**3GPP TSG RAN WG1 Meeting #106-bis-e R1-210xxxx**

**e-Meeting, October 11th – 19th, 2021**

**Agenda Item: 8.15**

**Source: Moderator (MediaTek)**

**Title: Summary of [106bis-e-R17-RRC-IoT-NTN] Email discussion on Rel-17 RRC parameters for NB-IoT/eMTC support for NTN**

**Document for: Discussion**

# Introduction

There was a preliminary email discussion on RRC parameters for NB-IoT/eMTC to support NTN [4]. RRC parameters pertinent for IoT NTN will be further discussed in RAN1#106bis-e.

This document is the Summary of [106bis-e-R17-RRC-IoT-NTN] Email discussion on Rel-17 RRC parameters for IoT over NTN

* 1st check point: October 14
* Final check point: October 19

# Time and frequency synchronization

## Related RRC parameters

Based on the agreements to date (up to RAN1#106-e) and the companies proposals submitted to RAN1#106-bis-e, a preliminary list of RRC parameters for Rel-17 IoT NTN and related to 8.15.1 Enhancements to time and frequency synchronization is provided below:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **WI code** | **Sub-feature group** | **RAN1 specification** | **Section** | **RAN2 Parant IE** | **RAN2 ASN.1 name** | **Parameter name in the spec** | **New or existing?** | **Parameter name in the text** | **Description** | **Value range** | **Default value aspect** | **Per (UE, cell, TRP, …)** | **UE-specific or Cell-specific** | **Specification** | **Comment** |
| LTE\_NBIOT\_eMTC\_NTN | Uplink Time pre-compensation | 36.213 |  |  |  | ULTimePre-compensation-r17NTACommon-r17SatelliteEphemerisStateVector-r17SatelliteOrbitalParameters-r17 | new |  | 1. UE specific TA calculation in RRC\_IDLE state based on its GNSS-acquired position and the serving satellite ephemeris.
2. UE specific TA calculation in RRC\_CONNECTED state based on its GNSS-acquired position and the serving satellite ephemeris.
3. UE applies common TA in RRC\_IDLE and RRC\_CONNECTED according to the parameters provided by the network (if any)
4. For TA update in RRC\_CONNECTED state, combination of both open (i.e. UE autonomous TA estimation, and common TA estimation) and closed (i.e., received TA commands) control loops

N\_(TA,common) is a network-controlled common TA, and may include any timing offset considered necessary by the network.When configured, N\_(TACommon) provides network-controlled common TA. It includes parameter X, Y, .N\_TAcommon with value of 0 is supported. Serving Satellite position state vector X,Y,Z in ECEF (m) and serving Satellite velocity state vector VX,VY,VZ in ECEF (m/s) is indicated Serving satellite Ephemeris orbital parameters are indicated:- Semi-major axis α [m] - Eccentricity e - Argument of periapsis ω [rad] - Longitude of ascending node Ω [rad] - Inclination i [rad] - Mean anomaly M [rad] at epoch time toServing satellite ephemeris Epoch time is implicitly known | TBD |  | cell | Cell-specific | 36.331 | TBD Value range based on NR NTN progress |
| LTE\_NBIOT\_eMTC\_NTN | Uplink Frequency pre-compensation | 36.213 |  |  |  | ULFrequencyPre-compensation-r17SatelliteEphemerisStateVector-r17SatelliteOrbitalParameters-r17 |  |  | 1. In RRC\_IDLE state calculate frequency pre-compensation to counter shift the Doppler experienced on the service link.
2. in RRC\_CONNECTED state, calculate frequency pre-compensation to counter shift the Doppler experienced on the service link.

