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CCITT SGXV
Working Party XV/1
Specialists Group on Coding for Visual Telephony
SOURCE : Japan
TITLE : Improvements of INTRA MODE

VTR

1. INTRODUCTION (Florida)

In Doc. #407 , the coding techniques for INTRA mode are disscussed . After Florida meeting we have been investigating the following for INTRA mode .

1) Transmitting DC offset values
2) FLC bits for DC values
3) INTRA NOT CODED mode

2 . SIMULATIONS AND RESULTS

2.1 Transmitting DC offset values

We investigated a method by which DC offset values of Y , Cr and Cb (coeffcient domain) are transmitted instead of DC mean values of Y , Cr and Cb . The following offset values are introduced for the simulation . Any values , however , can be selected as offset according to design .

Y : DC value of Y00 block (LSB1)
Cr , Cb : DC value of each MB

The simulations are carried out for a scene change sequence at p=1 (10Hz) and FCIF . And we also examined the method informed by Europe (transmitting mean values of each 6 blocks) — compared to RM7

The simulation result is shown in APPENDIX 1 . The method which transmits DC offset values instead of DC mean values does not degrade the image quality . At scene change , the method by Europe increases the number of bits for mean values and slightly worsens the image quality as compared to RM7 and DC offset methods . On the other hand , if DC offset values are transmitted , the DCT coefficients of INTRA mode can be transmitted with the same rule of INTER mode , making alogrithm simpler .

2.2 FLC bits for DC value

We changed the bits for Y , Cr and Cb DC values to 6 , 8 and 9 bits , respectively , at p=1 , 6 and 9 all for FCIF .

The simulation results are shown in APPENDIX 2−4 . In case of 9 bit FLC and p=6 , SNR for Cr and Cb are better appoximately 0.1 −0.2 dB than 8 bit FLC , which is negligible , and we can generally find no difference in all the other cases .

2.3 INTRA NOT CODED mode

INTRA NOT CODED mode is introduced in TYPE3 below

macro block type	code with relative addressing
1. no MC not coded	--
2. MC coded	1
3. MC not coded	01
4. no MC coded	001
5. Intra coded	0000
6. Intra not coded	0001

3 to 4

The simulations are carried out for

① the first frame where q step is fixed at 32

② a scene change sequence (Claire to Salesman)

We introduced the following method to simulation ② .

Inter / Intra switch is also applied in the case of overflow.

INTRA mode : transmitted as INTRA NOT CODED

INTER mode : transmitted as NO MC NOT CODED

The result of simulation ① is shown in APPENDIX 5 . By introducing INTRA NOT CODED ,we can save about 2000 bits at simulation ① for the sequence with monotonous background region such as Claire and Miss America.

APPENDIX 6 shows the result of simulation ② . We find the image quality is built up faster by introducing INTRA NOT CODED mode . According to RM7 simulation result, only 2 or 3 MB per frame are transmitted as INTRA mode, so we think 1 bit increase per INTRA MB in TYPE3 coding is negligible . Since we can improve the image quality at scene change by using INTER / INTRA switch in all cases and forcing INTRA to INTRA NOT CODED rather than to INTER NOT CODED and at least transmitting DC values for INTRA mode , INTRA NOT CODED mode is confirmed as effective for decreasing the number of bits.

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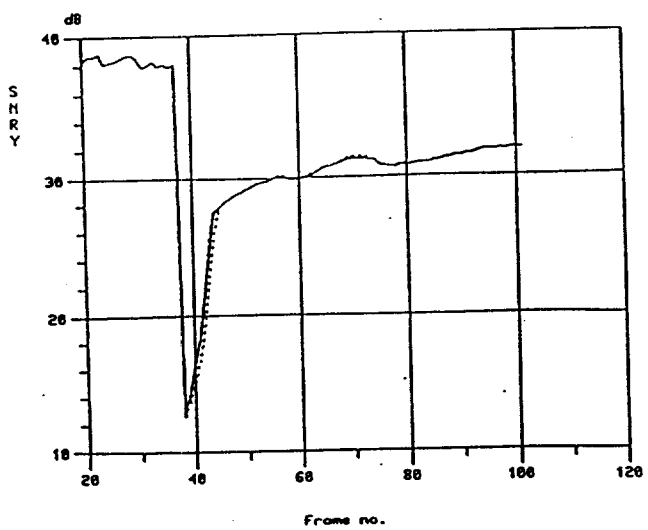
3. CONCLUSION

