Agenda Item:

Source: **SK Telecom**

Title: **Uplink Synchronization Transmission Scheme**
Document for: **Discussion**

_____

1. Introduction

Uplink Synchronous Transmission Technique was adopted as an optional techniques for low mobility UE in ARIB Volume 3 and has been discussed in ETSI layer 1 expert meetings[1][2]. But it has not been accepted in text and as a pending item, which is described in section 9. In this document, we propose the refined text for further discussion.
Major changes from the previous description are;
  - channelization code assignment method for reducing Peak to Average power Ratio [3].
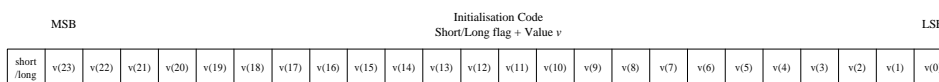 - refine the text and fix the undefined parameters.

2. Text Proposal

4.3.2   Scrambling codes

4.3.2.1 General

There are 2^{24} uplink scrambling codes. Either short or long scrambling codes should be used on the uplink. The short scrambling code is typically used in cells where the base station is equipped with an advanced receiver, such as a multi-user detector or interference canceller. With the short scrambling code the cross-correlation properties between different physical channels and users does not vary in time in the same way as when a long code is used. In cells where there is no gain in implementation complexity using the short scrambling code, the long code is used instead due to its better interference averaging properties. Both short and long scrambling codes are represented with complex-value.
The uplink scrambling generator (either short or long) shall be initialised by a 25 bit value. One bit shall indicate selection of short or long codes (short = 1, long = 0). Twenty four bits shall be loaded into the scrambling generators as shown in sections 4.3.2.2 and 4.3.2.3.

MSB										Initialisation Code Short/Long flag + Value *v*													LSB
short /long	v(23)	v(22)	v(21)	v(20)	v(19)	v(18)	v(17)	v(16)	v(15)	v(14)	v(13)	v(12)	v(11)	v(10)	v(9)	v(8)	v(7)	v(6)	v(5)	v(4)	v(3)	v(2)	v(1)	v(0)

Figure 115 - Initialisation Code for Uplink Scrambling generator

[Alternatively, if the system chooses, Uplink Synchronous Transmission Scheme(USTS described in section 9)RSTS for uplink transmission, the scrambling code is the same as the downlink scrambling code described in 5.2.2. In this case, the same scrambling code is allocated to all dedicated physical channels in the cell.]

9   UplinkReverse link synchronous transmission

< Editor's note: This clause is only to be found in ARIB Volume 3. Some more discussion on this technique is probably needed, and for now the original text is kept. The physical layer procedures of RSTS needs to be identified and further refined and described in this clause. >

9.1   General

Uplink~~Reverse Link~~ Synchronous Transmission (U~~R~~STS) can reduce reverse link intra-cell interference by means of making a node B receive orthogonalized signals from UEs in the cell. To orthogonalize receiving signals from UEs,
- the same scrambling code is allocated to all dedicated physical channels in the cell,
- different orthogonal spreading codes are allocated to all dedicated physical channels across all UEs in the cell,
- the channelization codes are chosen from either upper half part or the lower half part of the OVSF code tree,
- additional scrambling codes can be allocated if all channelization codes are occupied, and
- the signal arrival time of each UE is adjusted.

The spreading and modulation scheme according to U~~R~~STS is same as <section 4.,Uplink spreading and modulation>~~described in <update 3.2.4.2.1.2.2>~~. But, in USTS, a specific combination of channelization code and scrambling code can be used in a cell if and only if no other channelization code on the path from the specific code to the root of the tree or in the sub-tree below the specific code is used in the same cell with the same scrambling code. The timing control procedures are described later in this section. U~~R~~STS is an alternative technology applicable for low mobility terminals. A system mainly accommodating low mobility terminals may adopt the U~~R~~STS.

The transmission time control is carried out by two steps. The first step is initial synchronization and the second is tracking.
1) Initial synchronization: Adjust transmission time through the initial timing control message over FACH
2) Tracking Process (Closed Loop Timing control): Adjust the transmission time through the Time Alignment Bit (TAB) over DTCH.

9.2   Initial synchronisation

- When the node B received signal from UE over RACH, node B measures the difference in time between the received timing and the reference time.
- The message for initial synchronization is delivered to UE via FACH.
- UE adjust its transmission time according to the message ~~(the maximum amount of adjustments corresponds to the round trip delay of a cell)~~.
- When the difference in time of initial measurement in the first step is not big, it is possible to skip these initial synchronization processes.

9.3   Tracking process

- Node B periodically compares the difference between the reference time and received signal timing from UE.
- When the received timing is earlier than the reference time, Time Alignment Bit (TAB) = "0". When this is later than the reference time, TAB = "1".
- Since the timing control is carried out at much lower rate than TPC, TAB replaces the TPC bit every timing control period of 20 msec. ~~(In the exemplary embodiment, t~~The timing control period equals to the length of two frame~~s length or multiples of it. In case of the example of timing control every frame,~~ and the first TPC bit of e~~very two~~ach frame~~s~~ is replaced by TAB.~~)~~
- At the UE, hard~~soft~~ decision on the TAB shall be performed, and when it is judged as "0", the transmission time shall be delayed by ~~1/4 (or~~ 1/8~~)~~ chip, whereas if it is judged as "1", the transmission time shall be advanced by ~~1/4 (or~~ 1/8~~)~~ chip.

9.4   Reference time

The reference time of node B is set up at even numbered frame timing plus half slot duration.~~the starting point of forward link frame plus the median value between minimum and maximum round trip delay within a cell. < Editor's note: How can one take the median of two values? >~~

Note) The required L2, L3 procedures for supporting USTS

- As the USTS is optional technique, the message indicating whether a base station is based on USTS or not is included in BCH.
- The message for the initial synchronization process in FACH.
- Channelization code allocation message in ~~XXX~~ FACH

3. References

[1] TTA, "Reverse Link Synchronous Transmission Scheme," Tdoc SMG2 UMTS-L156/98
[2] TTA, "Text Proposal for Uplink Synchronous Transmission Scheme," Tdoc SMG2 UMTS-L1 410/98
[3] ETRI, "Channelization code assignment for RSTS" TSGR1#5(99)581