

**3GPP TSG RAN WG1 Meeting #91
Reno, USA, 27th November – 1st December 2017**

R1-171xxxx

2

Source: MCC Support

Title: Draft Report of 3GPP TSG RAN WG1 #90bis v0.1.0
(Prague, Czech Rep, 9th – 13th October 2017)

Document for: Comments



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Main facts summary

The 3GPP TSG WG RAN1#90bis meeting, hosted by European Friends of 3GPP, was held at the CLARION CONGRESS HOTEL PRAGUE, Czech Republic.

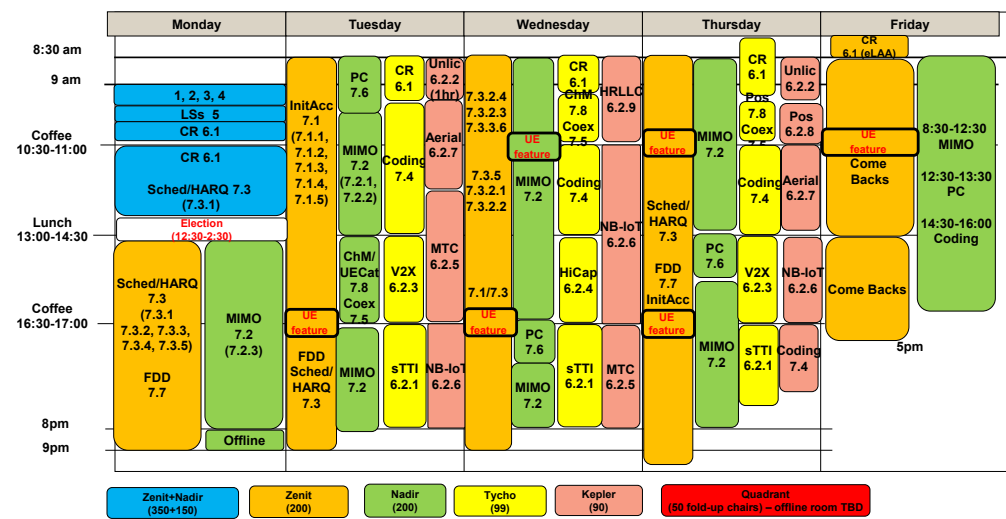
The meeting started at 9:00 on Monday 9th October and finished at 17:15 on Friday 13th October 2017.

The number of attending delegates, having confirmed their participation through the electronic check-in application, was **451**. Note that the number of registered was 584.

On day one, Monday 9th of October, the election of one WG RAN1 Vice Chairman took place and the result was as follows:

New Vice Chairman: **Dr. Havish Koorapaty (Ericsson LM, ETSI).**

The schedule of the week was as follows:



The list of action points that required RAN1 close follow-up is listed in Annex F (end of document).

The number of contributions for this meeting was xxxx.

Note: The amount of documents includes those discussed during the email discussion session post meeting.

	Contribution is agreed/approved
	Contribution is not pursued (no consensus)
	Further discussion is required – come-back needed
	Working assumption
	Specific action needed from MCC
	Contribution is for email discussion/approval

1 Opening of the meeting

Mr Wanshi Chen (RAN1 Chairman) welcomed the participants of the RAN WG1 #90 bis meeting and opened the meeting at 09:00.

Mr Nicolas Chuberre from Thales on behalf of the European Friends of 3GPP, Apple, BlackBerry, BT, Ericsson, Huawei, Intel, InterDigital, KPN, Motorola, Nokia, Orange, Qualcomm, SIM Alliance, Sony, TIM, Telefonica, Telenor, TeliaSonera, Thales, Deutsche Telekom, Vodafone, welcomed the delegates, and detailed the domestic arrangements for the full week.

1.1 Call for IPR

The attention of the members of this Technical Specification Group was drawn to the fact that 3GPP Individual Members have the obligation under the IPR Policies of their respective Organizational Partners to inform their respective Organizational Partners of Essential IPRs they become aware of.

The members take note that they are hereby invited:

- *to investigate whether their organization or any other organization owns IPRs which were, or were likely to become Essential in respect of the work of 3GPP.*
- *to notify their respective Organizational Partners of all potential IPRs, e.g., for ETSI, by means of the IPR Information Statement and the Licensing declaration forms (e.g. see the ETSI IPR forms <http://webapp.etsi.org/Ipr/>).*

1.2 Competition law statement

The Chairman also drew Member's attention to the fact that 3GPP activities are subject to antitrust and competition laws and that compliance with said laws is therefore required of any participant of this WG meeting including the Chairman and Vice Chairmen. In case of question, please contact your legal counsel.

The present meeting will be conducted with strict impartiality and in the interests of 3GPP.

Furthermore, the Chairman reminded Members that timely submission of work items/contributions in advance of WG meetings is important to allow for full and fair consideration of such matters.

1.3 Network usage conditions

The PCG has laid down the following network usage conditions:

Users shall not use the network to engage in illegal activities. This includes activities such as copyright violation, hacking, espionage or any other activity that may be prohibited by local laws.

Users shall not engage in non-work related activities that consume excessive bandwidth or cause significant degradation of the performance of the network.

Since the **network is a shared resource**, users should exercise some basic etiquette when using the 3GPP network at a meeting. It is understood that high bandwidth applications such as downloading large files or video streaming might be required for business purposes, but delegates should be strongly discouraged in performing these activities for personal use. Downloading a movie or doing something in an interactive environment for personal use essentially wastes bandwidth that others need to make the meeting effective. The meeting chairman should remind end users that the network is a shared resource; the more one user grabs, the less there is for another. Email and its attachments already take up significant bandwidth (certain email programs are not very bandwidth efficient). In case of need the chair can ask the delegates to restrict IT usage to things that are essential for the meeting itself.

- 1. DON'T place your WiFi device in ad-hoc mode**
- 2. DON'T set up a personal hotspot in the meeting room**
- 3. DO try 802.11a if your WiFi device supports it**
- 4. DON'T manually allocate an IP address**
- 5. DON'T be a bandwidth hog by streaming video, playing online games, or downloading huge files**
- 6. DON'T use packet probing software which clogs the local network (e.g., packet sniffers or port scanners)**

1.4 Check-in for Registered Delegates

The attention of the delegates to this meeting was drawn to the fact that it is not permitted to check in other delegates on their behalf. In the event of technical difficulties preventing check-in, delegates should present themselves in person to the Secretary.

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1.5 Aspects related to RAN1 Meeting Management

Delegates are encouraged to check [R1-1718766](#) for some thoughts on RAN1 meeting management.

2 Approval of Agenda

[R1-1716940](#) Draft Agenda of RAN1#90bis meeting RAN1 Chair

Wanshi Chen (RAN1 Chair) proposed the agenda for the meeting, as well the schedule of the week.

Discussion: Chairman highlighted that there was only 10 working days left until Dec... and warned the group to stay focused on basic and essential features.

Details of the elections were provided to the group. Refer to AI 8.

Decision: The agenda is approved.

3 Highlights from RAN plenary

[R1-1716943](#) Highlights from RAN#77 RAN1 Chair

The document was presented by Wanshi Chen (RAN1 Chair) and provides the highlights relevant to RAN1 from the last plenary.

Discussion: NR part was already presented in September ad-hoc.

Additional ad-hoc meeting in January 2018 will be hosted by NAF3, in Vancouver - Canada.

Decision: The document is noted.

4 Approval of Minutes from previous meetings

[R1-1716941](#) Report of RAN1#90 meeting ETSI

The document was presented by Patrick Merias from MCC (ETSI Mobile Competence Center) and provides the report from last RAN1#90 meeting in Prague.

Discussion: MCC recalled that the report (with a focus on NR) was presented in September ad-hoc meeting. [R1-1716941](#) is the final report including the LTE part.

Typo regarding the number of checked in delegates – should be read as 444.

Decision: The document is approved.

[R1-1716942](#) Report of RAN1#AH3_NR meeting ETSI

The document was presented by Patrick Merias from MCC (ETSI Mobile Competence Center) and provides the report from last RAN1 ad-hoc meeting in Nagoya.

Discussion: MCC asked for confirmation that no updates post AH3_NR are needed to both 38.201/202. Confirmed by rapporteur for 38.202.

Decision: The document is approved.

5 Incoming Liaison Statements

The document was presented by ... from ...

Discussion:

Decision: The document is noted.

[R1-1716945](#) Reply LS on Relay UE discovery RAN2, Nokia

RAN2 clarifies that currently discovery operation on AS layer is model-transparent and that discovery enhancements were not studied in RAN2 during the feD2D SI. However, the choice of discovery model is performed by the upper layers/Core Network and is known by the upper layers in the UE. Therefore, it can be feasible for the upper layers in the UE to indicate currently used discovery model when requesting AS layer to perform sidelink discovery transmission or sidelink discovery monitoring. If the information is provided by upper layers, then it can also be made possible for RRC Connected UE to indicate the utilized discovery model to the eNB, if needed.

Decision: The document is noted.

[R1-1716959](#) LS on FS_REAR study outcome SA2, Huawei

Decision: The document is noted.

[R1-1716946](#) Response LS to RAN1 on P2X RAN2, LG Electronics

RAN2 asks RAN1 to check the corresponding CRs and to give feedback if there is any concern.

Discussion: Huawei commented that some offline is required before any feedback to RAN2.

Decision: The document is noted. Discuss further offline – Hanbyul (LGE).

Friday: LGE confirmed that there was no need for a reply LS.

[R1-1716960](#) LS on RAR reception for NB-IoT RAN2, Nokia

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RAN2 has discussed the RAR reception issue due to large repetition numbers (e.g. 2048) for NPDCCH and NPDSCH transmission and agreed to the attached MAC CR. RAN1 to update RAN1 specifications accordingly.

Decision: The document is noted.

[R1-1716955](#) LS on effect of SRS switching in TDD + FDD CA RAN4, Qualcomm

Decision: The document is noted. Already discussed in last meeting.

[R1-1716948](#) Reply LS on sPDCCH monitoring in sTTIRAN2, Ericsson

RAN2 made the following agreement regarding retransmission timers for DRX:

drx-RetransmissionTimer, and *drx-ULRetransmissionTimer* for sTTI can be configured independently.

Decision: The document is noted.

[R1-1716951](#) LS on SPS and SR for sTTI RAN2, Huawei

Inform RAN1 that RAN2 desires to support SPS and check the feasibility of SPS activation/deactivation for sTTI.

Decision: The document is noted.

[R1-1717147](#) SPS for short TTIHuawei, HiSilicon

[R1-1717756](#) Draft LS reply on SPS for short TTI Huawei

Decision: The document is noted. Detailed to be handled in 6.2.1

[R1-1716950](#) LS on RAN2 agreements on Enhancements to LTE operation in unlicensed spectrum RAN2, Nokia

Decision: The document is noted. Details to be handled in 6.2.2

[R1-1716952](#) LS on latency requirement for Aerial Vehicles RAN2, NTT DOCOMO

- RAN2 informs RAN1 that the value 50 ms for latency requirements was confirmed and agreed.
- RAN2 agreed to adopt the following definition of “user plane latency” from the TS 38.913 and TR 38.802. The “latency” in TR 36.777 means “*The time it takes to successfully deliver an application layer packet/message from the radio protocol layer 2/3 SDU ingress point to the radio protocol layer 2/3 SDU egress point via the radio interface in both uplink and downlink directions, where neither device nor Base Station reception is restricted by DRX*”, and where “the radio protocol layer 2/3 SDU ingress point” means the input to PDCP in the transmitter and “the radio protocol layer 2/3 SDU egress” means the output from PDCP in the receiver.

Decision: The document is noted. Details to be handled in 6.2.7

[R1-1716962](#) LS on RSSI Definition in Signal Quality Measurements for Mobility in NR RAN4, Ericsson

RAN4 informs that the inter-frequency measurement requirements shall be defined using measurement gaps. However intra-frequency measurement requirements shall be defined using without measurement gaps and also with measurement gaps.

Asks RAN WG1 to take into account the above mentioned information and recommendation when defining RSSI part of the SSB based RSRQ and RSSI part of the CSI-RS based RSRQ.

Discussion: Samsung commented that the intra-frequency measurement may require more discussion in RAN1.

Decision: The document is noted. Details to be handled in 7.1.5

[R1-1718023](#) [Draft] Reply LS on Transport Block Sizes Samsung

Decision: The document (reply to [R1-1715355](#) (R2-1709802)) is noted. Details to be handled in 7.3.3.1

The following LSs are noted, without online presentation (unless specifically requested)

[R1-1716944](#) LS on CSG support in NB-IoT RAN2, Nokia

[R1-1716947](#) Reply LS on QoS support over PC5 RAN2, Nokia

[R1-1716949](#) LS on UE GNSS RTK measurement for high accuracy positioning RAN2, Nokia

[R1-1716953](#) Reply LS on LTE Rel-14 UE feature list for MUST RAN4, MediaTek inc.

[R1-1716954](#) LS reply on TM10 / FD-MIMO UE capability signalling RAN4, Intel Corporation

[R1-1716956](#) LS on new UE power class for Rel-15 efeMTC RAN4, Ericsson

[R1-1716957](#) LS on Rel-14 RAN4 UE feature list RAN4, Intel Corporation

[R1-1716958](#) Reply LS on support of CACC and platooning applications by 3GPP systems SA1, LG Electronics

[R1-1716961](#) LS on scenarios of multiple SSB RAN4, Huawei

[R1-1716963](#) Reply LS to RAN2 for NR UE categories and UE capabilities RAN4, Ericsson

TA Adjustment Stepsize in NR

[R1-1717047](#) Draft LS reply on UE timing advance adjustment step size Huawei, HiSilicon

Decision: The document is noted. Details to be handled in 7.1.4.2.

[R1-1717787](#) [DRAFT] LS on response to UE timing advance adjustment step size CATT

Decision: The document is noted. Details to be handled in 7.1.4.2.

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[R1-1717788](#) [DRAFT] LS on response to RACH agreements CATT
Decision: The document is noted. Details to be handled in 7.1.4.2

[R1-1717316](#) [draft] Reply LS on mixed numerologies FDM operation Intel Corporation
Decision: The document is endorsed and final LS is [approved in R1-1718829](#).

[R1-1718176](#) [Draft] Reply LS on NR L1 processing chain NTT DOCOMO, INC.
Decision: The document is noted. Continue discussion offline – Yuichi (NTT DOCOMO)
Friday: [R1-1719199](#) [Draft] Reply LS on NR L1 processing chain NTT DOCOMO, INC.
Decision: The document is endorsed and final version is [approved in R1-1719201](#).

[R1-1717315](#) [Draft] Response LS on simultaneous transmission and/or reception over EPC/E-UTRAN and 5GC/NR
Intel Corporation

Decision: The document is noted.

[R1-1718595](#) Draft response LS on simultaneous transmission and/or reception over EPC/E-UTRAN and 5GC/NR
Qualcomm Incorporated

Late submission

Continue discussion offline – Hong (Intel)/Peter (Qualcomm).

