

**IEEE P802.15**  
**Wireless Personal Area Networks**

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Re:	Comment Resolution for TG4g Sponsor Ballot	
Abstract	This document presents examples of the processing to generate FSK packets.	
Purpose	Proposed resolution for Comment ID 36	
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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.	

Proposed resolution to CID 36: Revised. Create Annex M as shown below.

## Annex M

(informative)

### Examples of encoding a frame for the MR-FSK PHY

This annex provides 14 examples of encoding a frame for the MR-FSK PHY as described in 16.1. In particular, generation of the PPDU bit sequence is described in detail. The first 6 examples use no coding, and the last 8 examples use convolutional coding. The examples are numbered from M.1 to M.14 and correspond to the scenarios in Table M.1. The frequency band used in these examples is the 915 MHz band, and these examples use Operating Mode #1 for the 2FSK examples.

In these examples, all binary sequences of length  $n$  are treated as bit strings:

$b_0 b_1 \dots b_{n-1}$

The corresponding entries are processed  $b_0$  first to  $b_{n-1}$  last.

In all these examples mode switch is not used, and the 4-octet FCS is used. In addition, the PIB attribute `phyFSKpreambleLength` is set to 4 so that 4 octets are used for all preambles.

**Table M.1 – Scenarios for MR-FSK**

Example Number	Modulation	Coding	Interleaving	Data Whitening	phyMRFKSFDF
M.1	2FSK	None	Off	Off	0
M.2	2FSK	None	Off	Off	1
M.3	2FSK	None	Off	On	1
M.4	4FSK	None	Off	Off	0
M.5	4FSK	None	Off	Off	1
M.6	4FSK	None	Off	On	0
M.7	2FSK	NRNSC	On	Off	1
M.8	2FSK	NRNSC	On	On	0
M.9	2FSK	RSC	Off	Off	0
M.10	2FSK	RSC	Off	On	0
M.11	2FSK	RSC	On	Off	0
M.12	2FSK	RSC	On	On	0
M.13	4FSK	NRNSC	On	Off	0
M.14	4FSK	NRNSC	On	On	0

In all examples 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:

- Generating the bit sequence of the SHR
- Generating the bit sequence of the PHR
- Generating the bit sequence of the PSDU
- Concatenating the PHR, PSDU, tail bits and pad bits
- Encoding the bit sequence of the PSDU with a rate  $\frac{1}{2}$  convolutional encoder (if necessary)
- Interleaving of the code-bit sequence (if necessary)
- Performing data whitening of the bits after the header (if necessary)

- h) Concatenation to form the PPDU
- i) mapping pairs of bits to symbols for 4FSK (if necessary)

## M.1 Example of 2FSK with no coding, no interleaving, no data whitening, and phyMRFSKSFD=0

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

```

phyFSKFECEnabled = FALSE
phyFSKFECScheme=0
phyFSKScramblePSDU=FALSE
phyMRFSKSFD = 0

```

### M.1.1 Generation of the SHR

The bit sequence of the SHR, consisting of four preamble octets and two SFD octets, is given as  
0101 0101 0101 0101 0101 0101 0101 0101 1001 0000 0100 1110

### M.1.2 Generation of the PHR

The Mode Switch (MS) field is set to (0) (no mode switch), the Reserved field entries are set to (0,0), the FCS Type (FCS) field is set to (0) corresponding to a 4-octet FCS, the Data Whitening (DW) field is set to (0) (data whitening is not used), and the Frame Length field entries are set to the binary representation of “7,” corresponding to the PSDU length of the packet. The complete PHR field is shown in Table M.2

**Table M.2 – PHR for MR-FSK**

Bit string index	0	1-2	3	4	5-15
Bit mapping	MS	R <sub>1</sub> -R <sub>0</sub>	FCS	DW	L <sub>10</sub> -L <sub>0</sub>
Field name	Mode Switch	Reserve d	FCS Type	Data Whitening	Frame Length
Value	0	0 0	0	0	0 0 0 0 0 0 0 0 1 1 1

