**3GPP TSG RAN WG1 Meeting #100bis-e R1-200xxxx**

**April 20th – April 30th, 2020**

**Agenda item: 7.2.2.1.1**

**Source: Moderator (Qualcomm Incorporated)**

**Title: Moderator’s summary of initial access signals and channels for NR-U**

**Document for: Discussion and Decision**

# Introduction

This paper summarizes the papers submitted to agenda item 7.2.2.1.1 on NR-U initial access signals and channels.

# SSB and Type0-PDCCH related

**Issue 2.1. Signaling of Q in MIB**

Proposal in [5]. Q is signaled in MIB using a combination of *subCarrierSpacingCommon* and *ssb-SubcarrierOffset*.

TP below:

>>> Text Proposal for 38.213, Section 4 >>>

\*\*\* Unchanged text omitted \*\*\*

Table 4-1: Mapping between the combination of subCarrierSpacingCommon and ~~[spare or~~ LSB of ssb-SubcarrierOffset~~]~~ to

|  |  |  |
| --- | --- | --- |
| *subCarrierSpacingCommon* | *~~[spare~~* ~~or~~LSB of *ssb-SubcarrierOffset~~]~~* |  |
| scs15or60 | 0 | 1 |
| scs15or60 | 1 | 2 |
| scs30or120 | 0 | 4 |
| scs30or120 | 1 | 8 |

\*\*\* Unchanged text omitted \*\*\*

>>> End Text Proposal >>>

**Issue 2.2. k\_SSB indication**

The proposals in [4].

Proposal #1: If LSB of *ssb-SubcarrierOffset* is used for signalling of *ssbPositionQCL-Relationship-r16*, LSB of k\_SSB is set to ‘0’ for SS/PBCH on a sync raster.

Proposal #2: If LSB of *ssb-SubcarrierOffset* is used for signalling of *ssbPositionQCL-Relationship-r16*, for a SS/PBCH not on a sync raster,

* If the distance between a synchronization raster for NR-U and the center frequency of the SS/PBCH is equal to integer multiple of 30 kHz, LSB of k\_SSB is set to ‘0’.
* Otherwise, if the distance between a synchronization raster for NR-U and the center frequency of the SS/PBCH is not equal to integer multiple of 30 kHz but equal to integer multiple of 15 kHz, LSB of k\_SSB is set to ‘1’.

TP below:

------------------------------------TP for 38.211, 7.4.3.1----------------------------------

7.4.3.1 Time-frequency structure of an SS/PBCH block

In the time domain, an SS/PBCH block consists of 4 OFDM symbols, numbered in increasing order from 0 to 3 within the SS/PBCH block, where PSS, SSS, and PBCH with associated DM-RS are mapped to symbols as given by Table 7.4.3.1-1.

In the frequency domain, an SS/PBCH block consists of 240 contiguous subcarriers with the subcarriers numbered in increasing order from 0 to 239 within the SS/PBCH block. The quantities  and  represent the frequency and time indices, respectively, within one SS/PBCH block. The UE may assume that the complex-valued symbols corresponding to resource elements denoted as 'Set to 0' in Table 7.4.3.1-1 are set to zero. The quantity  in Table 7.4.3.1-1 is given by . The quantity  is the subcarrier offset from subcarrier 0 in common resource block to subcarrier 0 of the SS/PBCH block, where is obtained from the higher-layer parameter *offsetToPointA* and the 4 least significant bits of  are given by the higher-layer parameter *ssb-SubcarrierOffset* and for SS/PBCH block type A the most significant bit of  is given by in the PBCH payload as defined in clause 7.1.1 of [4, TS 38.212]. For operation with shared spectrum channel access, the least significant bit of is set to 0 if the frequency offset between the lowest subcarrier of the SS/PBCH block and the lowest subcarrier of a SS/PBCH block located at the GSCN of a synchronization raster entry as defined in [X, TS 38.101-1] is equal to 0 or integer multiple of 30 kHz, otherwise, the least significant bit of is set to 1. If *ssb-SubcarrierOffset* is not provided, is derived from the frequency difference between the SS/PBCH block and Point A.

------------------------------------------------------------------------------------------------

**Issue 2.3. MIB interpretation if a band can be both licensed and unlicensed**

In [5], the issue for upper 6GHz band is raised where it can be either licensed or unlicensed

Proposal in [5]. RAN1 should discuss the MIB interpretation ambiguity issue for overlapping frequency bands and agree on if and how the issue should be resolved.

A few options provided

1. UE try both MIB interpretation
2. PBCH CRC scrambling carries information to separate two MIB structures
3. Different sync raster point for licensed and unlicensed

More discussion needed.

**Issue 2.4. Further restricting Type0-PDCCH monitoring**

In [2], [8], and [9], it is proposed to further restrict or add Type0-PDCCH monitoring configurations to support same slot delivery of Type0-PDCCH and the corresponding SSB.

Proposal in [2]: For NR-U, only configuration parameter M = 1/2 in Table 13-11 in 3GPP TS 38.213 should be supported to let SS/PBCH block and its associated Type-0 PDCCH in the same slot, and the following TP#1 can be considered.

