**IEEE P802.15**

**Wireless Personal Area Networks**

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| Project | IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) |
| Title | **Draft 1.0 Sensing Related Comments Resolution Part 1** |
| Date Submitted | July 2024 |
| Sources | Bin Qian, Panpan Li, Lei Huang, Rojan Chitrakar, David Xun Yang (Huawei)  |  |
| Re: |   |
| Abstract |  |
| Purpose | To propose comments resolution for “P802.15.4ab™/D1.0 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. |

***Comment Index #222, #223, #224, #225, #226 in 15-24-0371-01-04ab-consolidated-comments-draft-1-0***

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| **Index #** | **Commenter** | **Sub-Clause** | **Page** | **Line** | **Comment** | **Proposed Change** |
| 222 | Aniruddh Rao Kabbinale | 10.39.1 | 128 | 24 | Sensing initiator is the one who transmits always. | Remove the part of the line "For the cases that the sensing initiator is the sensing transmitter" |
| 223 | Aniruddh Rao Kabbinale | 10.39.1 | 129 | 1 | It is not clear by what is meant by "Initator is a sensing receiver". Since it is initiator who sends the sensing PPDUs and may receive CIR report from responder. However, controller can take up roles of sensing initiator or responder | Change as follows" Bistatic sensing - where controller is the sensing responder. |
| 224 | Aniruddh Rao Kabbinale | 10.39.1 | 129 | 2 | It is not clear by what is meant by "Initator is a sensing transmitter". Since it is the case always. However, controller can take up roles of sensing initiator or responder | Change as follows" Bistatic sensing - where controller is the sensing initiator. |
| 225 | Aniruddh Rao Kabbinale | 10.39.1 | 129 | 3 | It is not clear by what is meant by "Initator is a sensing receiver". Since it is initiator who sends the sensing PPDUs and may receive CIR report from responder. However, controller can take up roles of sensing initiator or responder | Change as follows " Multi static sensing, where controller is the responder" |
| 226 | Aniruddh Rao Kabbinale | 10.39.1 | 129 | 4 | It is not clear by what is meant by "Initator is a sensing transmitter". Since it is the case always. However, controller can take up roles of sensing initiator or responder | Change as follows: " Multistatic sensing, where controller is the initiator, supporting scheduling of CIR reports from multiple responders" |

**Discussion:**

In the bi-static sensing mode, there are two cases:

* Case A: Sensing initiator is the transmitter of the sensing packet, and sensing responder is the receiver of the sensing packet. The sensing measurement report is transmitted by the sensing responder to the sensing initiator.



* Case B: Sensing initiator is the receiver of the sensing packet, and sensing responder is the transmitter of the sensing packet. There is no sensing measurement report transmission from the sensing responder to the sensing initiator.



Similarly, in the multi-static sensing mode, there are two cases:

* Case A: Sensing initiator is the transmitter of the sensing packet, and sensing responders are the receivers of the sensing packet. The sensing measurement reports are transmitted by the sensing responders to the sensing initiator one by one.



* Case B: Sensing initiator is the receiver of the sensing packet, and sensing responders are the transmitters of the sensing packet. The sensing packets are transmitted by the sensing responders in the scheduled sensing slot. There is no sensing measurement report transmission from the sensing responders to the sensing initiator.



Furthermore, it is clearly stated in 10.39.4.1 that “During a sensing session, unless otherwise noted, the controller acts as the initiator, and the controlee acts as the responder”. Thus, the proposed change is not reasonable.

**Resolution: Rejected**

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***Comment Index #227 in 15-24-0371-01-04ab-consolidated-comments-draft-1-0***

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| **Index #** | **Commenter** | **Sub-Clause** | **Page** | **Line** | **Comment** | **Proposed Change** |
| 227 | Aniruddh Rao Kabbinale | 10.39.4.2 | 129 | 28 | Capabilities are not exchanged between initiator and responder but between controller and controlee | Change initiator to controller and responder to controlee |

**Discussion:**

It is clearly stated in 10.39.4.1 that “During a sensing session, unless otherwise noted, the controller acts as the initiator, and the controlee acts as the responder”. In this sentence, the initiator is the controller, and the responder is the controlee. Thus, the proposed change is not necessary.