### M.1.3 Concatenating the SHR with the PHR and PSDU

The bit sequence for the PPDU is given as

```

0101 0101 0101 0101 0101 0101 0101 0101 0101 1001 0000 0100 1110 0000 0000 0000 0111 0100 0000 0000 0000
0101 0110 0101 1101 0010 1001 1111 1010 0010 1000

```

## M.2 Example of 2FSK with no coding, no interleaving, no data whitening, and phyMRFSKSFD=1

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

```

phyFSKFECEnabled = FALSE
phyFSKFECScheme=0
phyFSKScramblePSDU=FALSE
phyMRFSKSFD = 1

```

### M.2.1 Generation of the SHR

The bit sequence of the SHR, consisting of four preamble octets and two SFD octets, is given as  
0101 0101 0101 0101 0101 0101 0101 0101 0111 1010 0000 1110

### M.2.2 Generation of the PHR

The bit sequence of the PHR is generated as in Table M.2 and is  
0000 0000 0000 0111

### M.2.3 Concatenating the SHR with the PHR and PSDU

The bit sequence for the PPDU is given as

```
0101 0101 0101 0101 0101 0101 0101 0101 0111 1010 0000 1110 0000 0000 0000 0111 0100 0000 0000 0000
0101 0110 0101 1101 0010 1001 1111 1010 0010 1000
```

### M.3 Example of 2FSK with no coding, no interleaving, data whitening, and phyMRFSKSFD=1

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

```
phyFSKFECEnabled = FALSE
phyFSKFECScheme=0
phyFSKScramblePSDU=TRUE
phyMRFSKSFD = 1
```

#### M.3.1 Generation of the SHR

The bit sequence of the SHR, consisting of four preamble octets and two SFD octets, is given as

```
0101 0101 0101 0101 0101 0101 0101 0101 0111 1010 0000 1110
```

#### M.3.2 Generation of the PHR

The Mode Switch (MS) field is set to (0) (no mode switch), the Reserved field entries are set to (0,0), 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 complete PHR field is shown in Table M.3

**Table M.3– PHR for MR-FSK**

Bit string index	0	1-2	3	4	5-15
Bit mapping	MS	R <sub>1</sub> -R <sub>0</sub>	FCS	DW	L <sub>10</sub> -L <sub>0</sub>
Field name	Mode Switch	Reserve d	FCS Type	Data Whitening	Frame Length
Value	0	0 0	0	1	0 0 0 0 0 0 0 0 1 1 1

#### M.3.3 Applying data whitening to the PSDU

The bit sequence of the example PSDU is

```
0100 0000 0000 0000 0101 0110 0101 1101 0010 1001 1111 1010 0010 1000
```

Data whitening is applied as in 16.1.3. The bit sequence for the PSDU after data whitening is given as

```
0100 1111 0111 0000 1110 0101 0011 0010 0110 1010 0110 0010 0110 0000
```

#### M.3.4 Concatenating the SHR with the PHR and PSDU

The bit sequence for the PPDU is given as

```
0101 0101 0101 0101 0101 0101 0101 0101 0101 0111 1010 0000 1110 0000 1000 0000 0111 0100 1111 0111 0000
1110 0101 0011 0010 0110 1010 0110 0010 0110 0000
```

### M.4 Example of 4FSK with no coding, no interleaving, no data whitening, and phyMRFSKSFD=0

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

```
phyFSKFECEnabled = FALSE
phyFSKFECScheme=0
phyFSKScramblePSDU=FALSE
phyMRFSKSFD = 0
```

#### M.4.1 Generation of the SHR

The preamble consists of phyFSKPreambleLength (which is 4 in these examples) multiples of the 16-bit sequence 0111 0111 0111 0111

The SFD bit sequence is  
1101 0111 0101 0101 0111 0101 1111 1101

The SHR is given as  
0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 1101 0111 0101 0101  
0111 0101 1111 1101

#### M.4.2 Generation of the PHR

The bit sequence of the PHR is generated as in Table M.2 and is  
0000 0000 0000 0111

#### M.4.3 Generation of the PSDU

The bit sequence of the PSDU is  
0100 0000 0000 0000 0101 0110 0101 1101 0010 1001 1111 1010 0010 1000