------------------------------------------ < Start of text proposal #1 for 38.213 [3]> ---------------------------------------------

13 UE procedure for monitoring Type0-PDCCH CSS sets

< Unchanged parts are omitted >

Table 13-11A: Parameters for PDCCH monitoring occasions for Type0-PDCCH CSS set - SS/PBCH block and CORESET multiplexing pattern 1 and FR1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Index |  | Number of search space sets per slot |  | **First symbol index** |
| 0 | 0 | 1 | 1/2 | 0 |
| 1 | 0 | 2 | 1/2 | {0, if  is even}, {, if  is odd} |
|  |  |  |  |  |
|  |  |  |  |  |
| 2 | 5 | 1 | 1/2 | 0 |
| 3 | 5 | 2 | 1/2 | {0, if  is even}, {, if  is odd} |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| 4-15 | / | / | / | / |

< Unchanged parts are omitted >

--------------------------------------------------- < End of text proposal #1> -----------------------------------------------------

Proposal in [8]: In the table 13-11 in 38.213, remove M=2, and replace M=1 with M=1/2 in the table, and reserve last 8 rows for new band (e.g. 6GHz), and consider to adopt the TP in Appendix 9.1.

TP below:

------------------------------------------------------ Start of Text Proposal ----------------------------------------------------------

13 UE procedure for monitoring Type0-PDCCH CSS sets

------------------------------------------------------ Unchanged parts omitted ------------------------------------------------------

For operation with shared spectrum channel access and for the SS/PBCH block and CORESET multiplexing pattern 1, a UE monitors PDCCH in the Type0-PDCCH CSS set over slots that include Type0-PDCCH monitoring occasions associated with SS/PBCH blocks that are quasi co-located with the SS/PBCH block that provides a CORESET for Type0-PDCCH CSS set with respect to average gain, QCL-TypeA, and QCL-TypeD properties, when applicable [6, TS 38.214]. For a candidate SS/PBCH block index , where , two consecutive slots starting from slot include the associated Type0-PDCCH monitoring occasions. The UE determines an index of slot as that is in a frame with system frame number (SFN) satisfying if , or in a frame with SFN satisfying if . and are provided by Table 13-11A, and based on the SCS for PDCCH receptions in the CORESET [4, TS 38.211]. The index for the first symbol of the CORESET in slots and is the first symbol index provided by Table 13-11. The UE does not expect to be configured with , or with , when .

------------------------------------------------------ Unchanged parts omitted ------------------------------------------------------

Table 13-11A: Parameters for PDCCH monitoring occasions for Type0-PDCCH CSS set - SS/PBCH block and CORESET multiplexing pattern 1 and FR1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Index |  | Number of search space sets per slot |  | **First symbol index** |
| 0 | 0 | 1 | 1/2 | 0 |
| 1 | 0 | 2 | 1/2 | {0, if  is even}, {, if  is odd} |
| 2 | 2 | 1 | 1/2 | 0 |
| 3 | 2 | 2 | 1/2 | {0, if  is even}, {, if  is odd} |
| 4 | 5 | 1 | 1/2 | 0 |
| 5 | 5 | 2 | 1/2 | {0, if  is even}, {, if  is odd} |
| 6 | 7 | 1 | 1/2 | 0 |
| 7 | 7 | 2 | 1/2 | {0, if  is even}, {, if  is odd} |
| 8 |  |  |  |  |
| 9 |  |  |  |  |
| 10 |  |  |  |  |
| 11 |  |  |  |  |
| 12 |  |  |  |  |
| 13 |  |  |  |  |
| 14 |  |  |  |  |
| 15 |  |  |  |  |

-------------------------------------------------------- End of Text Proposal --------------------------------------------------------

Proposal in [9]: The entries in Table below should be included in *pdcch-ConfigSIB1* in MIB in order to support:

* SSB and RMSI CORESET in the same slot with odd SFN,
* DRS with 8 beams and one SSB per slot.

Table 1. PDCCH monitoring occasions for Type0-PDCCH CSS set - SS/PBCH block and CORESET multiplexing pattern 1 in unlicensed band

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Index |  | Number of search space sets per slot |  | **First symbol index** |
| New | 0 | 1 | 1/2 | 0 |
| 1 | 0 | 2 | 1/2 | {0, if  is even}, {, if  is odd}  |
| New | 5 | 1 | 1/2 | 0 |
| 5 | 5 | 2 | 1/2 | {0, if  is even}, {, if  is odd}  |
| New | 10 | 1 | 1/2 | 0 |
| New  | 10 | 2 | 1/2 | {0, if  is even}, {, if  is odd}  |
| New | 15 | 1 | 1/2 | 0 |
| New  | 15 | 2 | 1/2 | {0, if  is even}, {, if  is odd}  |

**Issue 2.5. Do we need a (S=7, L =7) entry in the default PDSCH table**

In [2] and [9], it is proposed to not adding (S=7,L=7) entry.

In [7] and [8], it is proposed to add the entry.

Proposal in [7]: Replace table entry 10 of default TDRA table with (K0=0, S=7 and L=7) when UE operated on channel with shared channel access. Adopt the following TP.

-----------------Text proposal to 38.214---------------

5.1.2.1.1 Determination of the resource allocation table to be used for PDSCH

Table 5.1.2.1.1-1 defines which PDSCH time domain resource allocation configuration to apply. Either a default PDSCH time domain allocation A, B or C according to tables 5.1.2.1.1-2, 5.1.2.1.1-3, 5.1.2.1.1.-4 and 5.1.2.1.1-5 is applied, or the higher layer configured *pdsch-TimeDomainAllocationList* in either *pdsch-ConfigCommon* or *pdsch-Config* is applied. For operation with shared spectrum channel access, as described in [15, TS 37.213], UE reinterprets *S* and *L* in row 9 of Table 5.1.2.1.1-2 as *S=6* and *L=7*, and *S* and *L* in row 10 of Table 5.1.2.1.1-2 as *S=7* and *L=7*.

**----------- -------------------------------------------------**

Proposal in [8]: Replace row 10 with an entry with (S=7, L=7) for default A table for PDSCH SLIV for normal CP.

