Telit MEx10G1/ML865G1 GNSS Application Note

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APPLICABILITY TABLE

PRODUCTS

- ME310G1 SERIES
- ME910G1 SERIES
- ML865G1 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

- Telit_ME310G1_ME910G1_ML865G1_AT_Commands_Reference_Guide

2. GNSS/WWAN CO-EXISTENCE MANAGEMENT

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

In other words, WWAN and GNSS operation are mutually exclusive.

Hence, MDM9205 has been designed to work following “Priority” and “Session” concepts.

An arbitrator is designed to arbitrate concurrencies between WWAN and GNSS “session”.

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

Later in this application notes are explained how and when WWAN and GNSS session work and combine, according to the 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 priority.

Anyway, it is possible to set on which priority the modem will perform the next start up setting the “startup priority” parameter through AT$GPSCFG.

If needed, it is also possible to switch between WWAN priority and GNSS priority and vice versa in runtime (without rebooting the modem) setting the “runtime priority” parameter through AT$GPSCFG.

According to the priority chosen, the modem behaves differently.

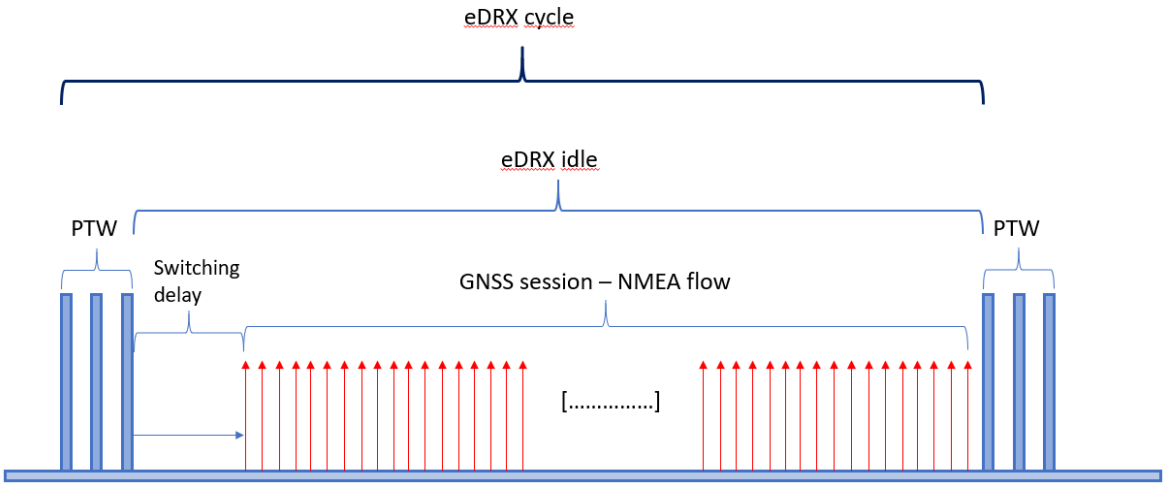
3.1. WWAN priority

GNSS session request succeeds only when modem is in WWAN SLEEP state, so that:

- NO WWAN page is missed
- RRC connection is not impacted by any GNSS operation
- GNSS session is deferred to when the UE goes to eDRX idle (WWAN sleep) state

Hence, a GNSS session can start only if:

- eDRX feature is both enabled on modem side and accepted by the camped network.
- eDRX period is configured sufficiently long to accommodate the GNSS session to start
- All WWAN tasks are completed



3.2. GNSS priority

GNSS session is always prioritized except when WWAN loads one of the high-priority tasks reported below:

The high-priority WWAN tasks are:

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

3.3. App priority – GNSS and WWAN summary table

Following table summarize modem behavior according to the priority set and the session requested:

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:

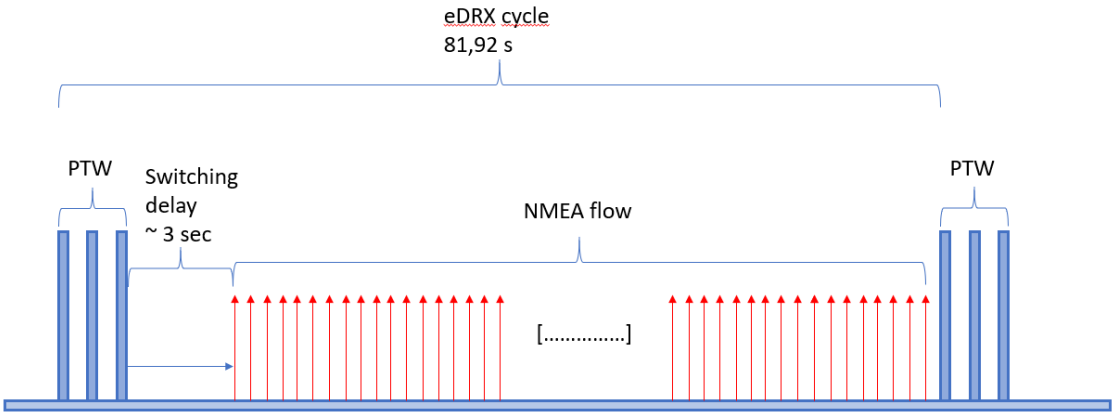
- Switch from WWAN to GNSS session: ~3 sec.
- Time to first fix (Cold start): ~40sec.

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

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 starts as priority task.

Time to first fix is 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 as long as the GNSS session is active and running.

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

5. MINIMUM EDRX CYCLE 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 values are suitable for letting the GNSS session start.

If a Cold Start GNSS fix takes an average of “cold fix” seconds, the minimum recommended value for eDRX should be calculated as follows:

eDRX > “total switch time” + “cold fix”

where:

“total switch time”: ~ 3 sec

“coldfix”: ≥ 40 sec

To let the modem enter in eDRX, eDRX PTW value must be choosen accordingly to DRX value received from network.

eDRX PTW must be set ≥ network provided DRX value

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

Following table summarizes which is the minimum eDRX value requested to start a GNSS session:

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 be 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. ASSISTED GNSS SERVICE

6.1. Introduction to Qualcomm GNSS Assistance Service - XTRA

Modules based on MDM9205, are equipped with the Qualcomm GNSS Assistance Service, formerly known as XTRA.

This feature allows to:

- Eliminate the need for GNSS navigation data demodulation over the air.
- Reduce the time required for generating a position fix.

Qualcomm GNSS Assistance Service can be enabled to allow the modem to automatically download a GNSS assistance service file.

The GNSS assistance service file contains orbit predictions, valid up to three days, for all GNSS constellations.

After three days the file expires, and the modem automatically downloads a new one.

To work and be effective, Qualcomm GNSS Assistance Service requires:

- a network connection and data service available.
- a valid GNSS fix has been calculated, before activating the service.

Once the GNSS Assistance Service has been enabled, GNSS session start-up is subject to the availability of service itself. Hence if requirements are not met, Qualcomm GNSS Assistance Service won't succed and consequently the GNSS session won't start.

7. BASIC GNSS PROCEDURES

7.1. Set Modem Priority at Startup

7.1.1. From WWAN priority to GNSS priority at startup

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

AT$GPSCFG=0,0
OK

Reboot the modem

AT#REBOOT
OK

The modem now starts in GNSS priority

7.1.2. From GNSS priority to WWAN priority at startup

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

AT$GPSCFG=0,1
OK

Reboot the modem

AT#REBOOT
OK

The modem now starts in WWAN priority

By default, Telit modems starts in WWAN priority.

It needs a reboot to apply settings. These operations must be done before turning on the GNSS engine.

