

Agenda Item: 14.1
Source: Ericsson
Title: **Scheduling of system information**
Document for: Discussion and Decision

1 Introduction

This contribution proposes a method for scheduling of the *system information blocks* and defining the scheduling information.

It also proposes text to be added into TS 25.331.

2 Discussion

The system information elements are broadcast in *system information blocks*. Different system information blocks may have different characteristics, e.g. regarding their repetition rate and the requirements on UEs to update the system information blocks. A *master information block* is used to specify what system information blocks are in use in a cell, and how they are scheduled. The *system information blocks* may also contain scheduling information for other *system information blocks* in a lower hierarchy.

The scheduling information consists of the following parameters:

- actual broadcast channel (if more than one exists)
- the repetition period (SIB_REP)
- the position (phase) within the repetition period (SIB_POS).

The scheduling is based on the Cell System Frame Number (SFN). The frame at which a particular *system information block* occurs is defined as follows:

$$\text{SFN mod SIB_REP} = \text{SIB_POS}$$

It is proposed that SIB_REP be defined as a power of 2. Thus a big range for SIB_REP can be achieved with only a few bits. This will also simplify the scheduling of various *system information blocks* with different repetition periods on the same channel. In that case two *system information blocks* with a low repetition rate can be multiplexed to give the next higher repetition rate, which can be multiplexed with a *system information block* with that repetition rate etc. This is illustrated in the figure below, where four different *system information blocks* are multiplexed on one channel. The SIBs have the following parameters:

SIB1: SIB_REP = 8 SIB_POS = 0
SIB2: SIB_REP = 8 SIB_POS = 4
SIB3: SIB_REP = 4 SIB_POS = 2
SIB4: SIB_REP = 2. SIB_POS = 1

SFN:	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	SIB1	SIB4	SIB3	SIB4	SIB2	SIB4	SIB3	SIB4	SIB1	SIB4	SIB3	SIB4	SIB2	SIB4	SIB3

If layer 2 segmentation is used, the scheduling information indicates the occurrence of the first part of the SIB. The SIB will then continue on the subsequent frames of the same logical channel, on which no other SIB shall be scheduled. Two logical BCCHs are used in order to allow mixing of SIBs with small SIB_REP and SIBs with segmentation over many frames. Only one BCCH can occur in each frame, which must be considered when scheduling the SIBs. The following example shows a case where SIB1 and SIB3 are segmented into two frames (a and b) and transmitted on BCCH2. SIB2 is transmitted on BCCH1. Some empty frames are also show. The SIBs have the following parameters:

SIB1: SIB_REP = 8 SIB_POS = 0
 SIB2: SIB_REP = 8 SIB_POS = 3
 SIB3: SIB_REP = 4 SIB_POS = 2

SFN:	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
BCCH1				SIB2								SIB2			
BCCH2	SIB1a	SIB1b	SIB3a		SIB3b		SIB3a	SIB3b	SIB1a	SIB1b	SIB3a		SIB3b		SIB3a

Note that the scheduling shown in the figures above may not be optimal. They do not even comply with the range proposed below. They are only shown to highlight the scheduling principles.

A suitable range for SIB_REP would be 16 to 2048 (3 bits required) corresponding to 0.16 to 20.48 seconds. SIB_POS must always be less than SIB_REP. The number of bits used to code SIB_POS can therefore be SIB_REP dependent (4 to 11). This will save bits and avoid an error case.

The *master information block* will be scheduled in the same way but the parameters will be specified (FFS). SIB_REP might be less the 16 if that is considered suitable.

3 Proposal

Include the following text in TS 35.331 [1]:

The following parameters are used for the scheduling of system information blocks on BCCH:

- actual broadcast channel [*Note: two logical channels will be mapped onto the BCH in order to allow segmentation over more frames than the shortest repetition period used*].
- the repetition period (SIB_REP), defined as a power of 2.
- the position (phase) within the repetition period (SIB_POS).

The scheduling is based on the Cell System Frame Number (SFN). The frame at which a particular system information block occurs is defined as follows:

$$SFN \text{ mod } SIB_REP = SIB_POS$$

$$\text{where } SIB_POS < SIB_REP$$

When layer 2 segmentation is used, the scheduling information indicates the occurrence of the first part of the system information block. The system information block will then continue in the subsequent frames on the same logical channel, in which no other system information block shall be scheduled. System information blocks shall not be scheduled on both logical channels in the same frame.

4 References

[1] TS 25.331 v1.2.0, RRC Protocol Specification