



Recommended System Selection Requirements for 1X and 1xEV-DO-Capable Terminals

CDG Document 143

Version 1.1

6 Jun 2008

CDMA Development Group
575 Anton Boulevard, Suite 560
Costa Mesa, California 92626
PHONE +1 888 800-CDMA
+1 714 545-5211
FAX +1 714 545-4601
<http://www.cdg.org>
cdg@cdg.org

Notice

Each CDG member acknowledges that CDG does not review the disclosures or contributions of any CDG member nor does CDG verify the status of the ownership of any of the intellectual property rights associated with any such disclosures or contributions. Accordingly, each CDG member should consider all disclosures and contributions as being made solely on an as-is basis. If any CDG member makes any use of any disclosure or contribution, then such use is at such CDG member's sole risk. Each CDG member agrees that CDG shall not be liable to any person or entity (including any CDG member) arising out of any use of any disclosure or contribution, including any liability arising out of infringement of intellectual property rights.

<page left blank intentionally>



Contents

Recommended System Selection Requirements for 1X and 1xEV-DO-Capable Terminals....	i
CDG Document 143.....	i
Version 0.6	i
16 Aug 2006	i
1. Introduction	1
1.1 Purpose	1
1.2 Scope	1
1.3 Terms and Definitions	1
1.4 References	2
2. PRL and Selection Preferences.....	4
2.1 PRL Versions	4
2.2 PRL Storage.....	4
2.3 Default PRL.....	5
2.4 OTA PRL Provisioning	5
2.5 PRL Acquisition Table.....	6
2.6 Roaming Indicator	6
2.7 PRL Channels	7
2.8 PRL Enhancements for International Roaming.....	8
2.9 NAM SID/NID List.....	9
2.10 PRL System Matching.....	9
2.11 Preference Order.....	12
2.12 Forbidden Systems	13
3. MRU Table.....	15
3.1 MRU Storage.....	15
3.2 MRU Logging	15
4. System Selection	17
4.1 Power-up.....	17
4.2 Better Service Reselection (BSR)	18
4.3 System Lost.....	21
4.4 Reverse Link Limited System.....	22

4.5 Redirection	23
4.6 Call Release	25
4.7 Voice and Data Call Origination	25
4.8 OTASP Call Origination	28
4.9 Emergency Call Origination	29
5. DO System Selection – Hybrid Mode	32
5.1 Collocated List.....	32
5.2 Power-up	35
5.3 Idle Operation.....	35
5.4 DO Better Service Reselection (DBSR)	36
5.5 DO System Lost	38
5.6 Redirection	39
5.7 Attempt to Open a Connection.....	40
5.8 Session Negotiation	42
5.9 Data Call Origination	44
5.10 Idle Digital Mode (IDM)	46
5.11 DO Traffic Operation	47
6. DO System Selection – Non-Hybrid	49
7. Acronyms and Abbreviations	51
A. Configurable Parameters.....	53
B. PRL Construction Guidelines	56
B.1 General PRL Construction Guidelines.....	56
B.2 DO-Specific PRL Construction Guidelines	57

List of Tables

Table 1-1 Reference Documents and Standards	2
Table 4-1 Silent Redial	28
Table 5-1 PRL Acquisition	33
Table 5-2 PRL System Table	33
Table A-1 Configurable Parameters	53

Revision History

Date	Version	Description
9 Aug 2006	0.1	Initial release
10 Aug 2006	0.2	Updated to incorporate CDG template format
11 Aug 2006	0.3	Formatting update
14 Aug 2006	0.4	Incorporate comments
15 Aug 2006	0.5	Add table format
16 Aug 2006	0.6	Updated requirements
16 Feb 2007	1.0	Updated for 1.0 publication
12 Sep 2007	1.0	Updated for 1.1 publication

<page left blank intentionally>



1. Introduction

1.1 Purpose

This document specifies recommended system selection requirements. This document is intended to capture the system selection requirements of all operators. It is strongly recommended that operators use this document for their system selection requirements rather than creating their own requirements document. Having all operators using the same system selection requirements would help in providing a consistent user experience when roaming in and out of the user home country.

Note: DO, EV-DO, HDR, and HRPD are used interchangeably in this document to refer to 1xEV-DO (Evolution Data-Optimized) systems.

1.2 Scope

This document is intended to be used by 1X and 1xEV-DO operators as their system selection requirements document. The target audiences for this document are 1X and 1xEV-DO operators and their handset vendors.

1.3 Terms and Definitions

Four categories of requirements are established:

(M) Mandatory	The handset must support that characteristic in order to achieve approval.
(HD) Highly Desirable	It is highly desirable and recommended that the handset supports this characteristic. This feature may become Mandatory in subsequent versions of the document. Supporting this characteristic will be valued in the commercial promotion of the terminal.
(O) Optional	It is left up to the manufacturer whether or not the terminal supports this characteristic. The handset may support this characteristic.
(D) Discard	The manufacturer shall not support this feature or function.



1.4 References

Reference documents, which may include standards and resource documents, are listed in Table 1-1. Reference documents that are no longer applicable are deleted from this table; therefore, reference numbers may not be sequential.

Table 1-1 Reference Documents and Standards

Ref.	Document	
Standards		
S1	Band Class Specification for cdma 2000 Spread Spectrum Systems	3GPP2 C.S0057
S2	PRL Enhancements for International Roaming	CDG document #86

<page left blank intentionally>

2. PRL and Selection Preferences

The Preferred Roaming List (PRL) is a data structure set up by the operator and programmed into the MS's NV memory or RUIM. The PRL instructs the MS where to look for service and, when a system is acquired, whether it is usable. In addition, the PRL specifies the roaming indicator to be displayed when providing service on a particular system.

2.1 PRL Versions

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
2.1.1	MS shall support IS-683-A PRL	M			
2.1.2	MS shall support IS-683-C PRL	HD	<p>Mandatory for devices that support 1xEV-DO. This requirement will become mandatory for all devices in the future.</p> <p>Having all MS supporting IS-683-C PRL reduces the numbers of PRL's an operator has to maintain.</p>		

2.2 PRL Storage

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
2.2.1	MS shall provide a minimum of 8 KB (8000 bypts) for PRL storage per NAM in NV memory	M			
2.2.2	MS that support an RUIM shall support PRL read configurations: see Remarks column	M	<p>Read PRL from RUIM only.</p> <p>Read PRL from NV memory only.</p> <p>Read PRL from RUIM if available (else read PRL from</p>		

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
			NV memory). Exposure of the PRL read configuration at UI level is optional.		
2.2.3	When reading the PRL from RUIM, MS shall first try to read PRL from EF-EPRL	HD	If the EF-EPRL read or validation fails, MS shall try to read the PRL from EF-PRL. If the PRL read or validation of both EF-EPRL and EF-PRL fail, MS shall build a default PRL, as defined in Section 2.3		

2.3 Default PRL

The purpose of a default PRL is to enable the MS to acquire service when no PRL is programmed into NV memory or RUIM, or when the PRL usage is disabled. Using a default PRL ensures that the MS would not enter an offline (or service required) state as a result of no PRL being programmed to NV/RUIM. When in offline state, the MS is not able to place calls, including emergency and OTASP calls.

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
2.3.1	MS shall build a default PRL during power-up if no valid PRL is stored in NV memory or RUIM	M	Default PRL shall include all preferred 1X channels from all the bands that are supported by the MS. Default PRL shall allow operation on any 1X systems, i.e., the SID field of all system table entries should be set to wildcard ('0').		

2.4 OTA PRL Provisioning

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
2.4.1	MS shall support IS-683-A-based OTA PRL provisioning	M			
2.4.2	MS shall support IS-683-C-based OTA PRL provisioning	HD	An R-UIM card that supports EF-EPRL is expected to write an IS-683-C or newer PRL to the		

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
			EF-EPRL storage location (as opposed to the EF-PRL storage location). Mandatory for devices that support 1xEV-DO		

1 2.5 PRL Acquisition Table

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
2.5.1	MS shall support a minimum of 80 unique mode/band/channel combinations in the PRL acquisition table	M	PRL acquisition records that list channels result in one mode/band/channel combination per listed channel. PRL acquisition records that list blocks result in one mode/band/channel combination for each preferred channel that is part of the block. Mode/band/channel combinations that are listed multiple times are only counted once.		
2.5.2	MS shall support a minimum of 180 unique mode/band/channel combinations in the PRL acquisition table	HD			
2.5.3	MS with DO capability shall support a minimum of 180 unique mode/band/channel combinations in the PRL acquisition table	M			

2 2.6 Roaming Indicator

3 The roaming indicator is an 8-bit value that is associated with each system table entry.
4 When the MS operates on a system that matches a particular system table entry, the
5 roaming indicator (ROAM_IND) field of that entry is displayed to the user. When the MS
6 operates on a system that is not listed in the PRL, the default roaming indicator
7 (DEF_ROAM_IND) of the PRL is displayed to the user.