7.2. Switching Runtime Between WWAN priority and GNSS priority and Vice versa

7.2.1. From WWAN priority to GNSS priority in runtime

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

AT$GPSCFG=3,0
OK

Get the current values
AT$GPSCFG?
$GPSCFG: 1,1,1,0
OK

7.2.2. From GNSS priority to WWAN priority in runtime

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

AT$GPSCFG=3,1
OK

Get the current values
AT$GPSCFG?
$GPSCFG: 1,1,1,1
OK

This feature is available starting from firmware version 37.00.xx2.

At every startup, modem starts with priority chosen through “startup priority” parameter. “runtime priority” setting does not override “startup priority” setting for the subsequent start-up.

7.3. Set Supported GNSS Constellation

These commands sequences allow to enable a specific GNSS constellation combination. Below are listed all the supported GNSS constellations.

It needs a reboot to apply settings. These operations must be done before turning on the GNSS engine (with AT$GPSP=1).

7.3.1. GPS+GLONASS

Set constellations GPS+GLO

AT$GPSCFG=2,1
OK

It needs a reboot to make effective the setting

AT#REBOOT
OK

This is the default GNSS constellation configuration.

7.3.2. GPS+GALILEO

Set constellations GPS+GALILEO

AT$GPSCFG=2,2
OK

It needs a reboot to make effective the setting

AT#REBOOT
OK

7.3.3. GPS+ BeiDou

Set constellations GPS+BeiDou

AT$GPSCFG=2,3
OK

It needs a reboot to make effective the setting

AT#REBOOT
OK

7.3.4. GPS+QZSS

Set constellations GPS+QZSS

AT$GPSCFG=2,4
OK

It needs a reboot to make effective the setting

AT#REBOOT
OK

7.4. Set GNSS Constellation Based on MCC of Camped Network

By using this, secondary constellation used along with GPS is selected based on the Mobile Country Code (MCC) of camped network.

AT$GPSCFG=2,0
OK

It needs a reboot to make effective the setting

AT#REBOOT
OK

Below are listed the constellation chosen for each world region, according to the MCC

MCC	Constellations
US/Russia/default	GPS+GLONASS
Europe related	GPS+GALILEO
China	GPS+BEIDOU
Japan related	GPS+QZSS

7.5. Start GNSS session with a Basic set of NMEA sentences in the NMEA Flow

GNSS session start-up is subject to procedures and rules of the priority set.

When GNSS engine is acquiring secondary constellation satellites, it might temporary provide a GPS-only fix, so it might show GPGSA and GPRMC instead GNGSA and GNRMC respectively, as per NMEA spec. For this reason, in this section will be shown how to enable RMC and GSA sentences in both cases.

7.5.1. GPS+GLONASS

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

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

GNSS controller is powered up

AT$GPSP=1
OK

To activate unsolicited NMEA sentences flow in the AT port and GPGGA, GPRMC, GPGSA and GPGSV sentences.

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

7.5.2. GPS+GALILEO

These sets GNGSA, GAGSV and GNRMC as available sentence in the unsolicited NMEA sentences.

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

GNSS controller is powered up

AT$GPSP=1
OK

To activate unsolicited NMEA sentences flow in the AT port and GPGGA, GPRMC, GPGSA and GPGSV sentences.

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

7.5.3. GPS+BeiDou and GPS+QZSS

These sets GNGSA, PQGSV and GNRMC as available sentence in the unsolicited NMEA sentences.

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

GNSS controller is powered up

AT$GPSP=1
OK

To activate unsolicited NMEA sentences flow in the AT port and GPGGA, GPRMC, GPGSA and GPGSV sentences.

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

7.6. 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

7.7. Get Actual Position with AT$GPSACP

GNSS controller must be powered up

AT$GPSP?
$GPSP: 1

OK

While the GNSS engine is calculating the fix, AT$GPSACP returns a void string

AT$GPSACP
$GPSACP: ,,,,,1,,,,,
OK

Once the fix has been calculated, AT$GPSACP returns a valid string

AT$GPSACP
$GPSACP:
091635.000,3913.6952N,00904.1505E,0.7,17.9,3,0.0,0.0,0.0,290920,10
OK

If AT$GPSACP returns a void string, send continuously AT$GPSACP command until it returns a valid string.

