CCITT SGXV
Working Party XV/1
Experts Group for ATM Video Coding

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Title: The estimation of coding and decoding delay and number of required field memorys for the predictions in TM1
Source : Japan
Purpose: Information

1. Introduction

Pure field, field structure and frame structure predictions are defined in TM1 for core experiments. In this document, the coding and decoding delay ((1)-(5) and (15)-(19) in MPEG92/10 (AVC-179)) and the number of required field memorys for three predictions are evaluated.

2. Evaluation results

The delays and the amount of field memorys are evaluated under the following assumptions;

1) Encoder has a capability to encode the input signal as soon as it arrives.
2) Decoder has a capability to decode the bitstream as soon as it arrives.
3) Buffering delay and transmission delay ((6)-(14) in MPEG92/10) are not included in this evaluation.
4) Any slice can be displayed just after it is decoded. (The display part is synchronized to decoder part.)
5) Motion Estimation is performed between original image and local decoded image.

The result is listed in Table 1. The details are attached in Annex A.

Table 1 Evaluation Results

	Encoder Buffer ref. re-order total (fields)	Decoder buffer ref. re-order fr/fi conv total (fields)	total delay time (1)-(5) and(15)-(19) in MPEG92/10 or AVC179 (field time)
(pure field)			
M=3 B-ref=3	3 + 3 = 6	3 + 0+a = 3+a	5
M=3 B-ref=2	2+a+ 2 = 4+a	2+a + 0 = 2+a	3
M=1	2+a+ 0 = 2+a	2+a + 0 2+a	0
(fi structure)			
M=3	4 + 4 = 8	4 + 0 = 4	6
M=2	4 + 2 = 6	4 + 0 = 4	4
M=1	2+a+ 0 = 2+a	2+a + 0 2+a	0
(fr structure)			
M=3	4 + 6 = 10	4 + 2 = 6	8
M=2	4 + 4 = 8	4 + 2 = 6	6
M=1	2+a+ 2 = 4+a	2+a + 1* = 3+a	2

Note: The buffer size "a" is equal to MC range.
* Reference field memory is used as the part of fr/fi conversion buffer.

3. Conclusion

The coding and decoding delay ((1)-(5) and (15)-(19) in MPEG92/10 (AVC-179)) and the required field memorys for each prediction are evaluated.