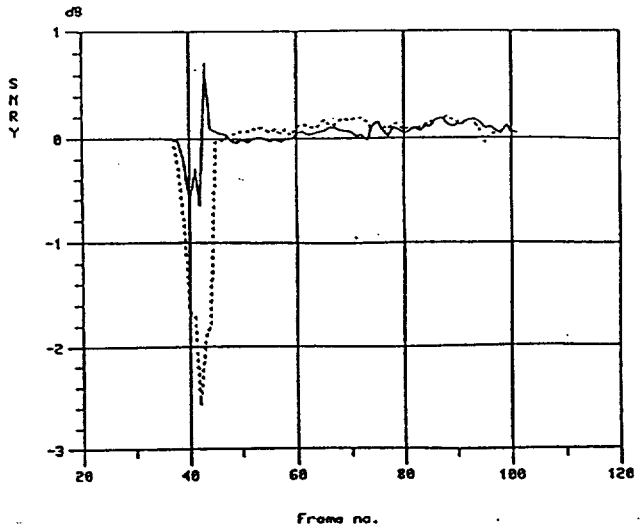
1) We have found no difference between RM7 and the method of transmitting DC offset values but have found the latter method is better than the method of transmitting 6 mean values for a MB in terms of SNR and subjective quality . We , therefore , propose the method of transmitting DC offset values with which hardware can be implemented more easily .

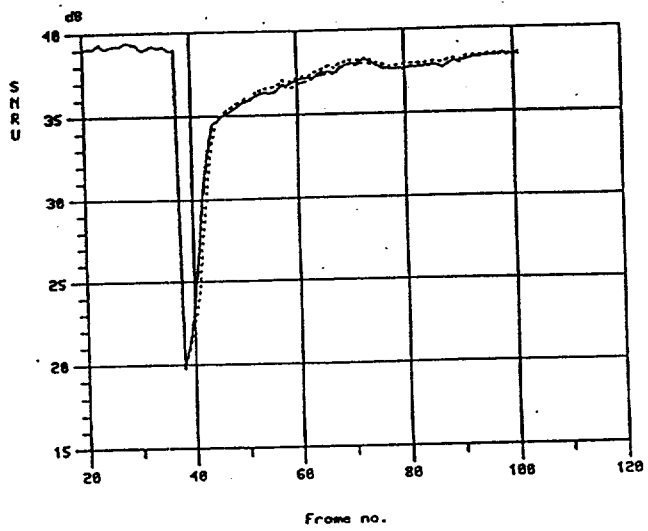
2) Eight (8) bits FLC for DC values are enough for the image quality .

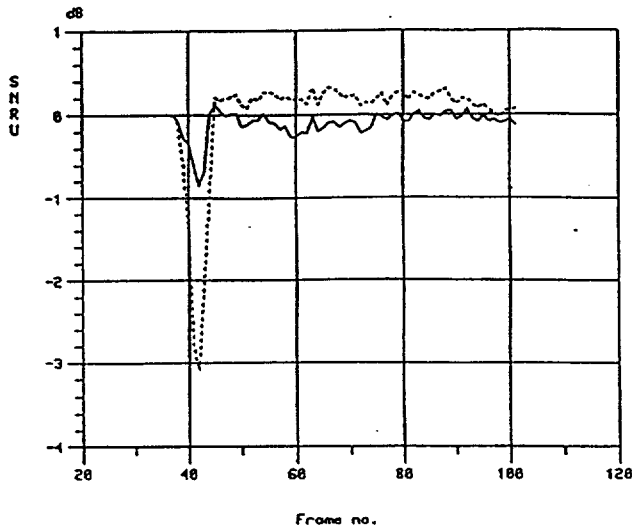
3) INTRA NOT CODED mode is effective for faster building up when a scene change occurs . We also propose INTRA NOT CODED mode .

