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APPLICABILITY TABLE

PRODUCTS

- ME310G1 SERIES
- ME910G1 SERIES

CONTENTS

1. INTRODUCTION

1.1. Scope

Scope of this document is to give an overview of AT commands related to the integrated GNSS engine, to provide some basic procedure for use it and about the concurrence of the WWAN and GNSS on the MDM9205 products.

1.2. Audience

This document is intended for those users that need to use the embedded GNSS engine on this specific module series.

1.3. Contact Information, Support

For general contact, technical support services, technical questions and report documentation errors contact Telit Technical Support at:

- TS-EMEA@telit.com
- TS-AMERICAS@telit.com
- TS-APAC@telit.com

Alternatively, use:

http://www.telit.com/support

For detailed information about where you can buy the Telit modules or for recommendations on accessories and components visit:

http://www.telit.com

Our aim is to make this guide as helpful as possible. Keep us informed of your comments and suggestions for improvements.

Telit appreciates feedback from the users of our information.

1.4. Text Conventions

Danger – This information MUST be followed or catastrophic equipment failure or bodily injury may occur.

Caution or Warning – Alerts the user to important points about integrating the module, if these points are not followed, the module and end user equipment may fail or malfunction.

Tip or Information – Provides advice and suggestions that may be useful when integrating the module.

All dates are in ISO 8601 format, i.e. YYYY-MM-DD.

1.5. Related Documents

- ME310G1/ME910G1/ML865G1 AT Commands Reference Guide - preliminary

2. GNSS/WWAN COEXISTENCE MANAGEMENT

2.1. Introduction

Modules based on MDM9205, WWAN and GNSS share some hardware blocks, therefore concurrent WWAN and GNSS operation are not supported.

An arbitrator is designed to arbitrate concurrencies between WWAN and GNSS operation.

Arbitrator maintains software state/procedure for all the RATs and feeds from the based priority set.

3. APP PRIORITY – GNSS AND WWAN

Priority on the MDM9205 can be set to WWAN or GNSS, by default Telit firmware will use WWAN.

3.1. Priority WWAN

GNSS fix request succeeds only in WWAN SLEEP state.

- NO WWAN page is missed
- RRC connection is not impacted by any GNSS operation
- GNSS session is deferred to when the UE goes to idle eDRX state (eDRX period must be configured sufficiently long)

3.2. Priority GNSS

GNSS fix request succeeds in all WWAN states except when the WWAN will load one of the high priority tasks reported below:

Those are high priority WWAN tasks:

- LPM/Power off/Mode change/Deep sleep/PSM high priority
- MO exception data
- PS Detach command from CM

SESSION LOADED	SWITCH TO	PRIORITY GNSS	PRIORITY WWAN
GNSS	WWAN	WWAN WILL BE REJECTED EXCEPT WHEN THE WWAN PROCEDURE PRIORITY IS HIGHER THAN THE CURRENT GNSS STATE THERE ARE TWO CASES WHERE WWAN PROCEDURE PRIORITY COULD BE HIGH: • WWAN HIGH PRIORITY TASK • GNSS STATE IS NOT ACTIVE	THE GNSS PROCEDURE WILL BE ABORTED AND WWAN SESSION WILL START
WWAN	GNSS	WWAN (IN ANY STATE EXCEPT HIGH PRIORITY TASKS) WILL BE RELEASED LOCALLY AND GNSS WILL BE LOADED	GNSS SESSION WILL BE REJECTED EXCEPT WHEN THE WWAN IS IN IDLE SLEEP STATE AND NEXT PAGE OCCURRENCE DOES NOT FALL WITHIN GNSS PROCEDURE DURATION

4. TECHNOLOGY SWITCHING DELAYS

4.1. WWAN Priority

Some delays are expected when the modem is in WWAN priority and it's requested to switch between the WWAN session and the GNSS session.

