3GPP TSG RAN WG1 #122 R1-2506398

Bengaluru, India, Aug 25th – 29th, 2025

**Agenda item:** 8.11.5

**Source:** Qualcomm Incorporated

**Title:** Feature lead summary #1 on IoT-NTN TDD mode

**Document for:** Discussion

# Introduction

In this contribution we summarize the issues brought up to RAN1#122. All the proposals from the contributions are listed, and discussion is highlighted as **\*\* High \*\*** or **\*\*Low\*\*** depending on FL’s perceived priority of the different proposals.

# Overall description (36.300)

## 2.1 Relevant input from contributions

#### [HW]

***Proposal 1: Capture TP#1 in subclause 5.0 in TS 36.300.***

* ***Reason for change: There are subframes undefined in TDD pattern.***
* ***Summary of change: The undefined 24 subframes after UL subframes are defined as guard periods.***
* ***Consequence if not approved: The definition of TDD pattern is not complete.***

|  |
| --- |
| -------------------- Start of TP#1 for CR of 36.300 --------------------\*\*\* Unchanged parts are omitted \*\*\*5.0 Frame structures and channelsDownlink and uplink transmissions are organized into radio frames with 10 ms duration. Three radio frame structures are supported:- Type 1, applicable to FDD;- Type 2, applicable to TDD;*…*For IoT-NTN TDD mode, Frame Structure Type-1 is used where uplink and downlink transmissions are separated in the time domain and constitute of set of D non-overlapping usable contiguous DL subframes and set of U usable contiguous UL subframes separated by fixed guard periods (GP). This pattern is repeated every N radio frames. IoT-NTN TDD mode is applicable for the IoT-NTN TDD band (1616-1626.5 MHz) specified in [36.102].\*\*\* Unchanged parts are omitted \*\*\*-------------------- End of TP#1 for CR of 36.300 -------------------- |

## 2.2 Feature lead proposal

The proposal from [HW] is simple and in FL’s view technically correct (since there are two guard periods). One issue of the proposal is that 36.300 is a RAN2 specification and we would need to send an updated LS. FL makes the following proposal:

**Proposal 2-1: The following TP (36.300) is endorsed from RAN1 perspective.**

* **Send the endorsed TP in an LS to RAN2.**
* **Highlight in the LS “The change is to correctly capture that there are two guard periods in the frame structure: one before the uplink subframes and one after the uplink subframes.”**

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| --- |
| -------------------- Start of TP#1 for CR of 36.300 --------------------\*\*\* Unchanged parts are omitted \*\*\*5.0 Frame structures and channelsDownlink and uplink transmissions are organized into radio frames with 10 ms duration. Three radio frame structures are supported:- Type 1, applicable to FDD;- Type 2, applicable to TDD;*…*For IoT-NTN TDD mode, Frame Structure Type-1 is used where uplink and downlink transmissions are separated in the time domain and constitute of set of D non-overlapping usable contiguous DL subframes and set of U usable contiguous UL subframes separated by fixed guard periods (GP). This pattern is repeated every N radio frames. IoT-NTN TDD mode is applicable for the IoT-NTN TDD band (1616-1626.5 MHz) specified in [36.102].\*\*\* Unchanged parts are omitted \*\*\*-------------------- End of TP#1 for CR of 36.300 -------------------- |

#### Q2-1: Please provide your comments on Proposal 2-1:

|  |  |
| --- | --- |
| Company | Comment |
| Lenovo | We are fine with the proposal in general.Do we need to consider the following update to make the LS clearer?**Highlight in the LS “The change is to correctly capture that there are two guard periods in every N radio frames ~~in the frame structure~~: one before the uplink subframes and one after the uplink subframes.”** |
| Ericsson | We are ok with Proposal 2-1, changing the word “period” from singular to plural is sufficient since a more detailed description around it is provided in section 4.4 of TS 36.211.  |
| OPPO | We are OK with the proposal. And for better alignment with RAN1 agreement, it can be further clarified that the fixed guard period of Frame structure Type-1 is defined at the ULSRP, as follows:-------------------- Start of TP#1 for CR of 36.300 --------------------\*\*\* Unchanged parts are omitted \*\*\*For IoT-NTN TDD mode, Frame Structure Type-1 is used where uplink and downlink transmissions are separated in the time domain and constitute of set of D non-overlapping usable contiguous DL subframes and set of U usable contiguous UL subframes separated by fixed guard periods (GP) at the uplink time synchronization reference point defined in clause 16.1.2 of TS 36.213 [6]. This pattern is repeated every N radio frames. IoT-NTN TDD mode is applicable for the IoT-NTN TDD band (1616-1626.5 MHz) specified in [36.102]\*\*\* Unchanged parts are omitted \*\*\*-------------------- End of TP#1 for CR of 36.300 -------------------- |
| Vivo1 | fine |
| Nordic  | OK |
| ZTE | TP in section 3 can be discussed first. |
| Spreadtrum | Fine |
| LGE | It would be good to have the sentence something like TP in section 3.2. As we know, there is a single GP between the set of contiguous DL subframes and the set of contiguous UL subframes in a period. There is another GP between the set of contiguous UL subframes in the period and the set of contiguous DL subframes in the next period.  |

# Frame structure description (36.211)

## 3.1 Relevant input from contributions

#### [HW]:

***Proposal 2: Capture TP#2 in subclause 4.4 in TS 36.211.***

* ***Reason for change: There are subframes undefined in TDD pattern.***
* ***Summary of change: The undefined 24 subframes after UL subframes are defined as guard periods.***
* ***Consequence if not approved: The definition of TDD pattern is not complete.***

