**IEEE 802.15**

**Wireless Specialty Networks (WSN)**

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| Project | IEEE 802.15 Working Group for Wireless Specialty Networks (WSN) |
| Title | **IEEE 802.15 TG 4ab (NG-UWB) minutes** |
| Date Submitted | [18 November, 2021] |
| Source | [David Xun Yang][][Bantian, Shenzhen, China][Clint Powell][Meta][Chandler, AZ] | Voice: [+86.159.1411.7462]Fax: [--]E-mail: [david.yangxun@huawei.com]Voice: [+1.480.586.8457]Fax: [--]E-mail: [cpowell@ieee.org] |
| Re: | [November 802.15 Plenary Meeting held virtually] |
| Abstract | [IEEE 802.15 Task Group 4ab minutes] |
| Purpose | [Official minutes of IEEE 802.15 TG 4ab] |
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# Thursday, 11 November 2021 – AM2

**Opening**

**11:12 AM** Chair, Ben Rolfe (Blind Creek Associates), called the meeting to order and opened the TG Agenda.
(*15-21-0565-01-04ab*)

* >80 attendees joined the meeting

## Legal

Chair reminded the group of the following from the 802.15 opening meeting:

* IEEE-SA patent policy
* Submission of Letter(s) of Assurance (LoA) or to identify patent claim(s)/patent application claim(s) and/or the holder of patent claim(s)/patent application claim(s) that the participant believes may be essential for any of the ongoing activities within the 802.15 WG.
	+ No essential patent claims were brought forth
* IEEE Anti-Trust statement
* IEEE Copyright Policy, including Code of Ethics

**Announcements**

Don’t forget to turn on your mic and announce your name and affiliation before you speak.

Chair announced the agenda doc. # for the week. After reviewing and making a few changes to the agenda, no one objected to approving the modified agenda, so it was approved by unanimous consent.
*(doc. # 15-21-0538-04-04ab)*

Chair discussed the recap and task operation. Chair proposed the appointment of TG officers. The motion of TG officers was approved by unanimous consent.

Chair introduced his proposed project schedule. Discussions on the schedule on the cut-off day, Draft 0 day, and comment resolutions. Chair encouraged people to think offline and continue the discussion on next Tuesday.

**TG Meeting Activity**

Using the meeting slides *(doc. # 15-21-0565-01-04ab)* Chair proceeding with running the meeting.

Chair deferred the discussion on TGD and TFD to EV1. No objection received.

 *(doc. # 15-21-0565-01-04ab)*

Michiel Soer (Sparking Microsystems) presented “Low Power Operation for Non-ranging Applications”

 *(doc. # 15-21-0585-00-04ab)*

This presentation discussed the packet structure for low power operation of non-ranging operation and flexible switch to ranging mode.

Questions raised include:

Link budget based on variable payload length or fixed payload length; preamble and payload RX sensitivity; puncturing of additional coding with low power consumption.

Chair presented the TGD and TFD.

 *(doc. # 15-21-0297-01-04ab) (doc. # 15-21-0442-00-04ab)*

Clint Powell suggested to move up the 2nd session of Friday up to AM2. Discussions continued in Thu EV1.

Chair recessed the mtg. @ 12:47pm, until Thu. EV1.

# Thursday, 11 November 2021 – PM1 (Joint .4ab, .14, .15)

**Opening**

**1:05 PM** TG Chairs, Ben Rolfe (Blind Creek Associates), Clint Powell (Meta), Phil Beecher (Wi-Sun Alliance), called the meeting to order and opened the agenda
(*doc. # 15-21-0584-01-0000*)

* ~ 65 attendees joined the meeting

## Legal

TG Chairs reminded the group of the following from the 802.15 opening meeting:

* IEEE-SA patent policy
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	+ No essential patent claims were brought forth
* IEEE Anti-Trust statement
* IEEE Copyright Policy, including Code of Ethics

**Announcements**

Don’t forget to turn on your mic and announce your name and affiliation before you speak.

Chairs reviewed the agenda (contained in the opening slides) for the week. After reviewing no changes were made and the chair asked if there were any objections to approving the agenda.