Below an example of WWAN priority, eDRX cycle and *first fix* behavior:

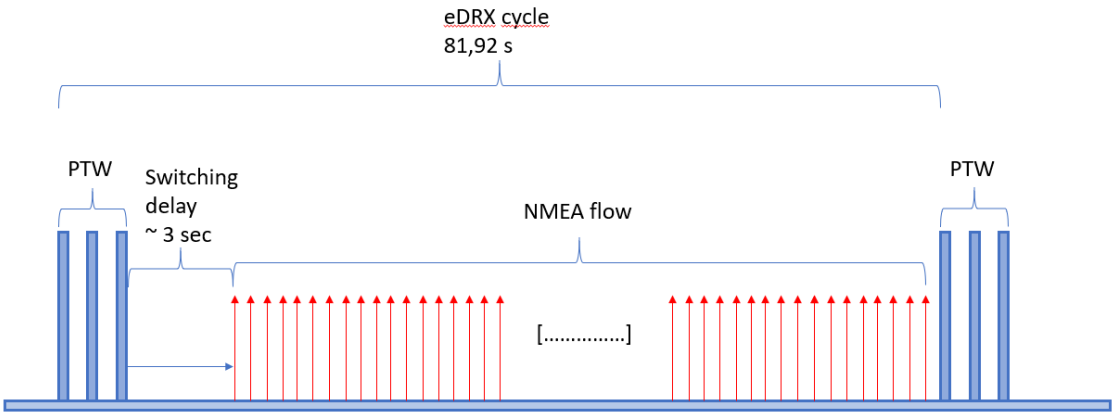
- Switch from WWAN to GNSS session: ~3sec
- Time to first fix (Cold start): ~40sec

So total time for obtain the position may be up to ~43ec.

Below an example of WWAN priority, eDRX cycle and *second fix* behavior:

- Switch from WWAN to GNSS session: ~3sec
- Time to first fix (Hot start/Warm start): from ~2sec to 25sec

So total time for obtain the position may be from ~5 to ~28sec.



4.2. GNSS Priority

When the modem is in GNSS priority, GNSS session start as priority task.

Time to first fix are not affected by switching delay described above and only the time for the fix has to be taken into account.

Since the priority is set to GNSS, every WWAN activity will be rejected.

Warning – Time to first fix value may show different results based on the GNSS signal strength provided.

5. MINIMUM EDRX RECOMMENDATION

For power-saving reason, before starting a GNSS session the internal arbitrator always checks if it's available enough time to calculate a fix in the worst case (Cold start) before the current eDRX cycle expires.

If there is not enough time, then the internal arbitrator doesn't start the GNSS session.

Hence, not all the eDRX value are suitable for letting the GNSS session start.

Assuming that a Cold Start GNSS fix takes a maximum average of “cold fix” secs, the minimum recommended value for eDRX should be calculated as follows:

eDRX > “total switch time” + “coldfix”

where:

“total switch time”: ~ 3 sec

“coldfix”: ≥ 40 sec

GNSS feature not available if Network does not support eDRX when WWAN priority is selected.

Following table summarize which is the minimum eDRX value

RAT	MINIMUN EDRX VALUE [S]
NB-IOT	81.92
CAT-M	81.92

Values has been calculated considering a good GNSS signal level (AVG C/N0 > 40 dBHz) coverage. They might not suitable eDRX values if lower GNSS signal level are used.

In GSM Network due to the fact that max DRX is 400ms GNSS session cannot start when WWAN priority is selected and module registered to the network

6. BASIC GNSS PROCEDURES

6.1. Switch between WWAN priority and GNSS priority and vice versa

It needs a reboot to apply settings.

These operations must be done before turning on the GNSS engine.

6.1.1. From WWAN priority to GNSS priority

Send the $GPSCFG command to change from WWAN priority to GNSS priority

AT$GPSCFG=0,0
OK

Reboot the modem

AT#REBOOT
OK

6.1.2. From GNSS priority to WWAN priority

Send the $GPSCFG command to change from GNSS priority to WWAN priority

AT$GPSCFG=0,1
OK

Reboot the modem

AT#REBOOT
OK

6.2. Start GNSS session with a basic set of NMEA sentences in the NMEA flow

6.2.1. GPS+GLONASS

These sets GNGSA, GLGSV, GNVTG, GNRMC, GNGGA as available sentence in the unsolicited NMEA sentences.

AT$GPSNMUNEX=0,1,1,0,0,0,0,0,0,0,1,1,1
OK

GNSS controller is powered up

AT$GPSP=1
OK

To activate unsolicited NMEA sentences flow in the AT port and the GPGSV sentence.

AT$GPSNMUN=2,0,0,0,1,0,0
OK

6.3. Stop NMEA flow and stop GNSS session

To de-activate unsolicited NMEA sentences flow.