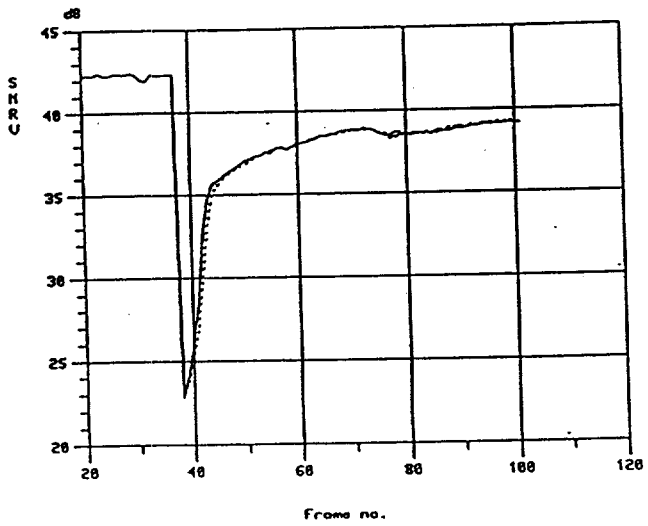
APPENDIX 1

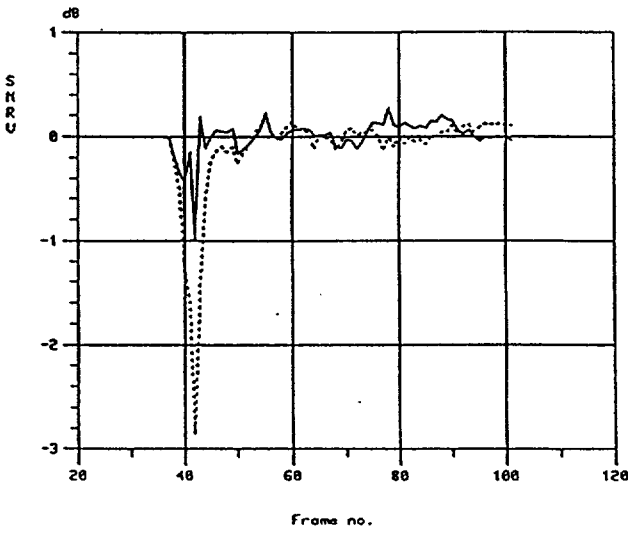










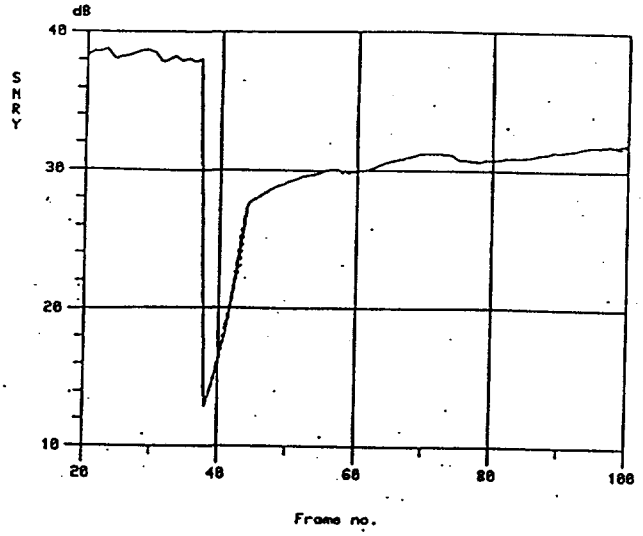


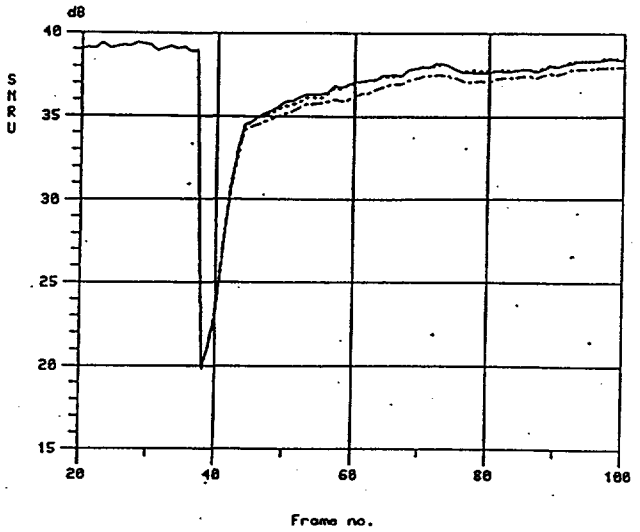
——— ①RM7
