



MEx10G1/ML865G1 GNSS

Application Note

80617NT11826A Rev. 8 – 2023-03-06

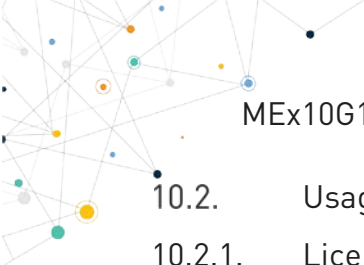
APPLICABILITY TABLE

PRODUCTS
ME310G1 SERIES
ME910G1 SERIES
ML865G1 SERIES

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1. INTRODUCTION

1.1. Scope

This document provides an overview of AT commands related to the integrated GNSS engine, as well as some basic usage instructions and information about the coexistence of WWAN and GNSS on the MDM9205 products.

1.2. Audience

This document is intended for users who require the embedded GNSS engine on this module series.

1.3. Contact Information, Support

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

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

Alternatively, use:

<https://www.telit.com/contact-us>

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

<https://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 the user feedback on our information.

1.4. Symbol Conventions



Danger: This information **MUST** be followed or catastrophic equipment failure or personal injury may occur.



Warning: Alerts the user on important steps about the module integration.



Note/Tip: Provides advice and suggestions that may be useful when integrating the module.



Electro-static Discharge: Notifies the user to take proper grounding precautions before handling the product.

Table 1: Symbol Conventions

All dates are in ISO 8601 format, that is YYYY-MM-DD.

1.5. Related Documents

- Telit_ME310G1_ME910G1_ML865G1_AT_Commands_Reference_Guide

2. GNSS/WWAN CO-EXISTENCE MANAGEMENT

Concurrent WWAN and GNSS operations are not supported since modules based on MDM9205, WWAN, and GNSS share some hardware blocks.

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

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

An arbitrator is designed to resolve conflicts between WWAN and GNSS “sessions.” The arbitrator maintains software state/procedure for all the RATs and feeds from the based “priority” set.

Later in this application note, it is explained how and when WWAN and GNSS sessions work and combine, according to the priority set.

3. APP PRIORITY – GNSS AND WWAN

The MDM9205's priority can be set to WWAN or GNSS; by default, Telit firmware uses WWAN priority.

In either case, the “startup priority” parameter in AT\$GPSCFG can be used to specify which priority the modem will use for its next startup.

Setting the “runtime priority” parameter through AT\$GPSCFG allows you to switch between WWAN and GNSS priority in runtime (without resetting the modem).

The modem behaves differently depending on the priority setting.

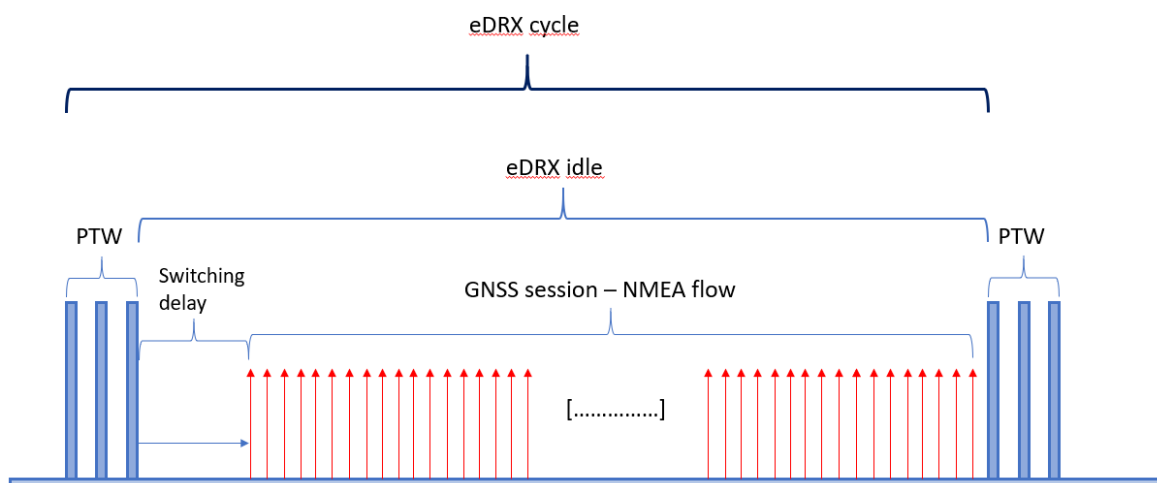
3.1. WWAN Priority

The GNSS session request succeeds only when the 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 until the UE goes to eDRX idle (WWAN sleep) state.

