

**Source:** Nokia  
**Title:** SFN offset in IE 10.3.7.106 'UE positioning OTDOA neighbour cell info'  
**Agenda item:** 7.2.2  
**Document for:** Discussion

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## 1 Introduction

The 3GPP TS 25.331 IE 10.3.7.106 'UE positioning OTDOA neighbour cell info' contains a field SFN offset (see below) sent as assistance data to a mobile making OTDOA positioning measurements. This field is mandatory in ASN. 1. It contains the difference between reference and neighbour frame numbers.

SFN offset	MP		Integer (0 .. 4095)	Define Tref as the time of beginning of system frame number SFNref of the reference cell. Define Tnc as the beginning of a frame from the neighbour cell occurring immediately after the time Tref. Let the corresponding system frame number be SFNnc. Then SFNnc = SFNref - SFN offset modulo 4096.
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The SFN offset defined now as a mandatory assistance data field is not needed by UE for measuring SFN-SFN observed time difference (OTD). The channels used for synchronisation and measurements (SCH and CPICH, respectively) have no variations from frame to frame and hence all frames can be measured. If the network does not use IPDLs, the mobile will not obtain any benefit from knowing the SFN offset. In the case of IPDLs the UE could, in principle, use the SFN offset information to calculate when the idle periods of neighbour base stations occur. It would then allow the UE to optimise the OTD measurements, e.g. to omit the search for base stations that have idle periods overlapping those of the reference cell or to search for some distant base station when the two nearest base stations have overlapping idle periods. There is at most one idle period in one radio frame and the probability for one overlapping idle period during one SFN cycle is around 0.002 % if idle period length 10 symbols is assumed. Additionally, a pseudo random generator determines the positions of idle periods in a base station and this further reduces the probability of continuously overlapping idle periods. Also the frequency drift of base stations introduces minor differences in idle period positions. Consequently, in most cases the SFN offset would not give the mobile any benefit in SFN-SFN OTD measurements.

This kind of optimisation through the knowledge of SFN offset in the mobile would increase its amount of controlling code. It is also difficult for a network supporting only OTDOA to deliver the SFN offset unless extra equipment (for the sole purpose of providing this offset) is used in the network.

If the network could not provide the SFN offset, the mobile would receive a non-valid value in this mandatory parameter field and this might cause problems for observed time difference measurements. A mobile that uses SFN offset for measurement optimisation could then omit the search for some base station, which in fact could be heard, or could try to measure some base station, which cannot be heard. On the other hand, there are currently no means for the mobile to know when the value in the SFN offset field is valid or non-valid.

A missing SFN offset value at the UE will not cause any difficulties from OTD measurement point of view. The change in received signal strength at the UE caused by overlapping idle periods at some neighbour base station and the reference cell are not likely to cause any problems for OTD measurements.

## **2 Proposed Solution**

The UE does not need the SFN offset assistance data field in IE 10.3.7.106 'UE positioning OTDOA neighbour cell info' for performing the SFN-SFN OTD measurements. The radio network might also encounter problems in delivering this offset value to the mobile unless extra equipment for the OTDOA method is used.

The optimum solution to the problem would be to define the SFN offset as optional. This would allow the UE to utilise the SFN offset whenever the IE is provided. At the same time we would avoid erroneous usage of the SFN offset when the network cannot deliver a valid value for it. This modification, however, would require changes in ASN.1. Therefore we propose that the value 4095 in the reported value range for SFN offset is reserved to indicate that the delivered SFN offset value is not valid and is not to be trusted by the UE. Even with this solution, the real measured value of 4095 is interpreted erroneously but these cases are not likely to occur too often. Nevertheless, this proposal leaves the ASN. 1 intact and, at the same time, allows use of the SFN offset.