No one objected to approving the agenda, and it was approved by unanimous consent.

**TG Meeting Activity**

Chairs communicated that Outreach Letters to External SDO’s using 802.15.4 Standard will go out after Nov. Mtg.

Discussed preparation for 802.1 Architecture Mtg., to being held Thurs. 12/2 from 4-6pm Eastern

* Topics to include in presentation/discussion to include:
	+ 48 / 64 bit addressing
	+ Propose 802.1 develop sol’n. for 48 / 64 bit addressing, and initiate IG’s within 802.11 and 802.15 to proactively support this effort
* Bridging requirements/issues beyond resolving 48 / 64 bit in integrating 802.15.4 into the 802.1 architecture
	+ Collect use cases from 802.11 and 802.15, dependent SDOs (Wi-Fi Alliance, CSA, Wi-SUN Alliance, etc.), and other stakeholders to determine requirements
	+ EtherType issues in 802.15
* Propose
	+ 802.1 starting a project to work on all of this and more
	+ With work in parallel in 802.15, 802.11, via WNGs and/or amendments to interface with 802. project

Chairs asked if there was any other business?

* None was heard

Chairs adjourned the joint mtg. @ 2:10pm.

# Thursday, 11 November 2021 – EV1

**Opening**

**5:10 PM** Chair, Ben Rolfe (Blind Creek Associates), called the meeting to order and opened meeting slides (*15-21-0565-01-04ab*)

* > 70 attendees joined the meeting

## Legal

Chair reminded the group of the following from the 802.15 opening meeting:

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* Submission of Letter(s) of Assurance (LoA) or to identify patent claim(s)/patent application claim(s) and/or the holder of patent claim(s)/patent application claim(s) that the participant believes may be essential for any of the ongoing activities within the 802.15 WG.
	+ No essential patent claims were brought forth
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* IEEE Copyright Policy, including Code of Ethics

**Announcements**

Don’t forget to turn on your mic and announce your name and affiliation before you speak.

Chair asked if anyone objected to approving the SG4ab minutes from the Sep **I**nterim. It was approved by unanimous consent.
*(doc. # 15-21-0498-03-04ab)*

**TG Meeting Activity**

Using the modified agenda *(doc. # 15-21-0538-03-04ab)* Chair proceeding with running the meeting.

Xiaohui Peng (Huawei) presented “CIR Feedback for UWB Sensing”.

*(doc. # 15-21-0570-00-04ab)*

This presentation introduced the model of CIR and discussed a compression method for CIR feedback to help UWB node to sense with low overhead.

Questions raised included:

* Feedback contents, whether all the scenarios are included, and how to make the simulations more realistic
* Suggest to use real environment to test and analyze

Chair asked if there were any presentations that could be given during this mtg. No request received.

Chair asked if people are OK with moving PM1 session to AM2 in Friday. There were several concerns received. PM1 session was kept unchanged.

There were a few changes of time slots of technical presentations in the agenda based on the requests.

*(doc. # 15-21-0538-04-04ab)*

Chair recessed the mtg. @ 5:00pm, until Fri. AM1

# Friday, 17 September 2021 – AM1

**Opening**

**9:10 AM** Chair, Ben Rolfe (Blind Creek Associates), called the meeting to order and opened the TG Agenda (*15-21-0565-02-04ab*)

* > 80 attendees joined the meeting

## Legal

Chair reminded the group of the following from the 802.15 opening meeting:

* IEEE-SA patent policy
* Submission of Letter(s) of Assurance (LoA) or to identify patent claim(s)/patent application claim(s) and/or the holder of patent claim(s)/patent application claim(s) that the participant believes may be essential for any of the ongoing activities within the 802.15 WG.
	+ No essential patent claims were brought forth
* IEEE Anti-Trust statement
* IEEE Copyright Policy, including Code of Ethics

**Announcements**

Don’t forget to turn on your mic and announce your name and affiliation before you speak.

