

# A Two-Step Time Delay Difference Estimation Method for Initial Random Access in Satellite LTE System

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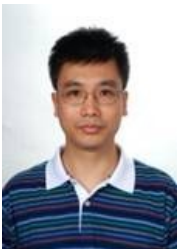
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**Abstract**—In initial random access, base station (BS) estimates the distance between the user equipment (UE) and BS. In the mobile satellite system (MSS), however, the characteristics of large transmission delay makes the estimation method used in the terrestrial system not applicable in the MSS. To solve this problem, a two-step time delay difference estimation scheme is proposed for orthogonal frequency division multiple access (OFDMA) multi-beam satellite system. We first divide a beam cell into some layered small sub-areas according to the different delay difference values. Then, two types of Physical Random Access Channel (PRACH) preamble burst format are performed: the first one is for the fractional delay difference value measurement and the second one is for the integer part. Further, complete criteria for the designation of PRACH parameters are proposed and closed-form expressions of the system performance are also derived, including the false alarm probability and the missed detection probability. Finally, according to the numerical analysis, the method shows good performance

**Keyword**—PRACH, LTE, satellite, random access, doppler shift



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