HRPD-cdma2000 1x Interoperability for Voice and Data

System Requirements

COPYRIGHT NOTICE
3GPP2 and its Organizational Partners claim copyright in this document and individual Organizational Partners may copyright and issue documents or standards publications in individual Organizational Partner's name based on this document. Requests for reproduction of this document should be directed to the 3GPP2 Secretariat at secretariat@3gpp2.org. Requests to reproduce individual Organizational Partner's documents should be directed to that Organizational Partner. See www.3gpp2.org for more information.
**EDITOR**
John Kay, Motorola

**REVISION HISTORY**

<table>
<thead>
<tr>
<th>Revision number</th>
<th>Content changes.</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Initial Publication Version</td>
<td>February 23, 2006</td>
</tr>
</tbody>
</table>
# Table of Contents

1 Table of Contents ........................................................................................................... 5
2 List of Tables .................................................................................................................. 6
3 List of Figures ................................................................................................................. 7
4 1 INTRODUCTION ......................................................................................................... 8
   1.1 REFERENCES .......................................................................................................... 8
7 1.2 DEFINITIONS AND ABBREVIATIONS ......................................................... 8
9 2 GENERAL DESCRIPTION ....................................................................................... 9
10 3 HIGH LEVEL SYSTEM REQUIREMENTS ...................................................... 9
11 3.1 General ................................................................................................................. 9
12 3.2 Registration .......................................................................................................... 10
13 3.3 Authentication ....................................................................................................... 11
14 3.4 Security ................................................................................................................. 11
15 3.5 Voice Quality ....................................................................................................... 11
16 3.6 Mobility ............................................................................................................... 11
17 3.7 Interaction of Simultaneous Voice and Data Calls ....................................... 12
18 3.8 Accounting ......................................................................................................... 13
19 3.9 Applicability of and Interactions with Wireless Features .................. 13
20
List of Tables

1. Table 1 Handoff scenarios ........................................................................... 12
List of Figures
1 INTRODUCTION

This document defines the system requirements for HRPD-cdma2000 1x Interoperability for Voice and Data. The cellular network includes Multimedia Domain (MMD), Legacy Mobile Station Domain Support (LMSD), and HRPD/cdma2000 1x radio access networks (RANs) for the delivery of voice, video, and data services.

1.1 REFERENCES

[4] 3GPP2 S.R0106-0 Packet Switched Video Telephony Stage 1 Requirements
[6] 3GPP2 X.S0013-003-0 All-IP Core Network Multimedia Domain; IP Multimedia (IMS) Session Handling; IP Multimedia (IM) Call Model, v1.0 2, December 2003

1.2 DEFINITIONS AND ABBREVIATIONS

1. cdma2000 1x – Abbreviated reference to system that utilizes the C.S0001~C.S0006.
2. AN – Access Network.
3. AT – Access Terminal.
4. BS – Base Station.
5. Emergency Services Call - A call requiring connection to a public safety authority, for example, a Public Safety Answering Point (PSAP).
6. HAT – Hybrid Access Terminal, a mobile terminal which contains both AT and MS capabilities. May function in both modes simultaneously or serially.
7. HRPD – High Rate Packet Data also known as 1xEV-DO.
8. IETF – Internet Engineering Task Force
9. LMSD1 – Legacy Mobile Station Domain Support Step 1.
10. LMSD2 – Legacy Mobile Station Support Step 2.
11. MMD – Multimedia Domain
12. MS – Mobile Station.
13. MSC – Mobile Switching Center. Depending on the context, the term MSC refers to both a legacy circuit MSC and an emulated MSC (MSCe).
14. MSCe – Mobile Switching Center Emulation.
15. PDSN – Packet Data Serving Node.
16. PSTN – Public Switched Telephone network.
17. RAN – Radio Access Network
18. VoIP – Voice over Internet Protocol
19. VT – Video Telephony

2 GENERAL DESCRIPTION

HRPD-cdma2000 1x Interoperability for voice and data describes several use cases that enable a user to originate or receive a voice call on a Hybrid Access Terminal that may also have a simultaneous active or dormant data session. The other party in the voice call may reside on a circuit-based network (either circuit PSTN or cdma2000 1x circuit core network) or packet based network (HRPD or cdma2000 1x packet connection). Mobility of the HAT in these use cases is also supported as well as extending these capabilities to video telephony service.
This document defines the system requirements that enable the HRPD-cdma2000 1x Interoperability feature as defined by the following use cases.