------------------------------------------------------ Start of Text Proposal ----------------------------------------------------------

------------------------------------------------------ Unchanged parts omitted ------------------------------------------------------

5.1.2.1.1 Determination of the resource allocation table to be used for PDSCH

For operation with shared spectrum channel access, as described in [16, TS 37.213], UE reinterprets *S* and *L* in row 9 of Table 5.1.2.1.1-2 as *S=6* and *L=7,* and UE reinterprets *S* and *L* in row 10 of Table 5.1.2.1.1-2 as *S=7* and *L=7*.

-------------------------------------------------------- End of Text Proposal --------------------------------------------------------

**Issue 2.6. SSB transmission in RB sets indication**

Proposal in [7]: *For operation on carrier with shared channel access,* *SIB1 may indicate which RB-sets of carrier including GBs contains SSB and whether SSB contains PBCH or not*

* *The SSBs on a carrier are transmitted with the same PCI*
* *The SSBs on a carrier are time-synchronized and QCLed.*
* *The PBCH of SSBs (if present) may be different.*
* *If parameter is not indicated, the SSB is present only in RB-set where UE detected the SSB.*
* *Adopt the following TP*

TP below:

=================TP for TS38.213 ===================

4.1 Cell search

<omitted text >

For operation with shared spectrum channel access, if the UE received bitmap provided by parameter XYZ in RMSI indicating that RB-set contains an SS/PBCH block, UE may assume that burst transmission windows of SS/PBCH blocks in the RB-sets are time-synchronised and quasi co-located with respect to average gain, QCL-TypeA, and QCL-TypeD properties, when applicable [6, TS 38.214].

<omitted text >

 =================================================

# CSI-RS enhancements in DRS

For CSI-RS transmission in DRS, [1], [2] propose no further enhancement necessary.

**Issue 3.1. P-CSI-RS transmission validation in DRS.**

In [1], it is proposed to use SSB reception to valid the P-CSI-RS transmission QCL’ed with SSB and transmitted in the same slot.

TP not provided.

Proposal in [8]: Outside of COT informed by DCI format 2-0, UE can measure periodic CSI-RS or semi-persistent CSI-RS,

* If UE detects a SSB or a Type0-PDCCH, and a periodic CSI-RS or semi-persistent CSI-RS resource occurs in the symbol of the SSB or the Type0-PDCCH, where the CSI-RS resource is confined in initial active DL BWP;
* UE detects a SSB or a Type0-PDCCH, and a periodic CSI-RS or semi-persistent CSI-RS resource occurs in the symbol after the SSB or the Type0-PDCCH with time gap of X symbol(s), where the CSI-RS resource is confined in initial active DL BWP.

TP not provided.

*Proposal in [9]: the valid CSI-RS resource in a DRS window is the one closest to the detected SSB and with TCI state associating with the same SSB index.*

**Issue 3.2. CSI-RS QCL with SSB in the same symbol.**

In [3], it is proposed to use automatically set the QCL of CSI-RS to the SSB in the same symbol.

Proposal in [3]: If the CSI-RS resource and the SSB resource are in the same OFDM symbol, the corresponding CSI-RS and SSB shall be assumed as quasi co-located.

TP below.

----------------------------------- TP2: Start of TP 37.213 section 4.0 ---------------------------------------------

4.0 General

<Unchanged parts are omitted>

- A *discovery burst* refers to a DL transmission burst including a set of signal(s) and/or channel(s) confined within a window and associated with a duty cycle. The *discovery burst* can be any of the following:

- Transmission(s) initiated by an eNB that includes a primary synchronization signal (PSS), secondary synchronization signal (SSS) and cell-specific reference signal(s)(CRS) and may include non-zero power CSI reference signals (CSI-RS).

- Transmission(s) initiated by a gNB that includes at least an SS/PBCH block consisting of a primary synchronization signal (PSS), secondary synchronization signal (SSS), physical broadcast channel (PBCH) with associated demodulation reference signal (DM-RS) and may also include CORESET for PDCCH scheduling PDSCH with SIB1, and PDSCH carrying SIB1 and/or non-zero power CSI reference signals (CSI-RS). The CSI-RS and the SS/PBCH block are quasi co-located with 'QCL-TypeD' if the CSI-RS resource and the SS/PBCH block are in the same OFDM symbol(s).

----------------------------------------End of TP 37.213 section 4.0 ---------------------------------------------

**Issue 3.3: CSI-RS QCI configuration**

Proposal in [3]: For the CSI-RS outside DRS window, the associated SSB index should be the SSB index, for the CSI-RS inside DRS window, the associated SSB should be the candidate SSB index.

**Issue 3.4. CSI-RS in DRS for RLM**

Proposal in [6]: At least for RLM, NR-U shall support the following enhancement to CSI-RS as part of discovery burst:

* UE assumes a CSI-RS resource has at least one transmission occasions in a discovery burst transmission window, wherein the slot index of the transmission occasion has the same value of ;
* The initial condition for generating the CSI-RS sequence in a discovery burst transmission window is the same in at least one transmission occasions and according to

.

================= Start of TP for TS 38.213 =================================

5 Radio Link Monitoring

===================== Unchanged Texts Omitted =================================

For operation with shared spectrum channel access, when a UE is provided a SS/PBCH block index by *ssb-Index*, the UE is expected to perform radio link monitoring using SS/PBCH block(s) in the discovery burst transmission window as described in Clause 4.1.

For operation with shared spectrum channel access, when a UE is provided a CSI-RS resource configuration index by *csi-RS-Index*, and the CSI-RS resource is configured in the discovery burst transmission window, the UE assumes the CSI-RS resource can be transmitted in one of the occasions in the discovery burst transmission window with slot index having the same value of , where is the slot index within the discovery burst transmission window.