Serving Satellite position state vector X,Y,Z in ECEF (m) and serving Satellite velocity state vector VX,VY,VZ in ECEF (m/s) is indicated Serving Satellite Ephemeris orbital parameters are indicated:- Semi-major axis α [m] - Eccentricity e - Argument of periapsis ω [rad] - Longitude of ascending node Ω [rad] - Inclination i [rad] - Mean anomaly M [rad] at epoch time to |  |  |  |  |  |  |
| LTE\_NBIOT\_eMTC\_NTN | UL-Synchronization -Validity-IoT NTN | 36.213 |   |   |   | ULSyncValidityDuration-r17 | new | Validity timer for UL synchronization for NB-IoT or eMTC | • Satellite ephemeris read on SIB are valid for the duration of sporadic short transmission in RRC\_CONNECTED.• Common TA parameters if indicated and read on SIB are valid for the duration of sporadic short transmission in RRC\_CONNECTED.• Note: The duration of the short transmission is not longer than the “validity timer for UL synchronization” referred to in the WID objective (but which still needs further discussion for specifying further details)The validity timer of UL synchronization is configured by the network. FFS: Whether a single validity timer or separate validity timers are used for satellite ephemeris and common TA parametersUE in RRC\_IDLE reads the satellite ephemeris on SIB and the common TA parameters if indicated on SIB and (re-)start the validity timer(s) for UL synchronization before moving to RRC\_CONNECTED.FFS: Details of the precise (re-)start time for the validity timer for UL synchronization to ensure a common understanding between gNB and UE. Other signaling details for validity timer are up to RAN2”A validity duration configured by the network for satellite ephemeris data / Common TA parameters if broadcast which indicates the maximum time during which the UE can apply the satellite ephemeris / common TA parameres if broadcast without having acquired new satellite ephemeris / common TA parameters if broadcast. | TBD |   | Cell | Cell-specifc | 36.331 | FFS: Whether a single validity timer or separate validity timers are used for satellite ephemeris and common TA parameters |
| LTE\_NBIOT\_eMTC\_NTN | UL synchronization-Transmission-IoT NTN | 36.213 |   |   |   | TransmissionDurationNPRACH-NB-r17 | new | Duration of UL transmission segment for UE pre-compensation for NPRACH transmission for NB-IoT | The UL transmission segment length for NPRACH refers to the duration of time during which the applied pre-compensation shall not be changed by the UE.The UL transmission segment duration is provided by UE-specific RRC signalling or by signalling in SIB.Duration of UL transmission segment for UE pre-compensation for NPRACH transmission is a number of NRACH repetition units configured by the network for NB-IoT NTN | For NB-IoT NTN, the network configures one of K values for the UL transmission segment duration of each PRACH preamble format in a k-bit field, where the size of the k-bit field and the number of K candidate values depend on the preamble format.- Format 0 and format 1: 3-bit field, K=6 candidate values [2.4.(TCP+TSEQ), 4.4.(TCP+TSEQ), 8.4.(TCP+TSEQ), 16.4.(TCP+TSEQ), 32.4.(TCP+TSEQ), 64.4.(TCP+TSEQ)- Format 2: 2-bit field, K=4 candidate values 2.6.(TCP+TSEQ), 4.6.(TCP+TSEQ), 8.6.(TCP+TSEQ), 16.6.(TCP+TSEQ) ]FFS: Down scoping of K candidate values, size of k-bit fieldFFS: Whether the same segment duration can be used for all preambles within a preamble format |   | TBD | TBD | 36.331 | NOTE: the values of UL transmission segment duration for NB-IoT can be different to those for eMTCFFS: Down scoping of K candidate values, size of k-bit fieldFFS: Whether the same segment duration can be used for all preambles within a preamble format |
| LTE\_NBIOT\_eMTC\_NTN | UL synchronization-Transmission-IoT NTN | 36.213 |   |   |   | TransmissionDurationPRACH-r17 | new | Duration of UL transmission segment for UE pre-compensation for PRACH transmission for eMTC | The UL transmission segment length for PRACH refers to the duration of time during which the applied pre-compensation shall not be changed by the UEThe UL transmission segment duration is provided by UE-specific RRC signalling or by signalling in SIB. | For eMTC, the network configures one of K values for the UL transmission segment duration of PRACH in a k-bit fieldFFS: K candidate values, size of k-bit field |   | TBD | TBD | 36.331 | NOTE: the values of UL transmission segment duration for NB-IoT can be different to those for eMTCFFS: K candidate values, size of k-bit field |
| LTE\_NBIOT\_eMTC\_NTN | UL synchronization-Transmission-IoT NTN | 36.213 |   |   |   | TransmissionDurationNPUSCH-NB-r17 | new | Duration of UL transmission segment for UE pre-compensation for NPUSCH transmission for NB-IoT | The UL transmission segment length for NPUSCH refers to the duration of time during which the applied pre-compensation shall not be changed by the UE.Duration of UL transmission segment for UE pre-compensation for NPUSCH transmission is a number of PUSCH repetition units configured by the networkFor NB-IoT, repetition unit is M\_identical^NPUSCH×N\_slot^UL×T\_slot  | For NB-IoT/eMTC NTN, the network configures one of K candidate values for the UL transmission segment duration of NPUSCH/PUSCH in a k-bit field. For NB-IoT, maximum 3-bit field with a maximum number of K=8 candidate values [2 ms, 4 ms, 8 ms, 16 ms, 32 ms, 64 ms, 128 ms, 256 ms] FFS: Down scoping of K candidate values, size of k-bit field |   | TBD | TBD | 36.331 | FFS: RAN1 to further discuss valid and invalid subframes FFS: Configuration detailsFFS: Down scoping of K candidate values, size of k-bit field |
| LTE\_NBIOT\_eMTC\_NTN | UL synchronization-Transmission-IoT NTN | 36.213 |   |   |   | TransmissionDurationPUSCH-r17 | new | Duration of UL transmission segment for UE pre-compensation for PUSCH transmission for eMTC | The UL transmission segment length for PUSCH refers to the duration of time during which the applied pre-compensation shall not be changed by the UE.Duration of UL transmission segment for UE pre-compensation for PUSCH transmission is a number of PUSCH repetition units configured by the network For eMTC, repetition unit is N\_slot^UL×T\_slot for sub-PRB allocation, where Tslot = 0.5 ms. For full-PRB allocation, repetition unit is one subframe. | For NB-IoT/eMTC NTN, the network configures one of K candidate values for the UL transmission segment duration of NPUSCH/PUSCH in a k-bit field. FFS: Down scoping of K candidate values, size of k-bit field |   | TBD | TBD | 36.331 | FFS: RAN1 to further discuss valid and invalid subframes FFS: Configuration detailsFFS: Down scoping of K candidate values, size of k-bit fieldNOTE: although it is not yet agreed by RAN1, it is expected that a corresponding (or the same) parameter will be needed also for PUCCH. |

## Company views

Apple R1-2110073, Ericsson R1-2109959, Samsung R1-2109536 proposed to remove rows 2-1 (NTAcommon), 2-2 (serving satellite ephemeris position and velocity state vector) and 2-3 (serving satellite orbital parameters) in R1-2108672 List of Rel-17 RRC parameters for IoT NTN submitted to RAN1#106-e.

* These rows were removed and merged into two new rows for “Uplink Time pre-compensation” and “Uplink Frequency pre-compensation”.

Samsung R1-2109536 proposed to add square brackets to parameters/descriptions not yet agreed

* Rows for UL transmission segments with values not yet finalized were put in brackets.

Apple R1-2110073 proposed to merge rows 2-5, 2-6 on validity timer in in R1-2108672 List of Rel-17 RRC parameters for IoT NTN submitted to RAN1#106-e into rows for UE pre-compensation.