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Annex A Detail of evaluation
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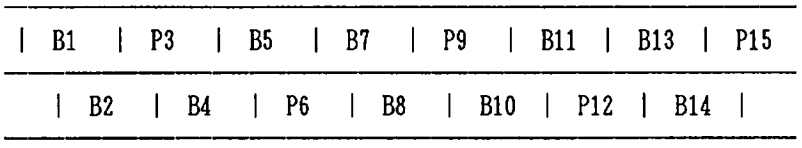
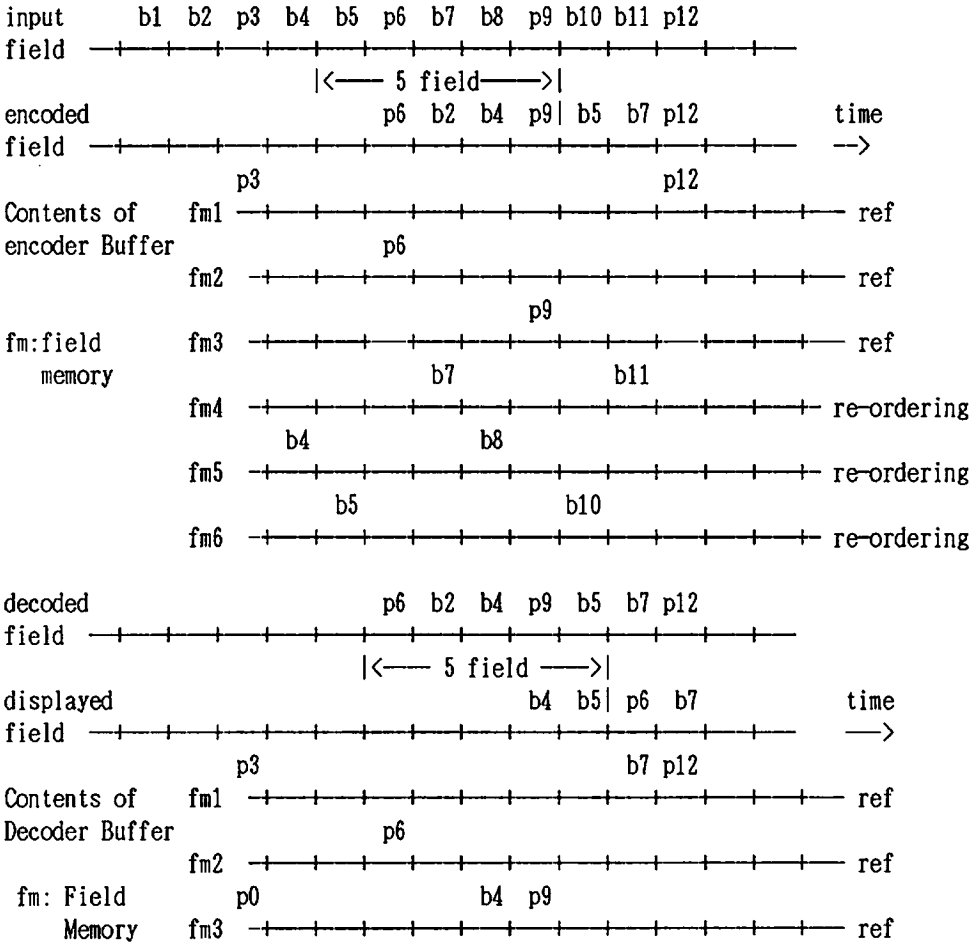
1) pure field (3 of B-picture reference) M=3

In case of 3 of B-picture references
a) M=3



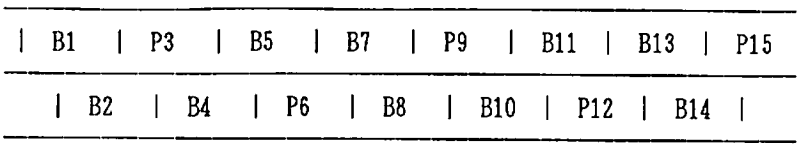
trns. order P6, B2, B4, P9, B5, B7, P12, B8, B10, P15, B11, B13, -



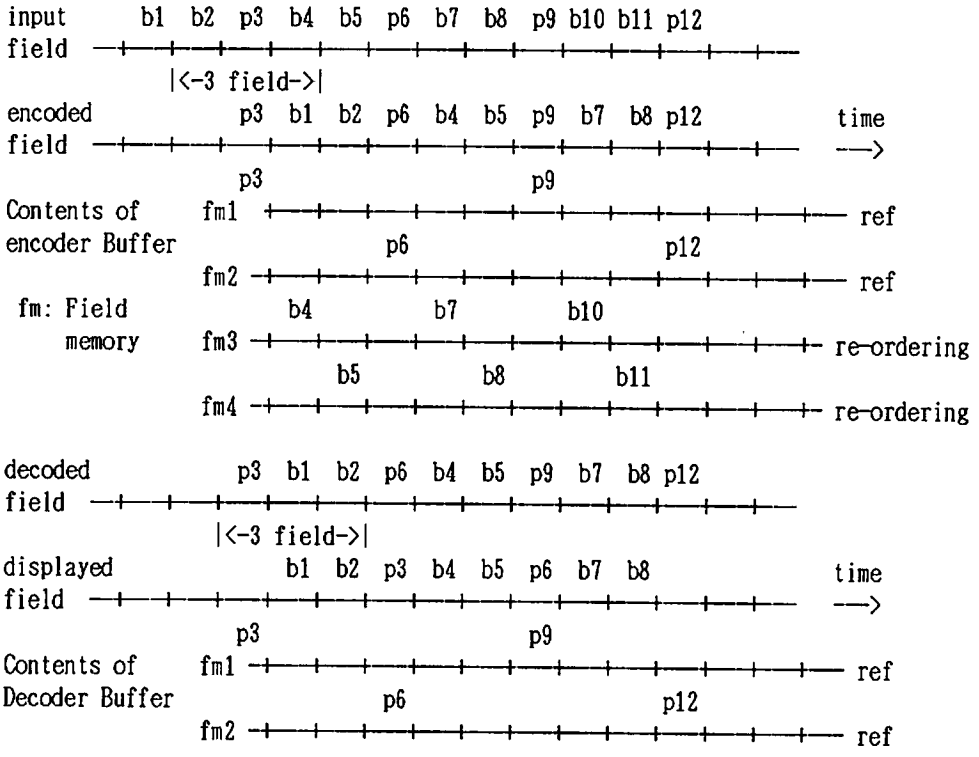
Encoder buffer : reference 3 fields + re-ordering buffer 3 fields
Decoder buffer : reference 3 fields + re-ordering buffer "a" field
* The buffer size "a" is equal to MC range.

