



Low Level Design Specification

% COPS LLD.

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0.2 Document History

Date	Version	Status	Author
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Initial version.			
2004-08-31	002	Draft	JuanVi Jativa-Villoldo
Modified based on the feedback from Thomas Luettig and Harald Mommer: <ol style="list-style-type: none"> 1. Removed the parameter <svrMode> from the set and the query command. 2. Added a new value "5" (For registration in limited service) to the <mode> parameter. 3. Added a "comma" to the query command for "Forward compatibility" with future extension of %COPS (In particular for the new <Act> parameter in G3PP 27.007, version 5.0.) 			
2004-09-01	003	Draft	JuanVi Jativa-Villoldo
Added a clarification about %COPS=2			
2004-09-01	004	Draft	JuanVi Jativa-Villoldo
Removed new value "5" in parameter <mode>. It has been considered that the only scenario in which limited service is required is given by using +COPS=0 when not PIN has been entered. In this case the network will automatically be registered in limited service. It has also been pointed out that +COPS=2 will return error if the network is not registered in full service.			
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Update of document properties: Document Type: Low Level Design specification.			
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Updated LLD after the first code implementation.			

0.3 References, Abbreviations, Terms

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1 Introduction

This document specifies the syntax of the new AT command %COPS and describes the Low Level Design of its implementation in the ACI.

This command will be implemented to encapsulate the functionality provided by the standard AT command +COPS and the Texas Instruments specific AT command %NRG. %COPS will support all the functionality provided by +COPS plus some extra features which are described below. It has been considered that the use of %COPS will give a more compact and elegant solution than the currently provided by %NRG. It will also remove some currently duplicated code between +COPS and %NRG.

%COPS will add, in principle, the following functionality to the standard AT command +COPS:

- Possibility to query the “service status” in which the phone is currently registered; the possible values will be “full service”, “limited service” or “no service”.
- Possibility to select the “last registered” operator using %COPS=1. %NRG=1 currently provides a similar functionality, but in the %NRG case the Information regarding the last registered operator is stored in the SIM Card, EF (LOCI), and in the %COPS=1 command this information will be stored in the FFS. The reason why this is required is that %NRG=1 doesn't seem to work with some SIM Cards (e.g. Vodafone) which seem to overwrite the SIM file EF(LOCI) when powering on.

2 %COPS: Operator selection syntax

Command	Possible response(s)
%COPS=[<mode> [, <format> [, <oper>]]]	+CME ERROR: <err>
%COPS?	%COPS: <mode> [[, <format>, <oper>] [, , <svrStat>]] +CME ERROR: <err>
%COPS=?	%COPS: [list of supported (<stat>, long alphanumeric <oper> , short alphanumeric <oper>, numeric <oper>)s] +CME ERROR: <err>

Description

Set command forces an attempt to select and register the GSM/UMTS network operator. <mode> is used to select whether the selection is done automatically by the MT or is forced by this command to operator <oper> (it shall be given in format <format>).

If <mode>=1, <oper> is not given, and the SIM card has not been changed since the last network registration, the MT will try to register to that operator which had been registered the last time. That operator will be stored in the Flash File System. If the SIM card has been changed, the MT will try to register to the operator stored in the EF(LOCI) in the SIM Card.

To achieve the “limited service” state, <mode>=0 should be set when the SIM is not activated or, if the SIM is already activated and there is Full service status, “limited service” will be obtained by using <mode>=2.

If the selected operator is not available, no other operator shall be selected (except <mode>=4). The selected operator name format shall apply to further read commands (%COPS?) also. <mode>=2 forces an attempt to deregister from the network and leads the MT to limited service.

The selected mode affects to all further network registration (e.g. after <mode>=2, MT shall be unregistered until <mode>=0 or 1 is selected). Refer subclause 9.2 for possible <err> values. This command should be abortable when registration/deregistration attempt is made.

