TELIT CINTERION
IoT MODULES

Customer Operating Guide

Operating NB-IoT NTN Satellite on the ME310M1

A practical operating guide for configuring and running 3GPP Release-17 NB-IoT Non-Terrestrial Network (satellite) connectivity on the Telit Cinterion ME310M1-W1N module — RAT selection, APN and band setup, UE positioning, operator profiles, and connection monitoring.

Module: ME310M1-W1N
Standard: 3GPP Rel-17 NB-IoT NTN
Satellites: GEO only
Operator: Skylo / Default

1 What is NB-IoT NTN

Satellite connectivity for NB-IoT, standardized in 3GPP Release 17.

NB-IoT Non-Terrestrial Networks (NB-IoT NTN) is a cellular technology, standardized from 3GPP Rel-17, that lets satellites provide telecommunication services to NB-IoT cellular modems — offering coverage virtually anywhere there is a suitable satellite overhead.

It is primarily used for **service continuity** — extending cellular coverage where terrestrial networks are not feasible (maritime, remote areas) — and for **service ubiquity** when terrestrial infrastructure is unavailable or out of service (e.g. natural disasters).

On the ME310M1-W1N, NTN works much like terrestrial NB-IoT, except the device telemetry is carried to the base station (eNB) through a satellite channel instead of a ground tower.

AT A GLANCE

Rel-17 NB-IoT NTN · GEO satellites only · UE position required for Timing-Advance compensation · NTN RAT selected with `AT%RATIMGSEL=4` · Skylo or Default operator profile.

2 How it works & satellite types

The further the satellite, the longer the round-trip delay the modem must compensate for.

NTN data travels from the modem to the eNB over a satellite link. The distance to the satellite drives the round-trip time (RTT) and therefore the complexity of timing compensation. The ME310M1-W1N supports **GEO satellites only**.

Type	Orbit altitude	Round-trip time	Notes
GEO Supported	35,786 km	≈ 541.46 ms	Circular equatorial orbit; appears motionless to observers
MEO	7,000–25,000 km	≈ 93.45 ms (10,000 km)	Medium-altitude orbit
LEO	500–2,000 km	≈ 25.77 ms (600 km)	Low-altitude orbit
HAPS	≈ 20 km	< 10 ms	Airborne (non-orbital)
Terrestrial	—	≈ 1 ms	Reference: ground-based eNB

PLATFORM NOTE

Only GEO satellites are supported on the ALT1350 / ME310M1-W1 platform. Non-geostationary constellations are not covered by the current implementation.

3 Timing Advance & why position is required

The defining challenge of NTN — and the reason the modem must know where it is.

Each LTE device is assigned a transmit timeslot. Because of signal propagation delay, the device must transmit *ahead of time* so its signal reaches the eNB at the expected moment. **Timing Advance (TA)** represents this round-trip delay. Over a GEO satellite the delay is large, so the modem must pre-compensate. TA is computed from three inputs:

- **UE position** — from GNSS or manually injected by the host application.
- **Satellite position** — orbital ephemeris received in the NTN `SIB31` broadcast.
- **TAcommon** — feeder-link RTT (Gateway-to-Satellite delay), also carried in `SIB31`.

POSITION IS MANDATORY

Automatic positioning from internal GNSS (iGNSS) is **not supported** in the current firmware. You must provide the UE position using **Static** or **Manual** mode (Section 7). Without it, attach fails.

4 Typical operation flow

What happens internally when the module establishes an NTN connection.

1. UE scans the configured NTN bands to check whether NTN cells are available.
2. ce an NTN cell is found, the UE retrieves `SIB31` (satellite ephemeris + timing information).
3. position is obtained — via static configuration or manual injection (automatic iGNSS retrieval is not supported).
4. ng SIB31 data and UE position, the UE computes the initial Timing Advance (TA).
5. UE uses the computed TA to establish an RRC connection.
6. eNB may estimate the TA error and send a Timing Advance Command (TAC) to correct it.
7. UE uses the corrected TA for uplink data transmission.

8 procedure repeats when validity parameters expire (SIB31 ephemeris validity, UE velocity, or elevation angle).

BE PATIENT ON FIRST ATTACH

The initial attach procedure may take **several minutes** to complete.

5 Prerequisites

Confirm these before any NTN configuration.

1

NTN module variant

Use the NTN-capable `ME310M1-W1N` (P/N 3990252862). Verify your module supports NTN.

2

Software baseline

Firmware `48.00.013.1-B003` (DVT3990252859) or later — the first beta supporting NTN.

3

Matching AT guide

Ensure your AT command reference (AVAS AT Guide) matches the firmware version in use.

4

RAT selected first

NTN RAT must be selected and the module reset *before* any NTN-specific configuration.

5

Skylo SIM & sky view

An activated Skylo SIM and a clear line of sight toward the GEO satellite.

6

Debug-mode OTP

A one-time password from Telit Technical Support to unlock UE-position configuration.