7.8. WWAN Priority – Set up GNSS session in eDRX with Basic set of NMEA sentences.

When in WWAN priority, GNSS session can start only if eDRX feature is enabled. Hence eDRX must be set in the modem and accepted by the camped network to have a GNSS session running.

NMEA sentences will flow out during eDRX idle phase.

As described in chapter “5”, eDRX cycle length must be selected ≥ 81.92 sec and eDRX PTW value must be chosen accordingly to DRX value received from network.

Following are the steps:

Set and activate eDRX parameters.

eDRX cycle of 81.92 sec and PTW of 5.12 sec in NB-IoT.

AT#CEDRXS=1,5,"0101","0001"
OK

Check if eDRX parameters has been accepted by the network

AT+CEDRXRDP

+CEDRXRDP: 5,"0101","0101","0001"
OK

Start GNSS session with a basic set on NMEA sentences, according to the GNSS constellation combination chosen.

AT$GPSNMUNEX=0,1,x,0,y,0,0,0,0,z,0,1,0
OK

where

x = 1, **y** = 0 and **z** = 0 for GPS+GLONASS combination;

x = 0, **y** = 1 and **z** = 0 for GPS+GALILEO combination;

x = 0, **y** = 0 and **z** = 1 for GPS+BeiDou or GPS+QZSS combination;

GNSS controller is powered up

AT$GPSP=1
OK

To activate unsolicited NMEA sentences flow in the AT port and GPGGA, GPRMC, GPGSA and GPGSV sentences.

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

When the modem is in eDRX idle, NMEA sentences will flow out.

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

AT$GPSNMUN=0
OK

GNSS controller is powered down

AT$GPSP=0
OK

7.9. Alternate WWAN Session and GNSS Session if no eDRX is supported

In case eDRX protocol is not supported by the MNO used, then the following procedure can be used to alternate WWAN session with GNSS session.

This could be useful if it's needed cellular data activity (i.e.: socket connection) and GNSS activity (i.e.: gathering of the device position) on cyclic basis

Prerequisites:

- WWAN priority, Module On, Sim inserted, APN set, cellular and GNSS antennas connected, PDP context active

Cellular data activity (i.e.: socket connection) is done here

Once done, de-activate the PDP context

AT#SGACT=1,0
OK

Switch from WWAN priority to GNSS priority to issue a GNSS session

AT$GPSCFG=3,0
OK

Start GNSS session with a basic set of NMEA sentences in the NMEA flow, according to the GNSS constellation combination used, as described in chapter 7.5

alternatively

Get actual position with AT$GPSACP, as described in chapter 7.7

After the position has been retrieved, stop NMEA flow and stop GNSS session

AT$GPSNMUN=0
OK
AT$GPSP=0
OK

Switch from GNSS priority to WWAN priority to issue again a WWAN session

AT$GPSCFG=3,1
OK

7.10. GNSS Assistance Service - XTRA

Since the Qualcomm GNSS Assistance Service feature requires a valid position before assistance data is downloaded, a fix must have been collected by the modem before using Qualcomm GNSS Assistance Service.

Prerequisites:

- Module On, Sim inserted, APN set, cellular and GNSS antennas connected.
- A valid GNSS fix must have been taken before enabling the service.

Enable Qualcomm GNSS Assistance Service.

AT$AGNSS=0,1
OK

Reboot the modem

AT#REBOOT
OK

Power the GNSS controller up

AT$GPSP=1
OK

Next GNSS fix will benefit from the XTRA assistance data.

If prerequisities are not met, Qualcomm GNSS Assistance Service feature won't succeed and consequently the GNSS session won't start.

XTRA data can be download only once a day. If the user deletes the XTRA data, the download will restart 24 hours after the previous download.

8. GNSS AT COMMANDS

8.1. 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 must 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

8.2. AT$GPSACP - Get Acquired Position

This command returns information about the last GPS position.