[R1-1719068](#) [Draft] Response LS on simultaneous transmission and/or reception over EPC/E-UTRAN and 5GC/NR
Intel

Discussion: Huawei never had a chance seeing this draft reply before its presentation – requested more time to look at it.
After reviewing it, Huawei suggested adding “capability” for further clarification.

Decision: The document is endorsed with the update “UE category/capability”, and final LS is [approved in R1-1719211](#).

LS received during the course of the week

[R1-1718940](#) Reply LS on power sharing for LTE-NR Dual connectivity RAN4, LG Electronics
Decision: The document is noted. Details to be handled in 7.6.1

[R1-1719192](#) LS to RAN1 on SCell activation and deactivation RAN2, OPPO
Decision: The document is noted.

[R1-1719193](#) LS to RAN1 on SPS and Grant-free RAN2, Samsung
Decision: The document is noted.

6 E-UTRA

6.1 Maintenance of E-UTRA Releases 8 – 14

[R1-1719120](#) Chairman's notes of AI 6.1 Maintenance of E-UTRA Releases 8 – 14 Ad-Hoc chair (Nokia)

The document was presented by Matthew Baker of Nokia.

Decision: The document is endorsed, and content incorporated below.

6.1.1 Maintenance of E-UTRA Release 8 – 13

eMTC

[R1-1716994](#) TBS for TDD special subframe for BL/CE UE without repetition Ericsson

Decision: The document is endorsed and [CR0980 to 36.213 \(Rel-13, F\) is agreed in R1-1718830](#).

To send an LS to RAN4 based on the above agreed CR.

Tuesday: Shadow [CR0987 to 36.213 \(Rel-14, A\) is agreed in R1-1719075](#)

LS to RAN4 – Johan - [R1-1719076](#)

Thursday: [R1-1719076](#) [Draft] LS on TBS for TDD special subframe for BL/CE UE without repetition Ericsson

Decision: The document is endorsed and final LS is [approved in R1-1719090](#) with CRs attached.

[R1-1717523](#) Correction on MPDCCH frequency hopping Samsung

Decision: The draft CR is endorsed in principle – to further add a change “SPS RNTI” to “SPS C-RNTI”.

Prepare final CRs

Tuesday: [Agreed in R1-1718831 \(36.211, Rel-13, CR0393\) and shadow CR in R1-1718837 \(36.211, Rel-14, CR0396\)](#) (w/o the change of SPS C-RNTI).

[R1-1717898](#) Draft CR on correct RRC parameter name for number of PUCCH repetitions Xiaomi Technology

Decision: The document is endorsed and [CR0982 to 36.213 \(Rel-13, F\) is agreed in R1-1718832](#).

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R1-1718088 Issue with handovers in eMTC Qualcomm Incorporated

Decision: The document is noted. To discuss further offline in drafting an LS covering both Rel-13 and Rel-14 (including handling the case of when MBSFN/SIB2 is not included in HO command) – Alberto (Qualcomm)

Thursday:

R1-1718879 [Draft] LS on handover issues for eMTC Qualcomm

Decision: The document is endorsed and final LS is approved in R1-1719091.

Agreement:

- For Rel-13, for the case where the MBSFN subframe configuration of the target cell is not otherwise known, the UE can assume that the MBSFN subframe configuration is the same as the valid/invalid mask in the handover message (*fdl-DownlinkOrTddSubframeBitmapBR-r13*).

R1-1718299 Draft CR for Non-repeated PUCCH SR transmissions on invalid UL subframes Nokia, Nokia Shanghai Bell

Decision: The document is noted. Continue discussion offline

Tuesday: CRs are agreed in R1-1719077 36213CR0988 (Rel-13/F) and R1-1719078 36213CR0989 (Rel-14/A) with the following change:

The SR transmission instances are $N_{\text{PUCCH,rep}}^{(m)}$ consecutive BL/CE uplink subframes when $N_{\text{PUCCH,rep}}^{(m)} > 1$, or one (BL/CE or non-BL/CE) uplink subframe when $N_{\text{PUCCH,rep}}^{(m)} = 1$, where $N_{\text{PUCCH,rep}}^{(m)}$ is provided by higher layer parameter *NumRepetitionCE-format1*. The starting from a subframe satisfying $(10 \times n_f + \lfloor n_s / 2 \rfloor - N_{\text{OFFSET,SR}}) \bmod SR_{\text{PERIODICITY}} = 0$, where $N_{\text{PUCCH,rep}}^{(m)}$ is provided by higher layer parameter *NumRepetitionCE-format1*.

Field Code Changed

Field Code Changed

NB-IoT

R1-1718824 Discussion on the postponement of NPUSCH transmission ZTE, SaneChips (rev of R1-1718022)

Decision: The document is noted. Continue discussion offline

Clarification (Tuesday):

Note that, as already specified, the 256ms before the first NPUSCH gap begins at the start of the NPUSCH grant, even if NPUSCH transmission is postponed due to a collision with NPRACH.

No CR needed.

CA

R1-1718086 Clarification on CSI report for one serving cell Qualcomm Incorporated

- Proposal: Clarify that it is RAN1 understanding that “For more than one serving cell” = “The transmitted aperiodic CSI report contains CSI for more than one serving cell”.
 - i.e., it is not a valid combination to have 2 cells configured, one activated only, and use up to 20PRBs for the case above.
 - RAN1 to discuss if a CR is needed.

Discussion: Intel supports the proposal

Fujitsu: which part of the spec is impacted should be clarified.

Decision: The document is noted.

Conclusion:

- In the following 36.213 text:
For a non-BL/CE UE and for $29 \leq I_{\text{MCS}} \leq 31$ the modulation order (Q_m) is determined as follows:
 - if DCI format 0 is used and $I_{\text{MCS}} = 29$ or, if DCI format 4 is used and only 1 TB is enabled and $I_{\text{MCS}} = 29$ for the enabled TB and the signalled number of transmission layers is 1, and if
 - the “CSI request” bit field is 1 bit and the bit is set to trigger an aperiodic report and, $N_{\text{PRB}} \leq 4$ or,
 - the “CSI request” bit field is 2 bits and is triggering an aperiodic CSI report for one serving cell according to Table 7.2.1-1A, and, $N_{\text{PRB}} \leq 4$ or,

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- the "CSI request" bit field is 2 bits and is triggering an aperiodic CSI report for more than one serving cell according to Table 7.2.1-1A and, $N_{PRB} \leq 20$ or,

....

The wording "for more than one serving cell" refers to "The transmitted aperiodic CSI report contains CSI for more than one serving cell"

- No CR is necessary

R1-1718087 Clarification for DAI Qualcomm Incorporated

Decision: The document is noted. Continue discussion offline.

Tuesday: Discuss whether PUCCH format 4/5 must be configured if a UE is configured with more than 5 CCs.

Thursday: Email discussion until 28th October – Alberto (Qualcomm)

MIMO

R1-1718089 Draft CR on clarification on DMRS ports associated with PDSCH Qualcomm Incorporated

Decision: The draft 36.211 CR is endorsed. Final CR is agreed in R1-1718835 (36.211, Rel-13, CR0394), and shadow CR in R1-1718336 (36.211, Rel-14, CR0395).

6.1.2 Maintenance of Release 14 Enhanced Licensed-Assisted Access to Unlicensed Spectrum

R1-1717317 Discussion on CSI report reference subframe for an LAA SCell Intel Corporation

Suggestion: When a UE is configured in transmission mode 1-9 or transmission mode 10 with a single configured CSI process for the serving cell, for aperiodic CSI reporting for an LAA SCell on a licensed cell, the Release 14 UE behavior needs to be aligned with the Release 13 UE behavior.

Decision: The document is endorsed. Prepare CR0981 to 36.213 (Rel-13) in R1-1718838.

Friday: CR0981 to 36.213 (Rel-13) in R1-1718838 is agreed.

R1-1715244 Correction on UL multicarrier operation for eLAA in 36.213 Huawei, HiSilicon

Allow the UE to select a carrier into multicarrier set C regardless whether the carrier is indicated with 25us LBT or Cat.4 LBT, i.e., The UE could include c_j indicated with Type 2 channel access procedure into set C and switch c_j to Type 1 channel access procedure if c_j is uniformly randomly selected from C .

Decision: The document is noted. Continue discussion offline

Friday: Still no consensus – not seen as an essential correction.

6.1.3 Maintenance of Release 14 V2V/V2X services based on LTE sidelink

R1-1716989 Correction on TBS selection for PSSCH transmission in TS 36.213 Huawei, HiSilicon

Exclude the V2X PSSCH MCS/TBS configurations that lead to decoding error floors.

Decision: The document is noted.

R1-1717046 Discussion on LTE Rel-14 V2X PSSCH Channel Interleaver (Error floors with $C_{mux} = 10$, and fix with $C_{mux} = 8$ or 9) NXP Semiconductors

Decision: The document is noted.

R1-1717096 Discussion on LTE Rel-14 V2X PSSCH network MCS optimization (non-monotonic MCS vs SNR curve, new MCS-TBS and MCS-exception tables) NXP Semiconductors

Decision: The document is noted. Continue discussion offline

Thursday:

R1-1718967 Way forward on LTE Rel-14 V2X rate-matching NXP, Huawei, HiSilicon, Ericsson, CATT

Agreement:

- Bullet 1 is agreed for PSSCH
- Bullet 2 is agreed with the following additional simulation cases:
 - 1st symbol is available
 - Retransmission is used
- Bullet 3 is not agreed – decide at RAN1#91 how to handle the list.

6.1.4 Maintenance of Release 14 Full-Dimension MIMO for LTE

R1-1718090 Correction on power boosting for UL DMRS Qualcomm Incorporated

Decision: The draft CR is endorsed. Final CR0398 to 36.211 (Rel-14, F) is agreed in R1-1718842.

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[R1-1718091](#) Clarification on supporting lower frequency domain density for Class A NZP CSI-RS Qualcomm Incorporated

Decision: The draft CR (36.213, Rel-14, F) is noted. Continue discussion offline.

Tuesday: Agreed in [R1-1718079](#) 36213CR0990 with deletion of “resource” in “CSI-RS resource configuration” x 2.

[R1-1718092](#) Renaming of duplicated table 7.2.1-1A Qualcomm Incorporated

Decision: The draft CR (36.213, Rel-14, D) is endorsed in principle - to fix the typo in cover page (7.1.1 to 7.2.1) & to add the necessary reference change in also 7.2.2 – prepare final CR.

Tuesday: Agreed in [R1-1718843](#) (CR0983)

CBSR

[R1-1718809](#) Discussions on CBSR for advanced CSI LG Electronics (Revision of [R1-1717244](#))

Proposal. If CBSR for advanced CSI is supported, beam restriction is sufficient.

Decision: The document is noted.

[R1-1717524](#) Codebook subset restriction for advanced CSI codebook Samsung

Proposal: For advanced CSI codebook,

- Beam restriction based on beam groups is supported
 - Partition $N_1 N_2 O_1 O_2$ DFT beams into beam groups $G(r_1, r_2)$ comprising (N_1, N_2) adjacent beams
 - (r_1, r_2) is the leading DFT beam, $r_1 \in \{0, N_1, \dots, (O_1 - 1)N_1\}$, $r_2 \in \{0, N_2, \dots, (O_2 - 1)N_2\}$
 - $G(r_1, r_2) = \{(r_1 + x_1, r_2 + x_2) : x_1 = 0, 1, \dots, N_1 - 1, x_2 = 0, 1, \dots, N_2 - 1\}$
 - Bitmap $B = B_1 B_2$
 - B_1 has a fixed length $O_1 O_2$ and restricts (r_1, r_2) values
 - $B_2 = B^{(1)} B^{(2)} \dots B^{(P)}$
 - $P = \#(r_1, r_2)$ values restricted via B_1
 - $B^{(i)}$ has length $N_1 N_2$ and restricts DFT beams in $G(r_1, r_2)$ corresponding to i -th restricted (r_1, r_2) value via B_1
 - Total length of the bitmap $= O_1 O_2 + P N_1 N_2$
 - P is fixed, e.g. $P=2$
- If WB beam power restriction can be supported for the beams in the P restricted beam groups
 - If supported, 1 bit is used to restrict WB beam power values for each beam.

Decision: The document is noted.

[R1-1717784](#) Codebook Subset Restriction in advanced CSI Huawei, HiSilicon

- Proposal1: Introduce beam + power restriction for CSR for advanced CSI codebook.
- Proposal2: CSR for type II codebook in NR is reused for advanced CSI codebook.

Decision: The document is noted.

[R1-1717875](#) Evaluation of CBSR for hybrid CSI Intel Corporation

- For hybrid CSI reporting, the codebook subset restriction should be introduced for both eMIMO types to avoid PMI reporting recommending beamforming of CSI-RS resource (of the 2nd eMIMO type with Class B FD-MIMO and $K = 1$) to the undesired directions.

Decision: The document is noted.

[R1-1718269](#) Advanced CSI Codebook Subset Restriction Ericsson

Proposals:

- Beam level CBSR is also supported for advanced CSI feedback.
- Option 1 based UE behavior is used for CBSR, i.e., when any of the two beams $\{b_1, b_2\}$ in a codeword is a restricted beam, the codeword is not used in CSI feedback.
- W2 based CBSR is not applied when advanced CSI is configured, at least for rank 1 and rank 2.
- Rank based CBSR should also be supported for advanced CSI feedback.

Decision: The document is noted.

Conclusion:

- Accept codebook subset restriction for Advanced CSI and Hybrid CSI for both eMIMO types under TEI-15
 - Further discussion offline on the corresponding details – to handle later this week

Thursday

[R1-1718918](#) WF on CBSR for advanced CSI codebook Huawei, HiSilicon, Samsung

Observations:

- Alt 1: Beam restriction, restricting both strong and weak beams together
- Alt 2: Joint beam/power restriction as in [R1-1718918](#)

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- Different views on performance gain from including the per-beam power restriction
- Some companies have concerns on:
 - complexity of joint beam/power search
 - restriction of flexibility of beam restriction for a given signalling overhead
- Alt 3: Two beam restriction bit maps, independently restricting the strong and weak beams.
 - Concerns on the signalling overhead

Next steps:

- Further evaluate the potential gains of Alt 2 and Alt 3 joint beam/power restriction under the assumption of the same signalling overhead as beam-only restriction.
- Aim to provide simulation results by 3rd November so that further email discussion can take place before RAN1#91.

6.1.5 Maintenance of Release 14 Further Enhanced MTC for LTE

R1-1718093 Retuning between SRS symbols Qualcomm Incorporated

Proposal: For the case of SRS->SRS retuning in UpPTS, and when one or more of the SRS symbols collide with the retuning gap (one or two symbols), it is up to UE implementation to drop any one or two SRS symbols.

Decision: The document is noted.