Encoder delay : 5 field time
Decoder delay : 5 field time
Total delay time : 5 field time

2)pure field (2 of B-picture reference)



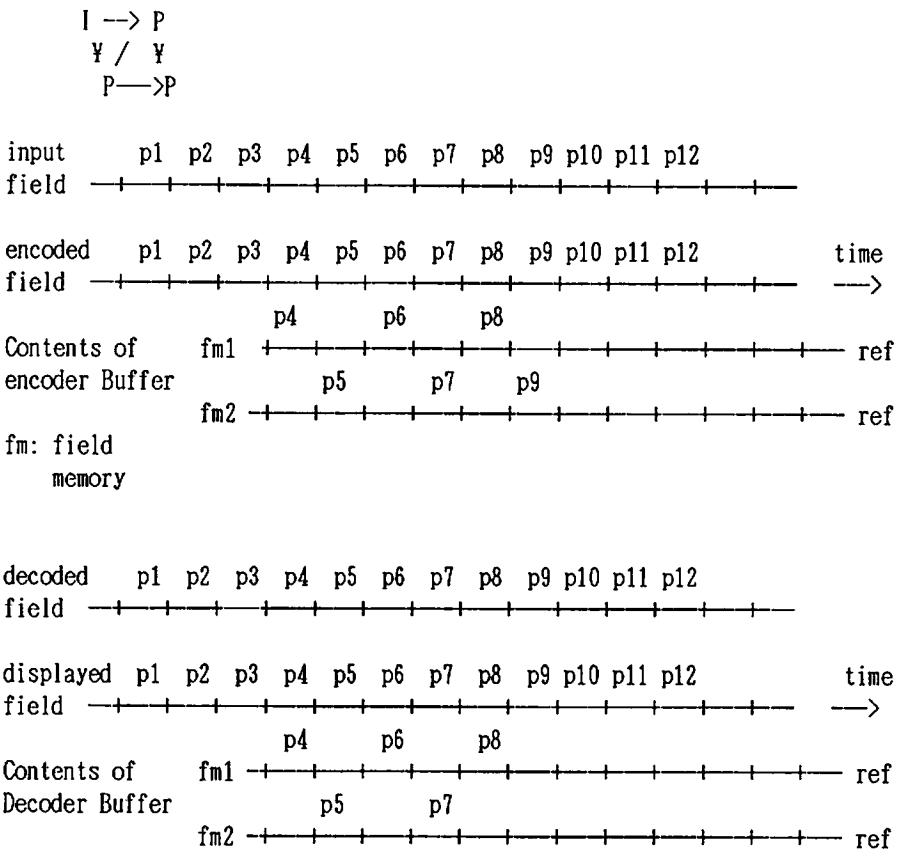
trns. order P3, B1, B2, P6, B4, B5, P9, B7, B8, P12, B10, B11, -



Encoder buffer : reference 2+a fields + re-ordering buffer 2 fields
Decoder buffer : reference 2+a fields
* The buffer size "a" is equal to MC range.

