System Determination Field Scenarios

Test Procedure

Revision B

March 22, 2017

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1 Introduction

1.1 **Purpose**

This document defines the test procedures to be performed in the Lab, for the system determination related field scenarios, providing required instructions, Pass/fail criteria and detailed information about test equipment setup.

1.2 **Scope**

These test procedures are applicable to all devices that will be submitted to the carriers for acceptance. These test procedures will be performed to pre-certify the system determination related field scenarios on the device before the carrier acceptance phase.

This document is intended for test engineers, who have good basic knowledge of the use of the equipment needed to execute these tests.

1.3 **Conventions**

In this document:

- Names of messages, requests, orders, etc. have been down styled

- Within text, names of buttons, menus, windows, commands, etc. are written as they appear on the related interface — mostly in Initial Caps

NOTE As exceptions to the above, some message, section, directory, file, etc. names may appear within quotes for clarity while reading.

- Function declarations, function names, type declarations, and code samples appear in a different font, e.g., `#include`

- Code variables appear in angle brackets, e.g., `<number>`

- Commands and command variables appear in a different font, e.g., **`copy a:*.*b:`**

Shading indicates content that has been added or changed in this revision of the document.

1.4 Revision history

Table 1-1 lists the revision history for this document.

Table 1-1 Revision history

Revision	Date	Description
A	January 2007	Initial release
B	March 2017	■ Changes are made in the doc to reflect change in Lab name. ■ Other minor updates to the content

1.5 References

Table 1-2 lists the references related to this document. References may include resources (Q#), standards (S#) and other resources (R#). References that are no longer applicable are deleted from this table; therefore, reference numbers may not always be sequential.

Table 1-2 References

Ref.	Description	
Documents		
Q1	*Generic System Determination Test Plan*	80-VD492-1
Q2	*System Determination Field Scenarios Test Plan*	80-VE047-1

1.6 Acronyms

Table 1-3 lists the acronyms used in this document.

Table 1-3 Acronyms

Acronym	Definition
BS	Base station
CAIT®	CDMA air interface tester
GEO	Geographical area
MRU	Most recently used
MS	Mobile station
NID	Network identification
OTA	Over the air
PRL	Preferred roaming list
SID	System Identification

1.7 Definitions

Not preferred exit

Whenever a Mobile station (MS) encounters a negative or a forbidden system, it performs a Not preferred exit. Whenever an MS encounters an available system it performs a Not preferred exit, looks for more preferred systems and camps back to the available system if more preferred systems are not available.

New system exit

When an MS in the idle state initiates a handoff to a booming/shooting pilot that is not in the neighbor list and in the process, it does a New system exit.

1.8 Execution notes

Following are the notes:

- Each test will require the tester to evaluate a log to determine if the MS meets the Pass/fail criteria. Hence, after each test, the log must be parsed and analyzed/reviewed
- Each test will require that any settings/changes to the Base station (BS) emulators' initial settings must be reverted so as to not interfere with the next test
- Each test requires that the Most recently used (MRU) table of the MS be cleared at the beginning of each test, unless mentioned otherwise
- For test cases that require dialing an emergency number, it is advised, that a bogus emergency number be programmed into the MS to avoid any connections to real emergency dispatcher

2 Equipment

2.1 Equipment required

The following test equipment is required for the Lab system determination field test suite:

- Aeroflex CDMA-AIME system (Racal)

- Amber application installed in Racal controller PC

- CDMA air interface tester (CAIT) diagnostic tool (installed in a laptop/remote PC for logging purpose), preferably Version 3.2 or higher shall be used

- Variable Attenuator

2.2 Equipment configuration

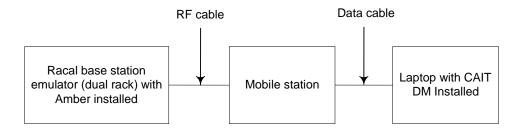The equipment configuration is as shown in Figure 2-1 and Figure 2-2
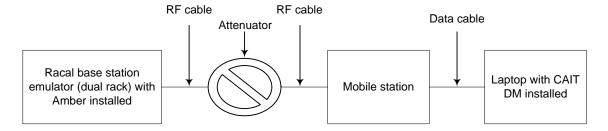
Figure 2-1 Racal setup

Figure 2-2 Racal setup with Attenuator

3 Test Scenarios

3.1 **Not preferred exit (test case 2.1)**

3.1.1 **Description**

This test verifies the behavior of MS when performing a Not preferred exit.