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| --- |
| -------------------- Start of TP#2 for CR of 36.211 --------------------\*\*\* Unchanged parts are omitted \*\*\*4.4 Frame structure type 1 for NTN-TDDFrame structure type 1 is applicable to NTN-TDD in band 249. Each radio frame is $T\_{f}=307200T\_{s}=10 ms$ long and consists of 10 subframes of length $30720T\_{s}=1 ms$, numbered from 0 to 9. Subframe $i$ in frame $n\_{f}$ has an absolute subframe number $n\_{sf}^{abs}=10n\_{f}+i$ where $n\_{f}$ is the system frame number.The frame structure for NTN-TDD, at the uplink time synchronization reference point defined in clause 16.1.2 of TS 36.213 [4], consists of 8 consecutive downlink subframes, followed by 50 consecutive guard period subframes, followed by 8 consecutive uplink subframes, followed by 24 consecutive guard period subframes in each 90 ms interval.- The UE shall not assume any signal or channel being transmitted in subframes other than downlink subframes 3, 4, 5, 6, 7, 8, 9, and 0 across two consecutive radio frames.- The UE shall not transmit any signal or channel on a subframe other than the 8 consecutive uplink subframes.\*\*\* Unchanged parts are omitted \*\*\*-------------------- End of TP#2 for CR of 36.211 -------------------- |

#### [E//]:

|  |
| --- |
| --------------------------------------------------------- Text Starts ---------------------------------------------------------4.4 Frame structure type 1 for NTN-TDDFrame structure type 1 is applicable to NTN-TDD in band 249. Each radio frame is $T\_{f}=307200T\_{s}=10 ms$ long and consists of 10 subframes of length $30720T\_{s}=1 ms$, numbered from 0 to 9. Subframe $i$ in frame $n\_{f}$ has an absolute subframe number $n\_{sf}^{abs}=10n\_{f}+i$ where $n\_{f}$ is the system frame number.The frame structure for NTN-TDD, at the uplink time synchronization reference point defined in clause 16.1.2 of TS 36.213 [4] consists of *D* = 8 consecutive downlink subframes, followed by 50 consecutive guard period subframes, followed by *U* = 8 consecutive uplink subframes, followed by 24 consecutive guard period subframes in each 90 ms interval.- The UE shall not assume any signal or channel being transmitted in subframes other than downlink subframes 3, 4, 5, 6, 7, 8, 9, and 0 across two consecutive radio frames.- The UE shall not transmit any signal or channel on a subframe other than the 8 consecutive uplink subframes.---------------------------------------------------------- Text Ends --------------------------------------------------------- |

#### [CATT]:

Adopt the following TP:

4.4 Frame structure type 1 for NTN-TDD

Frame structure type 1 is applicable to NTN-TDD in band 249. Each radio frame is $T\_{f}=307200T\_{s}=10 ms$ long and consists of 10 subframes of length $30720T\_{s}=1 ms$, numbered from 0 to 9. Subframe $i$ in frame $n\_{f}$ has an absolute subframe number $n\_{sf}^{abs}=10n\_{f}+i$ where $n\_{f}$ is the system frame number.

The frame structure for NTN-TDD , at the uplink time synchronization reference point defined in clause 16.1.2 of TS 36.213 [4] consists of 8 consecutive downlink subframes, followed by 50 consecutive guard period subframes, followed by 8 consecutive uplink subframes in each 90 ms interval. The remaining subframes within each 90 ms interval is functioned as GP.

- The UE shall not assume any signal or channel being transmitted in subframes other than downlink subframes 3, 4, 5, 6, 7, 8, 9, and 0 across two consecutive radio frames.

- The UE shall not transmit any signal or channel on a subframe other than the 8 consecutive uplink subframes.

#### [SS]:

Frame structure type 1 is applicable to NTN-TDD in band 249. Each radio frame is $T\_{f}=307200T\_{s}=10 ms$ long and consists of 10 subframes of length $30720T\_{s}=1 ms$, numbered from 0 to 9. Subframe $i$ in frame $n\_{f}$ has an absolute subframe number $n\_{sf}^{abs}=10n\_{f}+i$ where $n\_{f}$ is the system frame number.

The frame structure for NTN-TDD , at the uplink time synchronization reference point defined in clause 16.1.2 of TS 36.213 [4] consists of 8 consecutive downlink subframes, followed by 50 consecutive guard period subframes, followed by 8 consecutive uplink subframes, followed by 22 consecutive guard period subframes in each 90 ms interval.

- The UE shall not assume any signal or channel being transmitted in subframes other than downlink subframes 3, 4, 5, 6, 7, 8, 9, and 0 across two consecutive radio frames.

- The UE shall not transmit any signal or channel on a subframe other than the 8 consecutive uplink subframes

## 3.2 Feature lead proposal

All the proposals seem to go in the same direction by stating that there are 24 guard period subframes after the uplink subframes, which is in lie with previous RAN1 agreements. FL makes the following proposal:

**Proposal 3-1: Adopt the following TP for 36.211**

* **Reason for change: There are subframes undefined in TDD pattern.**
* **Summary of change: The 24 subframes after UL subframes are defined as guard periods.**
* **Consequence if not approved: The definition of TDD pattern is not complete.**

|  |
| --- |
| 4.4 Frame structure type 1 for NTN-TDDFrame structure type 1 is applicable to NTN-TDD in band 249. Each radio frame is $T\_{f}=307200T\_{s}=10 ms$ long and consists of 10 subframes of length $30720T\_{s}=1 ms$, numbered from 0 to 9. Subframe $i$ in frame $n\_{f}$ has an absolute subframe number $n\_{sf}^{abs}=10n\_{f}+i$ where $n\_{f}$ is the system frame number.The frame structure for NTN-TDD, at the uplink time synchronization reference point defined in clause 16.1.2 of TS 36.213 [4], consists of 8 consecutive downlink subframes, followed by 50 consecutive guard period subframes, followed by 8 consecutive uplink subframes, followed by 24 consecutive guard period subframes in each 90 ms interval.- The UE shall not assume any signal or channel being transmitted in subframes other than downlink subframes 3, 4, 5, 6, 7, 8, 9, and 0 across two consecutive radio frames.- The UE shall not transmit any signal or channel on a subframe other than the 8 consecutive uplink subframes.\*\*\* Unchanged parts are omitted \*\*\* |