Continue discussion offline particularly regarding up to UE implementation, or UE not expected to handle, or define explicit UE behaviour, etc.

Tuesday:

R1-1718881 SRS to SRS retuning in UpPTS Qualcomm Incorporated

Decision: CR in [R1-1718881](#) specifying that the UE is not expected to handle this case – [agreed in R1-1719080 36.211CR0397](#).

R1-1718094 Corrections on HARQ-ACK bundling Qualcomm Incorporated

Decision: The document is noted. Continue discussion offline.

R1-1718880 Corrections on HARQ-ACK bundling Qualcomm Incorporated

Thursday decision: DraftCR to 36.213 (Rel-14, F) is [agreed in R1-1719092 as CR0991](#) with change of M (x2) in penultimate bullet to a variable that is not used elsewhere.

R1-1718095 Discussion on comb 4 for eMTC Qualcomm Incorporated

Proposal: Adopt one of the following two options for SRS with comb 4:

- Option 1: Support only comb 2 for eMTC (i.e., remove support of comb 4 for eMTC similarly to the CR in [R1-1712755](#)).
- Option 2: Support comb 2 and comb 4 for eMTC, with separate capability to indicate support of comb 4 (and send LS to RAN2 to introduce this capability from Rel-14)

Also supported by Ericsson

Decision: The document is noted. Continue discussion offline.

Proposal (to be checked until Wed): Send an LS to RAN2 asking to add a new UE capability for comb-4 for eMTC - (Alberto).

Thursday: [R1-1719081](#) [Draft] LS on Comb 2 SRS enhancements Qualcomm

Decision: The document is noted. Final LS is [approved in R1-1719093](#) with the addition of “for Rel-14 BL/CE UEs” in the title.

6.1.6 Maintenance of Release 14 Enhancements of NB-IoT for LTE

36.212

R1-1716988 Correction to multi-carrier NPRACH IE name in PDCCH order DCI format N1 Huawei, HiSilicon

R1-1717029 Correction on NB-IoT DCI format N1 in 36.212 Ericsson

Continue discussion offline based on the above two CRs.

Tuesday: Both CRs are merged and [agreed as CR0266R1 to 36.212 \(Rel-14, F\) in R1-1718867](#).

36.213

R1-1717026 Corrections of parameter names for NB-IoT Ericsson

Decision: The draft CR is endorsed in principle. Discussion further offline on the detailed wording for SIB1 & correction of typo in the cover page (regarding wording parameter) – prepare final CR.

Tuesday: Final CR in [R1-1718846](#) (36.213, Rel-13, CR0984) & shadow CR in [R1-1718847](#) (36.213, Rel-14, CR0985)

Agreed in [R1-1719082](#) (Rel-13, CR0984R1) & [R1-1719083](#) (Rel-14, CR0985R1) with typos corrected on cover sheet.

R1-1718255 Clarification on timing relationships of 2 HARQ processes Huawei, HiSilicon

Decision: The document is noted. Continue discussion offline.

Tuesday: Revised in [R1-1718868](#) (36.213 CR0986, Rel-14, F) – discuss wording offline to clarify further.

Thursday: [Agreed in R1-1718964 as CR0986R1](#).

36.214

R1-1717024 Revision of UE measurement report definitions considering NB-IoT Ues Ericsson
Decision: The document (CR0047 to 36.214, Rel-14, F) is agreed.

Improved FH Randomization

R1-1717027 Improved FH randomization for NB-IoT Rel-14 Ericsson

Proposal 1: For random access on non-anchor carriers reinitialize and run the pseudo random frequency generator, based on a non-linear combination of the cell id, the frame and hyper frame numbers, before the start of each NPRACH resource.

Proposal 2: For random access on non-anchor carriers specify c_{init} in accordance with Equations 3 and 4:

$$(n_f - \lfloor N_{start}^{NPRACH} / 10 \rfloor) \bmod (N_{period}^{NPRACH} / 10) = 0 \quad (\text{Eq. 3})$$

$$c_{init} = (N_{ID}^{Ncell} + 1)((1024 \cdot n_{hf} + n_f) \bmod 79 + 1)^2 \cdot 2^9 + N_{ID}^{Ncell} \quad (\text{Eq. 4})$$

Decision: The document is noted.

R1-1717193 Improved frequency hopping randomization for NPRACH ZTE, SaneChips

Proposal 1: In Rel-14, it is proposed to limit the hopping pattern in non-anchor carriers.

Decision: The document is noted.

Continue discussion offline based on the above two contributions

Thursday: Check at RAN1#91.

RACH power control

R1-1716984 On Rel-14 NB-IoT RACH power control Huawei, HiSilicon

- Proposal 1: For a Rel-14 UE which has level ramped from NPRACH level 0 in a RACH procedure, use the NPRACH level 0 power control and power ramping procedure in the new NPRACH level, i.e. based on path-loss with power ramping.
- Proposal 2: Network can configure a cell-specific Δ additional to the NRSRP threshold of CE level 0 to indicate that the UE shall not perform level ramping when it measures NRSRP higher than "NRSRP threshold of CE level 0 + Δ ", Δ from the set {0, 10, 20, 30} dB.
- Proposal 2a: The UE in CE level 0 which does not perform level ramping shall consider the Random Access procedure unsuccessfully completed when it fails at the maximum number of attempts (i.e. $maxNumPreambleAttemptCE$) configured in CE level 0.
- Proposal 3: Network can configure whether NPUSCH power control for Msg3 shall be according to the existing open loop power control functionality in TS 36.213 but without the restriction on the number of repetitions.
- Proposal 4: Prepare a CR to section 16.3.1/16.2.1 of TS 36.213 and send LS to inform RAN2 accordingly.

Decision: The document is noted.

R1-1717028 On improved Random Access Procedure for NB-IoT Rel-14 Ericsson

Proposal: RAN1 to prepare CRs for implementing the herein described set of solutions in the scope of NB-IoT Release 14. A LS to inform RAN2 about this decision should be sent.

Decision: The document is noted.

R1-1717192 NPRACH power control for Rel-14 NB-IoT ZTE, SaneChips

Proposal 1: For UEs satisfy Measured RSRP Value $\geq$ RSRP_0 + Delta, if maximum ramping attempts is reached for CE level 0

- 1) Restart the preamble transmission on CE level 0
- 2) Reset ramp attempt count
- 3) Random powerRampingStep: UE selects randomized powerRampingStep value, since increasing Tx power difference will fasten the access time for these UEs

Proposal 2: For UEs Measured RSRP Value $<$ RSRP_0 + Delta, Rel-13 NPRACH power control is used.

Proposal 3: It is more effective to first fix the NPRACH hopping pattern problem in order to solve NPRACH capacity issue. With increased NPRACH capacity, the problem will be moot in most cases.

Decision: The document is noted.

Continue discussion offline based on the above three contributions

Wednesday:

R1-1718954 WF on NPRACH power control Huawei, HiSilicon, Ericsson, Softbank, Deutsche Telekom, China Telecom, China Unicom, Vodafone

- Agree to introduce the following solutions for Rel-14 to reduce the possible uplink interference caused by the NB-IoT UE which has level ramped from NPRACH level 0 in a RACH procedure.
 - For a Rel-14 UE which has level ramped from NPRACH level 0 in a RACH procedure, use the NPRACH level 0 power control and power ramping procedure in the new NPRACH level, i.e. based on path-loss with power ramping.

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- Network can configure a cell-specific Δ additional to the NRSRP threshold of CE level 0 to indicate that the UE shall not perform level ramping when it measures NRSRP higher than “NRSRP threshold of CE level 0 + Δ ”, Δ from the set {0, 10, 20, 30} dB.
 - The UE above which does not perform level ramping shall consider the Random Access procedure unsuccessfully completed when it fails at the maximum number of attempts (i.e. maxNumPreambleAttemptCE) configured in CE level 0.
- For a Rel-14 UE which has level ramped from NPRACH level 0 in a RACH procedure, network can configure whether NPUSCH power control for Msg3 shall be according to the existing open loop power control functionality in TS 36.213 but without the restriction on the number of repetitions.

Decision: The document is noted.

Proposal:

- Adopt the solution in [R1-1718954](#) as an optional UE capability
 - ZTE and Sanechips object.

Proposal:

- Adopt just the additional Δ bullet from [R1-1718954](#) as an optional UE capability

Thursday conclusion: no consensus – check whether situation has changed on Friday.

Friday

[R1-1719188](#) WF on NPRACH power control Huawei, HiSilicon, Ericsson, Softbank, Deutsche Telekom, China Telecom, China Unicom, Vodafone, Qualcomm

Agreements:

- **Working assumption:** introduce the following solutions for Rel-14 to reduce the possible uplink interference caused by the NB-IoT UE which has level ramped from NPRACH level 0 in a RACH procedure.
 - For a Rel-14 UE which has level ramped from NPRACH level 0 in a RACH procedure, use the NPRACH level 0 power control and power ramping procedure in the new NPRACH level, i.e. based on path-loss with power ramping.
 - Network can configure a cell-specific Δ additional to the NRSRP threshold of CE level 0 to indicate that the UE shall not perform level ramping when it measures NRSRP higher than “NRSRP threshold of CE level 0 + Δ ”, Δ from the set {0, 10, 20, 30} dB.
 - The UE above which does not perform level ramping shall consider the Random Access procedure unsuccessfully completed when it fails at the maximum number of attempts (i.e. maxNumPreambleAttemptCE) configured in CE level 0.
 - Adopt the solutions above as an optional UE capability.
 - FFS how to fix the Msg3 power control for Rel-14 UE measured in CE level 0.

Interference Randomization for NPUSCH

[R1-1717025](#) On interference randomization of NPUSCH Ericsson

Proposal: It is not necessary additional interference randomization for NPUSCH needs to be introduced.

Decision: The document is noted.

[R1-1717194](#) NPUSCH Interference randomization enhancement ZTE, SaneChips

Proposal 1: For Rel-14 unicast NPUSCH configured with interference randomization enhancement or Msg3 in non-anchor carrier, introduce the following symbol-level scrambling to SC-FDMA symbols in $M_{\text{identical}}^{\text{NPUSCH}} \cdot N_{\text{slots}}$ slots for $N_{\text{sc}}^{\text{RU}} > 1$:

$$y'(l) = y(l) \cdot \theta_f(l),$$

$$\theta_f(l) = \begin{cases} 1, & \text{if } c_f(2l) = 0 \text{ and } c_f(2l+1) = 0 \\ -1, & \text{if } c_f(2l) = 0 \text{ and } c_f(2l+1) = 1 \\ j, & \text{if } c_f(2l) = 1 \text{ and } c_f(2l+1) = 0 \\ -j, & \text{if } c_f(2l) = 1 \text{ and } c_f(2l+1) = 1 \end{cases},$$

$$l = 0, \dots, M_{\text{identical}}^{\text{NPUSCH}} \cdot N_{\text{slots}} \cdot (N_{\text{ymb}}^{\text{UL}} - 1) - 1,$$

where the scrambling sequence $c_f(j)$ is given by clause 7.2 of 36.211 and shall be initialized at the start of every

$$M_{\text{identical}}^{\text{NPUSCH}} \cdot N_{\text{slots}} \text{ slots}, j = 0, \dots, M_{\text{identical}}^{\text{NPUSCH}} \cdot N_{\text{slots}} \cdot (N_{\text{ymb}}^{\text{UL}} - 1) - 1,$$

$$c_{\text{init}} = (n_{\text{RNTI}} + 1) / (10n_f + \lfloor n_s / 2 \rfloor) \bmod 61 + 1 \cdot 2^9 + N_{\text{ID}}^{\text{Ncell}}$$

- Adopt the CR in [R1-1717195](#).

Decision: The document is noted.

[R1-1717195](#) Interference randomization for NPUSCH ZTE, SaneChips

Continue discussion offline based on the above three contributions

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Thursday
[R1-1718975](#) WF on NPUSCH scrambling for Rel-14 NB-IoT ZTE, LGE, Sanechips, Lenovo

Conclusions:

- Not adopted for Rel-14.
- No consensus for Rel-15.

6.1.7 Other

[R1-1717243](#) Clarification on PUSCH and SRS transmission in UpPTS MediaTek Beijing Inc.

Proposal: A UE shall not transmit SRS on symbols scheduled for PUSCH data transmission in UpPTS if a UE is configured for PUSCH transmission in UpPTS and a SRS transmission overlaps with a PUSCH transmission on the same symbol in UpPTS within a TDD serving cell.

Decision: The document is noted.

[R1-1717294](#) PUSCH and SRS Transmission in UpPTS MediaTek, CMCC

Discussion: Qualcomm CR may not be needed – simple clarification could be made

Decision: The document is noted. Continue discussion offline especially whether to take the CR0979 (36.213, Rel-14, F) in [R1-1717294](#) or alternatively specifying the UE is not expected to handle the case.

Thursday: Agreed in [R1-1719088](#) as 36.213CR979R1 with work item code for UL enhancement WI.

[R1-1717893](#) Discussion on additional signalling for special subframe configuration 10 CMCC

Decision: The document is noted. Continue discussion offline

Thursday
[R1-1719038](#) WF on higher layer signalling for special subframe configuration 10 CMCC

Agreement:

- For special subframe configuration 10 (SSP10), specify a Rel-14 cell-specific RRC signalling configuration to inform UEs of whether the CRS on the 5th symbol of DwPTS is transmitted or not.
 - If the UE is informed that no CRS is transmitted on the 5th symbol of DwPTS under SSP10, UE is not expected to perform CRS-based measurement and channel estimation on the 5th symbol of DwPTS, and UE is not expected to decode PDSCH in DwPTS.
- To keep backward compatibility with the legacy Rel-14 UEs who cannot read the newly specified signalling, a new Rel-14 IE 'TDD-Config-v14xy' in TS36.331 is recommended to be specified, which includes both configuration of the SSP10 and the newly specified signalling.
 - The new Rel-14 IE 'TDD-Config-v14xy' cannot be simultaneously configured with 'TDD-Config-v1430' in TS36.331.
- A new optional UE capability is introduced to signal whether the UE supports SSP10 with no CRS on the 5th symbol.
- Send an LS to RAN2 to specify the signalling - [R1-1719089](#) (CMCC) – revisit on Friday.

Friday
[R1-1719089](#) [Draft] LS on higher layer signalling for special subframe configuration 10 CMCC
Decision: The document is endorsed and final version is [approved in R1-1719204](#).

[R1-1718096](#) Introduction of 2Gbps category Qualcomm Incorporated

- Following guidance from RAN saying that CRs were to be checked in RAN WG for technical endorsement.

Decision: The document is noted.

Conclusion:

- RAN1 technically endorses the changes above from RAN1 perspective, corresponding to the CR in R2-1710247 (attached in 8096).
- Send LS to RAN2/RAN with the confirmation of technical endorsement from RAN1 perspective – Alberto (Qualcomm)

Tuesday:
[R1-1718850](#) [Draft] LS on 2Gbps category Qualcomm

Decision: The document is endorsed and final LS is [approved in R1-1719084](#).