* These rows were merged into the with two new rows for “Uplink Time pre-compensation” and “Uplink Frequency pre-compensation”.

ZTE R1-2109851 proposed to add “Serving satellite ephemeris Epoch time is implicitly known”.

* This was added in the two new rows for “Uplink Time pre-compensation” and “Uplink Frequency pre-compensation”.

ZTE R1-2109851 also proposed to add “UE report the validity duration of GNSS” and “Common TA estimation is based on indication of common TA drift rate.”.

* Though the moderator understands the motivation, RAN1 agreement will first be needed.

The revisions mentioned above are consistent with Huawei R1-2109156 proposal to put all the components related to the UL time pre-compensation under the same feature for LTE NB-IoT eMTC NTN.

Huawei R1-2109156 proposed to divide “UL transmission segment” into two feature groups, i.e. “UL transmission segment for NB-IoT” and “UL transmission segment for eMTC”.

* This is done as shown in Section 2.2 and in new version of spreadsheet for List of Rel-17 RRC parameters for IoT NTN.

MODERATOR NOTE: We used and revised the R1-2108672 List of Rel-17 RRC parameters for IoT NTN submitted to RAN1#106-e for the revisions and created a new version for RAN1#106bis-e, instead of the list of UE features submitted to RAN1#106-e since the intention is to provide a list of RRC parameters to RAN2.

**Moderator]:**

Companies are encouraged to provide comments on revised RRC parameters list (section 2.1):

|  |  |
| --- | --- |
| **Companies** | **Comments**  |
| Ericsson | We propose the following modifications:* Make separate versions for all RRC parameters for eMTC and NB-IoT.
* Put each parameter in a separate row and make a separate description for each.
* Break ServingSatelliteEphemerisStateVector and ServingSatelliteEphemerisOrbitalParameters up into 6 parameters each

According to guidelines in R1-2110415, the description (column J) should ”be such that RAN2 could copy in the specification as field description (not necessarily copy everything, but it should be written in a way that is comprehensible for specification.). Field description should be precise and concrete and as short as possible.”Also, it is not clear to us why references are made to e.g. Ericsson document R1-2109959 and Apple document R1-2110073 and why proposals from these documents have been used when updating the RRC parameters list. These documents are for agenda item 8.17.14, i.e., UE features for IoT NTN. |
| Nokia, NSB | * The description for common TA (e.g. "It includes parameter X, Y, .") should be only be updated according to the agreement, which should be removed now.
* There is still discussion on ephemeris epoch time in NR NTN, which should be updated accordingly if agreement updated for "Serving satellite ephemeris Epoch time is implicitly known".
 |
| Samsung | * Suggest to list each parameter separately.
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|  |  |

## Updated list of RRC parameters based on company views (First round of email discussions)

MODERATOR COMMENT: Based on the comments from companies, there as need to change the structure of RRC parameters as follows

* Separate RRC parameters for eMTC and NB-IoT
* Each parameter in a separate row and make a separate description for each
* Break ServingSatelliteEphemerisStateVector and ServingSatelliteEphemerisOrbitalParameters up into 6 parameters each
* Update RRC parameters based on RAN1 agreements for NR NTN and IoT NTN
* Alignment with UE features for Column B

It is the view of the moderator that indicating what the changes inred text strikethrough is not suitable way. Instead, the RRC parameters as captured in Version 0.1 of RRC parameter spreadsheet are copied below