**Resolution: Rejected**

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***Comment Index #228 in 15-24-0371-01-04ab-consolidated-comments-draft-1-0***

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| 228 | Aniruddh Rao Kabbinale | 10.39.4.4 | 130 | 19 | Sensing packets are sent by sensing initiator only. Responders only process CIR and may report to initiator | Remove the part " and/or sensing responders" |

**Discussion:**

In bi-static sensing mode and multi-static sensing mode, both the initiator and the responder could be the transmitter of the sensing packets. However, in one sensing session, the roles of initiator and responder(s) are not changed.

**Resolution: Revised**

**Proposed text changes on P802.15.4ab™-D01:**

**10.39.4.4 Sensing measurements**

*Change Line 19 on page 130 as follows*

In the sensing phase sensing packets are sent by the sensing initiator or sensing responders.

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***Comment Index #889 in 15-24-0371-01-04ab-consolidated-comments-draft-1-0***

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| **Index #** | **Commenter** | **Sub-Clause** | **Page** | **Line** | **Comment** | **Proposed Change** |
| 889 | Carl Murray | 10.39.4.6.2 | 132 | 16 | The following text is ambiguous as it refers to the signal bandwidth - better to refer to the channel bandwidth"The oversampling ratio is defined as the ratio of the CIR tap sampling rate to the signal bandwidth. For the frequency stitching feature, when the CIR of an effective larger bandwidth is obtained by an SDEV, the oversampling ratio is defined with respect to the aggregated bandwidth." | Change to"The oversampling ratio is defined as the ratio of the CIR tapsampling rate to the channel bandwidth. For the frequency stitching feature, when the CIR of an effective larger bandwidth is obtained by an SDEV, the oversampling ratio is defined with respect to the aggregated channel bandwidth." |

**Discussion:**

Channel bandwidth is a more accurate description than signal bandwidth.

**Resolution: Accepted**

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***Comment Index #890 in 15-24-0371-01-04ab-consolidated-comments-draft-1-0***

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| **Index #** | **Commenter** | **Sub-Clause** | **Page** | **Line** | **Comment** | **Proposed Change** |
| 890 | Carl Murray | 10.39.4.6.2 | 132 | 21 | There are no in-phase or quadrature taps. Both in-phase and quadrature are components of a tap. | Replace the text starting in line 21 and ending on line 24 as follows or similar"For each receive chain, the CIR measurement report shall be represented using a 16-bit signed value for the in-phase component of each CIR tap, and a 16-bit signed value for the quadrature component of each CIR tap. An SDEV may optionally represent the CIR measurement report using 10-bit, 12-bit, or 14-bit signed values separately for the in-phase component and quadrature component of each CIR tap value." |

**Discussion:**

The proposed changes make sense. In addition, it is suggested to use in-phase component and quadrature component instead of I/Q values or real/imaginary values throughout Draft 1.0.

**Resolution: Revised**

**Proposed text changes on P802.15.4ab™-D01:**

**10.39.4.6.2 Mandatory bitmap configurations**

*Change Line 21 on page 132 as follows*

For each receive chain, the CIR measurement report shall be represented using a 16-bit signed value for the in-phase component of each CIR tap, and a 16-bit signed value for the quadrature component of each CIR tap. An SDEV may optionally represent the CIR measurement report using 10-bit, 12-bit, or 14-bit signed values separately for the in-phase component and quadrature component of each CIR tap value.