============== Unchanged Texts Omitted =================================

================== End of TP for TS 38.213 =================================

==================== Start of TP for TS 38.211 =================================

7.4.1.5.2 Sequence generation

The UE shall assume the reference-signal sequence  is defined by



where the pseudo-random sequence  is defined in clause 5.2.1. The pseudo-random sequence generator shall be initialised with

at the start of each OFDM symbol where and is the slot index within the discovery burst transmission window, if the CSI-RS resource is configured within a discovery burst transmission window for radio link monitoring and for operation with shared spectrum channel access, and is the slot number within a radio frame otherwise,  is the OFDM symbol number within a slot, and  equals the higher-layer parameter s*cramblingID* or *sequenceGenerationConfig*.

================= End of TP for TS 38.211 =================================

**Issue 3.5. Early termination of CSI-RS trasnmission**

*Proposal in [9]: Once gNB transmits CSI-RS on a CSI-RS resource together with its corresponding SSB on a candidate SSB position, gNB can stop transmitting CSI-RS on the following CSI-RS resources corresponding to other candidate SSB positions with same SSB index in the same DRS window.*

# PRACH enhancements

**Issue 4.1. LBT gaps between ROs**

In [1], [6] and [7], it was proposed to enhance RO to allow gaps between ROs to avoid time domain adjacent ROs block each other.

In [1], it was proposed to consider every other ROs in a slot to be valid.

TP below

----------------------------------------TP1: Start TP for Section 8.1 of TS 38.213 -------------------------------------

For unpaired spectrum,

- if a UE is not provided *tdd-UL-DL-ConfigurationCommon*, a PRACH occasion in a PRACH slot is valid if it does not precede a SS/PBCH block in the PRACH slot and starts at least  symbols after a last SS/PBCH block reception symbol, where  is provided in Table 8.1-2.

- the index of the SS/PBCH block is provided by *ssb-PositionsInBurst* in *SIB1* or in *ServingCellConfigCommon*

- If a UE is provided *tdd-UL-DL-ConfigurationCommon*, a PRACH occasion in a PRACH slot is valid if

- it is within UL symbols, or

- it does not precede a SS/PBCH block in the PRACH slot and starts at least  symbols after a last downlink symbol and at least  symbols after a last SS/PBCH block symbol, where  is provided in Table 8.1-2, and if *ChannelAccessType-r16* = *semistatic* is provided, does not overlap with a set of consecutive symbols before the start of a next channel occupancy time where there shall not be any transmissions, as described in [15, TS 37.213]

- the index of the SS/PBCH block is provided by *ssb-PositionsInBurst* in *SIB1* or in
*ServingCellConfigCommon*.

- if operating in shared spectrum access, only odd numbered RACH occasions within one slot in time domain based on higher layer configuration for PRACH transmission [4, TS 38.211] are valid.

----------------------------------------TP1: End TP for Section 8.1 of TS 38.213 -------------------------------------

*Proposal in [6]. NR-U shall support non-consecutive ROs within the same RACH slot, wherein the ROs with even/odd indexes are reserved for LBT gap.*

============ Start of TP for TS 38.213 =================================

8.1 Random access preamble

============ Unchanged Texts Omitted =================================

For paired spectrum all PRACH occasions are valid.

For unpaired spectrum,

- if a UE is not provided *tdd-UL-DL-ConfigurationCommon*, a PRACH occasion in a PRACH slot is valid if it does not precede a SS/PBCH block in the PRACH slot and starts at least  symbols after a last SS/PBCH block reception symbol, where  is provided in Table 8.1-2.

- the index of the SS/PBCH block is provided by *ssb-PositionsInBurst* in *SIB1* or in *ServingCellConfigCommon*

- If a UE is provided *tdd-UL-DL-ConfigurationCommon*, a PRACH occasion in a PRACH slot is valid if

- it is within UL symbols, or

- it does not precede a SS/PBCH block in the PRACH slot and starts at least  symbols after a last downlink symbol and at least  symbols after a last SS/PBCH block symbol, where  is provided in Table 8.1-2, and if *ChannelAccessType-r16* = *semistatic* is provided, does not overlap with a set of consecutive symbols before the start of a next channel occupancy time where there shall not be any transmissions, as described in [15, TS 37.213]

- the index of the SS/PBCH block is provided by *ssb-PositionsInBurst* in *SIB1* or in *ServingCellConfigCommon*.

For preamble format B4 [4, TS 38.211], .

For both paired spectrum and unpaired spectrum, if operation with shared spectrum channel access, only the even numbered RO in a PRACH slot provided by higher layer configuration for PRACH transmission [4, TS 38.211] are available to be used.

============= Unchanged Texts Omitted =================================

============ End of TP for TS 38.213 =================================

In [7], it is proposed to shift ROs to leave gaps for LBT.

Proposal in [7]: *Within a PRACH slot, allocate 16 or 25 us (e.g. provided via configuration) LBT gap before each RO. CP extension can be used to provide the LBT gap so that “normal FFT” window setting can be used at gNB.*

* RO is moved by symbols, to create 1 symbol gaps between ROs
* ROs outside of the slot are not valid
* CP extension in the symbol preceding RO is created as agreed in channel access AI

TP below:

================TP for TS38.211=======================

5.3.2 OFDM baseband signal generation for PRACH

<omitted text >

For operation with shared spectrum channel access, the symbol position  is given by

where

-  is given by the parameter "starting symbol" in Tables 6.3.3.2-2 to 6.3.3.2-4;

- PRACHtransmission occasion partially or fully outside the PRACH slot is not a valid occasion

For operation with shared spectrum channel access, cyclic extension of the first OFDM symbol allocated for PRACH transmission, the time-continuous signal for the interval preceding the first OFDM symbol for PRACH is given by

where refers to the signal in the previous subframe and is given by

where

- higher layer parameter *CPExtensionPRACHr16* is either or

- as defined in 5.3.1 and where

<omitted text >

============= ========================================

**Issue 4.2. RO validation with respect to Type0-PDCCH monitoring**

In [3], it is proposed to validate RO with Type0-PDCCH monitoring location. This is not an agreed behaviour. Seems more discussion needed.