1 Generally, the roaming indicator is only associated with a visual indication that is to be
 2 displayed to the user. In some special cases, however, the roaming indicator field is
 3 used for other purposes, such as determining the relative priority of systems that are not
 4 listed in the same GEO. Therefore, there is a need to define the relative priority of the
 5 roaming indicator values.

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
2.6.1	MS shall support all 256 values of the roaming indicator, i.e., Enhanced Roaming Indicator (ERI)	M			
2.6.2	The preference order of the roaming indicators (most to least) shall be according to Home and Roam groups: see Remarks column	M	<p>The preference order shall be as follows:</p> <ol style="list-style-type: none"> 1. Home group, which includes the value '1' and all roaming indicator values that are defined by an operator as custom home 2. Roam group, which includes all the remaining roaming indicator values that are not part of the home group <p>Note: A system is said to be a home-system if its remaining roaming indicator value belongs to the home group</p> <p>Roam_mask (as defined in Table A-1) specifies the roaming indicator values that are defined by an operator as custom home.</p>		

6 **2.7 PRL Channels**

7 The acquisition table of the PRL lists mode/band/channel combinations that instruct the
 8 MS where to attempt service acquisition. Some older MS used to perform range checks
 9 on the channels that are listed in the PRL acquisition table at the time the PRL is pushed
 10 into the NV memory (or RUIM). If the channels were outside the range that is specified in
 11 the standard and/or supported by the MS, the PRL would be rejected.

12 To allow for the addition of new modes, band classes, and channels, it is expected that
 13 the MS would be able to accept PRLs with channels they do not support. While

- 1 operating with such PRLs, the MS would skip unsupported mode/band/channel
- 2 combinations.

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
2.7.1	MS shall not reject a PRL because acquisition records listing mode/band/channel combinations that are outside the spec range or MS capability	HD	MS shall ignore the channel number when validating a PRL		
2.7.2	MS shall skip over mode/band/channel combinations that are not supported by MS	M	<p>When trying to acquire service based on the PRL acquisition table, MS shall skip over mode/band/channel combinations that are not supported by the MS hardware or software</p> <p>The GEO and PRI fields of all system records must be accounted for, regardless if such system records are supported by the MS (or pointing at supported acquisition records). This is done in order to ensure that the MS correctly interprets the system table partitioning into GEOs and preference tiers.</p>		
2.7.3	MS shall support all channel numbers that are defined in 3GPP2 C.S0057 (as valid or not valid) for a particular band-class/subclass that is supported by the MS	M	<p>For example, MS capable of band-class 0, subclass 0 or 1, shall allow and support the following channel numbers:</p> <ul style="list-style-type: none"> - 1 to 799 (inclusive) - 991 to 1023 (inclusive) <p>Similarly, MS capable of band-class 1 shall allow and support the following channel numbers:</p> <ul style="list-style-type: none"> - 0 to 1199 (inclusive) 		

3 **2.8 PRL Enhancements for International Roaming**

4 PRL enhancements for international roaming enable substantial compression and
 5 simplification of the PRL system table. The idea is to use the MCC and IMSI_11_12 that
 6 come in the Extended System Parameters Message (ESPM) to identify 1X systems.

7 Since each operator is expected to have only one MCC/IMSI_11_12 broadcasted
 8 throughout its network (in a particular country), it is sufficient to list one
 9 MCC/IMSI_11_12 entry for each one of the international roaming partners.

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
2.8.1	MS shall support PRL with MCC/IMSI_11_12 based system records as described in CDG document #86	M	See S2 for reference document.		

2.9 NAM SID/NID List

The NAM SID/NID list is an alternate mechanism through which an operator can specify SID/NID combinations for which the roaming indicator is set to OFF (i.e., set to 1). Since this mechanism does not provide any additional functionality to what is already provided by the ROAM_IND field of a PRL's system table entry, it is recommended to not utilize the NAM SID/NID list. Saying this, the MS shall support the NAM SID/NID list as follows.

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
2.9.1	MS shall only use the NAM SID/NID list for the purpose of overwriting the roaming indicator to OFF (1)	M			
2.9.2	MS shall not overwrite the roaming indicator of systems that are listed in the PRL and their roaming indicator is other than 0 or 2	HD			
2.9.3	MS shall support a minimum of 20 entries in the NAM SID/NID list	M			

2.10 PRL System Matching

After obtaining the overhead information (SID, NID in the case of a 1X system) from the OTA signal, the MS attempts to find a match for the system in the PRL system table.

The rules for deciding whether the OTA system information matches a particular system table entry are listed below and should be followed carefully to eliminate any ambiguity between the PRL writer and the MS interpretation of the PRL.

In addition, because of the use of wildcard system IDs (SID=0 in the case of 1X), the MS may find a match with more than one system table entry. To resolve this situation, a more restrictive match overwrites all less restrictive matches. For example, an explicit SID match overwrites a wildcard SID match. Similarly, an explicit SID/NID match overwrites explicit SID + wildcard NID match.

Recommended System Selection Requirements for 1X and 1xEV-DO-Capable Terminals

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
2.10.1	MS shall consider an OTA 1X system to match a system table entry only if one or more of the conditions listed in the Remarks column are met. See also: 2.10.4.	M	<p>a. OTA system matches the SID, NID, mode (1X), and band class of the PRL system table entry.</p> <p>- The mode and band-class match are based on the acquisition table entry that is associated (via the acquisition table index) with the system table entry. For a match, the associated acquisition table entry must contain an element that matches the OTA mode (1X) and band class.</p> <p>b. OTA system matches the SID, mode, and band class of the PRL system table entry and the system table entry NID is set to wildcard (65535).</p> <p>- The mode and band-class match are based on the acquisition table entry that is associated (via the acquisition table index) with the system table entry.</p> <p>c. OTA system matches the mode, band-class, and channel of the PRL system table entry and the system table entry SID is set to wildcard (0).</p> <p>- The mode, band-class, and channels match are based on the acquisition table entry that is associated (via the acquisition table index) with the system table entry</p>		

Recommended System Selection Requirements for 1X and 1xEV-DO-Capable Terminals

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
2.10.2	MS shall consider an OTA DO system to match a PRL system table entry only if one or more of the conditions in the Remarks column are met	M	<p>a. OTA system matches the Subnet-ID and mode (DO) of the PRL system table entry.</p> <p>-For the Subnet-ID to match, all the bits of the PRL Subnet-ID must match with the OTA Subnet-ID. This implies that OTA bits that are outside the length of the PRL listed Subnet-ID are being ignored.</p> <p>b. OTA system matches the mode, band class, and channel of the PRL system table entry. The system table entry Subnet-ID is set to wildcard (Subnet-ID length is set to 0).</p> <p>Not applicable for devices that do not support 1xEV-DO</p>		
2.10.3	A more restrictive PRL match shall overwrite all less restrictive matches	M	<p>The order of the matching levels shall be as follows (most to least restrictive):</p> <ol style="list-style-type: none"> 1. Explicit SID and explicit NID (Subnet-ID for DO) 2. Explicit SID and wildcard NID 3. Wildcard SID (wildcard Subnet-ID for DO) 		
2.10.4	All entries that share the most restrictive match shall be considered	M	<p>In the case where the most restrictive match is with more than one entry, all such matches are considered. This condition is called a multi-GEO SID, i.e., a SID that is repeated, typically in more than one GEO.</p> <p>The roaming indicator to be displayed to the user is the most favorable out of all matches, as defined in Req. 2.6.2.</p>		

2.11 Preference Order

The most important objective of system selection is to select the most preferred system that is available in a particular market. Because more than one system may be present in a particular market, the MS needs to select among such systems based on their relative preference. This section specifies the requirements for determining the relative preference of any two systems.

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
2.11.1	<p>When comparing two systems (that are available OTA), MS shall step in order through the criteria listed in the Remarks column to determine and select the more preferred one.</p> <p>Once a criterion is met, MS shall use it and stop going through the list.</p>	M	<p>1. If there is a GEO in the PRL that lists both systems, select the one that is listed as the more preferred in this GEO.</p> <p>- If both systems are listed in more than one GEO, only look in the first GEO (from top to bottom of the PRL system table) that lists both systems to determine the priority.</p> <p>- If both systems are listed at the same preference, select/stay on the original system (to avoid ping-pong effect).</p> <p>2. If only one system is listed in the PRL system table (as a preferred system), select the one that is listed in the PRL.</p> <p>3. If the roaming indicator of one system is more favorable than the other (as defined in Req. 2.6.2), select the more favorable one.</p> <p>4. If one system is listed as most preferred system in its GEO, select that system.</p> <p>5. If the position of channels in the PRL acquisition table is different, select the system for which its channel is listed first. The position of the channel is determined by the first appearance of that channel in the acquisition table when traversed from top to bottom.</p> <p>6. If one system is digital and the other is not, select the digital one.</p> <p>7. Select/stay on the original</p>		

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
			system (to avoid ping-pong effect).		

