**IEEE P802.15**

**Wireless Personal Area Networks**

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| Project | IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) | |
| Title | Proposed Comments Resolution on Draft C  CIDs [859-862] | |
| Date Submitted | May 2024 | |
| Sources | Carl Murray (Qorvo) |  |
| Re: |  | |
| Abstract |  | |
| Purpose | To propose comments resolution for “P802.15.4ab™/D (pre-ballot) C Draft Standard for Low-Rate Wireless Networks” | |
| Notice | This document does not represent the agreed views of the IEEE 802.15 Working Group or IEEE 802.15.4ab Task Group. It represents only the views of the participants listed in the “Sources” field above.It is offered as a basis for discussion and is not binding on the contributing individuals. The material in this document is subject to change in form and content after further study. The contributors reserve the right to add, amend or withdraw material contained herein. | |

## Source Documents

1. 15-24-0204-01-04ab-draft-c-comment-resolution-cid-222.docx
2. 15-22-0608-01-04ab-header-ie-extension.pptx

# Comment IDs 859-862

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| --- | --- | --- | --- | --- | --- | --- |
| **Index #** | **Commenter** | **Sub-Clause** | **Page** | **Line** | **Comment** | **Proposed Change** |
| 859 | Carl Murray | 10.39.7.1 | 115 | 2 | Allow for a configuration of 32 - better than leaving reserved. | Revised |
| 860 | Carl Murray | 10.39.7.1 | 115 | 6 | Allow for a configuration of 32 - better than leaving reserved. | Revised |
| 861 | Carl Murray | 10.39.7.1 | 116 | 2 | Allow for a configurations of 8 and 16 - better than leaving reserved configurations and allows for the new ETSI +10dB | Revised |
| 862 | Carl Murray | 10.39.7.1 | 116 | 6 | Allow for a configurations of 8 and 16 - better than leaving reserved configurations and allows for the new ETSI +10dB | Revised |

We should take a forward looking position when designing the next release of the standard. We need to look beyond any current limitations and at the same time not go completely crazy 😊.

Note that this approach has already been taken many times, e.g. extending the UWB Channel field in the Application Control IE so that all the extended channels can be used (see CID #222 in [1])

### Discussion on 859 and 860

The common pushback on having more than 16 fragments is that the accumulated phase error will be too large for 32 fragments and beyond. This has the implicit assumption that the carrier frequency offset is not being tracked. There are usecases where this is not the case e.g. where there is a strong NLOS path but a very weak first path (the classic Fira FP dynamic range usecase).

Also in [2] by Alex et al, one of the stated aims of the 250kbps uncoded O-QPSK is to “… balance link budget of *32-fragment* MMS-UWB”. So 32 fragments were envisioned right from the start.

Currently there are reserved values in the ‘Number of RSF field value’. It is likely that these can only be used for specifying further RSF numbers. Similarly for the ‘Number of RIF field value’.

So why not assign them now. What else will they be used for?

## Proposed Resolution for 859 and 860 – Revised

**In section 10.39.7.1 on page 115 update Table 14 on line 1 as follows –**

|  |  |
| --- | --- |
| **Number of RSF field value** | **Meaning, Number of RSF** |
| 0 | 0 |
| 1 | 1 |
| 2 | 2 |
| 3 | 4 |
| 4 | 8 |
| 5 | 16 |
| 6~~-7~~ | ~~Reserved~~ 32 |
| 7 | Reserved |

**In section 10.39.7.1 on page 115 update Table 15 on line 5 as follows –**

|  |  |
| --- | --- |
| **Number of RIF field value** | **Meaning, Number of RIF** |
| 0 | 0 |
| 1 | 1 |
| 2 | 2 |
| 3 | 4 |
| 4 | 8 |
| 5~~–7~~ | ~~Reserved~~ 16 |
| 6 | 32 |
| 7 | Reserved |

**Revisit CID # 114**

Change the Table 12-8, Range values for "phyUwbMmsRifNumberFrags" to "0, 1, 2, 4, 8, 16, 32" and Range values for "phyUwbMmsRsfNumberFrags" to "0, 1, 2, 4, 8, 16, 32".

**In section 16.2.11.1 update the following text as indicated (text in black incorporates previous CIDs)**

Where X and Y are the number of RSF and RIF fragments respectively in the MMS UWB packet, the following are the combinations that should be supported by the HRP-ARDEV in the case of NBA UWB MMS operations:

* RSF only MMS packets, i.e., where Y=0 and X ∈ {1, 2, 4, 8, 16}.
* RIF only MMS packets, i.e., where X=0 and Y ∈ {1, 2, 4, 8}.
* Mixed RSF/RIF packets, i.e., where X ∈ {1, 2, 4, 8}, Y ∈ {1, 2, 4, 8}.