..... ②Mean value of each 6 block
—·—·— ③DC offset

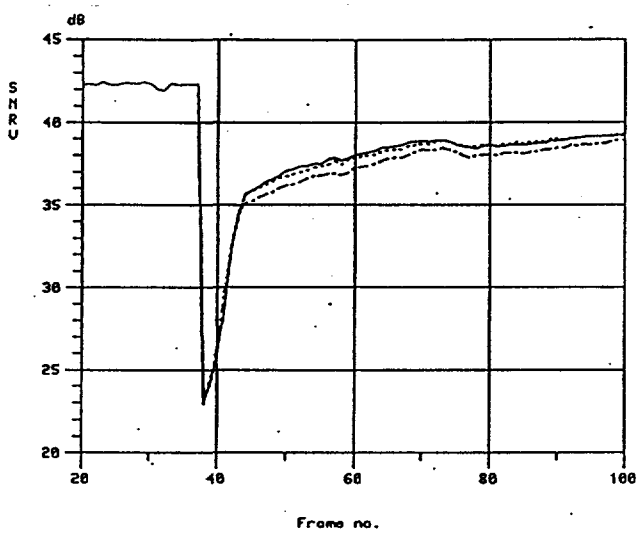
——— ③－①
..... ②－①

P=1 (10Hz)
FCIF
Scene change

APPENDIX 2







P=1 (10Hz)
FCIF
Scene change

——— DC 8bit FLC(RM7)