1

2

2.12 Forbidden Systems

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
2.12.1	MS shall avoid selecting a system that is forbidden by the PRL or user preferences	M	<p>A forbidden system is a system that matches one of the following criteria:</p> <p>A system that is listed as negative in the PRL</p> <p>A system that is not listed in the PRL and the PREF_ONLY field of the PRL is set to 1</p> <p>A system that is forbidden by one of the user's system selection preferences, such as:</p> <ul style="list-style-type: none"> - Mode preference - Band preference - Roaming preference <p>When looking for service in the context of an emergency call origination, OTASP call origination, or redirection, MS is allowed to select a system that conflicts with this requirement, as defined in Sections 4.9, 4.8, and 4.5, respectively.</p>		
2.12.2	MS shall avoid selecting a system that is locked out by user	HD	<p>The MS shall maintain a list of all 1X systems (SIDs) that were locked out by the user since the MS was powered on. The MS shall avoid selecting and operating on any SID that is listed in the user's locked-out systems list.</p> <p>If this feature is exposed at the UI, the currently acquired system (SID) shall be added to the locked-out system list upon</p>		

Recommended System Selection Requirements for 1X and 1xEV-DO-Capable Terminals

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
			<p>the user selecting this option.</p> <p>When looking for service in the context of an emergency call origination, OTASP call origination, or redirection, the MS is allowed to select a system that conflicts with this requirement, as defined in Sections 4.9, 4.8, and 4.5 respectively</p>		



3. MRU Table

The Most Recently Used (MRU) table is a mechanism that enables the MS to remember the most recently used systems (mode, band, and channel) on which service was provided. This table is ordered from the most recently used system, MRU[0], to the least recently used system.

Each MRU table entry contains information about the mode (CDMA, AMPS, DO, etc.), band class (Cellular, PCS, etc.), and channel. The MRU, or a portion of which, is saved into NV memory during power-down to speed up service acquisition the next time the MS is powering up.

Note: The MS which operates in Hybrid 1x-DO mode, has to maintain two MRU tables: one for CDMA/AMPS systems and another for DO systems.

3.1 MRU Storage

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
3.1.1	MS shall store in NV at least the top 10 entries of the MRU (MRU[0-9]) when being powered down	M			
3.1.2	MS that operates in Hybrid 1x-DO mode shall store in NV at least the top entry of the DO-MRU table (DO-MRU[0]) when being powered down	M			

3.2 MRU Logging

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
3.2.1	MS shall log into the MRU mode/band/channel combinations over which MS performed successful pilot, sync,	M	A channel shall only be logged into the MRU if, after receiving all overhead information (including 1X SID/NID or DO Subnet-ID), the MS decides to stay and operate on the		

Recommended System Selection Requirements for 1X and 1xEV-DO-Capable Terminals

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
	and paging channel acquisition		acquired system.		
3.2.2	During idle/access operation MS shall log into the MRU mode/band/channel combinations as shown in the Remarks column	M	<p>If SID, NID, or band class of a 1X system (or the Subnet ID of a DO system) is changed and the MS decides to stay on the acquired system, the MS shall log the current mode/band/channel combination.</p> <p>If only the channel is changed and the MS decides to stay on the acquired system, the MS shall log the current mode/band/channel combinations only if they are explicitly listed in the acquisition table of the PRL.</p> <p>During idle/access operation, the MS can get to new mode/band/channel combinations through channel hashing, idle handoff, or channel assignment to a new paging channel.</p>		



4. System Selection

This section provides information that is specific to 1X (CDMA and AMPS) system selection. This section describes the system selection requirements for specific conditions, such as power-up acquisition and acquisition after system lost.

4.1 Power-up

The power-up algorithm's objective is to acquire the most preferred system that is available in the location where the MS is powering up and as soon as possible. The general assumption is that most of the time the MS is powering up in the same market where it was powered down. When this is not the case, i.e., the MS is powering up in a different market than the one it was powered down in, the assumption is that the MS is likely to be powering up in a market it visited recently. Therefore, the MRU is the main mechanism for speeding up service acquisition during power-up.

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
4.1.1	MS shall attempt acquisitions on MRU entries (most to least recent) followed by PRL acquisition table (first to last entry) when powering-up	M	Within each PRL acquisition table entry, order should be first to last channel. This requirement does not exclude multiple acquisition attempts on channels, like MRU[0], before completing a pass through the MRU and PRL		
4.1.2	MS should indicate to user availability of service once it found a usable system	M	A usable system is one of the following: - A system that is listed in the PRL and is not marked as negative - A system that is not listed in the PRL, but the PREF_ONLY field of the PRL is set '0' (unchecked); such a system is called available system		

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
4.1.3	MS shall only stay and provide service on an available system if no preferred system was found after attempting acquisition on all MRU and PRL entries and the PREF_ONLY field of the PRL is set to 0	M	When MS finds an available system, it shall indicate service to the user and continue going through MRU and PRL channels; only after attempting acquisition (and failing) on all MRU and PRL entries, will MS provide service on an available systems		
4.1.4	When acquiring a PRL listed system that is not the most preferred in its GEO, MS shall try to acquire systems that are listed as more preferred in that GEO (top to bottom of GEO)	M	If MS fails to acquire a more preferred system, it shall go back and reacquire the original system (assuming the original system is not marked as negative in the PRL).		
4.1.5	MS shall stay and provide service on a system that is listed as most preferred in its GEO	M			

4.2 Better Service Reselection (BSR)

Generally speaking, the MS is required to operate on the most preferred system it is able to acquire according to the PRL and the current GEO.

It is possible, however, that the MS would not be able to acquire the most preferred 1X system right after power-up (or later on) because the signal is temporarily blocked (by a building for example) or the MS is outside the coverage of the cell. Furthermore, the MS may be able to acquire an alternate 1X system that is not listed as the most preferred system in its GEO.

When the MS runs into such a situation, it needs to perform better service reselection periodically in order to be able to come back to the most preferred system once it becomes available (or a short time thereafter).

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
4.2.1	MS shall perform better service reselection when the PRL indicates that a more preferred system (compared with the currently acquired system) is available	M	If MS fails to acquire better service, it shall go back and reacquire the original system		

Recommended System Selection Requirements for 1X and 1xEV-DO-Capable Terminals

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
4.2.2	MS shall not perform better service reselection when MS is in Access or Traffic state.	M	This is done in order to minimize interference with user or network initiated activity		
4.2.3	MS shall build the list of channels (i.e., the BSR list) to be attempted acquisition when looking for better service. See Remarks column.	M	<p>If the original system is listed in the PRL system table, only channels that are associated with system table entries listed as more preferred than the original system in the current GEO shall be placed into BSR list. The list should be ordered according to MRU, then system table entries in the current GEO</p> <p>-If SID/NID/band-class of the current system is matching more than one system table entry, as specified in 2.10 (i.e. multi-GEO SID), the BSR list should be built out of all matching entries and their GEOs.</p> <p>If the original system is not listed in PRL system table, all channels from PRL acquisition table (but the currently acquired channel) shall be placed into the BSR list; The list should be ordered according to MRU, then PRL acquisition table.</p>		

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
4.2.4	MS shall search for better service as specified in the remarks column.	M	<p>MS shall maintain two configurable reselection timers, T_bsr_dig for periodic reselection when acquired on a digital system (e.g., CDMA) and T_bsr_amps for periodic reselection when acquired on an AMPS system.</p> <p>- MS shall reset and start T_bsr_dig/T_bsr_amps timer upon acquisition or idle handoff to a less preferred digital/AMPS system.</p> <p>- MS shall clear and stop T_bsr_dig/T_bsr_amps timer upon acquisition or idle handoff to the most preferred system.</p> <p>MS shall perform the following algorithm:</p> <ol style="list-style-type: none"> 1. Wait for T_bsr_dig/T_bsr_amps timer to expire. 2. Try acquisition attempts on all channels of the BSR list bounded by 10 sec from start of reselection. 3. Reacquire original system. 4. Reset start T_bsr_dig/T_bsr_amps timer. 5. Go back to step 1. <p>The preference criteria that are specified in Req. 2.11.1 shall be used to determine if a system that is acquired during reselection is more preferred than the original system. The MS shall select the newly acquired system if and only if it is more preferred according to the Req. 2.11.1 criteria.</p> <p>When reselection is cut short due to the 10 sec time limit, MS shall ensure that over time all channels of the BSR list are attempted acquisitions.</p>		

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
			See Table A-1 for recommended value for T_bsr_dig re. See Table A-1 for recommended value for T_bsr_amps.		
4.2.5	MS shall perform better service reselection 5 sec after end of call (or call attempt), as described in 4.2	M	Note: This requirement is waived if 4.2.5b, which is more desirable, is implemented. For mobile terminated calls, MS must be released from Traffic state for activity to be considered as a call.		
4.2.5b	MS shall perform better service reselection T_bsr_call sec after end of call (or call attempt), as described in 4.2	HD	For mobile terminated calls, MS must be released from Traffic state for activity to be considered as a call. See Table A-1 for recommended value for T_bsr_call.		
4.2.6	A SID, NID or band-class change (during idle operation) that results in a system that is not the most preferred according to the PRL should trigger reselection (as specified in 4.1.3 and 4.1.4) in T_bsr_newsyst	M	The SID, NID or band-class can change as a result of channel hashing, idle handoff, or channel assignment to a new paging channel.		

