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APN Content Level	BASIC	✓	INTERMEDIATE		ADVANCED		Confidentiality	Public	✓	Private	
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Software Compatibility*	FW:	X4.x	Software Suite:	N/A	Plug-Ins:	TCP/IP	N/A	Security	N/A	Compiler Used:	N/A	Reference Hardware	No
		X5.x				Internet	N/A	LUA	N/A	Reference Software	No		
		X6.x				C-GPS	N/A		RTE :			N/A	
X7.x													

* refer to software compatibility matrix section for more detail

Hardware Compatibility	AirPrime Q Series :	Q2686	✓	Q2687	✓	Q26Extreme		Q26Elite	
	AirPrime WMP Series :	WMP50	✓	WMP100	✓	WMP120	✓	WMP150	✓
	AirPrime WS Series :	WISMO218		WISMO228					
	AirPrime AR Series	AR3550		AR5550		AR8550			
	AirLink FXT Series :	Fastrack Xtend GPRS	✓	Fastrack Xtend EDGE	✓	Fastrack Xtend HSPA		Fastrack Xtend CDMA	
	Legacy products (GSM):	Q24Classic	✓	Q24Plus	✓	Q24Extended	✓	Q24Auto	✓
		Fastrack Supreme	✓	Q64		Q52 Omni	✓		
Legacy products (CDMA):	Q2438F		Q2438R						



1 Version

Application Notes may be updated over their lifetime. To ensure you design with the correct version, please check the application notes page in www.sierrawireless.com for latest versions.

2 Introduction

This Application Note (APN) is provided to Sierra Wireless distributors and clients to aid more rapid development of embedded applications using the Sierra Wireless portfolio of cellular solutions. To request a new application note, contact your regional Sierra Wireless Product Marketing Manager.

3 Application Note Description

The aim of this document is to explain the Sierra Wireless implementation for PLMN selection and reselection. It will first describe the different elements and explains the different situations.

4 Definitions

Public Land Mobile Network (PLMN)

A PLMN is a network established and operated by an Administration or RPOA for the specific purpose of providing land mobile communication services to the public. It provides communication possibilities for mobile users. For communications between mobile and fixed users, inter-working with a fixed network is necessary.

A PLMN may provide service in one, or a combination, of frequency bands.

As a rule, the borders of a country are the limits of a PLMN. Depending on national regulations there may be more than one PLMN per country.

A relationship exists between each subscriber and his home PLMN (HPLMN). If communications are handled over another PLMN, this PLMN is referred to as the visited PLMN (VPLMN).

Automatic mode

When in automatic mode the module handle autonomously the PLMN reselection. (cops=0) No further action from the user is requested.

Manual mode

When in manual mode the module is only able to handle the specified PLMN. (cops=1)

Scan of PLMN

The scan is the procedure used by the mobile to detect surrounding PLMNs. The user via AT+cops can trigger it=?

Preferred PLMN

The operator and the user can store several PLMN names in the SIM. Those PLMN will be selected in priority when in roaming. (cpol)

Forbidden PLMN

A list of the last 4 forbidden PLMN is stored on the SIM. After being rejected by a PLMN, this PLMN is stored in this list. This PLMN will not be tried again in automatic mode but can be in manual mode.

Registered PLMN

The registered PLMN is the last PLMN the MS successfully camped on. That mean that registration was successful, and the service either for voice or packet is authorised. The registered PLMN is stored in the SIM in the LOCI field (see below)

Loci

The SIM stores information on the last registered area (PLMN and location area).

5 Information stored in the module

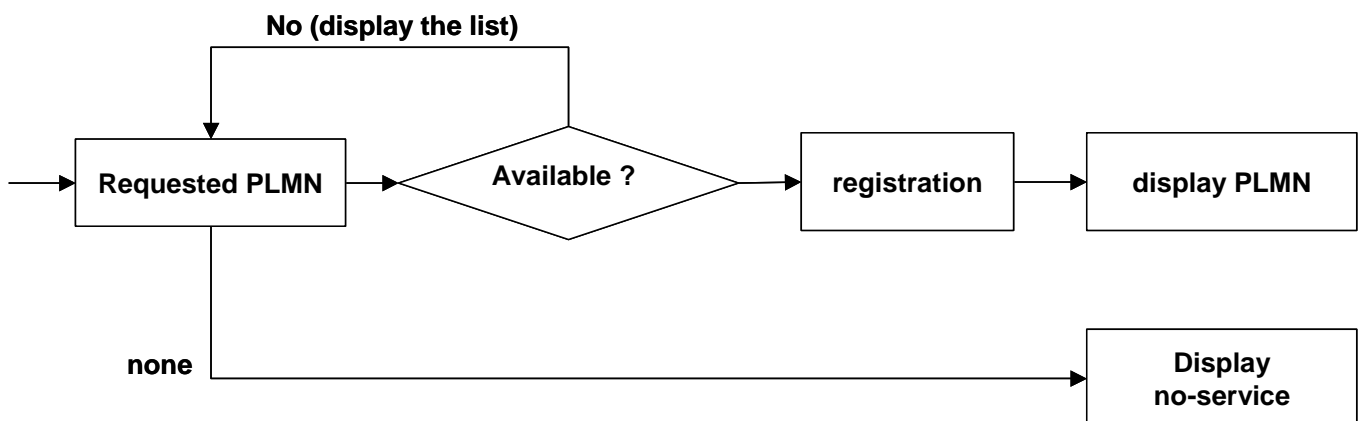
The module stores the operation mode (manual or automatic). In case of Manual mode the Last registered PLMN is also stored in memory.

