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u-blox SARA-R520 Smart Connection Manager User Guide

Contents

u-blox SARA-R520 Smart Connection Manager

Product Specifications

- Product Name: LEXI-R520 / SARA-R52 series
- Feature: Smart Connection Manager (uSCM)
- Document Number: UBX-21006919
- Revision Date: 12-Apr-2024
- Supported Products: LEXI-R520, SARA-R520, SARA-R520M10

Product Information

The u-blox Smart Connection Manager (uSCM) is a feature that maintains and automatically reestablishes the network registration and data connection in case of unexpected out-of-coverage conditions or any other interruption in the communication link.
Once enabled, uSCM handles all connectivity aspects, covering corner cases that are difficult to manage. It continuously monitors the network status, tracks user activity, and follows the profile configuration stored in a configuration JSON file in the module filesystem (FS).

Product Usage Instructions

Smart Connection Manager Overview
The uSCM manages network registration and data connection reestablishment automatically.

To enable uSCM:

1. Ensure the module filesystem (FS) contains the configuration JSON file.
2. Monitor network status and user activity.
3. Follow profile configurations for seamless operation.

AT Commands
The product supports AT commands for configuration.

To use AT commands:

1. Refer to the product manual for a list of available AT commands.
2. Send AT commands to configure uSCM settings as needed.

Use Cases
The uSCM can be used in various scenarios to maintain network connectivity.

Some common use cases include:

- Handling out-of-coverage situations.
- Reestablishing data connections after interruptions.
- Managing network registration seamlessly.

Frequently Asked Questions (FAQ)

1. **Q: How do I know if uSCM is enabled?**

A: Check the module filesystem for the presence of the configuration JSON file. If it is stored, uSCM is likely enabled.

2. **Q: Can uSCM handle all network-related issues automatically?**

   A: uSCM aims to cover most connectivity aspects automatically, but some complex issues may require manual intervention.

Abstract

This application note describes the functionalities of the u-blox Smart Connection Manager feature.

Document information

Title	**LEXI-R520 / SARA-R52 series**	
Subtitle	Smart connection manager (uSCM)	
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This document applies to the following products:

- Product name
- LEXI-R520
- SARA-R520
- SARA-R520M10

Smart connection manager overview

The u-blox Smart Connection Manager (uSCM) is a feature that maintains and automatically re-establishes the network registration and data connection in case of unexpected out-of-coverage condition or any other interruption in the communication link.
Once enabled, uSCM handles all the connectivity aspects, automatically covering all the corner cases that are difficult to handle.
uSCM operates by continuously monitoring the network status and by keeping track of the user activity and profile configuration. All its functionalities are guided through the uSCM algorithm which operates following the profile configuration and settings reported in a configuration JSON file, if stored in the module filesystem (FS).
Some existing functionalities of the radio policy manager entity have been incorporated into the uSCM feature. In addition, the uSCM has implemented new processes, algorithms, and controls, as described in the following sections.

Features overview

Smart connection manager supports several features, and it provides a globally optimized connectivity with automatic APN detection and handling. Additionally, through proper configuration, all the network settings (e.g., QoS and MNO optimize selection) are managed by uSCM. Furthermore, it facilitates low-power designs by implementing protection mechanisms to avoid ping-pong among cells and minimize the cell scan time. .

Additional features included are:

- SIM initialization.
- Possibility to handle multiple contexts with different configuration values.
- Transmission/networking/policies optimizations.
- Behavior monitoring and patterns identification.
- Detect out-of-coverage (OOC) situations. By OOC condition, the document is referring to any unsuitable conditions of the module where it cannot attempt the registration and/or if attempted this would fail.
- Possibility to automatically handle the APN selection
- Able to operate in a low-power scenario where the PSM is adopted.
- Data stall detection
- Cell ping-pong detection and relaxed cell monitoring
- Network connection KPI monitoring (SR failures, connection reestablishment count, RACH failures)
- Enhanced configuration for low power scenarios with static conditions.

The uSCM algorithm integrates all these features with the help of several working states, which are described in the next section.