····· DC 9bit FLC

—·—·— DC 6bit FLC

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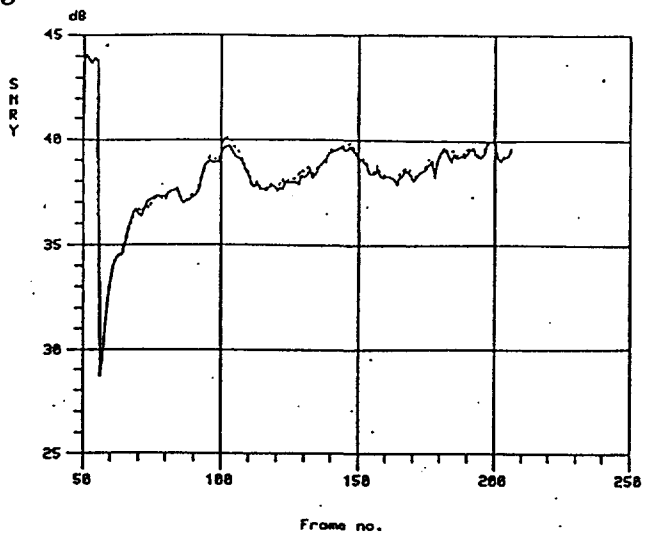
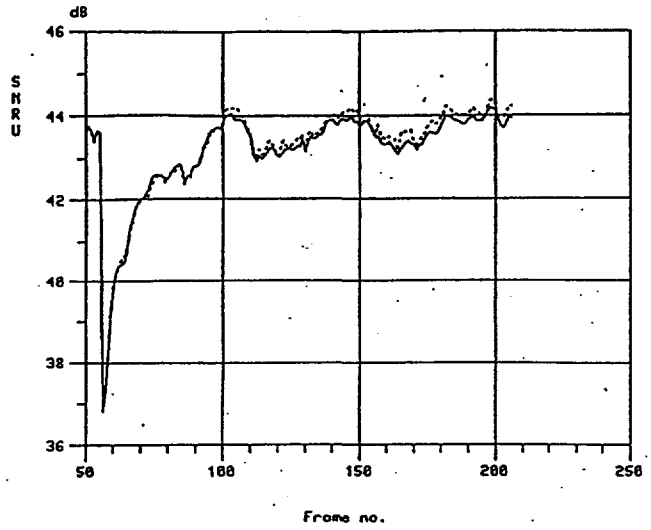
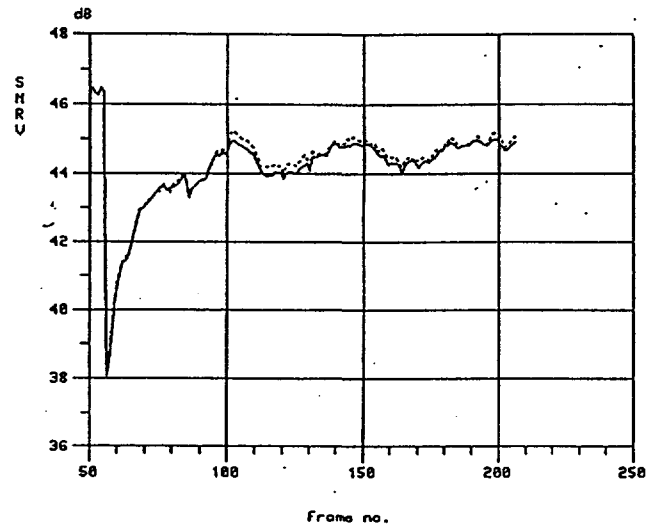
APPENDIX 3







