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[Continued on next page]

- (54) **Title:** METHODS FOR SIGNALING OF SUB-PU SYNTAX ELEMENT IN MULTI-VIEW AND 3D VIDEO CODING

|                                                 | Descriptor |
|-------------------------------------------------|------------|
| vps_extension2() {                              |            |
| while( !byte_aligned() )                        |            |
| vps_extension_byte_alignment_reserved_one_bit   | u(1)       |
| for( i = 0; i <= vps_max_layers_minus1; i++ ) { |            |
| layerid = layer_id_in_nuh[ i ]                  |            |
| if ( layerid != 0 ) {                           |            |
| iv_mv_pred_flag[ layerid ]                      | u(1)       |
| if ( !VpsDepthFlag[ layerid ] ) {               |            |
| iv_res_pred_flag[ layerid ]                     | u(1)       |
| depth_refinement_flag[ layerid ]                | u(1)       |
| view_synthesis_pred_flag[ layerid ]             | u(1)       |
| depth_based_blk_part_flag[ layerid ]            | u(1)       |
| } else {                                        |            |
| mpi_flag[ layerid ]                             | u(1)       |
| vps_depth_modes_flag[ layerid ]                 | u(1)       |
| lim_qt_pred_flag[ layerid ]                     | u(1)       |
| vps_inter_sdc_flag[ layerid ]                   | u(1)       |
| }                                               |            |
| }                                               |            |
| }                                               |            |
| cp_precision                                    | uc(v)      |
| for( i = 0; i < NumViews; i++ ) {               |            |
| cp_present_flag[ i ]                            | u(1)       |
| if( cp_present_flag[ i ] ) {                    |            |
| cp_in_slice_segment_header_flag[ i ]            | u(1)       |
| if( !cp_in_slice_segment_header_flag[ i ] )     |            |
| for( j = 0; j < i; j++ ) {                      |            |
| vps_cp_scale[ i ][ j ]                          | sc(v)      |
| vps_cp_off[ i ][ j ]                            | sc(v)      |
| vps_cp_inv_scale_plus_scale[ i ][ j ]           | sc(v)      |
| vps_cp_inv_off_plus_off[ i ][ j ]               | sc(v)      |
| }                                               |            |
| }                                               |            |
| }                                               |            |
| iv_mv_scaling_flag                              | u(1)       |
| log2_sub_pb_size_minus3                         | uc(v)      |
| }                                               |            |

Fig. 2

- (57) **Abstract:** Methods for signaling of sub-PU syntax in multi-view and 3D video coding are disclosed. The same syntax element for sub-PU size is used for techniques using sub-PU level processing.



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## METHODS FOR SIGNALING OF SUB-PU SYNTAX ELEMENT IN MULTI-VIEW AND 3D VIDEO CODING

### FIELD OF INVENTION

5        The invention relates generally to Three-Dimensional (3D) video processing. In particular, the present invention relates to the signaling of sub-PU syntax element in multi-view and 3D video coding.

### BACKGROUND OF THE INVENTION

10        3D video coding is developed for encoding or decoding video data of multiple views simultaneously captured by several cameras. Since all cameras capture the same scene from different viewpoints, multi-view video data contains a large amount of inter-view redundancy. To exploit the inter-view and inter-component redundancy, additional tools such as inter-view motion prediction (IVMP) and motion parameter inheritance (MPI) have been integrated to 3D-  
15        HEVC (High Efficiency Video Coding) or 3D-AVC (Advanced Video Coding) codec. To further improve the coding efficiency, sub-PU level IVMP and sub-PU level MPI are used.

      In current 3D-HEVC, a syntax element **iv\_mv\_pred\_flag** is sent for each layer with layer ID larger than zero to indicate whether IVMP is used. For each layer with layer ID larger than zero, the other syntax element **log2\_sub\_pb\_size\_minus3** is sent to indicate the sub-PU size.  
20        For depth coding, a syntax element **mpi\_flag** is sent for each layer with layer ID larger than zero to indicate whether MPI is used. However, the sub-PU size for MPI is shared by all layers and is indicated by another syntax element **log2\_mpi\_sub\_pb\_size\_minus3** at video parameter set (VPS). Fig. 1 shows the current syntax design in 3D-HEVC.

