Title: Proposed Changes to TIA/EIA 136-131 to include TDMA Half-Rate Speech Codec

Abstract:
This contribution proposes changes to TIA/EIA 136-131, [1], to include TDMA half-rate speech codec. The changes are based on Lucent Technologies' TDMA half-rate speech codec proposal, [2], and serve to complete the description of Lucent’s proposal. The document indicates the changes required within each section of TIA/EIA 136-131.

Recommendation:
FYI.

Notice:
The proposals in this submission have been formulated by Lucent Technologies to assist the Universal Wireless Communications Consortium (UWCC). This document is offered to UWCC as a basis for discussion and is not binding on Lucent Technologies. The results are subject to change in form and in numerical values after more study. Lucent Technologies specifically reserves the right to add to, or amend, the quantitative statements made herein. Nothing contained herein shall be construed as conferring by implication, estoppel, or otherwise any license or right under any patent, whether or not the use of information herein necessarily employs an invention of any existing or issued patent.

Copyright Statement:
Copyright © 1999 Lucent Technologies. All rights reserved. Lucent Technologies hereby gives permission for copying this submission for the legitimate purposes of the UWCC, provided Lucent Technologies is credited on all copies. Distribution or reproduction of this document, by any means, electronic, mechanical, or otherwise, in its entirety, or any portion thereof, for monetary gain or any non UWCC purpose is expressly prohibited.

Grant of License:
Lucent Technologies grants a free, irrevocable license to the Universal Wireless Communications Consortium (UWCC) to incorporate text contained in this submission and any modifications thereof in the creation of a UWCC publication; to copyright in UWCC’s name any UWCC publication even though it may include portions of this submission; and at UWCC’s sole discretion to permit others to reproduce in whole or in part the resulting UWCC publication.

IPR Declaration:
Lucent Technologies agrees to abide by the UWCC IPR policy.
Discussion

This contribution proposes changes to the TIA/EIA 136-131 to include TDMA half-rate speech codec. The changes are based on Lucent Technologies’ TDMA half-rate speech codec proposal [1], and serve to complete the description of Lucent’s proposal. The document indicates the changes required within each section of TIA/EIA 136-131. The section numbering follows the numbering scheme described in TIA/EIA 136-131. In the case where an entire section does not require any changes, we only include the top-most section heading. We also note that table and figure numbering will need to change after the new text is included in the document.

References


2. UWCC.GTF.HRP.99.05.26_, Lucent Technologies, (1999), *Lucent Technologies half-rate speech codec*. 
1. Digital Traffic Channel Structure

No change to TIA/EIA 136-131.

1.1. Shortened Burst Definition

No change to TIA/EIA 136-131.

1.2. Frame Length

The following description should be added after the second paragraph.

When the half-rate slot assignment is for the downlink (base-to-mobile), two slots per half-rate channel may be assigned. However, the assigned slots must be co-shared with another half-rate traffic channel. Figure 1.2-1 illustrates slot co-sharing between two half-rate traffic channels.

Figure 1.2-1: Slot co-sharing for TDMA half-rate solution in the downlink

1.2.1. Standard Offset Reference

No change to TIA/EIA 136-131.
1.3. Gross Rate for the Traffic Channel

No change to TIA/EIA 136-131.

1.4. Guard and Power Ramp Up Interval

No change to TIA/EIA 136-131.

1.5. Synchronization Word/Time Slot Identifier

No change to TIA/EIA 136-131.

1.6. Coded Digital Verification Code

No change to TIA/EIA 136-131.

1.7. Coded Digital Control Channel Locator

No change to TIA/EIA 136-131.

1.8. DATA

No change to TIA/EIA 136-131.

1.8.1. Channel Encoding

The following text is added at the end of the paragraph.

For TDMA half-rate speech codec, a punctured rate ½, K=7, convolutional code is used.

1.8.1.1. Channel Encoding for $\pi/4$ DQPSK Modulation

No change to TIA/EIA 136-131.

1.8.1.2. Channel Encoding for 8-PSK Modulation

For TDMA half-rate speech codec refer to TIA/EIA standard covering half-rate speech coder (for instance the specification in [2]).
1.8.2. **Interleaving**

No change to TIA/EIA 136-131.

1.8.2.1. **Interleaving for \(\pi/4\) DQPSK Modulation**

No change to TIA/EIA 136-131.

1.8.2.2. **Interleaving for 8-PSK Modulation**

For TDMA half-rate speech codec refer to TIA/EIA standard covering half-rate speech coder (for instance the specification in [2]).

1.9. **Pilot Symbol Fields (Pn)**

No change to TIA/EIA 136-131.

1.9.1. **Power Ramp (PRAMP)**

No change to TIA/EIA 136-131.