- **Use Case 1, Origination/Termination of a Voice Call with a connected HRPD Data Session:** A user in an active connection on the HRPD network, for example, downloading a large file, can originate/terminate a VoIP call in the HRPD network without ending the existing data session.

- **Use Case 2, Origination/Termination of a Voice Call with a Dormant HRPD Connection:** A user that establishes an active data connection and then transitions to a dormant data connection on the HRPD network can receive an incoming voice call on a cdma2000 1x network. In addition, the user can transition back to a connected state to originate or terminate a VoIP call on the HRPD network.

- **Use Case 3, Mobility between HRPD and cdma2000 1x for Voice Calls:** An HAT that is in a voice call (circuit or packet) on a cdma2000 1x network moves to a congested cell where the call may be dropped, but capacity is available in an overlaid HRPD network, the call can be handed off from cdma2000 1x to the HRPD network. Note that the HAT may have a dormant HRPD connection while connecting to a cdma2000 1x network. Alternatively, the HAT reaches the edge of HRPD coverage and if cdma2000 1x coverage exists, the call can be handed off from HRPD to the cdma2000 1x network. The cdma2000 1x network can redirect the HAT to HRPD during origination of a circuit voice call.

  Note: Redirection by the HRPD network is for future study

- **Use Case 4, Mobility of Video Telephony (VT) between HRPD and cdma2000 1x:** Video telephony mobility scenarios between cdma2000 1x and HRPD networks should be supported. In the event the cdma2000 1x network does not support VT, or if the HAT is on an HRPD VT call and moves out of the HRPD coverage, the VT call is handed off to a cdma2000 1x voice call (circuit or packet). When the HAT comes back to HRPD coverage with VT support, the full VT call may be re-established.

- **Use Case 5, Mobility of VoIP calls between HRPD systems:** A VoIP call can be handed off between HRPD systems.

### 3 HIGH LEVEL SYSTEM REQUIREMENTS

Note that not all requirements identified herein may be of equal desirability in terms of the feature development and may be implemented in the specifications via a series of revisions.

#### 3.1 General

**SYS001** - The system shall be capable of supporting VoIP calls over a cdma2000 1x RAN.

**SYS002** - The system shall be capable of supporting VoIP calls over a HRPD RAN.

**SYS003** – The HRPD – cdma2000 1x interoperable system shall be capable of supporting services enabled by MMD (e.g. SIP signaling based call control).

**SYS004** – The HRPD – cdma2000 1x interoperable system shall be capable of supporting services enabled by legacy MSCs, WIN, and other supporting legacy equipment.
SYS005 – The HPRD – cdma2000 1x interoperable system shall support simultaneous voice, video, and data services to a HAT.

SYS006 – The HPRD – cdma2000 1x interoperable system shall be able to support voice call (circuit or packet) origination and termination and data call origination for a HAT regardless of which network (HRPD or cdma2000 1x) is serving the terminal.

Note: SYS006 neither mandates nor precludes cross-paging or dual registration solutions.

SYS007 – The HAT shall be able to receive calls using a single user identity (e.g. Mobile Directory Number) regardless of which network (HRPD or cdma2000 1x) is serving the terminal.

SYS008 – It shall be possible to use a subscriber’s existing cdma2000 1x Mobile Directory Number for VoIP service.

SYS009 – The cdma2000 1x-HRPD interoperable system shall support the ability for either network to notify a user who is present in the other network of an attempt to initiate a service (e.g., the system shall allow the cdma2000 1x network to notify a user present in the HRPD network of an incoming cdma2000 1x voice call).

