
Project: IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)

Submission Title: TVWS-FSK SFD Selection

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Re: Presentation on SFD pattern selection for TG4m

Abstract: This contribution is prepared to demonstrate SFD pattern selection in TVWS-FSK PHY.

Purpose:

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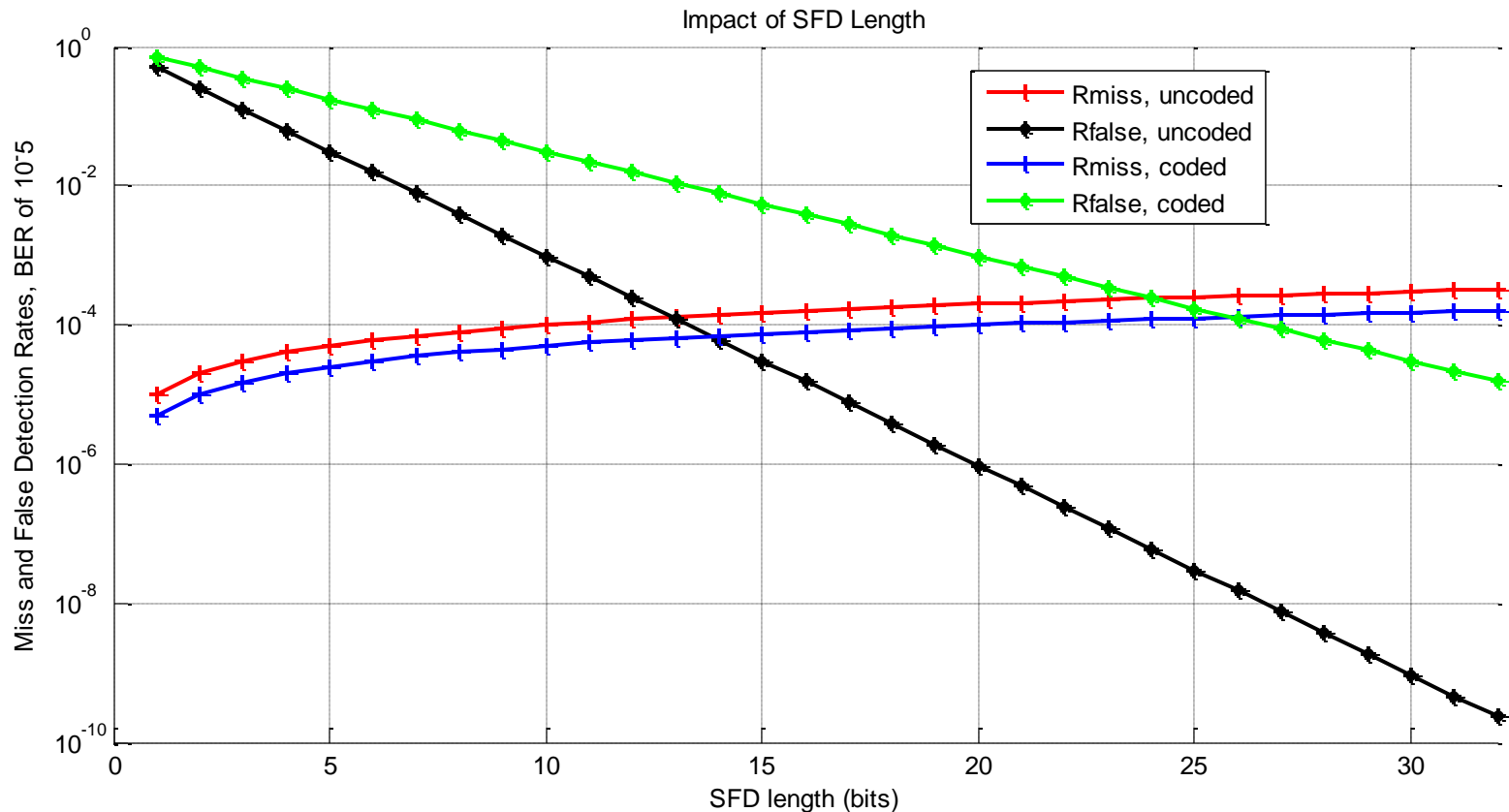
Desired Properties of TG4m FSK SFD

- Orthogonal SFD pair for un-coded and coded PPDU
- SFD length needs to be commensurate with the rest of the frame
- Balanced pattern
- Relatively short strings of 1's and 0's
- Good auto-correlation properties
- Low cross-correlation against preamble
- Low cross-correlation against self image