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

AT$GPSACP

Execution command returns information about the last GPS position in the format:

$GPSACP: <UTC>,<latitude>,<longitude>,<hdop>,<altitude>,<fix>,<cog>,<spkm>,<spkn>,<date>,<nsat>

Additional info:

▶▶ Meanings of the parameters returned by the command.

Name	Type	Default	Description
<UTC>	string	-	UTC time (hhmmss.sss) referred to GGA sentence
<latitude>	string	-	latitude in the format ddmm.mmmm N/S (referred to GGA sentence) where: dd: 00..90, degrees mm.mmmm: 00.0000..59.9999, minutes N/S: North/South
<longitude>	string	-	longitude in the format dddmm.mmmm E/W (referred to GGA sentence) where: ddd: 000..180, degrees mm.mmmm: 00.0000..59.9999, minutes E/W: East/West

<hdop>	string	-	Horizontal Dilution of Precision (referred to GGA sentence)
<altitude>	string	-	altitude - mean-sea-level (geoid) in meters (referred to GGA sentence)
<fix>	integer	N/A	fix type Values: 0 : invalid fix 1 : invalid fix 2 : 2D fix 3 : 3D fix
<cog>	string	-	Course over Ground (degrees, True) (referred to RMC sentence)
<spkm>	string	-	speed over ground (Km/hr) (referred to VTG sentence)
<spkn>	string	-	speed over ground (knots) (referred to VTG sentence)
<date>	string	-	date of fix (referred to RMC sentence) in the format ddmmyy where: dd: 01..31, day mm: 01..12, month yy: 00..99, year 2000 to 2099
<nsat>	integer	N/A	total number of satellites in use (referred to GGA sentence) Value: 0÷12 : total number of satellites in use

AT$GPSACP?

Read command has the same behavior as the Execution command.

AT$GPSACP=?

Test command returns the **OK** result code.

AT$GPSP?
$GPSP: 0

when module is down there no acquired position

AT$GPSACP
$GPSACP: ,,,,,0,,,,,
OK

AT$GPSP=1
OK

Until first fix is received the command will display initial GPS position

AT$GPSACP
$GPSACP: ,,,,,1,,,,,

Once fix has been received the command will display actual GPS position

OK

AT$GPSACP
$GPSACP:
091635.000,3913.6952N,00904.1505E,0.7,17.9,3,0.0,0.0,0.0,290920,10
OK

8.3. AT$GPSNMUN - Unsolicited NMEA Data Configuration

Set command activates an unsolicited GNSS data stream built with NMEA sentences on the standard serial port and defines which NMEA sentences will be available.

Refer to document NMEA 0183 Standard to have information on the NMEA sentences contents and formats.

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 second GNSS data stream format, and reserve the AT interface port only for the GNSS data stream
<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:

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

  The NMEA data stream format is the same as the one selected by <**enable**>=2

GLL NMEA sentence is not supported.

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

8.4. AT$GPSNMUNEX - Unsolicited NMEA Extended Data Configuration

Set command activates specific GNSS NMEA sentences (related to GALILEO, GLONASS, BEIDOU and QZSS constellation) in the GNSS data stream and defines which NMEA extended sentences will be available.

GNSS data stream must be activated with AT$GPSNMUN command.

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>]]]]]]]]]]]]]

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.

GNGGA, GPGRS and GNGNS NMEA sentences are not supported.

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$GPSP=1
OK

Enable only the GNRMC sentence
AT$GPSNMUNEX=0,0,0,0,0,0,0,0,0,0,1,0
OK

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

$GPSNMUN:
$GNRMC,133511.00,A,3917.27051,N,00900.13895,E,0.0,,120520,
0.1,W,A,V*6E
$GPSNMUN:
$GNRMC,133512.00,A,3917.27052,N,00900.13897,E,0.0,,120520,
0.1,W,A,V*6C
$GPSNMUN:
$GNRMC,133513.00,A,3917.27052,N,00900.13898,E,0.0,,120520,
0.1,W,A,V*62

8.5. AT$GPSCFG - Set GNSS Configuration Parameters

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

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	selects the configuration parameter to be set Values: 0 : set WWAN/GNSS startup priority 1 : set TBF 2 : set constellation 3 : set WWAN/GNSS runtime priority
<value>	integer	-	value depends on the first parameter. See Additional info section.