[R1-1718767](#) Discussion on modulation enhancements Qualcomm Incorporated, Samsung, KDDI (Revision of [R1-1718097](#))

Decision: The document is noted. Continue discussion offline

Thursday conclusion: not adopted in Rel-14 unless consensus to do so appears by RAN1#91.

6.2 LTE Release 15

[R1-1717725](#) Introduction of reduced control plane latency Ericsson

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[R1-1717729](#) Control Plane latency reduction Ericsson

Friday

Rapporteur to prepare summary of the agreements for feCoMP by 10/20.

Editors to provide initial draft CRs for feCoMP by 11/17, to be commented on and to update by 11/23.

6.2.1 Shortened TTI and processing time for LTE - *WID in RP-171468*

[R1-1719121](#) Chairman's notes of AI 6.2.1 Shortened TTI and processing time for LTE Ad-Hoc chair (Ericsson)

The document was presented by Mårten Sundberg of Ericsson.

Decision: The document is endorsed, and content incorporated below.

[R1-1718316](#) Introduction of shortened processing time and shortened TTI Ericsson

[R1-1718911](#) Introduction of shortened processing time and shortened TTI - 36.211 s03-05 Ericsson Rel-15 36.211 CR0385R2, B

Decision: Endorsed

[R1-1718911](#) Introduction of shortened processing time and shortened TTI - 36.211 s06-08 Ericsson Rel-15 36.211 CR0399, B

Decision: Endorsed

[R1-1717151](#) Introduction of shortened processing time and shortened TTI into 36.212 Huawei

Decision: Endorsed via email approval post RAN1#90.

[R1-1718791](#) Introduction of shortened processing time and shortened TTI into 36.213, s06-s09 Motorola Mobility

Decision: Endorsed via email approval post RAN1#90.

[R1-1718791](#) Introduction of shortened processing time and shortened TTI into 36.213, s10-s13 Motorola Mobility

Decision: Endorsed via email approval post RAN1#90.

Email approval on reached offline consensus at RAN1#90bis (Ericsson - Mårten, from 16th Oct to 20th Oct)

Email approval on list of physical layer related RRC parameters including sending an LS to RAN2 (Ericsson - Mårten, from 20th Oct to 27th Oct)

Friday

Rapporteur to update the summary of agreements by 10/14

Editors to provide updated CRs by 10/19, to be commented on and to update by 10/24.

6.2.1.1 Shortened processing time for 1ms TTI

6.2.1.1.1 Configuration of shortened processing time for 1ms TTI

Including DL/UL configuration of shortened processing time in single carrier and CA scenario

[R1-1717145](#) Configuration of shortened processing time for 1ms TTI Huawei, HiSilicon

[R1-1717156](#) Configuration and UE capabilities for 1ms n+3 Ericsson

[R1-1717181](#) On configuration of shortened processing time for 1ms TTI Nokia, Nokia Shanghai Bell

[R1-1717245](#) Discussion on configuration of shortened processing time for 1ms TTI LG Electronics

[R1-1717318](#) Capability indication for shortened processing time for 1ms TTI Intel Corporation

[R1-1717525](#) Configuration of shortened processing time for 1ms TTI Samsung

[R1-1718098](#) Configuration of shortened processing time for 1ms TTI Qualcomm Incorporated

Agreement: The previous agreement regarding UE capability is changed as per below

FROM: The UE capability of reduced processing time for 1 ms TTI is separately reported for FS1, FS2 and FS3.

TO: The UE capability is reported per band combination. For each band combination the maximum number of supported CCs for short processing time are reported. The reported number of carriers apply to all the FS-type(s) supported. The supported FS-type(s) are also reported per band combination.

Agreement: Shortened processing time for 1 ms TTI is configured per CC. The cell carrying the PUCCH should be configured with n+3 timing.

NOTE: In case some issues might be encountered further restrictions can be considered.

Agreement: Cross-carrier scheduling for short processing time is supported within the same PUCCH group. Both scheduling and scheduled cell shall be configured with short processing time.

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6.2.1.1.2 Handling collisions between n+4 and n+3

Including remaining issues of collisions for FS1 and FS2 (including the order of the numbers in the table for DL HARQ-ACK timing from PDSCH to HARQ-ACK)

R1-1717246	Discussion on PUCCH resource collision handling for FS2	LG Electronics
R1-1717124	Handling collisions between n+4 and n+3 for FS2	Huawei, HiSilicon
R1-1717696	Remaining issues of handling collisions between n+4 and n+3	ZTE, Sanechips
R1-1717235	Remaining issues of collision handling between n+3 and n+4	Nokia, Nokia Shanghai Bell
R1-1717157	Remaining aspects of collisions handling with reduced processing time for 1ms TTI	Ericsson
R1-1717526	Handling collisions between n+4 and n+3	Samsung
R1-1718099	Handling collisions between n+4 and n+3	Qualcomm Incorporated

[R1-1718935](#) WF on 1-ms FS2 Nokia, LG Electronics, Nokia Shanghai Bell

Proposed offline consensus:

For a carrier configured with shortened processing time, DL HARQ-ACK timing from PDSCH to HARQ-ACK, bit ordering, and PUCCH resource are determined by using the table below:

TDD UL/DL Configuration	Subframe n									
	0	1	2	3	4	5	6	7	8	9
0	-	-	(6)	3	(4), 3	-	-	(6)	3	(4), 3
1	-	-	(7), 6, 3	(4), 3	-	-	-	(7), 6, 3	(4), 3	-
2	-	-	(8), 7, 4, 6, 3	-	-	-	-	(8), 7, 4, 6, 3	-	-
3	-	-	7, 6, (11), 5	(6), 5, 4	(5), 4, 3	-	-	-	-	-
4	-	-	(12), 8, 7, 11, 6	6, 5, 4, (7), 3	-	-	-	-	-	-
5	-	-	(13), 12, 9, 8, 7, 5, 4, 11, 6, 3	-	-	-	-	-	-	-
6	-	-	(7), 6	(7), 4	(5), 4	-	-	(7), 6	(7), 3	-

Notes:

- DL subframes only for UEs not configured with shortened processing time are in parentheses
- DL subframes only for UEs configured with shortened processing time are highlighted in red.
- DL subframes highlighted in green are common for both above UE types
- A UE configured with shortened processing time should take into account:
 - DL subframes for UEs with applying either processing time (numbers highlighted in green), and DL subframes only for UEs configured with shortened processing time (numbers highlighted in red) in order to determine HARQ-ACK codebook for a certain UL subframe
 - Additionally, the UE should also consider DL subframes only for UEs not configured with shortened processing time (the ones in parentheses) in order to reserve PUCCH resource. I.e. implicit resource allocation is applied, without an additional RRC configured starting position

Conclusion: There is consensus on the overall description above. More time is requested to check the table details. Table details will be included in e-mail discussion after RAN1#90b

6.2.1.1.3 UL DCI for asynchronous UL HARQ

Including aspects related asynchronous HARQ in UL for the reduced processing time operation.

R1-1717182	On UL DCI details for asynchronous UL HARQ of 1ms TTI shortened processing time	Nokia, Nokia Shanghai Bell
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Offline consensus:

Amend the following fields to DCI format 0 and format 4 of an UL grant scheduling PUSCH with reduced processing time:

- HARQ ID
 - $\text{ceil}(\log_2(\text{UL HARQ processes for sTTI}))$ if configured with sTTI, 3 bit otherwise
- 2 bit RV indicating {0,1,2,3}
 - In case DCI format 4, the indicated RV applies to both PUSCH CWs.

R1-1717125	Asynchronous UL HARQ	Huawei, HiSilicon
R1-1717158	UL DCI for asynchronous HARQ for PUSCH	Ericsson
R1-1717319	Asynchronous HARQ for PUSCH transmissions	Intel Corporation
R1-1717527	UL DCI for asynchronous UL HARQ	Samsung
R1-1718100	UL DCI for asynchronous UL HARQ	Qualcomm Incorporated

6.2.1.1.4 Other

- [R1-1717126](#) CSI feedback for 1ms TTI Huawei, HiSilicon
[R1-1717159](#) Removing UL channel interleaver for 1ms TTI Ericsson
[R1-1717528](#) Clarification of fallback mode to n+4 timing Samsung
[R1-1717529](#) FS3 aspects for 1ms TTI Samsung
[R1-1717530](#) UL power control timing for 1ms TTI Samsung

6.2.1.2 Shortened TTI with shortened processing time

6.2.1.2.1 Aspects related to interaction between different TTI lengths

*Including dynamic switching between TTI and sTTI within a cell & across CCs; different sTTIs across PUCCH groups
Including HARQ processes handling, including the #HARQ processes, and TTI/sTTI collisions.*

- [R1-1717129](#) Aspects related to interaction between different TTI lengths Huawei, HiSilicon
[R1-1717160](#) Aspects related to the dynamic switching between 1ms TTI and sTTI Ericsson
[R1-1717183](#) On interaction between different TTI lengths Nokia, Nokia Shanghai Bell

[R1-1718793](#) Summary of Email discussion [90-12] on UL collision handling and power control (revision of [R1-1717247](#))
LG Electronics

Agreement:

- When HARQ-ACK for PDSCH is transmitted on sPUSCH due to collision between PUSCH and sPUSCH or between PUCCH and sPUSCH in the same subframe on a given carrier, joint coding of HARQ-ACK for PDSCH and sPUSCH is supported.
 - The feedback on sPUSCH consists of the concatenation of sPUSCH (from one with the lowest cell index) prior to HARQ-ACK (from one with the lowest cell index).

Agreement:

- When HARQ-ACK for PDSCH is transmitted on sPUSCH due to collision between PUSCH and sPUSCH in the same subframe on a given carrier, spatial bundling for HARQ-ACK of PUSCH before mapping onto sPUSCH is supported.
 - For 7os sPUSCH spatial bundling is applied when configured, for 2/3os sPUSCH spatial bundling is always applied
 - FFS other bundling

Agreement:

- When HARQ-ACK for PDSCH is transmitted on sPUSCH due to collision between PUCCH and sPUSCH in the same subframe on a given carrier, spatial bundling for HARQ-ACK of PUCCH before mapping onto sPUSCH is supported.
 - For 7os sPUSCH spatial bundling is applied when configured, for 2/3os sPUSCH spatial bundling is always applied
 - FFS other bundling

Agreement:

- When HARQ-ACK for PDSCH is transmitted on sPUCCH due to collision between PUCCH and sPUCCH in the same subframe on a given carrier, joint coding of HARQ-ACK for PDSCH and sPUCCH is supported.
 - The feedback on sPUCCH consists of the concatenation of sPUCCH (from one with the lowest cell index) prior to HARQ-ACK (from one with the lowest cell index).

Agreement:

- When HARQ-ACK for PDSCH is transmitted on sPUCCH due to collision between PUCCH and 2/3-OS sPUCCH in the same subframe on a given carrier, spatial bundling for HARQ-ACK of PUCCH before mapping onto 2/3-OS sPUCCH is always applied.
 - FFS other bundling

Proposed offline consensus:

When HARQ-ACK for PDSCH is transmitted on sPUCCH due to collision between PUCCH and sPUCCH in the same subframe on a given carrier, HARQ and sHARQ bits are determined independently (using fixed codebook or dynamic codebook, depending on configuration).

- How to determine the HARQ bits for 1 ms is FFS
 - Alt 1: No HARQ bits are included if no PDCCH is detected. If PDCCH is detected, use Alt 2
 - Alt 2:
 - All HARQ bits from the configured carriers are always included (fixed codebook size configured)
 - The HARQ bits are determined based on 1 ms DAI (dynamic codebook size configured)
 - Alt 3:
 - All HARQ bits from the configured carriers are always included (fixed codebook size configured)
 - The HARQ bits for 1 ms are determined based on 1 ms DAI in sDCI (dynamic codebook size configured)

Proposed offline consensus:

- In case of collision between PUSCH and sPUCCH in the same subframe on a given carrier, the UE should attempt to drop/stop as soon as possible (up to UE implementation) the whole/remaining transmission of PUSCH and shall transmit sPUCCH, and the UE shall not resume the dropped/stopped transmission.

Proposed offline consensus:

- In case of collision between PUSCH and 1-slot sPUCCH in the same subframe on a given carrier, HARQ-ACK of PUSCH is transmitted on 1-slot sPUCCH.
 - Spatial bundling for HARQ-ACK of PUSCH before mapping onto 1-slot sPUCCH is supported when configured.

Proposed offline consensus:

- In case of collision between PUSCH and 2/3-OS sPUCCH in the same subframe on a given carrier, HARQ-ACK of PUSCH is transmitted on 2/3-OS sPUCCH.
 - Spatial bundling for HARQ-ACK of PUSCH before mapping onto 2/3-OS sPUCCH is applied.
 - FFS on the support of bundling in frequency domain

Proposed offline consensus:

- In case of collision between PUSCH and sPUCCH in the same subframe on a given carrier, CSI of PUSCH is dropped.

Proposed offline consensus:

- In case of collision between PUCCH and sPUCCH in the same subframe on a given carrier for a UE, SR of PUCCH (if present) is transmitted on sPUCCH.

R1-1717248	Discussion on interaction between different TTI lengths	LG Electronics
R1-1717531	Remaining issues for dynamic switching between 1ms TTI and sTTI	Samsung
R1-1717697	Collision handling of 1ms TTI and sTTI in uplink	ZTE, Sanechips
R1-1718101	Aspects related to interaction between different TTI lengths	Qualcomm Incorporated

6.2.1.2.2 DL control channel design

6.2.1.2.2.1 sTTI scheduling

Considering fields for sDCI.

Email approval on details of sDCI formats (LGE(Kyuhwan), from 20th of Oct to 3rd of Nov)

R1-1717130	sTTI scheduling	Huawei, HiSilicon
R1-1717161	DCI for sTTI scheduling	Ericsson
R1-1717184	On scheduling of sPDSCH and sPUSCH	Nokia, Nokia Shanghai Bell

[R1-1717249](#) Summary of Email discussion [90-05] on DCI formats for sTTI LG Electronics

DL DCI format related:

Agreement: DL TM-dependent sDCI format is defined in each TM for sTTI operation with bit fields for which those of the legacy DL TM-dependent DCI format in the corresponding TM are the baseline.

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Proposed offline consensus:

The sDCI size is aligned between one of sDCI formats for DL assignment of configured DL TM and one of sDCI formats for UL grant of configured UL TM.

Agreement:

Following fields are removed from the baseline fields of DL sDCI format.

- Carrier indicator, MUST interference presence and power ratio
- Second TB-related, TB to CW swap if the working assumption to support a single codeword for sPDSCH is confirmed.
- FFS: flag for format 0/1A, scrambling identity, TPC command, aperiodic zero-power CSI-RS resource indicator for PDSCH RE mapping, SRS request

Agreement:

Following fields are inserted into the baseline fields of DL sDCI format.