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **WI code** | **Sub-feature group** | **RAN1 specification** | **Section** | **RAN2 Parant IE** | **RAN2 ASN.1 name** | **Parameter name in the spec** | **New or existing?** | **Parameter name in the text** | **Description** | **Value range** | **Default value aspect** | **Per (UE, cell, TRP, …)** | **UE-specific or Cell-specific** | **Specification** | **Comment** |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / UE pre-compensation for UL synchronization | 36.213 |   |   |   | ULPre-compensation-NB-r17 | new | UL Time Pre-compensation-NB-r17 | If set, UE does the following:1. UE specific TA calculation on the service link in RRC\_IDLE / RRC\_CONNECTED state based on its GNSS-acquired position and the serving satellite ephemeris.2. UE-specific calculation frequency pre-compensation to counter shift the Doppler experienced on the service link in RRC\_IDLE / RRC\_CONNECTED state based on its GNSS-acquired position and the serving satellite ephemeris. | [0, 1] | 0 | Cell | Cell-specifc | 36.331 | For NB-IoTConfiguration parameter used in the specifications. If it is set, operations related to UE pre-compensation for UL synchronization apply. |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / UE pre-compensation for UL synchronization | 36.213 |   |   |   | NTACommon-NB-r17 | new | NTA common-NB-r17 | NTACommon is a network-controlled common TA, and may include any timing offset considered necessary by the network.NTACommon with value of 0 is supported.  | TBD | 0 | Cell | Cell-specifc | 36.331 | For NB-IoTTBD Value range based on NR NTN progress |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / UE pre-compensation for UL synchronization | 36.213 |   |   |   | ServingSatelliteEphemerisStateVectorX-NB-r17 | new | ServingSatelliteEphemerisStateVectorX-NB-r17 | Indicate the x-coordinate of serving Satellite position state vector in ECEF (m)  | [+/- 42 200 000] | 0 | Per Cell | Cell-specifc | 36.331 | For NB-IoTTBD Value range based on NR NTN progress |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / UE pre-compensation for UL synchronization | 36.213 |   |   |   | ServingSatelliteEphemerisStateVectorY-NB-r17 | new | ServingSatelliteEphemerisStateVectorY-NB-r17 | Indicate the Y-coordinate of serving Satellite position state vector in ECEF (m)  | [+/- 42 200 000] | 0 | Per Cell | Cell-specifc | 36.331 | For NB-IoTTBD Value range for based on NR NTN progress |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / UE pre-compensation for UL synchronization | 36.213 |   |   |   | ServingSatelliteEphemerisStateVectorZ-NB-r17 | new | ServingSatelliteEphemerisStateVectorZ-NB-r17 | Indicate the Y-coordinate of serving Satellite position state vector in ECEF (m)  | [+/- 42 200 000] |   | Per Cell | Cell-specifc | 36.331 | For NB-IoTTBD Value range f based on NR NTN progress |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / UE pre-compensation for UL synchronization | 36.213 |   |   |   | ServingSatelliteEphemerisStateVectorXx-NB-r17 | new | ServingSatelliteEphemerisStateVectorXx-NB-r17 | Indicate the x-coordinate of serving Satellite velocity state vector in ECEF (m)  | [+/- 8000] | 0 | Per Cell | Cell-specifc | 36.331 | For NB-IoTTBD Value range based on NR NTN progress |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / UE pre-compensation for UL synchronization | 36.213 |   |   |   | ServingSatelliteEphemerisStateVectorYx-NB-r17 | new | ServingSatelliteEphemerisStateVectorYx-NB-r17 | Indicate the Y-coordinate of serving Satellite velocity state vector in ECEF (m)  | [+/- 8000] | 0 | Per Cell | Cell-specifc | 36.331 | For NB-IoTTBD Value range for based on NR NTN progress |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / UE pre-compensation for UL synchronization | 36.213 |   |   |   | ServingSatelliteEphemerisStateVectorZx-NB-r17 | new | ServingSatelliteEphemerisStateVectorZx-NB-r17 | Indicate the Y-coordinate of serving Satellite velocity state vector in ECEF (m)  | [+/- 8000] | 0 | Per Cell | Cell-specifc | 36.331 | For NB-IoTTBD Value range f based on NR NTN progress |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / UE pre-compensation for UL synchronization | 36.213 |   |   |   | ServingSatelliteEphemerisSemiMajorAxis-NB-r17 | new | ServingSatelliteEphemerisSemiMajorAxis-NB-r17 | Indicate the following ephemeris orbital parameter for the serving satellite: | [6500 000… 43000 000] | 0 | Per Cell | Cell-specifc | 36.331 | For NB-IoTTBD Value range based on NR NTN progress |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / UE pre-compensation for UL synchronization | 36.213 |   |   |   | ServingSatelliteEphemerisEccentricityE-NB-r17 | new | ServingSatelliteEphemerisEccentricityE-NB-r17 | Indicate the following ephemeris orbital parameter for the serving satellite:- Eccentricity e  | [0…0.015] | 0 | Per Cell | Cell-specifc | 36.331 | For NB-IoTTBD Value range for based on NR NTN progress |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / UE pre-compensation for UL synchronization | 36.213 |   |   |   | ServingSatelliteEphemerisArgumentOfPeriapsis-NB-r17 | new | ServingSatelliteEphemerisArgumentOfPeriapsis-NB-r17 | Indicate the following ephemeris orbital parameter for the serving satellite:- Argument of periapsis ω [rad]  | [0…2π] | 0 | Per Cell | Cell-specifc | 36.331 | For NB-IoTTBD Value range f based on NR NTN progress |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / UE pre-compensation for UL synchronization | 36.213 |   |   |   | ServingSatellite EphemerisLongitudeOfAscendingNode-NB-r17 | new | ServingSatellite EphemerisLongitudeOfAscendingNode-NB-r17 | Indicate the following ephemeris orbital parameter for the serving satellite:- Longitude of ascending node Ω [degrees]  | [-180o… +180o] | 0 | Per Cell | Cell-specifc | 36.331 | For NB-IoTTBD Value range based on NR NTN progress |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / UE pre-compensation for UL synchronization | 36.213 |   |   |   | ServingSatelliteEphemerisInclinationI-NB-r17 | new | ServingSatelliteEphemerisInclinationI-NB-r17 | Indicate the following ephemeris orbital parameter for the serving satellite:- Inclination i [degree]  | [-90o … +90o ] | 0 | Per Cell | Cell-specifc | 36.331 | For NB-IoTTBD Value range for based on NR NTN progress |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / UE pre-compensation for UL synchronization | 36.213 |   |   |   | ServingSatelliteEphemerisMeanAnomalyM-NB-r17 | new | ServingSatelliteEphemerisMeanAnomalyM-NB-r17 | Indicate the following ephemeris orbital parameter for the serving satellite:- Mean anomaly M [rad] at epoch time to | [0… 2π] | 0 | Per Cell | Cell-specifc | 36.331 | For NB-IoTTBD Value range f based on NR NTN progress |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / UL-Synchronization Validity | 36.213 |   |   |   | ntnServingSatULSyncValidityDuration-NB-r17 | new | ntnServingSatULSyncValidityDuration-NB-r17 | A validity duration for UL synchronization configured by the network for UE pre-compensation for UL synchronization which indicates the maximum time during where the UE can be considered to be synchornized on UL without acquiring new satellite ephemeris and common TA parameters if broadcast  | [GEO: up to 2 hours][LEO:  | 0 | Cell | Cell-specifc | 36.331 | For NB-IoTA single validity duration for both serving satellite ephemeris and common TA related parameters is defined at least if serving satellite ephemeris and common TA parameters are signalled in the same SIB message.The validity timer for UL synchronization is started/restarted with configured timer validity duration at the epoch time of the assistance information (i.e. serving satellite ephemeris data).• FFS: Precise definition of epoch time taking into account SIB repetitionsMavenir indicated that validity timer duration for GEO can be up to 2 hours. To be confirmed in RAN1.RAN1 discussed validity timer values in the order of 10 seonds, 30 seconds, or longer for LEO. To be confirmed in RAN1 |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / UL synchronization-Transmission-IoT NTN | 36.213 |   |   |   | TransmissionDurationNPRACH-NB-r17 | new | TransmissionDurationNPRACH-NB-r17 | The UL transmission segment length for NPRACH refers to the duration of time during which the applied pre-compensation shall not be changed by the UE.Configuration of UL transmission segment is indicated on SIB at least for initial access• FFS via UE-specific RRC signalling in RRC\_CONNECTED.Duration of UL transmission segment for UE pre-compensation for NPRACH transmission is a number of NRACH repetition units configured by the network for NB-IoT NTN |  Format 0 and 1:[2.4.