4.3 System Lost

System lost is a condition where the MS loses service over a system that was previously successfully acquired. During operation, system lost can happen in one of three states, idle, access, or in-traffic.

System lost typically results from a short signal fade, e.g., the signal is being temporarily blocked by a building. In more rare cases, system lost is a result of the MS moving outside the system coverage area.

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
4.3.1	When currently acquired system is lost,	M	1. MRU[0]		

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
	MS shall attempt acquisitions according to the order that is specified in the Remarks column.		<p>2. GEO (ordered according to MRU)</p> <p>3. MRU</p> <p>4. PRL acquisition table</p> <p>If MS acquires a system that is not the most preferred according to the PRL, MS shall try to acquire more preferred service as specified in Requirements 4.1.3 and 4.1.4.</p>		

1 **4.4 Reverse Link Limited System**

- 2 In a reverse link limited system, the MS is able to acquire the forward link, but is not able
3 to reach the tower. For example, the MS is not able to reach the tower when trying to
4 register with the network. This situation is referred to as max access probes.

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
4.4.1	MS shall follow these steps when observing max access probes failure	M	<p>Note: The MS shall follow the silent redial requirement (as defined in Table 4-1) if max access probes is observed while the MS is trying to originate a call.</p> <p>The MS shall build a channels list as follows:</p> <ul style="list-style-type: none"> - If the original system is listed in the PRL system table, only system table entries (i.e. their associated channels) that are within the same GEO shall be placed into the list. The order of channels should be according to the order of system table entries in the current GEO. That is, the channels that are pointed to by the first system table entry in the current GEO should be first in the list. - If the reverse link limited system is not listed in the PRL system table, all channels from the PRL acquisition table shall be placed into the list. The order of channels should be 		

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
			<p>according to MRU then PRL acquisition table.</p> <p>- The channel over which access failed shall be placed last in the channels list.</p> <p>The MS shall try to acquire service over the channels list (first to last channel).</p>		

4.5 Redirection

One reason for using redirection is for edge of coverage condition. The idea is for network A to redirect the MS to network B as they reach the edge of coverage of network A. Network A and B may or may not be owned by the same operator.

The edge of coverage redirection is typically done through beacon cells that are deployed along the edge of coverage of network A solely for the purpose of redirecting MS that approach the end of coverage. As the MS hands off to the beacon cell, it is being redirected, using Global Service Redirection Message (GSRDM), to network B.

Another reason for using redirection is to help with load sharing between two networks. The idea is for network A to redirect the MS to network B when network A gets overloaded. Network A and B may or may not be owned by the same operator.

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
4.5.1	Upon receiving invalid GSRDM with RETURN_IF_FAIL=0, MS shall avoid the currently acquired channel for 30 sec and search for service on other channels, as described in the Remarks.	M	<p>Invalid GSRDM is one that does not include any channel that is supported by the MS</p> <p>MS shall look for alternate service as follow</p> <ol style="list-style-type: none"> 1. GEO (ordered according to MRU) 2. MRU 3. PRL acquisition table 		
4.5.2	Upon receiving invalid GSRDM with RETURN_IF_FAIL=1, MS shall stay on the currently acquired system	HD	Invalid GSRDM is one that does not include any channel that is supported by the MS		

Recommended System Selection Requirements for 1X and 1xEV-DO-Capable Terminals

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
4.5.3	Upon failing to acquire the systems that are included in a redirection with RETURN_IF_FAIL=0, MS shall avoid the original channel over which the redirection was received for 30 sec and search for service on other channels, as described in the Remarks.	M	MS shall look for alternate service as follow 1. GEO (ordered according to MRU) 2. MRU 3. PRL acquisition table		
4.5.4	Upon failing to acquire the systems that are included in a redirection with RETURN_IF_FAIL=1, MS shall try to reacquire the original system over which the redirection was received	M			
4.5.5	If, as a result of following a redirection, MS selects other than the most preferred system (according to the PRL), MS should look for better service periodically	M	MS shall maintain a configurable timer, T_bsr_redir. MS shall reset and start T_bsr_redir when acquiring a system that is not the most preferred in its GEO as a result of following a redirectoin. MS shall clear and stop T_bsr_redir timer upon an acquisition or idle handoff to the most preferred system or upon losing the currently acquired system. MS shall try to acquire better service upon expiration of T_bsr_redir. If MS fails to acquire better service, it shall go back and reacquire the original system from which it got redirected. See Table A-1 for recommended value for T_bsr_redir.		
4.5.6	MS shall not select and operate on a system	M	Note: MS is allowed to operate on a system that is not		

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
	that is listed as negative in the PRL as a result of following a redirection		<p>listed in the PRL as a result of following a redirection (even if the PREF_ONLY field of the PRL is set to 1).</p> <p>Note: MS is allowed to operate on a system that conflicts with the user's system selection preferences as a result of following a redirection (as long as the redirecting system is allowed by such preferences)</p>		

1 4.6 Call Release

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
4.6.1	Upon call release MS shall first try to acquire the channel that is listed in MRU[0]	M	<p>Note: This requirement is waived if 4.6.1b, which is more desirable, is implemented.</p> <p>If MS fails to acquire MRU[0], it shall perform system lost algorithm based on MRU[0].</p>		
4.6.1b	Upon call release MS shall first try to acquire the last channel being used in Traffic state	HD	<p>If MS fails to acquire the last channel being used in Traffic state, it shall try to acquire the channel that is listed in MRU[0].</p> <p>If MS fails to acquire MRU[0], it shall perform system lost algorithm based on MRU[0].</p>		

2 4.7 Voice and Data Call Origination

3 Silent redial is a mechanism that increases the call origination success rate. The idea is
4 to silently redial failed call originations, on the same or alternate systems, up to a given
5 time limit since the call was originally placed.

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
4.7.1	MS shall silently redial failed call originations for a maximum of 30 sec	M	If more than 30 sec passed since the original call origination attempt was made, MS shall avoid silently		

Recommended System Selection Requirements for 1X and 1xEV-DO-Capable Terminals

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
			redialing a failed call origination. Once a call origination is successfully connected, it should not be silently redialed due to subsequent failures		
4.7.2	MS shall follow the policy in Table 4-1 when silently redialing voice/data calls.	M			

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
4.7.3	GEO based alternate service acquisition	M	<p>The MS shall build a channels list to be scanned as follows:</p> <ul style="list-style-type: none"> - If the original system is listed in the PRL system table, only channels that are associated with system table entries that are within the current GEO and comply with one of the following criteria shall be placed into the list: <ul style="list-style-type: none"> - System table entries that are same or more preferred than the original system - System table entries that have a home roaming indicator (as defined in Req. 2.6.2). <p>The list should be ordered according to the MRU, then system table entries in the current GEO.</p> <ul style="list-style-type: none"> - If the original system is not listed in the PRL system table, all channels from the PRL acquisition table shall be placed into the list. The list should be ordered according to the MRU then PRL acquisition table. - The channel over which origination failed shall be placed last in the channels list. - The channel list should be built only once per origination. <p>The MS shall try to acquire service over channels from the channels list (first to last channel).</p> <p>The MS shall only stay and try to place the call on systems that comply with one of the following criteria:</p> <ul style="list-style-type: none"> - Systems that are same or more preferred than the original system (as defined in Req. 2.11.1) 		

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
			<ul style="list-style-type: none"> - Systems have a home roaming indicator (as defined in Req. 2.6.2) - The MS is allowed to place the call on a system from a different GEO (i.e., jump a GEO) as long this system meets one of the above criteria. 		

1

Table 4-1 Silent Redial

Call origination failure	Silent redial action
No 1X service	Redial call in 4 sec or fail the call.
Max access probes	Try acquiring alternate service as described in Req. 4.7.3; redial call in 4 sec
Reorder order	Try acquiring alternate service as described in Req. 4.7.3 if $RSSI \leq -100$ dB; redial call in 4 sec
Intercept order	Fail call origination
Access denied	Try acquiring alternate service as described in Req. 4.7.3; redial call in 4 sec
Signal fade in access (T40m) or Traffic state	Try acquiring alternate service as described in Req. 4.7.3 if $RSSI \leq -100$ dB; redial call in 4 sec
Channel assignment timeout (T42m)	Try acquiring alternate service as described in Req. 4.7.3 if $RSSI \leq -100$ dB; redial call in 4 sec
Call released by BS	Fail call origination

2

4.8 OTASP Call Origination

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
4.8.1	MS shall support all standard OTASP activation codes, as defined by IS-683	M	The standard activation codes are “*228” and “*228xx”, where xx can take on values between ‘00’ and ‘07’ (inclusive).		

