TSG-RAN Working Group 4 (Radio) meeting #8   *TSG R4#8(99)677*
Sophia Antipolis, France
26-29 October 1999

Agenda Item:

Source: Motorola

Title: Comments on Base Station Modulation Accuracy and Code Domain Power

Document for: Discussion

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1   Introduction

Motorola has reviewed the current requirements for modulation accuracy (Section 6.8.2 of 25.104) and peak code domain error (Section 6.8.3 of 25.104) and would like to make several comments. These comments are based on many measurements of operating base stations and mobile stations.

2   Modulation Accuracy

Motorola believes that the requirements for EVM should be modified as follows:

- The EVM limit should be 23%, instead of the 12.5 place-holder value currently in the specification.
- Several power control groups should be measured to obtain sufficient statistical significance.
- A very tight (~1% EVM) spec should be placed on the test equipment, since the reference signal used for
  correlation in the test equipment must closely mimic the continuous 0.22 α RRC filter response.

This is based on the following assumptions:

1. **EVM has little effect on performance.**
   EVM has very little effect of the performance of the system over the range of 0 to 31% and is secondary in effect to channel effects. This is based on measurements of similar CDMA systems with rho values from near 1.000 down to approximately 0.912. For most data rates, the most noticeable attribute of EVM is lost power, and a slightly raised noise floor on the forward link. ISI-related effects only begin at the highest data rates where the S/N is significantly higher.

2. **Lower requirements for EVM limit the ability to reduce interference.**
   The system factors that most greatly degrade EVM are the digital pulse shaping, analog I- and Q- baseband filtering and matching, carrier feed-through, quadrature balance, SAW filtering, and cavity filters.

   While it is desirable to have a perfectly-matched filter when possible, there are scenarios when a tighter filter response is needed to resolve unique interference problems. A lower requirement for EVM precludes this necessary option. In similar CDMA systems operating in the N.A. Cellular Band, a unique interference case existed at the upper end of the B block, which prompted an increased rho requirement of 0.912 to allow extra filtering.

While the proposed value of 23% (rho of 0.95) is not as loose as the 31% value associated with a rho of 0.912 in some CDMA base stations today, it is thought to be sufficient to displace performance concerns and has precedence in the mobile station performance requirements in other CDMA systems today.

3   Peak Code Domain Error

Based on the acceptance of an EVM requirement of 23%, the code domain error specification can be calculated as the lost power divided over the number of possible orthogonal codes (assuming equal distribution of the noise power), which is (1-rho)/256 or –37 dB. Since some non-uniform distribution exists, it is suggested that a peak code domain error specification of –35 dB be accepted for Section 6.8.3 of 25.104 where the [ ] are currently present.

4   Suggested Text for 25.104

The following text is included in the attached CR.

6.8.2   Modulation Accuracy

The modulation accuracy is a measure of the difference between the measured waveform and the theoretical modulated waveform (the error vector). It is the square root of the ratio of the mean error vector power to the mean reference signal power expressed as a %. The measurement interval is one power control group (timeslot) in duration.

6.8.2.1   Minimum requirement

The Modulation accuracy shall not be worse than 23 % ~~12.5 %~~ at the maximum output power.

6.8.3   Peak code Domain error

The code domain error is computed by projecting the error vector power onto the code domain at the maximum spreading factor. The error vector for each power code is defined as the ratio to the mean power of the reference waveform expressed in dB. The peak code domain error is defined as the maximum value for the code domain error. The measurement interval is one power control group (timeslot) in duration.

6.8.3.1   Minimum requirement

The peak code domain error shall not exceed –35 ~~[   ]~~ dB.

5   Suggested Text for the "Test Equipment Performance" document

The requirements for the EVM test equipment shall provide a reference modulation signal with no worse than 1% EVM from the theoretical modulated waveform.

6   Suggested Text for 25.141

Add to the end of the modulation accuracy and peak code domain error sections:

Averaging over multiple measurement intervals shall be performed to achieve sufficient statistical significance for the measurement.

3G CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

CR

Current Version:

3G specification number ↑   *↑ CR number as allocated by 3G support team*

For submision to TSG **RAN4**   for approval **X**   *(only one box should*
list TSG meeting no. here ↑   for information   *be marked with an X)*

Form: 3G CR cover sheet, version 1.0   The latest version of this form is available from: ftp://ftp.3gpp.org/Information/3GCRF-xx.rtf

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Proposed change affects: USIM ☐   ME ☐   UTRAN **X**   Core Network ☐
(at least one should be marked with an X)

Source: Jason Losh, Motorola   **Date:**   20 Oct 1999

Subject: Comments on Base Station Modulation Accuracy and Code Domain Power

3G Work item: 25.104

Category: F   Correction   **X**
                A   Corresponds to a correction in a 2G specification
(only one category   B   Addition of feature
shall be marked   C   Functional modification of feature
with an X)   D   Editorial modification

Reason for change: Peak code domain error specification is not included. Furthermore, the EVM value is adjusted to agree with the proposed specified code domain error specification.

Clauses affected: 25.104: Sections 6.8.2 and 6.8.3

Other specs affected:
Other 3G core specifications   ☐ → List of CRs:
Other 2G core specifications   ☐ → List of CRs:
MS test specifications   ☐ → List of CRs:
BSS test specifications   ☐ → List of CRs:
O&M specifications   ☐ → List of CRs:

Other comments:

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