Working states
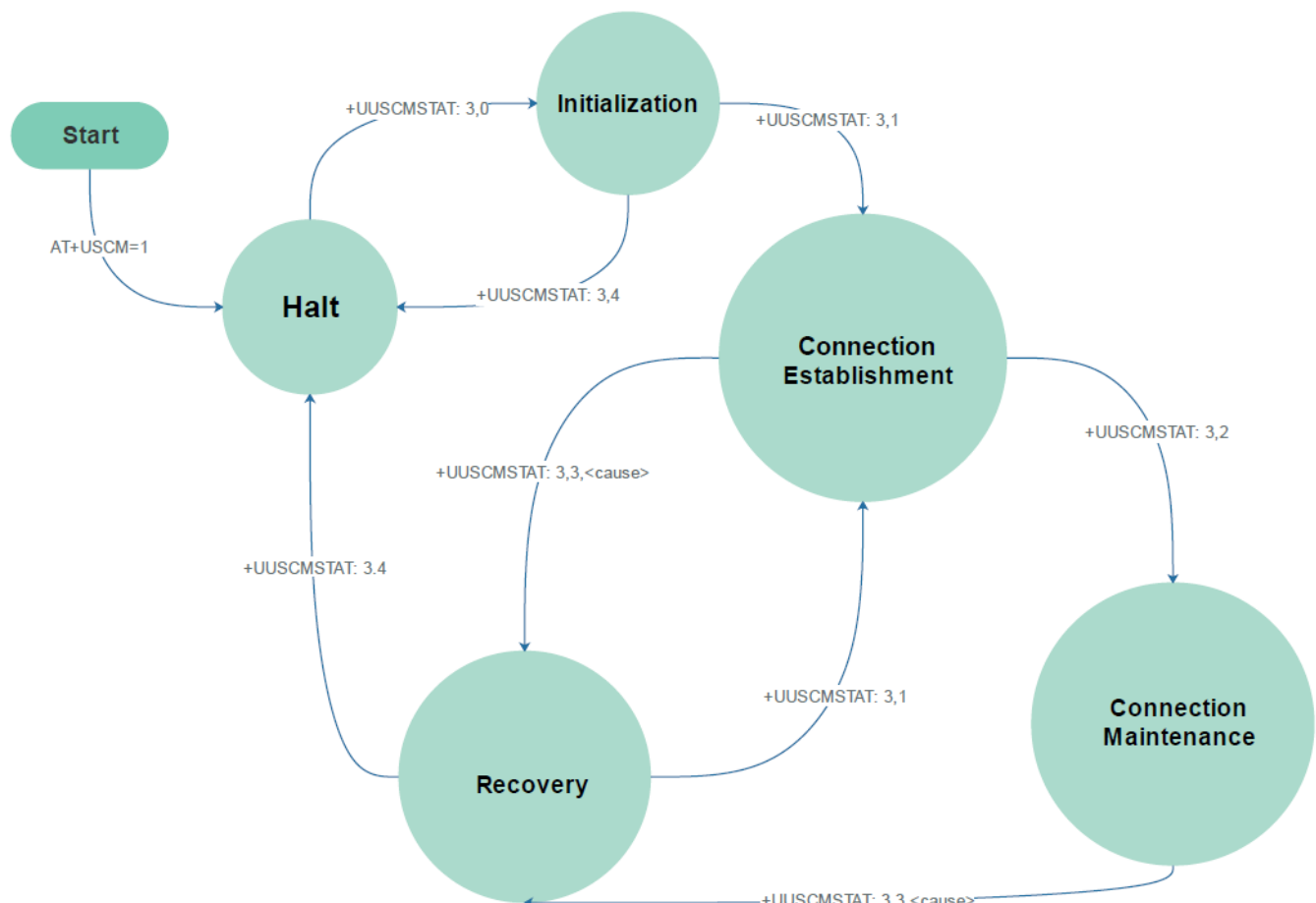
- uSCM initialization: uSCM is enabled via the +USCM AT command. Once enabled, it moves from the HALT state to the INITIALIZATION state. The initialization phase consists of some preliminary checks such as antenna presence and module ambiance temperature. If already registered to the network, the module will be deregistered so that uSCM performs all the start-up steps with full control of the registration process. All the RAT and CS/PS profile settings are read and taken from the module AT settings.
- Connection Establishment: After completing the initialization, uSCM moves to the CONNECTION_ESTABLISHMENT state. This state enables the module cellular functionalities and monitors the registration status. Once registered, also the packet switch data profile and PDP contexts are activated if properly configured in the parameters of the configuration file. As the final action in this step, uSCM either moves to the CONNECTION_MAINTENANCE state if registration and context activation is successful or it triggers a RECOVERY procedure if a failure is observed.
  - Context activation: uSCM will ensure that all the PDP context defined in the configuration file are activated. In particular:
- In HPLMN: all the CIDs present in configuration files, marked for "home", will be activated. Failure in any CID will result in an error.
- In VPLMN: all the CIDs present in configuration files, marked for "roaming", will be attempted for activation. No error will be returned if at least one CID is activated.
  - Registration status monitoring: This state helps uSCM to determine if the module is in a correct registration state with respect to CREG/CGREG/CEREG status, RAT setting, and CS/PS profile settings.
- Connection maintenance: In connection maintenance, uSCM will observe the registration status and others network KPIs which can indicate the health of connection. uSCM keeps the track of Cell IDs and Tracking Area Codes (TAC), any ping-pong in same Cell IDs or TACs may trigger the recovery response. If there is a failure in registration status due to out-of-coverage or weak coverage, RECOVERY is triggered.
- • Recovery: uSCM will enter the recovery process if out-of-coverage or weak coverage conditions occur. Moreover, also the identification of a context activation failure brings uSCM to this recovery state. A complete list of all the possible recovery causes can be found in the <cause> description of +UUSCMSTAT URC message in the AT commands manual [5].
  - Coverage failure: When the module is not registered for an amount of time, coverage failure will be detected by uSCM.

