**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 text for PAC TGD: Clustered Random Drop** | |
| Date Submitted | July 2014 | |
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| Re: | TG8 Technical Guidance Document (DCN 15-12-0568-09-0008), and  DCN 15-14-0410-00-0008. | |
| Abstract | This document provides text proposal for TG8 Technical Guidance Document. The proposed text provides detailed information for a new realistic distribution model of PDs for improved performance evaluation of PAC network, which is presented in DCN 15-14-0410-01-0008. | |
| Purpose | Discussion and Approval. | |
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## 9.4 System-level simulation (MAC)

*9.4.2.1 Simulation parameters for discovery*

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| **PD deployment** | \* Uniform random drop or clustered random drop in 500×500 m2 area  . The number of PDs: 100, 500, 1000, 5000, 10000. |
| **Simulation time** | At least10 sec |
| **Iteration** | Until smooth curve is obtained |
| **PHY interface abstraction** | \* Common PHY mode:  The received *Es/N0* can be used in the PER (Packet Error Rate) curves provided in DCN13-0058 to know the value of PER of discovery signal sent by BPSK and 1/2 coding rate. Such PER curves were obtained assuming using convolution code and a packet length of 150 bytes at AWGN channel. Assuming bit errors in a packet are independent and uniformly distributed, the PER curves for a packet length of 16 bytes are obtained as    . Optionally and in addition, proposers may provide results with their own PHY interface abstraction |
| **Discovery ID length** | 16 bytes and any other sizes are up to proposers |
| **Discovery transmission interval** | It depends on proposers. |

**Annex A Clustered Random Drop**

(Informative)

In a realistic network scenario, the PDs are distributed clustered around the area of attractions, and thus uniform distribution of PDs may lead to inaccurate performance evaluation in system simulations. In this annex, realistic distribution model of PDs for performance evaluation is provided.

**A.1 Clustered Random Drop Procedure**

1. Choose an area, where device will be randomly dropped.
2. The first PD is dropped according to uniform distribution.
3. Update the probability distribution of PDs.
4. Drop a PD according to the current probability distribution of PDs.
5. Repeat Step 3 – 4 until the target number of PDs are dropped.

**A.2 Probability Distribution of PDs**

Let be the probability distribution of the devices after dropping n devices, then

where

|  |  |
| --- | --- |
|  | a uniform distribution function |
|  | a scalar, |
|  | a scalar, |
|  | drop location of i-th device |
|  | pdf representing gravity or pull by *i*-th device |
| , where *A* is the area of the network | |

Note that

* can be a fixed number, which means the attraction by all PDs are identical. Alternatively, can be a number drawn from a probability distribution function. For example, a number drawn from a uniform random distribution between 0 and 1.
* is a probability distribution function representing the attraction, that is, the probabilistic “pull” exerted by the already dropped *i*-th PD on the PD being dropped. For example, normal distribution can be used as follows:
* When , clustered random drop becomes identical to uniform random drop. Smaller represents stronger attraction by existing PDs. A typical for clustered random drop is 0.2.
* A typical value for is 50 m.

**A.4 Matlab code for Clustered Random Drop**