Hence, a GNSS session in WWAN priority can start only if:

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





Note: If the MNO in use does not support the eDRX protocol, it is recommended to choose GNSS priority or alternate between WWAN and GNSS priority using the “runtime priority” parameter through AT\$GPSCFG as shown in section 8.9 Alternate between WWAN and GNSS Session if no eDRX is Supported.

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 based on the priority set, and the session requested:

Session Loaded	Switch To	Priority GNSS	Priority WWAN
GNSS	WWAN	WWAN will be rejected unless the WWAN procedure priority is higher than the current GNSS state. There are two cases where WWAN procedure priority could be high: <ul style="list-style-type: none"> • 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 the next page occurrence does not fall within GNSS procedure duration.

4. TECHNOLOGY SWITCHING DELAYS

As WWAN and GNSS technologies cannot coexist, when switching from a WWAN to a GNSS session and vice versa, a certain amount of time delay is expected when switching from one session to the other.

This delay is made of:

- Unload current session
- Allow the internal arbitrator to switch from current session to other session.
- Load other session

Typically, this results in a total switch time of 3 seconds from WWAN to GNSS and vice versa.

4.1. WWAN Priority

When the modem is set to WWAN priority and a request to switch between the WWAN and GNSS sessions is made, some delays are expected.

An example of WWAN priority, eDRX cycle, and first fix behavior is shown below:

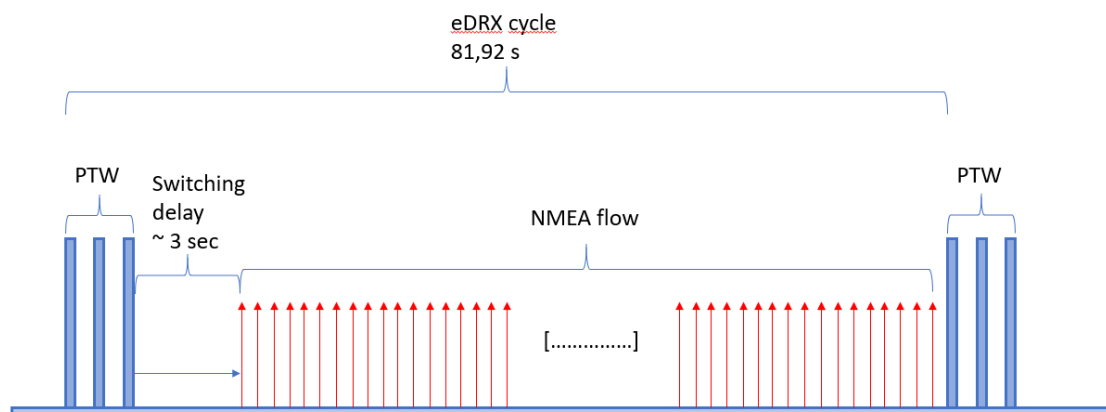
- Time to switch from WWAN to GNSS session: ~3 sec.
- Time to first fix (Cold start): ~40sec.

As a result, the total time for obtaining the position could be up to 43 seconds.

An example of WWAN priority, eDRX cycle, and second fix behavior is shown below:

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

As a result, the total time for obtaining the position could be from ~5 to ~28sec.



4.2. GNSS Priority

When the modem is in GNSS priority, GNSS session starts as a high-priority task.

The switching delay described above has no effect on the time to first fix as long as the modem is kept in GNSS priority and only the time for the fix has to be taken into account.



Danger: 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 reasons, before starting a GNSS session, the internal arbitrator always checks if it has 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 does not start the GNSS session.

Hence, not all the eDRX values are suitable for allowing 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:

$$\text{eDRX} > \text{“total switch time”} + \text{“cold fix”}$$

where:

“total switch time”: ~ 3 sec

“coldfix”: ≥ 40 sec



Warning: To allow the modem enter in eDRX, the eDRX PTW value must be selected in accordance with the DRX value received from the network.

eDRX PTW must be set \geq network provided DRX value.



Danger: When WWAN priority is selected, the GNSS feature is unavailable if the network does not support eDRX.

Following table summarizes the minimum eDRX value required to start a GNSS session:

RAT	Minimum eDRX Value [s]
NB-IOT	81.92
CAT-M	81.92



Warning: Values were calculated considering a good GNSS signal level (AVG C/N0 > 40 dBHz) coverage. If lower GNSS signal levels are used, they may not be suitable eDRX values.



Danger: Since the maximum DRX in a GSM network is 400ms, GNSS sessions cannot begin when WWAN priority is selected and the module is registered to the network.

6. ASSISTED GNSS SERVICE - XTRA

6.1. Introduction to Qualcomm GNSS Assistance Service

MDM9205-based modules 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 from a server.