uSCM timers
Several timers are maintained and monitored in the uSCM feature. These timers are used to monitor the different transit conditions and act accordingly with the uSCM functionalities.

- Scan Timer: Triggered immediately when the module is de-registered, (reported by +CEREG: 4 URC) the module is allowed to scan the PLMN for this time as per the default platform scheme. If the timer expires the module will enter the <suspend_mode> to save power. uSCM will maintain the module in this last mode for an interval of time defined by the backoff timer.
- Weak Coverage Interval Timer: Determines the maximum time interval (in seconds) during which the change between normal service and limited service/out-of-coverage condition is considered an unexpected event and is used to increment the guard counter. When the guard counter reaches the <bounce_count>, the module enters <suspend_mode> to save power as after the scan timer.
- Backoff Timer: When uSCM determines that the module is in out-of-coverage conditions (i.e., RSRP is in-valid and the scan timer expiries), it will take the module into <suspend_mode> (Radio Switch off Mode or Low

Power Mode can be selected by editing <suspend_mode> parameter in the configuration file) for backoff timer. This will help the module to save power during OOC conditions. This backoff timer defines the amount of time that the device will stop scanning for network and will remain in <suspend_mode>. Once uSCM moves to the CONNECTION_MAINTENANCE state, the PSD timer is reset to its initial value, set in <PSD>.

Configuration file
uSCM operates based on the functional configurations.

You have two options to specify the configurations:

- Use the pre-defined functional configurations profiles available in uSCM. Users can select any of the four configuration profiles by the +USCMCONF AT command.
- Use a functional configuration file (which is a single JSON file) to configure its functionalities if settings differ from the default profile values.

This section explains how to get access, edit, and update the functional configuration file. See example of the configuration file in appendix C.
The following sections provide instructions on how to deploy the configuration JSON file to the module and how to modify it.

Store functional configuration file with AT commands
The configuration file can be transferred to the module file system (FS) with the following AT commands.

Command	Response	Description
AT+UDWNFILE="scm_config.json ",<FILE_SIZE>,"SCM"	OK	Transfer the scm_config.json file to the module FS. <FILE_SIZE>: is the data count of file content to be

Command	Response	Description
		transferred. 'SCM' is used as Tag for selecting the specific folder to store the file.
AT+ULSTFILE=0,"SCM"	+ULSTFILE: "scm_config.json" OK	Verify if the configuration file is present in the module FS.

Any firmware update (either FOTA, FOAT, or via Easyflash) will remove the user configuration files from the module filesystem. Therefore, we recommend performing a backup of the configuration files, so they can be reloaded after the firmware update.