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
4.8.2	MS shall support a minimum of 5 custom OTASP numbers	M	Each custom OTASP number can be up to 32 digits long. Custom OTASP numbers shall be stored in NV memory or RUIM		
4.8.3	MS shall use the PRL (rather than the activation block) to acquire service during OTASP call if one of the conditions (see Remarks column) is true	M	PRL is locked, i.e., the Service Programming Code (SPC) is set to a value other than '000000'. User dialed "*228" or a custom OTASP number		
4.8.4	When performing block activation MS shall perform the steps in Remarks column	M	1. Build a list of preferred channels (OTASP channels list) that are associated with the dialed OTASP activation code, as defined in IS-683. 2. Order the OTASP channels list according to MRU, then GEO, then small to large channel. 3. If the MS is currently acquired on a channel that matches one of the channels in the OTASP channels list, place the OTASP call over that currently acquired channel. 4. Else, step through the OTASP channels list and try to acquire service and place the OTASP call. The MS shall try to place the OTASP call on any system that it is able to acquire, regardless if such system is forbidden by the PRL (e.g., a negative system) or user preferences. 5. If failing to place the OTASP call on the entire OTASP channels list, end the OTASP activation process		

1 **4.9 Emergency Call Origination**

- 2 The objective of an emergency call is to connect service as soon as possible. When the
- 3 user is trying to originate an emergency call the MS may need to attempt acquisition of

- 1 negative systems or systems that are not listed in the PRL. The assumption is that any
 2 system the MS is able to acquire would connect an emergency call (regardless of
 3 whether the MS is a subscriber or roamer of that system).
- 4 Note that the determination of which dial string is considered as emergency origination is
 5 beyond the scope of system selection. This determination is typically done by the phone-
 6 book manager, which is in the domain of the UI.

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
4.9.1	If an emergency call is placed when a system is acquired, MS shall try to place the emergency call on that system	M			
4.9.2	If an emergency call is placed when no system is acquired or if origination fails on the original system, MS shall follow the steps in the remarks	HD	<p>1. The MS shall build and order an emergency channels list as follows:</p> <ul style="list-style-type: none"> - All mode/band/channel combinations MS acquired since power-up (most to least recently acquired) - MRU (most to least recently acquired) - PRL acquisition table (first to last entry) - All preferred channels from all band classes that are supported by the MS (as defined in [S1]) - No system (i.e., mode, band, channel combination) should be listed multiple times in emergency list <p>2. The MS shall traverse the emergency channel list, top to bottom, and try to acquire service and place the call. The MS shall try to place the emergency call on any system that it is able to acquire, regardless if such system is forbidden by the PRL (e.g., a negative system) or user preferences.</p> <p>3. If the MS fails to connect the call, it should continue</p>		

Recommended System Selection Requirements for 1X and 1xEV-DO-Capable Terminals

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
			<p>traversing the list. Note that the MS is allowed to attempt acquisition of a particular channel multiple times, but it should not get stuck forever on any one channel.</p> <p>4. If the MS traversed the entire emergency list without being able to connect the emergency call, it should restart traversing the list from the beginning. The MS should only stop list traversal upon successfully connecting the emergency call or user ending the call origination.</p>		
4.9.3	After ending an emergency call that was successfully connected, MS shall enter Emergency Callback mode.	HD	<p>In Emergency Callback mode the MS shall only select the system over which the emergency call was connected. If that system is lost, the MS shall try to reacquire it.</p> <p>The MS shall exit Emergency Callback mode upon one of the following conditions:</p> <ul style="list-style-type: none"> - User requested to end the Emergency Callback mode. - System over which the emergency call was connected is lost, and the MS is not able to acquire that system for 15 sec. - User is trying to place a new emergency call. 		



5. DO System Selection – Hybrid Mode

In 1x-DO Hybrid mode (Hybrid mode for short) the MS operates as 1X and DO devices simultaneously. Therefore, in Hybrid mode, both protocol stacks (1X and DO) are active at the same time.

In Hybrid mode, the DO System selection is limited to systems that are collocated (associated) with the most recently acquired 1X system. The association is determined according to the PRL.

Note: The requirements in this section are only applicable for MS that are capable of 1x-DO Hybrid operation. There are no differences in DO system selection between Rev 0 and Rev A.

5.1 Collocated List

The collocated list is a list of DO systems that are associated with a 1X system in a given GEO (or GEOs in the case of a 1x multi-GEO match). The collocated list is used for narrowing down the list of DO channels to be attempted acquisition when looking for DO service.

The assumption is that DO service is overlaid on top of a 1X network. Limiting acquisition attempts of DO to systems that are collocated (associated) with the acquired 1X system speeds up the search for DO service, as well as saves on power consumption.

Note that the collocated list is updated whenever a new 1X service, which has a different GEO and/or association tag than the previous 1X service, is acquired.

The following example illustrates the collocated list concept. The acquisition table (Table 5-1) lists CDMA and HDR channels while the system table (Table 5-2) lists CDMA and HDR systems in a given GEO.

In this GEO, the HDR systems that are listed at indices 0 and 2 are associated with the 1X system that is listed at index 3. Therefore, once MS acquires service on a 1X system that matches system table index 3, the collocated list would contain DO channels BC1/150 and BC1/1125.

Similarly, if MS acquires a 1X system that matches system table index 4, the collocated list would contain channel DO BC0/100.

If MS acquires service on a 1X system that matches system table index 5, the collocated list would not contain any DO channels

Table 5-1 PRL Acquisition

Index	Acq_type	Band	Num_chans	Channels
0	10 (CDMA Generic)	BC1	1	225
1	11 (HDR Generic)	BC1	1	150
2	10(CDMA Generic)	BC0	1	25
3	11(HDR Generic)	BC0	1	100
4	10 (CDMA Generic)	BC1	1	75
5	11 (HDR Generic)	BC1	1	1125

Table 5-2 PRL System Table

Grp	Index	Type	Neg/pref	Geo	Pri	Acq index	Roam Ind	Assn inc	Assn Tag
G1	0	IS-856	Preferred	New	More	1	1	Yes	1
	1	IS-856	Preferred	Same	More	3	1	Yes	2
	2	IS-856	Preferred	Same	More	5	1	Yes	1
	3	95(A,B)/1X	Preferred	Same	More	0	1	Yes	1
	4	95(A,B)/1X	Preferred	Same	More	2	1	Yes	2
	5	95(A,B)/1X	Preferred	Same	More	4	1	No	

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
5.1.1	When first powering up (before 1X service is acquired), the collocated list shall be populated with all DO channels that are associated with a 1X system (any 1X system)	M	<p>In other words, collocated list would be built out of the set of acquisition table entries that are pointed to by a DO system table entry for which the ASSOCIATION_INC field is set to 1.</p> <p>Collocated list shall be ordered from top to bottom of PRL system table.</p>		
5.1.2	After the first time 1X service is acquired, the collocated list shall be populated with DO channels that are associated with the most recently acquired 1X service. See also 2.10.4.	M	<p>Note that even when 1X service is lost, the collocated list would still be populated with DO channels that are associated with the most recently acquired 1X service.</p> <p>Collocated list shall be ordered from top to bottom of the current GEO.</p>		

Recommended System Selection Requirements for 1X and 1xEV-DO-Capable Terminals

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
5.1.3	The collocated list shall be updated whenever a new 1X service with different GEO and/or association tag (compared with the previous 1X service) is acquired	M			
5.1.4	MS shall attempt to acquire DO service on channels from the collocated list when looking for DO service	M			
5.1.5	MS shall only provide service on a DO system that is collocated with the most recently acquired 1X system. See also 2.10.4.	M	<p>When acquiring a system from the collocated list the MS shall check the PRL system table to verify that the DO system is associated with the most recently acquired 1X system.</p> <p>For a DO system to be associated with the most recently acquired 1X system, there must be a GEO in the PRL system table that contains the following:</p> <ul style="list-style-type: none"> - A 1X system table entry that matches the most recently acquired 1X system - A DO system table entry that matches the acquired DO system - Within this GEO the 1X and DO system table entries are associated, i.e., the ASSOCIATION_INC field of both entries is set to '1' and the ASSOCIATION_TAG field of both entries is set to the same value <p>If no 1X system is acquired since power-up, a DO system shall be considered associated with 1X if its ASSOCIATION_INC field is set to '1'.</p>		

1 5.2 Power-up

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
5.2.1	When powering up, MS shall first attempt to acquire 1X service	M			
5.2.2	MS shall attempt looking for DO service once a 1X system that is collocated with one or more DO systems is acquired	M			
5.2.3	When acquiring a collocated DO system that is not the most preferred collocated DO system in its GEO, MS shall try to acquire collocated DO systems that are more preferred in that GEO (top to bottom of GEO)	M	If the MS fails to acquire a more preferred collocated DO system, it shall go back and reacquire the original system (assuming the original system is not marked as negative in the PRL).		
5.2.4	MS should indicate to user availability of DO service once it found a usable DO system as described in 5.1.5	M			

2 5.3 Idle Operation

3 The relationship between 1X and DO is a master-slave. This implies that during idle
4 operation, the DO service must be aligned at all times according to the most recently
5 acquired 1X service.