The GNSS assistance service file contains orbit predictions, valid up to three days at default setting, 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.
- Capability of reaching the “Qualcomm GNSS Assistance Service” servers
- Real time clock must be set on modem (up to FW version Ver. xx4 included)
- Before activating the service, a valid GNSS fix must be calculated (needed only on old FW version Ver. xx2)

If one of those requisites is not met, Qualcomm GNSS Assistance Service won't succeed.



Warning: Qualcomm GNSS Assistance Service client needs infrequent connection to Qualcomm servers, so it is suggested to keep data connection always available.

6.2. Prediction Validity Files and Size

GNSS assistance service prediction validity files can be:

- 7 days – 27.489 KB
- 3 days (default) – 17.827 KB
- 1 day – 12.993 KB

It can be configured using AT\$AGNSSCFG command, as described under section 8.10.1 Choose Qualcomm GNSS Assistance Service File .



Warning: File validity configuration is available starting from FW Ver. xx4, otherwise the default value (3 days) is used and cannot be changed.

6.3. Consideration on GNSS Assistance Service usage

In order for a GNSS receiver to provide a position fix, it requires that GPS time is first derived and verified from live GNSS signal, even before having satellite orbit predictions (ephemeris data).

If GNSS receiver starts up from a powered off state (Cold Start condition), the GNSS engine does not have GPS time onboard. Therefore, it must derive and verify date and time from the GNSS live signal before apply orbit prediction provided by Qualcomm GNSS Assistance Service and then provide a position fix.

While if GNSS receiver starts up with a GPS time already on board because it has previously navigated (Warm start condition), then GPS time verification phase is skipped, and orbit predictions are applied immediately.

Thus, the reduction of TTFF is more effective in Warm Start case than Cold start case.


7. OTHER GNSS FEATURES

7.1. Time Between Fixes (TBF)

TBF allows the user to set a fixed interval of time for providing position fixes report.

During these intervals, the GNSS engine is shut off, hence no NMEA sentences are sent out (if enabled).

TBF is set to 1 second by default.

 Send the \$GPSCFG command to change TBF value (In seconds)

```
AT$GPSCFG=1,10
```

```
OK
```

```
Reboot the modem
```

```
AT#REBOOT
```


```
OK
```

7.2. Static Pinning

Static pinning enables the internal GNSS filter the capability to detect whether the modem is static or not.

When enabled, it locks the position when the device is static and locates the position when device is in motion again to minimize wandering behavior.

Static pinning is enabled by default.

 Send the \$GPSCFG command to disable the Static Pinning feature

```
AT$GPSCFG=4,0
```

```
OK
```

```
Reboot the modem
```

```
AT#REBOOT
```

```
OK
```



Warning: Unless a low-dynamic application is used, the Static Pinning feature should be left enabled as per the default settings.

7.3. Dynamic Power Optimization (DPO)

DPO is a GNSS Low Power mode that is used to reduce power consumption during continuous tracking in moderate-to-strong signal conditions.

While GNSS DPO is engaged, the RF section device is cycled on and off to reduce power consumption, at the expense of some position accuracy reduction.

DPO is enabled by default.



Enable the DPO feature

```
AT$GPSDPO=1 or AT$GPSDPO=2
```

```
OK
```

Reboot the modem

```
AT#REBOOT
```

```
OK
```



Note: <DPO> = 2 is equivalent to <DPO> = 1 (DPO enabled) due to External Power Source implementation.

8. BASIC GNSS PROCEDURES

8.1. Set Modem Priority at Startup

8.1.1. 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

8.1.2. 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



Note: By default, Telit modems starts in WWAN priority.



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

8.2. Switching Runtime Between Priorities

8.2.1. 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
```

8.2.2. 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
```



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



Warning: At every startup, modem starts with the priority set by the “startup priority” parameter. The “runtime priority” setting does not override “startup priority” setting for the subsequent start-up.

8.3. Set Supported GNSS Constellation

These commands sequences enable a specific GNSS constellation combination. The supported GNSS constellations are as listed below.



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

8.3.1. GPS+GLONASS



Set constellations GPS+GLO

```
AT$GPSCFG=2,1
```

```
OK
```

It needs a reboot to make effective the setting

```
AT#REBOOT
```

```
OK
```



Note: This is the default GNSS constellation configuration.

8.3.2. GPS+GALILEO



Set constellations GPS+GALILEO

```
AT$GPSCFG=2,2
```

```
OK
```

It needs a reboot to make effective the setting

```
AT#REBOOT
```

```
OK
```

8.3.3. GPS+ BeiDou



Set constellations GPS+BeiDou

```
AT$GPSCFG=2,3
```

```
OK
```

It needs a reboot to make effective the setting

```
AT#REBOOT
```

```
OK
```

8.3.4. GPS+QZSS



Set constellations GPS+QZSS

```
AT$GPSCFG=2,4
```

```
OK
```

It needs a reboot to make effective the setting

```
AT#REBOOT
```

```
OK
```

8.4. Set GNSS Constellation Based on MCC of Camped Network

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



```
AT$GPSCFG=2,0
```

```
OK
```

It needs a reboot to make effective the setting

```
AT#REBOOT
```

```
OK
```

According to the MCC, the constellation selected for each world region is as listed below.