Store functional configuration file with m-center
You can use m-center evaluation software to store the JSON file into the module.
In the 'Tag' field it is mandatory to report the 'SCM' parameter to store the configuration file in the correct folder.
Any file can be stored in the module via the File System Tab shown in Figure 1, by clicking Store file. A window will open where the chosen file can be selected from Windows Explorer.
By clicking Dir, the m-center window will display all the stored files.
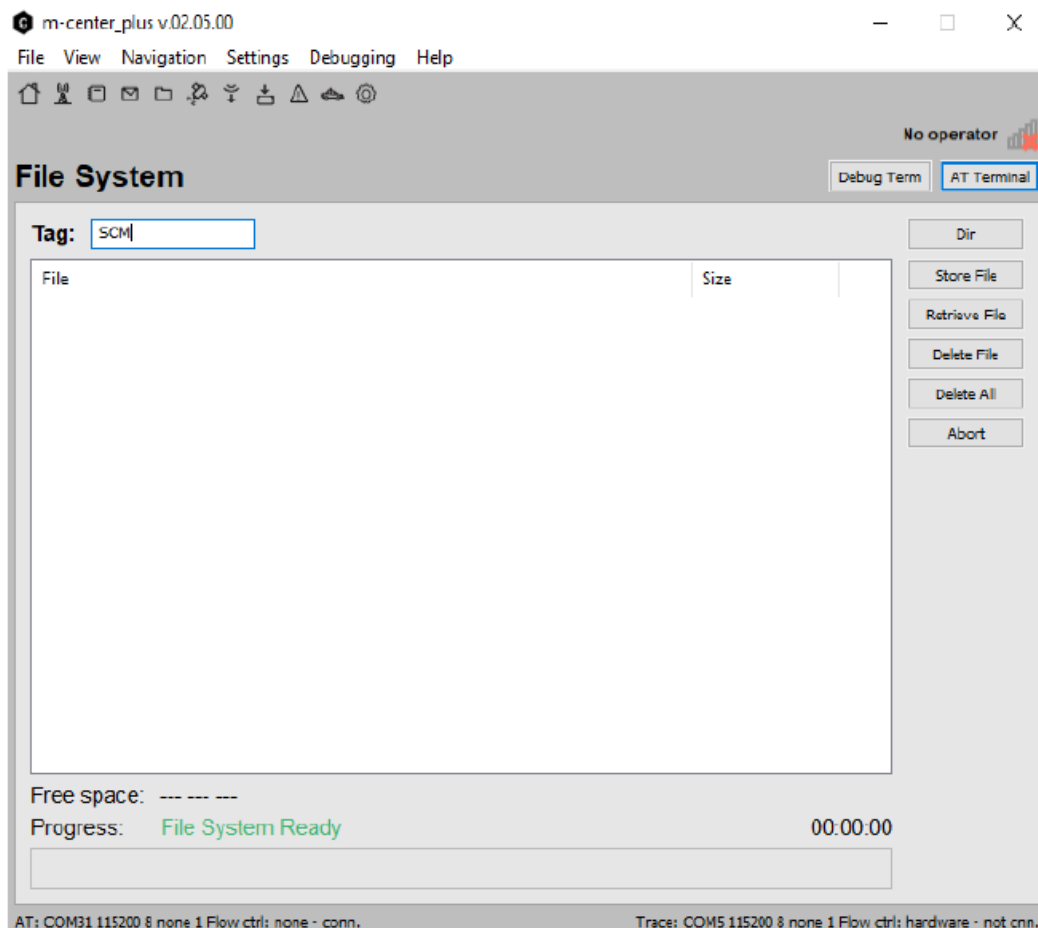Download the latest version of m-center for free at **https://www.u-blox.com/en/product/m-center**

Figure 1: m-center File System tab

Modify functional configuration file

All the parameters in the JSON file are categorized by their characteristics and defined with multiple sub-objects. The configuration manager in uSCM is responsible for loading the functional configurations.

See appendix A for descriptions and ranges for all configuration settings.

The use of the configuration file is not mandatory. In case a specific setting, different from the default profile, needs to be used, the user can download the configuration file and store it on the module. By properly defining a new value for this specific setting, uSCM will parse the content of the configuration file and overwrite the default profile value.

☞ Not all the settings must be reported in the JSON file, only the ones that differs can be reported.

☞ If the user loads configurations through the JSON file, the configuration manager will parse the configuration file stored in the FS. It checks for any out-of-range parameter, and if the file is correct, loads the configuration file in uSCM.

Initialization configurations

Update the following JSON object in the configuration file to define the module temperature ranges.

"init_info":
{
"reg_profile": 4
}

PDP context list

All the PDP contexts to be activated must be listed in the functional configuration file. Update the following JSON object to add any PDP context.

"ctxt_act":
{
"cid_count": 3,
"ctxt_data":[[0,0,"APN1″],[2,0,"APN2″],[5,1,"APN3″]] }

Power saving mode configuration

Update the following JSON object in the configuration file to define the parameters of the power saving mode configurations.
"power_saving_mode":
{
"suspend_mode": 1
}

AT commands

This section reports all the AT commands that are related to the uSCM functionalities. For details of the AT commands, see the AT commands manual [2].

uSCM control (+USCM)

The +USCM AT command provides the entire uSCM top level control. It enables or disables the uSCM feature and URCs.
The uSCM feature is disabled by default.
All the uSCM URC notifications can be identified with the string +UUSCMSTAT.

uSCM configuration (+USCMCONF)

The +USCMCONF AT command selects, reads, or resets (to the factory-programmed values) the uSCM profile parameters with the. It allows the user application to switch the functional default profile at run time even if uSCM is already enabled.
If an invalid configuration filename is provided, the +USCMCONF command will return an error and uSCM will start with the default profile.
The command can select between uSCM functional configurations from user configuration or the default profiles. The default profiles are shipped with different values of configuration parameters as per the profile requirements. Along with this +USCMCONF AT command, uSCM low level configurations are managed by a JSON formatted configuration file. This configuration file shall be stored in the module filesystem. See section 1.3 for details of configuration transfer and modification.