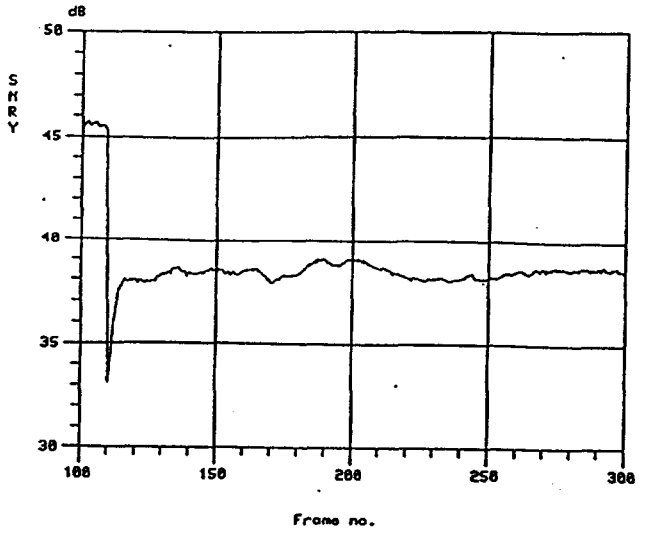
P=6 (15Hz)
FCIF
Scene change

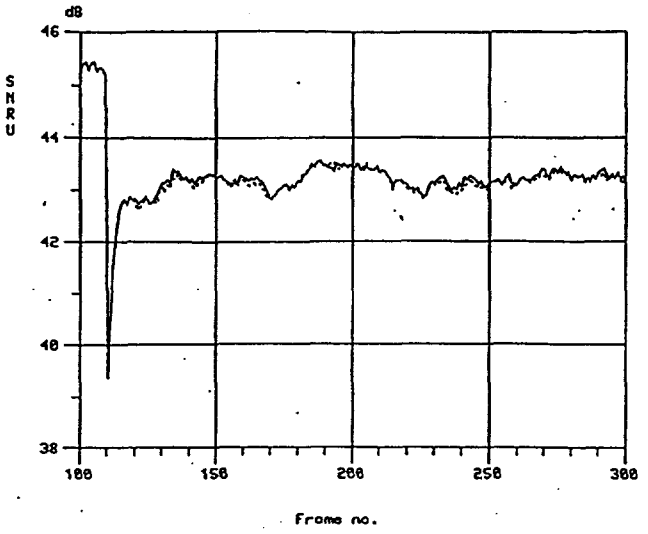
——— DC 8bit FLC(RM7)

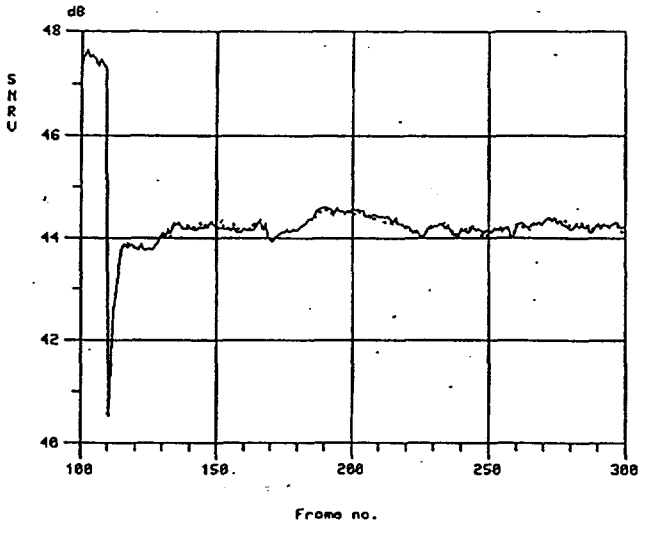
····· DC 9bit FLC

100

APPENDIX 4







P=24 (30Hz)
FCIF
Scene change

——— DC 8bit FLC(RM7)

····· DC 9bit FLC

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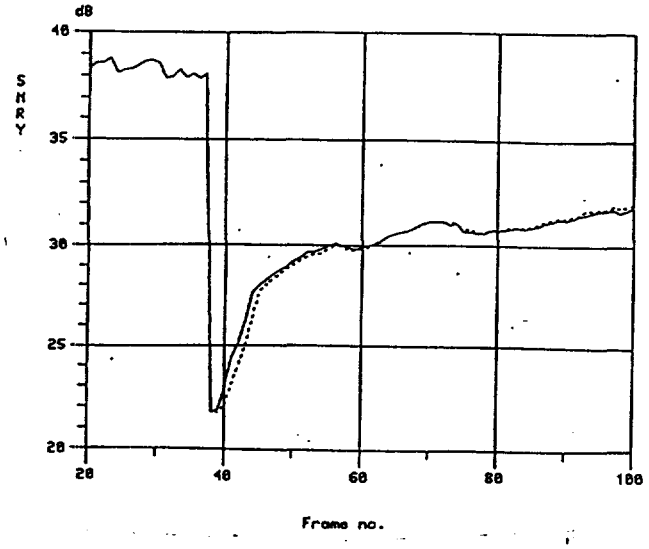
APPENDIX 5 : Result of INTRA NOT CODED simulation ①

