

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26

3GPP2 S.R0108-0  
Version 1.0  
Version Date: February 23, 2006



# ***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](mailto:secretariat@3gpp2.org). Requests to reproduce individual Organizational Partner's documents should be directed to that Organizational Partner. See [www.3gpp2.org](http://www.3gpp2.org) for more information.*

1  
2

1 **EDITOR**  
2 *John Kay, Motorola*

3  
4 **REVISION HISTORY**

---

5

<b>REVISION HISTORY</b>		
<b>Revision number</b>	<i>Content changes.</i>	<i>Date</i>
<b>1.0</b>	<i>Initial Publication Version</i>	<i>February 23, 2006</i>

6

# Table of Contents

1		
2		
3	Table of Contents .....	5
4	List of Tables.....	6
5	List of Figures .....	7
6	1 INTRODUCTION .....	8
7	1.1 REFERENCES.....	8
8	1.2 DEFINITIONS AND ABBREVIATIONS .....	8
9	2 GENERAL DESCRIPTION.....	8
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  
2 Table 1 Handoff scenarios..... 12  
3  
4

1  
2

## **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

- [1] 3GPP2 C.S0001~6 cdma2000 Spread Spectrum Systems Air Interface specifications
- [2] 3GPP2 C.S0024 cdma2000 High Rate Packet Data Air Interface Specification
- [3] 3GPP2 S.R0104-0 HRPD Network Access Authentication for a Hybrid Access Terminal (HAT) with an R-UIM Used to Access Spread Spectrum Systems System Requirements, v1.0, October 21, 2004
- [4] 3GPP2 S.R0106-0 Packet Switched Video Telephony Stage 1 Requirements
- [5] 3GPP2 S.R0006-0 Wireless Features Description, v1.0, December 13, 1999
- [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.

1 This document defines the system requirements that enable the HRPD-cdma2000 1x  
2 Interoperability feature as defined by the following use cases.

- 3
- 4 • **Use Case 1, Origination/Termination of a Voice Call with a connected HRPD**  
5 **Data Session:** A user in an active connection on the HRPD network, for example,  
6 downloading a large file, can originate/terminate a VoIP call in the HRPD network  
7 without ending the existing data session.
  - 8 • **Use Case 2, Origination/Termination of a Voice Call with a Dormant HRPD**  
9 **Connection:** A user that establishes an active data connection and then transitions  
10 to a dormant data connection on the HRPD network can receive an incoming voice  
11 call on a cdma2000 1x network. In addition, the user can transition back to a  
12 connected state to originate or terminate a VoIP call on the HRPD network.
  - 13 • **Use Case 3, Mobility between HRPD and cdma2000 1x for Voice Calls:** An HAT  
14 that is in a voice call (circuit or packet) on a cdma2000 1x network moves to a  
15 congested cell where the call may be dropped, but capacity is available in an  
16 overlaid HRPD network, the call can be handed off from cdma2000 1x to the HRPD  
17 network. Note that the HAT may have a dormant HRPD connection while connecting  
18 to a cdma2000 1x network. Alternatively, the HAT reaches the edge of HRPD  
19 coverage and if cdma2000 1x coverage exists, the call can be handed off from HRPD  
20 to the cdma2000 1x network. The cdma2000 1x network can redirect the HAT to  
21 HRPD during origination of a circuit voice call.
- 22 Note: Redirection by the HRPD network is for future study
- 23 • **Use Case 4, Mobility of Video Telephony (VT) between HRPD and cdma2000 1x:**  
24 Video telephony mobility scenarios between cdma2000 1x and HRPD networks  
25 should be supported. In the event the cdma2000 1x network does not support VT,  
26 or if the HAT is on an HRPD VT call and moves out of the HRPD coverage, the VT  
27 call is handed off to a cdma2000 1x voice call (circuit or packet). When the HAT  
28 comes back to HRPD coverage with VT support, the full VT call may be re-  
29 established.
  - 30 • **Use Case 5, Mobility of VoIP calls between HRPD systems:** A VoIP call can be  
31 handed off between HRPD systems.

### 32 **3 HIGH LEVEL SYSTEM REQUIREMENTS**

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

#### 36 **3.1 General**

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

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

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

42 **SYS004** – The HRPD – cdma2000 1x interoperable system shall be capable of  
43 supporting services enabled by legacy MSCs, WIN, and other supporting legacy  
44 equipment.