URC notifications

The URC +UUSCMSTAT reports changes in the uSCM state but also any other error and/or warning. Precisely, accordingly with its structure +UUSCMSTAT: <code>,<param1>[,<param2>[,<param3>]], the first argument <code> is used to indicate the type of reported URC which may vary in three different categories. Those categories are all highlighting a change in the uSCM state. However, the change may occur normally, with a warning and with an error condition.
For a complete list of all the possible values arguments <code> and the different <param#> may assume, see the AT commands manual document [5].

Parallel control of the radio functionalities

The use of any module's radio functionality commands such as +CFUN or +COPS will affect the operating mode of uSCM.
For instance, if radio functionalities are disabled with either AT+CFUN=0 or AT+COPS=2 command also the uSCM algorithm will be stopped. Similarly, if the application is recovering the radio functionality while uSCM is enabled, the uSCM algorithm will also restart its activity.
In case the module is booted with uSCM enabled two distinct use cases can occur.

- If radio functionality is set to airplane mode (option 4) the uSCM algorithm will start on halt mode.
- If radio functionality is set to normal mode (option 1) the uSCM algorithm will start its activity normally.

Use cases

Initial steps

Before starting using the uSCM user must decide if use one of the pre-defined functional configurations profiles or instead, load one via the JSON configuration file (to download the JSON file see section 1.3).

If a personal configuration is needed, the user can edit the file to adjust its configuration settings, a complete list of all the settings is reported in appendix A.

Then, use the +UDWNFILE AT command to store the scm_config.json file containing the uSCM configuration, in the file system of the module. This procedure was described in section 1.3.1.

Once enabled, uSCM can start working only if the module is in the full functionality state. This can be checked with AT+CFUN? command or enabled with AT+CFUN=1 command.

uSCM in OOC condition

In this section it is reported an example where a SARA-R5 module series with SCM enabled is experiencing an OOC condition.

Several activities are occurring and can be monitored with the +UUSCMSTAT URC messages. To summarize, after that OOC condition is detected, uSCM will enter scan mode and start a scan timer and upon its expiry uSCM will start the backoff timer and it will take the module to power save mode (R mode). After the PSD timer expires, it will again try to register the module and the cycle will go on until coverage is available.

Note that in this example, no PDP context is defined in the user configuration file, so uSCM will avoid controlling it.

Command	Response	Description
AT+CEREG=1	OK	Enable registration URC.
AT+USCMCONF="scm_config.json",,0,	OK	Set uSCM to use the configuration file in FS. ☞ The step of storing the configuration file is not mandatory and it is required only if user settings differ from the selected profile.
AT+USCM=1,7	OK	Enable uSCM feature and the URC reporting status details. Internally uSCM is initialized together with the network registration sequence. ☞ The AT+CFUN=1 command, to set the module to full functionality is triggered internally by uSCM.
	+UUSCMSTAT: 3,0	uSCM starts in SCM_INIT state.
	+CEREG: 0	De-registration indication is received if the module was registered previously, because SCM has issued the AT+CFUN=0 command.
	+UUSCMSTAT: 3,1	uSCM moved to SCM_CONN_EST state.
	+CEREG: 1	Module is registered to the home network.
	+UUSCMSTAT: 2,1,7	Warning: No PDP context provided in the user configuration file.
	+UUSCMSTAT: 2,1,6	Warning: UPSD profile activation skipped.
	+UUSCMSTAT: 3,2	uSCM moved to SCM_CONN_MANT state.

Command	Response	Description
Module moves in an out-of-coverage area.		
	+CEREG: 4	Module enters in OOC.
	+UUSCMSTAT: 3,1	uSCM moves back to SCM_CONN_EST state.
	+UUSCMSTAT: 3,3,8	OOC indication is received.
	+CEREG: 0	De-registration indication is received. Module functionality is disabled for time which is configured in Backoff timer
AT+CFUN?	+CFUN: 0,7 OK	uSCM has moved the modem to Radio Switch off Mode.
After backoff timer expiry, SCM checks again for NW by enabling the module functionality		
	+CEREG: 4	No network is present
	+UUSCMSTAT: 3,3,8	OOC indication is received
	+CEREG: 0	Module is de-registered.

uSCM with roaming network and PDP contexts handling
In this example, uSCM is used to handle the registration but also the activation of the PDP contexts that are present in the configuration file. The example is performed in a roaming network still, it would operate similarly in a home network.
After been enabled, uSCM starts in the SCM_INIT state, then loads the user configuration file and initializes the module to a known reference state. When successfully initialized uSCM shall register the module to the network, activate the provided PDP contexts, and move to SCM_CONN_MANT state.

