Proposed Resolution for Several Comments

March 17, 2011

IEEE P802.15
Wireless Personal Area Networks

Title:	Proposed Resolution for several comments
Date Submitted:	March 17, 2011
Source:	Michael Schmidt - Atmel (email: michael.schmidt@atmel.com)
Re:	Task Group 15.4g LB67 comment resolution
Abstract:	[]
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CID 11

Comment:

- MR-O-QPSK/DSSS should define uniform values for the lowest data rate supported in all frequency bands.

Response:
Reject.

CID 11

Resolution:

- For the wide band (WB) DSSS modes, this would introduce considerable preamble overhead and a major revision on the spreading scheme.
- Using narrow-band (NB) and wide band DSSS at the same band is in conflict with the mandatory legacy support of the O-QPSK PHY operating at the 780 MHz, 915 MHz, and 2450 MHz band (sub-clause 16.3.3). The receiver complexity will be increased due to the need for simultaneous receive of a NB and WB signal (higher ADC resolution required, two correlators operating at the same time).

CID 16

Comment:

- Equation 21g is not a parity check.

Response:
Accept in principle
Resolution:
change the “the single parity bit” in sub-clause 16.3.2.10 to “the reference value”

CID 399,457

Comment:

- Section "Operating frequency range" is missing for MR-O-QPSK.
- Add this section

Response:

Accept.

CID 399,457

Resolution:
Add the following section

16.3.4.1 Operating frequency range

The MR-O-QPSK PHY operates in the following bands:

- 470-510 MHz
- 779-787 MHz
- 868-870 MHz
- 902-928 MHz
- 917-923.5 MHz
- 950-958 MHz
- 2400-2483.5 MHz

CID 400

Comment:

- Section "Transmit power spectral density (PSD) mask" is missing for MR-O-QPSK.
- Add this section

Response:
Accept.

CID 400

Resolution:
Add the following section

16.3.4.2 Transmit power spectral density (PSD) mask

The MR-O-QPSK transmit PSD mask shall conform with local regulations.

FCS related CID 83, 381, (449), 451

Comment:

- Zero padding of the MPDU or calculation field is not required.
- Clarify.

FCS related CID 83, 381, (449), 451

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- Zero padding of the MPDU or calculation field is not required.
- Clarify.

Response:

- Accept in principle.

FCS related cont. CID 83, 381, (449), 451 I

Resolution:

- According to the base-line standard, the MPDU contains the FCS field.
- TG4g is not considering an amendment on the definition of the MPDU.
- Hence, the condition in the paragraph will never apply.
- Can we define the FCS for a calculation field with less than 4 octets?
- The answer is yes:
- In the following asume modulo 2 arithmetic.
- Let $F(x) = f_0 x^{k-1} + f_1 x^{k-2} + \cdots + f_{k-1}$ be the polynomial of the message sequence (calculation field) consisting of k bits.
- Let $L(x) = x^{31} + x^{30} + \cdots + 1$ denote the ones sequence of length 32.

FCS related cont. CID 83, 381, (449), 451 II

- Let $G(x) = x^{32} + x^{26} + x^{23} + x^{22} + x^{16} + x^{12} + x^{11} + x^{10} + x^8 + x^7 + x^5 + x^4 + x^2 + x + 1$ be the generator polynomial.
- Let

$$x^{32}F(x) + x^k L(x) = Q(x) + R(x)/G(x)$$

for some $Q(x)$ and remainder $R(x)$. Then the FCS polynomial is defined as

$$L(x) + R(x)$$

The expression $x^{32}F(x)$ already addresses zero padding of the message sequence with 32 zero bits.

- The author of this document cannot see a need for extending $F(x)$ such that its degree itself is at least 31.

FCS related cont. CID 83, 381, (449), 451 III

- However, assuming 4 octets as the minimum size of the calculation field, may lead to improved flexibility for efficient software implementations. Hence, although there is no need to require a 4 octet minimum size of the calculation field, the proposed solution is to deliberately introduce this.
- Instructions for the editors:
  "Upon transmission, if the length of the calculation field is less than 4 octets, the FCS computation shall assume padding the calculation field by appending zero value octets to make the calculation field length exactly 4 octets; however, these pad bits shall not be transmitted. Upon reception, if the calculation field is less than 4 octets, the received calculation field shall be appended with zero value octets to make the calculation field length exactly 4 octets prior to computing the FCS for validation."
  Place the example after this paragraph, as indicated.

FCS related cont. CID 83, 381, (449), 451 IV

As an example, consider an acknowledgment frame with no payload and the following 3 byte MHR:

0100 0000 0000 0000 0101 0110

Prior to FCS computation, the zero padded calculation field is given as follows:

0100 0000 0000 0000 0101 0110 0000 0000

The FCS for this case would be the following:

0101 1101 0010 1001 1111 1010 0010 1000

FCS related, CID 380

Comment:

- The FCS sequence for the given example calculation field at line 14 is not correct.
- Correct to 0101 1100 1010 0001 0100 0101 1000 1010

FCS related, CID 380

Comment:

- The FCS sequence for the given example calculation field at line 14 is not correct.
- Correct to 0101 1100 1010 0001 0100 0101 1000 1010

Response:

- Accept in principle.

