CCITT SGXV
Working party XV/1
Specialists Group on Coding for Visual Telephony

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Title : Connection test results with Test Signal Generator

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1. Introduction

There are several inadequate points in the Test Signal Generator. In this document, these points are listed in Section 2. In addition, Jerkiness of decoded image from the Japanese Flexible Hardware is analyzed. The result is shown in Section 3.

2. Comments on Test Signal Generator

Three points are found inadequate in the Test Signal Generator. They are shown below.

1) There is difference in two code words between the Test Signal Generator and the Doc.#217 as summarized in the following table.

Luminance Difference Value	Quantized Value (QSEL=21)	Variable Length Code Set	
		Test Signal Generator	Doc.#217
-42	-2	00011	00010
-84	-4	00010	0000010

2) The difference value for the luminance signal in Interframe mode is 1/8 times as large as that in Intraframe mode.

Example:
Signal level must turn from 23 to 233 at the first block of the 12th GOB in the 35th frame. Therefore, the difference value for DC coefficient must be +1680 = (233-23)*8. The corresponding variable length code should be V[+80](='0000 0001 1100 0101') when QSEL=21. However a variable

length code '0000 0001 0000 1010' is used in the test signal generator. This code represents V[+10] corresponding to +210 when QSEL=21.

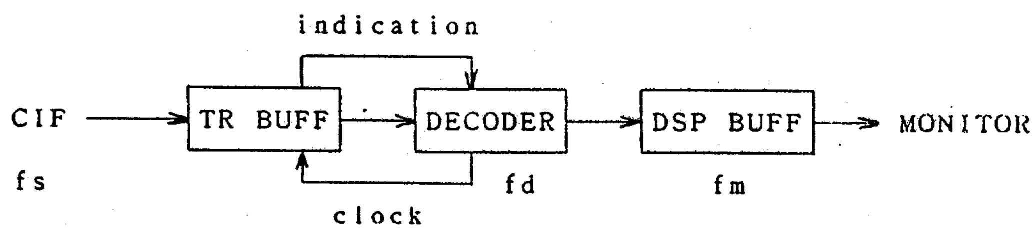
3) According to the users manual (7.1.3.2. Moving Edge), the CLASS must be '01'(Horizontal) for the initial blocks in the 6th GOB. However, it is '1'(Zig-zag) according to the ROM data, although this difference causes no problem as a result, because there are no significant coefficients but DC in these blocks.

3. Analysis on jerkiness of Sliding Bar

At Redbank meeting, it was pointed out that a slight jerkiness was observed in decoded test signals(see document #276R §4.6). This jerkiness occurs depending on the decoder structure, in which the amount of the decoder line buffer delay can be variable.

3.1 Decoder Line Buffer and Decoder behaviors

At Decoder, images are decoded only if there is data accumulated enough for one frame in the line buffer, or only if there are more than two PSCs in the line buffer. To prevent the line buffer from overflowing, Decoder Clock Frequency (or Decoder Frame Frequency) must be slightly higher than the input CIF frame frequency at Encoder. This prevents the decoder line buffer from underflowing automatically.



3.2 Decoded Image Display for Images without Frame Skipping

When a whole frame, like a test signal, is encoded and received in Decoder, Decoder works as follows.

Frame frequencies:

Encoder Input Frame Frequency	fs (29.97 Hz ± 50ppm),
Decoder Frame Frequency	fd (>fs),
Decoder Display Frame Frequency	fm (29.97 Hz ± 50ppm).

1) Decoder works so as the decoder line buffer to be empty, therefore a decoded frame is repeated once in several frames. Average frame repeat interval is

   Trepeat = 1/(fd-fs) sec.

2) At the display buffer (or Frame Synchronizer) the read reading clock fm is slower than the write clock fd. Therefore a decoded frame is discarded once in several frames, i.e., frame skipping occurs. Average frame skipping interval is

   Tdrop = 1/(fd-fm) sec.

3) From 1) and 2), in decoded images for the Sliding Bar sequence, Sliding Bar stops every Trepeat sec and jumps every Tdrop sec. Figure 1 shows the relation between the frame frequency difference and the interval of frame repeat / frame drop.

3.3 Examples

In Flexible Hardware fd can be set to be +50,000 ppm or +1,000 ppm against 29.97 Hz. Because fs is 29.9569 Hz (= 29.97 Hz - 437 ppm) in the Test Signal Generator, the interval of frame repeat / frame drop for each fd is summarized in the table blow. (fm is set at 29.97 Hz.)

fd	Trepeat	Tdrop	
+50,000 ppm	0.66 sec	0.66 sec	.... (shown at Redbank meeting)
+1,000 ppm	23.2 sec	33.3 sec	

3.4 Reduction of Decoder Buffer Delay

The time Tdec, required in reducing the Decoder Buffer Occupancy value by 10.7Kbits can be defined as follows using fd and fs.