Additional info:

- <**parameter**>=0, in this case the <**value**> assumes the meaning of <**startup priority**>.

Name	Type	Default	Description
<startup priority>	integer	1	it selects the priority, stored in NVM and effective from module startup Values: 0 : priority GNSS 1 : priority WWAN

It needs a reboot to apply settings.
This operation must be done before turning on the GNSS engine.

▶▶ <**parameter**>=1, in this case the <**value**> assumes the meaning of <**TBF**>.

Name	Type	Default	Description
<TBF>	integer	1	it defines the Time Between Fix
	Value:		
	0÷4294967 : expressed in seconds		

It needs a reboot to apply settings.
This operation must be done before turning on the GNSS engine.

▶▶ <**parameter**>=2, in this case the <**value**> assumes the meaning of <**constellation**>.

Name	Type	Default	Description
<constellation>	integer	1	selects the constellation

Values:

0 : the constellation is selected automatically based on Mobile Country Code (MCC) of camped network

1 : GPS+GLO

2 : GPS+GAL

3 : GPS+BDS

4 : GPS+QZSS

It needs a reboot to apply settings.
This operation must be done before turning on the GNSS engine.

▶▶ <**parameter**>=3, in this case the <**value**> assumes the meaning of <**runtime priority**>.

Name	Type	Default	Description
<runtime priority>	integer	-	it selects the priority runtime
	Values:		
	0 : priority GNSS		
	1 : priority WWAN		

NOTE 1

WWAN/GNSS startup priority is stored in NVM. This is the priority setting used from the module startup.
It's possible to change priority runtime using third parameter WWAN/GNSS runtime priority.
At the startup, runtime priority is equal to startup priority (stored in NVM).

NOTE2

For WWAN/GNSS startup priority, TBF (Time Between Fix) and constellation it needs a reboot to make effective the setting.

AT$GPSCFG?

Read command returns current values of **<startup priority>**, **<TBF>**, **<constellation>** and **<runtime priority>** in format:

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

AT$GPSCFG=?

Test command returns supported values range of **<priority>, <TBF>**, **<constellation>** and **<runtime priority>**

Set WWAN/GNSS Startup Priority, TBF (Time Between Fix) and constellation. It needs a reboot to make effective the setting.

Get the current values
AT$GPSCFG?
$GPSCFG: 1,1,1,1
OK

Set new WWAN/GNSS Startup Priority value
AT$GPSCFG=0,0
OK

Set 20 secs as new TBF value
AT$GPSCFG=1,20
OK

Set new constellations GPS+GAL
AT$GPSCFG=2,2
OK

Until a reboot is done old values remain the current values
AT$GPSCFG?
$GPSCFG: 1,1,1,1
OK

It needs a reboot to make effective the setting
AT#REBOOT
OK

New values are the new current values
AT$GPSCFG?
$GPSCFG: 0,20,2,0
OK

Enable GNSS with the new setting
AT$GPSP=1
OK

Set WWAN/GNSS runtime priority. It doesn't need a reboot to make effective the setting.

Get the current values
AT$GPSCFG?
$GPSCFG: 1,1,1,1
OK

Set new WWAN/GNSS runtime priority value
AT$GPSCFG=3,0
OK

Get the current values
AT$GPSCFG?
$GPSCFG: 1,1,1,0
OK

Enable GNSS with the new setting
AT$GPSP=1
OK

8.6. AT$GPSR - Reset the GPS Controller

This command resets the GNSS controller.

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

AT$GPSR=<resetType>

Execution command allows to reset the GNSS controller.

