

3GPP TSG-RAN Working Group 1 Meeting No. 7
August 30 – September 3 1999, Hannover, Germany

Agenda Item:

Source: Siemens AG

Title: Additional Midambles for PRACH in TDD Mode

Document for: Decision

Scope

In order to support larger cells in TDD mode, it was adopted during last WG1 meetings to support the usage of a set of different Basic Midamble Sequences per cell for RACH transmission. Regarding this it was discussed that additional Basic Midamble Sequences would be advantageous for that purpose. In this contribution we propose to use time-inverted basic sequences for this application and to limit the 'set' of sequences.

Principle

According to current TDD specification, midambles for different users are derived from a Basic Midamble Sequence which is fixed for each cell. In TS25.221, 128 different Basic Midamble Sequences are shown, thus 128 different Cell Parameter sets are defined in TS25.223.

However, due to the optional usage of two Basic Midamble Sequences per cell for RACH purposes, it was requested to provide additional sequences. If such additional sequences would have to be stored in the UE, this would require additional memory. For this reason we propose to invert the Basic Sequences in time domain. These inverted sequences can then be used for deriving additional user midambles without the need for additional memory.

In this context, we also propose to limit the number of different Basic Midamble Codes for RACH purposes to two per cell. This leads to a simple scheme where the cell's Basic Midamble scheme and its time-inverted sequence are used as the basis for RACH midamble generation.

Text proposal

In the text as given below required changes for usage of time-inverted Basic midamble sequences are shown. The changes apply to specification document TS25.221.

Conclusion

We propose to adopt the text from beyond to the specification document TS 25.221.

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5.3.2.3 PRACH Training sequences

The training sequences, i.e. midambles, of different users active in the same time slot are time shifted versions of ~~a small set of a single~~ periodic basic codes ~~(in cells with small radius, a single periodic code can be used)~~. The basic midamble codes used for PRACH bursts are the same as for burst type 1 and are shown in Annex A. The necessary time shifts are obtained by choosing either *all* $k=1,2,3,\dots,K$ (for cells with small radius) or *uneven* $k=1,3,5,\dots\leq K$ (for cells with large radius). Different cells use different periodic basic codes, i.e. different midamble sets.

For cells with large radius additional midambles may be derived from the time-inverted Basic Midamble Sequence. Thus, the second Basic Midamble Code m_2 is the time inverted version of Basic Midamble Code m_1 .

In this way, a joint channel estimation for the channel impulse responses of all active users within one time slot can be performed by a small number of maximum of two cyclic correlations (in cells with small radius, a single cyclic correlator suffices). The different user specific channel impulse response estimates are obtained sequentially in time at the output of the cyclic correlators.

5.3.2.4 Association between Training Sequences and Spreading Codes

For the PRACH there exists a fixed association between the training sequence and the spreading code. The generic rule to define this association is based on the order of the spreading codes $\mathbf{a}_Q^{(k)}$ given by k and the order of the midambles $\mathbf{m}_j^{(k)}$ given by k , firstly, and j , secondly, with the constraint that the midamble for a spreading factor Q is the same as in the upper branch for the spreading factor $2Q$. The index $j=1$ or 2 indicates whether the original Basic Midamble Sequence ($j=1$) or the time-inverted Basic Midamble Sequence is used ($j=2$)~~different basic periodic codes.~~

- For the case that all k are allowed and ~~there is~~ only one periodic basic code m_1 is available for the RACH, the association depicted in figure 23 is straightforward.
- For the case that only odd k are allowed the principle of the association is shown in figure 24. This association is applied for one and two basic periodic codes.

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