#### \*\* High \*\* Q3-1: Please provide your comments on Proposal 3-1:

|  |  |
| --- | --- |
| Company | Comment |
| Lenovo | We are fine with the proposal |
| Ericsson | Ok with the proposal, but we believe that we should also include the variables “D” and “U,” since TS 36.213 points to those variables in TS 36.211 (i.e., “the value of *D* defined in [3]” and “the value of *U* defined in [3]”), however those variables have not been defined.Thus, we suggest to include them as follows:The frame structure for NTN-TDD, at the uplink time synchronization reference point defined in clause 16.1.2 of TS 36.213 [4] consists of *D* = 8 consecutive downlink subframes, followed by 50 consecutive guard period subframes, followed by *U* = 8 consecutive uplink subframes, followed by 24 consecutive guard period subframes in each 90 ms interval. |
| OPPO | OK |
| Vivo1 | fine |
| Nordic  | OK |
| ZTE | OK |
| Spreadtrum | Fine |
| LGE | OK |

# PRACH gaps (36.211)

## 4.1 Relevant input from companies

#### [vivo]

===omitted===

A NPRACH configuration provided by higher layers contains the following:

- NPRACH resource periodicity (*nprach-Periodicity*),

- frequency location of the first subcarrier allocated to NPRACH  (*nprach-SubcarrierOffset*),

- number of subcarriers allocated to NPRACH  (*nprach-NumSubcarriers*),

- number of starting sub-carriers allocated to UE initiated random access  *(nprach-NumCBRA-StartSubcarriers*),

- number of NPRACH repetitions per attempt  (*numRepetitionsPerPreambleAttempt*),

- NPRACH starting time  (*nprach-StartTime*),

- Fraction for calculating starting subcarrier index for the range of NPRACH subcarriers reserved for indication of UE support for multi-tone msg3 transmission  (*nprach-SubcarrierMSG3-RangeStart*).

NPRACH transmission can start only  time units after the start of a radio frame fulfilling . For frame structure type 1 for FDD, after transmissions of  time units for preamble formats 0 and 1, or $16∙6(T\_{CP}+T\_{SEQ})$ time units for preamble format 2, a gap of  time units shall be inserted.

## 4.2 Feature lead proposal

RAN1 has agreed that uplink gaps do not apply to NB-IoT NTN TDD. The agreement is not correctly captured in 36.211 and FL’s view is that the TP above is correct.

**Proposal 4-1: Adopt the following TP for 36.211**

* **Reason for change: RAN1 agreed that uplink gaps do not apply to NB-IoT NTN TDD.**
* **Summary of change: Clarify that uplink gaps only apply to frame structure type 1 for FDD.**
* **Consequence if not approved: Specification is not in line with RAN1 agreements.**

|  |
| --- |
| 10.1.6.1 Time and frequency structure<Unchanged parts are omitted>NPRACH transmission can start only  time units after the start of a radio frame fulfilling . For frame structure type 1 for FDD, after transmissions of  time units for preamble formats 0 and 1, or $16∙6(T\_{CP}+T\_{SEQ})$ time units for preamble format 2, a gap of  time units shall be inserted.<Unchanged parts are omitted> |

#### \*\* High \*\* Q4-1: Please provide your comments on Proposal 4-1:

|  |  |
| --- | --- |
| Company | Comment |
| Lenovo | We are fine with the propsal |
| Ericsson | Ok with Proposal 4-1 |
| OPPO | OK |
| Vivo1 | support |
| Nordic  | Support |
| ZTE | OK |
| Spreadtrum | Fine  |
| LGE | OK |

# GNSS measurement gaps (36.211)

## 5.1 Relevant input from companies

#### [Xiaomi]:

\*\*\*TS 36.213 S16.10\*\*\*

16.10 GNSS measurement gap related procedures

For a NB-IoT UE in a NTN FDD or TDD serving cell, when the UE receives a GNSS Measurement Command MAC CE in a NPDSCH ending in DL subframe n,

- if the UE shall not provide HARQ-ACK information for the HARQ process associated with the transport block in the NPDSCH carrying GNSS Measurement Command MAC CE,

- the UE shall assume the start of the measurement gap in subframe n+13

- otherwise,

- the UE shall assume the start of the measurement gap in subframe k+2, where k is the first DL subframe after the end of the transmission of the NPUSCH carrying ACK/NACK response for the HARQ process associated with the transport block in the NPDSCH.

For a NB-IoT UE in a NTN serving cell, the UE is not required to monitor NPDCCH within the GNSS measurement gap duration, until it reacquires GNSS position and a contention based Random Access is performed as specified in TS 36.321 [8].

\*\*\*TS 36.213 S16.10\*\*\*

## 5.2 Feature lead proposal

FL’s view is that, although the text proposal above is technically correct, it is also unnecessary. If there is no further qualification of the term “NTN” in the specifications it should be understood that it applies to all NTN cases (FDD or TDD). Companies are encouraged to comment on this TP:

#### \*\* Low \*\* Q5-1: Please provide your comments on the TP above, and state if the TP is needed (and why)

|  |  |
| --- | --- |
| Company | Comment |
| Lenovo | We share the similar view as FL, and the corresponding CR proposal is not needed. |
| OPPO | Similar view as FL and Lenovo. |
| Vivo1 | Share similar view as FL |
|  Nordic  | Agree we FL assessment |
| Spreadtrum | Agree with FL |

# NPDCCH periodicities (36.211)

## 6.1 Relevant input from companies

#### [Xiaomi]:

Xiaomi is proposing to capture the following agreement in RAN1 specifications as follows:

Agreement

Confirm the following WA with the following modification

For NPDCCH monitoring, new periodicities are introduced for NPDCCH monitoring by ~~scaling the periodicity by a scaling factor F = 11.25~~ supporting values of G={11.25\*4, 11.25\*8} instead of G={4,8}

\*\*\*Unchanged part omitted\*\*\*

The locations of starting subframe  are given by where is the th consecutive NB-IoT DL subframe from subframe , excluding subframes used for transmission of SI messages, and , and , and where

- subframe  is a subframe satisfying the condition , where , *T*≥4.

