

Agenda item: AdHoc 17, Location Services
Source: Nokia, Ericsson
Title: Text Proposal for IPDL
Document for: Decision

1 Abstract

This contribution makes a proposal on the relationship between the downlink timing and the placement of the idle periods in support of IPDL. It is intended that this is discussed in the AdHoc 17 on Location Services and if an agreement is reached then a change request will be produced.

2 Introduction

In order to finalise the concept of IPDL in the WG1 specifications it is necessary to define exactly how the Idle Periods are arranged so that both the UE and UTRAN have a common understanding of when the idle periods will occur and how long they would be. It is proposed that the position of these idle periods are specified relative to the SFN and is based on a set of parameters communicated via higher layer signalling.

A formula that uses these parameters is used to calculate the position of the Idle Periods. This formula is not negotiated, it should be 'hardwired' into the WG1 specifications.

3 The higher layer parameters

The list of these parameters have already been discussed and agreed within WG2, they are:

- IP_Status: 0 = Continuous mode, 1= Burst mode
- IP_Spacing: The Average spacing between Idle Periods.
- IP_Length: The length of each Idle Period (5 or 10 symbols)
- Seed: A 6-bit number selected by UTRAN to randomise the Idle Period pattern.

Extra Parameters for use is Burst Mode:

- Burst_Start: The frame number where the 1st burst of Idle Periods starts within an SFN cycle.
- Burst_Length: The number of Idle Periods in a burst of Idle Periods.
- Burst_freq: The number of frames between the start of consecutive Idle Period bursts.

Note that WG2 also agreed to a 'Max_dev' parameter, but this is removed in this contribution as it is not needed to be communicated to the UE, it is purely an intermediate result used in the calculation of the Idle Period positions.

