CCITT SGXV **Document 528**
Working Party XV/1
Specialists Group on Coding
for Visual Telephony

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Title : RM8 Improvements for bit rates around 1 Mbit/s

Source : FRANCE

I - INTRODUCTION

During the last year the p x 64 kbit/s algorithm has been mainly optimized for pictures at very low bit rates (i.e. 64 kbit/s). For every modification we just took care of the fact that no new impairement was introduced at higher bit rates.

Now, that an I.S.O. group has been settled to standardize a compression technique for CD-ROM applications at 1.1 Mbit/s, and that the p x 64 kbit/s algorithm could be a good candidate, we have undertaken new simulation work with new test material at this bit rate: it turns out that for sequences including zooming and pan, it is preferable to come back to the RM3 technique regarding the way the loop filter is controlled, i.e. it is better to transmit side information.

The intention of this document is not to be a firm proposal because it is based on preliminary results, but to provide the description of a possible solution (actually the filter is not applied when there is no motion vector and is applied when a motion vector is present except in some cases which are signalled by side information).

Concerning the on/off filter control issue, our results show that a 4 DB or 3 DB gain can be obtained on the Table Tennis sequence, depending on whether the source signal is CIF 25 Hz or CIF 30 Hz.

II - DESCRIPTION

a - Block type modification

The basic scheme is RM8 with the following modification: there is a possibility to have not filtered MC coded blocks.
The macro block types have been then modified as follows:

Inter coded	1
MC coded and filtered	010
MC coded and not filtered	011
MC not coded and filtered	0010
MC not coded and not filtered	0011

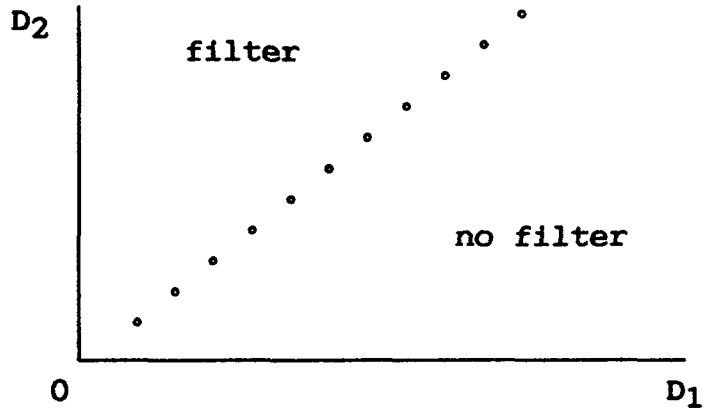
Inter coded + Q	00001
MC coded + Q	000001
Intra + Q	0000001

b - On/off filter decision

If there is no motion vector there is no filter.
If a motion vector is present the following decision criterion is employed:

Let be $D_1 = \Sigma_{M.B.}[d(i)]^2$ and $D_2 = \Sigma_{M.B.}[df(i)]^2$

d(i) = MC inter frame prediction error
df(i) = MC inter filtered frame prediction error



III - LIST OF IMPORTANT PARAMETERS

It is important for high bit rates to leave the door open for certain elements such as:

* On/off filtering control (the criterion decision is not for standardization)

* Quantization table: will the set of quantizers dependent on the bit rate?

* VLC for MB types: will the VLC dependent on the bit rate as well?

* etc...

IV - CONCLUSION

Due to the fact that the p x 64 kbit/s algorithm is a candidate for the I.S.O. standard for CD-ROM applications, we do not have to completely freeze several parameters, for improvements at bit rates 1 to 2 Mbit/s.

The question of knowing whether those parameters are mandatory at any bit rate or not is raised.

There is a general feeling in Europe that keeping the scheme as it is but leaving the door open for a set of parameters could be profitable for the I.S.O. work and for the future of the p x 64 kbit/s algorithm.

Statistics : RM8 Filter // Conditional filter
Bit rate : 1069.2 kbps
Source : CNET/FRANCE
Date : May 1989

249 frames are taken into account for the following statistic chart.

