

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

Submission Title: TG4k FSK Proposal Enhancements

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Re: Recommendations to TG4k

Abstract: This contribution is prepared to identify recommendations to TG4k.

Purpose:

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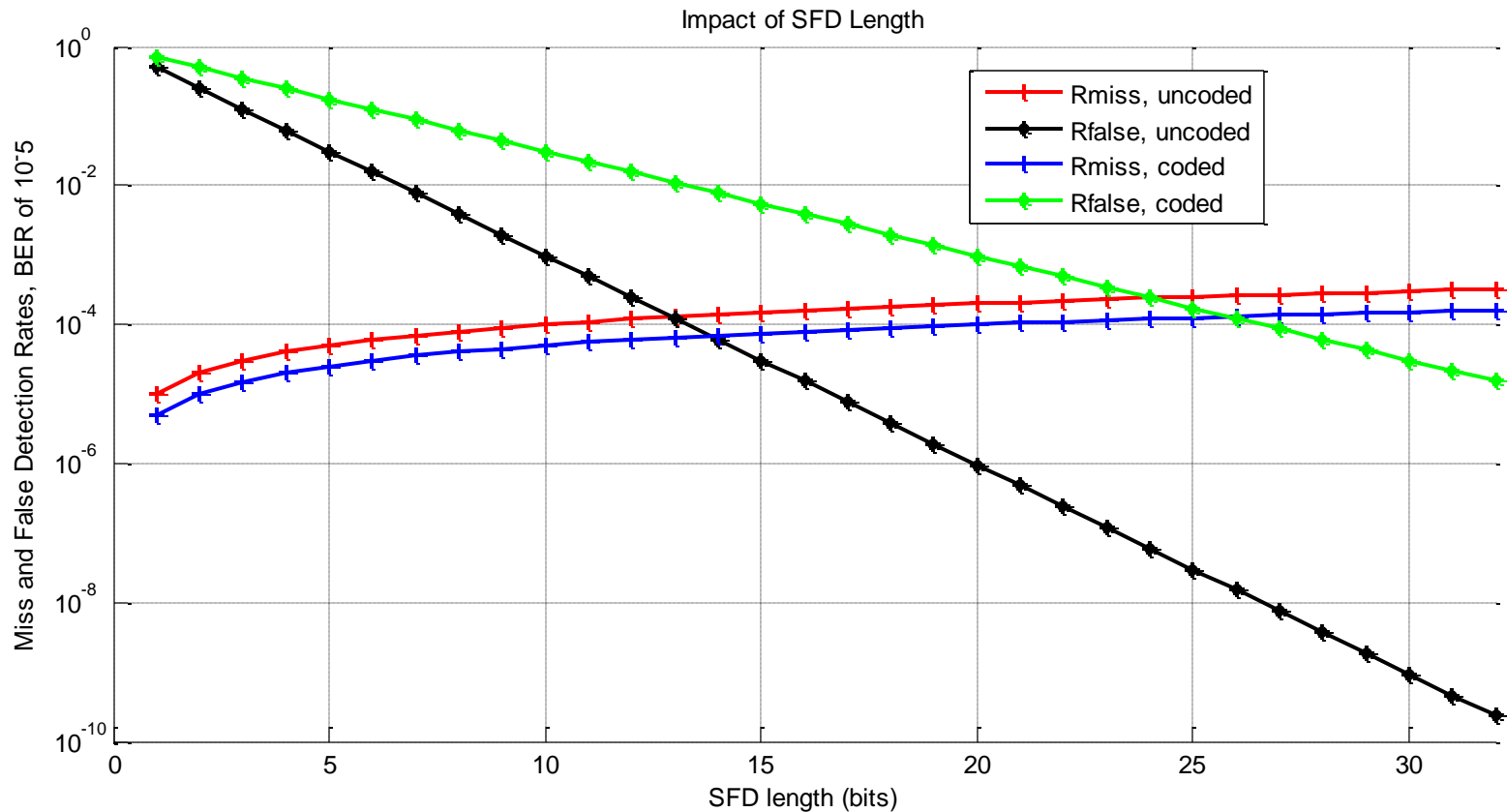
Introduction

- This work investigates aspects of the FSK proposal in TG4k.
- The areas investigated include:
 - Start Frame Delimiter (SFD) length
 - Channel spacing
 - Operating bands, modes
- This presentation makes recommendations to TG4k with regards to a number of parameters in the FSK proposal, including the SFD length and channel spacing.