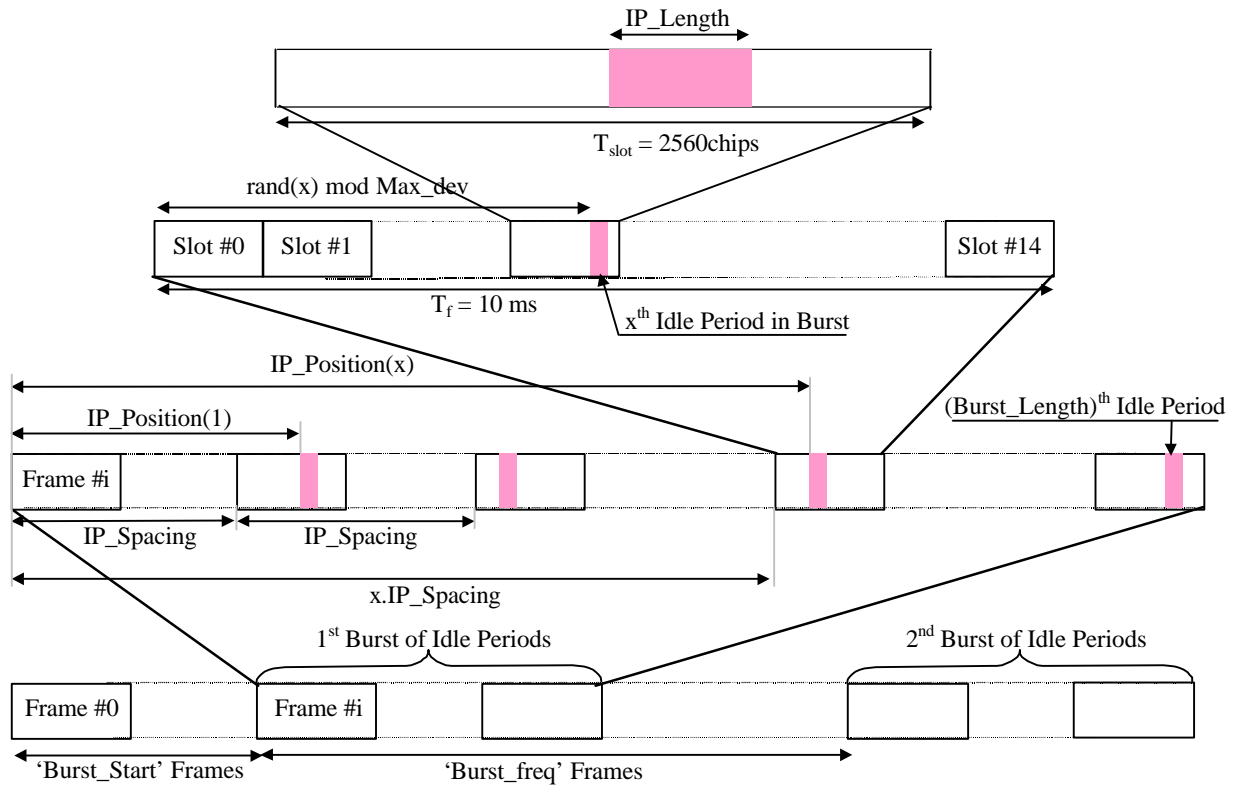
4 Layer 1 procedures

Using the above parameters the L1 has to create the Idle Periods using the following formula:

$$x * IP_Spacing * 150 + rand(x \bmod 64) \bmod Max_dev$$

where :

$$Max_dev = 150 - IP_Length,$$
$$rand(n) = (106 * rand(n - 1) + 1283) \bmod 6075, \quad \text{and}$$
$$rand(0) = Seed$$



The above diagram is drawn for the general case of burst mode operation where the idle periods occur in bursts, each burst is long enough for a UE to make sufficient measurements to allow its location to be calculated.

The Idle Periods can also occur in continuous mode where the Idle Periods don't occur in bursts, they are always active. This continuous mode can be considered as a specified case of the burst mode with just one burst spanning the whole SFN cycle.

In both burst and continuous mode the pattern generation functions are reset every SFN cycle so that there is never an ambiguity in the Idle Period position relative to the SFN.

The measurements that the UE has to perform during the idle periods in support of location services are already defined in 25.215 but these idle periods (which make these measurements possible) are not described anywhere. Therefore it is proposed that a section be added to 25.214[1] to describe the function idle periods and the exact details of how they are physically arranged.

5 Text proposal for TS 25.214

It is proposed that the following section be added to 25.214.

Start of Text Proposal

10 Idle Periods for IPDL Location method.

To support time difference measurements that need to be made for location services there needs to be Idle Periods created in the DownLink (IPDL) during which time all channels from a node B are temporally seized. During these Idle Periods the visibility of neighbour basestations from the UE is improved thus allowing the measurements to be performed.

The Idle Periods are arranged in a predetermined pseudo random fashion according to higher layer parameters, these parameters are used by layer 1 to arrange and use these Idle Periods. Idle Periods differ from compressed mode in that they are shorter in duration, all channels are silent simultaneously, and no attempt is made to prevent data loss.

In general there are two modes for these Idle Periods:

- Continuous mode, and
- Burst mode

In continuous mode the Idle Periods are active all the time. In burst mode the Idle Periods are arranged in bursts where each burst contains enough Idle Periods to allow a UE to make sufficient measurements for its location to be calculated. The bursts are separated by a period where no Idle Periods occur.

10.1 Parameters of IPDL

The follow parameters are signalled to the UE via higher layers:

IP_Status: This is a logic value that indicates if the Idle Periods are arranged in continuous or burst mode.

IP_Spacing: The number of 10ms frames between the start of a frame that contains an Idle Period and the next frame that contains an Idle Period. (Note that there is at most one Idle Period in a frame)

IP_Length: The length of the Idle Periods, expressed in symbols if the CPICH.

IP_offset: A cell specific offset (can be used to synchronise Idle Periods from different sectors within a node B).

Seed: A seed for a pseudo random number generator.

Additionally in the case of burst mode operation the following parameters are also communicated to the UE.

Burst_Start: The SFN where the first burst of Idle Periods starts.

Burst_Length: The number of Idle Periods in a burst of Idle Periods.

Burst_Freq: The number of frames of the primary CPICH between the start of a burst and the start of the next burst.