SFD Length

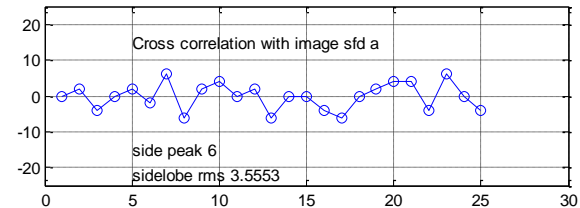
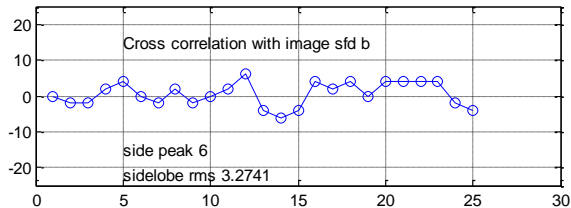
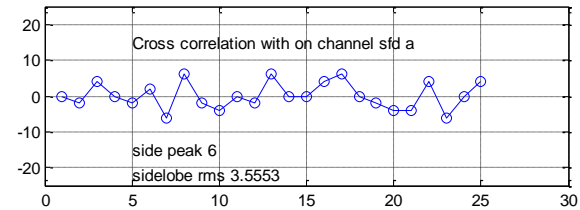
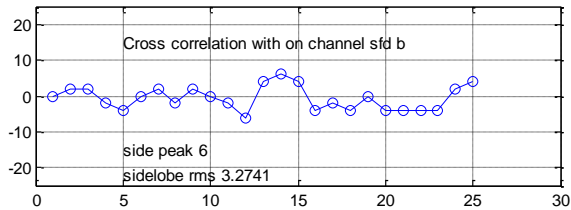
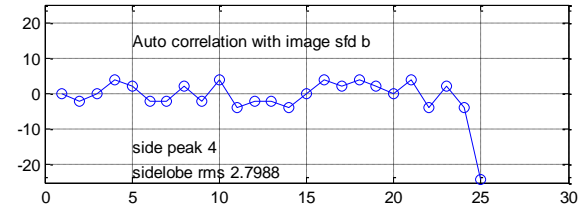
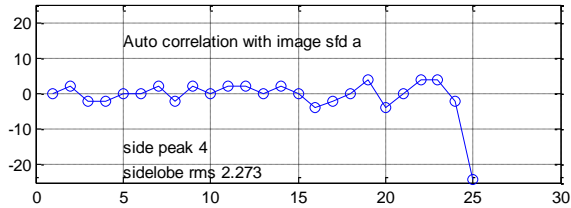
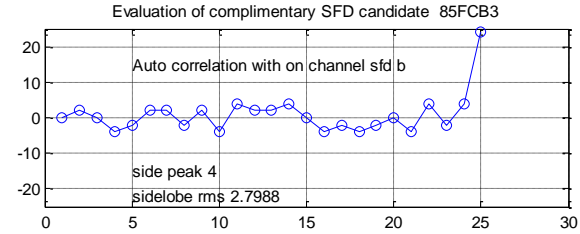
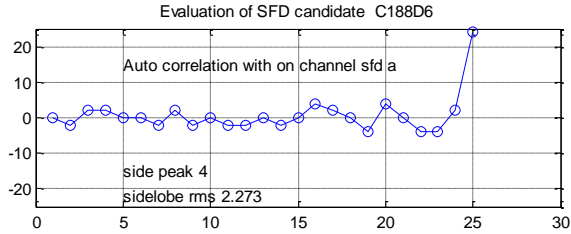
- SFD sequence length affects:
 - False detection rate R_{false} : detecting the start of a packet that is not really there
 - Missed detections rate R_{missed} : not detecting the presence of the packet
- SFD detection declared upon a match of the incoming stream with all of the bits in the SFD sequence or a fraction f thereof
- Assuming BER = bit error rate and n = length of SFD:
 - $R_{false} = 0.5^{n*f}$
 - $R_{miss} = 1 - (1 - BER)^{n*f} \sim n*f*BER$

SFD Length



- Cross-over points at 10^{-4} with $n=13$ for un-coded and $n=26$ for coded packets
- ***Recommend an SFD length of 3 bytes since FEC support is included.***

Identified SFD Pair: C188D6 and 85FCB3



Conclusions

- A 2-byte SFD pair from TG4g is included in the TVWS-FSK PHY for compatibility reasons.
- An optimized pair of SFD sequences is also included in the TVWS-FSK PHY.
- The proposed SFD pair uses a 3-byte length shown to be necessary for balancing coding gains.
- The proposed SFD pair is also demonstrated to have good correlation properties across desired dimensions.