3.1.2 **Equipment configuration**

To setup Racal, refer to Figure 2-1.

3.1.3 **Test procedure**

Following are the steps:

1. Program MS with these channels in NV: Pri A as 293, Sec A as 694, Pri B as 394, and Sec B as 797

2. Clear MRU table in MS

3. Load test1.prl into the phone

4. Prepare an available system with the following settings in Racal: BS 1 with BC 0 Ch 185, SID 115, NID 100, R_X = -65dBm, and Ec/Io = -7 dB

5. Start MS logging

6. MS starts searching for network

7. Observe the behavior of MS

8. Close log

9. Repeat steps 1 to 7 – In step 5, prepare a forbidden system by making the following settings in Racal: BS 1 with BC 0 Ch 185, SID 102, and NID 65535

10. Repeat steps 1 to 7 with the following exceptions:

   ■ In step 3 load test.prl

   ■ In step 5 prepare a negative system by making the following settings in Racal: BS 1 with BC 0 Ch 185, SID 102, and NID 65535

3.1.4 Pass/fail criteria

3.1.4.1 Test 1

Pass

MS performs a Not preferred exit for the first time it encounters an available system and then looks for preferred systems. If preferred systems are not available, it reacquires the available system.

Fail

MS does not perform a Not preferred exit.

3.1.4.2 Test 2

Pass

MS performs a Not preferred exit and does not acquire any system.

Fail

MS does not perform a Not preferred exit.

3.1.4.3 Test 3

Pass

MS performs a Not preferred exit and does not acquire any system.

Fail

MS does not perform a Not preferred exit.

3.1.5 Scanning algorithm

After MS performs a Not preferred exit, it continues scanning the Preferred roaming list (PRL) channels in the order they are and does not start scanning from the start of the PRL. The reason here is that the intended channel could be located at the end of the PRL.

When MS encounters channels from competitor network, it is very likely that the competitor channel could be located at the start of the PRL. In this case, MS performs a Not preferred exit multiple times and the acquisition time is much longer.

It is always better if MS continues scanning the PRL when it encounters a not preferred channel. This increases the possibility of acquiring the intended preferred system.

3.2 Invalid channel (test case 2.2)

3.2.1 Description

This test verifies MS behavior when it encounters channels from invalid range.

3.2.2 Equipment configuration

To setup Racal, refer to Figure 2-1.

3.2.3 Test procedure

Following are the steps:

1. Program MS with the test.prl file

2. Clear MRU from MS

3. Prepare Racal with the following settings: BS 1 with BC 0 Ch 337 which is an invalid channel, SID 100, NID 100, R_X = -65dBm, and Ec/Io = -7 dB

4. Start MS logging

5. Observe the behavior of MS

6. If MS acquires channel 337, perform a mobile terminated call; test a mobile-originated call to see that the call is successful

7. Close log

3.2.4 Pass/fail criteria

Pass

MS accepts a PRL with channel 337. The phone should not go into offline mode or a freeze condition. MS scans channel 337, acquires it, makes and receives calls.

Fail

MS does not scan or acquire channel 337 or the phone goes into a freeze condition.

3.3 New system exit (test case 2.3)

To be developed.

3.4 Providing signal from other GEOs (test case 2.4)

3.4.1 Description

This test verifies MS behavior when it is idle in one GEO and service is provided from another GEO.

3.4.2 Equipment configuration

To setup Racal, refer to Figure 2-1.

3.4.3 Test procedure

Following are the steps involved:

1. Program MS with the following channels in NV: Pri A as 293, Sec A as 694, Pri B as 394, Sec B as 797

2. Clear MRU table in MS

3. Load test.prl into the phone

4. Prepare BS 1 with BC 0 Ch 1, SID 100, NID 40 R_X = -65 dBm, and Ec/Io = -7 dB for test.prl, the most preferred system in a certain GEO

5. Provide service on BS 1

6. Allow MS to acquire this signal and go idle

7. Start logging

8. Prepare BS 2 with BC 0 Ch 594, SID 100, NID 41, R_X = -65 dBm, and Ec/Io = -7 dB for test.prl, the most preferred system in another GEO

9. Provide service on BS 2

10. Turn off the signal on BS 1, so that MS loses this system

11. Observe the behavior of MS and compare the result with Pass/fail criteria

12. Close log

3.4.4 Pass/fail criteria

Pass

MS searches for the lost system (MRU [0]), its GEO, MRU table, and PRL; MS then acquires BS 2.