10.2 Calculation of Idle Period Position

The position of the x^{th} Idle Period relative to the start of a burst, expressed in symbols of the CPICH, is given by the formula (assuming the Idle Periods are indexed from 1, i.e. the first Idle Period is $x=1$ etc):

$$x * IP_Spacing * 150 + rand(x \bmod 64) \bmod Max_dev + IP_offset$$

where : $Max_dev = 150 - IP_Length$,
 $rand(n) = (106 * rand(n - 1) + 1283) \bmod 6075$, and
 $rand(0) = Seed$

Continuous mode can be considered as a specific case of the burst mode with just one burst spanning the whole SFN cycle. Note also that x will be reset to x=1 for the first idle period in a SFN cycle for both continuous and burst modes and will also, in the case of burst mode, be reset for the first Idle Period in every burst.

Figure x.x illustrates the Idle Periods for the Burst Mode case.

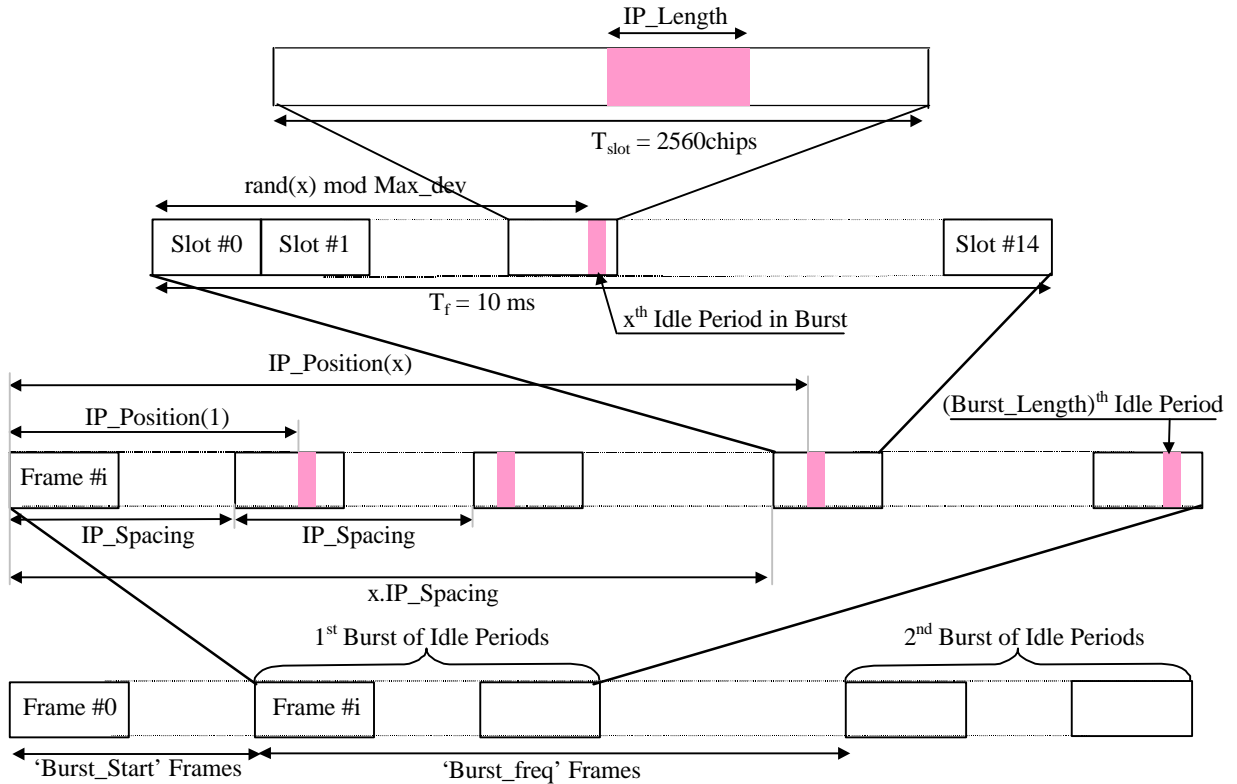


Figure x.x Idle Period placement in the case of burst mode operation.

End of Text Proposal

6 References

[1] TSG RAN WG1, "TS 25.214 v3.0.0 Physical layer Procedures (FDD)"