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- TSG-RAN Working Group 1 meeting #2
- Yokohama, Japan
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- **Agenda Item:** 8.4
- **Source:** Ad Hoc #3
- **Title:** Report from Ad Hoc #3: RACH
- **Document for:**

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1. INTRODUCTION

- The RACH AdHoc group (AdHoc #3) was created at the 1st WG1 meeting with the objective to merge the RACH schemes of ETSI and ARIB. Email discussions within the RACH AdHoc group has since then taken place.

2. DESCRIPTION OF CURRENT RACH SCHEME

- The ARIB RACH scheme is described in detail in [1]. The ETSI RACH scheme is described in [2], [3], and [4]. Here we focus on the commonalities and differences between the two schemes.

2.1 Commonalities

- The ETSI and ARIB RACH schemes have the following common features:
- In both cases, the RACH scheme is based on slotted ALOHA
- In both cases, the message part of each random-access transmission is of length 10 ms
- In both cases, the structure of the message part is similar to the structure of the uplink dedicated physical channel, i.e. it consists of a data part transmitted on the I branch and a control part transmitted on the Q branch.
- In both cases, the signature concept is used to allow for the reception of multiple simultaneous RACH transmissions.

2.2 Differences

- The main differences between the ETSI and ARIB RACH schemes are:
- In ETSI, the transmission of the message part is preceded by one or several preambles. There is no preamble in the ARIB RACH scheme.
- In ETSI, fast power ramping is carried out during the preamble transmission.
- There are also some minor differences between the two proposals:
- In ARIB, there are two channel rates for the data part (32 and 128 kbps, corresponding to spreading factors of 128 and 32 respectively). In ETSI there are four different rates for the data part (32 kbps, 64 kbps, 128 kbps, 256 kbps, corresponding to spreading factors of 128, 64, 32, and 16 respectively).
- In ETSI, the control part includes a field similar to the TFCI field of the dedicated physical channel. This field indicates the rate, or equivalently the spreading factor, of the data part. In ARIB, it is assumed that blind rate detection can be used to determine the rate of the data part.

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- In ETSI, there is a maximum of 8 access slots per frame, compared to a maximum of 16 access slots per frame in ARIB. The maximum number of access slots in ETSI is limited by the use of the preamble of length 1 ms.

3. RECOMMENDATION FOR 3GPP RACH SCHEME

- At an early time of the discussions within the AdHoc #3, a proposal was made by the vice-chairman (Takehiro Nakamura of NTT DoCoMo) that 3GPP should adopt the RACH scheme of ETSI. Some questions on the ETSI RACH scheme was then raised from the ARIB members but no objections have been raised against the proposal. The recommendation from the AdHoc #3 is therefore that 3GPP adopts the ETSI RACH scheme.
- The recommendation is based on the following arguments:
- Several papers submitted to the ETSI L1 Expert group has shown benefits in terms delay and spectral efficiency with power-ramping for the random-access transmission.
- The use of a preamble improves power-ramping performance and also allows for less complex RACH detector implementation. Adopting the preamble, implies that the maximum number of access slots per frame needs to be limited to 8.
- An increased number of data rates for the RACH transmission allows for increased flexibility.
- With an increased number of data rates, explicit rate information allows for less complex rate detection, compared to blind rate detection.

4. FAUSCH

- The current text describing the RACH scheme in ETSI document XX.03 also includes a description of the FAUSCH. The FAUSCH remains to be agreed upon in 3GPP and has not been discussed within AdHoc #3. It is proposed that the text on FASUCH in ETSI document XX.03 remains also in 3GPP document S1.11. However, the texts should be within brackets to indicate that this is an item not yet agreed upon within 3GPP.

5. TEXT PROPOSAL

- We propose that the current text in ETSI documents XX.03, XX.05, XX.07, describing the ETSI RACH scheme, should be used also within 3GPP. More specifically, the following parts of the ETSI XX-documents should be included in the 3GPP S-documents
- XX.03 section 5.2.2.1 → S1.11 section 5.2.2.1, text on FAUSCH in brackets.
- XX.05 section 6.1.2 → S1.13 section 6.2.2
- XX.05 section 6.2.3 → S1.13 section 6.3.3
- XX.07 section 6 → S1.14 section 7
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6. REFERENCES

- [1] Association of Radio Industries and Businesses (ARIB). Volume 3: Specifications of Air-Interface for 3G Mobile System, v1.0, 14th, January, 1999.
- [2] ETSI L1 Expert Group. UTRA FDD: Transport channels and physical channels. UMTS XX.03 v.1.3.0.
- [3] ETSI L1 Expert Group. UTRA FDD: Spreading and modulation description. UMTS XX.05 v.0.6.0.
- [4] ETSI L1 Expert Group. UTRA FDD: Physical layer procedures. UMTS XX.07 v.1.3.0.