#### M.4.4 Concatenating the SHR with the PHR and PSDU

The bit sequence for the PPDU is given as  
0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 1101 0111 0101 0101  
0111 0101 1111 1101 0000 0000 0000 0111 0100 0000 0000 0000 0101 0110 0101 1101 0010 1001 1111 1010  
0010 1000

### M.5 Example of 4FSK with no coding, no interleaving, no data whitening, and phyMRFSKSFD=1

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

```
phyFSKFECEnabled = FALSE
phyFSKFECScheme=0
phyFSKScramblePSDU=FALSE
phyMRFSKSFD = 1
```

#### M.5.1 Generation of the SHR

The preamble consists of phyFSKPreambleLength (which is 4 in these examples) multiples of the 16-bit sequence 0111 0111 0111 0111

The SFD bit sequence is  
0111 1111 1101 1101 0101 0101 1111 1101

The bit sequence of the SHR is given as

0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 1111 1101 1101  
0101 0101 1111 1101

### M.5.2 Generation of the PHR

The bit sequence of the PHR is generated as in Table M.2 and is  
0000 0000 0000 0111

### M.5.3 Generation of the PSDU

The bit sequence of the PSDU is  
0100 0000 0000 0000 0101 0110 0101 1101 0010 1001 1111 1010 0010 1000

### M.5.4 Concatenating the SHR with the PHR and PSDU

The bit sequence for the PPDU is given as  
0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 1111 1101 1101  
0101 0101 1111 1101 0000 0000 0000 0111 0100 0000 0000 0000 0101 0110 0101 1101 0010 1001 1111 1010  
0010 1000

## M.6 Example of 4FSK with no coding, no interleaving, data whitening, and phyMRFSKSFD=0

For this example, selected PIB attributes are set as follows:  
phyFSKFECEnabled = FALSE  
phyFSKFECScheme=0  
phyFSKScramblePSDU=TRUE  
phyMRFSKSFD = 0

### M.6.1 Generation of the SHR

The bit sequence of the SHR is given as  
0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 1101 0111 0101 0101  
0111 0101 1111 1101

### M.6.2 Generation of the PHR

The bit sequence of the PHR is generated as in Table M.3 and is  
0000 1000 0000 0111

### M.6.3 Generation of the PSDU

The bit sequence of the PSDU is  
0100 0000 0000 0000 0101 0110 0101 1101 0010 1001 1111 1010 0010 1000

Data whitening is applied as in 16.1.3. The bit sequence for the PSDU after data whitening is given as  
0100 1111 0111 0000 1110 0101 0011 0010 0110 1010 0110 0010 0110 0000

### M.6.4 Concatenating the SHR with the PHR and PSDU

The bit sequence for the PPDU is given as  
0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 1101 0111 0101 0101  
0111 0101 1111 1101 0000 1000 0000 0111 0100 1111 0111 0000 1110 0101 0011 0010 0110 1010 0110 0010

0110 0000

All of the following examples employ convolutional coding.

## **M.7 Example of 2FSK with NRNSC coding, interleaving, no data whitening, and phyMRFSKSFD=1**

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

```
phyFSKFECEnabled = TRUE
phyFSKFECScheme=0
phyFSKScramblePSDU=FALSE
phyMRFSKSFD = 1
```

### **M.7.1 Generation of the SHR**

The bit sequence of the SHR, consisting of four preamble octets and two SFD octets, is given as  
0101 0101 0101 0101 0101 0101 0101 0101 0110 0011 0010 1101

### **M.7.2 Generation of the PHR**

The bit sequence of the PHR is generated as in Table M.2 and is  
0000 0000 0000 0111

### **M.7.3 Concatenating the PHR, PSDU, tail bits, and pad bits**

Concatenation of the PHR, PSDU, tail bits, and pad bits is performed as described in 16.1.2.4. After concatenation the bit sequence is given as

0000 0000 0000 0111 0100 0000 0000 0000 0101 0110 0101 1101 0010 1001 1111 1010 0010 1000 0000 1011