Optionally the following additional combinations may be supported by the HRP-ARDEV in the case of UWB MMS operations:

* RSF only MMS packets, i.e., where Y=0 and X ∈ {32}.
* RIF only MMS packets, i.e., where X=0 and Y ∈ {16, 32}.
* Mixed RSF/RIF packets, i.e., where X ∈ {16}, Y ∈ {16}.

In the case of UWB-driven UWB MMS operations, the following are the combinations that should be supported by the HRP-ARDEV:

* RSF only MMS packets, i.e., where Y=0 and X ∈ {1, 2, 4, 8}.
* RIF only MMS packets, i.e., where X=0 and Y ∈ {1, 2, 4, 8}.
* Mixed RSF/RIF packets, i.e., where X ∈ {1, 2, 4, 8}, Y ∈ {1, 2, 4, 8}.

Optionally the following additional combinations may be supported by the HRP-ARDEV in the case of UWB-driven UWB MMS operations:

* RSF only MMS packets, i.e., where Y=0 and X ∈ {16, 32}.
* RIF only MMS packets, i.e., where X=0 and Y ∈ {16, 32}.
* Mixed RSF/RIF packets, i.e., where X ∈ {16}, Y ∈ {16}.

The mandatory parameter sets are specified in 10.38.11 and 10.38.12.

### Discussion on 861 and 862

In the original comment it states that one reason for using shorter fragments is that “… allows for the new ETSI +10dB”. This point was not properly explained and therefore has been misunderstood.

The essential point is that in the future there may be UWB devices that have an increased energy budget by +10dB (but with regulatory restrictions). To achieve this extra 10dB more than likely the transmitter will need to be more powerful. The reasoning here is that rather than increasing the sequence lengths by a factor of 10, it is likely that part of the solution will be to have a more powerful transmitter. Therefore, this more powerful transmitter could be used for MMS ***but*** still observe the existing energy budget of 37 nJ per ms. The idea is not to use the extra energy afforded by the extra +10dB for MMS but to use the more powerful transmitter.

One advantage of shorter fragments is less airtime and less receiver on-time.

The ‘MSR for MMRS field value’ has reserved values. There does not seem to be any disadvantage to allocating the reserved values for this purpose up front.

The ‘STS Segment Length’ does not have the same number of possible configurations as ‘MSR for MMRS’. This is probably an oversight independent of these CIDs as the RSF and RIF fragments should have similar energy.

## Proposed Resolution for 861 and 862– Revised

**In section 10.39.7.1 on page 114 update Table 132 on line 24 as follows –**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Bits: 0–2** | **3–5** | **6–11** | **12–18** | **19–21** | **22–2~~3~~4** | **2~~4~~5–2~~7~~8** | **2~~8~~9–31** |
| Number of RSF | Number of RIF | Preamble Code Index | MMRS Gap Size | MSR For MMRS | STS Segment Length | UWB Channel | Reserved |

**Figure 132—MMS Ranging Configuration field of the AC IE**

**In section 10.39.7.1 on page 116 update Table 16 on line 1 as follows –**

**Table 16—Values of the MSR for MMRS subfield in the MMS Ranging Configuration**

|  |  |
| --- | --- |
| **MSR for MMRS field value** | **Meaning, MSR** |
| 0 | ~~32~~ 8 |
| 1 | ~~40~~ 16 |
| 2 | ~~48~~ 32 |
| 3 | ~~64~~ 40 |
| 4 | ~~128~~ 48 |
| 5 | ~~256~~ 64 |
| 6~~–7~~ | ~~Reserved~~ 128 |
| 7 | 256 |

**In section 10.39.7.1 on page 116 update Table 17 on line 5 as follows –**

**Table 17—Values of the STS Segment Length subfield of the MMS Ranging Configuration**

|  |  |
| --- | --- |
| **STS Segment Length field value** | **Meaning, STS segment length** |
| 0 | ~~32~~ 8 |
| 1 | ~~64~~ 16 |
| 2 | ~~128~~ 32 |
| 3 | ~~256~~ 64 |
| 4 | 128 |
| 5 | 256 |
| 6-7 | Reserved |

**In section 16.2.11.2 update the following text as indicated (text in black incorporates previous CIDs)**

The same MMRS shall be used for all RSFs in an MMS packet, with the length of each RSF defined by the number MMRS symbol repetitions (MSR) used for the fragment.  Each RSF in the MMS packet shall employ the same MSR, where this MSR ∈ {32, 40, 48, 64, 128, 256}, or optionally where this MSR ∈ {8, 16}.

**In section 16.2.11.3 update the following text as indicated (text in black incorporates previous CIDs)**

Each RIF shall consist of a sequence of active STS pulses generated as described in 16.2.9, *Scrambled timestamp sequence (STS) field*, where the DRBG is called iteratively to generate a non-repeating sequence across all the RIF fragments of the packet, and the pulses are spread by the spreading factor L=4.  Each RIF in the packet shall have the same length from one of the following permitted lengths: 32, 64, 128 or 256, in units of 512 chips. Optionally lengths of 8 or 16, in units of 512 chips may be supported for each RIF in the packet.