- DMRS indication for 2/3 or sTTI
- ARI
- sPDCCH resource reuse if dynamic mechanism for the reuse of unused sPDCCH resource by explicit indication is agreed to be supported.
- FFS: UL/DL differentiation flag, Transmission scheme flag, sDCI/DCI flag, RA header, Number of scheduled sTTIs for multi-sTTI scheduling

Proposed offline consensus:

The bit size of DMRS indication field of DL sDCI format (if agreed to be inserted into the baseline DL sDCI format) is 1 bit.

Agreement: The bit size of UL/DL flag of UL/DL sDCI format (if agreed to be inserted into the baseline UL/DL sDCI format) is 1 bit.

Agreement:

- The bit size of following sDCI field is changed from the baseline fields of DL sDCI format.
 - RB assignment
 - FFS on DAI, MIMO-related (TPMI), HARQ process ID (at least for subslot and for TDD)

Proposed offline consensus:

The bit size of HARQ process ID is changed to 4 bits from that of the baseline DL sDCI format..

Proposal 1:

For down-selection at RAN1#90bis: DL fallback transmission scheme for sTTI

- Alt 1: *is* supported
- Alt 2: *is not* supported

Proposal 2:

DL fallback sDCI format (if supported) is defined for sTTI operation with bit fields for which those of the legacy DL fallback DCI format (i.e., DCI format 1a) are the baseline.

Proposal 26:

FFS whether to align the sDCI size between fallback and TM-dependent sDCI format.

Proposal 20:

The bit size of sPDCCH resource reuse (if agreed to be inserted into the baseline DL sDCI format) will be down-selected among [1, 2, 3, 4] bit(s).

UL sDCI format related

Agreement:

- For UL TM1, a single sDCI format is defined. The bit fields of the legacy DCI format 0 are used as baseline
 - FFS which bit fields are removed, and which bit fields that need to be added

Agreement:

- UL TM-dependent sDCI format is defined in TM2. The bit fields of the legacy DCI format 4 are used as baseline

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- FFS which bit fields are removed, and which bit fields that need to be added

Agreement: Following fields are removed from the baseline fields of UL sDCI format.

- Carrier indicator, Frequency hopping flag
- Second TB-related if only single codeword is agreed to be supported for sPUSCH.
- FFS: A-CSI request, Resource allocation type, multi-cluster flag, DAI, SRS request

Agreement: At least the following fields are inserted into the baseline fields of UL sDCI format.

- HARQ process ID, RV

Agreement: At least for one codeword and single sTTI scheduling, the bit size of RV field of UL sDCI format is 2 bits.

Agreement: Following fields are inserted into the baseline fields of UL sDCI format.

- DMRS position (2/3os)
- FFS: UL/DL differentiation flag, Transmission scheme flag, Fields related to IFDMA-based DMRS, Number of scheduled sTTIs for multi-sTTI scheduling

Agreement: The bit size of DMRS position field of UL sDCI format for 2/3-OS sTTI is 2 bits.

Proposed offline discussion:

The bit size of HARQ process ID field of UL sDCI format (if agreed to be inserted into the baseline UL sDCI format) is 4 bits.

Proposed offline discussion:

The bit size of following sDCI field is changed from the baseline fields of UL sDCI format.

- RB assignment
- FFS on Cyclic shift for DMRS and OCC index and IFDMA configuration (format 0), A-CSI request, DAI, HARQ process number, NDI, RV

Proposal 5:

For down-selection at RAN1#90bis: Fallback transmission scheme in UL for TM2 sTTI

- Alt 1: *is* supported
- Alt 2: *is not* supported

Proposal 6: UL fallback sDCI format (if supported) is defined in TM2 with bit fields for which those of the legacy UL DCI format 0 are the baseline.

Others

Proposal 9: FFS whether to support

- Subframe type-dependent DL TM,
- Dynamic indication of configured TM,
- Activating/Deactivating the sTTI operation

Proposal 14: FFS whether to support followings.

- Multi-sTTI DCI, DMRS sharing across sTTI in a slot

R1-1717320	Discussions on DCI formats for sTTI scheduling	Intel Corporation
R1-1717532	sTTI scheduling and sDCI formats	Samsung
R1-1717698	Discussion on sTTI scheduling	ZTE, Sanechips
R1-1718102	sTTI scheduling	Qualcomm Incorporated

6.2.1.2.2.2 sPDCCH design

Considering sCCE definition, mapping alternatives, RB sets, etc.

Email approval on remaining details of sPDCCH design and search space (Huawei(Chengyan), from 20th of Oct to 3rd of Nov)

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[R1-1717131](#) sPDCCH design Huawei, HiSilicon
[R1-1717162](#) Design aspects of sPDCCH Ericsson
[R1-1717185](#) On details of short PDCCH design Nokia, Nokia Shanghai Bell
[R1-1717250](#) Consideration on sPDCCH design LG Electronics
[R1-1717321](#) Remaining details of sPDCCH design for shortened TTI Intel Corporation
[R1-1717533](#) Remaining issues on sPDCCH design Samsung
[R1-1717699](#) Remaining issues of sPDCCH design ZTE, Sanechips
[R1-1718103](#) sPDCCH design Qualcomm Incorporated

[R1-1718118](#) **Summary of the email discussion [90-06] on sPDCCH design** Qualcomm Incorporated

Agreement:

- No maximum size needs to be specified for an sPDCCH RB set.
- The overall search space (over all ALs and RB sets) configured to a UE is limited up to 16 sCCEs for 2/3os.
 - FFS for 7os

Agreement:

- The starting sCCE index of an sPDCCH search space at aggregation level L is configured by higher layer signalling.
 - FFS if the actual starting index is signalled, or if a parameter impacting the starting index

Agreement: An RB set can be configured to apply to MBSFN, non-MBSFN subframes, or all subframes

Proposed offline consensus:

A UE can be configured with up to two RB sets for sPDCCH monitoring that apply to MBSFN subframes, and up to two RB sets that apply to non-MBSFN subframes

Agreement: DMRS bundling in frequency domain is mandatory for DMRS-based sPDCCH using a sPRG size of 2

Agreement: An sPDCCH candidate for CRS based sPDCCH is built up of consecutive logical sCCE(s).

Agreement: In case there is one RB remaining for 2/3os sPDCCH within an sPRG, the DMRS-based sPDCCH is not mapped to that single RB.

Agreement: For an RB set with CRS-based sPDCCH, the distributed sCCE-to-sREG mapping is implemented at the sREG level

Agreement: For an RB set with DMRS-based sPDCCH, the distributed sCCE-to-sREG mapping is implemented at the sCCE level.

Agreement: For a CRS-based sPDCCH, sREGs within an sPDCCH set X_m are numbered in a frequency-first time-second manner from 0 to $N_{os}^{X_m} N_{RB}^{X_m} - 1$, where $N_{os}^{X_m}$ is the number of configured symbols, and $N_{RB}^{X_m}$ is the number of RBs for the CRS-based sPDCCH RB set.

Offline consensus:

For a CRS-based sPDCCH RB set, the frequency-first, time-second mapping is performed from lower RB to higher RB for the first symbol, and from higher RB to lower RB for the second symbol.

NOTE: After deciding all resource elements for a candidate, the symbols are mapped to REs (k,l) in order of k increasing first and then l increasing.

Agreement: For a DMRS-based sPDCCH, sREGs within an sPDCCH set X_m are numbered in a time-first frequency-second manner from 0 to $N_{os}^{X_m} N_{RB}^{X_m} - 1$, where $N_{os}^{X_m}$ is the number of symbols, and $N_{RB}^{X_m}$ is the number of RBs for the DMRS-based sPDCCH RB set.

Proposal 2: The granularity of RB allocation for configuring an sPDCCH RB set is 1 RB.

- Note that based on Proposal 7, more discussions is needed for the DMRS-based sPDCCH.

Agreement: For DMRS-based sPDCCH, the number of sREGs forming an sCCE is 4 in a 2-symbol sPDCCH and is 6 in a 3-symbol sPDCCH.

Proposal 9: There is no consensus on supporting a 2-port DMRS-based sPDCCH in this WI.

Proposal 10: If a 2-port DMRS-based sPDCCH is supported, it is only used for distributed sCCE-to-sREG mapping.

Proposal 11: If a 2-port DMRS-based sPDCCH is supported, it is implemented via antenna hopping using two ports within an sREG.

Proposal 12: If a 2-port DMRS-based sPDCCH is supported, the 2 ports are multiplexed via OCC-2 in the time domain.

Proposal 13: The DMRS density for a 2-port DMRS-based sPDCCH is the same as that of the single port DMRS-based sPDCCH.

Proposal 18: FFS whether the size of the UE's sPDCCH search space is required to be limited.

Agreement: The DL DMRS pattern for sPDCCH associated with 2/3os and 7os sTTI, is reused from 2/3os sPDSCH.

[R1-1718291](#) sPDCCH design Motorola Mobility, Lenovo

6.2.1.2.2.3 Search space for sTTI operation

Considering the location of sPDCCH candidates for different aggregation levels per user, the configuration of sPDCCH candidates, etc

[R1-1717132](#) Search space for sTTI Huawei, HiSilicon

[R1-1717149](#) Summary of email discussion [90-07] on sPDCCH search space Huawei, HiSilicon

Agreement: DMRS-based sPDCCH can be operated in MBSFN subframe and non-MBSFN subframe

Agreement: The frequency resources of a configured RB set are identical across all sTTIs.

Agreement: For a given RB set, and a given sTTI index in the subframe, the configured number of sPDCCH candidates per aggregation level is associated with one of up to two sets. The sTTIs where the first set is applied are indicated by a bitmap (i.e. 5 bits corresponding to sTTI 1 to sTTI 5 respectively for each value). The sTTIs where the second set is applied are deduced from the complement. For example, if bitmap '11001' is signaled, set 1 applies to sTTI index 1,2,5 and set 2 to sTTI index 3,4.

Agreement:

- For localized CRS-based sPDCCH, the sREG corresponding to an sCCE index n are given by

$$n \cdot N_{sREG}^{sCCE} + j$$

Where $n=0, \dots, N_{sCCE}(p)-1$. $N_{sCCE}(p)$ is the number of sCCE in sPDCCH RB set p , and $j=0, \dots, N_{sREG}^{sCCE}-1$.
 N_{sREG}^{sCCE} is the number of sREG per sCCE

Agreement:

- For localized DMRS-based sPDCCH, the sREG corresponding to an sCCE index n are given by

$$n \cdot N_{sREG}^{sCCE} + j$$

Where $n=0, \dots, N_{sCCE}(p)-1$. $N_{sCCE}(p)$ is the number of sCCE in sPDCCH RB set p , and $j=0, \dots, N_{sREG}^{sCCE}-1$.
 N_{sREG}^{sCCE} is the number of sREG per sCCE

Agreement:

- For CRS-based sPDCCH and distributed configuration, the sREG corresponding to an sCCE index n are given by

$$n \bmod \left[\frac{N_{sREG}^{sCCE}}{N_{sREG}^{sCCE}} + \left\lceil \frac{n \cdot N_{sREG}^{sCCE}}{N_{sREG}^{sCCE}} \right\rceil * N_{sREG}^{sCCE} + i * \left\lceil \frac{N_{sREG}^{sCCE}}{N_{sREG}^{sCCE}} \right\rceil \right]$$

Where $n=0, \dots, N_{sCCE}(p)-1$ and $N_{sCCE}(p)$ is the number of sCCE in sPDCCH RB set p . $i=0, \dots, N_{sREG}^{sCCE}-1$, where N_{sREG}^{sCCE} is the number of sREG per sCCE. N_{sREG}^{sCCE} is the number of sREGs per each configured OFDM symbol in the sPDCCH RB set.

Agreement:

- For distributed DMRS-based sPDCCH, the sREG corresponding to an sCCE index n are given by

$$n \cdot N_{sREG}^{sCCE} + j$$

- For DMRS-based sPDCCH, the logical sCCEs corresponding to a distributed sPDCCH candidate m of the sPDCCH search space at aggregation level L are given by:

$$\left(Y_p^L + \left\lfloor \frac{m \cdot N_{sCCE,p}}{L \cdot M_p^{(L)}} \right\rfloor \right) \bmod \left\lfloor \frac{N_{sCCE,p}}{L} \right\rfloor + i \cdot \left\lfloor \frac{N_{sCCE,p}}{L} \right\rfloor$$

NOTE: The selection of the localized DMRS and CRS based sPDCCH is based on technical merit.

Proposed offline consensus:

For localized DMRS-based sPDCCH, the logical sCCEs corresponding to a sPDCCH candidate m of the sPDCCH search space at aggregation level L are given by:

- Alt 1: $L \cdot \left\{ \left(Y_{p,k}^L + \left\lfloor \frac{m \cdot N_{sCCE,p,k}}{L \cdot M_{p,k}^{(L)}} \right\rfloor \right) \bmod \left\lfloor N_{sCCE,p,k} / L \right\rfloor \right\} + i$ (EPDCCH equation)
- Alt 2: $\left\{ \left(Y_{p,k}^L + L \cdot \left\lfloor \frac{m \cdot N_{sCCE,p,k}}{L \cdot M_{p,k}^{(L)}} \right\rfloor \right) \bmod \left\lfloor N_{sCCE,p,k} / L \right\rfloor \right\} + i$

Proposed offline consensus:

For CRS-based sPDCCH, the logical sCCEs corresponding to a sPDCCH candidate m of the sPDCCH search space at aggregation level L are given by:

- Alt 1: $L \cdot \left(\left(Y_{p,k}^L + m \right) \bmod \left\lfloor N_{sCCE,p,k} / L \right\rfloor \right) + i$ (PDCCH equation)
- Alt 2: $\left(Y_{p,k}^L + Lm \right) \bmod \left\lfloor N_{sCCE,p,k} / L \right\rfloor + i$
- Alt 3: $\left\{ \left(Y_{p,k}^L + L \cdot \left\lfloor \frac{m \cdot N_{sCCE,p,k}}{L \cdot M_{p,k}^{(L)}} \right\rfloor \right) \bmod \left\lfloor N_{sCCE,p,k} / L \right\rfloor \right\} + i$

Proposed offline consensus:

The mapping of the modulated data symbols on the sREGs is frequency-first, time-second for both localized and distributed sPDCCH mapping. Solving the ambiguity between different ALs is FFS.

