**3GPP TSG RAN WG1 Meeting #101-e                     R1-200xxxx**

**e-Meeting, May 25 – June 5, 2020**

**Agenda Item: 7.2.2.2.2**

**Source: Charter Communications**

**Title: Draft [101-e-NR-unlic-NRU-InitAccessProc-01]**

**Document for: Discussion and Decision**

# Introduction

Four email discussions have been sanctioned in RAN1#101-e on initial access procedures for NR-U based on contributions submitted to this meeting [1]-[13]. This first discussion that aims to converge by 5/29 has the following scope:

[101-e-NR-unlic-NRU-InitAccessProc-01] Email discussion/approval on the following issues from R1-2003306 until 5/29; if necessary endorse associated TPs by 6/4 – Amitav (Charter)

* (#2.1, #2.3, #2.4, #2.5) Remaining corrections for cell search in TS 38.213.
* (#2.2, #2.6) Clarifications on PDSCH rate-matching around a given SSB index.

These issues have been selected based on the preparatory discussion summarized in [14].

# Company views

## Remaining corrections for cell search

### (#2.1)

**Description**: Replace the parameter “ssbPositionQCL-Relationship-r16” with “ssb-PositionQCL-r16” for signaling of Q in Clause 4.1 of TS 38.213 to align with TS 38.331 [2].

------------------------------------- < Start of TP#1 for Clause 4.1 of 38.213 > ------------------------------------------

4 Synchronization procedures

4.1 Cell search

< Unchanged parts are omitted >

For operation with shared spectrum channel access, a UE assumes that SS/PBCH blocks in a serving cell that are within a same discovery burst transmission window or across discovery burst transmission windows are quasi co-located with respect to average gain, QCL-TypeA, and QCL-TypeD properties, when applicable [6, TS 38.214], if a value of is same among the SS/PBCH blocks. is an index of a DM-RS sequence transmitted in a PBCH of a corresponding SS/PBCH block, and is either provided by *~~ssbPositionQCL-Relationship-r16~~ssb-PositionQCL-r16* or, if *~~ssbPositionQCL-Relationship-r16~~ssb-PositionQCL-r16* is not provided,obtained from a *MIB* provided by a SS/PBCH block according to Table 4.1-1 with [4, TS 38.211]. *subCarrierSpacingCommon* indicates SCS of RMSI only for the case of "operation without shared spectrum channel access". The UE can determine an SS/PBCH block index according to , or according to where is the candidate SS/PBCH block index. The UE assumes that within a discovery burst transmission window, a number of transmitted SS/PBCH blocks on a serving cell is not larger than and a number of transmitted SS/PBCH blocks with a same SS/PBCH block index is not larger than one.

Table 4.1-1: Mapping between the combination of subCarrierSpacingCommon and LSB of ssb-SubcarrierOffset to

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| *subCarrierSpacingCommon* | LSB of *ssb-SubcarrierOffset* |  |
| scs15or60 | 0 | 1 |
| scs15or60 | 1 | 2 |
| scs30or120 | 0 | 4 |
| scs30or120 | 1 | 8 |

Upon detection of a SS/PBCH block, the UE determines from *MIB* that a CORESET for Type0-PDCCH CSS set, as described in Clause 13, is present if  [4, TS 38.211] for FR1 or if  for FR2. The UE determines from *MIB* that a CORESET for Type0-PDCCH CSS set is not present if  for FR1 or if  for FR2; the CORESET for Type0-PDCCH CSS set may be provided by *PDCCH-ConfigCommon*.

< Unchanged parts are omitted >

-------------------------------------------------- < End of TP#1> -----------------------------------------------------

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### (#2.3)

**Description**: Modify the description in Clause 4.1 of TS 38.213 (If MSB , , of *ssb-PositionsInBurst* is set to 1, the UE assumes that one or more SS/PBCH blocks within the discovery burst transmission window with candidate SS/PBCH block indices corresponding to SS/PBCH block index equal to may be transmitted) to clarify only one transmitted SS/PBCH blocks with a same SS/PBCH block index within a discovery burst transmission window [2].