AT$GPSNMUN=0
OK

GNSS controller is powered down

AT$GPSP=0
OK

6.4. How to setup a GNSS session in eDRX with a basic set of NMEA sentences.

Since when in WWAN priority GNSS is available only during eDRX idle, eDRX must enabled on modem side to have a GNSS session running. As described in chapter 5, eDRX cycle length must be selected ≥ 81.92 sec. NMEA sentences flows when the modem is in eDRX idle, as described in subchapter 3.1

</>

Set and activate eDRX parameters.

eDRX cycle of 81.92 sec and PTW of 2.56 sec in NB-IoT, according to chapter 5.

AT#CEDRXS=1,5,"0101","0000"
OK

Check if eDRX parameters has been accepted by the network

AT+CEDRXRDP
+CEDRXRDP: 5,"0101","0101","0000"
OK

These sets GNGSA, GLGSV, GNVTG, GNRMC, GNGGA as available sentence in the unsolicited NMEA sentences.

AT$GPSNMUNEX=0,1,1,0,0,0,0,0,0,0,1,1,1
OK

GNSS controller is powered up

AT$GPSP=1
OK

To activate unsolicited NMEA sentences flow in the AT port and the GPGSV sentence.

AT$GPSNMUN=2,0,0,0,1,0,0
OK

NMEA sentences flows when the modem is in eDRX idle.

Once taken the position, to de-activate unsolicited NMEA sentences flow.

AT$GPSNMUN=0
OK

GNSS controller is powered down

AT$GPSP=0
OK

7. GNSS AT COMMANDS

7.1. AT$GPSP - GNSS Controller Power Management

This command powers on/off GNSS controller.

SIM Presence	Setting saved	Can be aborted	MAX timeout	SELINT
Not required	Other	No	-	2

AT$GPSP=<status>

The set command manages the power-up/power-down of the GNSS controller.

Parameter:

Name	Type	Default	Description
<status>	string	0	indicates the power status that has to be set. Values: 0 : GNSS controller is powered down 1 : GNSS controller is powered up

AT$GPSP?

The read command reports the current value of the **<status>** parameter, in the format:

$GPSP: <status>

AT$GPSP=?

The test command reports the supported values range for parameter **<status>**.

GNSS controller is powered up

AT$GPSP=1
OK

GNSS controller is powered down

AT$GPSP=0
OK

7.2. AT$GPSNMUN - Unsolicited NMEA Data Configuration

This command activates an unsolicited NMEA data stream built with a basic subset of NMEA sentences on the standard serial port and defines which NMEA sentences will be available for GPS sentences.

It enables sentences related GPS constellation only.

[1] NMEA 0183 Standard

When used in conjnction with another constellation, only GSV will be shown as GPS sentence. Other sentences must be activated with $GPSNMUNEX

SIM Presence	Setting saved	Can be aborted	MAX timeout	SELINT
Not required	Specific profile	No	-	2

AT$GPSNMUN=<enable>[,<GGA>,<GLL>,<GSA>,<GSV>,<RMC>,<VTG>]

Parameters:

Name	Type	Default	Description
<enable>	integer	0	Enables unsolicited GNSS data stream and selects one of the available GNSS data stream format display. <**enable**> parameter is also used to disable the GNSS data stream. Here is the list of the <**enable**> values. See Additional info section to have information on GNSS data stream formats.

Values:

0 : disable GNSS data stream

1 : enable the first GNSS data stream format

2 : enable the second GNSS data stream format

3 : enable the first GNSS data stream format, and reserve the AT interface port only for the GNSS data stream

Under development and it will be supported in next releases.

<GGA>	integer	0	enables/disables the presence of the Global Positioning System Fix Data NMEA sentence (GGA) in the GNSS data stream. Values: 0 : disable 1 : enable
<GLL>	integer	0	enable/disable the presence of the Geographic Position - Latitude/Longitude NMEA sentence (GLL) in the GNSS data stream. Values: 0 : disable 1 : enable
<GSA>	integer	0	enable/disable the presence of the GNSS DOP and Active Satellites NMEA sentence (GSA) in the GNSS data stream. Values: 0 : disable 1 : enable
<GSV>	integer	0	enable/disable the presence of the Satellites in View NMEA sentence (GSV) in the GNSS data stream. Values: 0 : disable 1 : enable
<RMC>	integer	0	enable/disable the presence of the Recommended Minimum Specific GNSS Data NMEA sentence (RMC) in the GNSS data stream. Values: 0 : disable 1 : enable

<VTG>	integer	0	enable/disable the presence of the GNSS Course Over Ground and Ground Speed NMEA sentence (VTG) in the GNSS data stream. Values: 0 : disable 1 : enable

Additional info:

- <**enable**>=1, GNSS data stream format:

  $GPSNMUN: <NMEA SENTENCE 1><CR><LF>
  ...
  $GPSNMUN: <NMEA SENTENCE N><CR><LF>
  ...