- for NPDCCH UE-specific search space,

- is given by the higher layer parameter *npdcch-StartSF-USS*, except for NPDCCH candidates associated with PUR-RNTI in which case it is given by higher layer parameter *npdcch-StartSF-USS* in *PUR-Config-NB*, and G is equal to ‘45’ or ‘90’ when ‘v4‘ or ‘v8’ is provided for a NB-IoT UE in a NTN TDD serving cell,

- is given by the higher layer parameter *npdcch-Offset-USS*, except for NPDCCH candidates associated with PUR-RNTI in which case it is given by higher layer parameter *npdcch-Offset-USS* in *PUR-Config-NB*,

- for NPDCCH Type2-NPDCCH common search space,

- is given by the higher layer parameter *npdcch-StartSF-CSS-RA*, and G is equal to ‘45’ or ‘90’ when ‘v4‘ or ‘v8’ is provided for a NB-IoT UE in a NTN TDD serving cell,

- is given by the higher layer parameter *npdcch-Offset-RA*,

- for NPDCCH Type2A-NPDCCH common search space,

- is given by the higher layer parameter *npdcch-startSF-SC-MTCH*, and G is equal to ‘45’ or ‘90’ when ‘v4‘ or ‘v8’ is provided for a NB-IoT UE in a NTN TDD serving cell,

- is given by the higher layer parameter *npdcch-Offset-SC-MTCH*,

For Type1-NPDCCH common search space,and is determined from locations of NB-IoT paging opportunity subframes.

For Type1A-NPDCCH common search space, and subframe  is a subframe satisfying the condition , where , *T*≥4 and

- is given by the higher layer parameter *npdcch-StartSF-SC-MCCH*, and G is equal to ‘45’ or ‘90’ when ‘v4‘ or ‘v8’ is provided for a NB-IoT UE in a NTN TDD serving cell,

- is given by the higher layer parameter *npdcch-Offset-SC-MCCH.*

\*\*\*Unchanged part omitted\*\*\*

## 6.2 Feature lead proposal

In R1-2503242, RAN1 sent an LS to RAN2 on the RRC parameters. For IOT NTN TDD, the following rows were agreed (some columns removed for brevity, and highlighted added):

|  |  |  |  |
| --- | --- | --- | --- |
| **WI code** | **RAN2 Parent IE** | **Value range** | **Comment** |
| IoT\_NTN\_TDD | SC-MTCH-Info-NB-r14, NPDCCH-SC-MCCH-Config-NB-r14, NPDCCH-ConfigDedicated-NB-r13, NPRACH-Parameters-NB-r13, NPRACH-Parameters-NB-r14, NPRACH-ParametersFmt2-NB-r15 | {v1dot5, v2, v4\*11.25, v8\*11.25, v16, v32, v48, v64} | AgreementConfirm the following WA with the following modificationFor NPDCCH monitoring, new periodicities are introduced for NPDCCH monitoring by supporting values of G={11.25\*4, 11.25\*8} instead of G={4,8}NOTE: It is up to RAN2 how to implement this agreement (e.g. keeping the same codepoints as in legacy but with a NOTE that for NBIOT NTN TDD 4/8 are interpreted as 4\*11.25/8\*11.25)NOTE: The new value of G should be applied to all defined search spaces (npdcch-StartSF-SC-MCCH-r14, npdcch-StartSF-USS-r13, npdcch-StartSF-CSS-RA-r13, npdcch-StartSF-CSS-RA-r14, npdcch-StartSF-CSS-RA-r15,  |

It is FL’s understanding that this issue will be handled by RAN2 and no further specification impact in RAN1 is expected. Companies are encouraged to comment on this issue

#### \*\* Low \*\* Q6-1: Please provide your comments on the TP above, and state if the TP is needed (and why)

|  |  |
| --- | --- |
| Company | Comment |
| Lenovo | We share the similar view as FL, and corresponding CR proposal is not needed.TS36.331 editor will update the note for each RRC parameter (e.g., the value range of parameter for TDD and FDD will be updated in the parameter note). |
| Ericsson | We believe that it can be handled by RAN2 without incurring in additional RAN1 specification impacts. |
| OPPO | We share the similar view as FL, Lenovo and E/// that only RAN2’s specification impact is expected. |
| Vivo1 | Share similar view as FL |
| Nordic  | TO our knowledge above changes were capture already in RAN2 CR |
| ZTE | Can be handled by RAN2 |

# NPDCCH start subframe offset

## 7.1 Relevant input from companies

#### [Iri]

**Conclusion 1:** The $α\_{offset}$ value which can result in fractional value of $T\* α\_{offset}$ can be avoided by implementation.

**Proposal 1:** The existing NPDCCH start subframe offset parameter values, along with the current method for calculating the start of the search space, are sufficient. No further enhancements are required.

#### [TH]

**Proposal 1:**

**For the issue of handling the NPDCCH offset, support Option 5: No enhancements are specified in Rel-19.**

## 7.2 Feature lead proposal

For the first issue brought up by Iridium (fractional value of $T\* α\_{offset}$), FL thinks it is not an issue since current 36.213 already has a *floor()* in that equation, e.g.:



Therefore there is no need to clarify the behavior in the case $T⋅ α\_{offset}$ is integer.

#### \*\* Low \*\* Q7-1: Please comment on above’s FL view. If you think there is a need for a conclusion on handling fractional values, please elaborate your answer

|  |  |
| --- | --- |
| Company | Comment |
| Lenovo | We share the similar view as FL, and corresponding conclusion proposal is not needed. |
| OPPO | We agree with FL that further discussion is not needed. |
| Vivo1 | Agree with FL that no further discussion is needed. |
| Nordic  | Agree |
| ZTE | Further discussion is not needed. |

On the 2nd issue (how to handle NPDCCH offsets), it should be understood that no further enhancements are needed. Although FL’s view is that no further agreement is strictly needed, RAN1 may want to agree to a conclusion to capture RAN1’s understanding.

