

Leaky factor overriding in Skip mode for AR-FGS /JVT-T021

July, 2006

Motivation 1/2

Leaky factor and of AR-FGS

: it is used in case where the coded transform coefficients of the co-located base layer block are all zero, in spatial domain. (if $Q_{bn} = 0$)

$$R_a^n = (1 - \alpha) \cdot X_b^n + \alpha \cdot R_e^{n-1} = (1 - \alpha) \cdot R_b^{n-1} + \alpha \cdot R_e^{n-1}$$

: it is used for the case that the transform coefficients are not all zero.

Adjusting leaky factor

JVT-S092 proposed leaky factor adjustment by Considering MB type

Skip mode +2/32, 16x16 -2/32, 16x8 and 8x16 : -4/32

It show the improvement of FGS coding performance.

In this contribution, we focused on leaky factor and SKIP mode MB.

Motivation 2/2

Properties of SKIP mode MB

If the collocated MB of BL is indicated as SKIP mode, it may also indicate there are no variations in the enhancement layer too.

Thereby the information of the skipped MB of EL can be strongly-believed in EL.

→ We can use a high value for SKIP mode, and it will be effective.

Proposed Overriding method for SKIP mode MB

the leaky factor for the skipped MB is overridden with higher values (32/32 ~ 29/32) without dependent with the slice-based leaky factor.

Coding Gain of Proposed Method

Two FGS Layer Test (EXCEL 1)

Low value (= 8 in JD 6.0; = 24 in JSVM 5.10): upto 2.0 dB
(Mobile)

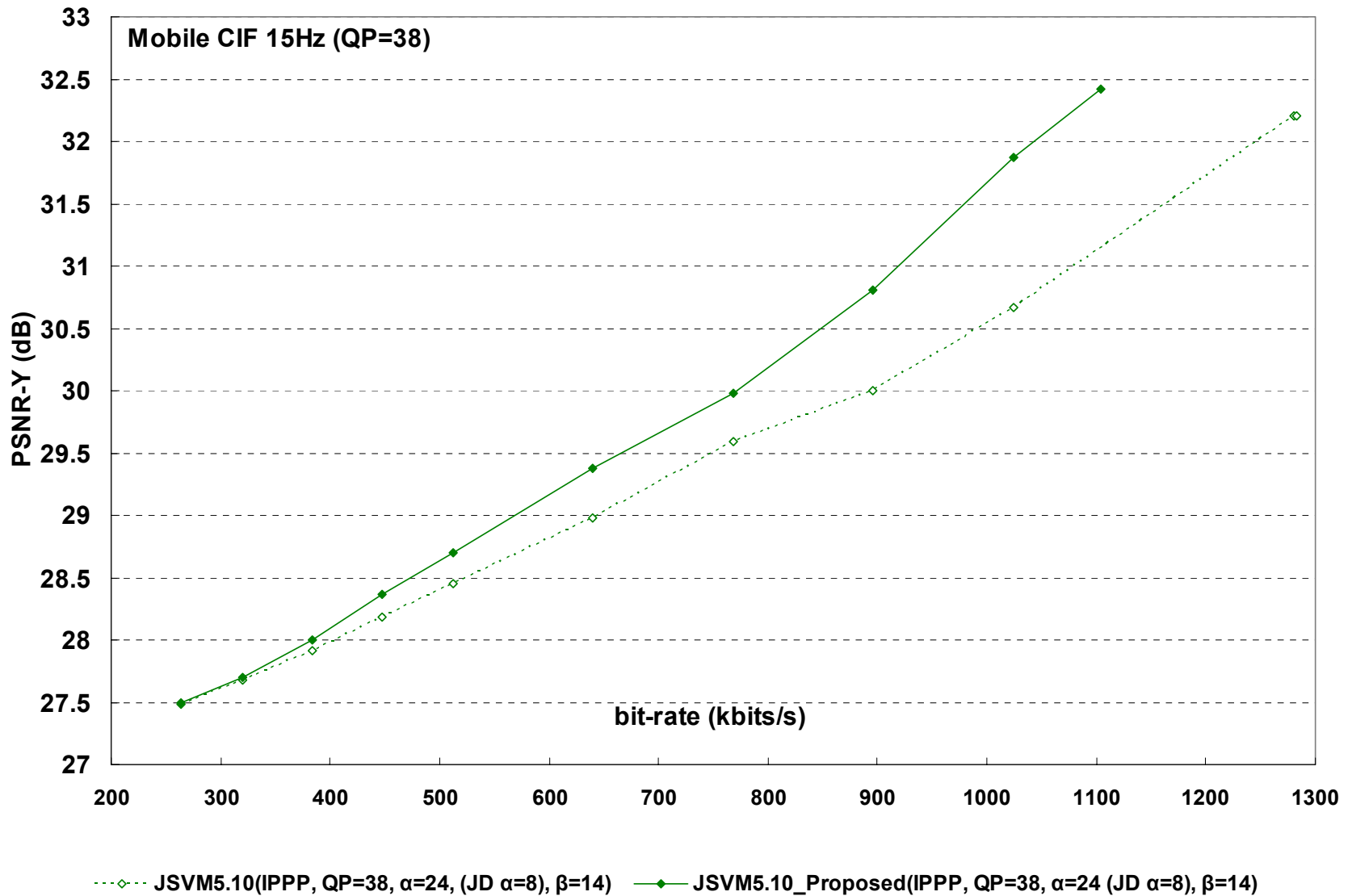
High value (= 28 in JD 6.0; = 4 in JSVM 5.10): upto 0.15 dB
(Foreman)