6 For example, when a new 1X service is acquired, the DO/1X association must be
7 checked. If the DO system is no longer associated with the newly acquired 1X system,
8 the MS must look for a new DO service (that is associated with the 1X system) by
9 attempting acquisitions over the channels that are in the collocated list.

10 If the newly acquired 1X system is not associated with any DO system, the collocated list
11 would not contain any DO channels. In such a case, no DO service will be acquired.

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
5.3.1	During idle operation MS shall align the DO service according to the most recently acquired 1X service at all times	M	<p>DO may become unassociated with the most recently acquired 1X service due to one of the following conditions:</p> <ul style="list-style-type: none"> - A new 1X service with different GEO and/or association tag (compared with the previous 1X service) is acquired - MS received a new Subnet-ID OTA, and this Subnet-ID is not associated with the most recently acquired 1X service 		

5.4 DO Better Service Reselection (DBSR)

Generally speaking, the MS is required to operate on the most preferred collocated DO system it is able to acquire according to the PRL and the current GEO.

It is possible, however, that the MS would not be able to acquire the most preferred collocated DO system right after power-up (or later on) because the signal is temporarily blocked (by a building, for example) or the MS is outside the coverage of the DO cell. Furthermore, the MS may be able to acquire an alternate DO system that is not listed as the most preferred collocated DO system.

When the MS runs into such a situation, it needs to perform better DO service reselection periodically in order to be able to come back to the most preferred system once it becomes available (or sometime thereafter).

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
5.4.1	MS shall perform better service reselection when the system table indicates that a more preferred collocated DO system (compared with the currently acquired system) is available in the current GEO	M	If the MS fails to acquire a more preferred system, it shall go back and reacquire the original system		

Recommended System Selection Requirements for 1X and 1xEV-DO-Capable Terminals

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
5.4.2	MS shall not perform better service reselection when MS is in Access or Traffic state	M	<p>This is done in order to minimize interference with user or network-initiated activity.</p> <p>If the reselection timer expires when MS is in Access or Traffic state, MS shall delay reselection until such time MS is back in Idle state (and in accordance with Req. 5.4.3 and 5.4.5)</p>		
5.4.3	MS shall not perform better service reselection immediately after transitioning back to DO Idle from DO Connected state	HD	<p>This is done in order to minimize interference with user or network initiated activity.</p> <p>The MS shall maintain a configurable T_dbsr_hold timer. The MS shall reset and start T_dbsr_hold (regardless if it is already running) upon transitioning back to idle from Connected state.</p> <p>The MS shall not perform better service reselection before T_dbsr_hold expires.</p> <p>See Table A-1 for recommended value for T_dbsr_hold.</p>		
5.4.4	MS shall build the list of channels (i.e., DBSR list) to be attempted acquisition when looking for better DO service as explained in the Remarks column.	M	<p>Only DO systems (and their associated channels) that are associated with the most recently acquired 1X service and are more preferred than the currently acquired DO system shall be placed into the DBSR list.</p> <p>The DBSR list should be ordered according to the current GEO (top to bottom of GEO).</p>		

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
5.4.5	MS shall search for periodic better DO service as explained in the Remarks column.	M	<p>The MS shall maintain two configurable better DO service reselection timers: T_dbsr for periodic DO reselection and T_dbsr_call for reselection after end of user originated DO call.</p> <p>- MS shall reset and start the T_dbsr timer (if it is not already running) upon acquisition or idle handoff to a less preferred system.</p> <p>- MS shall reset and start the T_dbsr_call timer (regardless if it is already running) upon end of user originated DO call on a less preferred system.</p> <p>- MS shall clear and stop the T_dbsr and T_dbsr_call timers upon an acquisition or idle handoff to the most preferred system.</p> <p>MS shall perform the following algorithm:</p> <ol style="list-style-type: none"> 1. Wait for T_dbsr_hold timer to expire if it is currently running. 2. Wait for T_dbsr or T_dbsr_call (if currently running) timer to expire. 3. Try full acquisition attempts on all channels that are in the DBSR list. 4. Reacquire the original system. 5. Reset and start the T_dbsr timer. 6. Go back to step 1. <p>See Table A-1 for recommended values for T_dbsr and T_dbsr_call.</p>		

1 5.5 DO System Lost

- 1 System lost is a condition where the MS loses service over a system that was previously
- 2 successfully acquired. During operation, system lost can happen in one of three states:
- 3 idle, access, or in-traffic.
- 4 System lost typically results from a short signal fade, e.g., the signal is being temporarily
- 5 blocked by a building. In more rare cases, system lost is a result of the MS moving
- 6 outside the system coverage area.

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
5.5.1	After DO system lost MS shall attempt to reacquire service from collocated list according to MRU order	M	MS may try to acquire service over MRU[0] multiple times		
5.5.2	If MS experiences 3 consecutive fades on the same system, it shall avoid the lost channel for 60 sec	HD	A consecutive system lost is one that is not separated by more than 20 sec from the previous system lost		
5.5.3	When acquiring a collocated DO system that is not the most preferred collocated DO system in its GEO, MS shall try to acquire collocated DO systems that are more preferred in that GEO (top to bottom of GEO)	HD	If the MS fails to acquire a more preferred collocated DO system, it shall go back and reacquire the original system (assuming the original system is not marked as negative in the PRL)		

7 **5.6 Redirection**

8 Redirect message allows the network to instruct the MS to move to a different channel.
9 One reason for using redirection is for edge of coverage condition. The idea is for
10 network A to redirect the MS to network B as they reach the edge of coverage of
11 network A. Network A and B may or may not be owned by the same operator.

12 The edge of coverage redirection is typically done through beacon cells that are
13 deployed along the edge of coverage of network A solely for the purpose of redirecting
14 the MS that approach the end of coverage. As the MS handoff to the beacon cell it is
15 being redirected using Global Service Redirection Message (GSRDM) to network B.

16 Another reason for using redirection is to help with load sharing between two networks.
17 The idea is for network A to redirect MS to network B when network A gets overloaded.
18 Network A and B may or may not be owned by the same operator.

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
5.6.1	MS shall leave the current DO channel if redirect is received in QuickConfig during system acquisition	M	Quick redirect instructs the mobile to move away from the current system/channel. If QuickConfig indicates Redirection while MS is in the process of acquiring a DO system, MS shall skip the channel and look for DO service on other channels		
5.6.2	MS shall follow these steps upon receiving a redirection	M	<p>1. Try to acquire DO service over the DO channels that are included in the redirection.</p> <p>2. If acquisition fails on all channels (or no channels were included), the MS shall avoid the original channel over which the redirection was received for 30 sec.</p> <p>- MS is allowed to select and operate on a DO system that is not collocated with the most recently acquired 1X system as a result of following a redirection from a collocated system.</p> <p>- MS shall not select and operate on a DO system that is forbidden (as defined in Section 2.12) as a result of following a redirection</p>		
5.6.3	If as a result of following a redirection, MS selects other than the most preferred collocated DO system (according to the PRL), MS should look for better DO service periodically (as defined in Section 5.4)	M	<p>The timer that specifies the reselection period in the context of redirection is T_dbsr_redir (rather than T_dbsr).</p> <p>See Table A-1 for recommended value for T_dbsr_redir</p>		

1 **5.7 Attempt to Open a Connection**

2 Even though the MS is able to acquire a particular DO network, it may still experience
3 difficulties to open a connection on this network for a variety of reasons.

4 As a general guideline, the MS should not get stuck on a network where it is not able to
5 open a connection.

1 **Note:** Some of the failures below are treated differently if they happen as a result of MS
2 trying to negotiate a session. In other words, such failures would be considered
3 as session negotiation related failures (as defined in Section 5.8) if they happen
4 while MS is trying to negotiate a session.