Sequence Frame rate	Table Tennis 25Hz RM8	Table Tennis 25Hz RM8+
S.N.R Y	31.404	32.410
S.N.R C	35.517	36.145
Step size	19.267	15.581
Nbr of non zeroes	Y: 8.47 C: 3.15	Y: 7.97 C: 3.48
Nbr of zeroes	Y: 15.94 C: 9.63	Y: 16.34 C: 9.70
MACRO BLOCK TYPE		
Fixed	94	63
Fixed MC No Filt	0	48
Fixed MC Filter	44	18
Inter	103	107
Inter MC No Filt	0	96
Inter MC Filter	142	51
Intra	10	9
NUMBER OF BITS		
MC Attributes	1752	2040
EOB	2897	3000
Motion vectors	1177	1164
Coefficients : Y	34279	33304
C	2449	2919
Total	42554	42427

Statistics : RM8 Filter // Conditional filter
Bit rate : 1069.2 kbps
Source : CNET/FRANCE
Date : May 1989

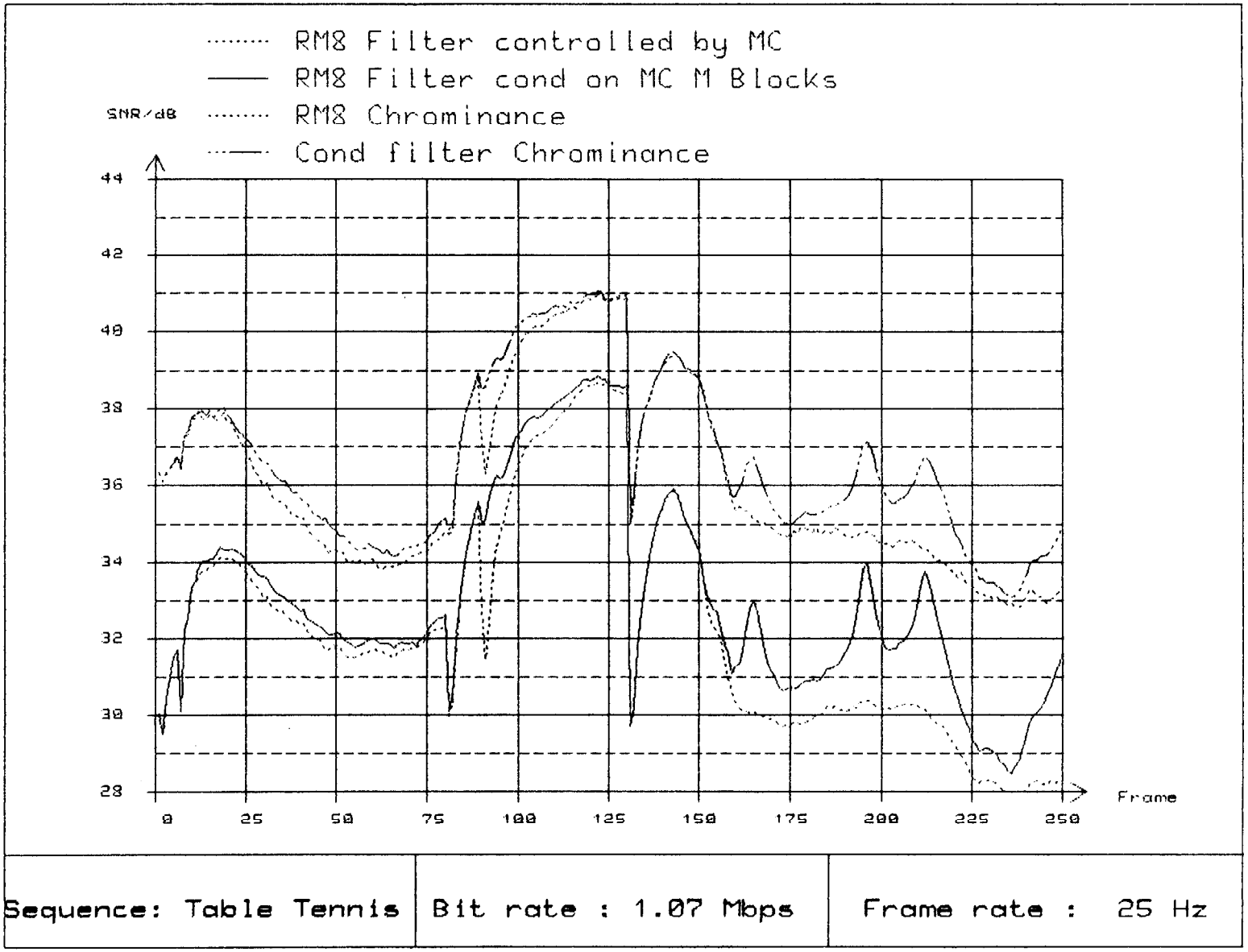
299 frames are taken into account for the following statistic chart.