Single FGS Layer Test (EXCEL 8)

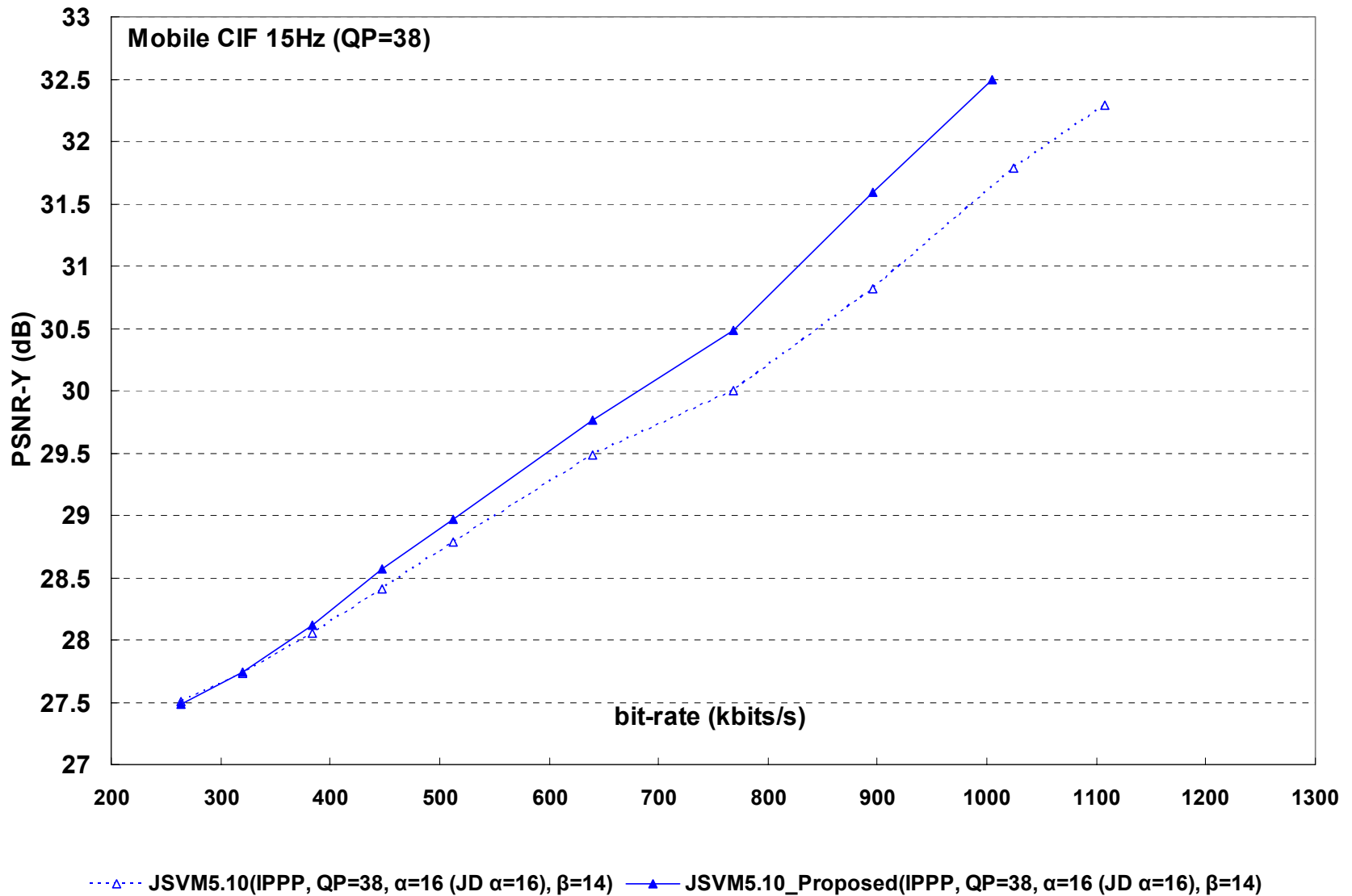
Low value (= 8 in JD 6.0; = 24 in JSVM 5.10): upto 1.2 dB
(Mobile)