### SUMMARY OF THE INVENTION

25        In light of the previously described problems, methods for signaling of sub-PU syntax element are proposed.

      Other aspects and features of the invention will become apparent to those with ordinary skill in the art upon review of the following descriptions of specific embodiments.

30

### BRIEF DESCRIPTION OF THE DRAWINGS

      The invention can be more fully understood by reading the subsequent detailed description and examples with references made to the accompanying drawings, wherein:

Fig. 1 is a table showing the current syntax design in 3D-HEVC;

Fig. 2 is a table showing an example of the proposed syntax design method 1;

Fig. 3 is a table showing an example of the proposed syntax design method 2;

Fig. 4 is a table showing an example of the proposed syntax design method 3;

5 Fig. 5 is a table showing an example of the proposed syntax design method 4.

## DETAILED DESCRIPTION

The following description is of the best-contemplated mode of carrying out the invention. This description is made for the purpose of illustrating the general principles of the invention  
10 and should not be taken in a limiting sense. The scope of the invention is best determined by reference to the appended claims.

The proposed methods are the signaling of the sub-PU size syntax element, wherein the same syntax element is used for sub-PU level inter-view motion prediction (IVMP) and sub-PU level and motion parameter inheritance (MPI).

15 In method 1, as shown in Fig.2, the sub-PU size is shared by each layer and is indicated by **log2\_sub\_pb\_size\_minus3** at VPS. In texture coding, **log2\_sub\_pb\_size\_minus3** indicate the sub-PU size of IVMP; in depth coding, it indicates the sub-PU size of MPI.

In method 2, as shown in Fig.3, the sub-PU size is signaled at each layer with layer ID larger than 0 and is indicated by **log2\_sub\_pb\_size\_minus3**. For each layer with layer ID  
20 larger than 0, **log2\_sub\_pb\_size\_minus3[layerId]** indicate the sub-PU size of IVMP in texture coding; in depth coding, it indicates the sub-PU size of MPI.

Signaling of **log2\_sub\_pb\_size\_minus3** can also be conditioned by the usage of IVMP and MPI. If IVMP or MPI is used (e.g., **iv\_mv\_pred\_flag** equal to 1 or **mpi\_flag** equal to 1), then **log2\_sub\_pb\_size\_minus3** is signaled; otherwise, **log2\_sub\_pb\_size\_minus3** is not  
25 signaled.

The syntax element **iv\_mv\_pred\_flag** and **mpi\_flag** can also be shared by all layers, and only signaled once in VPS.

For the other possible sub-PU level techniques, similar unification method for the sub-PU syntax element can be used.

30 In method 3, as shown in Fig. 4, the syntax element **log2\_sub\_pb\_size\_minus3** is only sent in each texture coding layer with layer ID larger than zero to indicate the sub-PU size of IVMP.

In method 4, as shown in Fig. 5, the syntax element **log2\_mpi\_sub\_pb\_size\_minus3** is also sent in each depth coding layer with layer ID larger than zero to indicate the sub-PU size of

MPI.

All the syntax element can also be signaled in the other high level syntax, for examples sequence parameter set (SPS), adaptive parameter set (APS), and slice header. The above methods can be applied to other techniques that use sub-PU level processing.

5       The sub-PU syntax signaling methods described above can be used in a video encoder as well as in a video decoder. Embodiments of sub-PU syntax signaling method according to the present invention as described above may be implemented in various hardware, software codes, or a combination of both. For example, an embodiment of the present invention can be a circuit integrated into a video compression chip or program codes integrated into video compression  
10       software to perform the processing described herein. An embodiment of the present invention may also be program codes to be executed on a Digital Signal Processor (DSP) to perform the processing described herein. The invention may also involve a number of functions to be performed by a computer processor, a digital signal processor, a microprocessor, or field programmable gate array (FPGA). These processors can be configured to perform particular  
15       tasks according to the invention, by executing machine-readable software code or firmware code that defines the particular methods embodied by the invention. The software code or firmware codes may be developed in different programming languages and different format or style. The software code may also be compiled for different target platform. However, different code formats, styles and languages of software codes and other means of configuring  
20       code to perform the tasks in accordance with the invention will not depart from the spirit and scope of the invention.

The invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described examples are to be considered in all respects only as illustrative and not restrictive. To the contrary, it is intended to cover various modifications and  
25       similar arrangements (as would be apparent to those skilled in the art). Therefore, the scope of the appended claims should be accorded the broadest interpretation so as to encompass all such modifications and similar arrangements.

## CLAIMS

1. A method for signaling of sub-PU (sub-prediction unit) syntax element in multi-view or 3D video coding, comprising signaling a sub-PU syntax element in a video bitstream.

5        2. The method as claimed in claim 1, wherein the same sub-PU syntax element is used for sub-PU level inter-view motion prediction (IVMP) and motion parameter inheritance (MPI).

3. The method as claimed in claim 2, the syntax element **log2\_sub\_pb\_size\_minus3** indicates a sub-PU size of IVMP in texture coding and also indicates a sub-PU size of MPI in depth coding.

10       4. The method as claimed in claim 3, the syntax element is shared by all layers with layer ID larger than 0 and signaled in video parameter set (VPS).

5. The method as claimed in claim 3, the syntax element is signaled for each layer with layer ID larger than 0.

15       6. The method as claimed in claim 3, the syntax element is sent in other high level syntax, sequence parameter set (SPS), adaptive parameter set (APS), or slice header.

7. The method as claimed in claim 2, the syntax element **log2\_sub\_pb\_size\_minus3** is signaled only if MPI or IVMP is used.

20       8. The method as claimed in claim 1, the syntax element **log2\_sub\_pb\_size\_minus3** is only sent in each texture coding layer with layer ID larger than zero to indicate a sub-PU size of IVMP.

9. The method as claimed in claim 1, the syntax element **log2\_mpi\_sub\_pb\_size\_minus3** is only sent in each depth coding layer with layer ID larger than zero to indicate a sub-PU size of MPI.

25

|                                                      | Descriptor |
|------------------------------------------------------|------------|
| vps_extension2() {                                   |            |
| while( !byte_aligned() )                             |            |
| <b>vps_extension_byte_alignment_reserved_one_bit</b> | u(1)       |
| for( i = 0; i <= vps_max_layers_minus1; i++ ) {      |            |
| layerId = layer_id_in_nuh[ i ]                       |            |
| if ( layerId != 0 ) {                                |            |
| <b>iv_mv_pred_flag</b> [ layerId ]                   | u(1)       |
| <b>log2_sub_pb_size_minus3</b> [ layerId ]           | ue(v)      |
| if ( !VpsDepthFlag[ layerId ] ) {                    |            |
| <b>iv_res_pred_flag</b> [ layerId ]                  | u(1)       |
| <b>depth_refinement_flag</b> [ layerId ]             | u(1)       |
| <b>view_synthesis_pred_flag</b> [ layerId ]          | u(1)       |
| <b>depth_based_blk_part_flag</b> [ layerId ]         | u(1)       |
| } else {                                             |            |
| <b>mpi_flag</b> [ layerId ]                          | u(1)       |
| <b>vps_depth_modes_flag</b> [ layerId ]              | u(1)       |
| <b>lim_qt_pred_flag</b> [ layerId ]                  | u(1)       |
| <b>vps_inter_sdc_flag</b> [ layerId ]                | u(1)       |
| }                                                    |            |
| }                                                    |            |
| }                                                    |            |
| <b>cp_precision</b>                                  | ue(v)      |
| for( i = 0; i < NumViews; i++ ) {                    |            |
| <b>cp_present_flag</b> [ i ]                         | u(1)       |
| if( cp_present_flag[ i ] ) {                         |            |
| <b>cp_in_slice_segment_header_flag</b> [ i ]         | u(1)       |
| if( !cp_in_slice_segment_header_flag[ i ] )          |            |
| for( j = 0; j < i; j++ ) {                           |            |
| <b>vps_cp_scale</b> [ i ][ j ]                       | se(v)      |
| <b>vps_cp_off</b> [ i ][ j ]                         | se(v)      |
| <b>vps_cp_inv_scale_plus_scale</b> [ i ][ j ]        | se(v)      |
| <b>vps_cp_inv_off_plus_off</b> [ i ][ j ]            | se(v)      |
| }                                                    |            |
| }                                                    |            |
| }                                                    |            |
| }                                                    |            |
| <b>iv_mv_scaling_flag</b>                            | u(1)       |
| <b>log2_mpi_sub_pb_size_minus3</b>                   | ue(v)      |
| }                                                    |            |