(TCP+TSEQ), 4.4.(TCP+TSEQ), 8.4.(TCP+TSEQ), 16.4.(TCP+TSEQ), 32.4.(TCP+TSEQ), 64.4.(TCP+TSEQ)]-Format 2: [2.6.(TCP+TSEQ), 4.6.(TCP+TSEQ), 8.6.(TCP+TSEQ), 16.6.(TCP+TSEQ) ]  | 0 | TBD | TBD | 36.331 | For NB-IoT NTN, the network configures one of K values for the UL transmission segment duration of each PRACH preamble format in a k-bit field, where the size of the k-bit field and the number of K candidate values depend on the preamble format.Format 0 and format 1: 3-bit field, K=6 candidate valuesFormat 2: 2-bit field, K=4 candidate valuesFor NB-IOT, the same value is used for segment durations for all NPRACH preambles for a particular NPRACH formatFFS: Down scoping of K candidate values, size of k-bit field |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / UL synchronization-Transmission-IoT NTN | 36.213 |   |   |   | TransmissionDurationNPUSCH-NB-r17 | new | TransmissionDurationNPUSCH-NB-r17 | The UL transmission segment length for NPUSCH refers to the duration of time during which the applied pre-compensation shall not be changed by the UE.For NB-IoT, maximum 3-bit field with a maximum number of K=8 candidate valuesConfiguration of UL transmission segment is indicated on SIB at least for initial access• FFS via UE-specific RRC signalling in RRC\_CONNECTED.Duration of UL transmission segment for UE pre-compensation for NPUSCH transmission is a number of PUSCH repetition units configured by the network- For NB-IoT, repetition unit is M\_identical^NPUSCH×N\_slot^UL×T\_slot  |  [2 ms, 4 ms, 8 ms, 16 ms, 32 ms, 64 ms, 128 ms, 256 ms ]  | 0 | TBD | TBD | 36.331 | For NB-IoT NTN, the network configures one of K candidate values for the UL transmission segment duration of NPUSCH in a k-bit field.  FFS: Down scoping of K candidate values, size of k-bit field |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / UE pre-compensation for UL synchronizationUplink Time pre-compensation | 36.213 |   |   |   | ULPre-compensation-r17 | new | UL Time Pre-compensation-r17 | If set, UE does the following:1. UE specific TA calculation on the service link in RRC\_IDLE / RRC\_CONNECTED state based on its GNSS-acquired position and the serving satellite ephemeris.2. UE-specific calculation frequency pre-compensation to counter shift the Doppler experienced on the service link in RRC\_IDLE / RRC\_CONNECTED state based on its GNSS-acquired position and the serving satellite ephemeris. | [0, 1] | 0 | Cell | Cell-specifc | 36.331 | For eMTC,Configuration parameter used in the specifications. If it is set, operations related to UE pre-compensation for UL synchronization apply. |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / UE pre-compensation for UL synchronizationUplink Time pre-compensation | 36.213 |   |   |   | NTACommon-r17 | new | NTA common-r17 | NTACommon is a network-controlled common TA, and may include any timing offset considered necessary by the network.NTACommon with value of 0 is supported.  | TBD | 0 | Cell | Cell-specifc | 36.331 | For eMTC,TBD Value range based on NR NTN progress |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / UE pre-compensation for UL synchronizationUplink Time pre-compensation | 36.213 |   |   |   | ServingSatelliteEphemerisStateVectorX-r17 | new | ServingSatelliteEphemerisStateVectorX-r17 | Indicate the x-coordinate of serving Satellite position state vector in ECEF (m)  | [+/- 42 200 000] | 0 | Per Cell | Cell-specifc | 36.331 | For eMTC,TBD Value range based on NR NTN progress |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / UE pre-compensation for UL synchronizationUplink Time pre-compensation | 36.213 |   |   |   | ServingSatelliteEphemerisStateVectorY-r17 | new | ServingSatelliteEphemerisStateVectorY-r17 | Indicate the Y-coordinate of serving Satellite position state vector in ECEF (m)  | [+/- 42 200 000] | 0 | Per Cell | Cell-specifc | 36.331 | For eMTC,TBD Value range for based on NR NTN progress |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / UE pre-compensation for UL synchronizationUplink Time pre-compensation | 36.213 |   |   |   | ServingSatelliteEphemerisStateVectorZ-r17 | new | ServingSatelliteEphemerisStateVectorZ-r17 | Indicate the Y-coordinate of serving Satellite position state vector in ECEF (m)  | [+/- 42 200 000] |   | Per Cell | Cell-specifc | 36.331 | For eMTC,TBD Value range f based on NR NTN progress |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / UE pre-compensation for UL synchronizationUplink Time pre-compensation | 36.213 |   |   |   | ServingSatelliteEphemerisStateVectorXx-r17 | new | ServingSatelliteEphemerisStateVectorXx-r17 | Indicate the x-coordinate of serving Satellite velocity state vector in ECEF (m)  | [+/- 8000] | 0 | Per Cell | Cell-specifc | 36.331 | For eMTC,TBD Value range based on NR NTN progress |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / UE pre-compensation for UL synchronizationUplink Time pre-compensation | 36.213 |   |   |   | ServingSatelliteEphemerisStateVectorYx-NB-r17 | new | ServingSatelliteEphemerisStateVectorYx-r17 | Indicate the Y-coordinate of serving Satellite velocity state vector in ECEF (m)  | [+/- 8000] | 0 | Per Cell | Cell-specifc | 36.331 | For eMTC,TBD Value range for based on NR NTN progress |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / UE pre-compensation for UL synchronizationUplink Time pre-compensation | 36.213 |   |   |   | ServingSatelliteEphemerisStateVectorZx-NB-r17 | new | ServingSatelliteEphemerisStateVectorZx-r17 | Indicate the Y-coordinate of serving Satellite velocity state vector in ECEF (m)  | [+/- 8000] | 0 | Per Cell | Cell-specifc | 36.331 | For eMTC,TBD Value range f based on NR NTN progress |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / UE pre-compensation for UL synchronizationUplink Time pre-compensation | 36.213 |   |   |   | ServingSatelliteEphemerisSemiMajorAxis-NB-r17 | new | ServingSatelliteEphemerisSemiMajorAxis-r17 | Indicate the following ephemeris orbital parameter for the serving satellite: | [6500 000… 43000 000] | 0 | Per Cell | Cell-specifc | 36.331 | For eMTC,TBD Value range based on NR NTN progress |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / UE pre-compensation for UL synchronizationUplink Time pre-compensation | 36.213 |   |   |   | ServingSatelliteEphemerisEccentricityE-NB-r17 | new | ServingSatelliteEphemerisEccentricityE-r17 | Indicate the following ephemeris orbital parameter for the serving satellite:- Eccentricity e  | [0…0.015] | 0 | Per Cell | Cell-specifc | 36.331 | For eMTC,TBD Value range for based on NR NTN progress |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / UE pre-compensation for UL synchronizationUplink Time pre-compensation | 36.213 |   |   |   | ServingSatelliteEphemerisArgumentOfPeriapsis-r17 | new | ServingSatelliteEphemerisArgumentOfPeriapsis-r17 | Indicate the following ephemeris orbital parameter for the serving satellite:- Argument of periapsis ω [rad]  | [0…2π] | 0 | Per Cell | Cell-specifc | 36.331 | For eMTC,TBD Value range f based on NR NTN progress |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / UE pre-compensation for UL synchronizationUplink Time pre-compensation | 36.213 |   |   |   | ServingSatellite EphemerisLongitudeOfAscendingNode-r17 | new | ServingSatellite EphemerisLongitudeOfAscendingNode-r17 | Indicate the following ephemeris orbital parameter for the serving satellite:- Longitude of ascending node Ω [degrees]  | [-180o… +180o] | 0 | Per Cell | Cell-specifc | 36.331 | For eMTC,TBD Value range based on NR NTN progress |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / UE pre-compensation for UL synchronizationUplink Time pre-compensation | 36.213 |   |   |   | ServingSatelliteEphemerisInclinationI-r17 | new | ServingSatelliteEphemerisInclinationI-r17 | Indicate the following ephemeris orbital parameter for the serving satellite:- Inclination i [degree]  | [-90o … +90o ] | 0 | Per Cell | Cell-specifc | 36.331 | For eMTC,TBD Value range for based on NR NTN progress |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / UE pre-compensation for UL synchronizationUplink Time pre-compensation | 36.213 |   |   |   | ServingSatelliteEphemerisMeanAnomalyM-r17 | new | ServingSatelliteEphemerisMeanAnomalyM-r17 | Indicate the following ephemeris orbital parameter for the serving satellite:- Mean anomaly M [rad] at epoch time to | [0… 2π] | 0 | Per Cell | Cell-specifc | 36.331 | For eMTC,TBD Value range f based on NR NTN progress |