In manual mode if there is a conflict between the information stored on the SIM or on the module, the information from the module will be preferred.

6 General procedure

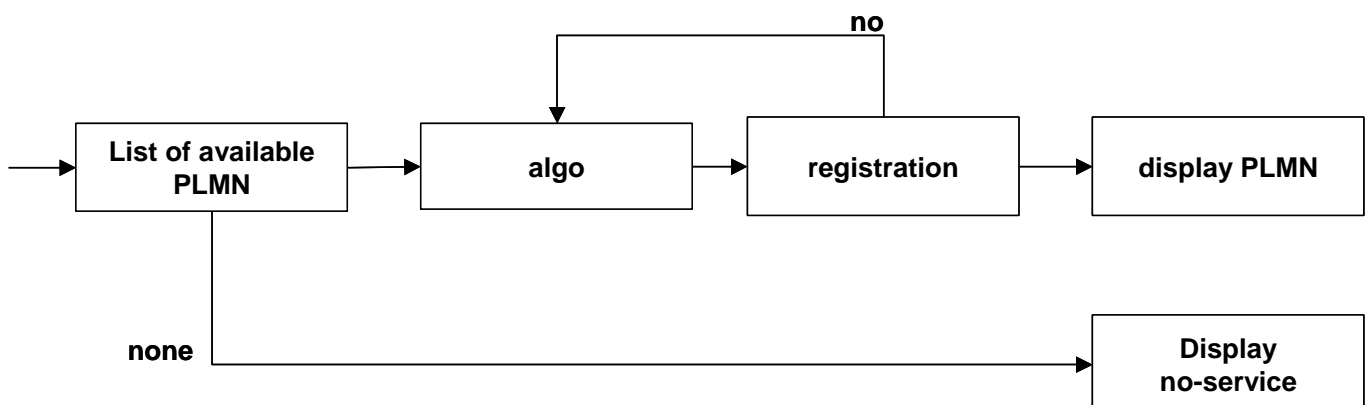
Both manual and automatic procedures have a common part. This is described hereafter.

The low layer will scan for the available cells. If the requested PLMN is found the procedure will finish. Otherwise a list of available PLMN will be forwarded to the upper part to trigger the selection algorithm (from GSM specifications).



Specific PLMN request

This is the case where the user starts a manual reselection (with cops=1) or if its MS loses his Home PLMN.



Any PLMN request

This is the case where the user starts an automatic reselection (with cops=0) or if we are in roaming and we lose the visited PLMN.

7 At switch on or recovery from lack of coverage

At switch on, or following recovery from lack of coverage, the MS selects the registered PLMN. The registered PLMN is the one stored in the SIM (or in some cases in the module). That means the last registered PLMN is the last one the MS successfully camped on in full service. If successful registration is achieved, the MS indicates the selected PLMN.

If there is no registered PLMN, or if registration is not possible due to the PLMN being unavailable or registration failure, the MS follows one of the following two procedures depending on its operating mode.

Automatic Network Selection Mode Procedure

The MS selects and attempts registration on other PLMNs, if available and allowable, in the following order:

1. PLMN (if not previously selected);
2. each PLMN in the preferred PLMN list in the SIM (in priority order);
3. other PLMN with received high quality signal in random order (>85dBm);
4. other PLMN in order of decreasing signal quality.

Manual Network Selection Mode Procedure

The MS indicates whether there are any PLMNs, which are available. This includes PLMNs in the "forbidden PLMNs" list. If displayed, PLMNs meeting the criteria above are presented in the following order:

1. HPLMN;
2. PLMNs in the preferred PLMN list in the SIM (in priority order);
3. other PLMN with received high quality signal in random order (>85dBm)
4. other PLMN in order of decreasing signal quality.

8 User reselection

At any time (except while performing a circuit-switched call or in a data packet transfer) the user may request the MS to initiate reselection and registration onto an available PLMN, according to the following procedures, dependent upon the operating mode.

Automatic Network Selection Mode Procedure

The previously selected PLMN is the PLMN that the MS has selected prior to the start of the user reselection procedure and on that the MS was camped on (In full service). The MS selects and attempts registration on PLMNs, if available and allowable, in all of its bands of operation in accordance with the following order:

1. HPLMN;
2. PLMNs in the preferred PLMN list in the SIM (in priority order) excluding the previously selected PLMN;
3. Other PLMN/ with the received high quality signal in random order excluding the previously selected PLMN;
4. Other PLMN/access technology combinations, excluding the previously selected PLMN in order of decreasing signal quality or, alternatively, the previously selected PLMN may be chosen ignoring its signal quality;
5. The previously selected PLMN.