Fig. 1

|                                                      | Descriptor |
|------------------------------------------------------|------------|
| vps_extension2() {                                   |            |
| while( !byte_aligned() )                             |            |
| <b>vps_extension_byte_alignment_reserved_one_bit</b> | u(1)       |
| for( i = 0; i <= vps_max_layers_minus1; i++ ) {      |            |
| layerId = layer_id_in_nuh[ i ]                       |            |
| if ( layerId != 0 ) {                                |            |
| <b>iv_mv_pred_flag[ layerId ]</b>                    | u(1)       |
| if ( !VpsDepthFlag[ layerId ] ) {                    |            |
| <b>iv_res_pred_flag[ layerId ]</b>                   | u(1)       |
| <b>depth_refinement_flag[ layerId ]</b>              | u(1)       |
| <b>view_synthesis_pred_flag[ layerId ]</b>           | u(1)       |
| <b>depth_based_blk_part_flag[ layerId ]</b>          | u(1)       |
| } else {                                             |            |
| <b>mpi_flag[ layerId ]</b>                           | u(1)       |
| <b>vps_depth_modes_flag[ layerId ]</b>               | u(1)       |
| <b>lim_qt_pred_flag[ layerId ]</b>                   | u(1)       |
| <b>vps_inter_sdc_flag[ layerId ]</b>                 | u(1)       |
| }                                                    |            |
| }                                                    |            |
| }                                                    |            |
| <b>cp_precision</b>                                  | ue(v)      |
| for( i = 0; i < NumViews; i++ ) {                    |            |
| <b>cp_present_flag[ i ]</b>                          | u(1)       |
| if( cp_present_flag[ i ] ) {                         |            |
| <b>cp_in_slice_segment_header_flag[ i ]</b>          | u(1)       |
| if( !cp_in_slice_segment_header_flag[ i ] )          |            |
| for( j = 0; j < i; j++ ) {                           |            |
| <b>vps_cp_scale[ i ][ j ]</b>                        | se(v)      |
| <b>vps_cp_off[ i ][ j ]</b>                          | se(v)      |
| <b>vps_cp_inv_scale_plus_scale[ i ][ j ]</b>         | se(v)      |
| <b>vps_cp_inv_off_plus_off[ i ][ j ]</b>             | se(v)      |
| }                                                    |            |
| }                                                    |            |
| }                                                    |            |
| }                                                    |            |
| <b>iv_mv_scaling_flag</b>                            | u(1)       |
| <b>log2_sub_pb_size_minus3</b>                       | ue(v)      |
| }                                                    |            |

Fig. 2

|                                                      | Descriptor |
|------------------------------------------------------|------------|
| <b>vps_extension2()</b> {                            |            |
| while( !byte_aligned() )                             |            |
| <b>vps_extension_byte_alignment_reserved_one_bit</b> | u(1)       |
| for( i = 0; i <= vps_max_layers_minus1; i++ ) {      |            |
| layerId = layer_id_in_nuh[ i ]                       |            |
| if ( layerId != 0 ) {                                |            |
| <b>iv_mv_pred_flag</b> [ layerId ]                   | u(1)       |
| <b>log2_sub_pb_size_minus3</b> [ layerId ]           | ue(v)      |
| if ( !VpsDepthFlag[ layerId ] ) {                    |            |
| <b>iv_res_pred_flag</b> [ layerId ]                  | u(1)       |
| <b>depth_refinement_flag</b> [ layerId ]             | u(1)       |
| <b>view_synthesis_pred_flag</b> [ layerId ]          | u(1)       |
| <b>depth_based_blk_part_flag</b> [ layerId ]         | u(1)       |
| } else {                                             |            |
| <b>mpi_flag</b> [ layerId ]                          | u(1)       |
| <b>vps_depth_modes_flag</b> [ layerId ]              | u(1)       |
| <b>lim_qt_pred_flag</b> [ layerId ]                  | u(1)       |
| <b>vps_inter_sdc_flag</b> [ layerId ]                | u(1)       |
| }                                                    |            |
| }                                                    |            |
| }                                                    |            |
| <b>cp_precision</b>                                  | ue(v)      |
| for( i = 0; i < NumViews; i++ ) {                    |            |
| <b>cp_present_flag</b> [ i ]                         | u(1)       |
| if( cp_present_flag[ i ] ) {                         |            |
| <b>cp_in_slice_segment_header_flag</b> [ i ]         | u(1)       |
| if( !cp_in_slice_segment_header_flag[ i ] )          |            |
| for( j = 0; j < i; j++ ) {                           |            |
| <b>vps_cp_scale</b> [ i ][ j ]                       | se(v)      |
| <b>vps_cp_off</b> [ i ][ j ]                         | se(v)      |
| <b>vps_cp_inv_scale_plus_scale</b> [ i ][ j ]        | se(v)      |
| <b>vps_cp_inv_off_plus_off</b> [ i ][ j ]            | se(v)      |
| }                                                    |            |
| }                                                    |            |
| }                                                    |            |
| }                                                    |            |
| <b>iv_mv_scaling_flag</b>                            | u(1)       |
| }                                                    |            |