Chair announced the agenda doc. # for the week. After reviewing and making a few changes to the agenda, no one objected to approving the modified agenda.
*(doc. # 15-21-0538-05-04ab)*.

**TG Meeting Activity**

Using the modified agenda *(doc. # 15-21-0538-05-04ab)* Chair proceeding with running the meeting.

Michael Mclaughlin (Qorvo) presented “UWB Wakeup Signaling”

 *(doc. # 15-21-0557-01-04ab)*

This presentation proposed a wake up radio using the UWB channel, which can perform similarly as narrow band.

Lots of questions were raised and further discussions were encouraged.

Frank Leong (NXP) presented “Ranging QoS”.

*(doc. # 15-21-0505-00-04ab)*

This presentation discussed the following methods:

* Lower data rate option for link budget benefit
* Higher data rate option for reduced airtime, e.g., BQPSK
* Preamble options for enhanced channel capacity, e.g., PRFDMA
* Wake-up (WUP) PHY

Chair asked if a new session is added on Monday morning. There is no objection to add one time slot on Monday AM2.

Chair recessed the mtg. @ 11:08am, until Fri. PM1.

# Friday, 13 November 2021 – PM1

**Opening**

**1:10 PM** Chair, Ben Rolfe (Blind Creek Associates), called the meeting to order and opened the TG Agenda (*15-21-0565-02-04ab*)

* > 70 attendees joined the meeting

## Legal

TG Chair reminded the group of the following from the 802.15 opening meeting:

* IEEE-SA patent policy
* Submission of Letter(s) of Assurance (LoA) or to identify patent claim(s)/patent application claim(s) and/or the holder of patent claim(s)/patent application claim(s) that the participant believes may be essential for any of the ongoing activities within the 802.15 WG.
	+ No essential patent claims were brought forth
* IEEE Anti-Trust statement
* IEEE Copyright Policy, including Code of Ethics

**Announcements**

Don’t forget to turn on your mic and announce your name and affiliation before you speak.

Chair announced the agenda doc. # for the week. After reviewing and making changes to the agenda, no one objected to approving the modified agenda.

*(doc. # 15-21-0538-06-04ab)*.

**TG Meeting Activity**

Using the modified agenda *(doc. # 15-21-0538-06-04ab)* Chair proceeding with running the meeting.

Huan-bang Li (NICT) presented “UWB channel access aided by pilot narrow band radio”

*(doc. # 15-21-0589-00-04ab)*

This presentation discussed the methods of channel access by using the CCA value of pilot narrow band.

Questions raised include how the multiple devices to coordinate when sensing the channel and possible fairness issues.

Rani Keren (Huawei) presented “UWB ranging accuracy limiting factor”

*(doc. # 15-21-0556-00-04ab)*

This presentation discussed some factors limiting the ranging accuracy of TOA.

Ersen Ekrem (Apple) presented “More on Narrow band assisted multi-millisecond UWB”

*(doc. # 15-21-0593-02-04ab)*

This presentation discussed the procedure of narrow band assisted multi-millisecond UWB operation and its related PHY design.

Lots of questions raised include the gain from narrow band assistance, 5MHz channel hopping in band UNII-3, and O-QPSK link margin, etc.

Chair recessed the mtg. @ 3:06pm, until Mon. AM2.

# Monday, 15 November 2021 – AM2 (1st Half, Joint .4ab, .6a, .15)

**Opening**

**11:05 AM** TG Chairs, Clint Powell (Meta), Ben Rolfe (Blind Creek Associates), Ryuji Kohno (YNU), called the meeting to order and opened the agenda
(*doc. # 15-21-0596-00-0000*)

* ~ 45 attendees joined the meeting

## Legal

TG Chairs reminded the group of the following from the 802.15 opening meeting:

* IEEE-SA patent policy
* Submission of Letter(s) of Assurance (LoA) or to identify patent claim(s)/patent application claim(s) and/or the holder of patent claim(s)/patent application claim(s) that the participant believes may be essential for any of the ongoing activities within the 802.15 WG.
	+ No essential patent claims were brought forth
* IEEE Anti-Trust statement
* IEEE Copyright Policy, including Code of Ethics

**Announcements**

Don’t forget to turn on your mic and announce your name and affiliation before you speak.

