# 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:**

# 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:

  - $R_{false} = 0.5^{n*f}$
  - $R_{miss} = 1 - (1 - BER)^{n*f} \sim n*f*BER$

Cristina Seibert
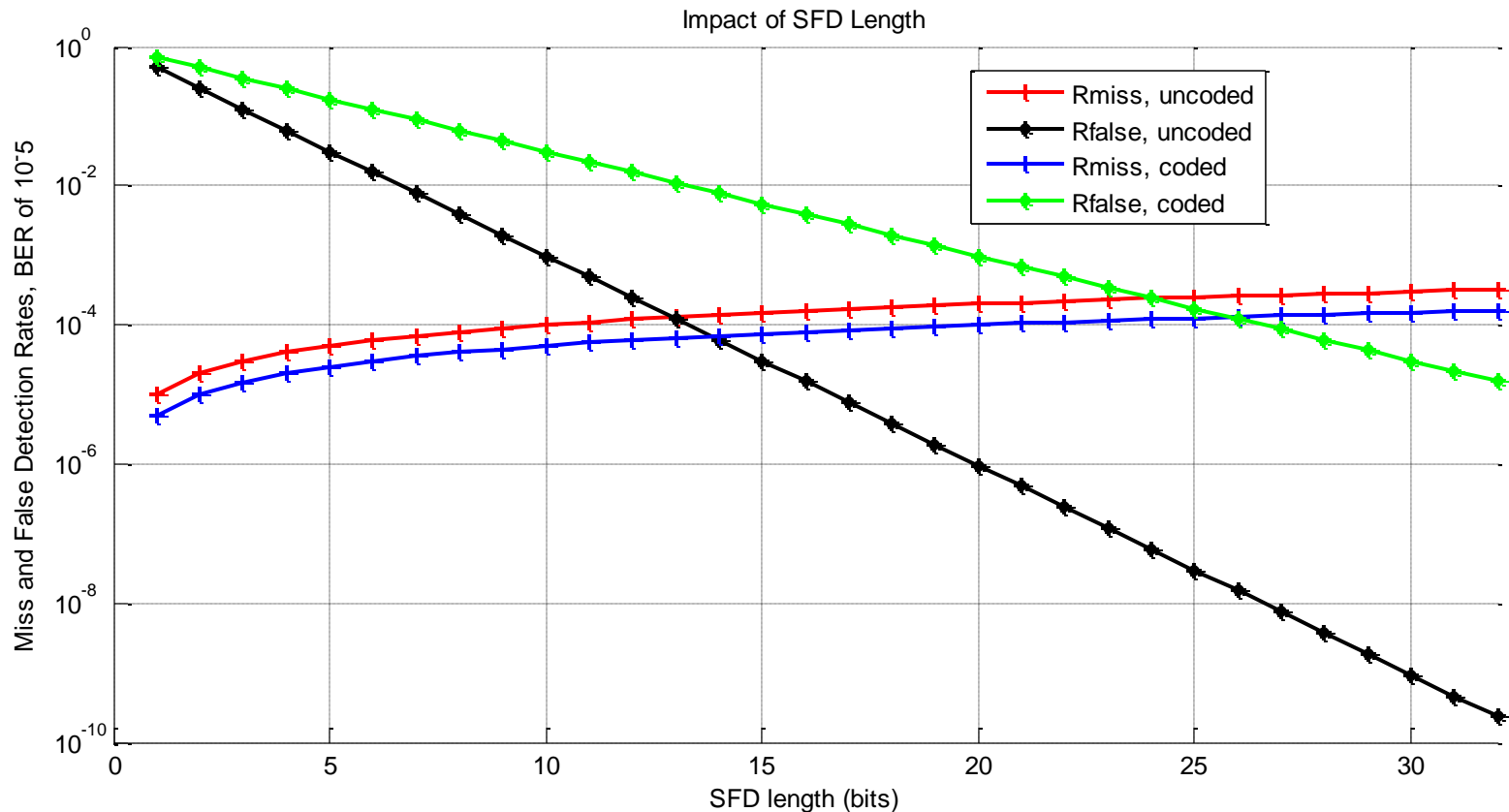
# SFD Length



- 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