## Updated list of RRC parameters based on company views (Second round of email discussions)

**Moderator]:**

Companies are encouraged to provide comments on revised RRC parameters list (section 2.3):

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| --- | --- |
| **Companies** | **Comments**  |
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# Enhancements on 8.15.2 Timing relationship enhancements

## Related RRC parameters

Based on the agreements to date (up to RAN1#106-e) and the companies proposals submitted to RAN1#106-bis-e, a preliminary list of RRC parameters for Rel-17 IoT NTN and related to 8.15.2 Timing relationship enhancements is provided below:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **WI code** | **Sub-feature group** | **RAN1 specification** | **Section** | **RAN2 Parant IE** | **RAN2 ASN.1 name** | **Parameter name in the spec** | **New or existing?** | **Parameter name in the text** | **Description** | **Value range** | **Default value aspect** | **Per (UE, cell, TRP, …)** | **UE-specific or Cell-specific** | **Specification** | **Comment** |
| LTE\_NBIOT\_eMTC\_NTN | Timing relationships-Koffset-IoT NTN | 36.213 |   |   |   | CellspecificKoffset -r17Koffset -r17 | new | Enhancing timing relationships using a time offset | UE receives cell specific Koffset or UE specific KoffsetConfiguration of K\_offset is cell-specific and Update of K\_offset is UE-specificUE applies Koffset in timing relationship The Koffset has a unit of a number of slots. | TBD |   | Cell | Cell-specific | 36.331 | The K\_offset is a scheduling offset used for the identified timing relationships that need to be modified for IoT NTN. It has a unit of a number of slots.For IoT NTN, support cell-specific Koffset configuration for use during initial access.For IoT NTN, support the use of UE-specific Koffset in CONNECTED mode.The Koffset is used for- For NB-IoT, on receiving UL grant on DCI format N0 in subframe n, NPUSCH Format 1 is transmitted with a delay of Koffset as compared to transmission as per current specification.- For NB-IoT, on receiving a NPDSCH with a RAR message that ends in subframe n, the corresponding Msg3 is transmitted on NPUSCH format 1, with a delay of Koffset as compared to transmission as per current specification.- For NB-IoT, a UE upon detection of a NPDSCH transmission for which it should provide an ACK/NACK feedback, shall transmit the HARQ ACK/NACK with a delay of Koffset as compared to transmission as per current specification.- For NB-IoT, on receiving a timing advance command ending in DL subframe n, the corresponding adjustment of the uplink transmission timing by the received time advance shall be delayed by Koffset as compared to current specification. For IoT NTN, no modifications are needed for the calculation in NR NTN for estimate of UE-eNB RTT.FFS Configuration, Value of cell-specific Koffset |