SYS010 – The cdma2000 1x-HRPD interoperable system shall support the ability to notify the initiating network that the service identified in a cross-network notification has been rejected.

SYS011 – The HRPD – cdma2000 1x interoperable system shall be capable of supporting Emergency Services Calls.

3.2 Registration

REG001 – The cdma2000 1x-HRPD interoperable system shall support the ability for a HAT to have an established HRPD session simultaneously with being registered on a cdma2000 1x system.

REG002 – The cdma2000 1x-HRPD interoperable system shall support the ability for a HAT to have an established HRPD session simultaneously with an active cdma2000 1x voice call.

REG003 – The cdma2000 1x-HRPD interoperable system shall support the ability for a HAT to be registered for VoIP and have an established HRPD session.

Note: Registration for VoIP is access technology agnostic.

REG004 – The cdma2000 1x-HRPD interoperable system shall support the ability for a HAT to be registered for VoIP and have an established HRPD session with an active VoIP call on HRPD.

REG005 – The cdma2000 1x-HRPD interoperable system shall support the ability for a HAT to be registered on a cdma2000 1x system and have an established dormant packet data session on cdma2000 1x.

REG006 – The cdma2000 1x-HRPD interoperable system shall support the ability for a HAT to be registered on a cdma2000 1x system and have an established dormant packet data session on cdma2000 1x with an active cdma2000 1x circuit voice call.

REG007 – The cdma2000 1x-HRPD interoperable system shall support the ability for a HAT to be registered on a cdma2000 1x system and have an established active packet data session on cdma2000 1x with no cdma2000 1x circuit voice call active.

REG008 – The cdma2000 1x-HRPD interoperable system shall support the ability for a HAT to be registered on a cdma2000 1x system and have an established active session for packet data on cdma2000 1x with an active cdma2000 1x circuit voice call.
3.3 Authentication

See [3] for HAT authentication requirements.

3.4 Security

Requirements related to Security in support of the HRPD–cdma2000 1x interoperability work item are For Future Study.

3.5 Voice Quality

VQ001 – Interruption of voice due to handoffs between cdma2000 1x and HRPD RANs shall be no worse than existing hard handoff interruptions within a given RAN.

3.6 Mobility

3.6.1 General Mobility Requirements

MOB001 - The HRPD - cdma2000 1x interoperable system shall have the capability to indicate to the HAT a preference amongst available networks for specific HAT originated services.

MOB002 - The cdma2000 1x network of an HRPD - cdma2000 1x interoperable system shall have the capability to re-direct the HAT to a different network during service origination.

MOB003 - The core network shall have be capable of delivering a call to a HAT via either the MSC or via the IMS network.

MOB004 - The HRPD network shall have the capability of notifying the HAT of the presence of cdma2000 1x neighbor cells.

MOB005 - The cdma2000 1x network shall have the capability of notifying the HAT of the presence of HRPD neighbor cells.

MOB006 - The HRPD network shall have the capability to handoff to another HRPD network without disconnecting the existing voice and video telephony calls and data services with the HAT.

MOB007 – The HRPD - cdma2000 1x interoperable system shall be capable of handing off a service if the equivalent service is available on the target network.

3.6.2 Packet Data Service Mobility

MOB008 - The HRPD - cdma2000 1x system shall be capable of supporting active hard handoffs between HRPD and cdma2000 1x RANs for data calls.

3.6.3 Voice Service Mobility

MOB009 - The system shall be capable of supporting handoffs between two HRPD RANs for VoIP calls.

MOB010 - Handoff from HRPD VoIP to cdma2000 1x CS voice call shall be supported.

MOB011 - Handoff from HRPD VoIP to cdma2000 1x VoIP shall be supported.

MOB012 - Handoff from cdma2000 1x CS voice call to HRPD VoIP shall be supported.