Proposal in [3]: If a PRACH occasion is overlapped (fully or partially) with a slot which contains RMSI, the PRACH occasion should be treated as invalid PRACH occasion.

TP below.

---------------------------------------- TP1: Start of TP 38.213 section 8.1----------------------------------------------

8.1 Random access preamble

<Unchanged parts are omitted>

For unpaired spectrum

if a UE is not provided tdd-UL-DL-ConfigurationCommon, a PRACH occasion in a PRACH slot is valid if it does not precede a SS/PBCH block in the PRACH slot and starts at least Ngap symbols after a last SS/PBCH block reception symbol, where Ngap is provided in Table 8.1-2

if a UE is not provided tdd-UL-DL-ConfigurationCommon, a PRACH occasion in a PRACH slot is valid if it is not in the Type0-PDCCH monitoring slot.

<Unchanged parts are omitted>

------------------------------------------End of TP 38.213 section 8.1----------------------------------------------

**Issue 4.3. Mixed use of short and long PRACH**

Proposal in [7]: *Introduce parameter PRACH\_ValidOnlyInSharedChannelOccupancy allowaing short PRACH only within the shared COT.*

TP below:

=============8.1 Random access preamble=================

<omitted text >

For operation with shared spectrum channel access, if the UE is configured with higher layer parameter *PRACH\_ValidOnlyInSharedChannelOccupancy* set to ‘true’

* if a PRACH occasion associated with *prach-RootSequenceIndex (short PRACH)* overlaps with a shared channel occupancy defined in [3GPP TS 37.213] and
* if the PRACH occasion associated with *prach-RootSequenceIndex* *(short PRACH)* does not collide with DL symbol as described in [3GPP TS38.213, sub-clause 11], the

the PRACH occasion is valid.

<omitted text >

====================================== =============

**Issue 4.4. LBT for PUSCH transmission for 2-step RACH.**

*Proposal in [3]: In 2-step RACH, if a PO is within a COT initiated by a UE for PRACH transmission on an associated RO, for PUSCH transmission on the PO,*

* *If the gap between the RO and the PO is smaller than 16, type 2C channel access procedure should be used.*
* *If the gap between the RO and the PO is more than or equal to 16 but less than 25, type 2B channel access procedure should be used.*
* *If the gap between the RO and the PO is more than or equal to 25, type 2A channel access procedure should be used.*

TP below:

----------------------------------- TP3: Start of TP 37.213 section 4.2.1 ---------------------------------------------

4.2.1 Channel access procedures for uplink transmission(s)

<Unchanged parts are omitted>

A UE shall use Type 1 channel access procedure for transmissions related to random access procedure that initiate a channel occupancy with UL channel access priority class in Table 4.2.1-1.

In Type-2 random access procedure, a UE may transmit a PUSCH on a PUSCH occasion within a channel occupancy that the UE initiated for a PRACH transmission on an associated RACH occasion after a gap as follows:

- If the gap is up to, the UE can transmit the PUSCH on the channel after performing Type 2C UL channel access as described in subclause 4.2.1.2.3.

- If the gap is more than or equal to 16 but less than 25,the UE can transmit the PUSCH on the channel after performing Type 2B UL channel access as described in subclause 4.2.1.2.2.

- If the gap is more than or equal to 25, the UE can transmit the PUSCH on the channel after performing Type 2A UL channel access as described in subclause 4.2.1.2.1.

<Unchanged parts are omitted>

----------------------------------------End of TP 37.213 section 4.2.1 ---------------------------------------------

# Misc

In [1], it is proposed to allow using wideband preamble to be used for 2-step RACH. Seems that this is clarification only and it should be already allowed in the current version of the spec.

In [2], it is proposed to clarify the RAN1 agreement on “The SCS for all SSBs and Coreset #0 on a carrier is always the same for operation of NR in unlicensed spectrum” is applicable between SSB and the corresponding coreset #0 only. Need to discuss if there are companies think otherwise.

Proposal in [8]: Do not define “discovery burst” terminology in spec 38.211/212/213.

Proposal in [8]: Clarify whether the discovery burst sent with Cat 2 LBT can be multiplexed with OSI/paging/RAR.

Proposal in [9]: Dynamic scheduling of PRACH occasion via DCI and via DRS could be considered in NR-U.

# Email discussion preparation

Many issues have been proposed for email discussion in the contributions, and as guided by the Chair, we have two email threads.

