CCITT SG XV
Working Party XV/1
Specialists Group on Coding for Visual Telephony

Document #272
Oct. 1987

Source: NTT,KDD,NEC and FUITSU
Title : Modification of 2D-VLC CODE WORDS

Basic structure of 2D-VLC was discussed in Doc.#224.

This document describes an example of 2D-VLC code set, with which the occurence of 8-bits-zero-run is suppressed. Moreover, the code word representing zero run length and zero level is defined for underflow protection.

This code set is shown in what follows.

Code Lengths:

		LEVEL(absolute value)																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18.....128
	0	3	5	6	8	10	10	11	13	13	13	13	13	13	13	13	16	16	16..... 16
	1	4	7	10	11	13	13	14	22	22	22	22	22	22	22	22	22	22	22..... 22
	2	5	8	11	13	14	22	22	22	22	22	22	22	22	22	22	22	22	22..... 22
	3	6	10	13	14	22	22	22	22	22	22	22	22	22	22	22	22	22	22..... 22
	4	6	11	13	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22..... 22
R	5	7	13	14	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22..... 22
U	6	7	13	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22..... 22
N	7	7	13	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22..... 22
	8	8	13	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22..... 22
L	9	8	14	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22..... 22
E	10	10	14	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22..... 22
N	11	10	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22..... 22
G	12	10	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22..... 22
T	13	11	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22..... 22
H	14	11	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22..... 22
	15	11	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22..... 22
	16	13	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22..... 22
	17	13	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22..... 22
	18	13	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22..... 22
	19	13	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22..... 22
	20	13	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22..... 22
	21	13	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22..... 22
	22	13	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22..... 22
	23	13	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22..... 22
	24	13	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22..... 22
	25	13	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22..... 22
	26	13	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22..... 22
	27	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22..... 22
	28	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22..... 22
	.																		
	.																		
	63	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22..... 22

RUN	LEVEL	CODE LENGTH	CODE	
0	-1	3	111	
0	1	3	110	VLC
1	-1	4	1011	VLC
1	1	4	1010	
2	-1	5	10011	
2	1	5	10010	VLC
0	-2	5	10001	
0	2	5	00101	
3	-1	6	000111	
3	1	6	000110	VLC
4	-1	6	000101	
4	1	6	000100	
0	-3	6	000011	
0	3	6	000010	
5	-1	7	0011111	
5	1	7	0011110	
1	-2	7	0011101	
1	2	7	0011100	VLC(4)+FLC(3)
6	-1	7	0011011	
6	1	7	0011010	
7	-1	7	0011001	
7	1	7	0011000	
8	-1	9	001001111	
8	1	9	001001110	
0	-4	9	001001101	
0	4	9	001001100	VLC(8)+FLC(3)
9	-1	9	001001011	
9	1	9	001001010	
2	-2	9	001001001	
2	2	9	001001000	
10	-1	10	1000011111	
10	1	10	1000011110	
0	-5	10	1000011101	
0	5	10	1000011100	
1	-3	10	1000011011	
1	3	10	1000011010	
3	-2	10	1000011001	VLC(6)+FLC(4)
3	2	10	1000011000	
11	-1	10	1000010111	
11	1	10	1000010110	
12	-1	10	1000010101	
12	1	10	1000010100	
0	-6	10	1000010011	
0	6	10	1000010010	
13	-1	11	10000011111	
13	1	11	10000011110	
4	-2	11	10000011101	
4	2	11	10000011100	
14	-1	11	10000011011	
14	1	11	10000011010	
15	-1	11	10000011001	VLC(7)+FLC(4)
15	1	11	10000011000	
1	-4	11	10000010111	
1	4	11	10000010110	
2	-3	11	10000010101	
2	3	11	10000010100	
0	-7	11	10000010011	
0	7	11	10000010010	
5	-2	13	1000000111111	
5	2	13	1000000111110	
16	-1	13	1000000111101	
16	1	13	1000000111100	
17	-1	13	1000000111011	
17	1	13	1000000111010	
6	-2	13	1000000111001	
6	2	13	1000000111000	
0	-8	13	1000000110111	
0	8	13	1000000110110	
3	-3	13	1000000110101	
3	3	13	1000000110100	
1	-5	13	1000000110011	
1	5	13	1000000110010	
18	-1	13	1000000101111	VLC(8)+FLC(5)
18	1	13	1000000101110	
19	-1	13	1000000101101	
19	1	13	1000000101100	
0	-9	13	1000000101011	
0	9	13	1000000101010	
20	-1	13	1000000101001	
20	1	13	1000000101000	
21	-1	13	1000000100111	
21	1	13	1000000100110	
7	-2	13	1000000100101	
7	2	13	1000000100100	
2	-4	13	1000000100011	
2	4	13	1000000100010	
0	-10	13	1000000011111	
0	10	13	1000000011110	
4	-3	13	1000000011101	
4	3	13	1000000011100	
8	-2	13	1000000011011	
8	2	13	1000000011010	
0	-11	13	1000000011001	VLC(9)+FLC(4)
0	11	13	1000000011000	
22	-1	13	1000000010111	
22	1	13	1000000010110	
23	-1	13	1000000010101	
23	1	13	1000000010100	
24	-1	13	1000000010011	
24	1	13	1000000010010	

25	-1	13	1000010001111	
25	1	13	1000010001110	
26	-1	13	1000010001101	
26	1	13	1000010001100	
0	-12	13	1000010001011	
0	12	13	1000010001010	
0	-13	13	1000010001001	VLC(9)+FLC(4)
0	13	13	1000010001000	
0	-14	13	1000010000111	
0	14	13	1000010000110	
0	-15	13	1000010000101	
0	15	13	1000010000100	
1	-6	13	1000010000011	
1	6	13	1000010000010	
1	-7	14	10000010001111	
1	7	14	10000010001110	
2	-5	14	10000010001101	
2	5	14	10000010001100	
3	-4	14	10000010001011	
3	4	14	10000010001010	VLC(10)+FLC(4)
5	-3	14	10000010001001	
5	3	14	10000010001000	
9	-2	14	10000010000111	
9	2	14	10000010000110	
10	-2	14	10000010000101	
10	2	14	10000010000100	
[EOB]		2	01	
[ESCAPE CODE A]		7	0010001	
[ESCAPE CODE B]		7	0010000	

If RUN=0 and LEVEL > 15
[ESCAPE CODE B](7 bits) + LEVEL(9 bits)

else
[ESCAPE CODE A](7 bits) + RUN(6 bits) + LEVEL(9 bits)

For underflow protection a code word is defined, representing zero run length and zero level. This code is expresed with
[ESCAPE CODE B](7 bits) + LEVEL 0(9 bits:001000001)

LEVEL CODE (9bit fix)

LEVEL	CODE	
0	001000001	
1	00100001S	
2	00100010S	
3	00100011S	
4	00100100S	
5	00100101S	
6	00100110S	
7	00100111S	
8	00101001S	
9	00101010S	
10	00101011S	
11	00101100S	
12	00101101S	
13	00101110S	
14	00101111S	
.	.....	
.	.....	
.	.....	
120	10100001S	
121	10100010S	
122	10100011S	
123	10100100S	
124	10100101S	
125	10100110S	
126	10100111S	
127	10101001S	
128	10101010S	S:sign bit

RUN CODE(6bit fix)

RUN LENGTH	CODE
1	000001
2	000010
3	000011
4	000100
5	000101
.	.
.	.
.	.
63	111111