CCITT SG XV
Specialists Group on Coding
for Visual Telephony

Doc. No. 438
Dec. 88

Title: **About the Implementation of a Stuffing Codeword**

Source: FRG, F, UK, I, NL, N, S

The idea and the usefulness of a stuffing codeword has been widely accepted. But different demands must be considered for the specific implementation :

1. Coding hierarchy and application:

A stuffing codeword can be defined on different levels of coding hierarchy.

- The definition of a stuffing codeword on a GOB level is well suited for applications concerning multipoint conferencing. The possibility to insert stuffing codewords after the block data of each GOB satisfies the demands of combining four QCIF-pictures to one CIF picture.
- A more flexible technique for preventing buffer underflowing is the insertion of stuffing codewords on macro block basis. It enables the buffer control unit to keep the content of the transmitter buffer small. This significantly reduces the total time delay. The needs of multipoint conferencing can be fulfilled as well.

2. Hardware considerations:

- The use of stuffing codewords can cause problems with some kinds of decoders with prebuffer. When decoding is synchronized to a fixed internal block frequency and the decoder is designed to process not more than 64 coefficients during a block time, some problems might occur when a sequence of stuffing codewords must be processed in addition to the coefficients of the block. In this cases the stuffing codewords have to be removed before writing them into the receiver buffer. To enable removing without knowing anything about the context a unique sequence of bits has to be defined for the stuffing codeword.
- On the other hand, to keep the design of the decoder manageable the allowed positions for inserting stuffing codewords should be restricted, since the removing procedure has to be installed in all influenced code tables.

3. Codeword considerations:

The position of the stuffing codeword influences the choice of the codeword.

- On a GOB level, as proposed in CCITT Doc.#387, a not valid GOB header or Picture header is a good selection because decoding is always interrupted by a start code and continues depending on the group number without regarding any action taken before.
- Applying the same stuffing codeword on a macro block level would cause a complicated decoding sequence each time a start code appears. Two consecutive decoding cycles have to be taken into account (one for the start code and another one for the group number) before deciding whether to go back and continue with decoding macro blocks or to start

with a new GOB or picture. As a consequence stuffing on macro block basis should be done with a special unique codeword not derived from GoB or picture start codeword.

Conclusion:

The best solution for implementing a stuffing codeword is a unique codeword (no start code) which can be inserted at each position where a macro block address is expected.

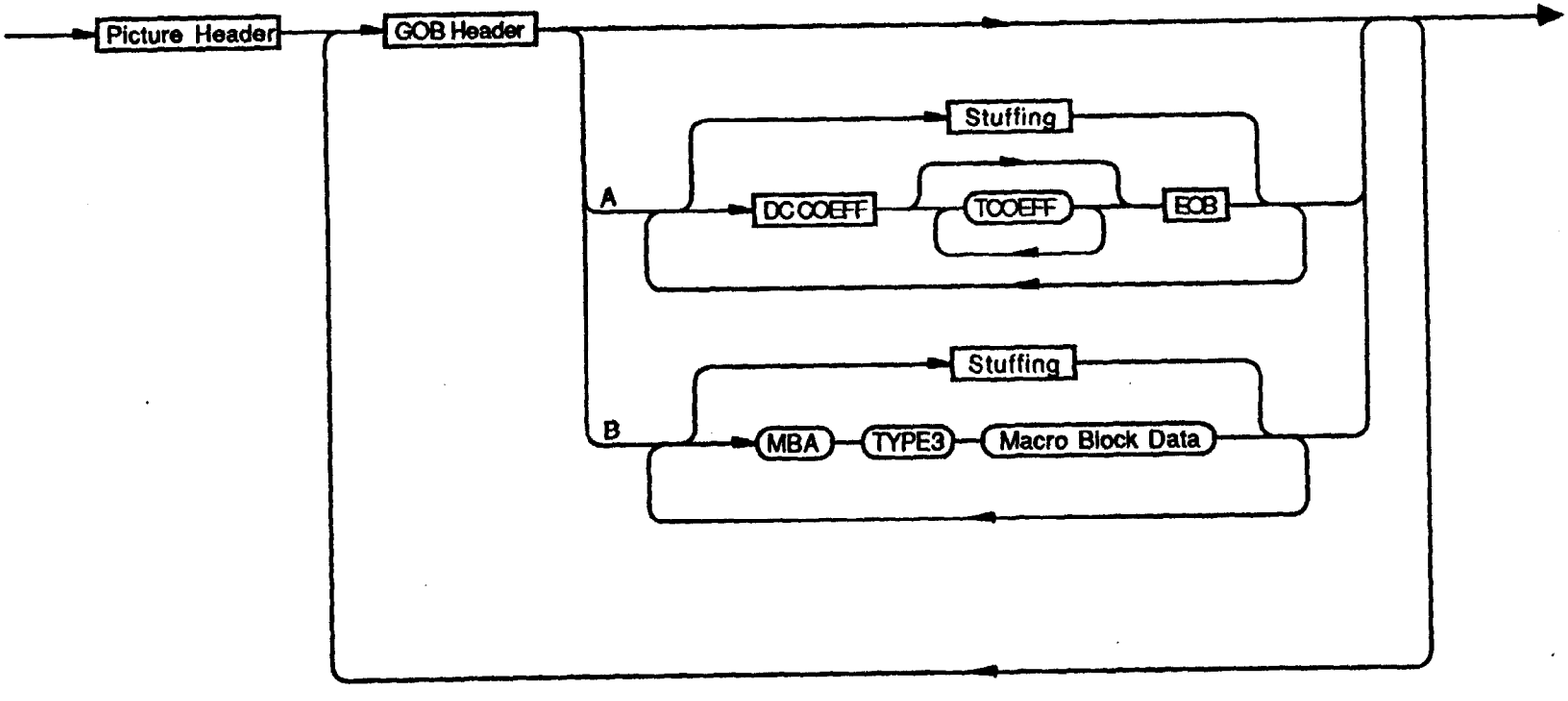
For completeness the insertion of a stuffing codeword should also be allowed in case that all blocks are coded in intra mode. In this case a stuffing codeword can occur at the position of an expected DC coefficient .

A syntax diagram is given to show the allowed positions graphically.

The special codeword is for further study.

## Multiplex Scheme with Stuffing

**Picture:**




A: All blocks of GOB "intra"
B: not A