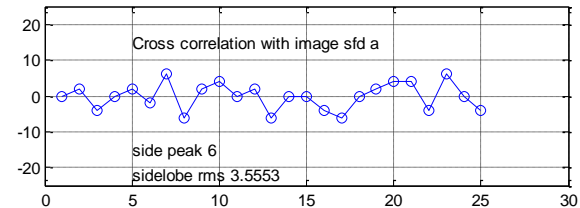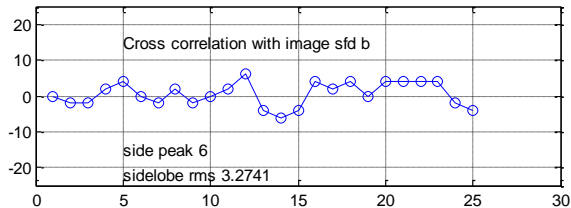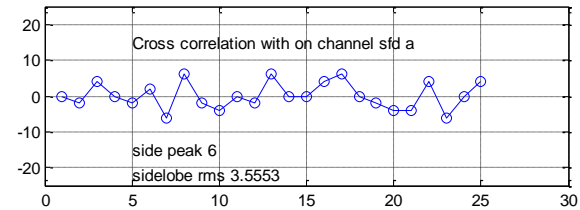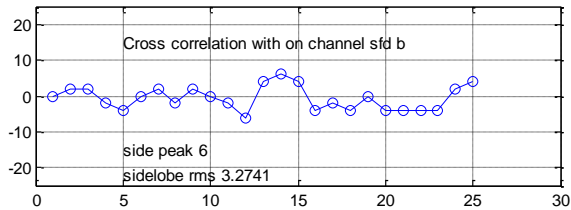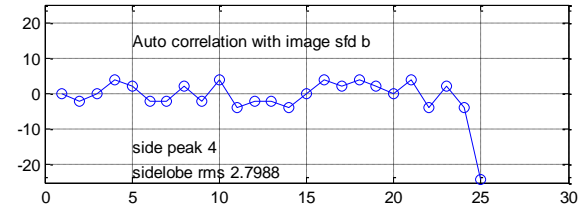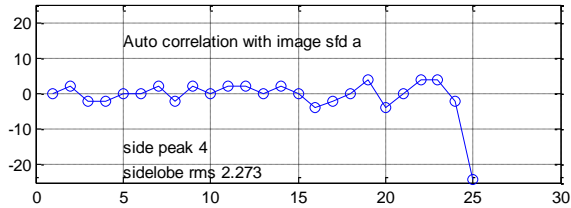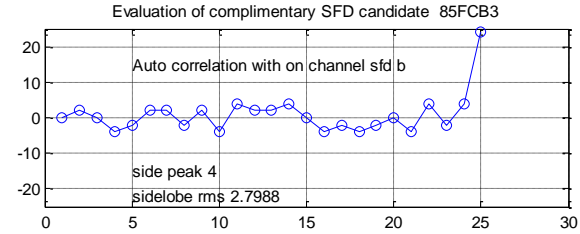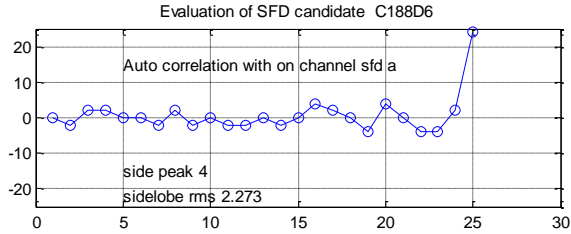
# Conclusions

- 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.