Command	Response	Description
AT+CREG=1	OK	Enable CS network registration URC.
AT+CEREG=1	OK	Enable EPS registration URC.
AT+USCMCONF="scm_config.json",,0,	OK	Set uSCM to use the configuration file in FS. ☞ The step of storing the configuration file is not mandatory and it is required only if user settings differ from the selected profile.
AT+USCM=1,7	OK	Enable uSCM and status URC reporting. Internally, uSCM is initialized together with the network registration sequence. ☞ The AT+CFUN=1 command, to set the module to full functionality is triggered internally by uSCM.
	+UUSCMSTAT: 3,0	uSCM starts in SCM_INIT state.
	+CREG: 0	De-registration indication is received if the module was registered previously, because uSCM has issued the AT+CFUN=0 command.
	+CEREG: 0	De-registration indication is received if the module was registered previously, because uSCM has issued the AT+CFUN=0 command.
	+UUSCMSTAT: 3,1	uSCM moved to SCM_CONN_EST state.
	+CREG: 5	Module is registered to the roaming network.
	+CEREG: 5	Module is registered to the roaming network.

Command	Response	Description
	+UUSCMSTAT: 2,1,0	Indication: Module is registered to a roaming network.
	+UUSCMSTAT: 3,2	uSCM moved to SCM_CONN_MANT state.
AT+CGDCONT?	+CGDCONT:	Three different PDP contexts are activated with valid IP addresses. ☞ <CID>=1 is the default context, while instead, <CID> 2 and 3 are enabled by uSCM because defined in the "scm_config.json" file.
	1,"IPV4V6","default.mnc001.m	
	cc001.gprs","192.168.20.6	
	42.11.173.64.0.1.16.33.42.11	
	.173.64.0.1.16.33",0,0,0,2,0	
	,0,0,0,0,0,0	
	+CGDCONT:	
	2,"IP","internet2.mnc001.mcc	
	001.gprs","192.168.24.2",243	
	,92,96,255,40,0,0,255,255,25	
	5,0	
	+CGDCONT:	
	3,"IP","internet3.mnc001.mcc	
	001.gprs","192.168.25.2",243	
	,92,96,255,40,0,0,255,255,25	
	5,0	
	OK	
AT+CGACT?	+CGACT: 1,1 +CGACT: 2,1 +CGACT: 3,1 OK	As a check, all the provided <CID>s have been activated.

uSCM response when module is passing from OOC area to a coverage condition
In this last example, it is reported all the uSCM URC messages that are provided when the module is moved from a network out-of-coverage condition to a normal coverage one.
As in the previous examples, uSCM starts in SCM_INIT state, load the user configuration file and initialize the module. After the successful initialization uSCM try to register the module to the network but observes the OOC condition and starts the scan timer. When the first scan timer is expired, the module is still in OOC, uSCM will start the PSD timer and switch off the radio. In the meanwhile, the module enters a coverage area therefore, after PSD timer expiry, the registration to the network would be successful and activate the provided PDP contexts, and then move to the SCM_CONN_MANT state.

Command	Response	Description
Module is in an out-of-coverage area.		
AT+CEREG=1	OK	Enable registration URC.
AT+USCMCONF="scm_config.json",,0,	OK	Set uSCM to use the configuration file in FS. ☞ The step of storing the configuration file is not mandatory and it is required only if user settings differ from the selected profile.
AT+USCM=1,7	OK	Enable uSCM feature and the URC reporting status details. Internally uSCM is initialized together with the network registration sequence. ☞ The AT+CFUN=1 command, to set the module to full functionality is triggered internally by uSCM.
	+UUSCMSTAT: 3,0	uSCM starts in SCM_INIT state.

Command	Response	Description
	+CEREG: 0	De-registration indication is received if the module was registered previously, because uSCM has issued the AT+CFUN=0 command.
	+UUSCMSTAT: 3,1	uSCM moved to SCM_CONN_EST state.
	+CEREG: 4	Module detects the OOC condition.
	+UUSCMSTAT: 3,3,8	OOC indication is received.
	+CEREG: 0	De-registration indication is received. Module functionality is disabled for time which is configured in Backoff timer
AT+CFUN?	+CFUN: 0,7 OK	uSCM has moved the modem to Radio Switch off mode.
Module moves in a coverage area and backoff timer is elapsed		
	+CEREG: 1	Module is registered to the home network.
	+UUSCMSTAT: 3,1	uSCM moved to the SCM_CONN_EST state.
	+UUSCMSTAT: 3,2	uSCM moved to the SCM_CONN_MANT state.