R1-1717163	Search space for sTTI	Ericsson
R1-1717251	On search space for sTTI operation	LG Electronics
R1-1717322	Search spaces for sPDCCH	Intel Corporation
R1-1717446	On search space design for sPDCCH	Nokia, Nokia Shanghai Bell
R1-1717534	Remaining issues on Search space for sTTI operation	Samsung
R1-1717700	Remaining issues of search space for sTTI operation	ZTE, Sanechips
R1-1718104	Search space for sTTI operation	Qualcomm Incorporated
R1-1718292	Search space for sTTI operation	Motorola Mobility, Lenovo

6.2.1.2.2.4 sPDCCH multiplexing with data

Email discussion on remaining details of sPDCCH multiplexing with data (Nokia(Karol), from 20th Oct to 3rd of Nov)

R1-1717133	sPDCCH multiplexing with data	Huawei, HiSilicon
R1-1717164	Multiplexing sPDCCH with sPDSCH/PDSCH	Ericsson
R1-1717252	Consideration on multiplexing sPDCCH with data	LG Electronics
R1-1717447	Summary of email discussion [90-08] on sPDCCH multiplexing with data, including sPDCCH resource reuse scheme	Nokia, Nokia Shanghai Bell

Offline conclusion:

For 2/3os sTTI, TDM of CRS-based sPDCCH [RB-set] with DMRS-based sPDSCH is not supported.

Proposed offline consensus:

Reuse of unused sPDCCH resources by rate-matching around at least the sPDCCH scheduling sPDSCH (FFS: Rate-matching around the RB set by configuration) is intended to be supported.

Proposed offline consensus:

Alt 1:

- If not configured by higher layers, UE only rate-matches around the sDCI scheduling the sPDSCH
 - If configured by higher layers, UE rate-matches around the sPDCCH RB set configured for rate-matching

Alt 1A:

- If not configured by higher layers, UE only rate-matches around the sDCI scheduling the sPDSCH
 - If configured by higher layers, UE rate-matches around the sPDCCH RB set which does not contain sDCI scheduling the sPDSCH

Alt 2:

- If not configured by higher layers, UE rate-matches around all sPDCCH RB sets
 - If configured by higher layers, UE only rate-matches around the sDCI scheduling the sPDSCH

Alt 3:

- If not configured by higher layers, UE only rate-matches around the sPDCCH RB set containing the sDCI scheduling the sPDSCH
 - If configured by higher layers, UE rate-matches around the sPDCCH RB set configured for rate-matching

Alt 4:

- If not configured by higher layers, UE only rate-matches around the sDCI scheduling the sPDSCH
 - If configured by higher layers, UE rate-matches around the sPDCCH RB set containing the sDCI scheduling the sPDSCH.
 - If configured by higher layers, UE rate-matches around the sPDCCH RB set configured for rate-matching

Alt 5:

- Other solution

Proposed offline consensus:

Dynamic mechanism for reuse of unused sPDCCH resources by explicit indication in sDCI scheduling the sPDSCH is intended to be supported. Details are FFS.

Proposed conclusion:

If the rate-matching of sPDSCH around the DL assignment scheduling the sPDSCH is supported, the ambiguity problem of detecting transmitted AL can be solved by using different mapping principle, e.g. sREG-to-sCCE or symbols-to sREG, for different ALs.

Proposal 2:

Select between two alternatives at RAN1#90b

- Alternative 1: Support TDM between 1-symbol-long CRS-based sPDCCH [RB-set] and DMRS-based sPDSCH in 2-OS sTTI and TDM between 2-symbol-long CRS-based sPDCCH and DMRS-based sPDSCH in 3-OS sTTI
 - FFS on how to inform a UE about rate-matching around potential sPDSCH DMRS
- Alternative 2: Support only FDM between 1-symbol-long CRS-based sPDCCH [RB-set] and DMRS-based sPDSCH in 2-OS sTTI and FDM between 2-symbol-long CRS-based sPDCCH and DMRS-based sPDSCH in 3-OS sTTI

Proposal 4: The dynamic reuse mechanism of sPDCCH, using explicit indication in the sPDSCH assignment, is part of the default sTTI operation. Details are FFS.

Proposal 5: Select at RAN1#90bis one of the following 3 reuse mechanisms:

- Option 1: Indicate the last used logical sCCE/sCCE-group within PDCCH RB-set(s) configured to the UE for monitoring in a given sTTI.
- Option 2: Separate the sCCEs, in RB-sets configured to the UE for monitoring, into N groups of sCCEs. Indicate by single bit per each group of sCCEs, whether sPDSCH is mapped or not into the group of sCCEs.
 - FFS on the sCCE grouping mechanism
- Option 3: Indicate by 1 bit for each sPDCCH RB-set, configured to UE for monitoring, whether sPDSCH is mapped or not.
 - Reuse mechanism operates on the unit of RB-set

Proposal 6: In case the Option 3 of Proposal-5 is selected, inconsistent L1 signalling indication for two overlapping RB-sets can be supported. FFS how to treat the overlapping resource of two overlapping RB-sets in case of inconsistent signalling.

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Proposal 7: In case the Option 2 of Proposal-5 is agreed, inconsistent L1 signalling indication for two overlapping sCCE groups can be supported. FFS how to treat the overlapping resource of two overlapping sCCE groups in case of inconsistent signalling.

R1-1717448	On multiplexing of sPDCCH and sPDSCH, and sPDCCH resource reuse	Nokia, Nokia Shanghai Bell
R1-1717535	Remaining issues on sPDCCH multiplexing with data	Samsung
R1-1717701	sPDCCH multiplexing with sPDSCH	ZTE, Sanechips
R1-1718105	sPDCCH multiplexing with data	Qualcomm Incorporated
R1-1718293	sPDCCH multiplexing with data	Motorola Mobility, Lenovo

6.2.1.2.3 UL control channel design

6.2.1.2.3.1 sPUCCH design

Including sPUCCH design in terms of remaining details of format design, format selection, resource management and SR design.

Email approval on remaining details of sPUCCH design (including HARQ-ACK bundling for {2,7}), (ZTE(Xianghui), from 20th of Oct to 3rd of Nov)

R1-1717134	sPUCCH design	Huawei, HiSilicon
R1-1717165	Design aspects of sPUCCH	Ericsson
R1-1717236	sPUCCH Design for shortened TTI	Nokia, Nokia Shanghai Bell
R1-1717253	Remaining issues on sPUCCH design	LG Electronics
R1-1717536	Remaining issues on sPUCCH design	Samsung

R1-1717702 Summary of email discussion 90-09 on sPUCCH format design ZTE, Sanechips

Agreement: HARQ-ACK bundling across different TTI lengths is not supported

Agreement: The maximum payload size is X=11 for PF3-based 7-OS sPUCCH format carrying more than 2 bits ACK/NACK and SR (if any).

Agreement:

- The channel coding scheme for PF4-based 2-OS sPUCCH format carrying more than 2 bits ACK/NACK and SR (if any) is defined as:
 - Up to 11 bits: Single RM coding
 - 12-22: Dual RM
 - More than 22 bits: TBCC+8bit-CRC

Agreement: The maximum number of PRBs is 8 for PF4-based 2-OS sPUCCH format carrying more than 2 bits ACK/NACK and SR (if any).

Agreement:

- When a UE is to transmit UCI in a 2/3-symbol sPUCCH, sPUCCH format selection between sequence-based sPUCCH and PF4-based sPUCCH is based on the following rules.
 - For SR (if any) and up to 2 bits HARQ-ACK, the UE shall use sequence-based sPUCCH.
 - For SR (if any) and more than 2 bits HARQ-ACK, the UE shall use PF4-based sPUCCH.
 - FFS the possible ambiguity of the number of HARQ-ACK and SR bits between eNB and UE

Agreement:

- For PF1-based 7-OS sPUCCH format, the cyclic shifts on different sPUCCH symbols and the OCC in different slots can be different for a given UE. Cyclic shift randomization and OCC variations are re-used from 1 ms operation to support multiplexing with legacy PUCCH format 1/1a/1b/2.
 - Note: the OCC is not applied when frequency hopping is enabled.

Conclusion:

- Sequence-based 2/3OS sPUCCH format can be CDMed with PF1a/1b-based 7-OS sPUCCH format with/without frequency hopping by using different cyclic shifts on each symbol.

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Agreement: For PF3-based 7-OS sPUCCH format the cyclic shifts of the DMRS and the OCC used in different slots follow the principle of PUCCH format 3.

Agreement: When 1/2-bit HARQ-ACK is to be transmitted on 2/3-OS sPUCCH and there is a negative SR in the same sTTI, HARQ-ACK is transmitted on sPUCCH resource for HARQ-ACK.

Agreement:

- When more than 2 bits HARQ-ACK are to be transmitted on 2/3-OS sPUCCH and there is a positive/negative SR in the same sTTI
 - When there is a positive SR:
 - SR and HARQ-ACK are transmitted on sPUCCH resource for HARQ-ACK.
 - When there is negative SR:
 - SR and HARQ-ACK are transmitted on sPUCCH resource for HARQ-ACK.

Proposed agreement:

HARQ-ACK bundling across DL sTTI is not supported when configured with {2,7} sTTI operation.

Agreement: 7-OS sPUCCH format selection:

If sPF3 and sPF4 are configured:

- 1-2 bits HARQ, sPUCCH format 1a/1b;
- 3-11 bits HARQ, sPUCCH format 3
- 12 bits HARQ or more, sPUCCH format 4

If only sPF4 is configured:

- 1-2 bits HARQ, sPUCCH format 1a/1b;
- 3 bits HARQ or more, sPUCCH format 4

If only sPF3 is configured

- 1-2 bits HARQ, sPUCCH format 1a/1b;
- 3-11 bits HARQ, sPUCCH format 3

Proposal 6:

For PF4-based 2-OS sPUCCH format carrying more than 2 bits ACK/NACK and SR (if any), IFDMA is not supported.

Proposed agreement:

- When a UE is to transmit UCI in a 7-symbol sPUCCH, the following sPUCCH format selection is adopted for TDD HARQ-ACK feedback or FDD-TDD HARQ-ACK feedback for primary cell FS2:
 - Reuse the rules adopted in eCA for TDD, except that the UE shall use PF3-based sPUCCH for cases originally using PUCCH Format 1b with channel selection.

Agreement: The earlier agreement related to 1-bit HARQ-ACK and SR for sequence based sPUCCH is changed as per below:

~~Two sPUCCH resources are configured for SR and 1-bit HARQ-ACK+HARQ and two sPUCCH resources are configured for only HARQ.~~

- When positive SR and 1-bit HARQ-ACK are to be transmitted on 2/3-symbol sPUCCH in the same sTTI, one resource is used for SR+ACK and another is used for SR+NACK, one of the options can be supported

Agreement: When only positive SR is to be transmitted on 2/3-symbol sequence based 1-bit sPUCCH, the SR is transmitted on the sPUCCH resource that is used to transmit SR+NACK

Agreement: The periodicity of sSR sent on 7OS sPUCCH is set as one of from {0.5ms, 1ms, 2ms, 5ms, 10ms}

Agreement: The periodicity of sSR sent on 2/3-OS sPUCCH is set as one of from {1 sTTI, 2 sTTI, 3 sTTI, 4 sTTI, 5 sTTI, 1ms, 5ms, 10 ms}

Observation 3: It seems better to first specify the use cases for 2-bit HARQ-ACK+SR transmission in sequence based 2/3-OS sPUCCH, e.g.

- Case 1: The 2-bit HARQ-ACK is for 2 code-words of sPDSCH.
- Case 2: The 2-bit HARQ-ACK is comprised of 1-bit sHARQ-ACK and 1-bit HARQ-ACK.
- Case 3: The 2-bit HARQ-ACK is for 2 carriers.

Proposal 18:

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For 2-bit HARQ-ACK+SR transmission in sequence based 2/3-OS sPUCCH, option 3 is adopted, i.e. four sPUCCH resources are configured for SR+HARQ-ACK and four sPUCCH resources are configured for only HARQ-ACK.

[R1-1717703](#) Remaining issues on sPUCCH format design ZTE, Sanechips
[R1-1718106](#) sPUCCH design Qualcomm Incorporated

6.2.1.2.3.2 UCI on sPUSCH

Proposals from e-mail discussion on sPDSCH/sPUSCH design in [R1-1717150](#)

Agreement: Re-use the legacy mapping rule of UCI on 1ms PUSCH for UCI mapping on 1-slot sPUSCH.

[R1-1718885](#) WF on remaining issues of beta offset for sPUSCH LG Electronics, NTT DOCOMO, Ericsson

Agreement: For UCI on sPUSCH:

- The HARQ-ACK offset values are independently configured for 7-OS sPUSCH and 2/3-OS sPUSCH.
- If CSI transmission on sPUSCH is supported, the beta offset values for CSI are independently configured for 7-OS sPUSCH and 2/3-OS sPUSCH.

Proposed offline consensus:

For UCI mapping on 2/3-symbol sPUSCH with 1 data symbol, the HARQ-ACK is mapped from the end of the symbol by puncturing sPUSCH data REs, and RI and PMI/CQI are mapped from the start of the symbol in the order of RI first, PMI/CQI second, which are rate matched by sPUSCH data.

Proposal 37: For UCI mapping on 2/3-symbol sPUSCH, the protection priority is HARQ-ACK > RI > PMI/CQI > data.

Proposal 39: For UCI mapping on 2/3-symbol sPUSCH with 2 data symbol, the HARQ-ACK is mapped from the lowest frequency index of the data symbol closest to the DMRS by puncturing UL-SCH REs, RI is mapped from the lowest frequency index of another data symbol by rate matching and PMI/CQI are mapped from the largest frequency index in the time first frequency second manner, which are rate matched by UL-SCH data.

[R1-1717136](#) UCI on sPUSCH Huawei, HiSilicon
[R1-1717166](#) UCI on sPUSCH with short TTI Ericsson
[R1-1717237](#) UCI on sPUSCH Nokia, Nokia Shanghai Bell
[R1-1717254](#) UCI transmission on sPUSCH LG Electronics
[R1-1717323](#) UCI transmission on sPUSCH Intel Corporation
[R1-1717537](#) UCI on sPUSCH Samsung
[R1-1717704](#) UCI transmission on sPUSCH in sTTI ZTE, Sanechips
[R1-1718107](#) UCI on sPUSCH Qualcomm Incorporated

6.2.1.2.3.3 CSI reporting for sTTI

Email discussion of remaining details of CSI reporting (Qualcomm(Kianoush), from 20th of Oct to 3rd of Nov)

[R1-1717127](#) CSI feedback for short TTI Huawei, HiSilicon
[R1-1717167](#) On CSI reporting for sTTI Ericsson
[R1-1717238](#) On CSI Reporting for sTTI Nokia, Nokia Shanghai Bell
[R1-1717255](#) Discussion on CSI for sTTI operation LG Electronics
[R1-1717538](#) Remaining issues on CSI reporting for sTTI Samsung
[R1-1718073](#) CSI reporting for sTTI operation ITRI
[R1-1718108](#) CSI reporting for sTTI Qualcomm Incorporated
[R1-1718119](#) Summary of the email discussion [90-10] on sTTI CSI reporting Qualcomm Incorporated

Offline consensus:

- Only aperiodic CSI reporting is intended to be supported for the sTTI operation in Rel-15 WI with up to 3-bit trigger.
 - FFS: Restrictions

Proposed offline consensus:

For enabling fast CSI reporting (if supported), the CSI reference resource is defined based on the sTTI length.