1.9.2. **\(\pi/4\) DQPSK for ACELP (CC2)**

No change to TIA/EIA 136-131.

1.10. **8-PSK**

No change to TIA/EIA 136-131.

1.11. **Fast Power Control (F)**

No change to TIA/EIA 136-131.

1.12. **Reserved (RSVD)**

No change to TIA/EIA 136-131.
2. Digital Voice and Data Signal – Mobile Station

No change to TIA/EIA 136-131.

2.1. Modulation

No change to TIA/EIA 136-131.

2.1.1. π/4 DQPSK Modulation

No change to TIA/EIA 136-131.

2.1.2. 8-PSK modulation

For TDMA half-rate speech coder the absolute phase $\Phi$ shall be determined according to the following Table.

Table 2.1.2-1: 8-PSK symbol phases for half-rate speech codec

<table>
<thead>
<tr>
<th>$X_k$</th>
<th>$Y_k$</th>
<th>$Z_k$</th>
<th>$\Phi$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>$\pi/4$</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>$\pi/2$</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>$3\pi/4$</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>$\pi$</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>$-3\pi/4$</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>$-\pi/2$</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>$-\pi/4$</td>
</tr>
</tbody>
</table>
2.1.3. **Modulation Accuracy**

No change to TIA/EIA 136-131.

2.1.3.1. **Description of the Technique used to specify the Modulation Accuracy Requirement**

No change to TIA/EIA 136-131.

2.1.3.2. **Average Frequency Error Definition**

No change to TIA/EIA 136-131.

2.1.3.3. **Error Vector Magnitude Requirement-π/4 DQPSK**

No change to TIA/EIA 136-131.

2.1.3.4. **Error Vector magnitude Requirement-8-PSK**

The following table describes the sequence B(k) for the TDMA half-rate speech codec.

**Table 2.1.3.4- 8-PSK mapping for B(k) for half-rate speech codec**

<table>
<thead>
<tr>
<th>Xk</th>
<th>Yk</th>
<th>Zk</th>
<th>B(k)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>7</td>
</tr>
</tbody>
</table>
2.2. Demodulation

No change to TIA/EIA 136-131.

2.2.1. $\pi/4$ DQPSK Modulation

No change to TIA/EIA 136-131.

2.2.2. 8-PSK Modulation

No change to TIA/EIA 136-131

2.3. De-Interleaving

For TDMA half-rate speech codec refer to TIA/EIA standard covering half-rate speech coder (for instance the specification in [2]).

2.4. Convolutional Decoding

For TDMA half-rate speech codec refer to TIA/EIA standard covering half-rate speech coder (for instance the specification in [2]).

2.5. Cyclic Redundancy Check

For TDMA half-rate speech codec refer to TIA/EIA standard covering half-rate speech coder (for instance the specification in [2]).

2.6. Downlink Power Control Requirements

No change to TIA/EIA 136-131.
3. Digital Voice and Data Signals-Base Station

No change to TIA/EIA 136-131.

3.1. Modulation

No change to TIA/EIA 136-131.

3.1.1. Channel Sharing

The following text should be added after the last paragraph.

As an alternate form of channel sharing, applicable to half-rate traffic channels, a time-slot for receiving data from the base station will be assigned to two mobile stations (two slots per TDMA frame). Both mobile stations must be able to demodulate the entire data contained within the slot and then select the data corresponding to their assigned traffic channels.

3.1.2. π/4 DQPSK Modulation

No change to TIA/EIA 136-131.

3.1.3. 8-PSK Modulation

No change to TIA/EIA 136-131.

3.2. Demodulation

No change to TIA/EIA 136-131.

3.2.1. π/4 DQPSK Modulation

No change to TIA/EIA 136-131.

3.2.2. 8-PSK Modulation

No change to TIA/EIA 136-131.
3.3. **Speech Coding**

For TDMA half-rate speech codec refer to TIA/EIA standard covering half-rate speech coder (for instance the specification in [2]).

3.4. **De-Interleaving**

For TDMA half-rate speech codec refer to TIA/EIA standard covering half-rate speech coder (for instance the specification in [2]).

3.5. **Convolutional Decoding**

For TDMA half-rate speech codec refer to TIA/EIA standard covering half-rate speech coder (for instance the specification in [2]).

3.6. **Speech Decoding**

For TDMA half-rate speech codec refer to TIA/EIA standard covering half-rate speech coder (for instance the specification in [2]).

3.7. **Downlink Power Control Requirements**

No change to TIA/EIA 136-131.

3.8. **Delay Interval Requirements**

No change to TIA/EIA 136-131.
4. Change History for TIA/EIA-136-131

Changes will reflect the inclusion of TDMA half-rate speech coder.