AT+CGDCONT?	+CGDCONT:	
	1,"IPV4V6″,"default.mnc001.m	
	cc001.gprs","192.168.20.6	
	42.11.173.64.0.1.16.33.42.11	
	.173.64.0.1.16.33″,0,0,0,2,0	
	,0,0,0,0,0,0	
	+CGDCONT:	
	2,"IP","internet2.mnc001.mcc	Three different PDP contexts are activated with valid IP addresses.
	001.gprs","192.168.24.2″,243	☞ <CID>=1 is the default context, while instead, <CID> 2 and 3 are enabled by u
	,92,96,255,40,0,0,255,255,25	SCM because defined in the "scm_config.json" file.
	5,0	
	+CGDCONT:	
	3,"IP","internet3.mnc001.mcc	
	001.gprs","192.168.25.2″,243	
	,92,96,255,40,0,0,255,255,25	
	5,0	
	OK	
AT+CGACT?	+CGACT: 1,1 +CGACT: 2,1 +CGACT: 3,1 OK	Check all the provided <CID>s have been activated.

Appendix

List of configuration file parameters

Name	Type	Values	Definition

Initialization: "init_info"			
reg_profile	Number	0,2,4	Registration profile which must be maintained by the module. Allowed values are: • 0: PS Attach (Data centric) • 1: CS/PS Attach (Voice centric) • 2: CS/PS Attach (Data centric) • 3: PS Attach (Voice Centric) • 4: uSCM shall not change the module CEMODE settings but, use the current setting for its internal operation.
cmm_enable	Number	0 – 1	Enable or disable CMM mode. By default, it is enabled with value 1.
SIM Initialization: "sim_init"			
sim_pin	String	4 – 8 characters.	String pin to be used for SIM unlocking.
Data Connectivity: "data_connectivity"			
ip_data_test_count	Number	1 – 5	PING or DNS query failure count. This count defines how many times PING and/or DNS query failures should happen before returning error.
no_user_data_trans_count	Number	0 – 5	Number of cycles allowed for no data transmission when module moves from RRC to IDLE mode. 0 means disable the data connectivity algorithm.
Context Activation: "ctxt_act"			
cid_count	Number	0 – 12	Number of total CIDs that should be activated.
ctxt_data	Array	0 – 12	This array will hold the information for user defined PDP contexts. Its format is defined as:[[<cid>, <pdp_type>, <APN>, <apn_auth_type>, <apn_auth_usr>, <apn_auth_pas>, <en_data_in_roam>, <cid_nw_type>]…]. All array elements are defined in the following. Up to 12 PDP contexts can be defined in the array format. For empty array set 'null'. ☞ The number of array elements shall be equal to the value set in the "cid_count" parameter.
cid	Number	0 – 11	Number which is to be used as CID while defining the PDP context.
pdp_type	Number	1 – 3, 5	Indicates type of PDP context which is to be defined and activated. • 1: IP/IPv4 • 2: IPv6 • 3: IPv4v6 • 5: Non-IP

apn	String	"apn_add r ess"	APN name for respective CID. ☞ Maximum length is 128 characters.
apn_auth_type	Number	0 – 3	Specify the type of context authentication. Allowed values are: • 0: no authentication • 1: PAP • 2: CHAP • 3: automatic selection of authentication type (none/CHAP/PAP)
apn_auth_usr	String	"name"	Username for the authentication. ☞ Maximum length is 50 characters.
apn_auth_pas	String	"password"	Password for the authentication. ☞ Maximum length is 50 characters.

Name	Type	Values	Definition
en_data_in_roam	Number	0 – 1	Enable use of data in roaming condition (VPLMN). Values are: • 0: Yes • 1: No
cid_nw_type	Number	0 – 2	Specify if the given CID is applicable for HPLMN or VPLMN (roaming network). Values are: • 0: CID is targeted for HPLMN only • 1: CID is targeted for VPLMN only • 2: CID is targeted for both HPLMN and VPLMN
Network: "network_conditions"			
tau_change_timer_val	Number	0, 120 – 1200	Parameter used to track the TAU changes. If the number of TAC change exceeds a given value while this is enabled, then uSCM recovery response will be triggered.
relaxed_monit_dbm_thre shol d	Number	0, 6,9,12,1 5	Sets threshold value for Relaxed Cell monitoring feature. Refer to the +UDCONF=92 command description for further details. 0 indicates that the relaxed cell monitoring feature is not enabled nor used by SCM.
Power Saving Mode: "power_saving_mode"			
suspend_mode	Number	1 – 2	Defines the mode in which uSCM will take the module, after entering in the suspended mode: • 1: Take module into minimum functionality • 2: Take module into the low power mode

List of default parameters for the different profiles.