High value (= 8 in JD 6.0; = 24 in JSVM 5.10): upto 0.23 dB
(Mobile)

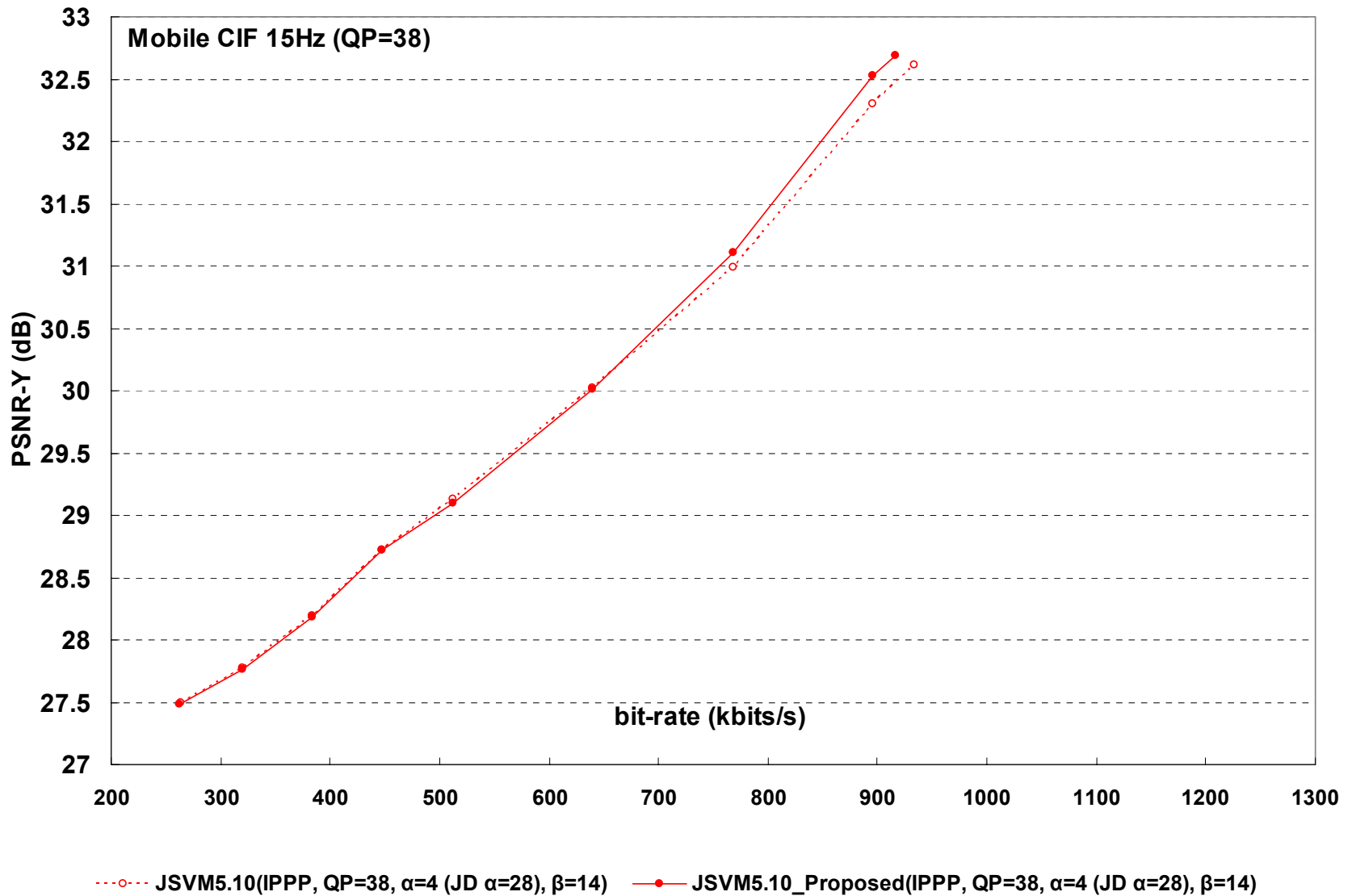
Results: Coding Gain at low value (=8 JD, 24 JSVM)