Encoder delay : 3 field time
Decoder delay : 3 field time
Total delay time : 3 field time

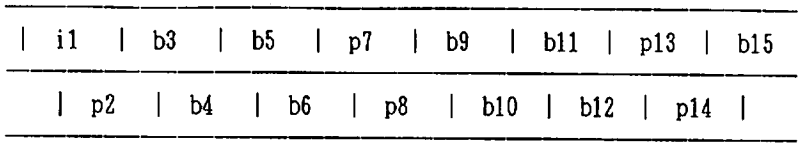
(3) pure field M=1



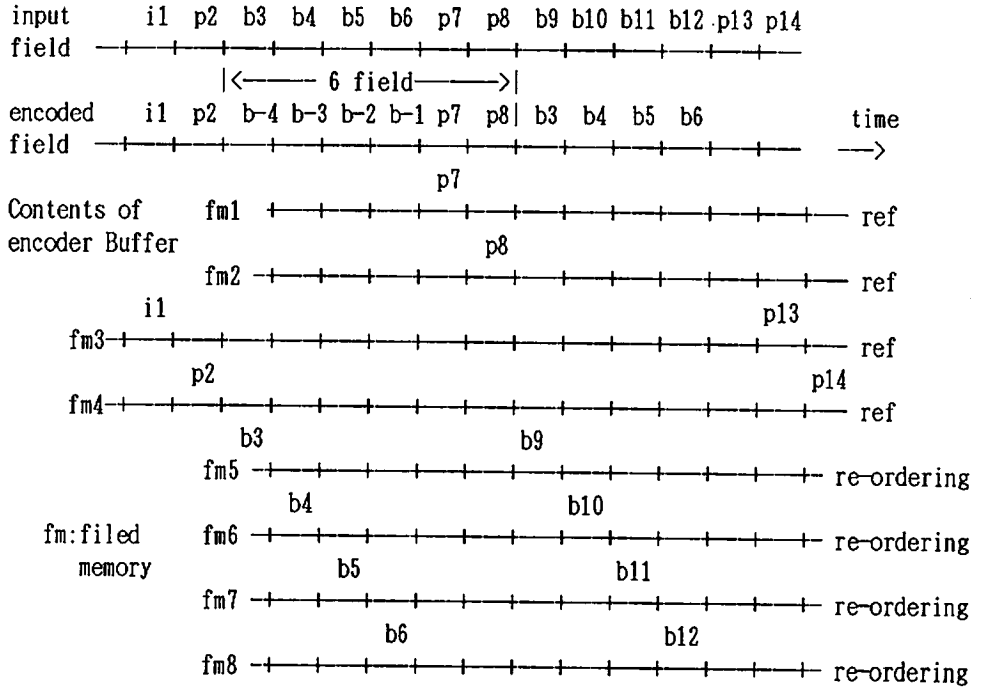
Encoder buffer : reference 2+a fields
Decoder buffer : reference 2+a fields
* The buffer size "a" is equal to MC range.