Out of the issues suggested, there are a few topics that have not been discussed before. I would suggest spending some time discussing that, instead of topics that have been discussed extensively before without conclusion. The next table captures the “higher” priority issues I identified. Please provide “Yes” or “No” for your view on further email discussion

Table 2. Higher priority issues

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Company | 2.3 | 2.4 | 2.6 | 3.2 | 3.4 | 3.5 | 4.2 | 4.4 |
| Huawei, HiSilicon | N | Y | N | Y | N | Y | N | N |
| Samsung |  |  | No |  | Yes |  | No | No |
| Ericsson | Y | N | N | N | N | N | N | N |
| Charter Communications | Y | N | N |  |  | Y | N | N |
| ZTE | N | Y | N | N | N | N | N | N |
| QC | Y | N | N | N | N | N | N | Y |
| vivo | Y | Y | N | N | N | N | N | N |
| LG Electronics | Y | N | N | N | N | N | N | N |
| Sharp | N | N | N |  | N | N | Y |  |
| NTT DOCOMO |  | N | N |  | Y |  | N | N |
| Spreadtrum |  | Y | Y |  |  |  |  |  |
| Nokia, NSB | N | N | Y | N | N | N | Y | Channel access AI  |
| OPPO | N |  | N | Y | Y |  | Y | Y or 7.2.2.2.1 |

|  |  |
| --- | --- |
| Company | Comments |
| Samsung | 2.3 Agree with the observation that it may be a potential issue, but not urgent to discuss in our view2.4 OK with the proposals, but maybe a little late to discuss (we had similar proposals before, but we also understand companies have strong concern towards this direction)2.6 This is an optimization feature in our understanding. Using the same PCID for all SSBs in a carrier has significant impact on measurement aspect (from UE point of view, a cell ID being associated with a SSB is the baseline for measurement)3.2 OK with the proposal, but even without the proposal there is no significant issue observed3.4 Support. The issue we figured out is, for RLM, there are only at most 4 RLM-RS, including SSB and CSI-RS, so it is impossible to configure multiple CSI-RS resources in a DBTW. Allowing multiple transmission locations of a CSI-RS resource is a reasonable solution to resolve this issue. 3.5 Understand the motivation of this proposal, but would like to clarify the UE behaviour according to this proposal. 4.2 Not an essential feature to support. We didn’t see any issue without this feature. Same topic has been discussed in Rel-15.4.4 Should be discussed in 7.2.2.2.1.  |
| Ericsson | 2.3 This issue was discussed in RAN2, and it was decided to defer to RAN1. It should at least be discussed, since it is likely that there will be overlapping bands (e.g., upper half of 6 GHz band) which are licensed in one region and unlicensed in another. A global UE will not know a priori the correct interpretation of the MIB. There are several options that can be discussed on how to help the UE.2.4 We don’t believe that Rel-15 functionality should be removed. It is important to maintain the ability to have RMSI in a different slot than SSB for larger RMSI payloads. In RAN1 we have already agreed to 2 restrictions on the configuration; we do not need further restrictions.2.6 Seems like a rather large change for maintenance3.2 We don’t see a need for this restriction3.4 This was discussed in the last meeting, and was difficult to achieve consensus. SSB-based RLM seems like a natural choice for NR-U. For CSI-RS based RLM, we believe that there are configuration options in Rel-15 that will enable CSI-RS-based RLM to work, even if not 100% optimized.3.5 We believe that this is an optimization for high-load/high LBT failure which is not the preferred operating regime. |
|  | 4.2 Agree with Samsung4.4 It seems like this is already covered in 37.213 |
| Charter Communications | 2.3 Agree that this issue appears to be relevant and requires further discussion for efficient operation in 6 GHz spectrum.2.4 Further restrictions on the configuration were not agreed to in the WI phase and may be difficult to achieve consensus on now.2.6 If persistent LBT failure is blocking Cat-2 LBT DRS on a particular RB-set, then simply transmitting a SSB with the same PCI on another RB-set will not solve all issues and gNB will eventually have to HO the UE anyway. 3.2 OK with the proposal, though not a critical fix.3.4 Neutral, open to further discussion if a serious issue has been identified.3.5 This is a reasonable proposal for further discussion.4.2 Not an essential feature.4.4 Agree with Samsung, should be discussed in 7.2.2.2.1. |
| ZTE | On Issue 2.3, we don’t think this needs to be discussed now since the frequency band of 6 GHz for NRU haven’t been determined yet.On Issue 2.6, it seems to be an enhancement issue and we don’t see too much impact on this problem.On Issue 3.2, we don’t see the necessity to further discuss and capture it in 37.213, as it has been captured in 38.214.On Issue 4.4, it might be more appropriate to be discussed in AI 7.2.2.2.1 Channel Access Procedures about whether to introduce Type 2B for gap between 16us and 25us. |