**Proposal 7-2 (Conclusion): For the issue of handling NPDCCH offsets: No further enhancements are specified in Rel-19.**

#### \*\* Low \*\* Q7-2: Please comment on proposal 7-2

|  |  |
| --- | --- |
| Company | Comment |
| Lenovo | Since there is no further agreement to enhance the NPDCCH offsets and current specification is aligned with existing agreements, there is no need to have this conclusion. |
| OPPO | We agree with Lenovo that the conclusion is not necessary. |
| Vivo1 | agree with Lenovo that the conclusion is not necessary. |
| Nordic  | Agree |
| ZTE | No need of conclusion. |

# NRS availability (36.211)

## 8.1 Relevant input from companies

#### [QC]

**Proposal 1: Before acquiring *operationModeInfo* and before obtaining *SystemInformationBlockType1-NB*, the UE may assume NRS is present in all D-subframes not carrying sync signals.**

Before a UE obtains *operationModeInfo*:

- If frame structure type 1 is used in FDD, the UE may assume narrowband reference signals (NRSs) are transmitted in subframes #0 and #4 and in subframes #9 not containing NSSS.

- If frame structure type 2 is used, the UE may assume narrowband reference signals (NRSs) are transmitted in subframes #9 and in subframes #0 not containing NSSS.

- If frame structure type 1 is used in NTN TDD, the UE may assume narrowband reference signals (NRSs) are transmitted in subframes #0, #3, #4, #6, #7, #8 and in subframes #9 not containing NSSS within the *D* consecutive downlink subframes according to the TDD pattern.

On an NB-IoT carrier for which a UE receives higher-layer parameter *operationModeInfo* indicating *guardband* or *standalone.*

- If frame structure type 1 is used in FDD, before the UE obtains *SystemInformationBlockType1-NB*, the UE may assume narrowband reference signals are transmitted in subframes #0, #1, #3, #4 and in subframes #9 not containing NSSS.

- If frame structure type 2 is used, before the UE obtains *SystemInformationBlockType1-NB*, the UE may assume narrowband reference signals are transmitted in subframes #9, and in subframes #0 not containing NSSS, and in subframes #4 if subframes #4 is configured for *SystemInformationBlockType1-NB* transmissions.

- If frame structure type 1 is used, after the UE obtains *SystemInformationBlockType1-NB*, the UE may assume narrowband reference signals are transmitted in subframes #0, #1, #3, #4, subframes #9 not containing NSSS, and in NB-IoT downlink subframes.

- If frame structure type 2 is used, after the UE obtains *SystemInformationBlockType1-NB*, the UE may assume narrowband reference signals are transmitted in subframes #9, subframes #0 not containing NSSS, in subframes #4 if subframes #4 is configured for *SystemInformationBlockType1-NB* transmissions, and in NB-IoT downlink subframes.

- If frame structure type 1 is used in NTN TDD, the UE may assume narrowband reference signals (NRSs) are transmitted in subframes #0, #3, #4, #6, #7, #8 and in subframes #9 not containing NSSS within the *D* consecutive downlink subframes according to the TDD pattern.

## 8.2 Feature lead proposal

Qualcomm is proposing to align 36.211 NRS assumptions to the agreement that the valid bitmap is not applicable to NB-IoT NTN TDD. This was briefly discussed in previous meetings with no conclusion.

#### \*\* High \*\* Q8-1: Please provide your views on the TP above

|  |  |
| --- | --- |
| Company | Comment |
| Lenovo | We need a new agreement to support the corresponding CR. |
| OPPO | We think the legacy UE behaviour should be reused as much as possible, the NRS assumptions can be discussed case by case. For example, before a UE obtains *operationModeInfo*, the NRS assumption is used for NPBCH detection, and the legacy UE assumes that NRSs are transmitted in subframes #0 and #4 and in subframes #9 not containing NSSS. When it comes to NTN-TDD frame structure, we support that the UE still assumes that NRSs are transmitted in subframes #0 and #4 and in subframes #9 not containing NSSS within the D consecutive downlink subframes, and the specification impact can be further discussed. |
| Vivo1 | Since there is no issue with PBCH/SIB1 decoding under the legacy NRS assumption in the FDD case, the legacy NRS assumption should also work for TDD and the proposed change for TDD appears to be an optimization. As suggested by OPPO, the legacy NRS assumption can be maintained. |
| Nordic  | Based on previous studies we know that SIB1 is the most challenging among initial access techniques. Proposed NRS assumption would allow for better synchronization at the UE. Nordic is open to specify such assumption.. |
| ZTE | In the study phase, no decoding issue is identified based on the existing spec. As minimized spec impact is preferred for IoT-NTN TDD mode especially in maintenance phase, the legacy NRS assumption is preferred. |
| LGE | For better understanding, it would be necessary to clarify how the companies assume the channel estimation and RS density to provide PBCH performance. If the NRS pattern based on the existing specification is assumed for PBCH performance with TDD mode, we echo other companies’ view.  |

# Support of non-anchor carriers

## 9.1 Relevant input from companies

#### [QC]

**Proposal 2: The set of D-subframes in the non-anchor carrier is the same as the set of D-subframes in the anchor carrier, and is transmitted at the same time.**

**Proposal 3: In a non-anchor carrier, the UE can assume NRSs are transmitted in subframes #3, #4, #5, #6, #7, #8, #9, #0 contained within the set of *D*=8 usable consecutive downlink subframes in the TDD structure**

## 9.2 Feature lead proposal

Qualcomm proposes to clarify how the TDD frame is captured for non-anchor carriers, and also the NRS availability. Feature lead welcomes comments on the two above proposals:

#### \*\* High \*\* Q9-1: Please provide your views on the two proposals above regarding non-anchor carriers

|  |  |
| --- | --- |
| Company | Comment |
| Lenovo | We think there is a need to discuss whether NTN-TDD is adopted in non-anchor carrier first. |
| OPPO | The WID approved that the NTN-TDD mode is specified for standalone deployment with anchor and non-anchor carriers, so the NTN-TDD frame structure should also be applicable to non-anchor carriers. For simplicity, we support Proposal 2 to use the same TDD pattern in the anchor and non-anchor carriers.Regarding Proposal 3, further discussion is needed because the legacy NRS assumptions only depends on the NPDCCH/NPDSCH transmission. |
| Vivo1 | Proposal 3 depends on Q8-1 and should be postponed.We are fine with the first half of proposal2, but we are not sure if the second half “and is transmitted at the same time” is necessary, as this seems to be part of NW operation. |
| Nordic  | Non-anchors are essential. We are supportive of proposal. It saves a UE from frequent re-tuning.  |
| ZTE | For proposal 2, open to further discuss non-anchor carrier.For proposal 3, Q8.1 can be discussed first. |
| LGE | On Proposal 2, according to WID, the work objectives assume standalone deployment with anchor and non-anchor carriers (i.e. operating in carrier(s) used only for NB-IoT). Since we agreed a single TDD pattern, it would be straight forward to apply the agreement for the TDD pattern to the non-anchor carrier.  |

# Pre-compensation (36.213)

## 10.1 Relevant input from companies

#### [oppo]

* Reason for change

It is not specified how to adjust time and frequency pre-compensation in NTN TDD.

* Summary of change

It is specified that the UE may adjust its time/frequency pre-compensation before the beginning of each set of consecutive 8 uplink subframes in NTN TDD.

* Consequences if not approved

Time and frequency pre-compensation adjustment is not supported in NTN TDD.

-------------------- start of TP#1 for 36.213 --------------------

**16.1.2 Timing synchronization**

\*\*\* Unchanged parts are omitted \*\*\*

For a NB-IoT UE communicating over NTN FDD, time and frequency pre-compensation is adjusted per uplink segment with a transmission duration of $N\_{segment}^{precompensation}$ time units, where the quantity $N\_{segment}^{precompensation}$ is provided by higher layers, as specified in 3GPP TS 36.331 [11].

For a NB-IoT UE communicating over NTN TDD, time and frequency pre-compensation may be adjusted per *U* consecutive uplink subframes according to the TDD pattern and the value of *U* defined in [3].

\*\*\* Unchanged parts are omitted \*\*\*

-------------------- end of TP#1 ---------------------------------

## 10.2 Feature lead proposal

FL’s view is that the proposal above seems to be technically correct, but it may overlap with RAN4 specifications. Companies are encouraged to comment on the TP and whether it is needed or not:

#### \*\* High \*\* Q10-1: Please provide your views on the TP above

|  |  |
| --- | --- |
| Company | Comment |
| Lenovo | We share the similar view as FL, and we don’t need to have the CR in RAN1 specification. |
| OPPO | 36.213 only specifies the segmented time and frequency pre-compensation for NTN-FDD, and the pre-compensation for NTN-TDD is not provided. In the last meeting, we have agreed that “The UE may adjust its time/frequency pre-compensation before the beginning of each set of consecutive 8 uplink subframes”, so it should be captured in the RAN1 specification to make the UE behaviour clear.Regarding the potential overlap with RAN4 specification mentioned by FL, the precedent for segmented time/frequency pre-compensation for NTN FDD already exists, i.e., the segmented pre-compensation is captured in RAN1 and RAN4 specification respectively as follows, so there is no need to worry about the overlap with RAN4 specification.

|  |
| --- |
| 16.1.2 Timing synchronization in 36.213 For a NB-IoT UE communicating over NTN FDD, time and frequency pre-compensation is adjusted per uplink segment with a transmission duration of $N\_{segment}^{precompensation}$ time units, where the quantity $N\_{segment}^{precompensation}$ is provided by higher layers, as specified in 3GPP TS 36.331 [11].7.20A.2 Requirements in 36.133when a repetition is configured on the uplink for which R>1, the UE shall not adjust the uplink transmission timing autonomously during an ongoing repetition period other than at initial transmission or at the start of a transmission segment boundary, as defined above. |

 |
| Vivo1 | It may be more suitable to reflect this agreement in the RAN4 specification. |
| Nordic  | We prefer to capture this in RAN4, btw, we are still waiting for reply from RAN4 on this subject.  |
| LGE | In our understanding, now this issue is up to RAN4.  |

# Change of wording of “TDD pattern” (36.213)

## 11.1 Relevant input from companies

#### [ZTE]

--------------------Start of TP for TS 38.213 V19.0.0 ---------------------------------

<Unchanged parts are omitted>

**16 UE Procedures related to narrowband IoT**

Throughout this clause,

- for a NB-IoT UE in a NTN TDD serving cell,

- the UE shall not assume any downlink physical signal or physical channel is present in any subframe other than within the *D* consecutive downlink subframes according to the ~~TDD pattern~~ frame structure for NTN-TDD and the value of *D* defined in [3],

- the UE shall not transmit any uplink physical signal or physical channel in any subframe other than within the *U* consecutive uplink subframes according to the ~~TDD pattern~~ frame structure for NTN-TDD and the value of *U* defined in [3].

- for a NB-IoT UE, the value of $K\_{offset}$ is given by,

- if the UE is configured with the higher layer parameter *k-Offset,*

- $K\_{offset}= K\_{cell\\_offset}-K\_{UE\\_offset}$ where

 $K\_{cell\\_offset}$ is the parameter *k-Offset* provided by higher layers, and

 $K\_{UE\\_offset}$ is the parameter *Differential Koffset* provided by higher layers, otherwise $K\_{UE\\_offset}=0$

- otherwise,

- $K\_{offset}=0$.

