**IEEE P802.15**

**Wireless Personal Area Networks**

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| Project | IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) | |
| Title | **and their values – comments for 15-14-0338-04** | |
| Date Submitted | June 3, 2014 | |
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| Re: | [Subclause 7.1 of 802.15 TG10 TGD and [TGD Scenario Parameters #319r0](https://mentor.ieee.org/802.15/dcn/14/15-14-0319-00-0010-tgd-scenario-parameters.docx)] | |
| Abstract | [Comments on 15-14-0338-04, Scenario Parameters for CfFP - Working Document.] | |
| Purpose | [Define the parameters to consider in the scenario for final proposals] | |
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**Introduction**

This document was prepared to suggest some comments on 15-14-0338-04 regarding the operational scenarios which will be included in the TG10 TGD so that the TG10 scenarios **meet all requirements and fit better to real situations, by which proposals can be fairly compared.**

**Comments on 15-14-0338-04**

Green parts below are proposed modifications with the comments for the table from 15-14-0338-04.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | **Scenarios** | | |
| **Parameter** | | | **Mostly Upstream:**  **Smart metering, infrastructure monitoring, Irrigation Optimization** | **Mostly Downstream:**  **Street lighting, smart lighting** | **Balanced upstream and downstream:**  **CEMS, BEMS, HEMS** |
| Packet size | | | 100 bytes | | 31 bytes, 255 bytes, 2047 bytes |
| Data rate | | | 100kbps, 250kbps | | 20kbps, 250kbps[5], 2Mbps[6] |
| Packet birth rate | | | 1 packet every 30 min |  | 1 packet/sec (only for 250kbps and 2Mbps), 1 packet/min, 1 packet/30min |
| Duty cycle | | | 100%, 1%, 0.1% | | |
| Node density | | | 8000 / km2 ~~(household density in Tokyo)~~ |  |  |
| Mobile devices (Y/N) - speed | | | N | N | Y – 1.4m/s (human walking speed) |
| Number of entry points | | | M-1 | 1 | 1, 3 |
| Number of exit points | | | 1 | M-1 | 1, 3 |
| PAN Coord to Device | | Unicast (Y/N) | Y | | |
| Multicast (Y/N) | Y | | |
| Broadcast (Y/N) | Y | | |
| Device to PAN Coord | | | Y | | |
| Device to device | | Unicast (Y/N) | N | | Y |
| Multicast (Y/N) | N | | Y |
| Broadcast (Y/N) | N | | Y |
| Multiple devices to device (Y) [4] | | |  |  | Y |
| Number of PAN coordinators [4] | | | 1 | | 1, 3 |
| Linear Topology (Y/N) | | | N | Y | N |
| Energy consumption | TX | | 28 mA | 30 mA | |
| RX | | 11.2 mA | 37 mA | |
| Idle | | 1.5 uA [1] | 500 uA | |
| Sleep | | 0.1 uA [1] | 0.2 uA | |
| Tx power | | | 13 dBm [1] | 0 dBm | |
| Rx sensitivity | | | - 97 dBm [1] | -92 dBm [2] | |

**Definitions**:

Data rate: data rate at the physical layer

Packet birth rate: rate at which packets are being generated at the application layer of the device

Duty cycle: ratio of awake time to total operational time including asleep time of a device

Device: node other than the PAN coordinator

M: Number of nodes in the PAN

M = 121 (11x11), 1089 (33x33), 10,000 (100x100)

For Linear Topology M = 1089 (33x33), where the middle row or column has M =100

Unicast: transmission from 1 source to 1 destination

Multicast: transmission from 1 source to n destinations (m < M -1)

m=11 for M=121, m=33 for M =1089, and m=100 for M =10000

Broadcast: transmission from 1 source to M -1 destinations

Multiple devices to device: transmission from n devices to one device

m=11 for M =121, m=33 for M =1089, and m=100 for M =10000

**References**

1. <http://www.semtech.com/images/datasheet/sx1272.pdf>
2. MC13202, Low power transceiver for the IEEE 802.15.4 Standard, http://cache.freescale.com/files/rf\_if/doc/data\_sheet/MC13202.pdf?pspll=1&Parent\_nodeId=1141674020187711908069&Parent\_pageType=product
3. Tokyo statistical yearbook, Population and Households, <http://www.toukei.metro.tokyo.jp/tnenkan/2012/tn12qa021000.xls>
4. 15-14-0239-02 Proposed operational scenarios of L2R networks for TG10 TGD
5. C. Townsend, S. Arms (2005). Wireless Sensor Networks: Principles and Applications. In J.S. Wilson (Ed), Sensor Technology Handbook (pp. 575-589). Oxford, UK: Elsevier.

Nordic Semiconductor, nRF24L01+, https://www.sparkfun.com/datasheets/Components/SMD/nRF24L01Pluss\_Preliminary\_Product\_Specification\_v1\_0.pdf

**Some other comments for the scenario parameters**

Comment 1: Linear topology

Add a definition for linear topology as follows:

Linear topology: transmission from the left and upper most device to the right and bottom most device by transmitting a packet to an adjacent device as shown in the figure.

For Linear Topology M = 1089 (33x33), ~~where the middle row or column has M =100~~

Comment 2: Effects of signal quality/link quality

A measure by which effects of signal quality, link quality, and/or loss and addition of devices can be included in the scenario should be defined. From the parameters and numbers shown in the table of 15-14-0338-04, it is not easy to have a common understanding among proposers by which these effects are evaluated with the scenarios suggested.

TX power and RX sensitivity may be used for this purpose with a signal propagation model, but more detailed description to utilize these parameters should be provided.

This area should be studied further in this group. One possible way is using link failure rates to reflect these effects as proposed in 15-14-0292 and 15-14-0344.

Comment 3: Packet birth rate

The worst scenario for packet birth rate is as follows:

With packet size of 2047 bytes, considering 20kbps, 1 packet has a length in the time domain

1 packet: 2047 bytes x 8 bits/byte = 16 kbits

Duty cycle of this packet 16/20 = 80% if this packet size is for the PHY layer. If it is not the case, other overhead should be considered and 1 packet/sec can be considered only data rates except 20kbps.

Comment 4: Energy consumption, TX power, and RX sensitivity

More explanation on how and why these parameters are included in the scenarios can be provided so that proposers can use them for evaluation of their proposals.