Manual Network Selection Mode Procedure

The MS indicates whether there are any PLMNs, which are available. This includes PLMNs in the "forbidden PLMNs" list. If displayed, PLMNs meeting the criteria above are presented in the following order:

1. HPLMN;
2. PLMNs in the preferred PLMN list in the SIM (in priority order);
3. other PLMN with received high quality signal in random order (>85dBm)
4. other PLMN in order of decreasing signal quality.

9 FAQ

Here are listed common question on PLMN reselection.

Why do the PLMN always change when I do a `at+cops=0` or select the menu automatic selection?

When this command or this item is selected this trigger a user reselection in automatic mode. This explains why the previous PLMN is selected in last position.

Why can the mobile stay stuck in no service or emergency after a manual selection (`cops=1,?,?` or manual selection menu) ?

When entering the manual mode the module will only look for the specified network. If this network is lost or not found then the module will not try to register on a different PLMN.

What is manual/automatic mode (`cops=4,?,?`)?

This operation mode is a special Sierra Wireless mode. The module will try to register on a specific PLMN. If the registration is successful the module will revert to automatic mode and stay stuck on the required PLMN. If the specified PLMN is not present the module will revert to normal automatic mode.

10 Package Deliverables

This application note is delivered as a single compressed zip archive as follows:

Filename	Description
WM_DEV_OAT_APN_008-003.zip	Application Note

11 Related Documents

	Standard	Comment
[1]	3GPP TS 22.011	Service accessibility
[2]	3GPP TS 23.122	Non-Access-Stratum (NAS) functions related to Mobile Station (MS) in idle mode

12 Software Compability Matrix

Firmware	Software Suite	Plug-Ins
4x (X40, X41 ...)	N/A	N/A
5x (X50a, 6.55 ...)	N/A	N/A
6.6x (6.60, 6.61 ...)	N/A	N/A
6.5	N/A	N/A
7.x (R7.1, R7.2 ...)	N/A	N/A

13 Support

For direct clients: contact your Sierra Wireless FAE

For distributor clients: contact your distributor FAE

For distributors: contact your Sierra Wireless FAE

14 Document History

Level	Date	Details
001	March 10, 2006	First Edition

Level	Date	Details
002	August 25, 2009	Updates and reformat
003	February 11, 2010	Updates and reformat

15 Legal Notice

Important Notice

Due to the nature of wireless communications, transmission and reception of data can never be guaranteed. Data may be delayed, corrupted (i.e., have errors) or be totally lost. Although significant delays or losses of data are rare when wireless devices such as the Sierra Wireless modem are used in a normal manner with a well-constructed network, the Sierra Wireless modem should not be used in situations where failure to transmit or receive data could result in damage of any kind to the user or any other party, including but not limited to personal injury, death, or loss of property. Sierra Wireless accepts no responsibility for damages of any kind resulting from delays or errors in data transmitted or received using the Sierra Wireless modem, or for failure of the Sierra Wireless modem to transmit or receive such data.

Safety and Hazards

Do not operate the Sierra Wireless modem in areas where blasting is in progress, where explosive atmospheres may be present, near medical equipment, near life support equipment, or any equipment which may be susceptible to any form of radio interference. In such areas, the Sierra Wireless modem **MUST BE POWERED OFF**. The Sierra Wireless modem can transmit signals that could interfere with this equipment. Do not operate the Sierra Wireless modem in any aircraft, whether the aircraft is on the ground or in flight. In aircraft, the Sierra Wireless modem **MUST BE POWERED OFF**. When operating, the Sierra Wireless modem can transmit signals that could interfere with various onboard systems.

Note: Some airlines may permit the use of cellular phones while the aircraft is on the ground and the door is open. Sierra Wireless modems may be used at this time.

The driver or operator of any vehicle should not operate the Sierra Wireless modem while in control of a vehicle. Doing so will detract from the driver or operator's control and operation of that vehicle. In some states and provinces, operating such communications devices while in control of a vehicle is an offence.

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Portions of this product may be covered by some or all of the following US patents:

5,515,013	5,629,960	5,845,216	5,847,553	5,878,234	5,890,057	5,929,815	6,169,884
6,191,741	6,199,168	6,339,405	6,359,591	6,400,336	6,516,204	6,561,851	6,643,501
6,653,979	6,697,030	6,785,830	6,845,249	6,847,830	6,876,697	6,879,585	6,886,049
6,968,171	6,985,757	7,023,878	7,053,843	7,106,569	7,145,267	7,200,512	7,295,171
7,287,162	D442,170	D459,303	D599,256	D560,911			

and other patents pending.

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