------------------------------------- < Start of TP#2 for Clause 4.1 of 38.213 > ------------------------------------------

4 Synchronization procedures

4.1 Cell search

< Unchanged parts are omitted >

For operation with shared spectrum channel access, a UE assumes that transmission of SS/PBCH blocks in a half frame is within a discovery burst transmission window that starts from the first symbol of the first slot in a half-frame. The UE can be provided per serving cell by *DiscoveryBurst-WindowLength-r16* a duration of the discovery burst transmission window. If *DiscoveryBurst-WindowLength-r16* is not provided, the UE assumes that the duration of the discovery burst transmission window is a half frame. For a serving cell, the UE assumes that a periodicity of the discovery burst transmission window is same as a periodicity of half frames for receptions of SS/PBCH blocks in the serving cell. The UE assumes that one or more SS/PBCH blocks indicated by *ssb-PositionsInBurst* may be transmitted within the discovery burst transmission window and have candidate SS/PBCH blocks indices corresponding to SS/PBCH block indices provided by *ssb-PositionsInBurst*. If MSB , , of *ssb-PositionsInBurst* is set to 1, the UE assumes that one SS/PBCH block among~~or more~~ SS/PBCH blocks within the discovery burst transmission window with candidate SS/PBCH block indices corresponding to SS/PBCH block index equal to may be transmitted; if MSB is set to 0, the UE assumes that the SS/PBCH block(s) are not transmitted.

< Unchanged parts are omitted >

-------------------------------------------------- < End of TP#2> -----------------------------------------------------

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### (#2.4) Editorial corrections

**Description**:

* Correct indexing references or add ‘candidate SS/PBCH block index’ terminology in:
	+ TS 38.214 Subclause 5.1.4 relating to PDSCH rate matching [8].
	+ TS 38.213 Subclause 8.1 relating to RO validation [9].
	+ TS 38.213 Subclause 11.1.1 relating to UL validation in SFI [9].
	+ TS 38.213 Subclause 9.2.3 relating to PUCCH repetition [9].
	+ TS 38.213 Subclause 5 relating to RLM [7].
	+ TS 38.213 Subclause 8.1 relating to association between SS/PBCH blocks and PRACH occasions [6].
	+ TS 38.213 Subclause 7 relating to path loss reference [6].

==================== Start of TP#3 for Clause 5.1.4 of TS 38.214 =======================

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

5.1.4 PDSCH resource mapping

When receiving the PDSCH scheduled with SI-RNTI and the system information indicator in DCI is set to 0, the UE shall assume that no SS/PBCH block is transmitted in REs used by the UE for a reception of the PDSCH.

When receiving the PDSCH scheduled with SI-RNTI and the system information indicator in DCI is set to 1, RA-RNTI, MsgB-RNTI, P-RNTI or TC-RNTI, the UE assumes SS/PBCH block transmission according to *ssb-PositionsInBurst*, and if the PDSCH resource allocation overlaps with PRBs containing SS/PBCH block transmission resources the UE shall assume that the PRBs containing SS/PBCH block transmission resources are not available for PDSCH in the OFDM symbols where SS/PBCH block is transmitted.

A UE expects a configuration provided by *ssb-PositionsInBurst* in *ServingCellConfigCommon* to be same as a configuration provided by *ssb-PositionsInBurst* in *SIB1*.

When receiving PDSCH scheduled by PDCCH with CRC scrambled by C-RNTI, MCS-C-RNTI, CS-RNTI, or PDSCHs with SPS, the REs corresponding to the configured or dynamically indicated resources in Clauses 5.1.4.1, 5.1.4.2 are not available for PDSCH. Furthermore, the UE assumes SS/PBCH block transmission according to *ssb-PositionsInBurst* if the PDSCH resource allocation overlaps with PRBs containing SS/PBCH block transmission resources, the UE shall assume that the PRBs containing SS/PBCH block transmission resources are not available for PDSCH in the OFDM symbols where SS/PBCH block is transmitted.

A UE is not expected to handle the case where PDSCH DM-RS REs are overlapping, even partially, with any RE(s) not available for PDSCH*.*

For operation with shared spectrum channel access, SS/PBCH block transmission according to *ssb-PositionsInBurst* represents candidate SS/PBCH blocks corresponding to SS/PBCH block indices provided by *ssb-PositionsInBurst* as described in Clause 4.1 of [6, TS 38.213].

================================== End of TP#3 ============================

===================== Start of TP#4 for Clause 8.1 of TS 38.213 =======================

**8.1 Random access preamble**

------------------------------------------------------ Unchanged parts 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  symbols after a last SS/PBCH block reception symbol, where  is provided in Table 8.1-2.

- the SS/PBCH block is provided according to *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 SS/PBCH block is provided according to *ssb-PositionsInBurst* in *SIB1* or in *ServingCellConfigCommon*.