| Qualcomm | Issue 2.3 needs discussion. Issue 4.4 can be discussed either here, or in 7.2.2.2.1. If there are too many things to handle in 7.2.2.2.1, we can handle it here as well.Other issues are more on the optimization side.  |
| vivo | Issue 2.3: valid problem and needs discussion. Issue 2.4: Good to have this for NRUIssue 2.6: Only small optimization with large change in spec. Issue 3.2: CSI-RS configuration could indicate QCL SSB index anyway and don’t see need to have thisIssue 3.4: CSI-RS validation with multiple CSI-RS resource configuration could achieve the same goal. Issue 3.5: Not clear the proposal here. Now CSI-RS configuration should be corresponding to ssb-index not the candidate ssb-indexIssue 4.2: Not essential issue. Issue 4.4: Not very clear the problem. It seems TS37.213 could cover all these cases. |
| LG Electronics | 2.3 Agree with Ericsson that it needs to be discussed considering different band allocation per regional regulation, especially for 6 GHz band.3.5 Not clear on the impact of UE behavior4.2 Not essential. It is unclear why only the Type0-PDCCH monitoring requires a RO validation process.4.4 Although we think the proposal in 4.4 seems to be essential and needs to be specified for UE’s LBT procedure in 2-step RACH, it should be clarified that applying the proposal in 4.4 is limited to the case where no gap transmission (e.g., with CP extension) between RO and PO is not allowed. |
| Sharp | 2.3 Agree with Samsung.2.4 Technically we support. However, in the late stage of CR, it’s not essential.2.6 If the proposal is to configure more than one cell-defining SSB, the spec impact may be quite large.3.2 The network can configure.4.2 Considering that semi-static DL may not be applicable for some NR-U scenarios, the proposed solution may be necessary. |
| NTT DOCOMO | 2.3: Discussion for the topic may be necessary. Is it Rel-16 discussion or future discussion ?2.4: We had lots of proposals in WI phase, and had no consensus.3.2: The proposal is reasonable, on the other hand, do we need specify it.3.4: We believe that the enhancement of QCLed CSI-RS is beneficial for NR-U.3.5: The proposal is reasonable, on the other hand, it seems optimization. |
| Spreadtrum | 2.3: We have no strong position for this. In our view, if a certain spectrum of 6GHz band is also used for licensed access, maybe special design should be applied for MIB interpretation for the spectrum in the future.2.4: We support the further restriction. We have listed the potential issues with *M*=1 or 2in our contribution, such as large gap b/w SSB and the associated Type0-PDCCH, uneven distribution of SIB1 PDSCH resource, missing of Type0-PDCCH if SSB and the associated Type0-PDCCH are not in a DL transmission burst, the gap b/w SSB and the associated Type0-PDCCH varying based on candidate SSB index. Especially from UE perspective, if missing of Type0-PDCCH will cause additional power consumption. Furthermore, it is contradict with current definition of “discovery burst”, if SSB and the associated Type0-PDCCH are not in a DL transmission burst, since discovery burst is a DL transmission burst indeed.2.6: In our view, multiple SSBs in RB-sets may raise SSB transmission opportunities which is helpful for network congestion. But it seems increasing UE complexity. We are open for this discussion.3.2: The same view with ZTE.3.4: Neutral.3.5: It seems also related to validation of CSI-RS from UE perspective, so it can be jointly discussed in DL topic. |
| Nokia, NSB | 2.3 should be discussed when it becomes relevant. So far NR does not support licensed bands in 6GHz.2.4 discussed already in 100e, there was no consensus. If 2.4 is re-discussed also 4.2. should be re-discussed. 😊2.6 We agree this is optimization, but it would significantly improve system performance, on the other hand, we respect that companies do not want to discuss at this point.3.2 we are bit confused, QCL type D does not apply to NR-U3.4 RLM is based on SSB currently (when following RAN4 requirements), and that should work.3.5 Optimization 4.2 Validation of PRACH in LBE and particularly in FBE should be discussed. |
| OPPO | 2.3 this is not an essential case, if not a corner caser. If it exists, UE implementation can handle it. 2.4 similar proposal was discussed, but no consensus. We are open for the discussion, if possible progress can be reached, otherwise, no need to waste time.2.6 it seems a big change, not suitable for CR phase. 3.2 we thought this is a straightforward TP, and don’t see a motivation if they are not QCL’ed3.4 we agree with Samsung that the solution to the issue should be discussed. 3.5 we think this issue should be discussed if time allows. But if not discussed in this meeting, it should be discussed in next meeting. We are open to discuss this issue. 4.2 support to discuss this issue. 4.4 support to discuss either here or in channel access AI. |