### **M.7.4 Encoding of the bit sequence**

Convolutional coding is performed as described in 16.1.2.4. The bit sequence after convolutional coding is given as

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

### **M.7.5 Interleaving of the bit sequence**

Interleaving is performed as described in 16.1.2.5. The bit sequence after interleaving is given as

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

### **M.7.6 Concatenating the SHR with the PHR and PSDU**

The bit sequence for the PPDU is given as

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

## **M.8 Example of 2FSK with NRNSC coding, interleaving, data whitening, and phyMRFSKSFD=0**

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

```
phyFSKFECEnabled = TRUE
phyFSKFECScheme=0
phyFSKScramblePSDU=TRUE
```

phyMRFSKSFD = 0

### M.8.1 Generation of the SHR

The bit sequence of the SHR, consisting of four preamble octets and two SFD octets, is given as  
0101 0101 0101 0101 0101 0101 0101 0101 0110 1111 0100 1110

### M.8.2 Generation of the PHR

The bit sequence of the PHR is generated as in Table M.3 and is  
0000 1000 0000 0111

### M.8.3 Concatenating the PHR, PSDU, tail bits, and pad bits

Concatenation of the PHR, PSDU, tail bits, and pad bits is performed as described in 16.1.2.4. After concatenation the bit sequence is given as

0000 1000 0000 0111 0100 0000 0000 0000 0101 0110 0101 1101 0010 1001 1111 1010 0010 1000 0000 1011

### M.8.4 Encoding of the bit sequence

Convolutional coding is performed as described in 16.1.2.4. The bit sequence after convolutional coding is given as  
1111 1111 0010 0000 1111 1111 1100 0110 1000 0100 0011 1111 1111 1111 1111 1111 1100 1011 0111 1001  
1111 1011 1010 1000 0100 1110 1101 0011 0110 0101 0110 0001 0000 0010 1101 0000 1111 1111 0010 1110

### M.8.5 Interleaving of the bit sequence

Interleaving is performed as described in 16.1.2.5. The bit sequence after interleaving is given as

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

### M.8.6 Applying data whitening to the PSDU

Data whitening is applied as in 16.1.3. Note that data whitening is not applied to the header, and the 16-bit header becomes 32 bits after the convolutional coding. The bit sequence for the PSDU after data whitening is given as

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

### M.8.7 Concatenating the SHR with the PHR and PSDU

The bit sequence for the PPDU is given as

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

## M.9 Example of 2FSK with RSC coding, no interleaving, no data whitening, and phyMRFSKSFD=0

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

```
phyFSKFECEnabled = TRUE  
phyFSKFECScheme=1  
phyFSKFECInterleavingRSC=FALSE  
phyFSKScramblePSDU=FALSE  
phyMRFSKSFD = 0
```

### M.9.1 Generation of the SHR

The bit sequence of the SHR, consisting of four preamble octets and two SFD octets, is given as  
0101 0101 0101 0101 0101 0101 0101 0101 0110 1111 0100 1110



**M.9.2 Generation of the PHR**

The bit sequence of the PHR is generated as in Table M.2 and is

```
0000 0000 0000 0111
```

**M.9.3 Concatenating the PHR, PSDU, tail bits, and pad bits**

Concatenation of the PHR, PSDU, tail bits, and pad bits is performed as described in 16.1.2.4. After concatenation the bit sequence is given as

```
0000 0000 0000 0111 0100 0000 0000 0000 0101 0110 0101 1101 0010 1001 1111 1010 0010 1000 1100 1011
```

**M.9.4 Encoding of the bit sequence**

Convolutional coding is performed as described in 16.1.2.4. The bit sequence after convolutional coding is given as

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

**M.9.5 Concatenating the SHR with the PHR and PSDU**

The bit sequence for the PPDU is given as

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

**M.10 Example of 2FSK with RSC coding, no interleaving, data whitening, and phyMRFSKSFD=0**

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

```
phyFSKFECEnabled = TRUE
phyFSKFECScheme=1
phyFSKFECInterleavingRSC=FALSE
phyFSKScramblePSDU=TRUE
phyMRFSKSFD = 0
```