*Change Line 26 on page 132 as follows*

Assuming that the complex CIR tap values are given by *h(k)*, where *k = 1, 2, …, K*, then the largest absolute value of the in-phase component and quadrature component, *m*, is given by:

*m* = max[max(abs(*h*R(*k*)), abs(*h*I(*k*)))] ∀ *k* ∈ {1, 2, …, *K*}

*Change Line 32 on page 132 as follows*

The new quantized in-phase component and quadrature component would be round(*h*R(*i*)/2α) and round(*h*I(*k*)/2α) respectively.

**10.39.6.1 Application Control IE (AC IE)**

*Change Line 6 on page 145 as follows*

The CBW field specifies the number of bits used to encode each of the signed in-phase component and quadrature component values in the CIR report. These values are normalized per antenna receive chain and per segment. The CBW field shall have one of the values specified in Table 34.

**Table 34 - CIR IQ Bit Widths field values**

|  |  |
| --- | --- |
| CBW Field Value | Meaning |
| 0 | 10 bits for each in-phase component value and 10 bits for each quadrature component value |
| 1 | 12 bits for each in-phase component value and 12 bits for each quadrature component value |
| 2 | 14 bits for each in-phase component value and 14 bits for each quadrature component value |
| 3 | 16 bits for each in-phase component value and 16 bits for each quadrature component value |

**10.39.6.2 CIR Report IE**

*Change Line 25 on page 155 as follows*

The CIR Taps field contains the CIR tap values, with one CIR tap value for each bit in the CIR Bitmap that is set to a binary-one, where each CIR tap consists of a signed 16-bit in phase component and a signed 16-bit quadrature component, in that order. Support for using 10, 12, or 14-bit values instead of 16-bit values for these in-phase and quadrature components is optional.

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***Comment Index #250 in 15-24-0371-01-04ab-consolidated-comments-draft-1-0***

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| **Index #** | **Commenter** | **Sub-Clause** | **Page** | **Line** | **Comment** | **Proposed Change** |
| 250 | Li-Hsiang Sun | 10.39.5.1 | 135 | 10 | Sensing requesting device is a controlee associating to a controller. The controller (sensing initiator) does not initiating SBP setup and does not need to know controlee’s SBP capability | as in comment |

**Discussion:**

The SBP setup is initiated by the sensing requesting device. If the sensing requesting device requests an SBP operation from a sensing initiator, it is indicated that the sensing requesting device supports SBP. Thus, the sensing initiator (controller) does not need to know controlee’s SBP capability. However, the sensing requesting device (controlee) needs to know controller’s SBP capability to initiate an SBP.

**Resolution: Revised**

**Proposed text changes on P802.15.4ab™-D01:**

**10.39.5 Sensing by proxy**

**10.39.5.1 General**

*Change Line 10 on page 135 as follows*

An SDEV supporting SBP shall set the SBP field of the Session Configuration field in the HRP UWB Association Response command to one.

**10.40.4.1 HRP UWB Association Request command**

*Change Line 1 on page 164 as follows*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Bits: 0 | 1 | 2-3 |  | 4 | 5 | 6 | 7-15 |
| LDPC | High Throughput | Supported AIFS |  | Dynamic PHR | Frequency Stitching | Aggregated Channel Report | Reserved |

**Figure 180 - HRP UWB Capability Information field format**

*Remove Line 9 on page 164*

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***Comment Index #892 in 15-24-0371-01-04ab-consolidated-comments-draft-1-0***