FIRMWARE LIMITATIONS (CURRENT VERSION)

FOTA upgrade from this version to the next is not supported · automatic positioning is not yet supported · initial attach may take several minutes.

6 NTN RAT selection, APN & bands

The first three configuration steps. Run them in order after power-up.

1

Select the NTN RAT and reset

Switch the module to the NB-IoT NTN image, then reset. **All** subsequent NTN configuration must be done after this.

```
AT%RATIMGSEL=4
OK
ATZ
OK
```

2 Configure the APN

Provision the data context for NB-IoT NTN — IP or non-IP.

```
// IP service
AT+CGDCONT=1,"IPV4V6","skylo.ip"
OK
// non-IP service
AT+CGDCONT=1,"non-IP","telit.poc"
OK
```

IMPORTANT

NTN PDN parameters are stored in a dedicated **NBNTN APN table** and must be provisioned separately — even if the same APN is already configured for Cat-M or NB-IoT RAT.

3 Check (and optionally set) NTN bands

By default all four NTN bands are enabled. Verify, then narrow only if required.

```
AT%GETCFG="BAND"
Bands: 255 ,256 ,23 ,252
OK

// restrict to specific bands (quote each value)
AT%SETCFG="BAND","255","256"
OK
```

Band	Name	DL freq. (MHz)	UL freq. (MHz)
255	L-band (NTN 1.6 GHz)	1525–1559	1626.5–1660.5
256	S-band (NTN 2 GHz)	2170–2200	1980–2010
252	AWS-4	2180–2200	2000–2020
23	Skylo (same as Band 252)	2180–2200	2000–2020

Supported per 3GPP Releases 17 & 19.

7 UE positioning

Mandatory for NTN. Choose Static (fixed installs) or Manual (mobile / on-request).

Step A — Enter debug mode OTP required

UE-position configuration requires engineering mode. Request the OTP from **Telit Technical Support**, providing your module **IMEI** (`AT+CGSN`) and **firmware version** (`AT+CGMR`).

```
AT%SRVCHANGE="debug","<OTP>"
OK
ATZ
OK
```

Step B (option 1) — Static UE position

Stores the position in non-volatile memory (persists across reboot). Best for fixed installations.

```
AT%SETCFG="NTN_UE_POS_MODE","1"
OK
AT%SETCFG="NTN_UE_STATIC_POS","<lat>","<lon>","<alt>"
OK
```

Latitude / longitude in decimal degrees; altitude in metres.

Step B (option 2) — Manual UE position

The module requests a fresh position from the host before each transmission when the current one expires. Autoconnect must be disabled.

```
AT%SETCFG="NTN_UE_POS_MODE","3"
OK
AT%SETACFG="modem_apps.Mode.AutoConnectMode","false"
OK

// enable the position-request URC
AT%NTNEV="POSREQ",1
OK

// when the module emits %NTNEVU: "POSREQ", inject position:
AT%NTNCMD="POS","<lat>","<lon>","<alt>",20
OK
```

POSITION ACCURACY

600 m accuracy is sufficient (≈ 66 µs RTT error — negligible per 3GPP). Inject the position **before** any command that triggers transmission: `AT+CGATT`, `AT+CFUN=4`, `AT+CSODCP`, `AT+CMGS`, etc.

8 Operator profile, eDRX & monitoring URCs

Final configuration: pick the operator profile, optionally tune eDRX, and enable the monitoring URCs.

Operator-specific configuration

Two NTN operator profiles are available — select with `AT%NWOPER`:

- **DEFAULT** — no operator-specific features; intended for use with test equipment.
- **SKYLO** — enables Skylo-specific features required by the Skylo compliance matrix.

```
// TN operator = default, NTN operator = default
AT%NWOPER="default",,"default"
OK
// TN operator = default, NTN operator = skylo
AT%NWOPER="default",,"skylo"
OK
```

eDRX for NTN (optional)

Extended Discontinuous Reception can be configured independently for NTN RAT (3GPP Rel-18). Set `<AcT-type>` to **6** (satellite E-UTRAN NB-S1 mode).

```
AT+CEDRXS=<mode>,<AcT-type>[,<Requested_eDRX_value>]
OK
```

Recommended monitoring URCs

Enable these for real-time visibility during integration and field testing — they are essential for diagnosis.

```
AT%NOTIFYEV="SIB31",1   // SIB31 reception notification
AT%NTNEV="TA",1         // Timing Advance reporting
AT+CEREG=2             // registration status + location info
```

9 Worked examples

Complete end-to-end sequences with the actual module responses.