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

8.5. Start GNSS Session with a basic set of NMEA Sentences

Below is a description on how to enable a basic set of NMEA sentences in the NMEA Flow using AT\$GNSSNMEA, which is the suggested AT Command.

It returns the specific NMEA sentence selected according to GNSS constellation combination used.



A basic NMEA set includes RMC, GSA, GSV, and GNS sentences. An unsolicited NMEA sentence flow in the AT port is enabled by sending:

```
AT$GNSSNMEA=1,8D
```

```
OK
```

```
GNSS controller is powered up
```

```
AT$GPSP=1
```

```
OK
```



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



Warning: AT\$GNSSNMEA command is available starting from firmware version 37.00.xx4. If a previous version is used, \$GPSNMUN and \$GPSNMUNEX commands must be used.

8.6. Stop NMEA Flow and Stop GNSS Session



To de-activate unsolicited NMEA sentences flow.

```
AT$GNSSNMEA=0
```

```
OK
```

GNSS controller is powered down

```
AT$GPSP=0
```

```
OK
```

8.7. Get Actual Position with AT\$GNSSACP



GNSS controller must be powered up

```
AT$GPSP?
```

```
$GPSP: 1
```

```
OK
```

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

```
AT$GNSSACP
```

```
$GNSSACP: ,,,,1,,,,
```

```
OK
```

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

```
AT$GNSSACP
```

```
$GNSSACP:
```

```
102713.000,270521,3913.6939N,00904.1533E,20.6,0.7,0.6,3,0.0,0.0,0.0,AANNNN,16
```

```
OK
```

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



Warning: AT\$GNSSACP command is available starting from firmware version 37.00.xx4. If a previous version is used, \$GPSACP command must be used.

8.8. WWAN Priority – GNSS Session in eDRX with basic set of NMEA Sentences

When WWAN priority is selected, 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 only during eDRX idle phase.

As described in chapter 5. Minimum EDRX Cycle Recommendation, eDRX cycle length must be selected ≥ 81.92 sec and eDRX PTW value must be chosen as per the DRX value received from the 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 of NMEA sentences, according to the GNSS constellation combination chosen.

```
AT$GNSSNMEA=1,8D
```

```
OK
```

GNSS controller is powered up

```
AT$GPSP=1
```

```
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$GNSSNMEA=0
```

OK

GNSS controller is powered down

AT\$GPSP=0

OK

8.9. Alternate between WWAN and GNSS Session if no eDRX is Supported

If the MNO does not support the eDRX protocol, the following procedure can be used to alternate WWAN and GNSS sessions.

This could be useful if cellular data activity (i.e.: socket connection) and GNSS activity (i.e.: gathering of the device position) are required on a cyclic basis.

The concept behind this procedure is to switch between WWAN and GNSS priority, using “runtime priority” command to let the modem load the user’s requested session.



Warning: “Runtime priority” switch time belongs also to internal modem tasks and mobile network operation completion.



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 under section 8.5. Start GNSS Session with a basic set of NMEA Sentences

Alternatively, get actual position with AT\$GNSSACP, as described under section 8.7. Get Actual Position with AT\$GNSSACP

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

```
AT$GNSSNMEA=0
```

OK

```
AT$GPSP=0
```

OK

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

```
AT$GPSCFG=3,1
```

OK

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

And so on.

8.10. Using GNSS Assistance Service – XTRA

When the prerequisites are met, using the Qualcomm GNSS Assistance Service feature is quite easy. Once the feature has been enabled and reboot is done, the Qualcomm GNSS Assistance Service internal client starts when the GNSS engine is started up. An URC message provides the Qualcomm GNSS Assistance Service download status, if enabled.



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



Prerequisites:

- Module On, Sim inserted, APN set, cellular and GNSS antennas connected.
- Real time clock must be set on modem (up to FW version Ver. xx4 included).
- Before enabling the service, a valid GNSS fix must be obtained (needed only on FW version Ver. xx2).