Fig. 3

|                                                      | Descriptor |
|------------------------------------------------------|------------|
| <b>vps_extension2()</b> {                            |            |
| while( !byte_aligned() )                             |            |
| <b>vps_extension_byte_alignment_reserved_one_bit</b> | u(1)       |
| for( i = 0; i <= vps_max_layers_minus1; i++ ) {      |            |
| layerId = layer_id_in_nuh[ i ]                       |            |
| if ( layerId != 0 ) {                                |            |
| <b>iv_mv_pred_flag</b> [ layerId ]                   | u(1)       |
| if ( !VpsDepthFlag[ layerId ] ) {                    |            |
| <b>log2_sub_pb_size_minus3</b> [ layerId ]           | ue(v)      |
| <b>iv_res_pred_flag</b> [ layerId ]                  | u(1)       |
| <b>depth_refinement_flag</b> [ layerId ]             | u(1)       |
| <b>view_synthesis_pred_flag</b> [ layerId ]          | u(1)       |
| <b>depth_based_blk_part_flag</b> [ layerId ]         | u(1)       |
| } else {                                             |            |
| <b>mpi_flag</b> [ layerId ]                          | u(1)       |
| <b>vps_depth_modes_flag</b> [ layerId ]              | u(1)       |
| <b>lim_qt_pred_flag</b> [ layerId ]                  | u(1)       |
| <b>vps_inter_sdc_flag</b> [ layerId ]                | u(1)       |
| }                                                    |            |
| }                                                    |            |
| }                                                    |            |
| <b>cp_precision</b>                                  | ue(v)      |
| for( i = 0; i < NumViews; i++ ) {                    |            |
| <b>cp_present_flag</b> [ i ]                         | u(1)       |
| if( cp_present_flag[ i ] ) {                         |            |
| <b>cp_in_slice_segment_header_flag</b> [ i ]         | u(1)       |
| if( !cp_in_slice_segment_header_flag[ i ] )          |            |
| for( j = 0; j < i; j++ ) {                           |            |
| <b>vps_cp_scale</b> [ i ][ j ]                       | se(v)      |
| <b>vps_cp_off</b> [ i ][ j ]                         | se(v)      |
| <b>vps_cp_inv_scale_plus_scale</b> [ i ][ j ]        | se(v)      |
| <b>vps_cp_inv_off_plus_off</b> [ i ][ j ]            | se(v)      |
| }                                                    |            |
| }                                                    |            |
| }                                                    |            |
| }                                                    |            |
| <b>iv_mv_scaling_flag</b>                            | u(1)       |
| <b>log2_mpi_sub_pb_size_minus3</b>                   | ue(v)      |
| }                                                    |            |