Proposed offline consensus:

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- Under the 2-symbol sTTI operation, the sTTI reference resource is defined based on the CSI reporting timing, and can be a 2-symbol or a 3-symbol sTTI. If based on the timing, a 3-symbol sTTI is a reference resource, for CSI computation, TBS scaling shall be performed.
 - FFS on the details of the TBS scaling.

Proposed offline consensus:

- If A-CSI is triggered from sDCI, the sTTIs in MBSFN subframes are not considered as valid downlink sTTIs for TM1-8.

Offline consensus:

The A-CSI triggered by sDCI is reported via sPUSCH.

Offline consensus:

For A-CSI triggered by sDCI, the reporting timeline is the same as the sPUSCH scheduling timeline.

Proposed offline consensus:

A DCI only triggers a CSI reporting on PUSCH and sDCI only triggers a CSI reporting on sPUSCH.

Offline consensus:

A zero power/non-zero power CSI-RS configuration with an increased periodicity as compared to the legacy LTE is not supported/introduced.

Offline consensus:

For the sTTI based aperiodic CSI reporting, the subband sizes are increased at least for 2/3os sTTI as compared to those of the legacy LTE.

- The subband size is FFS.

Proposal 6: The UE shall assume no CSI-RS overhead over the reference resource.

Proposal 5: Over the reference resource, the UE shall derive the control overhead based on the configured RB sets.

Proposal 7: The UE shall assume no DMRS overhead over the reference resource if it is not configured with one of the DMRS-based TMs.

Proposal 8: The UE shall assume the CRS overhead over the reference resource in one of the following ways:

- The CRS overhead is dependent on the presence of the CRS in the reference resource.
- A fixed CRS overhead shall be assumed over all reference resources.
 - FFS on how to define a fixed CRS overhead.

Proposal 12: For a bandwidth class with a single CC, the max. number of CSI processes supported on a CC within a band with PDSCH TM10 is reported separately for the 1ms TTI and sTTI operations.

Proposal 13: For a bandwidth class with multiple CCs, the max. number of CSI processes supported on a single CC within a band with PDSCH TM10 is reported separately for the 1ms TTI and sTTI operations.

Proposal 14: For a bandwidth class with multiple CCs, the max. number of CSI processes supported on all CCs within a band with PDSCH TM10 is reported separately for the 1ms TTI and sTTI operations.

Proposal 15: For the sTTI operation, the UE capability which indicates the maximum number of CSI processes to be updated per UE across CCs is reported separately from that of the 1ms TTI operation.

- Maximum number of CSI processes to be updated indicated in the UE capability signaling should not be less than X. FFS X.

Proposal 18: Under the 2-symbol sTTI operation, if CFI = 2 or 3, sTTI#0 is not a valid DL sTTI.

Proposal 19: If a UE is configured with TM1-9 or TM10 with a single CSI process for a serving cell, then the triggering sTTI, if it is a valid DL sTTI, is the reference resource.

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Proposal 20: If a UE is configured with TM1-9 or TM10 with a single CSI process for a serving cell, if the triggering sTTI is a not valid DL sTTI, the former sTTI is considered as a reference resource.

Proposal 21: If a UE is configured with TM10 and multiple CSI processes for a serving cell, the definition of the sTTI reference resource is FFS.

Proposal 22: Select between two alternatives at RAN1#90bis

- Alternative 1: For the sTTI operation, all the aperiodic legacy CSI reporting modes are supported.
 - FFS on reporting restrictions.
- Alternative 2: For the sTTI operation, the aperiodic CSI reporting modes 1-2, 2-2 and 3-2 are not supported.
 - FFS on further reduction of the aperiodic CSI reporting modes.

Proposal 25: The ratio of the PDSCH EPRE to CSI-RS EPRE for 1ms TTI and sTTI are:

- Option 1: Identical.
- Option 2: Set separately.

Proposal 27: Whether some restrictions on the number of back-to-back CSI reporting triggers should be introduced or not is FFS.

[R1-1718272](#) Views on on short CSI reporting in sTTI KT Corp.
[R1-1718294](#) CSI aspects of shortened TTI Motorola Mobility, Lenovo

6.2.1.2.3.4 sPUCCH power control

Email approval on remaining issues of sPUSCH/sPUCCH PC + sTTI/TTI collisions (LGE(Hyunho), from 20th of Oct to 3rd of Nov)

Proposals from e-mail discussion on UL collision handling and power control in [R1-1717247](#)

Agreement:

- For sPUCCH, the power control equation is reused from the PUCCH power control equation for 1ms TTI.
 - FFS on separate handling of 2os or 3os sTTI

Agreement: For sPUCCH, the parameter $p_{0,sPUCCH}$ for sTTI operation is the same value configured as for 1ms TTI.

Agreement: For sPUCCH, the parameter of $\Delta_{F,sPUCCH}(F)$ is defined relative to PUCCH format 1a (as in legacy) and separately configured for sTTI operation from 1ms TTI operation.

Agreement: The delta_F values can be configured by higher layer signalling in the range

sPUCCH format	Proposed parameter range
2/3os sPUCCH, format 1a	5,6,7,8,9,10,11,12
7os sPUCCH, format 1a	1,2,3,4,5,6,7,8
2/3os sPUCCH, format 1b	6,7,8,9,10,11,12,13
7os sPUCCH, format 1b	3,4,5,6,7,8,9,10
7os sPUCCH, format 3	4,5,6,7,8,9,10,11
2/3os sPUCCH, format 4 (RM)	15,16,17,18,19,20,21,22
2/3os sPUCCH, format 4 (TBCC)	13,14,15,16,17,18,19,20
7os sPUCCH, format 4 (RM)	13,14,15,16,17,18,19,20
7os sPUCCH, format 4 (TBCC)	10,11,12,13,14,15,16,17

Agreement:

- For sPUCCH, in order to derive $\Delta_{TF,sPUCCH,e}(i)$ the existing equation for 1ms TTI is reused with modification of the definition on BPPE as $\Delta_{TF,sPUCCH,e}(i) = 10 \log_{10} \left(2^{1.25 \cdot BPPE_{sPUCCH}(i)} - 1 \right)$, where $BPPE_{sPUCCH}$ is the sum of total number of UCI bits including CRC bits on sPUCCH format 4 divided by the number of REs for sPUCCH.

Agreement:

- For sPUCCH, the current $h(n_{CQI}, n_{HARQ}, n_{SR})$ for format 3 definition is reused.
 - To derive $h(n_{CQI}, n_{HARQ}, n_{SR})$, the sum of HARQ-ACK bits for PDSCH as well as those for sPDSCH carried by sPUCCH should be taken into account if PUCCH/PUSCH is collided with sPUCCH within the same subframe on a given carrier.

Agreement: Tx diversity in sPUCCH format 1/1a/1b/3 is defined as in legacy PUCCH and is a separate UE capability between 1 ms and sTTI.

Agreement: $\Delta_{TxD}(F')$ is separately configured for sTTI operation using the same parameter range as for 1 ms operation.

Agreement: For sPUCCH, only the TPC from sDCI is considered.

Agreement:

- For PUCCH, only the TPC from DCI is considered.
 - NOTE: This is legacy behaviour and has no impact to the specification

- [R1-1717146](#)[R1-1717168](#)[R1-1717539](#)[R1-1718109](#)
- sPUCCH power control
sPUCCH power control
Remaining issues on sPUCCH power control
sPUCCH power control
- Huawei, HiSilicon
Ericsson
Samsung
Qualcomm Incorporated

6.2.1.2.4 DL data channel design

6.2.1.2.4.1 sPDSCH design

Including aspects related to sPDSCH resource allocation, TM, TBSs.

Email approval on remaining details of sPDSCH/sPUSCH design, UCI mapping on sPUSCH (Huawei(Yubo), 20th Oct to 3rd of Nov)

- [R1-1717137](#)[R1-1717150](#)
- sPDSCH design
Summary of email discussion [90-11] on sPDSCH/sPUSCH design
- Huawei, HiSilicon
Huawei, HiSilicon

sPDSCH resource allocation and sRBG size:

Agreement: Resource allocation type 0 indicating non-contiguous sRBGs using a bitmap is supported for sPDSCH scheduling.

Agreement: The sRBG size for resource allocation type 0 is defined as per below table for both 2/3os and 7os sTTI using an sPRG size of 2:

5 MHz	10 MHz	15 MHz	20 MHz
6	6	12	12

Agreement: In case of 1.4 MHz or 3 MHz system bandwidth, the RBG size is re-used from legacy and the PRG size is 2 for sTTI operation.

Agreement: Resource allocation type 2 indicating contiguous resource units is supported for sPDSCH scheduling for 5 MHz, 10 MHz, 15 MHz and 20 MHz is supported with the sRBG size and starting position according to the table below.

	5 MHz	10 MHz	15 MHz	20 MHz
sRBG size	4	6	4	4
Starting point granularity	2	6	4	4

Agreement: The used resource allocation type is not dependent on transmission mode

Proposed agreement: The used resource allocation type is configured by

- Alt 1: RRC configuration of a single RA type
- Alt 2: Dynamically switched
- Alt 3: RRC configuration of type 0 and/or type 2

sPDSCH CW:

Agreement: Confirm the working assumption that single codeword for sPDSCH is supported.

sPDSCH Transmission modes configuration and fallback:

Agreement:

- DL transmission modes for sTTI and 1ms TTI are configured independently.
 - NOTE: This does not require sTTI specific CSI reporting

Proposed offline consensus:

For sPDSCH transmission, a transmission scheme corresponding to the configured transmission mode, and a robust transmission scheme, such as Table 7.1-5 in TS 36.213 are supported.

Proposal 20:

The indication of fallback to a robust transmission scheme (if supported) for sPDSCH transmission is down-selected between 1-bit flag in sDCI and different sDCI formats.

Observation 10:

The transmission mode of sPDSCH in MBSFN subframes is for further study.

sPDSCH TBS:

Agreement: The TBS scaling principle is the same for UL and DL data

Agreement:

- For sPUSCH and sPDSCH, the value in the legacy TBS is scaled according to $TBS \cdot \alpha$ with the resulting TBS rounded off to the closest valid TBS.
 - NOTE: The α value can be the same or different for different sTTI lengths and for sPUSCH and sPDSCH
 - The TBS scaling is performed assuming the same number of layers within a codeword for PDSCH and sPDSCH.

Agreement: For 1-slot sTTI, the DL TBS scaling factor is 0.5.

Agreement: The DL TBS scaling factor for 2/3-symbol sTTI is 1/6.

R1-1717169	On sPDSCH design	Ericsson
R1-1717186	On details of short PDSCH design	Nokia, Nokia Shanghai Bell
R1-1717256	Remaining issues on sPDSCH	LG Electronics
R1-1717324	On the details of sPDSCH designs	Intel Corporation
R1-1717540	Remaining issues on sPDSCH design	Samsung
R1-1717705	sPDSCH transmission in sTTI	ZTE, Sanechips
R1-1718110	sPDSCH design	Qualcomm Incorporated

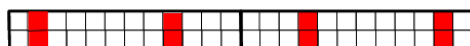
6.2.1.2.4.2 DL DMRS design

Including aspects related to number of layers and DMRS patterns.

[R1-1717150](#) Summary of email discussion [90-11] on sPDSCH/sPUSCH design Huawei, HiSilicon

Agreement:

- Up to 4-layers is supported for 2/3os sPDSCH. The DMRS pattern is defined over two RB, mapped over 4 sub-carriers (see figure below for up to 2-layers). In case of 3 or 4-layer transmission, the UE is not expected to receive DMRS more than once over two consecutive 2/3os sTTIs.



Proposed agreement:

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- Alt 1: The same shift of the DMRS is applied for all DMRS positions within a non-MBSFN subframe
- Alt 2: The same shift of the DMRS is applied only in sTTIs where the DMRS is colliding with CRS
- Alt 3: The same shift of the DMRS is applied for all DMRS positions for all subframes

Proposed offline consensus:

For 2/3-symbol and 7os sPDSCH, when a DMRS pair is colliding with a CRS in any sTTI index of the subframe, the colliding DMRS pair(s) in all sTTI index in the subframe is/are shifted to the next or to the previous REs in frequency domain.

Agreement: For 2/3-symbol sPDSCH, avoiding collision between DMRS and CSI-RS can be handled by eNB configuration without spec impacts.

Agreement: For DMRS of 2/3-symbol sPDSCH, the DMRS sharing across slots within a subframe is supported.

Agreement: For DMRS of 2/3-symbol sPDSCH, the DMRS sharing among 3 consecutive sTTIs is not supported.

Agreement: For 1-slot DMRS based sPDSCH, up to 4 layers transmission is supported for TM 9/10 and up to 2 layers transmission is supported for TM 8.

Agreement: For the first 1-slot sPDSCH in a subframe, one pair of DMRS are placed in OFDM symbol index #3 and #4, of slot 0.

Agreement: For the second 1-slot sPDSCH in a subframe, one pair of DMRS are placed in OFDM symbols index #2 and #3, of slot 1.

Agreement: For 1-slot sPDSCH, only a single pair of DMRS in time is supported.

Agreement: For up to 2 layers transmission of 1-slot sPDSCH, the DMRS is placed on 3 subcarriers spaced by 4 subcarriers within an RB.

Agreement: For 4 layers transmission of 2/3os (if supported) and 1-slot DMRS-based sPDSCH, the pairs for 2 layers are repeated in frequency

Agreement: For DMRS of 1-slot sPDSCH, avoiding collision between DMRS and CSI-RS can be handled by eNB configuration without spec impacts.

Agreement: The time-domain position for DL DMRS of 3-symbol sPDSCH is placed in the first two symbols

R1-1717138	DL DMRS design for short TTI	Huawei, HiSilicon	
R1-1717170	DL DMRS design	Ericsson	
R1-1717257	Consideration on DL DMRS for sTTI	LG Electronics	
R1-1717449	On details of DMRS design for 2-OS and 7-OS DL shorter TTI		Nokia, Nokia Shanghai Bell
R1-1717541	DL DMRS design	Samsung	
R1-1717706	DL DMRS design in sTTI	ZTE, Sanecips	
R1-1718111	DL DMRS design	Qualcomm Incorporated	

6.2.1.2.5 UL data channel design

6.2.1.2.5.1 sPUSCH design

Including aspects related to sPUSCH resource allocation, TM, TBS.

Proposals from e-mail discussion on sPDSCH/sPUSCH design in [R1-1717150](#)

sPUSCH Resource allocation and granularity

Agreement: The resource allocation type 1 is not supported for scheduling of sPUSCH.

Agreement: The sRBG size and starting point granularity for 2/3os and 7os sPUSCH is as per table below.