Enable Qualcomm GNSS Assistance Service.

```
AT$AGNSS=0,1
```

OK

Enable Qualcomm GNSS Assistance Service download status URCs. (optional)

```
AT$AGNSSCFG=0,1,1
```

OK

Reboot the modem

```
AT#REBOOT
```

OK

Start the GNSS engine up. This automatically triggers Qualcomm GNSS Assistance Service database download.

```
AT$GPSP=1
```

OK

Once Qualcomm GNSS Assistance Service database is downloaded successfully, the following URC is shown (if enabled).

```
$AGNSS: GNSS Assistance successfully downloaded
```

Otherwise.

```
$AGNSS: GNSS Assistance download failed
```

The next GNSS fix will benefit from the XTRA assistance data.



Warning: If the prerequisites are not met, Qualcomm GNSS Assistance Service feature will fail and consequently the GNSS session will not start (in FW xx2) or will delay GNSS session to start.



Warning: With Qualcomm GNSS Assistance Service files prediction already on board, after a module shutdown or reboot the GNSS receiver might take up to 5 secs to return NMEA sentences after AT\$GPSP=1 command.



Warning: Qualcomm GNSS Assistance Service download status URCs are available starting from FW version xx4.



Note: 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.

8.10.1. Choose Qualcomm GNSS Assistance Service File Validity

Qualcomm GNSS Assistance Service allows the user to choose between three different “prediction intervals” files to be downloaded and used: 1 week, 3 days (default) or 1 day.

The procedure for selecting a different file validity than the default one is provided below.



Download and use “one day” prediction file

```
AT$AGNSSCFG=0,0,0
```

```
OK
```

Alternatively

Download and use “one week” prediction file

```
AT$AGNSSCFG=0,0,2
```

```
OK
```

Reboot the modem

```
AT#REBOOT
```

```
OK
```

8.10.2. Qualcomm GNSS Assistance files manual download and injection

It is possible to inject into the GNSS modem a Qualcomm GNSS Assistance file which has been downloaded manually.

These are the Qualcomm GNSS Assistance files address to be downloaded for manual injection:

- GPS+GLO -> <https://path1.xtracloud.net/xtra3gr.bin>
- GPS+GAL -> <https://path1.xtracloud.net/xtra3ge.bin>
- GPS+BDS -> <https://path1.xtracloud.net/xtra3gc.bin>

- o GPS+QZSS -> <https://path1.xtracloud.net/xtra3gj.bin>



Warning: Qualcomm GNSS Assistance files manual download and injection is available starting from FW version xx5.

The procedure for selecting download and inject a specific Qualcomm GNSS Assistance file is provided below.



Prerequisites:

- FW version xx5.
- Have downloaded on Host the selected Qualcomm GNSS Assistance file from the address mentioned above.

Upload the Qualcomm GNSS Assistance file from the Host to the modem.

```
AT#M2MWRITE="/GNSS/xtra.bin",size_of_file
```

>>> here receives the prompt; then send the file, sized *size_of_file* bytes

OK

Enable Qualcomm GNSS Assistance Service.

```
AT$AGNSS=0,1
```

OK

Reboot the modem

```
AT#REBOOT
```

OK

After the module is rebooted, Qualcomm GNSS Assistance file can be injected into the GNSS engine:

```
AT$AGNSSFINJ=0
```

OK

Start the GNSS engine up. This automatically triggers Qualcomm GNSS Assistance Service to use injected file.

```
AT$GPSP=1
```

OK

9. GNSS AT COMMANDS

9.1. 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

-  Power up clears GPS memory and then starts the GPS receiver. GPS data cleaning is performed on the base of the current value of the <reset_type> parameter (see \$GPSR).
-  GPS operation mode is performed on the base of the current values of \$GPSSLSR configuration (see \$GPSSLSR).



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>.



<status> value is stored through \$GPSSAV command.



GNSS controller is powered down

AT\$GPSP=0
OK

9.2. 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 and static pinning operation.

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	
4	:	set static pinning operation	
<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	

►► **<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:

1÷4294967 : expressed in seconds

►► **<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

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

Name	Type	Default	Description
------	------	---------	-------------

<runtime priority> integer N/A it selects the priority runtime

Values:

0 : priority GNSS

1 : priority WWAN

►► **<parameter>=4**, in this case the **<value>** assumes the meaning of **<static pinning>**.


Name	Type	Default	Description
------	------	---------	-------------


<static pinning>	integer	1	Sets the static pinning operation
-------------------------------	---------	---	-----------------------------------

Values:

0 : Disable static pinning

1 : Enable static pinning

- 

WWAN/GNSS startup priority is stored in NVM. This is the priority setting used from the module startup.
It is 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).
 - 

For WWAN/GNSS startup priority, TBF (Time Between Fix), constellation and static pinning a reboot is needed to make effective the setting.
-



AT\$GPSCFG?

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

\$GPSCFG: <startup priority>,<TBF>,<constellation>,<runtime priority>, <static pinning>



AT\$GPSCFG=?

