IEEE P802.15
Wireless Personal Area Networks

Project	IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)
Title	**Example of encoding a packet for the TVWS-FSK PHY**
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Re:	Comment Resolution for TG4m Letter Ballot
Abstract	This document presents example of the processing to generate TVWS-FSK packets.
Purpose	Example of packet encoding for the TVWS-FSK PHY
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Release	The contributor acknowledges and accepts that this contribution becomes the property of IEEE and may be made publicly available by P802.15.

List of Tables

Proposed resolution to CID 308 of the letter ballot 87: Accept in Principle. Create Annex T as shown below.

Annex T

(informative)

Example encoding a packet for the TVWS-FSK PHY

T.1 Introduction

The purpose of this annex is to show examples of encoding a packet for the TVWS-FSK PHY, as described in 20.1. All features are enabled in order to provide data for each feature of the PHY, with the bit sequences shown at each processing step.

The message encoded is a PSDU of 7 octets shown below. The message constitutes an acknowledgment frame with a 3-octet MHR and a 4-octet FCS, as defined in 5.2.1.9. The bit sequence of the example PSDU is: 0100 0000 0000 0000 0101 0110 0101 1101 0010 1001 1111 1010 0010 1000

The encoding illustration goes through the following stages:
a) Generating the bit sequence of the SHR.
b) Generating the bit sequence of the PHR.
c) Concatenating the PHR and tail bits, encoding and interleaving the concatenated sequence.
d) Concatenating the PSDU, tail and pad bits, encoding and interleaving the concatenated sequence.
e) Data whitening of the PSDU.
f) Spreading of the encoded and interleaved PHR and of the encoded, interleaved and data whitened PSDU.
g) Concatenation to form the PPDU.

The settings of the PIB attributes are also shown.

T.2 PIB Attribute Settings

For this example, selected PIB attributes are set as follows:

phyFSKPreambleLength=8
phyTVWSSFDLength = 24
phyFSKFECEnabled = TRUE

phyFSKScramblePSDU=TRUE
phyTVWSFSKSpreading=TRUE
phyTVWSFSKSpreadingFactor=8
phyTVWSFSKSpreadingPattern = NON_ALTERNATING

T.3 Stage a)

The bit sequence of the SHR, consisting of eight preamble octets and three SFD octets as described in 20.1.1.2, is given as:

0101 0101 0101 0101 0101 0101 0101 0101 0101 0101 0101 0101 0101 0101 0101 1100 0001 1000 1000 1101 0110

T.4 Stage b)

The Reserved field entry of the PHR is set to 0, the Ranging bit is set to 1, the FCS Type (FCS) field is set to (0) corresponding to a 4-octet FCS, the Data Whitening (DW) field is set to (1) (data whitening is used), and the Frame Length field entries are set to the binary representation of "7," corresponding to the PSDU length of the packet. The Parity Check field is set to the XOR of all the other bits in the PHR, resulting in a value of 1. The complete PHR field is shown in Table 1:

Table 1: PHR for scenario in this annex

Bit string index	0	1	2	3	4	5-15
Bit mapping	R_0	RNG	PC	FCS	DW	L_{10}-L_0
Field name	Reserved	Ranging	Parity Check	FCS Type	Data Whitening	Frame Length
Value	0	1	1	0	1	0 0 0 0 0 0 0 0 1 1 1

T.5 Stage c)

The PHR is concatenated with tail bits, and passed through the FEC encoder as described in 20.1.2.4. The resulting bit pattern is as follows:

0011 1010 1110 0110 1110 1100 0011 1001 0100 0101 0111

Subsequently, the coded sequence is interleaved as described in 20.1.2.5. The resulting bit pattern is as follows:

1011 1111 1001 0010 1111 0110 1101 0011 0011 0000 1000

T.6 Stage d)

The PSDU is concatenated with tail and pad bits, and passed through the FEC encoder described in 20.1.2.4. The bit sequence after convolutional coding is given as:

0011 0111 1100 1011 0000 0000 0000 0000 0011 0100 1000 1101 1011 1101 1001 1100 0010 0110 1001 1110 0111 0110 0000 1011 1010 0011 1110 1101 1110 1100 0000 0000 0000 0000 0000 0000

Interleaving is performed on the encoded PSDU as described in 20.1.2.5. The bit sequence after interleaving is given as:

0111 0010 0100 1010 0101 1001 0100 0110 0001 0100 0101 1000 0100 1101 0011 1010 0011 0010 0000 1100 0111 0011 0100 1110 0001 0000 1101 0010 0100 1001 0010 0100 0110 0010 1000 1101

T.7 Stage e)

Data whitening of the PSDU is performed as described in 20.1.3. The bit sequence after data whitening is given as:

0111 1101 0011 1010 1110 1010 0010 1001 0101 0111 1100 0000 0000 0101 1001 0100 1000 1110 1001 1011 0100 1011 0101 0011 1100 0011 0000 0110 1110 1001 0111 0001 0001 1111 1110 0101

T.8 Stage f)

Spreading of the encoded and interleaved PHR and encoded, interleaved and scrambled PSDU is performed as described in 20.1.2.6. The resulting bit sequence is as follows:

0100 1110 1011 0001 0100 1110 0100 1110 0100 1110 0100 1110 0100 1110 0100 1110 0100 1110 1011 0001 1011 0001 0100 1110 1011 0001 1011 0001 0100 1110 1011 0001 0100 1110 0100 1110 0100 1110 1011 0001 0100 1110 0100 1110 1011 0001 0100 1110 0100 1110 1011 0001 0100 1110 1011 0001 1011 0001 0100 1110 0100 1110 1011 0001 1011 0001 0100 1110 0100 1110 1011 0001 1011 0001 1011 0001 1011 0001 0100 1110 1011 0001 1011 0001 1011 0001 0100 1110 0100 1110 0100 1110 0100 1110 0100 1110 1011 0001 0100 1110 1011 0001 1011 0001 0100 1110 0100 1110 0100 1110 1011 0001 0100 1110 1011 0001 0100 1110 0100 1110 0100 1110 1011 0001 0100 1110 1011 0001 0100 1110 1011 0001 1011 0001 1011 0001 0100 1110 1011 0001 0100 1110 1011 0001 1011 0001 0100 1110 1011

0001 0100 1110 1011 0001 0100 1110 1011 0001 0100 1110 0100 1110 0100 1110 0100 1110
0100 1110 1011 0001 1011 0001 1011 0001 1011 0001 1011 0001 1011 0001 1011 0001 1011
0001 1011 0001 1011 0001 1011 0001 0100 1110 1011 0001 0100 1110 0100 1110 1011 0001
1011 0001 0100 1110 1011 0001 0100 1110 1011 0001 1011 0001 0100 1110 1011 0001 1011
0001 1011 0001 0100 1110 0100 1110 0100 1110 1011 0001 0100 1110 1011 0001 1011 0001
0100 1110 0100 1110 1011 0001 0100 1110 0100 1110 1011 0001 0100 1110 1011 0001 1011
0001 0100 1110 1011 0001 0100 1110 0100 1110 1011 0001 0100 1110 1011 0001 0100 1110
1011 0001 1011 0001 0100 1110 0100 1110 0100 1110 0100 1110 1011 0001 1011 0001 1011
0001 1011 0001 0100 1110 0100 1110 1011 0001 1011 0001 1011 0001 1011 0001 1011 0001
0100 1110 0100 1110 1011 0001 0100 1110 0100 1110 0100 1110 1011 0001 0100 1110 1011
0001 1011 0001 0100 1110 1011 0001 0100 1110 0100 1110 0100 1110 1011 0001 1011 0001
1011 0001 0100 1110 1011 0001 1011 0001 1011 0001 0100 1110 0100 1110 0100 1110 0100
1110 0100 1110 0100 1110 0100 1110 0100 1110 1011 0001 1011 0001 0100 1110 1011 0001
0100 1110

T.9 Stage g)

The sequence for the PPDU is given as:

0101 0101 0101 0101 0101 0101 0101 0101 0101 0101 0101 0101 0101 0101 0101 0101 1100
0001 1000 1000 1101 0110 0100 1110 1011 0001 0100 1110 0100 1110 0100 1110 0100 1110
0100 1110 0100 1110 0100 1110 1011 0001 1011 0001 0100 1110 1011 0001 1011 0001 0100
1110 1011 0001 0100 1110 0100 1110 0100 1110 0100 1110 1011 0001 0100 1110 0100 1110
1011 0001 0100 1110 0100 1110 1011 0001 0100 1110 1011 0001 1011 0001 0100 1110 0100
1110 1011 0001 1011 0001 0100 1110 0100 1110 1011 0001 0100 1110 1011 0001 1011 0001
0100 1110 1011 0001 1011 0001 1011 0001 1011 0001 0100 1110 0100 1110 0100 1110 0100
1110 0100 1110 1011 0001 0100 1110 1011 0001 1011 0001 0100 1110 0100 1110 0100 1110
1011 0001 0100 1110 1011 0001 0100 1110 0100 1110 0100 1110 1011 0001 0100 1110 1011
0001 0100 1110 1011 0001 1011 0001 1011 0001 1011 0001 0100 1110 1011 0001 0100 1110
1011 0001 0100 1110 1011 0001 0100 1110 1011 0001 0100 1110 0100 1110 0100 1110 0100
1110 0100 1110 0100 1110 0100 1110 1011 0001 1011 0001 1011 0001 1011 0001 1011 0001
1011 0001 1011 0001 1011 0001 1011 0001 1011 0001 0100 1110 1011 0001 0100 1110 1011
0001 0100 1110 1011 0001 0100 1110 1011 0001 1011 0001 0100 1110 1011 0001 1011 0001
0100 1110 1011 0001 1011 0001 1011 0001 0100 1110 0100 1110 0100 1110 1011 0001 0100
1110 1011 0001 1011 0001 0100 1110 0100 1110 1011 0001 0100 1110 0100 1110 0100 1110
1011 0001 1011 0001 1011 0001 1011 0001 0100 1110 0100 1110 1011 0001 1011 0001 1011
0001 1011 0001 1011 0001 0100 1110 0100 1110 1011 0001 0100 1110 0100 1110 0100 1110
1011 0001 0100 1110 1011 0001 1011 0001 0100 1110 1011 0001 0100 1110 0100 1110 0100
1110 1011 0001 1011 0001 1011 0001 0100 1110 1011 0001 1011 0001 1011 0001 1011 0001
0100 1110 0100 1110 0100 1110 0100 1110 0100 1110 0100 1110 1011 0001 1011 0001 1011
0001 0100 1110 1011 0001 0100 1110