-------------------------------------------------------- End of TP#4 ------------------------------------------------------------------

----------------------------------------------- Start of TP#5 for Clause 11.1.1 in TS 38.213 -------------------------------------

**11.1.1 UE procedure for determining slot format**

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

For a set of symbols of a slot corresponding to SS/PBCH blocks with candidate SS/PBCH block indices indicated to a UE by *ssb-PositionsInBurst* in *SIB1,* or by *ssb-PositionsInBurst* in *ServingCellConfigCommon*, the UE does not expect to detect a DCI format 2\_0 with an SFI-index field value indicating the set of symbols of the slotas uplink.

-------------------------------------------------------- End of TP#5 ------------------------------------------------------------------

----------------------------------------------- Start of TP#6 for Clause 9.2.3 in TS 38.213 -------------------------------------

**9.2.6 PUCCH repetition procedure**

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

A SS/PBCH block symbol is a symbol of an SS/PBCH block with candidate SS/PBCH block index indicated to a UE by *ssb-PositionsInBurst* in *SIB1* or *ssb-PositionsInBurst* in *ServingCellConfigCommon*.

-------------------------------------------------------- End of TP#6 ------------------------------------------------------------------

===========================Start of TP#7 for Clause 5 in 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, where the SS/PBCH block(s) have candidate SS/PBCH block index corresponding to SS/PBCH block index provided by *ssb-Index*.

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

================================= End of TP#7 for TS 38.213 =============================

===========================Start of TP#8 for Clause 8.1 in TS 38.213========================

**8.1 Random access preamble**

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

Physical random access procedure is triggered upon request of a PRACH transmission by higher layers or by a PDCCH order. A configuration by higher layers for a PRACH transmission includes the following:

- A configuration for PRACH transmission [4, TS 38.211].

- A preamble index, a preamble SCS, , a corresponding RA-RNTI, and a PRACH resource.

A PRACH is transmitted using the selected PRACH format with transmission power ,as described in Clause 7.4, on the indicated PRACH resource.

For Type-1 random access procedure, a UE is provided a number  of SS/PBCH block~~s~~ indices associated with one PRACH occasion and a number  of contention based preambles per SS/PBCH block index per valid PRACH occasion by *ssb-perRACH-OccasionAndCB-PreamblesPerSSB*.

For Type-2 random access procedure with common configuration of PRACH occasions with Type-1 random access procedure, a UE is provided a number of SS/PBCH block~~s~~ indices associated with one PRACH occasion by *ssb-perRACH-OccasionAndCB-PreamblesPerSSB* and a number of contention based preambles per SS/PBCH block index per valid PRACH occasion by *msgA-CB-PreamblesPerSSB*. The PRACH transmission can be on a subset of PRACH occasions associated with a same SS/PBCH block index for a UE provided with a PRACH mask index by *msgA-ssb-sharedRO-MaskIndex* according to [11, TS 38.321].

For Type-2 random access procedure with separate configuration of PRACH occasions with Type-1 random access procedure, a UE is provided a number of SS/PBCH block~~s~~ indices associated with one PRACH occasion and a number of contention based preambles per SS/PBCH block index per valid PRACH occasion by *ssb-perRACH-OccasionAndCB-PreamblesPerSSB-msgA* when provided; otherwise, by *ssb-perRACH-OccasionAndCB-PreamblesPerSSB*.

For Type-1 random access procedure, or for Type-2 random access procedure with separate configuration of PRACH occasions from Type 1 random access procedure, if , one SS/PBCH block index is mapped to consecutive valid PRACH occasions and contention based preambles with consecutive indices associated with the SS/PBCH block index per valid PRACH occasion start from preamble index 0. If , contention based preambles with consecutive indices associated with SS/PBCH block index , , per valid PRACH occasion start from preamble index where is provided by *totalNumberOfRA-Preambles* for Type-1 random access procedure, or by *msgA-totalNumberOfRA-Preambles* for Type-2 random access procedure with separate configuration of PRACH occasions from a Type 1 random access procedure, and is an integer multiple of .

For Type-2 random access procedure with common configuration of PRACH occasions with Type-1 random access procedure, if , one SS/PBCH block index is mapped to consecutive valid PRACH occasions and contention based preambles with consecutive indices associated with the SS/PBCH block index per valid PRACH occasion start from preamble index . If , contention based preambles with consecutive indices associated with SS/PBCH block index , , per valid PRACH occasion start from preamble index , where is provided by *totalNumberOfRA-Preambles* for Type-1 random access procedure.

For link recovery, a UE is provided SS/PBCH block~~s~~ indices associated with one PRACH occasion by *ssb-perRACH-Occasion* in *BeamFailureRecoveryConfig*. For a dedicated RACH configuration provided by *RACH-ConfigDedicated*, if *cfra* is provided, a UE is provided SS/PBCH block~~s~~ indices associated with one PRACH occasion by *ssb-perRACH-Occasion* in *occasions*. If , one SS/PBCH block index is mapped to consecutive valid PRACH occasions. If , all consecutive SS/PBCH blocks indices are associated with one PRACH occasion.