- <**enable**>=2, GNSS data stream format:

  <NMEA SENTENCE 1><CR><LF>
  ...
  <NMEA SENTENCE N><CR><LF>
  ...

- <**enable**>=3, in this case, the AT interface port is dedicated to NMEA sentences, it is not possible to send AT commands. Use the escape sequence "+++" to return in command mode. GNSS data stream format:

  $GPSNMUN: <NMEA SENTENCE 1><CR><LF>
  ...
  $GPSNMUN: <NMEA SENTENCE N><CR><LF>
  ...

  The NMEA data stream format is the same as the one selected by <**enable**>=1.

  Under development and it will be supported in next releases.

AT$GPSNMUN?

Read command returns whether the unsolicited GNSS data stream is currently enabled or not, along with the current NMEA mask configuration, in the format:

$GPSNMUN:<enable>,<GGA>,<GLL>,<GSA>,<GSV>,<RMC>,<VTG >

AT$GPSNMUN=?

Test command returns the supported range of values for parameters:

<**enable**>, <**GGA**>, <**GLL**>, <**GSA**>, <**GSV**>, <**RMC**>, <**VTG**>.

Set the GSA as available sentence in the unsolicited message
AT$GPSNMUN=1,0,0,1,0,0,0
OK

Turn-off the unsolicited mode
AT$GPSNMUN=0
OK

Read the current NMEA mask configuration:
AT$GPSNMUN?
$GPSNMUN: 1,0,0,1,0,0,0
OK

The unsolicited message will be:
$GPSNMUN:
$GPGSA,A,3,23,20,24,07,13,04,02,,,,,,2.4,1.6,1.8*3C

7.3. AT$GPSNMUNEX - Unsolicited NMEA Extended Data Configuration

This command permits to activate some additional NMEA sentences related to other GNSS constellation in the streaming of NMEA data. This is needed if others constellation rather than GPS only is used.

SIM Presence	Setting saved	Can be aborted	MAX timeout	SELINT
Not required	Auto	No	-	2

AT$GPSNMUNEX=[<GNGNS>[,<GNGSA>[,<GLGSV>[,<GPGRS>[,<GAGSV>[,<GAGSA>[,<GAVTG>[,<GPGGA>[,<PQGSA>[,<PQGSV>[,<GNVTG>[,<GNRMC>[,<GNGGA>]]]]]]]]]]]]]

Set command permits to activate specific GNSS NMEA sentences (related to (GALILEO, GLONASS and BEIDOU constellation) through the NMEA port when AT$GPSNMUN is activated and defines which NMEA extended sentences will be available.

Parameters:

Name	Type	Default	Description
<GNGNS>	integer	0	Fix data of GNSS receivers.
	Values:		
	0 : disable		
	1 : enable		
<GNGSA>	integer	0	DOP and active satellites of GNSS.
	Values:		
	0 : disable		
	1 : enable		
<GLGSV>	integer	0	GLONASS satellites in view
	Values:		
	0 : disable		
	1 : enable		
<GPGRS>	string	0	GPS Range Residuals
	Values:		

	0 : disable 1 : enable		
<GAGSV>	integer	0	Galileo satellites in view Values: 0 : disable 1 : enable
<GAGSA>	integer	0	Galileo DOP and active satellites Values: 0 : disable 1 : enable
<GAVTG>	integer	0	Galileo track made good and ground speed Values: 0 : disable 1 : enable
<GPGGA>	integer	0	GPS fix data Values: 0 : disable 1 : enable
<PQGSA>	integer	0	Proprietary string for fix data regarding BeiDou and QZSS Values: 0 : disable 1 : enable
<PQGSV>	integer	0	Proprietary string for satellites in view regarding BeiDou and QZSS Values: 0 : disable 1 : enable

<GNVTG>	integer	0	Track made good and ground speed Values: 0 : disable 1 : enable
<GNRMC>	integer	0	Recommended Minimum Specific GNSS Data Values: 0 : disable 1 : enable
<GNGGA>	integer	0	GNSS fix data Values: 0 : disable 1 : enable

NMEA extended data is displayed on NMEA port depending on **$GPSNMUN <enable>** parameter setting.

AT$GPSNMUNEX?