## Company views

Apple R1-2110073 proposed to revise rows for Koffset to use name “enhancing timing relationships using a time offset” and the components toUE receives cell specific $K\_{offset}$ or UE specific $K\_{offset}$ and UE applies $K\_{offset}$ in timing relationship enhancements

* The rows with Koffset and cell-specific Koffset were merged into a new row for Koffset with revised name and description.

ZTE R1-2109851 proposed to add “Configuration of K\_offset” and “Update of K\_offset”.

* It was added that “Configuration of K\_offset is cell-specific” and “Update of K\_offset is UE-specific” into the new row for Koffset

MODERATOR NOTE: We used and revised the R1-2108672 List of Rel-17 RRC parameters for IoT NTN submitted to RAN1#106-e for the revisions and created a new version for RAN1#106bis-e, instead of the list of UE features submitted to RAN1#106-e since the intention is to provide a list of RRC parameters to RAN2.

**Moderator]:**

Companies are encouraged to provide comments on revised RRC parameters list (section 3.1):

|  |  |
| --- | --- |
| **Companies** | **Comments**  |
| Ericsson | * Separate rows are needed for cell-specific K\_offset and UE-specific K\_offset
* Unit of K\_offset is not yet agreed in RAN1.
* The description (column J) of K\_offset should be made clearer. The text in the Comments column is more informative and could be used as starting point.

Again, it is unclear why references are made to documents about UE features, which should not impact the RRC parameter definitions. |
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## Updated list of RRC parameters based on company views (First round of email discussions)

MODERATOR COMMENT: Based on the comments from companies, there as need to change the structure of RRC parameters as follows

* Separate RRC parameters for eMTC and NB-IoT
* Each parameter in a separate row and make a separate description for each
* Break ServingSatelliteEphemerisStateVector and ServingSatelliteEphemerisOrbitalParameters up into 6 parameters each
* Update RRC parameters based on RAN1 agreements for NR NTN and IoT NTN
* Alignment with UE features for Column B

It is the view of the moderator that indicating what the changes inred text strikethrough is not suitable way. Instead, the RRC parameters as captured in Version 0.1 of RRC parameter spreadsheet are copied below