<Unchanged parts are omitted>

**16.4 Narrowband physical downlink shared channel related procedures**

A NB-IoT UE shall determine whether a downlink subframe or a TDD special subframe configured for NB-IoT DL transmission is a NB-IoT DL subframe as follows

- If the UE determines that the subframe contains NPSS/NSSS/NPBCH/ *SystemInformationBlockType1-NB* transmission, then the subframe is not assumed as a NB-IoT subframe.

- Else if the UE is in a NTN TDD serving cell and the UE determines the subframe is not one of the *D* consecutive downlink subframes according to the ~~TDD pattern~~ frame structure for NTN-TDD and the value of *D* defined in [3], then the subframe is not assumed as a NB-IoT DL subframe.

<Unchanged parts are omitted>

**16.5 Narrowband physical uplink shared channel related procedures**

For a NB-IoT UE that supports *twoHARQ-Processes-r14* or the UE is configured with higher layer parameter *npusch-MultiTB-Config*, there shall be a maximum of 2 uplink HARQ processes.

For a NB-IoT UE and NPUSCH transmission using preconfigured uplink resource, there shall be 1 uplink HARQ process.

A NB-IoT UE shall determine whether a subframe is a NB-IoT UL subframe as follows

- If higher layer parameter *resourceReservationConfigUL* is configured

- for NPUSCH format 1 transmission associated with C-RNTI or SPS C-RNTI using UE-specific NPDCCH search space including NPUSCH format 1 transmission without a corresponding NPDCCH

- if the Resource reservation field in the DCI is set to 0, then the subframe is assumed as a NB-IoT UL subframe

- else if the Resource reservation field in the DCI is set to 1, then the subframe is assumed as a NB-IoT UL subframe if it is not fully reserved according to the higher layer parameters (a subframe is considered fully reserved if and only if all SC-FDMA symbols are reserved in the subframe).

- for NPUSCH format 2 transmission

- the subframe is assumed as a NB-IoT UL subframe if it is not fully reserved according to the higher layer parameters (a subframe is considered fully reserved if and only if all SC-FDMA symbols are reserved in the subframe).

- In all other cases,

- for TN TDD, a NB-IoT UE shall assume a subframe as a NB-IoT UL subframe if, for a NB-IoT carrier, it is configured as NB-IoT UL subframe by higher layers

- for FDD, a NB-IoT UE shall always assume a subframe as a NB-IoT UL subframe

- for NTN TDD, a NB-IoT UE shall assume a subframe as a NB-IoT UL subframe if it is one of the *U* consecutive uplink subframes according to the ~~TDD pattern~~ frame structure for NTN-TDD and the value of *U* defined in [3].

<Unchanged parts are omitted>

--------------------End of TP for TS 38.213 V19.0.0 ---------------------------------

11.2 Feature lead proposal

ZTE is proposing to change the wording of “TDD pattern” with “frame structure for NTN-TDD’. Feature lead agrees with ZTE’s statement and proposes to replace the wording as proposed:

**Proposal 11-1: Replace “TDD pattern” with “frame structure for NTN-TDD” in sections 16.5, 16.4 and 16 of TS 36.213**

#### \*\* High \*\* Q11-1: Please provide your views on the proposal 11-1

|  |  |
| --- | --- |
| Company | Comment |
| Lenovo | We are fine with the proposal |
| OPPO | Support. |
| Nordic  | OK |
| ZTE | Support |

# Introduction of new table for $k\_{0}$(36.213)

## 12.1 Relevant input from companies

#### [NOK]

|  |  |
| --- | --- |
| ***Reason for change:*** | Current scheduling delay for NPDSCH will cause large absolute scheduling delay in the frame structure of 8 subframes for UL and DL in 90ms period, resulting in the issues of restricted scheduling or resource waste. |
|  |  |
| ***Summary of change:*** | Update the scheduling delay of NPDSCH to 0/2/4/6/8/10/12/14 or 0/4/8/12/16/20/24/28 for IoT NTN TDD mode. |
|  |  |
| ***Consequences if not approved:*** | The DCI has less options to schedule NPDSCH with small absolute scheduling delay in the IoT NTN TDD frame structrure with 8 subframe for UL and DL in 90ms period. |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| * 16.4.1

<omitted text>*k0* is the number of NB-IoT DL subframe(s) starting in DL subframe *n*+5 for FDD or subframe *n*+5 for TDD, until DL subframe *n0*, where *k0* is determined by the scheduling delay field () for DCI format N1, and *k0* = 0 for DCI format N2. For DCI CRC scrambled by G-RNTI, *k0* is determined by the scheduling delay field () according to Table 16.4.1-1a, and for NTN-TDD, *k0* is determined by the scheduling delay field () according to Table 16.4.1-1b, otherwise *k0* is determined by the scheduling delay field () according to Table 16.4.1-1. The value of is according to Clause 16.6 for the corresponding DCI format N1,<omitted text>Table 16.4.1-1: for DCI format N1.

|  |  |
| --- | --- |
|  |  |
|  |  |
| 0 | 0 | 0 |
| 1 | 4 | 16 |
| 2 | 8 | 32 |
| 3 | 12 | 64 |
| 4 | 16 | 128 |
| 5 | 32 | 256 |
| 6 | 64 | 512 |
| 7 | 128 | 1024 |

Table 16.4.1-1a: for DCI format N1 with DCI CRC scrambled by G-RNTI.

|  |  |
| --- | --- |
|  |  |
| 0 | 0 |
| 1 | 4 |
| 2 | 8 |
| 3 | 12 |
| 4 | 16 |
| 5 | 32 |
| 6 | 64 |
| 7 | 128 |

Table 16.4.1-1b: for DCI format N1 for NTN-TDD.

|  |  |
| --- | --- |
|  |  |
|  |  |
| 0 | 0 | 0 |
| 1 | 2 | 4 |
| 2 | 4 | 8 |
| 3 | 6 | 12 |
| 4 | 8 | 16 |
| 5 | 10 | 20 |
| 6 | 12 | 24 |
| 7 | 14 | 28 |