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

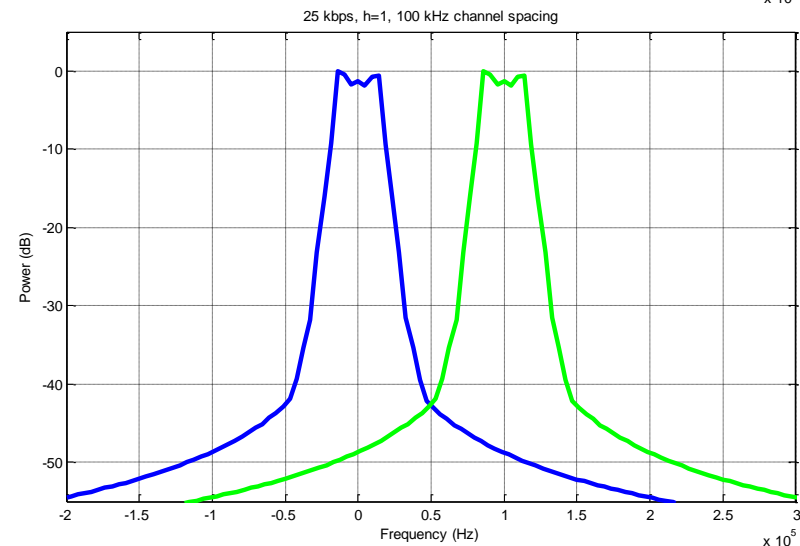
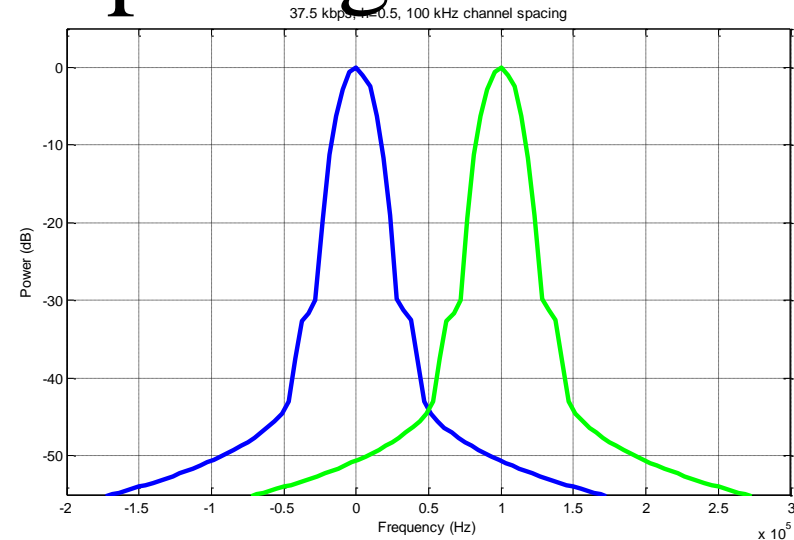
SFD Length



- 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 if FEC is included, otherwise 2 bytes.***

Channel Spacing

- Two channel spacings currently defined
 - 100 kHz in Europe
 - 200 kHz elsewhere
 - **Recommend using 100 kHz everywhere***
 - Spectral properties are suitable
 - Doubles the number of available channels
- * Except perhaps at 2.4 GHz (see later slide)



Missing Bands

- 433MHz ISM band
- 169MHz European band
- Recommend adding those bands

Modes at 2.4 GHz

- Much bandwidth available
- Yet crowded spectrum with interference issues
- Penetration issues also due to higher carrier frequency
- Channel availability less of an over-riding constraint
- Recommend using larger channel spacing, and higher signaling rates coupled with FEC coding or spreading to achieve the desired data rate.

Unsupported Modes

- Why is the 12.5kbps not supported from end device to coordinator?
- Some modes excluded because said not to meet regulatory requirements (e.g. European band).
- This leads to reduced functionality and inconsistent design.
- Recommend including support for all modes bi-directionally.

Conclusions

- Use a SFD length of 3 bytes iff FEC is included, otherwise 2 bytes.
- Use a channel spacing of 100 kHz in all bands except at 2.4 GHz where larger channel spacing and signaling rates should be used.
- Include support for all modes bi-directionally.
- Include missing bands such as the 433 MHz ISM band.