|  |  |  |  |  |  |  |
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| **Index #** | **Commenter** | **Sub-Clause** | **Page** | **Line** | **Comment** | **Proposed Change** |
| 892 | Carl Murray | 10.39.6.1 | 140 | 1 | The field names 'Number of RSF' and 'Number of RIF' are misleading as they do not store the number of RSF and RIFs but rather are an index into a table. | Rename the fields 'Number of RSF' and 'Number of RIF' to 'RSF Number Index' and 'RIF Number Index' respectively.Also make the appropriate changes elsewhere to related text. |
| 893 | Carl Murray | 10.39.6.1 | 140 | 1 | The field name MSR For MMRS is wrong. The 'M' in MSR stands for MMRS! Also it doesn’t contain the number of repetitions, i.e. the 'R'. So it is an index. | Change the field name to 'MSR Index'Also make the appropriate changes elsewhere to related text. |
| 894 | Carl Murray | 10.39.6.1 | 140 | 6 | The units for the STS segment length are not defined. | Define the units of the STS segment length. |
| 1248 | Billy Verso | 10.39.6.1 | 141 | 5 | The STS Segment Length field, is misnamed, since there are no "STS segments" in the MMS ranging, i.e., this should be called RIF Fragment Length. | Change the field name from "STS Segment Length" to "RIF Fragment Length", in Figure 149, and lines 5,6,7 of p141, and in Table 28. |
| 1249 | Billy Verso | 10.39.6.1 | 141 | 8 | In Table 28, the units of this RIF Fragment Length specifier ("STS Segment Length field") are not defined. Assume this as 512-chip units | Add into table 28, in the meaning column, "in units of 512 chips (~1 μs)" |

**Discussion:**

1. MMRS is short for multi-millisecond ranging sequence. MMS is short for multi-millisecond. MSR is short for MMRS symbol repetitions. The “MMRS” in the field name “MSR For MMRS” is redundant.
2. In 15.4z, the STS segment length is defined in units of 512 chips (~1 $μs$). It is reasonable to follow 15.4z to define the units of this RIF Fragment Length field (STS Segment Length field).

**Resolution: Revised**

**Proposed text changes on P802.15.4ab™-D01:**

**10.39.6.1 Application Control IE (AC IE)**

*Change Line 1 on page 140 as follows*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Bits: 0-2 | 3-5 | 6-11 | 12-18 | 19-21 | 22-23 | 24-30 | 31 |
| RSF Number Index | RIF Number Index | PreambleCodeIndex | MMRSGap Size | MSR Index  | RIF FragmentLength | UWBChannel | Reserved |

**Figure 149—MMS Ranging Configuration field of the AC IE**

The RSF Number Index field specifies the number of RSFs that will be used in the forthcoming ranging exchange. The RSF Number Index field shall have one of the non-reserved values defined in Table 25.

**Table 25—Values of RSF Number Index subfield in the MMS Ranging Configuration**

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

The RIF Number Index field specifies the number of RIFs that will be used in the forthcoming ranging exchange. The RIF Number Index field shall have one of the non-reserved values defined in Table 26.

**Table 26—Values of RIF Number Index subfield in the MMS Ranging Configuration**

|  |  |
| --- | --- |
| RIF Number Index field value | Meaning, Number of RIF |
| 0 | 0 |
| 1 | 1 |
| 2 | 2 |
| 3 | 5 |
| 4 | 8 |
| 5-7 | Reserved |

*Change Line 1 on page 141 as follows*

The MSR Index field indicates the MSR that will be used in the forthcoming ranging exchange. The MSR Index field shall have one of the non-reserved values defined in Table 27.

**Table 27—Values of the MSR Index subfield in the MMS Ranging Configuration**

|  |  |
| --- | --- |
| MSR Index field value | Meaning, MSR |
| 0 | 32 |
| 1 | 40 |
| 2 | 48 |
| 3 | 64 |
| 4 | 128 |
| 5 | 256 |
| 6-7 | Reserved |

*Change Line 5 on page 141 as follows*

RIF Fragment Length field specifies the configuration options for RIF fragment length. The RIF Fragment Length field shall have one of the values defined in Table 28.