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



- Set WWAN/GNSS Startup Priority, TBF (Time Between Fix) and constellation. A reboot is needed 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 4321s as new TBF value

AT\$GPSCFG=1,4321

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

A reboot is needed to make effective the setting

AT#REBOOT

OK

New values are the new current values

AT\$GPSCFG?

\$GPSCFG: 0,4321,2,0

OK

Enable GNSS with the new setting

AT\$GPSP=1

OK

- Set WWAN/GNSS runtime priority. It does not 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

9.3. AT\$GNSSNMEA - Unsolicited NMEA Data Configuration

Set command activates an unsolicited GNSS data stream, in the form of NMEA sentences, on the standard serial port and defines which NMEA sentences will be available.

Refer to document [1] to have information on the NMEA sentences contents and formats.



[1] NMEA 0183 Standard

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



AT\$GNSSNMEA=<enable>[,<nmea_mask>]

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. See Additional info section to have information on GNSS data stream formats.
Values:			
0 : disable GNSS data stream			
1 : enable the GNSS data stream format			
2 : enable the GNSS data stream format and reserve the AT interface port only for the GNSS data stream			
<nmea_mask>	hex	-	The <nmea_mask> value defines which NMEA sentences will be available (see Additional info). The default <nmea_mask> value is 0 (No sentences available). The hexadecimal format of the bit mask does not require the prefix 0x; example : 0, 1F, 3F

Additional info:

►► [Bitmap description of the <nmea_mask> parameter](#)

<nmea_mask>	Sentences
Bit 0	RMC
Bit 1	GGA

Bit 2	GSA
Bit 3	GSV
Bit 4	GLL
Bit 5	VTG
Bit 6	ZDA
Bit 7	GNS
Bit 8	GRS
Bit 9 - 31	Not Used

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

<NMEA SENTENCE 1><CR><LF>

...

<NMEA SENTENCE N><CR><LF>

...

- **<enable>=2**, 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>=1**.



AT\$GNSSNMEA?

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

\$GNSSNMEA:<enable>,<nmea_mask>



AT\$GNSSNMEA=?

Test command returns the supported range of values for parameters:

<enable>, (list of supported **<nmea_mask>** values).



Set the GSA as available sentence in the unsolicited message

```
AT$GNSSNMEA=1,4
OK
```

Read the current NMEA mask configuration:

```
AT$GNSSNMEA?
$GNSSNMEA: 1,4
OK
```

The unsolicited message will be:

```
$GNSSNMEA:
$GNGSA,A,3,23,20,24,07,13,04,02,,,,,,,,2.4,1.6,1.8°3C
```

Turn-off the unsolicited mode

```
AT$GNSSNMEA=0
OK
```

9.4. AT\$GNSSACP - Get Acquired Position

This command returns information about the last GNSS position.



- NMEA 0183 Standard

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



AT\$GNSSACP

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

```
$GNSSACP: <UTC>,<date>,<latitude>,<longitude>,<altitude>,<hdop>,<vdop>,<fix>,<cog>,<spkm>,<spkn>,<mode>,<nsat>
```

Additional info:

- ▶▶ Meaning of the parameters returned by the command

Name	Type	Default	Description
<UTC>	string	-	UTC time (hhmmss.sss) referred to GGA 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
<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
<altitude>	string	-	altitude - mean-sea-level (geoid) in meters (referred to GGA sentence)
<hdop>	string	-	Horizontal Dilution of Precision (referred to GGA sentence)
<vdop>	string	-	Vertical Dilution of Precision (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/h) (referred to VTG sentence)
<spkn>	string	-	speed over ground (knots) (referred to VTG sentence)

<mode>	string	-	<p>Mode Indicator: six characters that indicate the operating mode of the six constellations GPS, GLONASS, Galileo, BDS, QZSS, NavIC (Not supported).</p> <p>The characters shall take one of the following values:</p> <p>A = Autonomous. D = Differential. E = Estimated (dead reckoning) Mode. F = Float RTK. M = Manual Input Mode. N = No fix. P = Precise. R = Real Time Kinematic. S = Simulator Mode.</p> <p>(referred to GNGNS sentence)</p>
<nsat>	integer	-	total number of satellites in use (referred to GNS sentence)



AT\$GNSSACP?

Read command has the same behavior as the Execution command.



AT\$GNSSACP=?

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



AT\$GPSP?

\$GPSP: 0

When the module is down there is no acquired position:

AT\$GNSSACP

\$GNSSACP: ,,,,,,0,,,,

OK

AT\$GPSP=1

OK

Until first fix is received the command will display this:

AT\$GNSSACP

\$GNSSACP: ,,,,,,1,,,,

Once fix has been received the command will display actual GNSS time and position:

OK

AT\$GNSSACP

\$GNSSACP: 132807.000,130521,3913.6929N,00904.1545E,8.2,0.8,0.8,3,0.0,0.0,0.0,AANNNN,14

OK

9.5. AT\$AGNSSCFG - AGNSS Configuration

This command handles Assisted GNSS configuration. Some settings may require a reboot for the change to take effect.

