**IEEE P802.15**

**Wireless Specialty Networks**

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| Project | IEEE P802.15 Working Group for Wireless Specialty Networks (WSNs) – 802.15.4ab |
| Title | **Proposed Text for NBA UWB Framework TFD – Optional RIF waveform** |
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| Re: | Developing technical content for actual specification text. |
| Abstract | This document provides the text for inclusion into the NBA-UWB Technical Framework (for draft 0) |
| Purpose | Support development of technical content for the draft |
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***Insert the new sub-clause in MMS UWB packet description in 2.3.2 of [***NBA-UWB-TFD***] as follows:***

* Optional RIF waveform based on contributions [0413, 0651]
	+ Optional RIF waveforms consist of a sequence of pseudo-randomized pulses arranged in groups of pulses. Each group contains Nppg={1, 2, 4, 8} pulses which are transmitted at the peak PRF (499.2 MHz); Nppg=1 (1 pulse per group) is equivalent to baseline STS waveform described in section above and specified in 15.2.9 of IEEE 802.15.4z-2020.
	+ Within a group, the pulse has a predefined and fixed polarity pattern. Each group is BPSK modulated by a random polarity bit generated using the DRBG based on AES-128 in counter mode as specified in 15.2.9 of IEEE 802.15.4z-2020. Each group of pulses is separated by a guard interval such that the whole RIF is operating at a mean PRF of 124.8 MHz (spreading factor L=4).
	+ The length of the RIF in total number of chips is allowed from the set NS={32, 64, 128, 256} in units of 512 chips. The number of random polarity bits that modulate the group is 512∙NS/L/Nppg (example for NS=32, Nppg=4: length of the RIF=512∙32=16384 chips, number of active chips=512∙32/L=4096, number of AES-generated random polarity bits=512∙32/L/Nppg=1024, see figure below).

TRIF= 512∙NS∙Tc

Tgroup

Tguard

Tgroup

Tguard

Nppg

Tc

* + Random polarity bits are decoded individually from each group of pulses over Tint,RF at the time of arrival according to the guidelines described in section 10.3.2 of IEEE 802.15.4z-2020. The security level of the ranging is given by reporting the number of errors vs. the transmitted random polarity bits saccording to the formula in section 6.9.8.2.2 of IEEE 802.15.4z

**References**

[NBA-UWB-TFD] 15-23-0004-0x-04ab-nba-uwb-technical-framework-proposal-2023-feb-v6.docx
[0413] 15-22-0413-00-04ab-performance-analysis-of-ranging-integrity-fragment-with-distance-commitment
[0651] 15-22-0651-00-04ab-recap-and-new-considerations-on-nba-mms-ranging-integrity-fragments.pptx