MOB013 - Handoff from cdma2000 1x VoIP to HRPD VoIP shall be supported.
The system shall be capable of supporting handoffs between cdma2000 1x CS-based and cdma2000 1x PS-based for voice calls. The requirements for the specific scenarios are as follows:

**MOB014** - Handoff from cdma2000 1x CS voice call to cdma2000 1x VoIP shall be supported.

**MOB015** - Handoff from cdma2000 1x VoIP to cdma2000 1x CS voice call shall be supported.

The following table summarizes the relevant requirements for the possible handoff scenarios for voice calls:

<table>
<thead>
<tr>
<th>Source Target</th>
<th>cdma2000 1x CS Voice</th>
<th>HRPD VoIP</th>
<th>cdma2000 1x PS Voice</th>
</tr>
</thead>
<tbody>
<tr>
<td>cdma2000 1x CS Voice</td>
<td>Existing Capability</td>
<td>MOB010</td>
<td>MOB015</td>
</tr>
<tr>
<td>HRPD VoIP</td>
<td>MOB012</td>
<td>MOB009</td>
<td>MOB013</td>
</tr>
<tr>
<td>cdma2000 1x PS Voice</td>
<td>MOB014</td>
<td>MOB011</td>
<td>Existing Capability</td>
</tr>
</tbody>
</table>

*Table 1 Handoff scenarios*

### 3.6.4 Video Telephony Mobility

**Vid001** - The HRPD - cdma2000 1x system shall be capable of handing off the voice component of a packet based video telephony call on the HRPD network to a (circuit or packet) cdma2000 1x voice call when video telephony is not available on the cdma2000 1x network.

**Vid002** - The HRPD - cdma2000 1x system shall be capable of handing off a packet based video telephony call on the cdma2000 1x network to a HRPD voice call when video telephony is not available on the HRPD network.

**Vid003** – The HRPD - cdma2000 1x system shall be capable of re-establishing the video component of a video telephony call upon handing off a (circuit or packet) 1x voice call (that was originally initiated as a video call on the HRPD network) back to the HRPD network.

**Vid004** – The HRPD - cdma2000 1x system shall be capable of re-establishing the video component of a video telephony call upon handing off a HRPD voice call (that was originally initiated as a video call on the cdma2000 1x network) back to the cdma2000 1x network.

**Vid005** – During the handoff of a video telephony call between cdma2000 1x and HRPD systems where video is available, the video component should be allowed to gracefully degrade/upgrade.

The reader is referred to [4] for additional Video Telephony related requirements.

### 3.7 Interaction of Simultaneous Voice and Data Calls

**Int001** – The HRPD network shall be capable of accepting a response from the HAT to the indication of an incoming voice call.
Int002 – The HRPD - cdma2000 1x system shall be capable of delivering a voice call as
a VoIP call when the HAT is in an active HRPD session.

Int003 – The HRPD - cdma2000 1x system shall be capable of terminating an incoming
voice call which originated in either the packet switched or circuit switched domain to a
HAT on the HRPD RAN.

Int004 – The HRPD - cdma2000 1x system shall be capable of delivering a circuit voice
call via the cdma2000 1x RAN when the HAT is in a dormant HRPD session.

3.8 Accounting

Acct001 - Currently defined accounting requirements and procedures for cdma2000 1x
and HRPD functionality shall be supported.

Acct002 - The HRPD - cdma2000 1x system shall be capable of recording inter-
technology mobility events (HRPD – cdma2000 1x) in the scope of network accounting
data.

Additional requirements related to Accounting in support of the HRPD–cdma2000 1x
interoperability work item are For Future Study.

3.9 Applicability of and Interactions with Wireless Features

The support for wireless features [5] based on the IMS IP multimedia call model [6], e.g.,
VoIP over HRPD, will be realized through SIP signaling. The feasibility and applicability
of any specific wireless feature in the HRPD-cdma2000 1x interoperable system should
be determined during the Stage-2/3 development.

Feat-001 - The HRPD - cdma2000 1x interoperable system should support, where
applicable, wireless features such as Call Forwarding, Call Waiting, Calling Number
Identification Presentation, Conference Calling, Voice Message Retrieval, SMS, etc.