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



AT\$AGNSSCFG=<provider>,<parameter>,<value>

Parameters:

Name	Type	Default	Description
<provider>	integer	N/A	select the AGNSS provider to be set
Value:			
0 : use XTRA AGNSS provider			
<parameter>	integer	N/A	set the parameter to configure
Values:			
0 : XTRA duration hours			
1 : Enable or disable URCs for XTRA download			
<value>	integer	-	value depends on the previous <parameter> . See Additional info section

Additional info:

►► **<parameter>=0**: in this case, **<value>** handles the configuration of XTRA duration hours

Name	Type	Default	Description
<duration>	integer	1	select the time validity of XTRA data. It is effective only after a module reboot
Values:			
0 : 24 hours (one day)			
1 : 72 hours (three days)			

2 : 168 hours (one week)

►► <parameter>=1, in this case <value> permits to configure URCs for XTRA download

Name	Type	Default	Description
<URCs>	integer	0	enable or disable URCs for XTRA download. The effect of the command is immediate.
Values:			
0 : Disable			
1 : Enable			



AT\$AGNSSCFG?

Read command returns configurations for AGNSSCFG.

Two rows will be printed.

The first row has <parameter>=0. It has the following form:

\$AGNSSCFG: <provider>,<parameter>,<active>,<requested>

In the second row, with <parameter>=1, <requested> has no meaning (because the configuration is applied instantly), so it is not printed:

\$AGNSSCFG: <provider>,<parameter>,<active>

Additional info:

►► Below the meanings of <active> and <requested> parameters.

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



AT\$AGNSSCFG=?

Test command returns the supported value range for <provider>,<parameter>,<value>.



Get active and requested values for XTRA duration, and the availability for XTRA download status URCs:

AT\$AGNSSCFG?

\$AGNSSCFG: 0,0,1,1

\$AGNSSCFG: 0,1,0

OK

In the above example, active and requested XTRA duration values are set to 72 hours, and URCs are not enabled.

Set XTRA duration hours = 168 hours

AT\$AGNSSCFG=0,0,2

OK

Until a reboot is done, the active value remains the same but the requested value changes:

AT\$AGNSSCFG?

\$AGNSSCFG: 0,0,1,2

\$AGNSSCFG: 0,1,0

OK

A reboot is needed for the change to take effect (requested value will become the active value)

AT#REBOOT

OK

Active value is now the previously requested value

AT\$AGNSSCFG?

\$AGNSSCFG: 0,0,2,2

\$AGNSSCFG: 0,1,0

OK

Conversely, the effect of applying URCs availability is immediate

AT\$AGNSSCFG=0,1,1

OK

The above command enables URCs, and a reboot is not required for the change to take effect

AT\$AGNSSCFG?

\$AGNSSCFG: 0,0,2,2

\$AGNSSCFG: 0,1,1

OK

9.6. 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
Value:			
0 : use XTRA AGNSS provider			
<status>	integer	N/A	set the AGNSS provider enable status
Values:			
0 : set selected AGNSS provider disabled			
1 : set selected AGNSS provider enabled			



AT\$AGNSS?

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

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

Additional info:

►► Here are the meanings of **<active>** and **<requested>** parameters.