Tdec = 1/(fd - fs) sec

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For larger value of fd, reduction speed is higher.(See Fig.1.)

4. Conclusion

Suitable Decoder Frame Frequency fd depends upon both the interval of frame repeat / frame drop the required time in reducing the decoder line buffer delay (See Doc.#287). The interval of frame repeat / frame drop and the required time are traded off. According to the discussion above, appropriate fd is +1,000ppm.

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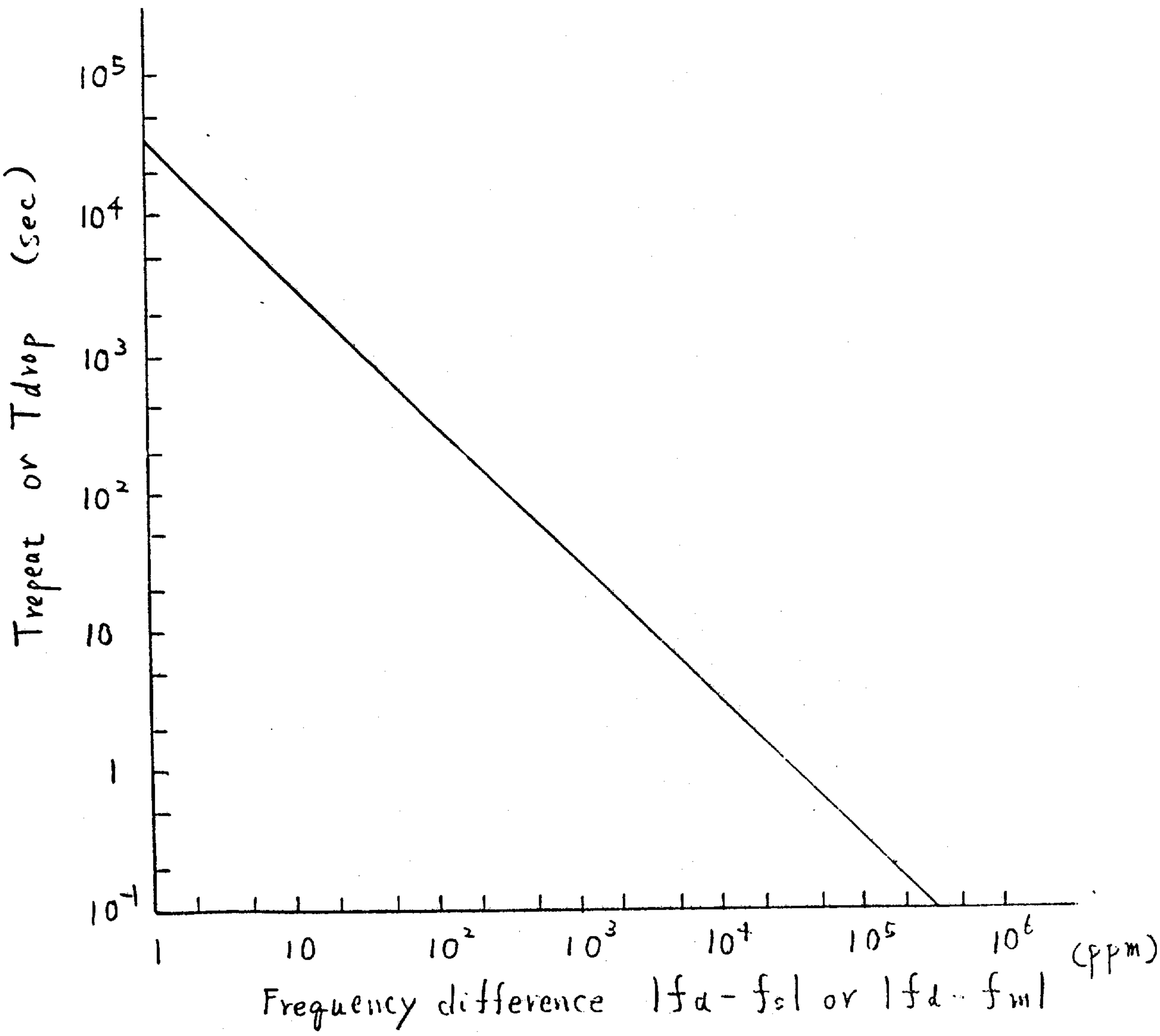

Figure 1 Trepeat / Tdrop vs. Decoder operation frame frequence fd