**Table 28—Values of the RIF Fragment Length subfield of the MMS Ranging Configuration**

|  |  |
| --- | --- |
| RIF Fragment Length field value | Meaning, RIF fragment length in units of 512 chips (~1 $μs$) |
| 0 | 32 |
| 1 | 64 |
| 2 | 128 |
| 3 | 256 |

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***Comment Index #895 in 15-24-0371-01-04ab-consolidated-comments-draft-1-0***

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| **Index #** | **Commenter** | **Sub-Clause** | **Page** | **Line** | **Comment** | **Proposed Change** |
| 895 | Carl Murray | 10.39.6.1 | 140 | 10 | The maximum channel number is 113 but the UWB Channel field allows for values up to 127. What happens if values greater that 113 are used. | Specify what happens if this field is 114 to 127 |

**Resolution: Revised**

**Proposed text changes on P802.15.4ab™-D01:**

**10.39.6.1 Application Control IE (AC IE)**

*Change Line 9 on page 141 as follows*

The UWB Channel field when 0 to 113 indicates the UWB channel number for the forthcoming ranging exchange, as per 11.1.3.5 (*Channel numbering for HRP UWB PHY*) and 16.4.1.2, and other values are reserved.

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***Comment Index #1342 in 15-24-0371-01-04ab-consolidated-comments-draft-1-0***

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| **Index #** | **Commenter** | **Sub-Clause** | **Page** | **Line** | **Comment** | **Proposed Change** |
| 1342 | B. Rolfe | 10.39.6.1 | 141 | 11 | "may not" is never correct.  | change "may not be present " to "may be omitted" |

**Discussion:**

The original text is “One or more fields defined in the AC IE, may not be present in the AC IE of the current ranging round, if the parameters specified in these fields follow the same configuration as before.”

**Resolution: Accepted**

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***Comment Index #895 in 15-24-0371-01-04ab-consolidated-comments-draft-1-0***

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| **Index #** | **Commenter** | **Sub-Clause** | **Page** | **Line** | **Comment** | **Proposed Change** |
| 902 | Carl Murray | 10.39.6.1 | 152 | 9 | The maximum channel number is 113 but the UWB Channel field allows for values up to 255. What happens if values greater that 113 are used. | Specify what happens if this field is 114 to 255.Alternatively reduce the field to 7 bits and specify what happens if this field is 114 to 127 |
| 265 | Li-Hsiang Sun | 10.39.6.1 | 152 | 7 | UWB Channel field should be set to base channel number if Frequency Stitching Parameters field is included | as in comment |

**Resolution: Revised**

**Proposed text changes on P802.15.4ab™-D01:**

**10.39.6.1 Application Control IE (AC IE)**

*Change Line 5 on page 152 as follows*

The UWB Channel field specifies the UWB channel to use. Values in the range 0 to 15 refer to channelsdefined in Table 16-27 (*HRP UWB PHY band allocation*), while values 16 to 113 refer to the extendedchannel numbering as specified in 16.4.1.2, and other values are reserved. When the Frequency Stitching Parameters Present field in the Sensing Control field is set to 1, the UWB Channel field shall be set as the starting channel for sensing.

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***Comment Index #86 in 15-24-0371-01-04ab-consolidated-comments-draft-1-0***

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| **Index #** | **Commenter** | **Sub-Clause** | **Page** | **Line** | **Comment** | **Proposed Change** |
| 85 | Mickael Maman | 10.39.6.1 | 144 | 10 | add reserved for value 3 | as in comment |

**Resolution: Revised**

**Proposed text changes on P802.15.4ab™-D01:**

**10.39.6.1 Application Control IE (AC IE)**

*Change Line 10 on page 144 as follows*

**Table 33—Fields to be compressed**

|  |  |
| --- | --- |
| **Report Type****Field Value** | **Fields to be compressed when Compression field value is one** |
| 0 | The CIR Taps field of each receive report in the CIR Report IE (10.39.6.2). |
| 1 | The Full Target Report List field and the Sparse Target Report List field in the Processed Target Feature IE (10.39.6.6) |
| 2 | The CIR Taps field of each receive report in the CIR Report IE, and the Full Target List Report field and Sparse Target Report List field in the Processed Target Feature IE |
| 3 | Reserved |