Fig. 4

|                                                      | Descriptor |
|------------------------------------------------------|------------|
| vps_extension2() {                                   |            |
| while( !byte_aligned() )                             |            |
| <b>vps_extension_byte_alignment_reserved_one_bit</b> | u(1)       |
| for( i = 0; i <= vps_max_layers_minus1; i++ ) {      |            |
| layerId = layer_id_in_nuh[ i ]                       |            |
| if ( layerId != 0 ) {                                |            |
| <b>iv_mv_pred_flag[ layerId ]</b>                    | u(1)       |
| if ( !VpsDepthFlag[ layerId ] ) {                    |            |
| <b>log2_sub_pb_size_minus3[ layerId ]</b>            | ue(v)      |
| <b>iv_res_pred_flag[ layerId ]</b>                   | u(1)       |
| <b>depth_refinement_flag[ layerId ]</b>              | u(1)       |
| <b>view_synthesis_pred_flag[ layerId ]</b>           | u(1)       |
| <b>depth_based_blk_part_flag[ layerId ]</b>          | u(1)       |
| } else {                                             |            |
| <b>mpi_flag[ layerId ]</b>                           | u(1)       |
| <b>log2_mpi_sub_pb_size_minus3</b>                   | ue(v)      |
| <b>vps_depth_modes_flag[ layerId ]</b>               | u(1)       |
| <b>lim_qt_pred_flag[ layerId ]</b>                   | u(1)       |
| <b>vps_inter_sdc_flag[ layerId ]</b>                 | u(1)       |
| }                                                    |            |
| }                                                    |            |
| }                                                    |            |
| <b>cp_precision</b>                                  | ue(v)      |
| for( i = 0; i < NumViews; i++ ) {                    |            |
| <b>cp_present_flag[ i ]</b>                          | u(1)       |
| if( cp_present_flag[ i ] ) {                         |            |
| <b>cp_in_slice_segment_header_flag[ i ]</b>          | u(1)       |
| if( !cp_in_slice_segment_header_flag[ i ] )          |            |
| for( j = 0; j < i; j++ ) {                           |            |
| <b>vps_cp_scale[ i ][ j ]</b>                        | se(v)      |
| <b>vps_cp_off[ i ][ j ]</b>                          | se(v)      |
| <b>vps_cp_inv_scale_plus_scale[ i ][ j ]</b>         | se(v)      |
| <b>vps_cp_inv_off_plus_off[ i ][ j ]</b>             | se(v)      |
| }                                                    |            |
| }                                                    |            |
| }                                                    |            |
| }                                                    |            |
| <b>iv_mv_scaling_flag</b>                            | u(1)       |
| }                                                    |            |

Fig. 5

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2014/080516

**A. CLASSIFICATION OF SUBJECT MATTER**

H04N 19/70(2014.01)i; H04N 13/00(2006.01)n

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; G06T

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)

CNPAT, WPI, EPODOC, CNKI, IEEE: syntax element, sub PU, MPI, HEVC, IVMP, SPS, VPS, vps\_extension, vps\_extension2, signaling

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                                                                                                                                                                        | Relevant to claim No. |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| X         | TECH, Gerhard et al. "3D-HEVC Draft Text 2"<br><i>Joint Collaborative Team on 3D Video Coding Extension Development of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29/WG 11, 6th Meeting: Geneva, CH, 25 Oct.-1 Nov. 2013</i> ,<br>01 November 2013 (2013-11-01),<br>ISSN: JCT3V-F1001,<br>section, H.7.3.2.1.2 | 1-9                   |
| X         | TECH, Gerhard et al. "3D-HEVC Draft Text 4"<br><i>Joint Collaborative Team on 3D Video Coding Extensions of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29/WG 11, 8th Meeting: Valencia, ES, 29 March-4 April 2014</i> ,<br>04 April 2014 (2014-04-04),<br>ISSN: JCT3V-H1001,<br>section, I.7.3.2.1.2           | 1, 8-9                |
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Further documents are listed in the continuation of Box C.



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                                                                | "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                                              |
| "E" | earlier application or patent but published on or after the international filing date                                                                               | "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                                                                     |
| "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) | "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 |
| "O" | document referring to an oral disclosure, use, exhibition or other means                                                                                            | "&" | document member of the same patent family                                                                                                                                                                                                    |
| "P" | document published prior to the international filing date but later than the priority date claimed                                                                  |     |                                                                                                                                                                                                                                              |

Date of the actual completion of the international search

26 February 2015

Date of mailing of the international search report

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Name and mailing address of the ISA/CN

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**INTERNATIONAL SEARCH REPORT**  
**Information on patent family members**

International application No.

**PCT/CN2014/080516**

| Patent document<br>cited in search report |            |    | Publication date<br>(day/month/year) | Patent family member(s) |             |    | Publication date<br>(day/month/year) |
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