**M.10.1 Generation of the SHR**

The bit sequence of the SHR, consisting of four preamble octets and two SFD octets, is given as

```
0101 0101 0101 0101 0101 0101 0101 0101 0110 1111 0100 1110
```

**M.10.2 Generation of the PHR**

The bit sequence of the PHR is generated as in Table M.3 and is

```
0000 1000 0000 0111
```

**M.10.3 Concatenating the PHR, PSDU, tail bits, and pad bits**

Concatenation of the PHR, PSDU, tail bits, and pad bits is performed as described in 16.1.2.4. After concatenation the bit sequence is given as

```
0000 1000 0000 0111 0100 0000 0000 0000 0101 0110 0101 1101 0010 1001 1111 1010 0010 1000 0100 1011
```

**M.10.4 Encoding of the bit sequence and data whitening**

Convolutional coding is performed as described in 16.1.2.4 followed by data whitening as described in 16.1.3. The bit sequence after convolutional coding and data whitening is given as

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

**M.10.5 Concatenating the SHR with the PHR and PSDU**

The bit sequence for the PPDU is given as

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

### **M.11 Example of 2FSK with RSC coding, interleaving, no data whitening, and phyMRFSKSFD=0**

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

```
phyFSKFECEnabled = TRUE
phyFSKFECScheme=1
phyFSKFECInterleavingRSC=TRUE
phyFSKScramblePSDU=FALSE
phyMRFSKSFD = 0
```

#### **M.11.1 Generation of the SHR**

The bit sequence of the SHR, consisting of four preamble octets and two SFD octets, is given as

```
0101 0101 0101 0101 0101 0101 0101 0101 0110 1111 0100 1110
```

#### **M.11.2 Generation of the PHR**

The bit sequence of the PHR is generated as in Table M.2 and is

```
0000 0000 0000 0111
```

#### **M.11.3 Concatenating the PHR, PSDU, tail bits, and pad bits**

Concatenation of the PHR, PSDU, tail bits, and pad bits is performed as described in 16.1.2.4. After concatenation the bit sequence is given as

```
0000 0000 0000 0111 0100 0000 0000 0000 0101 0110 0101 1101 0010 1001 1111 1010 0010 1000 1100 1011
```

#### **M.11.4 Encoding of the bit sequence**

Convolutional coding is performed as described in 16.1.2.4. The bit sequence after convolutional coding is given as

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

#### **M.11.5 Interleaving of the bit sequence**

Interleaving is performed as described in 16.1.2.5. The bit sequence after interleaving is given as

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

#### **M.11.6 Concatenating the SHR with the PHR and PSDU**

The bit sequence for the PPDU is given as

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

### **M.12 Example of 2FSK with RSC coding, interleaving, data whitening, and phyMRFSKSFD=0**

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

```
phyFSKFECEnabled = TRUE
phyFSKFECScheme=1
```

```

phyFSKFECInterleavingRSC=TRUE
phyFSKScramblePSDU=TRUE
phyMRFSKSFD = 0

```

### M.12.1 Generation of the SHR

The bit sequence of the SHR, consisting of four preamble octets and two SFD octets, is given as  
0101 0101 0101 0101 0101 0101 0101 0101 0110 1111 0100 1110

### M.12.2 Generation of the PHR

The bit sequence of the PHR is generated as in Table M.3 and is  
0000 1000 0000 0111

### M.12.3 Concatenating the PHR, PSDU, tail bits, and pad bits

Concatenation of the PHR, PSDU, tail bits, and pad bits is performed as described in 16.1.2.4. After concatenation the bit sequence is given as

```
0000 1000 0000 0111 0100 0000 0000 0000 0101 0110 0101 1101 0010 1001 1111 1010 0010 1000 0100 1011
```

### M.12.4 Encoding of the bit sequence, interleaving, and data whitening

Convolutional coding is performed as described in 16.1.2.4 followed by interleaving as described in 16.1.2.5 and data whitening as described in 16.1.3. The bit sequence after convolutional coding and data whitening is given as  
1100 0000 1110 1000 0110 1000 0000 1100 1010 0101 1101 1010 1011 0000 0110 1111 1001 0000 1001 1100  
0001 1111 1110 0110 1010 1010 0100 1100 1010 0000 1110 1001 1001 1001 1001 1111 0001 0010 1001 1011