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
5.7.1	MS shall avoid the DO channel for 7 min if access attempt fails because of persistence test failure	M			
5.7.2	MS shall avoid the DO channel for 1 min if DO observes max access probes failure	M	Note: This requirement is waived if 5.7.2b, which is more desirable, is implemented.		
5.7.2b	MS shall avoid the DO channel according to a 2, 4, 8, 8, 8, 16 min schedule if DO observes max access probes failure	HD	<p>The MS shall maintain a max access probes failure counter. The MS shall increment the counter upon a max access probes failure. The MS shall reset the counter to 0 upon completing successful access attempt.</p> <p>Upon max access probes failure, the MS shall avoid the current channel for:</p> <ul style="list-style-type: none"> - 2 min if the counter is 1 - 4 min if the counter is 2 - 8 min if the counter is 3 to 5 - 16 min if the counter is 6 or greater 		
5.7.4	MS shall avoid the DO channel for 10 min if access attempt fails because of connection deny with reason=Authentication or billing	M	Note: The MS shall follow the session negotiation failure requirement (as defined in Req. 5.8.2) if Connection Deny with reason=Authentication or billing is received from the network while the MS is trying to negotiate a session		

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
5.7.5	MS shall avoid the DO channel for 1 min if access attempt fails because of connection deny with reason=Network-Busy or General	HD	<p>Note: This requirement is waived if 5.7.5b, which is more desirable, is implemented.</p> <p>Note: The MS shall follow the session negotiation timeout requirement (as defined in Req. 5.8.1) if Connection Deny with reason=Network-Busy or general is received from the network while the MS is trying to negotiate a session</p>		
5.7.5b	MS shall avoid the DO channel for 1 min if access attempt fails 3 consecutive times because of connection deny with reason=Network-Busy or General	HD	<p>Note: The MS shall follow the session negotiation timeout requirement (as defined in Req. 5.8.1) if Connection Deny with reason=Network-Busy or general is received from the network while the MS is trying to negotiate a session</p>		
5.7.7	MS shall move away from the DO channel if it observes 3 consecutive Traffic Channel Assignment (TCA or RTCAck) timeouts	HD	<p>Note: The MS shall follow the session negotiation timeout requirement (as defined in Section 5.8) if it observes TCA or RTCAck timeouts while trying to negotiate a session.</p> <p>The MS shall declare a TCA timeout upon failure to acquire the forward traffic channel after TCA.</p> <p>The MS shall maintain a TCA/RTCAck counter. The MS shall increment the counter upon TCA or RTCAck timeout. The MS shall reset the counter to 0 upon successful TCA or Subnet-ID change.</p> <p>Upon TCA or RTCAck timeout, the MS shall move away from the current channel if counter is 3 or greater.</p>		

1 **5.8 Session Negotiation**

- 2 Session negotiation is performed between the MS and the network. Session negotiation
- 3 enables the MS to obtain UATI, exchange various air interface protocol parameters, etc.
- 4 A session is a shared state maintained between the MS and the network.

- 1 As a general guideline, the MS should not get stuck in a network where session
- 2 negotiations are not successful.
- 3 Session negotiation is done in a network where there is no open session or the session
- 4 keep-alive timer has expired.

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
5.8.1	MS shall avoid the DO channel according to a 1, 2, 4, 8, 16 min schedule if session negotiation times out	HD	<p>Session negotiation timeout occurs when the MS fails to open/negotiate a session due to poor RF or network overload (i.e., network is not responding to the MS request to open a session). For example, the following failures are considered a session negotiation timeout if they happen repeatedly (typically 5 or more times) when the MS is trying to open/negotiate a session:</p> <ul style="list-style-type: none"> - Traffic Channel Assignment (TCA or RTCAck) timeouts - Connection deny with reason=Network-Busy or General <p>The MS shall maintain a session negotiation timeout counter. The MS shall increment the counter upon a session negotiation timeout. The MS shall reset the counter to 0 upon successful session negotiation or Subnet-ID change.</p> <p>Upon session negotiation timeout, the MS shall avoid the current channel for:</p> <ul style="list-style-type: none"> - 1 min if the counter is 1 - 2 min if the counter is 2 - 4 min if the counter is 3 - 8 min if the counter is 4 to 6 - 16 min if counter is 7 or greater 		

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
5.8.2	MS shall avoid the DO channel for 10 min if session negotiation fails	M	<p>Session negotiation failure occurs when MS is explicitly being rejected by the network when trying to open/negotiate a session. For example, the following failures are considered a session negotiation failure if they happen repeatedly when the MS is trying to open/negotiate a session:</p> <ul style="list-style-type: none"> - Repeated UATI assignment failures (typically 5 failures) - Network repeatedly sends Connection Deny with reason=Authentication-or-Billing (typically 5 or more times) - Network repeatedly closes the session before negotiation is completed (typically 3 or more times). Note that network is expected to close the session if AN authentication fails. - Any other repeated protocol negotiation failure, such as noncompliant signaling message fields or message exchange timeout 		

1 **5.9 Data Call Origination**

- 2 Generally, data call originations are preferred over DO. Under certain failure conditions,
3 however, data call shall be placed over 1X. This section lists the requirements for data
4 call origination and various call failure handling scenarios.

Recommended System Selection Requirements for 1X and 1xEV-DO-Capable Terminals

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
5.9.1	MS shall first try to place a data call on DO	M	If only 1X service is acquired at the time the call is placed (and the collocated list contains DO channels), the MS shall try quick acquisition on the most recently acquired collocated DO channel (if no collocated channel is in the MRU, the MS shall try quick acquisition on first collocated DO channel according to the current GEO). If successful, the MS shall first try to place the call over DO. Else, the MS shall try to place the call on 1X.		
5.9.2	MS shall silently redial failed data call originations for a maximum of 30 sec	M	If more than 30 sec passed since the original attempt was made, the MS shall not silently redial a failed call origination. The 30 sec limit includes DO and 1X redials.		
5.9.3	When silently redialing a DO call, MS shall fallback to 1X if attempts on all collocated DO channels failed	M	Note: This requirement is waived if 5.9.3b, which is more desirable, is implemented. If 1X service is available and the MS fails two origination attempts (not acquisition attempts) on DO, the MS shall try to place the call on 1X (even if acquisition/origination was not attempted on all collocated DO channels) The MS shall attempt acquisition on other collocated DO channels if the current channel is to be avoided as a result of a failure, such as max access probes, connection deny, RTC/RTCAck failure, or signal fade. If the acquisition succeeds on a collocated DO channel, the MS shall attempt origination on that channel. If the MS is unable to originate on all		

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
			collocated DO channels due to acquisition or origination failures and 1X service is acquired, then the MS shall try to place the call on 1X without further attempts on DO. See 4.7 for complete redial requirements.		
5.9.3b	When silently redialing a DO call, MS shall fallback to 1X if attempts on all collocated DO channels failed	HD	The MS shall attempt acquisition on other collocated DO channels if the current channel is to be avoided as a result of a failure, such as max access probes, connection deny, RTC/RTCAck failure, or signal fade. If the acquisition succeeds on a collocated DO channel, the MS shall attempt origination on that channel. If the MS is unable to originate on all collocated DO channels due to acquisition or origination failures and 1X service is acquired, then the MS shall try to place the call on 1X without further attempts on DO. See 4.7 for complete redial requirements.		

5.10 Idle Digital Mode (IDM)

Idle Digital mode is a mechanism that enables the MS to inform the network over which mode (1X or DO) the network should page the MS with incoming data calls. Generally IDM would be set to DO, indicating that data pages should come over the DO network. Under certain failure conditions, however, IDM would be set to 1X.

It is implicitly assumed that IDM is aligned with the mode (DO or 1X) on which a data call is currently connected.

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
5.10.1	MS shall set IDM to DO when DO service is acquired	M	If IDM is changed from 1X to DO during a PPP session, the MS shall send DO location notification to inform the network that incoming pages		

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
			should come over DO		
5.10.2	MS shall set IDM to 1X if DO service is lost for 5 or more sec	M	If IDM is changed from DO to 1X during a PPP session, the MS shall send 1X origination with DRS=0 to inform the network that incoming pages should come over 1X		

1

2 **5.11 DO Traffic Operation**

3 Because 1X acquisition and access attempts interfere with DO traffic operation and
4 throughput, 1X acquisition activity needs to be throttled down when DO is in Traffic state.

5 For example, if the 1X signal fades while DO is in traffic, 1X reacquisition attempts would
6 be throttled in order to not adversely affect DO traffic operation.

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
5.11.1	MS shall not attempt 1X acquisitions when DO is in traffic	M	Note: This requirement is waived if 5.11.1b, which is more desirable, is implemented.		
5.11.1b	MS shall throttle down 1X acquisitions when DO is in traffic according to the following schedule	HD	No more than one acquisition attempt every 5 sec for the first four acquisition attempts No more than one acquisition attempt every 10 sec thereafter		
5.11.3	MS shall avoid sending 1X page response to Async DATA, FAX, or Packet Data (SO 33) pages when DO is in traffic	M	That is, the MS shall avoid sending a page response to SO 4, 5, 12, 13, or 33 pages when the DO is in traffic		

7



6. DO System Selection – Non-Hybrid

In the Non-Hybrid mode, the MS operates either as a 1X device or as a DO device. Therefore, in Non-Hybrid mode only one protocol stack (1X or DO) can be active at one time.

