**Reply on the Reviewer comments for the IEEE letter**

**Reviewer 1:**

1. "In page 1, formulas given in (1) are not probability distributions but expectations; this is neither indicated nor taken into account later in the paper."

* What was meant by “*The distribution of these tags in each frame L*” is the expected number of idle, successful, and collided slots in each frame as shown in [2].
* The main equations of the paper (equ. 2 & 4) depend on these expectations of the number of idle, collided, successful slots per frame.

1. Definition of \eta\_{TA} is not clear, since T\_e, T\_s and T\_c are by nature random variables (this is not said in the paper), there are several interpretations of formula (4) as the expectation of a ratio, or as the ratio of expectations. Note that since random variables involved are not independent both definitions will differ. Authors seems to assume the latter case (without justification), but the rational approach should be to select the former one.

* As shown in [1], the conventional efficiency equation in formula (2) is verified. Where S, C, and E are expected values not a random variables, and from formula (5), T\_e, T\_s and T\_c are just multiplication of these expected values by a constants (t\_e, t\_s, and t\_c) the slot durations. Therefore, formula (4) is a ratio of expectations.

1. In formula (7) authors derivate a discrete function (it is only defined for integer values of L). This is a mathematical error. Therefore result obtained by (12) can only be considered an approximation which is not validated later.

* As shown in [2], in the RFID applications, we have unknown and variable number of objects, so it is common to differentiate the efficiency equation with respect to the frame length L function of the expected number of tags to find the optimal frame length in each reading cycle.

1. Section III seems unnecessary, since the optimal frame values can be computed once as a function of S, E and L and then can be stored in a lookup table in the readers.

* The main issue in the RFID anti-collision algorithm is to identify all the objects as soon as it can. DFSA algorithms divide the reading process into multiple reading cycles. In each reading cycle, the reader should do two main tasks: First, is to precisely estimate the number of objects in the system. Second, is to set the optimal frame length to identify these objects. So we need to search for the optimal frame length for each reading cycle as a function of the number of tags. Section III is so important because it converts the exact solution to a linear equation function of the number of tags which is so fast compared to the lookup table for the dese RFID networks.

**Reviewer: 2**  
1.      A primary concern on this paper is the validity of equation (13). The authors need to proof if Ct>1, the optimal frame length from equation (13) still satisfies equation (12).

* We are not interested in the range of Ct>1 because Ct presents the ratio between the idle slot duration and the collided slot. Based on the ISO 18000-6C RFID protocol [3] and as mentioned in section IV figure 3. The idles slot duration is always smaller than the collided slot duration and in the conventional (worst) case the idle slot duration is equal to the collided slot duration which make the interesting range of Ct is from 0 to 1 and no meaning for Ct>1.

2.      A more detailed derivation of equation (12) from equation (11) should be added to this paper.

* I thought that it is clear but we can try to clarify the intermediate steps in more details.

3.      From the discussions about the increase and decrease of Ct, the authors claim that the reading efficiency will be decreased both in the two cases. This result seems unreasonable. The authors should provide a few evidences to verify this result.

* The main issue of this part is to clarify why the collision coefficient is only function of the collided slot duration and the idle slot duration. Mathematically it is clear from formula (10) that there is no effect from the successful slot duration to set the new frame length. Basically, to choose the optimal frame size in FSA to identify a specific number of tags. If this frame is too small we will have a large collided time. However if this frame is too large, we will face a large idle time. So if we have an increase in the collided slot duration we have to increase the frame size to till we find the optimal length. And if we have an increase in the idle slot duration, we have to decrease the frame length till we reach to the optimal frame length.

4.      The references used in this paper are a little out-of-date. A few references in five years should be added.

* The new references are IEEE trans. 2010 and IEEE comm. Letter 2011 and will be inserted in the references.

Bibliography:

1. L. Zhu and T.S.P. Yum, “Optimal Framed Aloha Based Anti-Collision Algorithms for RFID Systems,” IEEE Trans. Comm.,vol. 58, no. 12, pp. 3583-3592, Dec. 2010.
2. B. Li and J. Wang, “Efficient Anti-Collision Algorithm Utilizing the Capture Effect for ISO 18000-6C RFID Protocol,” IEEE Comm. Letters, vol. 15, no. 3, pp. 352-354, Mar. 2011.
3. “EPC radio-frequency protocols class-1 generation-2 UHF RFID protocol for communications at 860 MHz 960 MHz version 1.1.0 2006.”