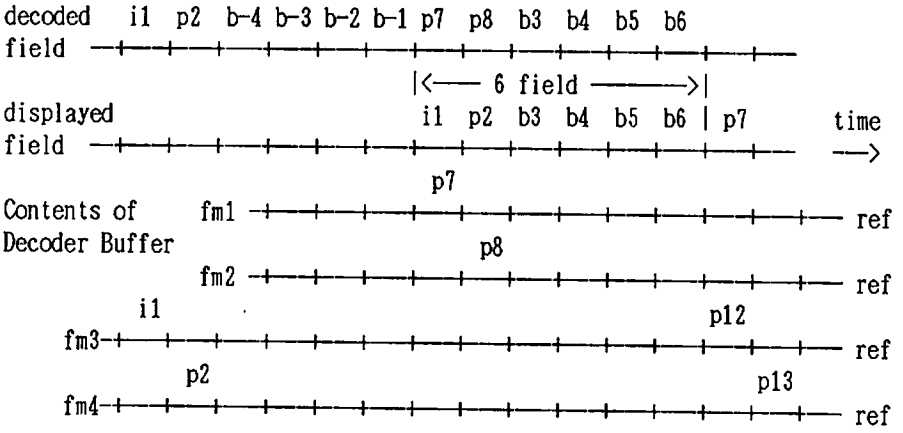
Encoder delay : 0 field time
Decoder delay : 0 field time
Total delay time : 0 field time

4) field structure M=3



trns. order i1, p2, p7, p8, b3, b4, b5. b6, p13, p14, b9, b10, b11, b12,..



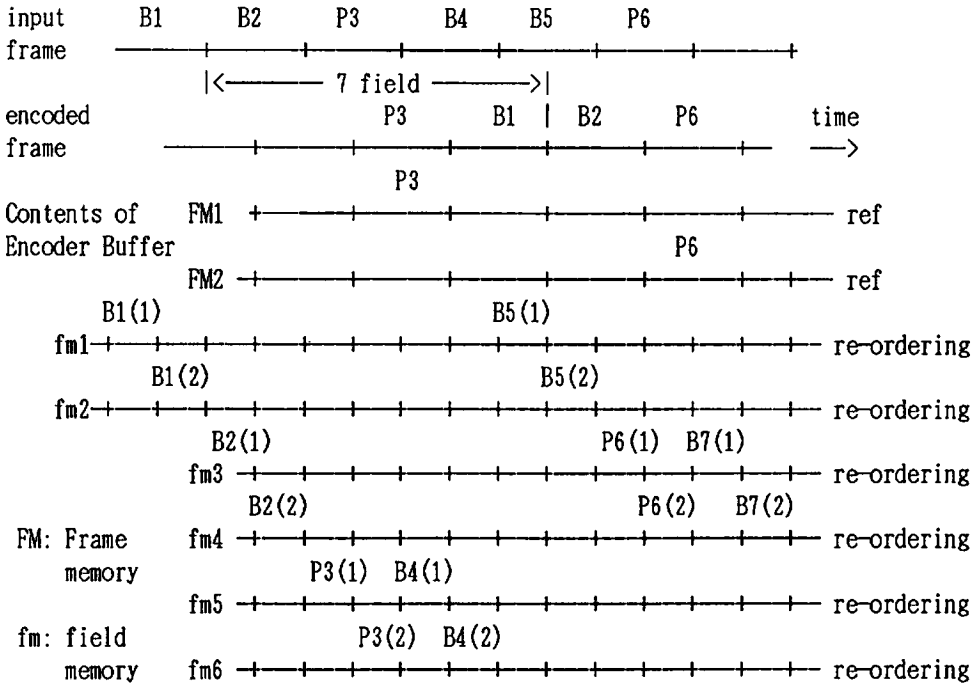


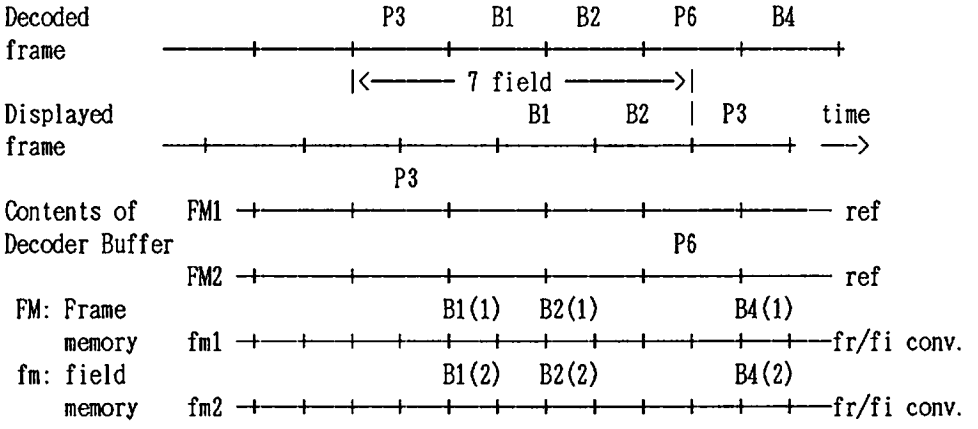
Encoder buffer : reference 4 fields + re-ordering buffer 4 fields
Decoder buffer : reference 4 fields