Parameter Name	Type	Mobility Performance (0)	Static Performance (1)	Mobility Power Saving (2)	Static Power Saving (3)
Initialization: "init_info"					
reg_profile	Number	4	4	4	4
cmm_enable	Number	1	1	1	0
SIM Initialization: "sim_init"					
sim_pin	String	empty	empty	empty	empty
Data Connectivity: "data_connectivity"					
ip_data_test_count	Number	1	1	1	1
no_user_data_trans_count	Number	2	2	2	2
Context Activation: "ctxt_act"					
cid_count	Number	0	0	0	0
ctxt_data	Array	empty	empty	empty	empty
cid	Number	N/A	N/A	N/A	N/A
pdp_type	Number	N/A	N/A	N/A	N/A
apn	String	N/A	N/A	N/A	N/A
apn_auth_type	Number	N/A	N/A	N/A	N/A
apn_auth_usr	String	N/A	N/A	N/A	N/A
apn_auth_pas	String	N/A	N/A	N/A	N/A
en_data_in_roam	Number	N/A	N/A	N/A	N/A
cid_nw_type	Number	N/A	N/A	N/A	N/A
Network: "network_conditions"					
tau_change_timer_val	Number	0	900	0	600
relaxed_monit_dbm_threshold	Number	6	9	6	9
Power Saving Mode: "power_saving_mode"					
suspend_mode	Number	1	1	1	1

Configuration file example
{
"init_info":
{
"high_temperature": 85,
"low_temperature": 0,
"temperature_unit": 0,
"check_antenna": 1,

"post_reg_delay_timer": 500,
"post_reg_delay_attempts": 1,
"post_reg_delay_step": 1,
"reg_profile": 4
}
, "sim_init":
{
"sim_pin": "1234",
"sim_puk": "12345678"
},
"data_connectivity":
{
"test_host_addr": null,
"ip_date_test_count": 1,
"connected_mode_time": 30,
"no_user_data_ul_dl_change_count": 2
},
"rejection_handling":
{
"emm_cause_recurrence_count": 5
},
"ctxt_act":
{
"upsd_profile": 7,
"upsd_cid_map": 0,
"upsd_pdp_type_preference": 0,
"cid_count": 1,
"ctxt_data": [[3,1,"internet3",0,"username","password",0,1]] },
"network_conditions":
{
"sr_fail_count": 2,
"sr_fail_handle": 0,
"rach_fail_count": 4,
"rach_fail_handle": 0,
"conn_restab_count": 5,
"conn_restab_count": 0,
"tau_count": 2,
"tau_count_handle": 0,
"tau_change_timer_val": 0,
"cell_ID_change_count": 2,
"cell_ID_change_handle": 0,
"cell_ID_change_timer_val": 0,
"nw_cond_parsing_timer_val": 300,
"relaxed_monit_dbm_val": 6,
"relaxed_monit_mode": 0
},
"coverage_failure":
{
"scan_time": 30,
"bounce_count": 10,
"interval": 20,
"en_weak_coverage": 0
},
"power_saving_mode":
{
"suspend_mode": 1,
"back_off_timer_type": 0,
"basic_back_off_timer_value": 60,
"basic_back_off_timer_step": 1,

"adv_back_off_timer_data": [[10,0,1,10],[0,1,2,10],[0,0,6,10],[0,0,3,10]] }
}

Glossary

Abbreviation	Definition
APN	Access Point Name
eDRX	extended Discontinuous Reception
FS	Filesystem
CPU	Central Processing Unit
HPLMN	Home Public Land Mobile Network
MNO	Mobile Network Operator
OOC	Out-of-Coverage
PSM	Power Saving Mode
QoS	Quality of Service
RAT	Radio Access Technology
SCC	Secure Cloud Connect
uSCM	u-blox Smart Connection Manager
UL	Uplink
URC	Unsolicited Result Code
VPLMN	Visiting Public Land Mobile Network

Revision history

Revision	Date	Name	Comments
R01	12-Apr-2024	mreb	Initial release

Related documentation

- [1] SARA-R5 series data sheet, UBX-19016638
- [2] u-blox SARA-R5 series system integration manual, UBX-19041356
- [3] u-blox LEXI-R520 series data sheet, UBX-22020070
- [4] u-blox LEXI-R520 series system integration manual, UBX-23008006
- [5] u-blox LEXI-R5 / SARA-R5 AT commands manual, UBX-19047455
- [6] u-blox EVK-LEXI-R520 user guide, UBXDOC-686885345-1791
- [7] u-blox EVK-R5 user guide, UBX-19042592
- [8] u-blox LEXI-R520 / SARA-R5 application development guide, UBX-20009652

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Documents / Resources

LEXI-R520 / SARA-R52 series Smart connection manager (uSCM) Application note	**u-blox SARA-R520 Smart Connection Manager** [pdf] User Guide SARA-R520, SARA-R520M10, SARA-R520 Smart Connection Manager, SARA-R520, Smart Connection Manager, Connection Manager

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- **User Manual**