Sequence Frame rate	Table Tennis 30Hz RM8	Table Tennis 30Hz RM8+
S.N.R Y S.N.R C	32.902 36.507	33.663 37.035
Step size	16.876	13.835
Nbr of non zeroes	Y: 7.12 C: 3.07	Y: 6.66 C: 3.30
Nbr of zeroes	Y: 12.04 C: 8.86	Y: 13.50 C: 8.48
MACRO BLOCK TYPE		
Fixed Fixed MC No Filt Fixed MC Filter Inter Inter MC No Filt Inter MC Filter Intra	96 0 41 106 0 145 5	72 39 18 113 93 53 5
NUMBER OF BITS		
MC Attributes	1727	1978
EOB	2918	3017
Motion vectors	1076	1051
Coefficients : Y C	27180 2402	26466 2738
Total	35303	35250

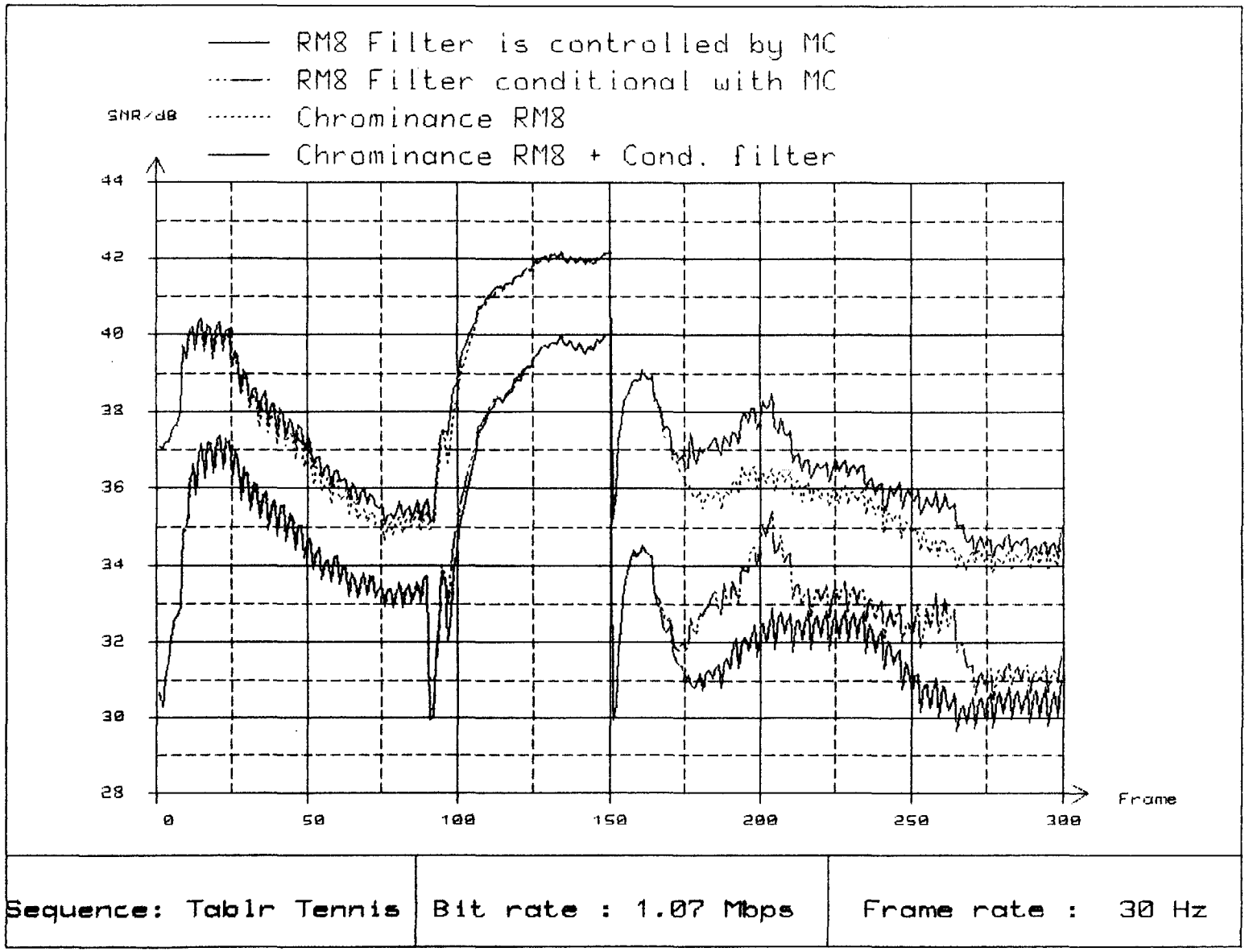
Statistics : RM8 Filter // Conditional filter
Bit rate : 1069.2 kbps
Source : CNET/FRANCE
Date : May 1989

105 frames are taken into account for the following statistic chart.