Encoder delay : 6 field time
Decoder delay : 6 field time
Total delay time : 6 field time

(5) field structure M=1
(Same as pure filed M=1)

(6) Frame structure M=3



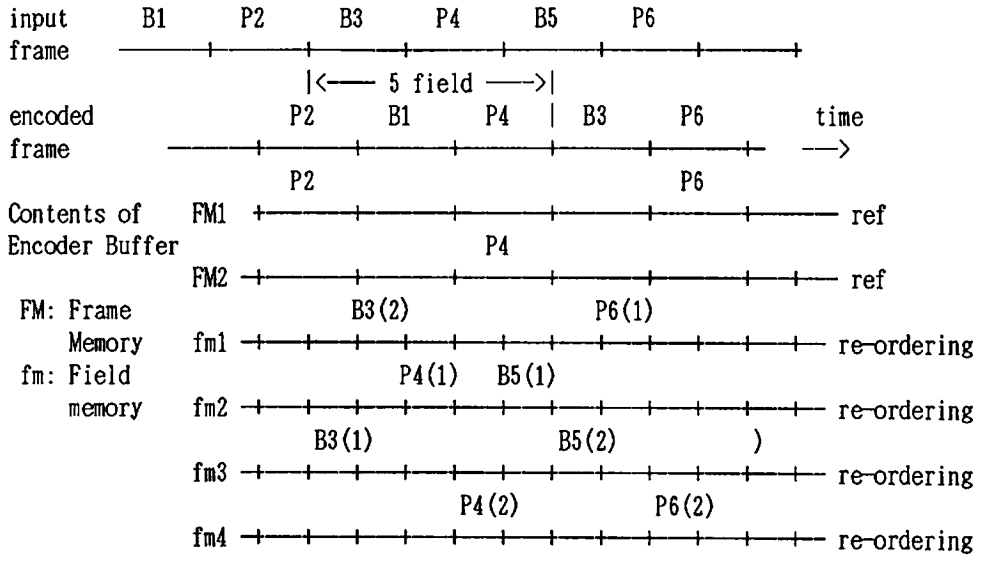


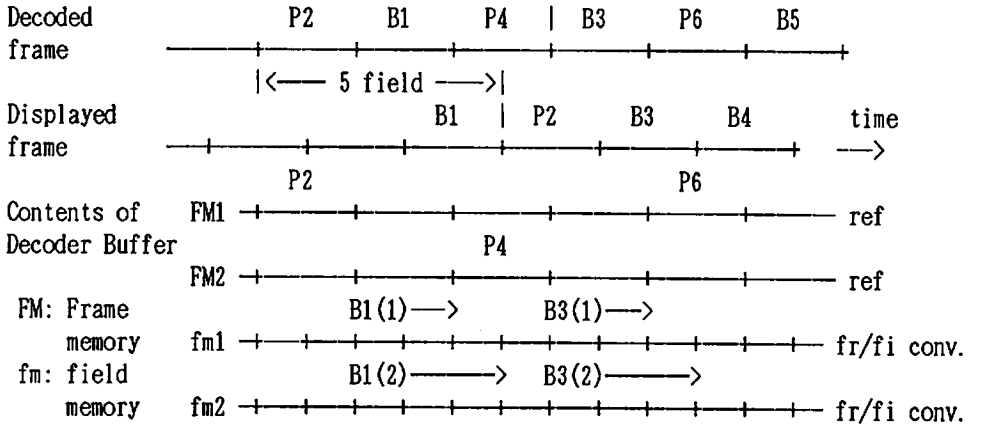
Notation:
P2(1): P2 frame 1st field
P2(2): P2 frame 2nd field