Fail

MS searches the entire PRL immediately.

3.5 Normal voice call in a multi-GEO scenario (test case 2.5)

3.5.1 Description

This procedure tests the ability of the phone to originate a voice call in a multi-GEO scenario.

3.5.2 Equipment configuration

To setup Racal with Attenuator, refer to Figure 2-2.

4 Additional Information

4.1 Files

PRL files

Two PRL files, test.prl and test1.prl, should be loaded into the phone as per the test case requirements. They are accessible in Perforce at //depot/CTG/Field Scenarios.

CAIT scripts

The clearmru2.scr script file is required for clearing MRU. The same is available in Perforce at //depot/CTG/Field Scenarios.

4.2 How to write channels into NV

The following is a manual procedure for writing channels into MRU:

1. In CAIT press F8 to open the scripting window

2. Type `NV_WRITE MRU2_TABLE` {nam, index, mode, band_class, cs}

   - nam – NAM in use; 0 for NAM 1 and 1 for NAM 2

   - index – place in MRU table; starts with 0 as most recent

   - mode – CDMA or analog; 2 for CDMA and 1 for analog

   - band_class – cellular or PCS; 0 for cellular and 1 for PCS

   - **cs** – A or B for the cellular band, or 25-1175 for PCS; channel number also should work for cellular

   For example:

   - `nv_write mru2_table {0,0,2,0,199}`
     This writes to NAM 1, INDEX 0, MODE CDMA, BAND_CLASS 0, CS Ch 199

   - `nv_write mru2_table {0,0,2,0,0}`
     This writes to NAM 1, INDEX 0, MODE CDMA, BAND_CLASS 0, CS Ch 0 (equivalent to no channel in MRU)

The following is an automated way for clearing the MRU table:

Run clearmru2.scr from the scripting window to erase all the channels and clear/empty MRU table. Type `run clearmru2.scr` in the scripting window and the result will be a clear MRU

NOTE The SPC considered in clearmru2.scr file is 000000. If this script is run on an MS that has a random SPC, change the script code accordingly. However, it is always advisable to have SPC 000000 in the MS while running these tests.

4.3 Notes

Following are the general observations while carrying out the test procedures:

- When using an Aeroflex Amber solution and test cases requiring attenuation to be applied, both the BSes are turned off when attenuation is applied as both the BSes have a single RF output.

  - For test cases involving handoff from BS 1 to BS 2, i.e. for test cases where MS is idle on BS 1 and MS is expected to acquire BS 2 (especially in voice calls handoff scenarios), attenuation should be applied for about 5 to 10 seconds and then released so that there is a possibility of MS acquiring BS 2.

  - Though this is not a very consistent approach, the test can be reproduced by repeating the process 3 or 4 times.

- It is advisable to use CAIT Version 3.2 as the clearmru2 script runs successfully; higher versions of CAIT use a different format of MRU clearing.

- It is advisable to have the "debug messages" option (F3) enabled on the phone; it becomes very convenient to troubleshoot when this option is enabled on the phone.

5 Frequently Asked Questions

What is the purpose of this test procedure?

These test cases have been developed based on our field observations. As these are quite recurring in the field, we felt that these tests should be simulated in the Lab as well.

For test case 2.2 (Section 3.2), why not look at PCS channels too?

Yes, it can be extended to PCS channels. As these field issues were observed more with carriers in India where CDMA cellular is predominant, we felt that the focus should be on invalid cellular channels. The scope of this document can be extended by incorporating PCS in the next release.

For test case 2.3 (Section 3.3), should this test be quarantined because it is incomplete as per the test procedure?

Yes, this test case has been quarantined in the test plan. We have not been able to simulate this test case successfully and so it has been mentioned in an incomplete form in the test procedure and quarantined in the test plan.

Despite being common observations in the field, why have the conditions – System Lost, Maximum Access Probe Exit, Access Denied, etc. not been covered in this document?

These conditions are covered in depth by the *Generic System Determination Test Plan* (see [Q1]) that also deals with system determination testing in the Lab.