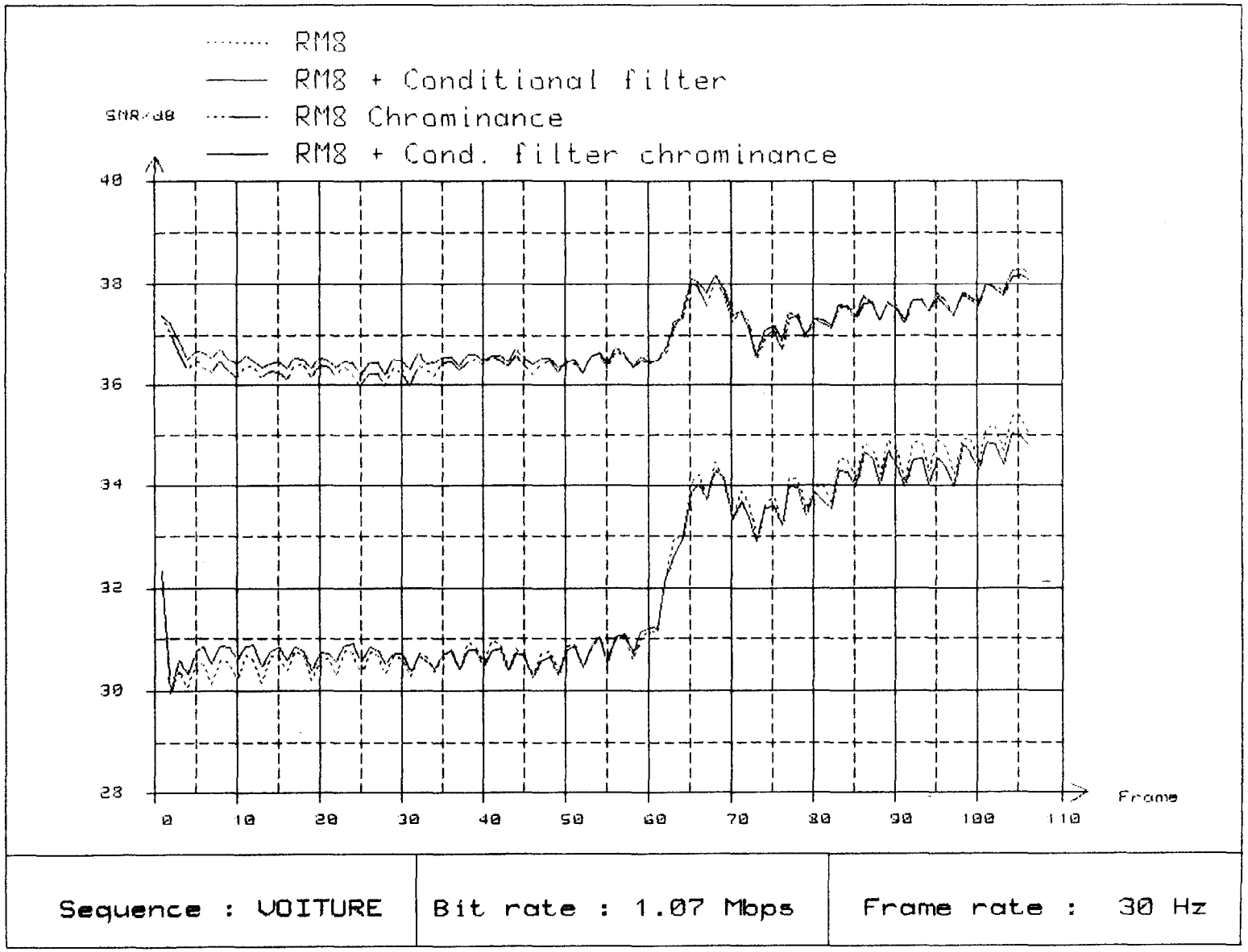
Sequence Frame rate	Voiture 30Hz RM8	Voiture 30Hz RM8+
S.N.R Y	31.795	31.813
S.N.R C	36.805	36.905
Step size	19.401	17.965
Nbr of non zeroes	Y: 5.60 C: 1.58	Y: 5.59 C: 1.68
Nbr of zeroes	Y: 9.73 C: 7.52	Y: 10.65 C: 7.23
MACRO BLOCK TYPE		
Fixed	47	42
Fixed MC No Filt	0	15
Fixed MC Filter	26	15
Inter	130	134
Inter MC No Filt	0	102
Inter MC Filter	176	72
Intra	15	13
NUMBER OF BITS		
MC Attributes	1950	2154
EOB	3433	3454
Motion vectors	1256	1260
Coefficients : Y	27487	27218
C	1205	1230
Total	35331	35316



Sequence: Table Tennis	Bit rate : 1.07 Mbps	Frame rate : 25 Hz



Sequence: Tablr Tennis	Bit rate : 1.07 Mbps	Frame rate : 30 Hz



Sequence : VOITURE	Bit rate : 1.07 Mbps	Frame rate : 30 Hz