Encoder buffer : reference 4 fields + re-ordering buffer 6 fields
Decoder buffer : reference 4 fields + fr/fi conversion buffer 2 fields

Encoder delay : 7 field time
Decoder delay : 7 field time
Total delay time : 8 field time

(7) Frame structure M=2



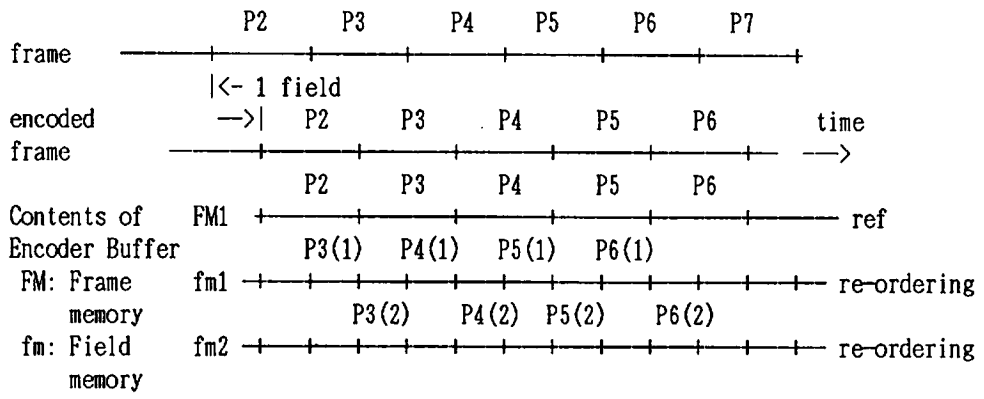


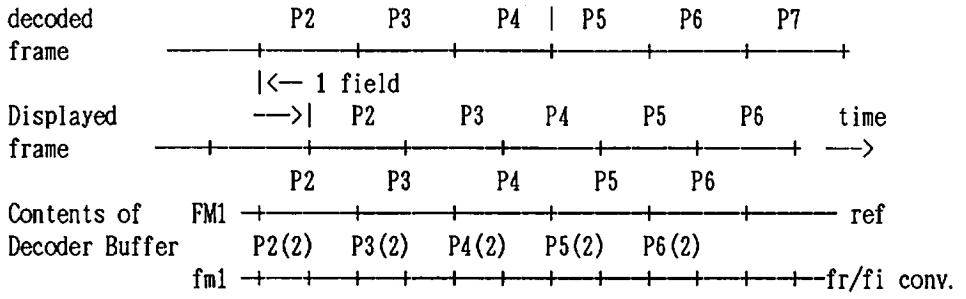
Notation:
P2(1): P2 frame 1st field
P2(2): P2 frame 2nd field

Encoder buffer : reference 4 fields + re-ordering buffer 4 fields
Decoder buffer : reference 4 fields + fr/fi conversion buffer 2 fields

Encoder delay : 5 field time
Decoder delay : 5 field time
Total delay time : 6 field time

(8) frame structure M=1





Notation:

P2(1): P2 frame 1st field

P2(2): P2 frame 2nd field

Encoder buffer : reference 2+a fields + re-ordering buffer 2 fields

Decoder buffer : reference 2+a fields + fr/fi conv. buffer 1* field

* Reference field memory is used as the part of fr/fi conversion buffer.

** The buffer size "a" is equal to MC range.

Encoder delay : 1 field time

Decoder delay : 1 field time

Total delay time : 2 field time