Chairs reviewed the agenda (contained in the opening slides) for the week. After reviewing no changes were made and the chair asked if there were any objections to approving the agenda.

No one objected to approving the agenda, and it was approved by unanimous consent.

**TG Meeting Activity**

Goals from Sept. Interim – updates from TG6a on

* PHY direction (common w/15.4 UWB or not)
* Channel model development for HBAN/VBAN applications

Once the PHY and Channel Model(s) are determined, this will help in paving the way to discussing coexistence

Presentation given by Marco Hernandez, Ryuji Kohno, Takumi Kobayashi, Minsoo Kim (YRP-IAI, YNU) "Joint session 15.6a, 15.4ab, 15.14 November Plenary Meeting", on material for harmonization discussions of UWB technologies across UWB-based IEEE 802.15 Stds

<https://mentor.ieee.org/802.15/dcn/21/15-21-0604-00-006a-join-session-15-6a-15-4ab-15-14-november-plenary-meeting.pptx>

Covering:

* Channel models
1. TG6a working on models for VBAN (document 15-21-0516)
	1. Based on 15.4a channel models and 15.6 BAN channel models updated for vehicles and other systems expected to operate in and around vehicles
* PHY similarities and differences
1. 6a needs at least 50 Mbps to 64 Mbps
2. Packet delivery rate (PDR) 99% of 100msec, end to end latency 250 msec
3. MAC and PHY implications
4. Some proposals in 15.4ab look useful
5. Not seen much MAC yet (but it is coming)
* Discussion then ensued on:
1. Note 15.4z added longer packet lengths
2. TG6a is expecting to adopt the 4ab PHY (more or less)
3. Coexistence if a primary goal of cooperation between TGs
4. May see influence both ways to achieve harmonization
5. Use case summary for 4ab would be useful
6. The TGD (Document 15-21-0297) summarizes requirements derived from presented use cases
7. Adding a summary of the use cases from which the requirements were derived would be useful (seeking volunteer)
8. Emphasis of coexistence
	* Coexistence between UWB and also other systems like 802.11
9. Emphasis that FEC may be another common ground with similar needs
10. Noted that there is a dependence in 6a on development of proposals and content in 4ab
11. Achieving the goals of commonality and coexistence
12. Input into the 6a TRD from participants in 4ab would be greatly appreciated
* TG6a will present their TRD to TG4ab during the Mon. EV1 Session
* TG4ab will present their TGD to TG46a during the Tues. AM1 Session
* After the 802.15 closing plenary TG4ab and TG6a leadership will discuss offline some goals for the Jan. Mtg.

Chairs asked if there was any other business?

* None was heard

Chairs adjourned the joint mtg. @ 12:05pm.

# Monday, 15 November 2021 – AM2 (2nd Half)

**Opening**

**12:10 PM** Chair, Ben Rolfe (Blind Creek Associates), called the meeting to order and opened the TG Agenda (*15-21-0565-02-04ab*)

* > 60 attendees joined the meeting

## Legal

TG Chair reminded the group of the following from the 802.15 opening meeting:

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	+ No essential patent claims were brought forth
* IEEE Anti-Trust statement
* IEEE Copyright Policy, including Code of Ethics

**Announcements**

Don’t forget to turn on your mic and announce your name and affiliation before you speak.

**TG Meeting Activity**

Using the modified agenda *(doc. # 15-21-0538-06-04ab)* Chair proceeding with running the meeting.

Carl Murray (Qorvo) presented “High Data Rate”

*(doc. # 15-21-0592-00-04ab)*

This presentation discussed some original thoughts on channel models, channel coding and the related parameters.

Questions raised include low latency requirement, channel models and channel coding.

Chair recessed the mtg. @ 12:51pm, until Mon. EV1.