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **WI code** | **Sub-feature group** | **RAN1 specification** | **Section** | **RAN2 Parant IE** | **RAN2 ASN.1 name** | **Parameter name in the spec** | **New or existing?** | **Parameter name in the text** | **Description** | **Value range** | **Default value aspect** | **Per (UE, cell, TRP, …)** | **UE-specific or Cell-specific** | **Specification** | **Comment** |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / Timing relationships enhancements | 36.213 |   |   |   | Koffset-NB -r17 | new | Koffset-NB -r17 | The K\_offset is a scheduling offset used for the timing relationships in RRC\_IDLE or RRC\_CONNECTEDFor IoT NTN, with respect to the granularity, configuration, indication and update of K\_Offset, the mechanisms concluded in NR-NTN shall be taken as baseline as listed below.-When UE is not provided with K\_offset value other than the one signaled in system information, the K\_offset value signaled in system information is used for all timing relationships that require K\_offset enhancement.-Signalling one value for cell-specific K\_offset is supported.-The unit of K\_offset is number of slots for a given subcarrier spacing. For the reference subcarrier spacing value for the unit of K\_offset in FR1, a value of 15 kHz is used.-The UE-specific K\_offset can be provided and updated by network with MAC CE. · FFS: UE can be provided and updated by network with a UE-specific K\_offset in RRC reconfiguration o FFS: Details on whether and how the two solutions work together | (0...X)X is TBD | 0 | Per Cell, Per UE | Cell-specific, UE-specific | 36.331 | For NB-IoTThe Koffset is used for- For NB-IoT, on receiving UL grant on DCI format N0 in subframe n, NPUSCH Format 1 is transmitted with a delay of Koffset as compared to transmission as per current specification.- For NB-IoT, on receiving a NPDSCH with a RAR message that ends in subframe n, the corresponding Msg3 is transmitted on NPUSCH format 1, with a delay of Koffset as compared to transmission as per current specification.- For NB-IoT, a UE upon detection of a NPDSCH transmission for which it should provide an ACK/NACK feedback, shall transmit the HARQ ACK/NACK with a delay of Koffset as compared to transmission as per current specification.- For NB-IoT, on receiving a timing advance command ending in DL subframe n, the corresponding adjustment of the uplink transmission timing by the received time advance shall be delayed by Koffset as compared to current specification. -In IoT NTN, for a random access procedure initiated by a NPDCCH order, the UE shall delay the transmission of the random access preamble by Koffset as compared to the current specification.For IoT NTN, no modifications are needed for the calculation in NR NTN for estimate of UE-eNB RTT.Granularity, periodicy for update of Koffset, contents of UE-specific Koffset are FFS |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / Timing relationships enhancements | 36.213 |   |   |   | K\_mac-NB-r17 | new | K\_mac-NB-r17 | K\_mac is a scheduling offset provided by network if downlink and uplink frame timing are not aligned at gNB. It is needed for UE action and assumption on downlink configuration. | (0…Y)Y is TBD | 0 | Per Cell | Cell-specific | 36.331 | For NB-IoTNR NTN -The information of K\_mac is carried in system information.-The unit of K\_mac is number of slots for a given subcarrier spacing.· FFS: one subcarrier spacing value or different subcarrier spacing values for different scenarios.For NB-IoT, if the UE has initiated an NPUSCH transmission using pre-configured uplink resources ending in subframe n, the UE shall start or restart to monitor the NPDCCH from DL subframe n+4+K\_mac (where K\_mac is defined as in NR-NTN). |
| LTE\_NBIOT\_eMTC\_NTN | TAreport-IoT NTN |   |   |   |   | TA\_Report-NB-r17 | new | TA\_Report-NB-r17 | UE-specific TA reporting is supported in IoT-NTN · FFS: Detailed contents of report | TBD | 0 | Per UE | UE-specific | 36.331 | For NB-IoTNR NTN agreed the granularity of the reported TA is slot.• FFS how to round TA value to slot level granularity |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / Timing relationships enhancements | 36.213 |   |   |   | Koffset-r17 | new | Koffset-r17 | The K\_offset is a scheduling offset used for the timing relationships in RRC\_IDLE or RRC\_CONNECTEDFor IoT NTN, with respect to the granularity, configuration, indication and update of K\_Offset, the mechanisms concluded in NR-NTN shall be taken as baseline as listed below.-When UE is not provided with K\_offset value other than the one signaled in system information, the K\_offset value signaled in system information is used for all timing relationships that require K\_offset enhancement.-Signalling one value for cell-specific K\_offset is supported.-The unit of K\_offset is number of slots for a given subcarrier spacing. For the reference subcarrier spacing value for the unit of K\_offset in FR1, a value of 15 kHz is used.-The UE-specific K\_offset can be provided and updated by network with MAC CE. · FFS: UE can be provided and updated by network with a UE-specific K\_offset in RRC reconfiguration o FFS: Details on whether and how the two solutions work together | (0...X)X is TBD | 0 | Per Cell, Per UE | Cell-specific, UE-specific | 36.331 | The Koffset is used for-For eMTC, on receiving an UL grant via MPDCCH that ends in DL subframe n, PUSCH is transmitted with a delay of Koffset as compared to transmission as per current specification-For eMTC, on receiving a RAR in a PDSCH that ends in subframe n, PUSCH for Msg3 is transmitted with a delay of Koffset as compared to transmission as per current specification.-For eMTC, when an MPDCCH ending in subframe n activates UL SPS, the time of the first subframe in which the UE is allowed to transmit SPS-PUSCH is delayed by Koffset as compared to transmission per current specification.-For eMTC, on reception of a PDSCH ending in subframe n, the corresponding HARQ-ACK feedback on PUCCH is transmitted with a delay of Koffset as compared to transmission as per current specification.-For eMTC, for an MPDCCH received in subframe n that triggers aperiodic SRS transmission, SRS is transmitted with a delay of Koffset as compared to transmission as per current specification.-For eMTC, on receiving a timing advance command ending in subframe n, the corresponding adjustment of the uplink transmission timing by the received time advance shall be delayed by Koffset as compared to current specification.-In IoT NTN, for a random access procedure initiated by a MPDCCH order, the UE shall delay the transmission of the random access preamble by Koffset as compared to the current specification.-For eMTC in IoT NTN, if the UE determines that a preamble retransmission is necessary, the choice of a suitable preamble retransmission subframe shall be delayed by Koffset as compared to current specifications.For IoT NTN, no modifications are needed for the calculation in NR NTN for estimate of UE-eNB RTT.Granularity, periodicy for update of Koffset, contents of UE-specific Koffset are FFS |
| LTE\_NBIOT\_eMTC\_NTN | Basic IoT over NTN support / Timing relationships enhancements | 36.213 |   |   |   | K\_mac-r17 | new | K\_mac-r17 | K\_mac is a scheduling offset provided by network if downlink and uplink frame timing are not aligned at gNB. It is needed for UE action and assumption on downlink configuration. | (0…Y)Y is TBD | 0 | Per Cell | Cell-specific | 36.331 | NR NTN -The information of K\_mac is carried in system information.-The unit of K\_mac is number of slots for a given subcarrier spacing.· FFS: one subcarrier spacing value or different subcarrier spacing values for different scenarios.For eMTC, if the UE has initiated an PUSCH transmission using pre-configured uplink resources ending in subframe n, the UE shall start or restart to monitor the MPDCCH from DL subframe n+4+K\_mac (where K\_mac is defined as in NR-NTN). |
|   | TAreport-IoT NTN |   |   |   |   | TA\_Report-r17 | new | TA\_Report-r17 | UE-specific TA reporting is supported in IoT-NTN · FFS: Detailed contents of report | TBD | 0 | Per UE | UE-specific | 36.331 | NR NTN agreed the granularity of the reported TA is slot.• FFS how to round TA value to slot level granularity |

## Updated list of RRC parameters based on company views (Second round of email discussions)

**Moderator]:**

Companies are encouraged to provide comments on revised RRC parameters list (section 3.3):

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| --- | --- |
| **Companies** | **Comments**  |
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# Reference

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|  |  |
|  | 1. R1-2108672 List of RRC parameter for Rel-17 IoT-NTN, up to RAN1 #106-e, Moderator (MediaTek)
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