Read command returns the NMEA extended sentences availability status, in the format:

$GPSNMUNEX:<GNGNS>,<GNGSA>,<GLGSV>,<GPGRS>,<GAGSV>,<GAGSA>,<GAVTG>, <GPGGA>,<PQGSA>,<PQGSV>,<GNVTG>,<GNRMC>,<GNGGA>

AT$GPSNMUNEX=?

Test command returns the supported range of values for parameters:

<GNGNS>,<GNGSA>,<GLGSV>,<GPGRS>,<GAGSV>,<GAGSA>,<GAVTG>,<GPGGA>, <PQGSA>,<PQGSV>,<GNVTG>,<GNRMC>,<GNGGA>

AT$GPSNMUN=1
OK

AT$GPSNMUNEX=1,0,0,0,0,0,0,0,0,0,0,0
OK

These sets the GNGNS as available sentence in the unsolicited NMEA sentences.

AT$GPSNMUNEX?
$GPSNMUNEX: 1,0,0,0,0,0,0,0,0,0,0,0
OK

Give the current frame selected (GNGNS)

The unsolicited message will be:
$GNGNS,080558.0,3731.306144,N,12655.784429,E,AN,09,1.0,68.0,18.0,,*5B

7.4. AT$GPSCFG – Set GNSS configuration parameters

This command sets the following GNSS parameters: WWAN/GNSS priority, TBF (Time Between Fix) and constellation.

It needs a reboot to apply settings.

These operations must be done before turning on the GNSS engine.

SIM Presence	Setting saved	Can be aborted	MAX timeout	SELINT
Not required	Auto	No	-	2

AT$GPSCFG=<parameter>,<value>

Parameters:

Name	Type	Default	Description
<parameter>	integer	N/A	select the configuration parameter to be set Value: 0 : set WWAN/GNSS priority 1 : set TBF 2 : set constellation
<value>	integer	-	see Additional info section.

Additional info:

- <**value**> value depends on the first parameter

  Values for priority: 0 (priority GNSS) – 1 (priority WWAN)
  Default: 1

Values for TBF: 1÷4294967 [sec]

Default: 1

Values for constellation: 0 – The constellation is selected based on Mobile Country Code (MCC) of camped network

1 – GPS+GLO

2 – GPS+GAL

3 – GPS+BDS

4 – GPS+QZSS

Default: 1

AT$GPSCFG?

Reports the priority, TBF and constellation values in the form:

$GPSCFG: <priority>,<TBF>,<constellation>

AT$GPSCFG=?

Test command reports the supported range of values for priority, TBF and constellation.

AT$GPSCFG=0,0
OK

Set GNSS priority

AT$GPSCFG=2,1
OK

Set constellations GPS+GLO.

AT$GPSCFG?
$GPSCFG: 0,1,1
OK

Give the current values selected

AT#REBOOT
OK

Reboot the modem

AT$GPSCFG?
$GPSCFG: 0,1,1
OK

Give the current values selected

AT$GPSP=1
OK

Enable GNSS engine with the new settings

7.5. AT$GPSSW - GNSS Software Version

This command provides the GNSS module software version.

SIM Presence	Setting saved	Can be aborted	MAX timeout	SELINT
Not required	No	No	-	2

AT$GPSSW

Execution command returns the GNSS module software version in the format:

$GPSSW: <swVersion>

AT$GPSSW?

Read command has the same behavior as the execution command.

AT$GPSSW=?

Test command returns the **OK** result code

8. GLOSSARY AND ACRONYMS

	Description
TTSC	Telit Technical Support Centre
USB	Universal Serial Bus
HS	High Speed
DTE	Data Terminal Equipment
NMEA	National Marine Electronics Association
WWAN	Wireless Wide area Network
eDRX	Extended DRX
PSM	Power saving mode
UART	Universal Asynchronous Receiver Transmitter
MCC	Mobile Country Code
SIM	Subscriber Identification Module
CN0	Carrier to noise
TTFF	Time to first fix

9. DOCUMENT HISTORY

Revision	Date	Changes
0	2020-02-12	First issue DRAFT
1	2020-02-25	Update Applicability Table
2	2020-02-27	Update chapter 2
3	2020-03-13	Released, updated footer and header
4	2020-03-17	Update chapter 7
5	2020-04-02	Moved Basic GNSS procedures to chapter 6 Moved GNSS AT Command to chapter 7 Added AT$GPSCFG command Updated chapter 6

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