Results: Coding Gain at middle value (=16 JD & JSVM)



Results: Coding Gain at high value (=28 JD, 4 JSVM)



Experiment conditions : Coding Gain Test

Two FGS layer coding test in JVT-Q307

(CE7 improved and low delay FGS, NICE, 2005)
QP=38, CIF 15Hz (Bus/foreman/football/mobile)
Compare with JSVM 5.10

Experiment Results ([EXCEL 1](#))

Overriding of SKIP Mode MB shows significant coding gain at Low (=8) value (upto 2.07 dB Mobile)

Overriding of SKIP Mode MB shows coding gain at middle (=16) value (upto 1.00 dB Foreman)

Overriding of SKIP Mode MB shows very similar coding gain at high (=28) value (upto 0.15 dB Foreman)

Tuning overriding (29~32)

In high (=28), overriding show the best result with
30 for Foreman and Bus
29 for Mobile and football

In middle (=16) overriding = 32 show the best result

In low (=8), overriding = 32 show the best result

Experiment conditions : FGS Loss Test

There is a trade-off relation between coding performance and drift control according to leaky factor in AR-FGS

FGS Loss Test

QP=38, CIF 15Hz

We drop FGS Layer 1 (QL1) and 2 (QL2) at 50th Frame

We drop FGS Layer 2 (QL2) at 100th Frame

Experiment Results ([EXCEL 2](#))

Proposed overriding method shows negligible differences of drift control performance

The difference decrease according to the decreasing overriding from 32 to 29

Extra Experiment results (excel file 3 ~ 8)

REF 1: FGS Layer loss Test of Proposed Method
Overriding (29~32) vs Drift control

REF 2: FGS Layer loss Test of JSVM 5.10
vs Drift control

REF 3: Coding Performance Test of Proposed Method
Overriding value (29(=skip 3) 30, 31, 32(=skip 0)) vs PSNR

REF 4: Coding Performance Test of JSVM 5.10
vs coding Performance in JSVM 5.10

REF 5: Coding Performance of JVT-S092 in JSVM 5.10
adjusting of only skip mode MB by JVT-S092 vs PSNR

REF 6: Coding Performance: JSVM 5.10 vs Proposed Method (Single FGS QP 38)

Proposal of Syntax and Semantics #1/2

Slice Header in Scalable Extension

if(slice_type == PR && fragment_order == 0) {		
adaptive_ref_fgs_flag	2	u(1)
if(adaptive_ref_fgs_flag) {		
max_diff_ref_scale_for_zero_base_block	2	u(5)
max_diff_ref_scale_for_zero_base_coeff	2	u(5)
override_max_diff_ref_scala_for_zero_base_block_flag	2	u(1)
if(override_max_diff_ref_scala_for_zero_base_block_flag)		
max_diff_ref_scale_for_skipped_base_block	2	u(2)
fgs_entropy_order_flag	2	u(1)
}		
motion_refinement_flag	2	u(1)
}		

Proposal of Syntax and Semantics #2/2

Semantics

override_max_diff_ref_scale_for_zero_base_block_flag equal to 1 specifies that max_diff_ref_scale_for_skipped_base_block presence in the progressive slice of a key picture

max_diff_ref_scale_for_skipped_base_block specifies the maximum scaling factor to be used for scaling the differential reference signal in constructing the Inter prediction samples used in decoding the progressive slice of a key picture, when the transform block in the base layer is skipped.

The value of max_diff_ref_scale_for_skipped_base_block shall be in the range of 0 to 3, inclusive.

A variable MaxDiffRefScaleSkippedBaseBlock is derived as follows.

max_diff_ref_scale_for_skipped_base_block	MaxDiffRefScaleSkippedBaseBlock
0	=32
1	=31
2	=30
3	=29

Modified Decoding Process

F.8.7.2.1 Scaling process for differential Inter prediction samples of 4x4 luma blocks

- If numBaseSig is equal to 0, the following applies.
 - A scaling factor sF is derived as follows.
 - If mb_type is equal to P_Skip and override_max_diff_ref_scale_for_zero_base_block_flag is equal to 1, sF is set equal to MaxDiffRefScaleSkippedBlock.
 - Else If ctx4x4Id is equal to 0, sF is set equal to MaxDiffRefScaleZeroBaseBlock.
 - Otherwise (ctx4x4Id is not equal to 0), sF is set equal to max(0, MaxDiffRefScaleZeroBaseBlock – 4).
 - The 4x4 array diffPred4x4 of differential luma prediction samples is modified by

$$\text{diffPred4x4}[x, y] = (sF * \text{diffPred4x4}[x, y] + 16) \gg 5 \quad \text{with } x, y = 0 \dots 3$$