# Monday, 15 November 2021 – EV1

**Opening**

**5:05 PM** Chair, Ben Rolfe (Blind Creek Associates) called the meeting to order and opened the TG Meeting Slides (*15-21-0565-02-04ab*)

* >70 attendees joined the meeting

## Legal

Chair reminded the group of the following from the 802.15 opening meeting:

* IEEE-SA patent policy
* Submission of Letter(s) of Assurance (LoA) or to identify patent claim(s)/patent application claim(s) and/or the holder of patent claim(s)/patent application claim(s) that the participant believes may be essential for any of the ongoing activities within the 802.15 WG.
	+ No essential patent claims were brought forth
* IEEE Anti-Trust statement
* IEEE Copyright Policy, including Code of Ethics

**Announcements**

Don’t forget to turn on your mic and announce your name and affiliation before you speak.

Chair announced the agenda doc. # for the week. After reviewing and making a few changes to the agenda, no one objected to approving the modified agenda
*(doc. # 15-21-0538-07-04ab)*.

**TG Meeting Activity**

Using the modified agenda *(doc. # 15-21-0538-07-04ab)* Chair proceeding with running the meeting.

Yong Liu (Apple) presented “NBA-MMS-UWB MAC Consideration”

*(doc. # 15-21-0605-00-04ab)*

This presentation discussed the MAC consideration for narrow band assisted multi-millisecond UWB method.

Questions raised include channel hopping access details and regulatory in UNII-3, the proposed scheme used for ranging only, the reliability of narrow band transmission and operation of narrow band in different band from UWB band, e.g., synchronization, TX power, etc.

Marco Hernandez introduced the discussion in the joint meeting with 6a in AM2, and presented “Technical Requirements Document” of 6a.

*(doc. # 15-21-0577-01-006a)*

Chair recessed the mtg. @ 6:41pm, until Tue. EV1.

# Tuesday, 16 November 2021 – EV1

**Opening**

**5:10 PM** Chair, Ben Rolfe (Blind Creek Associates) called the meeting to order and opened the TG Meeting Slides (*15-21-0565-03-04ab*)

* >60 attendees joined the meeting

## Legal

Chair reminded the group of the following from the 802.15 opening meeting:

* IEEE-SA patent policy
* Submission of Letter(s) of Assurance (LoA) or to identify patent claim(s)/patent application claim(s) and/or the holder of patent claim(s)/patent application claim(s) that the participant believes may be essential for any of the ongoing activities within the 802.15 WG.
	+ No essential patent claims were brought forth
* IEEE Anti-Trust statement
* IEEE Copyright Policy, including Code of Ethics

**Announcements**

Don’t forget to turn on your mic and announce your name and affiliation before you speak.

Chair announced the agenda doc. # for the week. After reviewing the agenda, no one objected to approving the modified agenda.

*(doc. # 15-21-0538-08-04ab)*.

**TG Meeting Activity**

Using the modified agenda *(doc. # 15-21-0538-08-04ab)* Chair proceeding with running the meeting.

Yongsen Ma (Red Point Positioning) presented “Beacon and Ranging Frames to Support Downlink TDOA (DL-TDOA) Location Service in 802.15”

*(doc. # 15-21-0616-00-04ab)*.

This presentation is a follow-up of presentation “Downlink TDOA (DL-TDOA) Location Service in 802.15” *(doc. # 15-21-0399-00-04ab).* It further discussed frame formats related to DL TDOA.

Questions raised include the scenario requirements, resolution, accuracy and narrow band operation.

Carlos Aldana (Meta) presented “Higher PHY data rates”

*(doc. # 15-21-0610-00-04ab)*.

This presentation introduced an equalizer design for higher data rate RX.

Questions raised include the equalizer structure, transmission range, link budget, and further simulations.

Chair discussed the updated proposed project schedule, project process, task group leadership roles. Chair discussed the telecon agenda between Nov plenary and Jan Interim and updated the agenda to plan B based on comments. No objection to the updated telecon agenda.

*(doc. # 15-21-0565-03-04ab)*

Chair reminded people to register early for Jan Interim meeting.

Chair asked if there was any additional business, and none was raised.

Chair adjourned the mtg. @ 7:10pm.