FCS related, CID 380

Resolution:

- The example sequence in the text is not correct, since it was computed based on assumption, which was not applicable.
- The resolution of this comment is given 381.
- No further change is required.

CID 422

Comment:

- The statement, "O-QPSK with half-sine shaping is very similar to O-QPSK with raised cosine shaping." is debatable. Raised Cosine OQPSK shaping results in non-constant envelope modulation and, thus, is not the same as O-QPSK with half-sine shaping - which is a constant envelope modulation and is also spectrally identical to MSK.
- As legacy support has been documented as critical, hence, the inclusion of 16.3.3 in the document, either remove the raised cosine requirement or make it optional and provide a 100 percent mechanism that ensures that transmit/receive using (32,4)-DSSS with O-QPSK half-sine shaping is fully compliant with the 15.4g standard. This could be done in the PICS.

CID 422

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Response:

- Accept in principle.

cont. CID 442 I

Resolution:

- Specify impulse response depending on the frequency band.
- Change as follows:
  In the 915 MHz and the 2450 MHz bands, the half-sine pulse shape is used to represent each baseband chip and is given by

$$p(t) = \begin{cases} \sin(\frac{\pi t}{2T_c}) & \text{, for } 0 \leq t \leq 2T_c \\ 0 & \text{, otherwise} \end{cases}$$

  where the chip duration T_c is the inverse of the chip rate (see Table 147 and Table 148).
  In the 470 MHz, 868 MHz, 780 MHz, 917 MHz, and the 950 MHz band, a raised cosine pulse shape with roll-off factor of

cont. CID 442 II

$r = 0.8$ is used to represent each baseband chip and is described by

$$p(t) = \begin{cases} \frac{\sin(\pi t/T_c)}{\pi t/T_c} \cdot \frac{\cos(r\pi t/T_c)}{1-r^2t^2/T_c^2} & \text{, for } t \neq 0 \\ 1 & \text{, for } t = 0 \end{cases}$$

- In 16.3.3, delete the following paragraph:
  O-QPSK modulation is used. O-QPSK with half-sine shaping is very similar to O-QPSK with raised cosine shaping. Since the impulse response of a raised cosine shaping filter satisfies the first Nyquist criteria, the following EVM specification can be easily met: a transmitter shall have EVM values of less than 35 % when measured for 1000 chips.

CID 444

Comment:

- Having an exception for O-QPSK mode is making things more complicated since each SUN device must support also MR-FSK PHY. This wording leads to two different symbol durations for MR-OQPSK devices.
- Replace "the MR-FSK and MR-OFDM PHYs" by "SUN devices". Remove the last sentence, starting with "For the MR-O-QPSK PHY".

CID 444

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- Replace "the MR-FSK and MR-OFDM PHYs" by "SUN devices". Remove the last sentence, starting with "For the MR-O-QPSK PHY".

Response:

- Reject.

444

Resolution:

- For MR-O-QPSK there is only one definition of the symbol rate, which is given 16.3.2.14. The definition was proposed in the 2011 January meeting and approved by the group.
- The wording "mandatory mode" in the paragraph is probably misleading.
- To the authors understanding it is referring to the mandatory mode of the given sub PHY (MR-FSK, MR-O-OQPSK, MR-OFDM) and not to the common signaling mode based on the MR-FSK PHY.
- Referencing the symbol time of a PHY with respect to another PHY (without even being specific) will cause a lot of confusion. This has never been used in the base line standard.

CID 394,457

Comment:

- The interleaver depth of 176 will introduce a significant number of padding bits for ACK frames.
- Consider using a slightly shorter interleaver depth. A good choice (for PSDU) is 18x 7 = 126 and lambda = 7 (still prime). This will introduce small overhead for the ACK frames with default FCS type.

CID 394,457

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- Consider using a slightly shorter interleaver depth. A good choice (for PSDU) is 18x 7 = 126 and lambda = 7 (still prime). This will introduce small overhead for the ACK frames with default FCS type.

Response:

- Accept.

CID 394,457 I

Resolution:

- The outcome of letter ballot LB59 was to have RateMode zero and SpreadingMode DSSS as the mandatory mode for MR-O-QPSK.
- The interleaver depth according to the current draft is based on degree $\lambda = 11$ and $N_{\mathrm{INTRLV}} = \lambda \times 16 = 176$.
- A slightly shorter prime degree of $\lambda = 7$ will reduce overhead to the mandatory mode.
- For $N_{\mathrm{INTRLV}} = 7 \times 18$, the degradation relative to $N_{\mathrm{INTRLV}} = 11 \times 16$ for the optional modes is very low.
- An ACK frame with 7 octets (default FCS type) needs to be zero padded by 7 bits only (already including the 6 zero bits for FEC-trellis termination).

CID 394,457 II

- Required change for the editors:
  - in row PSDU change the entry of column "degree λ" to "7"
  - in row PSDU change the entry of column "depth N_{INTRLV}" to "7 x 18 = 126"
  - leave entries of row PHR unchanged

CID 403

Comment:

- Give Example frame for MR-O-QPSK in ANNEX.
- Use ACK frame with default FSC, Mandatory Mode, chip rate 100 kchip/s

Response:

- Accept in principle.

CID 403

Resolution:

- Use payload bits of the FCS example:
  0100 0000 0000 0000 0101 0110 0101 1101 0010 1001 1111 1010 0010 1000