(F-18)

Summary

Leaky factor Overriding method for skip mode MB

It shows significant coding gain upto 2dB

It shows negligible drift control loss

Verification results and S/W by Samsung (JVT-047)

We recommend the adopt of proposed method into next JSVM

Appendix

% of Skip MB in BL (QP 38)

Foreman : 12 %

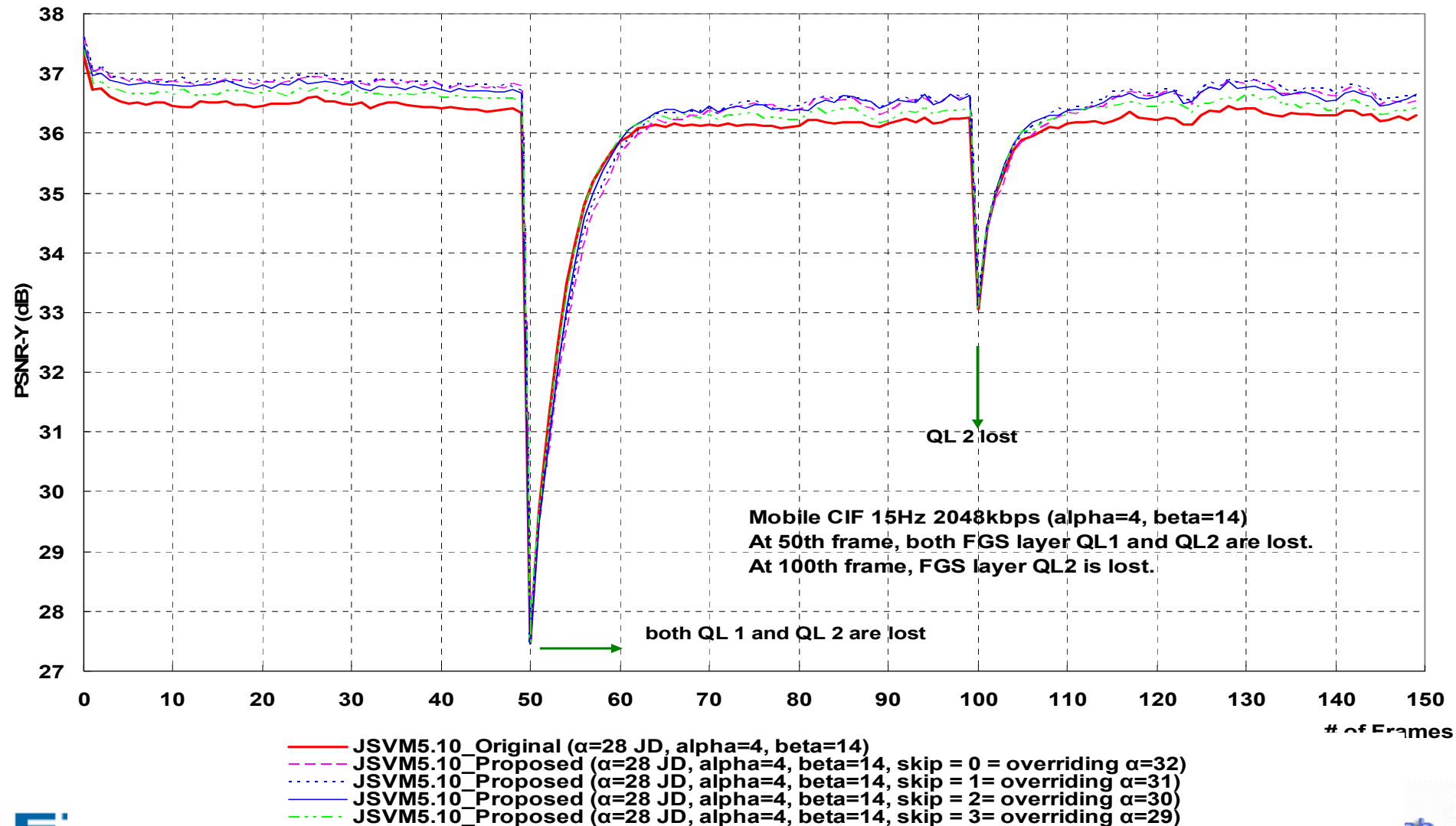
Bus : 8 %

Mobile : 22 %

Football : 6 %

FGS Loss Test vs Overriding (at high $\alpha=28$)

(EXCEL 3 REF 1)



FGS Loss Test vs Overriding (at low $\alpha=8$)