SS/PBCH block indices provided by *ssb-PositionsInBurst* in *SIB1* or in *ServingCellConfigCommon* are mapped to valid PRACH occasions in the following order where the parameters are described in [4, TS 38.211].

- First, in increasing order of preamble indices within a single PRACH occasion

- Second, in increasing order of frequency resource indices for frequency multiplexed PRACH occasions

- Third, in increasing order of time resource indices for time multiplexed PRACH occasions within a PRACH slot

- Fourth, in increasing order of indices for PRACH slots

An association period, starting from frame 0, for mapping SS/PBCH block~~s~~ indices to PRACH occasions is the smallest value in the set determined by the PRACH configuration period according Table 8.1-1 such that  SS/PBCH block~~s~~ indices are mapped at least once to the PRACH occasions within the association period, where a UE obtains  from the value of *ssb-PositionsInBurst* in *SIB1* or in *ServingCellConfigCommon*. If after an integer number of SS/PBCH block~~s~~ indices to PRACH occasions mapping cycles within the association period there is a set of PRACH occasions or PRACH preambles that are not mapped to  SS/PBCH block~~s~~ indices, no SS/PBCH block~~s~~ indices are mapped to the set of PRACH occasions or PRACH preambles. An association pattern period includes one or more association periods and is determined so that a pattern between PRACH occasions and SS/PBCH block~~s~~ indices repeats at most every 160 msec. PRACH occasions not associated with SS/PBCH block~~s~~ indices after an integer number of association periods, if any, are not used for PRACH transmissions.

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

================================= End of TP#8 for TS 38.213 =============================

===========================Start of TP#9 for Clause 7.1.1 in TS 38.213========================

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

- If the UE is not provided *pathlossReferenceRSs* or before the UE is provided dedicated higher layer parameters, the UE calculates  using a RS resource obtained from ~~the~~ an SS/PBCH block with the same SS/PBCH block index as the one that the UE uses to obtain *MIB*

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

================================= End of TP#9 for TS 38.213 =============================

===========================Start of TP#10 for Clause 7.2.1 in TS 38.213======================

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

- If the UE is not provided *pathlossReferenceRSs* or before the UE is provided dedicated higher layer parameters, the UE calculates  using a RS resource obtained from ~~the~~ an SS/PBCH block with the same SS/PBCH block index as the one that the UE uses to obtain *MIB*

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

================================= End of TP#10 for TS 38.213 ============================

===========================Start of TP#11 for Clause 7.3.1 in TS 38.213======================

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

- If the UE is not provided *pathlossReferenceRS* or *SRS-PathlossReferenceRS*, or before the UE is provided dedicated higher layer parameters, the UE calculates  using a RS resource obtained from ~~the~~ an SS/PBCH block with the same SS/PBCH block index as the one that the UE uses to obtain *MIB*

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

================================= End of TP#11 for TS 38.213 ===========================

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### (#2.5)

**Description**: Add “The maximum number of transmitted SS/PBCH blocks within a discovery burst transmission window is 8.” to TS 38.213 Clause 4.1 [4].

==================== Start of TP#12 for Clause 4.1 of TS 38.213 =======================

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

The candidate SS/PBCH blocks in a half frame are indexed in an ascending order in time from 0 to , where is determined according to SS/PBCH block patterns for Cases A through E. is a maximum number of SS/PBCH block indices in a cell, and

- for operation without shared spectrum channel access,

- for operation with shared spectrum channel access, for and 15 kHz SCS of SS/PBCH blocks and for and 30 kHz SCS of SS/PBCH blocks. The maximum number of transmitted SS/PBCH blocks within a discovery burst transmission window is 8.

For , a UE determines the 2 LSB bits of a candidate SS/PBCH block index per half frame from a one-to-one mapping with an index of the DM-RS sequence transmitted in the PBCH as described in [4, TS 38.211].

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

================================== End of TP#12 ============================

## (#2.2, #2.6) Clarifications on PDSCH rate matching around SSBs

**Proposal A:** UE performs rate-matching for all of SS/PBCH block candidate position indices (within configured DRS transmission window) QCLed with actually transmitted SS/PBCH block indices that are provided by *ssb-PositionsInBurst* in RMSI [10].

==================== Start of TP#13 for Clause 5.1.4 of TS 38.214 =======================

**5.1.4 PDSCH resource mapping**

When receiving the PDSCH scheduled with SI-RNTI and the system information indicator in DCI is set to 0, the UE shall assume that no SS/PBCH block is transmitted in REs used by the UE for a reception of the PDSCH.