- 1 **SYS005** – The HRPD – cdma2000 1x interoperable system shall support simultaneous  
2 voice, video, and data services to a HAT.
- 3 **SYS006** – The HRPD – cdma2000 1x interoperable system shall be able to support voice  
4 call (circuit or packet) origination and termination and data call origination for a HAT  
5 regardless of which network (HRPD or cdma2000 1x) is serving the terminal.
- 6 Note: **SYS006** neither mandates nor precludes cross-paging or dual registration  
7 solutions.
- 8 **SYS007** – The HAT shall be able to receive calls using a single user identity (e.g. Mobile  
9 Directory Number) regardless of which network (HRPD or cdma2000 1x) is serving the  
10 terminal.
- 11 **SYS008** – It shall be possible to use a subscriber’s existing cdma2000 1x Mobile  
12 Directory Number for VoIP service.
- 13 **SYS009** - The cdma2000 1x-HRPD interoperable system shall support the ability for  
14 either network to notify a user who is present in the other network of an attempt to  
15 initiate a service (e.g., the system shall allow the cdma2000 1x network to notify a user  
16 present in the HRPD network of an incoming cdma2000 1x voice call).
- 17 **SYS010** - The cdma2000 1x-HRPD interoperable system shall support the ability to  
18 notify the initiating network that the service identified in a cross-network notification  
19 has been rejected.
- 20 **SYS011** – The HRPD – cdma2000 1x interoperable system shall be capable of  
21 supporting Emergency Services Calls.

## 22 **3.2 Registration**

- 23 **REG001** – The cdma2000 1x-HRPD interoperable system shall support the ability for a  
24 HAT to have an established HRPD session simultaneously with being registered on a  
25 cdma2000 1x system.
- 26 **REG002** – The cdma2000 1x-HRPD interoperable system shall support the ability for a  
27 HAT to have an established HRPD session simultaneously with an active cdma2000 1x  
28 voice call.
- 29 **REG003** – The cdma2000 1x-HRPD interoperable system shall support the ability for a  
30 HAT to be registered for VoIP and have an established HRPD session.  
31 Note: Registration for VoIP is access technology agnostic.
- 32 **REG004** – The cdma2000 1x-HRPD interoperable system shall support the ability for a  
33 HAT to be registered for VoIP and have an established HRPD session with an active VoIP  
34 call on HRPD.
- 35 **REG005** – The cdma2000 1x-HRPD interoperable system shall support the ability for a  
36 HAT to be registered on a cdma2000 1x system and have an established dormant packet  
37 data session on cdma2000 1x.
- 38 **REG006** – The cdma2000 1x-HRPD interoperable system shall support the ability for a  
39 HAT to be registered on a cdma2000 1x system and have an established dormant packet  
40 data session on cdma2000 1x with an active cdma2000 1x circuit voice call.
- 41 **REG007** – The cdma2000 1x-HRPD interoperable system shall support the ability for a  
42 HAT to be registered on a cdma2000 1x system and have an established active packet data  
43 session on cdma2000 1x with no cdma2000 1x circuit voice call active.
- 44 **REG008** – The cdma2000 1x-HRPD interoperable system shall support the ability for a  
45 HAT to be registered on a cdma2000 1x system and have an established active session for  
46 packet data on cdma2000 1x with an active cdma2000 1x circuit voice call.

1     **3.3 Authentication**

2     See [3] for HAT authentication requirements.

3     **3.4 Security**

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

6     **3.5 Voice Quality**

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

9     **3.6 Mobility**

10    **3.6.1 General Mobility Requirements**

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

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

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

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

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

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

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

28    **3.6.2 Packet Data Service Mobility**

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

31    **3.6.3 Voice Service Mobility**

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

34    The HRPD - cdma2000 1x interoperable system shall be capable of supporting handoffs  
35    between HRPD and cdma2000 1x RANs for voice calls. The requirements for the specific  
36    scenarios are as follows:

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

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

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

40    **MOB013** - Handoff from cdma2000 1x VoIP to HRPD VoIP shall be supported.

1 The system shall be capable of supporting handoffs between cdma2000 1x CS-based and  
 2 cdma2000 1x PS-based for voice calls. The requirements for the specific scenarios are  
 3 as follows:

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

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

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

<b>Source → Target ↓</b>	<b>cdma2000 1x CS Voice</b>	<b>HRPD VoIP</b>	<b>cdma2000 1x PS Voice</b>
<b>cdma2000 1x CS Voice</b>	Existing Capability	MOB010	MOB015
<b>HRPD VoIP</b>	MOB012	MOB009	MOB013
<b>cdma2000 1x PS Voice</b>	MOB014	MOB011	Existing Capability

11

**Table 1 Handoff scenarios**

### 12 **3.6.4 Video Telephony Mobility**

13

14 **Vid001** - The HRPD - cdma2000 1x system shall be capable of handing off the voice  
 15 component of a packet based video telephony call on the HRPD network to a (circuit or  
 16 packet) cdma2000 1x voice call when video telephony is not available on the cdma2000  
 17 1x network.

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

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

25 **Vid004** - The HRPD - cdma2000 1x system shall be capable of re-establishing the video  
 26 component of a video telephony call upon handing off a HRPD voice call (that was  
 27 originally initiated as a video call on the cdma2000 1x network) back to the cdma2000  
 28 1x network.

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

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

### 33 **3.7 Interaction of Simultaneous Voice and Data Calls**

34 **Int001** - The HRPD network shall be capable of accepting a response from the HAT to  
 35 the indication of an incoming voice call.

1 **Int002** –The HRPD - cdma2000 1x system shall be capable of delivering a voice call as  
2 a VoIP call when the HAT is in an active HRPD session.

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

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

### 8 **3.8 Accounting**

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

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

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

### 16 **3.9 Applicability of and Interactions with Wireless Features**

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

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