<omitted text> |

|  |  |
| --- | --- |
| ***Reason for change:*** | Current scheduling delay for NPUSCH will cause large absolute scheduling delay in the frame structure of 8 subframes for UL and DL in 90ms period, resulting in the issues of restricted scheduling or resource waste. |
|  |  |
| ***Summary of change:*** | Update the scheduling delay of NPUSCH to 0/4/8/12 for IoT NTN TDD mode. |
|  |  |
| ***Consequences if not approved:*** | The DCI has less options to schedule NPUSCH with small absolute scheduling delay in the IoT NTN TDD frame structrure with 8 subframe for UL and DL in 90ms period. |

<omitted text>

A UE shall upon detection on a given serving cell of a NPDCCH with DCI format N0 ending in NB-IoT DL subframe *n* scheduling NPUSCH intended for the UE, perform, at the end of

*- n+k0+K*offset DL subframe for FDD,

*- k0* NB-IoT UL subframes following the end of *n+*8 subframefor TDD,

a corresponding NPUSCH transmission using NPUSCH format 1 in *N* consecutive NB-IoT UL slots *ni* with *i = 0, 1, …, N-1* according to the NPDCCH information where

- subframe *n* is the last subframe in which the NPDCCH is transmitted and is determined from the starting subframe of NPDCCH transmission and the DCI subframe repetition number field in the corresponding DCI; and

- , where the value of  is determined as specified in Clause 16.5.1.1, the value of is determined by the resource assignment field in the corresponding DCI (see Clause 16.5.1.1), the value of  is the number of NB-IoT UL slots of the resource unit (defined in clause 10.1.2.3 of [3]) corresponding to the  allocated number of subcarriers (as determined in Clause 16.5.1.1) in the corresponding DCI, and the value of is determined by the Number of scheduled TB for Unicast field, if present, in the corresponding DCI,  otherwise

- *n0* is the first NB-IoT UL slot starting after the end of subframe *n+k0+K*offset for FDD

- *n0* is the first NB-IoT UL slot starting after *k0* NB-IoT UL subframes following the end of *n*+8 subframe for TDD

- value of *k0* is determined by the scheduling delay field () in the corresponding DCI according to Table 16.5.1-1 for FDD, Table 16.5.1-1A for TDD and Table 16.5.1-1B for NTN-TDD

<omitted text>

Table 16.5.1-1: for DCI format N0 for FDD.

|  |  |
| --- | --- |
|  |  |
| 0 | 8 |
| 1 | 16 |
| 2 | 32 |
| 3 | 64 |

Table 16.5.1-1A: for DCI format N0 for TDD.

|  |  |
| --- | --- |
|  |  |
| 0 | 0 |
| 1 | 8 |
| 2 | 16 |
| 3 | 32 |

Table 16.5.1-1B: for DCI format N0 for for NTN-TDD.

|  |  |
| --- | --- |
|  |  |
| 0 | 0 |
| 1 | 4 |
| 2 | 8 |
| 3 | 12 |

<omitted text>

## 12.2 Feature lead proposal

The issue of adjusting the scheduling delays was discussed during the work item, with no consensus to introduce them. Additionally, the table for NPUSCH seems incorrect, since it will lead to no processing time at the UE – note that the delay of 8ms is included in the procedural text for TDD TN as follows, but not for FDD or NTN TDD:



#### \*\* Low \*\* Q12-1: Please provide your views on the proposals to introduce new scheduling delays for NB-IOT NTN TDD

|  |  |
| --- | --- |
| Company | Comment |
| Lenovo | We share similar view as FL, and the current/existing agreement can’t support the CR. |
| Vivo1 | Not necessary. Although the legacy k0 values may lead to restriction to NW scheduling or resource waste, but they are still applicable. |
| Nordic  | We prefer to keep legacy offsets. They work just fine. |
| ZTE | Not needed in maintenance phase considering that current delay can work. |
| Spreadtrum | Legacy $k\_{0}$ can be reused. It is unnecessary to introduce new table for $k\_{0}$ |
| LGE | This is the maintenance phase. New functional change should be avoided if there is no specification hole.  |

# References

|  |  |  |
| --- | --- | --- |
| [R1-2505220](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_122/Docs/R1-2505220.zip) | Maintenance on IoT-NTN TDD mode | Huawei, HiSilicon [HW] |
| [R1-2505279](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_122/Docs/R1-2505279.zip) | Maintenance on TDD NB-IoT NTN | Ericsson [E///] |
| [R1-2505319](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_122/Docs/R1-2505319.zip) | Maintenance on IoT-NTN TDD mode | CATT [CATT] |
| [R1-2505391](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_122/Docs/R1-2505391.zip) | Maintenance on IoT-NTN TDD mode | Vivo [vivo] |
| [R1-2505439](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_122/Docs/R1-2505439.zip) | Remaining issues on the support of IoT NTN TDD mode | Xiaomi [Xiaomi] |
| [R1-2505504](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_122/Docs/R1-2505504.zip) | Remaining issues on IoT-NTN TDD mode | ZTE Corporation, Sanechips [ZTE] |
| [R1-2505556](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_122/Docs/R1-2505556.zip) | Remaining issues on IoT-NTN TDD mode | Samsung [SS] |
| [R1-2505715](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_122/Docs/R1-2505715.zip) | Discussion on IoT-NTN TDD mode | OPPO [OPPO] |
| [R1-2505861](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_122/Docs/R1-2505861.zip) | Maintenance on IoT-NTN TDD mode | Nokia, Nokia Shanghai Bell [NOK] |
| [R1-2505866](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_122/Docs/R1-2505866.zip) | Remaining aspects and naming convention for IoT NTN TDD | Iridium Satellite LLC [Iri] |
| [R1-2506192](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_122/Docs/R1-2506192.zip) | IOT-NTN TDD mode | Qualcomm Incorporated [QC] |
| [R1-2506328](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_122/Docs/R1-2506328.zip) | Maintenance on IoT-NTN TDD mode | THALES [TH] |