Read command returns the current mode, the currently selected operator, and the current service status <svrStat>. Please note that an additional comma has been added for “forward compatibility” reasons, to support the new <AcT> (Access technology) parameter in the future, added to +COPS in G3PP 27.007, version 5.0.

Test command returns a list of quadruplets, each representing an operator present in the network. Quadruplet consists of an integer indicating the availability of the operator <stat>, long and short alphanumeric format of the name of the operator, and numeric format representation of the operator. Any of the formats may be unavailable and should then be an empty field. The list of operators shall be in order: home network, networks referenced in SIM/UICC, and other networks.

Defined values

<mode>:

- 0 automatic (<oper> field is ignored)
- 1 manual (<oper> field shall be present)
- 2 deregister from network
- 3 set only <format> (for read command +COPS?), do not attempt registration/deregistration (<oper> field is ignored); this value is not applicable in read command response
- 4 manual/automatic (<oper> field shall be present); if manual selection fails, automatic mode (<mode>=0) is entered

<format>:

- 0 long format alphanumeric <oper>
- 1 short format alphanumeric <oper>
- 2 numeric <oper>

<oper>: string type; <format> indicates if the format is alphanumeric or numeric; long alphanumeric format can be upto 16 characters long and short format up to 8 characters (refer GSM MoU SE.13 [9]); numeric format is the GSM Location Area Identification number (refer GSM 04.08 [8] subclause 10.5.1.3) which consists of a three BCD digit country code coded as in ITU-T E.212 Annex A [10], plus a two BCD digit network code, which is administration specific; returned <oper> shall not be in BCD format, but in IRA characters converted from BCD; hence the number has structure: (country code digit 3)(country code digit 2)(country code digit 1)(network code digit 2)(network code digit 1)

<stat>:

- 0 unknown
- 1 available
- 2 current
- 3 forbidden

<svrStat>

- 0 full service
- 1 limited service
- 2 no service

3 Interface Changes

3.1.1 AT command interface.

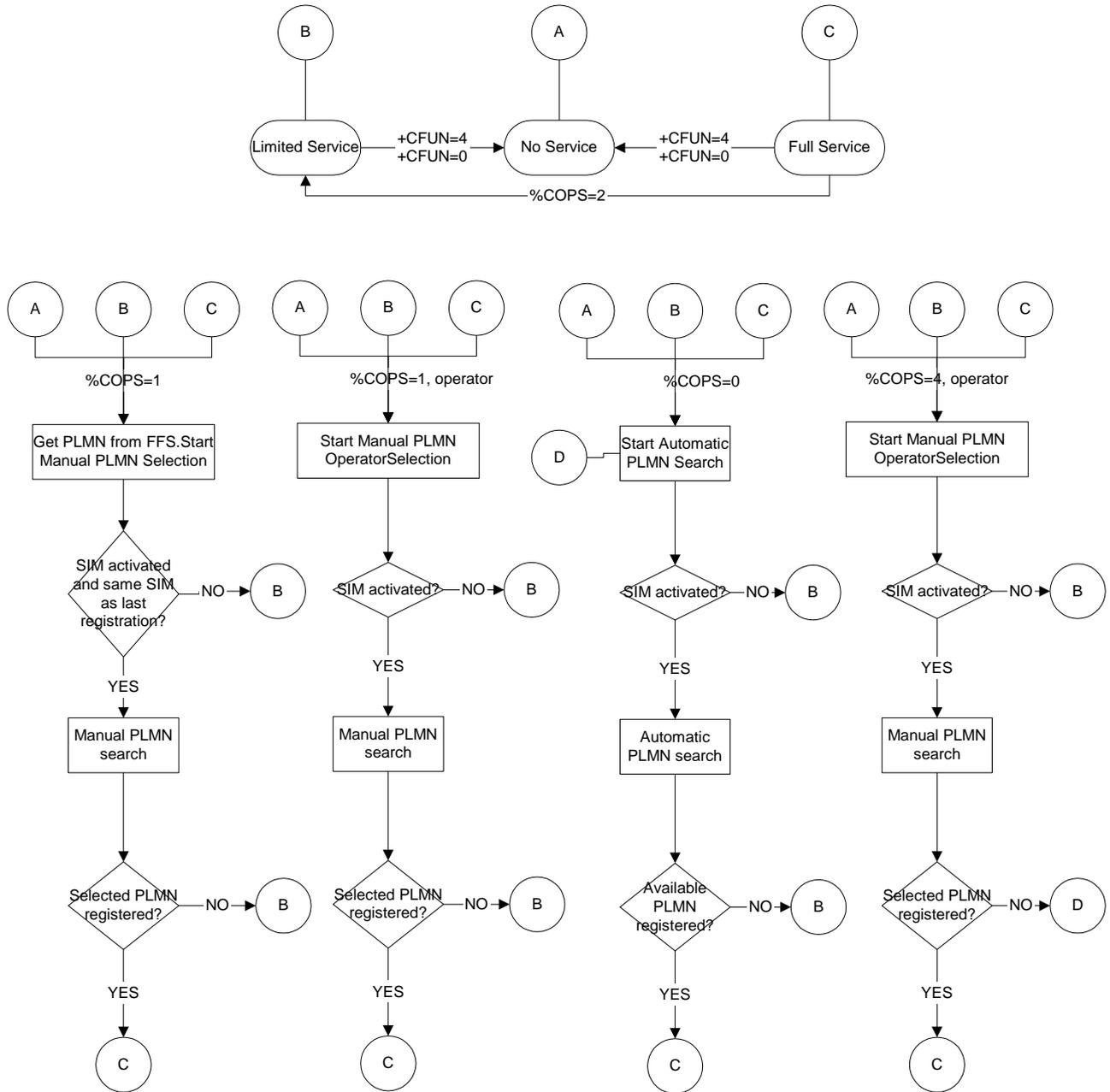
The new AT command %COPS will be defined as described in section 2.

3.1.2 Functional interface.

The new functions sAT_PercentCOPS() , qAT_PercentCOPS(), and tAT_PercentCOPS() will be added to the ACI functional interface.

4 Service status diagram.

The following figure represents the relationship between Service Status, %COPS and +CFUN.



NOTES
 1) Only transitions which change the status have been represented.
 2) The total loss of network coverage will lead to "No Service". The loss of available network service will lead to "Limited Service".

5 Proposed Low Level Design.

5.1 ATI Modifications.

5.1.1 New Functions:

- -setatPercentCOPS(). File "ati_mm.c". It will parse the %COPS set command parameters.
- -queatPercentCOPS().File "ati_mm.c". It will handle the %COPS query command.
- -tesatPercentCOPS().File "ati_mm.c". It will handle the %COPS test command.

5.1.2 Modified Functions:

None

5.1.3 Affected Global variables:

- The ATI array "cmds", in the file "ati_cmd.c", will be updated with the new functions setatPercentCOPS() , queatPercentCOPS() and tesatPercentCOPS().

5.1.4 Description of the changes:

- Function setatPercentCOPS (char *cl, UBYTE srcId); It will parse the parameters of % COPS according to the syntax described above. It will then call the new CMH function sAT_PercentCOPS().
- Function queatPercentCOPS(). It will call the new CMH function qAT_PercentCOPS(), get its output and send it to the corresponding Source.
- Given that the "%COPS=?" will initially do exactly the same as "+COPS=?", no tesatPercentCOPS() will be implemented, and tesatPlusCOPS() will be used instead.

