**IEEE P802.15**

**Wireless Personal Area Networks**

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| Project | IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) |
| Title | Pulse shape text changes for HRP UWB PHY |
| Date Submitted | 3 March 2020 |
| Source | Michael McLaughlin (Qorvo), Jochen Hammerschmidt (Apple),Brima Ibrahim (NXP),Billy Verso (Qorvo)  |  |
| Re: | Contribution to TG4z for IEEE 802.15.4z regarding pulse shape  |
| Abstract | Contribution to TG4z amendment of IEEE Std 802.15.4-2015 |
| Purpose | This submission proposes text to for the IEEE Std 802.15.4z draft amendment to IEEE Std 802.15.4.  |
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| EXTRA NOTE(s): This submission provides text intended to be ready to integrate directly into the 802.15.4z draft. |

**BACKGROUND / INTRODUCTION:**

Based on 15-19-0443-01-004z, 15-20-0084-00-004z and 15-20-0086-00-004z and some offline discussions we have come up with text that is our view of what should be put into the 802.15.4z amendment.

The appropriate text changes to the draft are captured below….

**16.4.5 Baseband impulse response**

***Change the editorial instruction text of P802.15.4z-D6 relating to clause 16.4.5 as shown:***

***Insert at the end of subclause 16.4.5 the following text and figure:***

To help with interoperability in ranging scenarios, it is recommended that the RDEV supports a mode in which the transmitted pulse exhibits minimum precursor energy. In Figure 16-13, the middle pulse has precursors while the left-hand pulse has no precursors. Note that this is not suggesting that either of these particular pulses are recommended.

***And, insert the following new text and figure directly after the above D6 paragraph:***

For a device electing to use a pulse with precursor, it is recommended that the transmitted pulse follows the mathematical formula of the reference root raised cosine pulse r(t) with a roll-off factor of beta of 0.45, over at least ± 3 chip periods.

If the transmitted pulse follows the minimum precursor pulse recommendation, the transmitted pulse shape *p(t)* should be constrained by the time domain mask of Figure 1, where the peak magnitude of the pulse is scaled to a value of one, and the time unit is *Tp*, defined in Table 16-12. The pulse shall monotonically rise to a first peak amplitude; the first peak amplitude is defined as the maximum amplitude of the pulse before it first drops more than 1.25 %.

It is further recommended that some method, e.g. an out-of-band means or some upper layer message, is used to indicate whether an ERDEV's transmitter is employing a minimum precursor pulse or a pulse with precursors. This information might be used by receiving ERDEVs to improve the accuracy of their RMARKER arrival estimates, and/or to correctly reflect the expected accuracy level in the reported FoM value. In some circumstances additional performance benefits may be obtained if the receiver is provided with the shape of the minimum precursor pulse being used by the transmitter.



**Figure 1—Recommended time domain mask for the HRP UWB PHY pulse**

 ***[END]***