The lower priority issues includes 2.1 (editorial), 2.2 (also editorial?), 2.5, 3.1, 3.3, 4.1, and 4.3. We can discuss them if there is enough support of course. Please leave your comments below, together with other comments, if any.

Other comments:

|  |  |
| --- | --- |
| Company | Comments |
| Huawei, HiSilicon | On issue 2.1, it might be covered in AI7.2.2.2.2 considering the original agreement achieved there. On issue 2.3, we do not see the urgency to solve it right now. Issues related to 5GHz should be prioritized. On issue 3.1, it can be discussed together with topic of CSI-RS validation in DL AI.On issue 3.4, it has been discussed in last meeting and seems not easy to get consensus. On issue 4.3, it can be regarded as dynamic validation of RO based on DCI 2\_0. To some extent, it should be categorized together with what we proposed in [9]. On issue 4.4, it should base on the agreement in 2 step RACH WI on the gap between PRACH and PUSCH.  |
| Samsung | 2.1 Support and we had the same TP in 7.2.2.2.2. This is straightforward according to the RAN2 LS. 2.2 Not editorial and has impact to UE implementation (need to calculate a frequency difference first before determining k\_SSB), and the only benefit is for ANR purpose with SCS = 15 kHz and SSB is located even integer multiple of 15 kHz from sync raster, so the optimization may not be needed. Setting the LSB of k\_SSB as 0 is sufficient. 2.5 Support3.1 Can be discussed together with CSI-RS validation (may not be in this agenda)3.3 Not an essential feature to support. We didn’t see any issue without this feature. 4.1 Support4.3 Not an essential feature to support. We didn’t see any issue without this feature. |
| Ericsson | 2.1 Agree with Samsung and Huawei, this can be treated in AI 7.2.2.2.2.2.5. S=6/L=7 is supported already. There is no need for the extra flexibility of S=7/L=7.3.1 Should be in AI 7.2.2.1.2 (DL Signals and Channels)3.3 Discussed last meeting without consensus. Not essential.4.1 Has been discussed without consensus. Not essential for Rel-16. Other approaches (if needed, could be introduced in a later release, e.g., puncturing the first symbol of a PRACH occasion). Throwing away every 2nd RO creates a 50% loss in capacity that cannot be recovered.4.3 Non-essential optimization. RAN2 impact. |
| Charter Communications | 2.1 Has already been proposed by FL of 7.2.2.2.2 to discuss further in that AI ☺4.3 Non-essential optimization in our opinion. |
| ZTE | On Issue 2.2, it doesn’t seem to be an editorial issue, but we are OK whether to discuss this or not. |
| Qualcomm | 2.1 Agree this can be handled in 7.2.2.2.2 |
| vivo | 2.1: Agree to be handled in 7.2.2.2.23.1: OK to be discussed in AI 7.2.2.1.24.1: Support to be discussed. It could improve initial access performance for NRU. Without this, UE may be blocked by another UE’s RACH. Corresponding to Ericsson’s comment, gNB could configure multiple PRACH slots or smaller period to make up for the loss. |
| LG Electronics | 2.2 Should be discussed to determine how to set LSB of k\_SSB if LSB of *ssb-SubcarrierOffset* is used for signaling of Q.Response to Samsung’s comment: No further impact of UE implementation. For on-sync raster SSB, LSB of k\_SSB is set to 0. For off-sync raster SSB, UE should calculate frequency offset between the SSB and sync raster at least to determine CORESET#0 as we agreed in the last meeting. Furthermore, RAN1 specification needs to fully provide ANR functionality wherever ANR SSB is located and it should be noted that ANR SSB can be configured with ARFCN-NR parameter having 15 kHz SCS.2.5 No need to add (S=7, L=7) in addition to (S=6, L=7).3.1 Can be discussed under DL agenda item3.3 Seems not essential4.1 It is not agreeable since if only even ROs are used, the RO capacity will be decreased (in other words, resource overhead to make gap will be increased). Rather, other alternatives can be considered (e.g., puncturing a part of RO to create gap).4.3 Not essential. As for UL RA type configuration where contiguous RA is disabled when the interlaced RA is enabled, it is reasonable for short PRACH preamble is disabled when the long PRACH preamble is enabled. |
| Sharp | 2.2 Support proposal 1. |
| Spreadtrum | 2.1: Treated in Initial access procedure.2.2: It is not editorial, and to be discussed.2.5: We have found a use case for {S, L}={7, 7} in other companies contribution, i.e. CSI-RS is located in symbol#6 immediately after the first SSB, and PDSCH is scheduled to starting from symbol#7. In this use case, there could be a DL transmission burst of SSB/CSI-RS/PDSCH, which is compact in time domain. |
| Nokia, NSB | 2.2 We think that for SSB outside of synch raster (which can of 15kHz SCS), there should not be limitation to 30kHz granularity only, there is no need since Q is explicitly configured. This could be clarified.3.1 I would move this issue to DL AI for CSI-RS validation3.3. Discussed last time, found not needed.4.3 Essential for European market, where gNB must configure long PRACH for initial access, but may operate with significantly better efficiency within shared COT. 2.5 There is clear benefit for contiguous PDSCH scheduling and no harm, and spec change is small. |
| Samsung  | 2.2 Response to LG’s comment: First to clarify, we fully agree that there is spec impact from RAN2’s LS. How to deal with the calculation of k\_SSB should be updated in 38.211 due to the usage of LSB of ssb-SubcarrierOffset for indicating Q. Our concern is, it may not be as complicated as you proposed ^ ^Then, in our understanding, there can be three types of SSBs, 1) SSB on syn raster; 2) SSB not on sync raster and for ANR purpose (UE needs to read MIB to get k\_SSB and Q); 3) SSB not on sync raster but not for ANR purpose (k\_SSB can be calculated and Q is configured). So far, there is no issue for SSB 1) and 3), and your proposal is trying to give full flexibility of the k\_SSB values for the SSB 2) when the SCS is 15 kHz, and our point is that may not be necessary (since it is not an essential scenario). Further to clarify the UE implementation, it is true that UE needs to calculate distance between GSCN and ssbFrequency to determine CORESET#0 RB offset, but it doesn’t mean the UE needs to calculate the subcarrier offset. In your proposal, there is an extra step to calculate the subcarrier offset before determining k\_SSB, which is not there in legacy Rel-15. Finally, one comment that all the above k\_SSB mentioned should be restricted to SS/PBCH block type A (i.e., k\_SSB values from 0 to 23), since this is the range of k\_SSB that indicates the subcarrier offset and has an associated CORESET#0, and the functionality of k\_SSB to indicate another SSB with CORESET#0 (i.e, k\_SSB values from 24 to 31) should not be impacted (I remember we discussed this point before ^ ^). This point should be taken into consideration when we discuss the TP. To summarize, we are not objecting to discuss this issue, and actually we believe the discussion is necessary. We prefer a simpler solution to resolve the issue, but if all other companies prefer the flexibility of k\_SSB for SSB 2) and the extra complexity is acceptable to all companies, we are open to discuss.  |
| OPPO | 2.1 essential editorial but can be discussed in initial access procedure AI2.2 move to initial access procedure AI2.5 no strong view but would like to see the essential difference between (7,7) and (6,7)4.1 seems have been discussed already.4.3 like the idea but not sure if this enhancement is suitable for discussion at the moment.  |

# References

[1]. R1-2001649, Remaining issues on initial access signals and channles, vivo

[2]. R1-2001702, Remaining issues on the initial access signals for NR-U, ZTE, Sanechips

[3]. R1-2001756, Discussion on the remaining issues of initial access signal/channel, OPPO

[4]. R1-2001932, Remaining issues of initial access signals and channels for NR-U, LG Electronics

[5]. R1-2002028, Initial access signals and channels, Ericsson

[6]. R1-2002114, Initial access signals and channels for NR-U, Samsung

[7]. R1-2002224, Remaining issues on Initial Access Signals and Channels for NR-U, Nokia, Nokia Shanghai Bell

[8]. R1-2002262, Remaining issues on initial access signals/channels, Spreadtrum Communications

[9]. R1-2002575, Maintainance on the initial access signals and channels, Huawei, HiSilicon