5.2 CMH Modications.

5.2.1 New Functions:

- cmhMM_OperatorSelect(). File "cmh_mmf.c". This function will encapsulate the common CMH functionality of sAT_PlusCOPS(), sAT_PercentCOPS(), and sAT_PercentNRG(). This will remove any existing duplicated code.
- cmhMM_OperatorQuery(). File "cmh_mmf.c". This function will encapsulate the common CMH functionality of qAT_PlusCOPS(), qAT_PercentCOPS(), and qAT_PercentNRG(). This will remove any existing duplicated code.

- sAT_PercentCOPS(). File “cmh_mms.c”. This will be the functional counterpart of the %COPS set command. It will call the function cmhMM_OperatorSelect() with the appropriate parameters.
- qAT_PercentCOPS(). File “cmh_mmq.c”. This will be the functional counterpart of the %COPS query command. It will call the function cmhMM_OperatorQuery() with the appropriate parameters.
- tAT_PercentCOPS(). File “cmh_mmt.c”. This will only call sAT_PlusCOPS(), since it does exactly the same.
- cmhMM_OperatorStoreInFFS(). File “cmh_mmf.c”. It writes the current PLMN and IMSI to FFS.
- cmhMM_OperatorReadFromFFS. File “cmh_mmf.c”. It reads the current PLMN and IMSI from FFS.

5.2.2 Modified Functions:

- sAT_PlusCOPS(). Most of its code will be moved to the function cmhMM_OperatorSelect().
- qAT_PlusCOPS(). Most of its code will be moved to the function cmhMM_OperatorQuery().
- SAT_PercentNRG(). Most of its code will be moved to the function cmhMM_OperatorSelect().
- qAT_PercentNRG(). Most of its code will be moved to the function cmhMM_OperatorQuery().
- cmhMM_Registered(). It will be modified to store the selected PLMN and the IMSI information in the Flash File System.
- SAT_Abort(). Added the AT_CMD_P_COPS case.
- cmhMM_OpSetPNNLst(). Added the AT_CMD_P_COPS case.
- cmhMM_Deregistered(). Added the AT_CMD_P_COPS case.
- cmhMM_NetworkLst(). Added the AT_CMD_P_COPS case.
- cmhMM_SelNetwork(). Added the AT_CMD_P_COPS case.
- cmhSIM_SIMSync(). Added the AT_CMD_P_COPS case

5.2.3 Affected Global variables:

None

5.2.4 Description of the changes:

See 5.2.1 for new functions. The critical point of this feature is making sure that the encapsulation of the functionality provided by +COPS and %NRG in %COPS keeps the previous functionality intact and “regression free”. +COPS and %NRG duplicate most of their code, but some algorithms are a bit different and special attention will have to be paid to them.

The Last registered PLMN and the IMSI of the SIM card will be stored in FFS, in function cmhMM_Registered(). This function is called every time a new operator is registered. This will apply to both Manual and Automatic Selection. When using %COPS=1, the ACI will attempt to register that operator manually, but only if the SIM card has not changed (The current IMSI will be compared to the one in FFS). If the SIM card has changed, or the operator selection fails, the ACI will return an error and the MT will go to limited Service.

6 Testing.

Given that important commands like +COPS and %NRG are going to be modified for this new command, regression testing of all test cases applying to those functions is extremely important. Similar test cases will be written specifically for %COPS.

In addition, new simulation test cases will have to be written for the %COPS=1 functionality. This is a summary of the new scenarios that will be tested:

- Manual Network selection to “Operator 1”. Reboot. Same SIM card. “Operator 1” available.
 - Expected: %COPS=1 successfully registered to “Operator 1”.
- Automatic Network Selection. “Operator 1” selected. Reboot. Same SIM card. “Operator 1” available.
 - Expected: %COPS=1 successfully registered to “Operator 1”.
- Manual Network Selection. “Operator 1” selected. Reboot. “Operator 1” not available.
 - Expected: %COPS=1 returns ERROR.
- Manual Network Selection. “Operator 1” selected. Reboot. Different SIM Card. “Operator 1” available.
 - Expected: %COPS=1 returns ERROR.