### M.12.5 Concatenating the SHR with the PHR and PSDU

The bit sequence for the PPDU is given as

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

## M.13 Example of 4FSK with NRNSC coding, interleaving, no data whitening, and phyMRFSKSFD=0

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

```

phyFSKFECEnabled = TRUE
phyFSKFECScheme=0
phyFSKScramblePSDU=FALSE
phyMRFSKSFD = 0

```

### M.13.1 Generation of the SHR

The preamble consists of phyFSKPreambleLength (which is 4 in these examples) multiples of the 16-bit sequence  
0111 0111 0111 0111

The SFD bit sequence is

```
0111 1101 1111 1111 0111 0101 1111 1101
```

The bit sequence of the SHR is given as

```
0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 1101 1111 1111
0111 0101 1111 1101
```

### M.13.2 Generation of the PHR

The bit sequence of the PHR is generated as in Table M.2 and is  
0000 0000 0000 0111

### M.13.3 Concatenating the PHR, PSDU, tail bits, and pad bits

Concatenation of the PHR, PSDU, tail bits, and pad bits is performed as described in 16.1.2.4. After concatenation the bit sequence is given as

0000 0000 0000 0111 0100 0000 0000 0000 0101 0110 0101 1101 0010 1001 1111 1010 0010 1000 0000 1011

### M.13.4 Encoding of the bit sequence

Convolutional coding is performed as described in 16.1.2.4. The bit sequence after convolutional coding is given as

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

### M.13.5 Interleaving of the bit sequence

Interleaving is performed as described in 16.1.2.5. The bit sequence after interleaving is given as

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

### M.13.6 Concatenating the SHR with the PHR and PSDU

The bit sequence for the PPDU is given as

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

## M.14 Example of 4FSK with NRNSC coding, interleaving, data whitening, and phyMRFSSFD=0

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

phyFSKFECEnabled = TRUE  
phyFSKFECScheme=0  
phyFSKScramblePSDU=TRUE  
phyMRFSSFD = 0

### M.14.1 Generation of the SHR

The preamble consists of phyFSKPreambleLength (which is 4 in these examples) multiples of the 16-bit sequence  
0111 0111 0111 0111

The SFD bit sequence is

0111 1101 1111 1111 0111 0101 1111 1101

The bit sequence of the SHR is given as

0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 0111 1101 1111 1111  
0111 0101 1111 1101

### M.14.2 Generation of the PHR

The bit sequence of the PHR is generated as in Table M.3 and is

0000 1000 0000 0111

**M.14.3 Concatenating the PHR, PSDU, tail bits, and pad bits**

Concatenation of the PHR, PSDU, tail bits, and pad bits is performed as described in 16.1.2.4. After concatenation the bit sequence is given as

```
0000 1000 0000 0111 0100 0000 0000 0000 0101 0110 0101 1101 0010 1001 1111 1010 0010 1000 0000 1011
```

**M.14.4 Encoding of the bit sequence**

Convolutional coding is performed as described in 16.1.2.4. The bit sequence after convolutional coding is given as

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

**M.14.5 Interleaving of the bit sequence**

Interleaving is performed as described in 16.1.2.5. The bit sequence after interleaving is given as

```
1011 0011 0111 0011 0011 1011 1111 0011 1111 1100 1111 1101 1111 1100 1111 0010 0011 0111 1010 1010
1011 1100 1011 0111 0101 1110 0001 0011 1010 0100 0101 1101 1011 0010 1111 0000 1011 0100 0011 1100
```

**M.14.6 Applying data whitening to the PSDU**

Data whitening is applied as in 16.1.3. Note that data whitening is not applied to the header, and the 16-bit header becomes 32 bits after the convolutional coding. The bit sequence for the PSDU after data whitening is given as

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

**M.14.7 Concatenating the SHR with the PHR and PSDU**

The bit sequence for the PPDU is given as

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