Parameter:

Name	Type	Default	Description
<resetType>	integer	-	set the type of GNSS controller reset.

Values:

0 : Factory Reset: this option clears all the GNSS memory including Clock Drift and Extended Ephemeris files stored into flash memory.

1 : Coldstart (No Almanac, No Ephemeris): this option clears all data that is currently stored in the internal memory of the GNSS receiver, including Last Position, Almanac, Ephemeris and Time.

All assistance data including XTRA Ephemeris, almanac, SV health etc. will be deleted.

However, the stored Clock Drift and Extended Ephemeris are retained.

2 : Warmstart (No ephemeris): this option clears Ephemeris and Last Position only. Almanac and Extended Ephemeris are retained.

3 : Hotstart (with stored Almanac and Ephemeris): the GNSS receiver restarts by using all data that is currently stored in the internal memory: valid Almanac, Ephemeris and Extended Ephemeris are therefore retained and used.

At the moment a **Cold Start** is performed when **Factory Reset** is selected.

At the moment **Hot Start** is not available.

AT$GPSR=?

Test command reports the range of supported values for parameter <**resetType**>.

Factory reset
AT$GPSR=0
OK

8.7. AT$AGNSS - Set AGNSS Enable

This command set the AGNSS providers enable or disable. It needs a reboot to make effective the setting.

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

AT$AGNSS=<provider>,<status>

Parameters:

Name	Type	Default	Description
<provider>	integer	N/A	Selects the AGNSS provider to be set Values: 0 : use XTRA agnss provider
<status>	integer	N/A	Set the provider enable status . Values: 0 : set selected agnss provider disabled 1 : set selected agnss provider enabled

Before enable XTRA the module must have get a valid GNSS fix. If XTRA is enable before, the GNSS could not start.

AT$AGNSS?

Read command returns the requested and the active status for each agnss provider.

$GPSAGNSS: <provider>,<active>,<requested>

Additional info:

- Parameters returned by the read command, in format:

  $GPSAGNSS: <provider>,<requested>,<active>

Name	Type	Default	Description
<active>	integer	-	value showing the actual status.
<requested>	integer	-	value showing the requested status that will be activated on the next power ON.

AT$AGNSS=?

Test command returns supported values range of **< provider >, <status >**

Get the active value and requested value
AT$AGNSS?
$AGNSS: 0,0,0
OK

Set AGNSS enable status
AT$AGNSS=0,1
OK

Until a reboot is done active value remain and requested value change
AT$AGNSS?
$AGNSS: 0,0,1
OK

It needs a reboot to make effective the setting
AT#REBOOT
OK

Active value is now the requested value
AT$AGNSS?
$AGNSS: 0,1,1
OK

8.8. 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

9. GLOSSARY AND ACRONYMS

	Description
A-GPS	Assisted-Global Positioning System
BeiDou (BDS)	The Chinese GNSS
CN0	Carrier to Noise
eDRX	Extended DRX
Ephemeris	A set of precise orbital parameters that is used by a GNSS receiver to calculate satellite position and velocity.
Galileo	The European GNSS
GLONASS	The Russian GNSS
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
MCC	Mobile Country Code
NMEA	National Marine Electronics Association
QZSS	The Japanese local GNSS
TTFF	Time to First Fix
UART	Universal Asynchronous Receiver Transmitter
URC	Unsolicited Result Code
WWAN	Wireless Wide Area Network

10. 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$GPSCFG command Updated chapter 6
6	2020-11-18	Updated document name Added ML865G1 series Updated “related document” Added “How to alternate WWAN session and GNSS session if no eDRX is supported” chapter Added “Assisted GNSS services” and “AT$AGNSS” command Added “eDRX PTW value” warning in chapter 5 Updated chapter “Basic GNSS procedures” Added AT$GPSACP command Updated AT$GPSNMUN command Updated AT$GPSNMUNEX command Updated GLOSSARY AND ACRONYMS

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