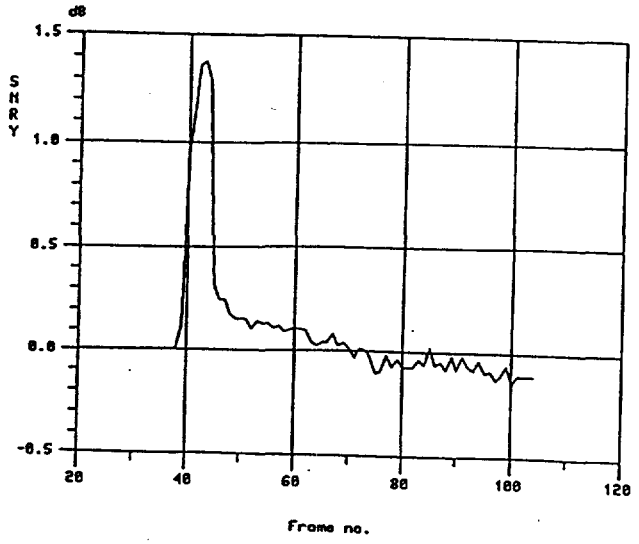
simulation ① : the first frame where quantization step is fixed at 32

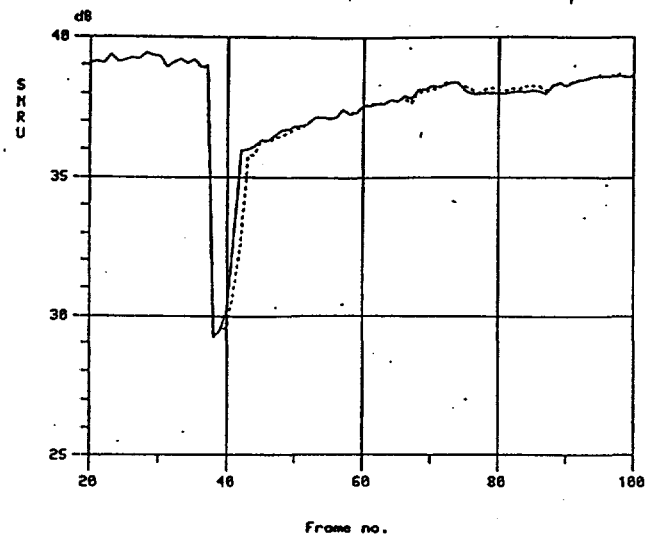
sequence	Salesman	Claire	Swing	Miss USA	
intra coded MB	371	164	307	167	[Number of MB]
intra not coded MB	25	232	89	229	
saved bits (*)	− 96	+2388	+672	+ 2352	[bits]

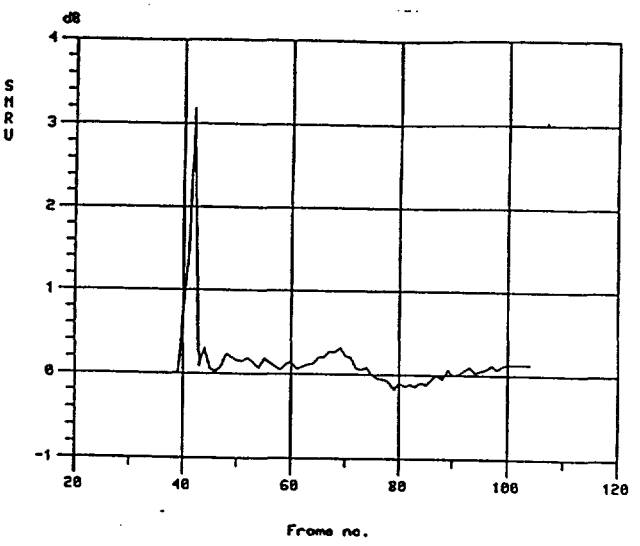
*: saved bits by introducing INTRA NOT CODED mode (compared with RM7)