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
```

9.7. AT\$GPSR - Reset GPS Controller

This command resets the GNSS controller.

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



AT\$GPSR=<resetType>

Execution command allows to reset the GNSS controller.

Parameter:

Name	Type	Default	Description
<resetType>	integer	N/A	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\$GPSR=?

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



Factory reset
AT\$GPSR=0
OK

9.8. 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

9.9. AT\$AGNSSFINJ – AGNSS File Injection

This command handles Assisted GNSS file injection. XTRA file should be downloaded in the host and sent to MDM through **AT#M2MWRITE**. Also, XTRA must be enabled before the injection.

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



AT\$AGNSSFINJ=<provider>

Parameter:

Name	Type	Default	Description
<provider>	integer	N/A	select the AGNSS provider to be set
Value:			
0 : use XTRA AGNSS provider			



AT\$AGNSSFINJ=?

Test command returns the supported value range for <provider>



Send XTRA file to MDM card. It is required to use the destination path /GNSS/xtra.bin:

AT#M2MWRITE="/GNSS/xtra.bin",22748

>>> here receives the prompt; then send the file, sized (in this example) 22748 bytes

OK

XTRA must be enabled and the system must be rebooted for the change to take effect:

AT\$AGNSS=0,1

OK

AT#REBOOT

OK

After the module is rebooted, XTRA can be injected into the GNSS engine:

AT\$AGNSSFINJ=0

OK

Eventually, NMEA session using XTRA data can be launched:

AT\$GNSSNMEA=1,FF

OK

AT\$GPSP=1

OK

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Make sure the use of this product is allowed in your country and in the environment required. The use of this product may be dangerous and has to be avoided in areas where:

- it can interfere with other electronic devices, particularly in environments such as hospitals, airports, aircrafts, etc.
- there is a risk of explosion such as gasoline stations, oil refineries, etc. It is the responsibility of the user to enforce the country regulation and the specific environment regulation.

Do not disassemble the product; any mark of tampering will compromise the warranty validity. We recommend following the instructions of the hardware user guides for correct wiring of the product. The product has to be supplied with a stabilized voltage source and the wiring has to be conformed to the security and fire prevention regulations. The product has to be handled with care, avoiding any contact with the pins because electrostatic discharges may damage the product itself. Same cautions have to be taken for the SIM, checking carefully the instruction for its use. Do not insert or remove the SIM when the product is in power saving mode.

The system integrator is responsible for the functioning of the final product. Therefore, the external components of the module, as well as any project or installation issue, have to be handled with care. Any interference may cause the risk of disturbing the GSM network or external devices or having an impact on the security system. Should there be any doubt, please refer to the technical documentation and the regulations in force. Every module has to be equipped with a proper antenna with specific characteristics. The antenna has to be installed carefully in order to avoid any interference with other electronic devices and has to guarantee a minimum distance from the body (20 cm). In case this requirement cannot be satisfied, the system integrator has to assess the final product against the SAR regulation.

The equipment is intended to be installed in a restricted area location.

The equipment must be supplied by an external specific limited power source in compliance with the standard EN 62368-1:2014.

The European Community provides some Directives for the electronic equipment introduced on the market. All of the relevant information is available on the European Community website:

https://ec.europa.eu/growth/sectors/electrical-engineering_en

11. GLOSSARY

Acronym	Definition
A-GPS	Assisted-Global Positioning System
BeiDou (BDS)	The Chinese GNSS
CN0	Carrier to Noise
DPO	Dynamic Power Optimization
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	Quasi-Zenith Satellite System (Japanese local GNSS)
TTF	Time to First Fix
UART	Universal Asynchronous Receiver Transmitter
URC	Unsolicited Result Code
WWAN	Wireless Wide Area Network
XTRA	GNSS Assistance Service


12. DOCUMENT HISTORY

Revision	Date	Changes
8	2023-03-06	<p>Updated warnings in sections 8.5 and 8.7</p> <p>Modified the following sections:</p> <ul style="list-style-type: none"> 6.1. Introduction to Qualcomm GNSS Assistance Service 8.10. Using GNSS Assistance Service – XTRA <p>Updated chapter 9 to the latest template</p> <p>Added chapter 9.9 AT\$AGNSSFINJ</p> <p>Added paragraph 8.10.2</p>
7	2021-08-04	<p>Added description under chapter 4. Technology Switching Delays</p> <p>Added section 6.2 Prediction Validity Files and Size</p> <p>Added new commands</p> <p>Updated “AT\$GPSCFG” command</p> <p>Modified the following sections:</p> <ul style="list-style-type: none"> 8.5. Start GNSS Session with a basic set of NMEA Sentences 8.6. Stop NMEA Flow and Stop GNSS Session <p>Updated the document to new Telit template standards.</p>
6	2020-11-18	<p>Updated document name</p> <p>Added ML865G1 series</p> <p>Updated “related document”</p> <p>Added “How to alternate WWAN session and GNSS session if no eDRX is supported” chapter</p> <p>Added “Assisted GNSS services” and “AT\$AGNSS” command</p> <p>Added “eDRX PTW value” warning in chapter 5</p> <p>Updated chapter “Basic GNSS procedures”</p> <p>Added AT\$GPSACP command</p> <p>Updated AT\$GPSNMUN command</p> <p>Updated AT\$GPSNMUNEX command</p> <p>Updated GLOSSARY AND ACRONYMS</p>
5	2020-04-02	<p>Moved Basic GNSS procedures to chapter 6</p> <p>Moved GNSS AT Command to chapter 7</p> <p>Added AT\$GPSCFG command</p> <p>Updated chapter 6</p>
4	2020-03-17	Update chapter 7
3	2020-03-13	Released, updated footer and header
2	2020-02-27	Update chapter 2




1	2020-02-25	Update Applicability Table
0	2020-02-12	First issue DRAFT

From Mod.0809 rev.3



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