9.1 — Static UE position mode

```
// 1. APN
AT+CGDCONT=1,"IPV4V6","skylo.ip"
OK
// 2. NTN RAT + reset
AT%RATIMGSEL=4
OK
ATZ
OK
// 3. check bands
AT%GETCFG="BAND"
Bands: 255 ,256 ,23 ,252
// 4. (optional) restrict bands
AT%SETCFG="BAND","255","256"
OK
// 5. debug mode
AT%SRVCHANGE="debug","<OTP>"
OK
ATZ
OK
// 6. static position
AT%SETCFG="NTN_UE_POS_MODE","1"
OK
AT%SETCFG="NTN_UE_STATIC_POS","48.825972","2.267738","85"
OK
// 7. URCs, enable radio, wait for registration
AT+CFUN=4
OK
AT%NOTIFYEV="SIB31",1
OK
AT+CEREG=2
OK
AT%NTNEV="TA",1
OK
AT+CFUN=1
OK

+CEREG: 2
+CEREG: 0
+CEREG: 2
%NOTIFYEV: "SIB31"
%NTNEVU: "TA","RACH",512,9123,697459
%NTNEVU: "TA","TAC",1,156,697618
+CEREG: 1,"0FAB","0010D88B",9
```

SUCCESS INDICATOR

`+CEREG: 1,...,9` means the module is registered on an NTN cell (AcT = 9: E-UTRAN NB-IoT NTN).

9.2 — Manual UE position mode

```
// APN, RAT+reset, debug mode as above, then:
AT%SETCFG="NTN_UE_POS_MODE","3"
OK
AT%SETACFG="modem_apps.Mode.AutoConnectMode","false"
OK
ATZ
OK
// URCs (POSREQ mandatory in manual mode)
AT+CFUN=4
AT%NOTIFYEV="SIB31",1
AT%NTNEV="TA",1
AT%NTNEV="POSREQ",1
AT+CEREG=2
// enable radio, inject position on request, attach
AT+CFUN=1
OK
+CEREG: 2
+CEREG: 0
AT+CGATT=1
ERROR   // UE position is required first
%NTNEVU: "POSREQ"   // module requests position
%NOTIFYEV: "SIB31"
AT%NTNCMD="POS","48.825972","2.267738","85",20
OK
AT+CGATT=1
OK
%NTNEVU: "TA","RACH",512,2776,176147
%NTNEVU: "TA","TAC",1,160,176376
+CEREG: 1,"0FAB","0010D88B",9
```

9.3 — Non-IP data transfer (CSODCP)

```
// enable data-transfer notification
AT%CSODCP="NOTIFY",1
OK
// send hex-encoded payload
AT%CSODCP="SEND",1,100,"01020304...0a",1,0
%CSODCP: 1
OK
// position requested (manual mode) — inject it
%NTNEVU: "POSREQ"
AT%NTNCMD="POS","48.825972","2.267738","85",20
OK
%NTNEVU: "TA","RACH",511,30149,523067
%NTNEVU: "TA","TAC",1,156,523276
// data sent successfully
%CSODCPU: 0,1
```

10 Monitoring & troubleshooting

Read the URCs to understand exactly where the connection stands.

For advanced debug, contact Telit Technical Support and provide your module **IMEI** (`AT+CGSN`) and **firmware version** (`AT+CGMR`).

URC	Meaning & action
`%NOTIFYEV: "SIB31"`	SIB31 received — the module has satellite ephemeris data.
`%NTNEVU: "TA","RACH",<sf>,<ta>,<earfcn>`	TA computed during RACH. `<ta>` is the TA value in Ts units.
`%NTNEVU: "TA","TAC",<step>,<ta>,<earfcn>`	TA correction from the eNB. `<step>` is the TAC step size.
`%NTNEVU: "POSREQ"`	UE position required (manual mode). Inject via `AT%NTNCMD="POS",...`.
`+CEREG: 1,"<TAC>","<CI>",9`	Registered on an NTN cell (AcT = 9: E-UTRAN NB-IoT NTN). **Success.**
`+CEREG: 0`	Not registered — check band configuration, APN, and UE position.
`AT+CGATT=1` returns `ERROR`	UE position has not been provided. Inject position first, then re-attach.

REMINDER

Always inject UE position *before* any transmission-triggering command. A first attach can legitimately take several minutes.

11 SIB reference & related documents

The satellite information the module relies on, and where to find more.

SIB1 (NTN)

3GPP Rel-17 added NTN fields to SIB1. An NTN cell sets `cellBarred` to active so legacy terrestrial devices skip it, and SIB1 carries the scheduling information for SIB31.

Critical SIB31 fields

Field	Description
Satellite ephemeris	Orbital parameters of the serving satellite, used for position/TA computation.
TAcommon	Propagation delay between Gateway and Satellite (feeder-link RTT).
Koffset	Timing-offset parameter for UL/DL frame alignment.
Kmac	MAC-layer timing parameter.
ul-SyncValidityDuration	Validity duration of SIB31 — determines when the UE must re-acquire it.

Related documents

- **ME310M1 Hardware Design Guide** — Doc 1VV0301897
- **3GPP TS 22.261** — Service requirements for the 5G system (NTN architecture)
- **3GPP TS 36.102** — E-UTRA UE radio transmission and reception (NTN bands)
- Current documentation & downloads: dz.telit.com