28,29, 31,36, 37,39, 44,45,47
	----- -/--	

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2013/048707

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	<p>Benjamin Bross ET AL: "WD5: Working Draft 5 of High-Efficiency Video Coding", 8. JCT-VC meeting; 99. MPEG meeting; 1-2-2012 - 10-2-2012; San Jose; (Joint Collaborative Team on Video Coding of ISO/IEC JTC1/SC29/WG11 and ITU-T SG.16) 9 February 2012 (2012-02-09), pages 1-228, XP55117607, Retrieved from the Internet: URL:http://wftp3.itu.int/av-arch/jctvc-site/ [retrieved on 2012-02-23] page 33 -----</p>	7,8
Y	<p>JEONG S ET AL: "Syntax on entropy slice information", 9. JCT-VC MEETING; 100. MPEG MEETING; 27-4-2012 - 7-5-2012; GENEVA; (JOINT COLLABORATIVE TEAM ON VIDEO CODING OF ISO/IEC JTC1/SC29/WG11 AND ITU-T SG.16); URL: HTTP://WFTP3.ITU.INT/AV-ARCH/JCTVC-SITE/,, no. JCTVC-I0138, 16 April 2012 (2012-04-16), XP030111901, the whole document -----</p>	7,8
Y	<p>WAN W ET AL: "AHG4: Specifying entry points to facilitate different decoder implementations", 9. JCT-VC MEETING; 100. MPEG MEETING; 27-4-2012 - 7-5-2012; GENEVA; (JOINT COLLABORATIVE TEAM ON VIDEO CODING OF ISO/IEC JTC1/SC29/WG11 AND ITU-T SG.16); URL: HTTP://WFTP3.ITU.INT/AV-ARCH/JCTVC-SITE/,, no. JCTVC-I0237, 17 April 2012 (2012-04-17), XP030112000, the whole document -----</p>	7,8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/048707

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-6, 9-14, 17-23, 26-31, 34-39, 42-47, 50-52

CABAC encoding syntax for simultaneous wavefront and tile processing;

2. claims: 7, 8, 15, 16, 24, 25, 32, 33, 40, 41, 48, 49

CABAC encoding syntax for signalling wavefront processing entry points.