When receiving the PDSCH scheduled with SI-RNTI and the system information indicator in DCI is set to 1, RA-RNTI, MsgB-RNTI, P-RNTI or TC-RNTI, the UE assumes SS/PBCH block transmission according to *ssb-PositionsInBurst*, and if the PDSCH resource allocation overlaps with PRBs containing SS/PBCH block transmission resources the UE shall assume that the PRBs containing SS/PBCH block transmission resources are not available for PDSCH in the OFDM symbols where SS/PBCH block is transmitted.

A UE expects a configuration provided by *ssb-PositionsInBurst* in *ServingCellConfigCommon* to be same as a configuration provided by *ssb-PositionsInBurst* in *SIB1*.

When receiving PDSCH scheduled by PDCCH with CRC scrambled by C-RNTI, MCS-C-RNTI, CS-RNTI, or PDSCHs with SPS, the REs corresponding to the configured or dynamically indicated resources in Clauses 5.1.4.1, 5.1.4.2 are not available for PDSCH. Furthermore, the UE assumes SS/PBCH block transmission according to *ssb-PositionsInBurst* if the PDSCH resource allocation overlaps with PRBs containing SS/PBCH block transmission resources, the UE shall assume that the PRBs containing SS/PBCH block transmission resources are not available for PDSCH in the OFDM symbols where SS/PBCH block is transmitted.

A UE is not expected to handle the case where PDSCH DM-RS REs are overlapping, even partially, with any RE(s) not available for PDSCH*.*

For operation with shared spectrum channel access, SS/PBCH block transmission according to *ssb-PositionsInBurst* represents all of the candidate SS/PBCH block indices according to SS/PBCH block indices provided by *ssb-PositionsInBurst* as described in [Section 4.1, TS 38.213].

================================== End of TP#13 ============================

**Proposal B:** The UE performs PDSCH rate-matching around the resources of candidate SS/PBCH blocks corresponding to a same SS/PBCH block index according to *ssb-PositionsInBurst*, until the UE has successfully detected one SS/PBCH block within a discovery burst transmission window [2].

---------------------------- < Start of TP#14 for Clause 5.1.4 of 38.214 > ------------------------------------------

**5.1.4 PDSCH resource mapping**

< Unchanged parts are omitted >

When receiving PDSCH scheduled by PDCCH with CRC scrambled by C-RNTI, MCS-C-RNTI, CS-RNTI, or PDSCHs with SPS, the REs corresponding to the configured or dynamically indicated resources in Clauses 5.1.4.1, 5.1.4.2 are not available for PDSCH. Furthermore, the UE assumes SS/PBCH block transmission according to *ssb-PositionsInBurst* if the PDSCH resource allocation overlaps with PRBs containing SS/PBCH block transmission resources, the UE shall assume that the PRBs containing SS/PBCH block transmission resources are not available for PDSCH in the OFDM symbols where SS/PBCH block is transmitted until the UE has detected one SS/PBCH block within a discovery burst transmission window.

A UE is not expected to handle the case where PDSCH DM-RS REs are overlapping, even partially, with any RE(s) not available for PDSCH*.*

-------------------------------------------------- < End of TP#14> -----------------------------------------------------

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# References

1. R1-2003371 Remaining issues on initial access procedure for NR-U vivo
2. R1-2003451 Remaining issues on the initial access procedure for NR-U ZTE, Sanechips
3. R1-2003513 Maintenance on the initial access procedures Huawei, HiSilicon
4. R1-2003657 Remaining issues on initial access procedure for NR-U operation MediaTek Inc.
5. R1-2003729 Enhancements to initial access and mobility for NR-unlicensed Intel Corporation
6. R1-2003844 Enhancements to initial access procedures Ericsson
7. R1-2003861 Initial access procedures for NR-U Samsung
8. R1-2003973 Remaining issues on initial access procedure for NR-U ETRI
9. R1-2004001 Remaining issues on initial access procedure Spreadtrum Communications
10. R1-2004014 Remaining issues of initial access and mobility for NR-U LG Electronics
11. R1-2004086 Discussion on the remaining issues of enhancements to initial access procedure OPPO
12. R1-2004444 TP for Initial access and mobility procedures for NR-U Qualcomm Incorporated
13. R1-2004526 On Enhancements to Initial Access Procedure for NR-U Nokia, Nokia Shanghai Bell
14. R1-2003306 Feature lead summary on for initial access procedures enhancements Charter Communications