This chapter lists the differences between Hybrid and Non-Hybrid DO operation.

Note: Unless indicated differently below, MS behavior in Non-Hybrid mode is similar to Hybrid mode.

Req. #	Requirement	Category	Remarks	Refs	PRI Configuration
6.1	MS shall perform same better service reselection as defined for 1X	M			
6.2	MS shall perform same system lost algorithm as defined for 1X	M			
6.3	MS shall not avoid DO channels because of signal fade	M			
6.4	MS shall not avoid DO channels because of max access probes failure	M			
6.5	MS shall not avoid DO channels because of TCA or RTCAck timeout	M			

1

<page left blank intentionally>

2



7. Acronyms and Abbreviations

Acronym	Description
1X	Third generation wireless technology that offers enhanced voice and data capacity and higher data rates than previous, second generation wireless technologies.
1xEV-DO	Part of a family of CDMA2000 1x digital wireless standards. EV-DO provides data rates over 10 times faster than 1xRTT, the previous data technology for CDMA networks
AMPS	Advanced Mobile Phone System
Available system	A system (SID/NID/band class) that is not listed in the PRL, but the PREF_ONLY field of the PRL is set '0' (unchecked)
BSR	Better Service Reselection
CDG	CDMA Development Group
CDMA	Code Division Multiple Access
DBSR	DO Better Service Reselection
DO	Data Optimized
DRS	Data Ready Set
EF	Elementary File
EPRL/E-PRL	Enhanced Preferred Roaming List
ERI	Enhanced/Extended Roaming Indicator
EV-DO	Evolution-Data Optimized
Forbidden System	A negative system or a system that is not listed in the PRL and the PREF_ONLY field of the PRL is set '1' (checked)
GEO	A geographical area (a set of system table entries that are listed in a single geographical area in the PRL)
GSRDM	Global Service Redirection Message
HDR	High Data Rate
HRPD	High Rate Packet Data
ID	Identifier
IDM	Idle Digital Mode
IMSI	International Mobile Subscriber Identity
MCC	Mobile Country Code
MRU	Most Recently Used
Most preferred system	A system (SID/NID/band class) that is listed in the PRL, is not marked as negative, and is listed as the most preferred in its GEO
MS	Mobile Station
NAM	Number Assignment Module
Negative system	A system (SID/NID/band class) that is listed in the PRL and is marked as negative
NID	Network Identification
NV	Non-volatile
OTA	Over-the-Air
OTASP	Over-the-Air Service Provisioning

Recommended System Selection Requirements for 1X and 1xEV-DO-Capable Terminals

Acronym	Description
PPP	Point-to-point Protocol
Preferred system	A system (SID/NID/band class) that is listed in the PRL and is not marked as negative
PRI	Product Release Instruction
PRL	Preferred Roaming List
RTCAck	Reverse Traffic Channel Acknowledgement
RUIM	Removable User Identity Module
SID	System Identification
SPC	Service Programming Code
TCA	Traffic Channel Assignment
UATI	Unicast Access Terminal Identifier
UI	User Interface
URL	Universal Resource Locator

1

2



A. Configurable Parameters

Table A-1 lists configurable system selection parameters. The MS shall support means to retrieve these parameters by an external test environment.

Table A-1 Configurable Parameters

Parameter	Description	Recommended value	Default
T_bsr_dig	Timer (in sec) for periodic reselection when MS is acquired on a digital system, like 1X; also used for DO in Non-Hybrid mode (e.g., DO-Only mode)	180 to 600 sec	180 sec
T_bsr_amps	Timer (in sec) for periodic reselection when MS is acquired on an AMPS system	120 to 600 sec	120 sec for cell only MS 60 sec for multi-band MS
T_bsr_newsys	Timer (in sec) for reselection when SID, NID or band-class changes during idle operation and new system is not the most preferred.	1-600 sec	1 sec
T_bsr_redir	Timer (in sec) for periodic reselection when MS acquires other than the most preferred system as a result of following GSRDM	180 to 600 sec	180 sec
T_bsr_call	Timer (in sec) for reselection after end of call	5 to 180 sec	5 sec
T_dbsr_hold	Timer (in sec) for holding DO reselection right after MS transitions back to Idle state from Connected state	5 to 180 sec	130 sec
T_dbsr	Timer (in sec) for periodic DO reselection in Hybrid mode	600 to 3600 sec	3600 sec
T_dbsr_call	Timer (in sec) for DO reselection after end of call in Hybrid mode	5 to 130 sec	130 sec
T_dbsr_redir	Timer (in sec) for DO reselection when MS acquires other than the most preferred system as a result of following a redirection	600 to 3600 sec	3600 sec

Recommended System Selection Requirements for 1X and 1xEV-DO-Capable Terminals

Parameter	Description	Recommended value	Default
Roam_mask	A 256 bit (32 bytes) mask for specifying roaming indicator values that are defined by an operator as custom home. If the bit in position n is set to 1, then n is a custom home roaming indicator value. If the bit is set to 0, then n isn't a custom home roaming indicator value.		64, 65 and 76 through 83

1

<page left blank intentionally>



B. PRL Construction Guidelines

B.1 General PRL Construction Guidelines

B.1.1 Negative Systems

Because a negative system is less preferred than any nonnegative system, it is strongly recommended to place any negative systems at the bottom of their GEO. That is, within a GEO, a negative system should not be placed above a preferred system

B.1.2 GEO Size

Smaller GEOs typically lead to more optimized operation when the MS is not able to acquire the most preferred system in a particular GEO. In a smaller GEO, the set of channels that the MS has periodically checked for more preferred service is smaller, which leads to less power consumption and typically shorter time to find the most preferred system.

B.1.3 Acquisition Table

It is recommended to only list one or a small number of anchor frequencies for each network in the PRL acquisition table. Other than for the wildcard SID entry, there is no need to list all channels to which the MS can get through channel hashing or handoff. This is because channel matching is not required for an OTA system to match a non-wildcard system table entry.

Having fewer channels in the PRL acquisition table generally provides for a more optimized operation during system lost and when the MS is not able to acquire the most preferred system in the current GEO.

In addition, in accordance with the preference order requirement of 2.11.1, bullet 5 it is recommended to list the acquisition records of more preferred technologies first in the acquisition table. Doing so will ensure that when the preference order of two systems (each using a different air interface technology) can't be resolved according to 2.11.1, bullets 1 through 4, the more preferred technology will be selected.

For example, an operator that provides service over CDMA and AMPS networks and considers CDMA as more preferred than AMPS would want to list CDMA acquisition records before AMPS acquisition records in the acquisition table.

Following the same logic, if the operator also provides service over a DO network and consider DO as more preferred than CDMA, would want to list DO records before CDMA records.

B.1.4 Wildcard SID

When using a 1X wildcard SID (SID=0) system table entry, it is important to list all the channels to which the MS can get through channel hashing or handoff in the associated acquisition record. This is required because a wildcard SID match requires the channel in the associated acquisition table entry to match the OTA channel.

Failure to do so would result in the MS declaring a mismatch with the wildcard system table entry upon a transition to a channel that is not listed in the associated acquisition table entry.

B.2 DO-Specific PRL Construction Guidelines

B.2.1 DO System Priority

It is recommended to list a DO system as higher priority than the 1X system it is associated with. This arrangement would ensure that the MS would prefer the DO system when operating in non-hybrid 1X/DO mode.

In Non-Hybrid mode, the MS operates either as 1X protocol or DO protocol at any given time (similar to the way 1X and AMPS operation is performed in 1X/AMPS terminals).

B.2.2 DO Channels

It is recommended to list only one or a small number of DO anchor frequencies for each DO network.

Having fewer DO channels in the PRL acquisition table generally provides for a more optimized operation during system lost and when the MS is not able to acquire the most preferred DO system in the current GEO.

In addition, it eliminates unnecessary search over duplicate or nonexistent DO channels before falling back to 1X during data call origination.

B.2.3 DO Subnet ID

The use of wildcard Subnet-ID is not recommended in GEOs where more than one DO network is present. Using wildcard Subnet-ID in such GEOs introduces a substantial risk that the MS would fail to select the desired DO system.

Because of this reason and the possibility that, over time, most markets would have more than one DO network (belonging to one or more operators), it is strongly recommended to avoid using wildcard Subnet-IDs in the PRL.

To simplify the PRL maintenance, operators are encouraged to use a single Subnet-ID to identify their DO network throughout the country. Many operators decided to follow the ANSI-41 Method, using one of their 1X home SIDs.

- ¹ See http://www.3gpp2.org/Public_html/specs/C.S0024-0_v4.0.pdf (section 10.9.2.1.2.1
- ² ANSI-41 Method).