

Efficient Transmitter Design Techniques in Digital Communication

Theresh Babu Benguluri, Sandeep Kumar, Siddharth Maurya, Sai Manasa, Raktim Goswami, Abhishek Bairagi, G V V Sharma*

CONTENTS

1	Interleaver/Deinterleaver	1
2	Physical Layer Framing(PLFRAMING)	1
3	Pulse Shaping	2
References		2

Abstract—A brief description about the Efficient Transmitter Design techniques. Which includes Interleaver/Deinterleaver for combating bursty errors, Physical Layer Framing for the efficient detection of Frame starting, and Pulse Shaping for combating the InterSymbol Interference.

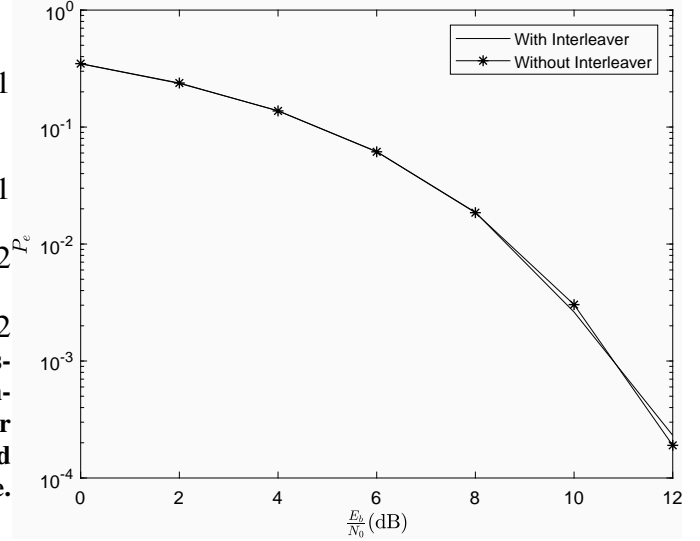


Fig. 1: Bit interleaver for 8PSK

1. INTERLEAVER/DEINTERLEAVER

For 8PSK, 16APSK, and 32APSK modulation formats, the output of the LDPC encoder shall be bit interleaved using a block interleaver. Data is serially written into the interleaver column-wise, and serially read out row-wise (the MSB of BBHEADER is read out first, except 8PSK rate 3/5 case where MSB of BBHEADER is read out third).

Fig. 1 shows the comparison of 8PSK mapping schem with interleaver and without interleaver.

The configuration of the block interleaver for each modulation format is specified [1].

2. PHYSICAL LAYER FRAMING(PLFRAMING)

- In order to form the PLFRAME which is used for receiver synchronization, a header is inserted in the beginning of each frame.
- If pilots are used, then a 36 symbols pilot field is inserted every 16 slots of data symbols.

*The author is with the Department of Electrical Engineering, Indian Institute of Technology, Hyderabad 502285 India e-mail: gadepall@iith.ac.in.

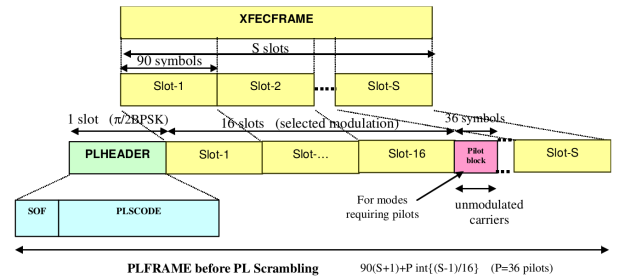


Fig. 2: Structure of PLFRAME.

Given that a PLFRAME cannot terminate to a pilot field, the total number of pilot fields is

$$\alpha_{PIL} = \left\lfloor \frac{(S-1)}{16} \right\rfloor$$

- The total length of the PLFRAME in symbols is

$$K = \begin{cases} 90 \times (S + 1) & \text{with out pilots} \\ 90 \times (S + 1) + 36 \times \alpha_{PIL} & \text{with pilots} \end{cases} \quad (2.1)$$

- The different frame formats, parameters of the

PARAMETERS OF THE *normal* AND *short* PLFRAME

	normal frame: $\eta_{LDPC} = 64800$ bits				short frame: $\eta_{LDPC} = 16200$ bits			
η_{MOD}	S	α_{PIL}	K	η (%)	S	α_{PIL}	K	η (%)
QPSK: 2	360	22	33282	97.35	90	5	8370	96.77
8PSK: 3	240	14	22194	97.32	60	3	5598	96.46
16APSK: 4	180	11	16686	97.09	45	2	4212	96.15
32APSK: 5	144	8	13338	97.17	36	2	3402	95.24

Fig. 3: paramters of plframe

normal andshort DVB-S2 frame for all constellation formats were tabulated in above table as specified in [1]

3. PULSE SHAPING

- After randomization, the signals shall be square root raised cosine filtered. The roll-off factor shall be $\alpha = 0,35, 0,25$ and $0,20$, depending on the service requirements.
- Suitable $H(f)$ will be choosen from the [1].

$$H(f) = \begin{cases} 1 & |f| < f_N(1 - \alpha) \\ \left\{ \frac{1}{2} + \frac{1}{2} \sin \frac{\pi}{2} \left[\frac{f_N - |f|}{\alpha} \right] \right\}^{\frac{1}{2}} & |f| = f_N(1 - \alpha) \\ 0 & |f| > f_N(1 - \alpha) \end{cases} \quad (3.1)$$

REFERENCES

- [1] A. Morello and V. Mignone, "DVB-S2X: The New Extensions to the Second Generation DVB Satellite Standard DVB-S2," *Int. J. Satell. Commun. Netw.*, vol. 34, no. 3, pp. 323–325, May 2016. [Online]. Available: <https://doi.org/10.1002/sat.1167>