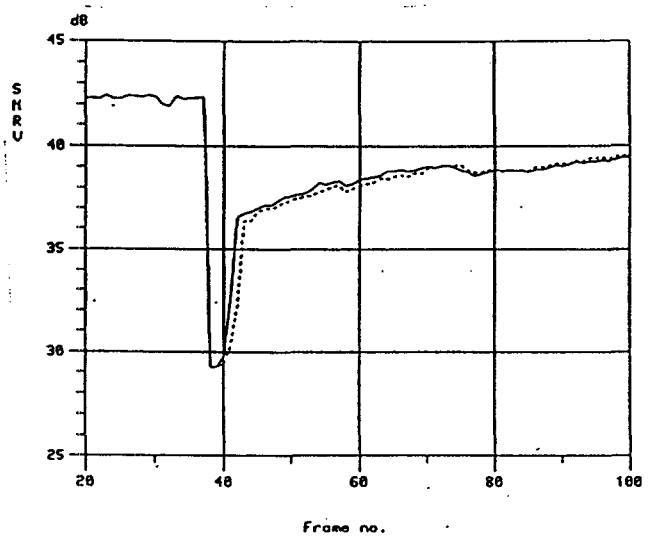
APPENDIX 6

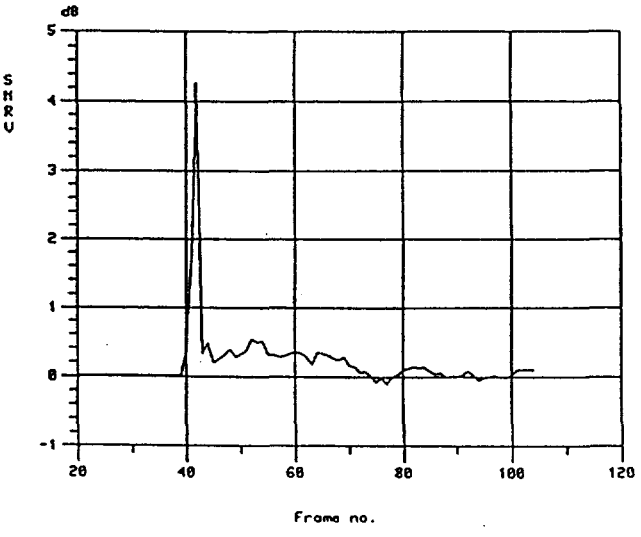












——— ①Intra not coded

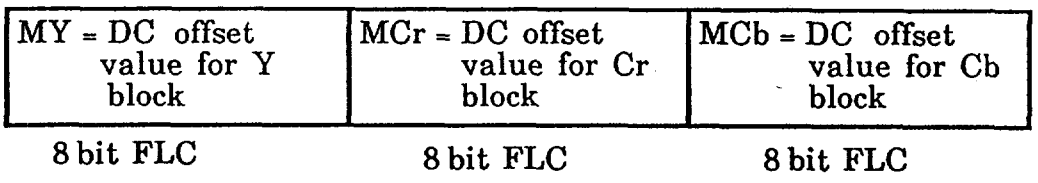
····· ②RM7

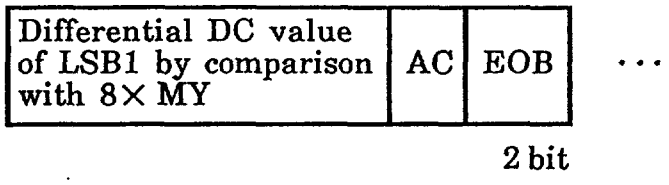
——— ①－②

P=1 (10Hz)
FCIF
Scene change

APPENDIX 7

i) Intra coded





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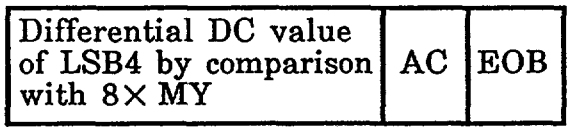

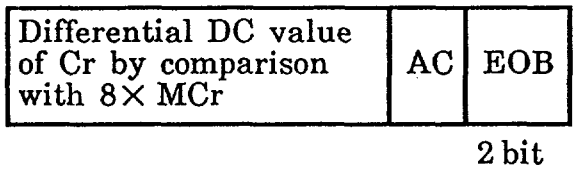

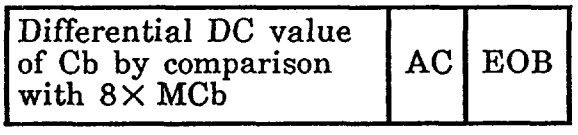

ii) Intra not coded