	5 MHz	10 MHz	15 MHz	20 MHz
sRBG size	4	4	4	4
Starting point granularity	4	4	4	4

Agreement: For resource allocation in:

- DL: The last sRBG is increased to cover the system bandwidth.
- UL: Only multiples of the sRBGs size can be allocated to sPUSCH

sPUSCH Transmission modes configuration and fallback

Agreement: UL transmission modes for sTTI and 1ms TTI are configured independently.

Proposed offline consensus:

For sPUSCH transmission, a transmission scheme corresponding to the configured transmission mode, and a robust transmission scheme, such as Table 8-3 in TS 36.213 are supported.

Proposal 31:

The indication of fallback to a robust transmission scheme for sPUSCH transmission is down-selected between 1-bit flag in sDCI and different sDCI formats.

sPUSCH TBS

Agreement: For 1-slot sPUSCH, the TBS scaling factor is 0.5.

Agreement: The TBS scaling factor for 2/3-symbol sPUSCH is 1/12 and 2/12 for 1 and 2 data symbols in sPUSCH respectively.

R1-1717139	sPUSCH design	Huawei, HiSilicon
R1-1717171	Design aspects of sPUSCH	Ericsson
R1-1717450	On details of short PUSCH design	Nokia, Nokia Shanghai Bell
R1-1717542	Remaining issues on sPUSCH design	Samsung
R1-1717707	sPUSCH transmission in sTTI	ZTE, Sanechips
R1-1718112	sPUSCH design	Qualcomm Incorporated

6.2.1.2.5.2 UL DMRS design

Including aspects related to sPUSCH number of layers and UL DMRS signalling.

Proposals from e-mail discussion on sPDSCH/sPUSCH design in [R1-1717150](#)

Proposal 25:

For 2/3-symbol sPUSCH, IFDMA RPF=1 is supported.

Agreement: For 1-slot sPUSCH, IFDMA with RPF=1 and 2 is supported. FFS configuration.

Agreement: For 2/3os and 1-slot sPUSCH, single codeword sPUSCH transmission for up to 4 layers is supported. The UE will indicate the number of supported layers for sPUSCH as UE capability, independent of UL sTTI length. No new precoder in the UL is defined.

Agreement: If 1-slot sPUSCH with 4 layers is supported, DMRS port multiplexing is supported by different cyclic shifts for RPF=1, and by combination of combs and cyclic shifts for RPF=2.

Observation 8: Whether any other DMRS and data combination is supported needs further study.

Observation 9: The indication of UL DMRS related aspects by sDCI needs further study.

R1-1717140	UL DMRS design for sPUSCH	Huawei, HiSilicon
R1-1717172	On UL DMRS for short TTI	Ericsson
R1-1717239	UL DMRS Design for sTTI	Nokia, Nokia Shanghai Bell
R1-1717543	UL DMRS design	Samsung
R1-1718113	UL DMRS design	Qualcomm Incorporated

6.2.1.2.5.3 sPUSCH power control

Including in addition to sPUSCH power control, and also the power handling in case of CA.

Proposals from e-mail discussion on UL collision handling and power control in [R1-1717247](#)

Agreement: For sPUSCH, the power control equation is reused from the PUSCH power control equation for 1ms TTI.

- FFS on sTTI specific parameter definition and configurations

Agreement: For sPUSCH, the scaling parameter for path-loss estimate $\alpha_{e(j)}$ for sTTI operation is reused from the parameter for 1ms TTI.

Proposed offline consensus:

The PHR transmitted on sPUSCH shall be reported for all carriers (irrespective of TTI length). PHR for sTTI is calculated using the same principle as for 1 ms operation.

Agreement:

Simultaneous transmission of different TTI lengths across different carriers are allowed only if a UE reports the capability. A common capability/configuration is defined regardless of UL TTI length combinations. The capability is defined per band/band combination. The UE capability is not separated per combination of different channel types (e.g., {PUSCH, sPUSCH}, {PUCCH, sPUCCH}, {PUSCH, sPUCCH}, {sPUSCH, PUCCH}, {sPUSCH, sPUSCH}, {sPUSCH, sPUCCH}, {sPUCCH, sPUCCH}).

Proposed offline consensus:

Regarding UE behaviour in case simultaneous transmission of different TTI lengths across different carriers is allowed/supported but when the UE is power-limited, RAN1 down-selects between the following alternatives:

- **Alt 1:** A guaranteed power for each TTI length is reserved. The power of the earlier transmission (e.g., longer TTI) can be at most {P_{max} – the guaranteed power of the later transmission} and the power of the later overlapped transmission (e.g., shorter TTI) is determined by {P_{max} – the required power of the earlier transmission}. (like PCM2 in DC)
- **Alt 1a:** A guaranteed power for each TTI length is reserved, in case the TTI is scheduled.
 - The power of the earlier transmission (e.g., longer TTI) can be at most {P_{max} – the guaranteed power of the later transmission} and the power of the later overlapped transmission (e.g., shorter TTI) is determined by {P_{max} – the required power of the scheduled earlier transmission}
- **Alt 2:** In case a UE is power-limited, TTI channel(s) with lower priority (e.g., longer TTI) is(are) dropped/stopped until the condition that the UE becomes non-power-limited is met.
 - Consider the TTI length (e.g., shorter TTI > longer TTI), channel type (e.g., PUCCH > PUSCH with UCI > PUSCH without UCI), UCI type (e.g., HARQ-ACK/SR > CSI > data > SRS), and cell index (e.g., lower cell index > higher cell index)

Agreement: For sPUSCH, the configured P₀ (for 1 ms operation) is reused for sTTI operation.

Agreement: For sPUSCH, the power offset value depending on MCS $\Delta_{\text{TF,sPUSCH,c}}(i)$ for sTTI operation is derived by reusing the existing parameter for 1ms TTI.

Agreement: For sPUSCH, only the TPC from sDCI is considered.

Agreement: For PUSCH, only the TPC from DCI is considered.

- NOTE: This is legacy behaviour and has no impact to the specification

R1-1717142	sPUSCH power control	Huawei, HiSilicon
R1-1717173	sPUSCH power control and PHR report for sTTI	Ericsson
R1-1717258	Discussion on power control for sPUSCH	LG Electronics
R1-1717544	Remaining issues on sPUSCH power control	Samsung
R1-1717708	sPUSCH power control	ZTE, Sanechips
R1-1718074	Uplink power control related issues for sTTI operation	ITRI
R1-1718114	sPUSCH power control	Qualcomm Incorporated

6.2.1.2.6 FS2 aspects

Email approval on remaining issues for 1 ms + FS2 (sTTI and 1 ms) + FS3 (Samsung(Jeongho), from 20th Oct to 3rd of Nov)

Email approval on UL HARQ RTT for FS2 including sending an LS to RAN2 (Ericsson(Laetitia), from 18th of Oct to 25th of Oct)

R1-1717144	TDD-specific design for short TTI	Huawei, HiSilicon
R1-1717174	FS2 aspects of short TTI	Ericsson

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[R1-1717545](#) Remaining issues on FS2 aspects for sTTI Samsung

[R1-1717546](#) Summary of [90-13] Email discussion on remaining issues of FS2 including HARQ timing and UL scheduling tables Samsung

Agreement: DMRS-based and CRS-based sPDSCH are supported in the first slot of the DwPTS, except for SSC 0 and 5.

Agreement: DMRS-based and CRS-based sPDSCH are supported in the second slot of the DwPTS for SSC 3,4,8.

Proposed agreement: Friday, still no consensus

DMRS-based and CRS-based sPDSCH in the second slot of the DwPTS for SSC 1,2,6,7 is supported.

Agreement: Support sPUCCH in UpPTS only for SSC 10.

Agreement: Support HARQ-ACK on sPUSCH in UpPTS for SSC 10.

Agreement:

Transmission of sDCI to schedule sPUSCH is supported in X-symbol sTTI, where the X-symbol sTTI denotes the part of DwPTS in the second slot of a special subframe and X is the number of symbols of DwPTS in the second slot.

If HARQ-ACK transmission for sPDSCH is supported (Proposal D) in UpPTS for SSC 10,

Proposal F-1:

For SSC 0-9, the following pre-defined table is used for the timing between sPDSCH and HARQ-ACK. In the following table describing k, HARQ-ACK is transmitted in slot n, where the corresponding sPDSCH transmitted in n-k.

TDD UL/DL	slot number <i>n</i>																			
Conf.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
0					4	4	4	4							4	4	4	4		
1					6,5	5,4	4	4							6,5	5,4	4	4		
2					8,7,12,11	7,6,5,4									8,7,12,11	7,6,5,4				
3					14,13,12	12,11,10	10,9	9,8	8,7	7,6										
4					16,15,14,13	13,12,11,10	10,9,8,7	7,6,5,4												
5					18,17,16,15,14,13,12,22,21	12,11,10,9,8,7,6,5,4														
6					6	6	6	6	6	6					4	4	4	4		

If HARQ-ACK transmission for sPDSCH is supported (Proposal D) in UpPTS for SSC 10,

Proposal F-2:

For SSC 10, the following pre-defined table is used for the timing between sPDSCH and HARQ-ACK. In the following table describing k, HARQ-ACK is transmitted in slot n, where the corresponding sPDSCH transmitted in n-k.

TDD UL/DL	slot number <i>n</i>																			
Conf.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
0					4	4	4	4							4	4	4	4		
1				5	5	5	5	5						5	5	5	5	5		
2				7,6,11	6,5	5,4								7,6,11	6,5	5,4				
3				13,12	12,11	11,10	10,9	9,8	8,7	7										
4				15,14,13	13,12,11	11,10,9	9,8,7	7,6,5												
5				17,16,15, 14,13,21	13,12,11, 10,9,8	8,7,6,5,4														
6				5	5	5	5	5							4	4	4			

Agreement:

- For SSC 1,2,3,4,6,7,8, the following pre-defined table is used for the timing between UL grant and sPUSCH for TDD UL/DL configuration 1-5. In the following table describing k, sPUSCH is transmitted in slot n+k, where the corresponding UL grant is received in slot n.

TDD UL/DL	slot number n																			
Configuration	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	4	4	4	4							4	4	4	4						

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2	4	4								4	4								
3	6	6	6	6													6	6	
4	4	4	4	4															
5	4	4																	

Proposed offline consensus G-2:

For SSC 1,2,3,4,6,7,8, the following pre-defined table is used for the timing between UL grant and sPUSCH for TDD UL/DL configuration 0 and 6. In the following table describing k, sPUSCH is transmitted in slot n+k, where the corresponding UL grant is received in slot n.

TDD UL/DL	slot number n																			
Configuration	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
0	4	4,5	5,6	6							4	4,5	5,6	6						
6	6	6	6	6							4	4	4	4					6	6

Proposed offline consensus:

For SSC 0,5,9,10, the following pre-defined table is used for the timing between UL grant and sPUSCH for TDD UL/DL configuration 1-5. In the following table describing k, sPUSCH is transmitted in slot n+k, where the corresponding UL grant is received in slot n. The red-colored font is for SSC 10.

TDD UL/DL	slot number <i>n</i>																			
Configuration	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	5	5	5						5	5	5	5	5						5	5
2	4	4								4	4	4								4
3	7	7	7														7	7	7	7
4	5	5	5																5	5
5	4	4																		4

Proposal G-3:

For SSC 0,5,9,10, the following pre-defined table is used for the timing between UL grant and sPUSCH for TDD UL/DL configuration 0 and 6. In the following table describing k, sPUSCH is transmitted in slot n+k, where the corresponding UL grant is received in slot n. The red-colored font is for SSC 10.

TDD UL/DL	slot number <i>n</i>																			
Configuration	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
0	4,5	5,6	6,7,11								4,5	5,6	6,7,11							9
6 (SSC 0,5,9)	6	6	6,7								4	4	4,5						6	6
6 (SSC 10)	5,6	6,7	7,11								4	4	4,5						5	5

- [R1-1717709](#) TDD-specific considerations on sTTI ZTE, Sanechips
[R1-1717894](#) Discussion on HARQ timing for shortened TTI in TDD CMCC
[R1-1718115](#) FS2 aspects Qualcomm Incorporated

6.2.1.2.7 Other

- [R1-1717128](#) sTTI combinations in CA scenario Huawei, HiSilicon
[R1-1717135](#) sPUCCH resource allocation Huawei, HiSilicon
[R1-1717143](#) TBS determination for short TTI Huawei, HiSilicon
[R1-1717148](#) Discussion on sDCI2 Huawei, HiSilicon
[R1-1717175](#) TBS scaling for short TTI Ericsson
[R1-1717176](#) UE capabilities for sTTI Ericsson

- [R1-1717179](#) SPS for sTTI Ericsson
[R1-1717147](#) SPS for short TTI Huawei, HiSilicon
[R1-1717756](#) Draft LS reply on SPS for short TTI Huawei

- [R1-1719060](#) [Draft] LS reply on SPS for short TTI Huawei
[R1-1719193](#) LS reply on SPS for short TTI Source: RAN1; To: RAN2
Decision: The LS is approved.

Email approval on SPS details (Huawei(Yubo), 27th of Oct until 10th of Nov)

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[R1-1717180](#) Multi-sTTI scheduling Ericsson
[R1-1717755](#) Discussion on SR in shortened TTI scenario Huawei, HiSilicon
[R1-1718071](#) On power control for different UL sTTI lengths Huawei, HiSilicon

6.2.1.3 Maximum TA and processing time

Including maximum supported TA for sTTI and 1 ms operation, minimum data processing time for short TTI and potential relationship between them.

[R1-1717141](#) Maximum TA and processing time reduction Huawei, HiSilicon
[R1-1717155](#) Summary of Email discussion [90-14] on max TA, processing time and {2,7} sTTI issues Nokia, Nokia
Shanghai Bell

Agreement: Define a single maximum TA value for reduced processing time operation of 1ms TTI (i.e. no UE capability for different maximum TA support).

Agreement: The minimum processing time assumption for subslot sTTI operation is configured by RRC.

Agreement: For {2,7} sTTI operation, the UL grant for 7OS sPUSCH in a certain slot can be sent in either one of three defined subslot DL sTTIs.

- NOTE: The UE is expected to only receive one UL grant from the set of 2/3-symbol sTTIs mapped to a single UL slot sTTI

Agreement:

- For {2,7} sTTI operation, the sPDSCH HARQ-Ack of subslot sPDSCH is mapped to the earliest possible slot UL sTTI. The HARQ-Ack of subslot sPDSCH in sTTI#x of SF#N is to be mapped on the 1-slot UL sTTI in slot/sTTI#y of SF#N+n for a minimum processing time assumption of k subslot sTTIs.
 - $y = \text{mod}\{[(x+k)/3], 2\}$
 - $n = \lceil [(x+k)/3]/2 \rceil$

Proposed offline consensus:

Support 16 UL and 16 DL HARQ processes for shorter TTI operation for FS1 independently of the UL/DL sTTI combination as well as for the slot sTTI operation of FS2.

- NOTE: The soft buffer definition is not changed

Observation:

The maximum timing advance value for shortened processing time of 1ms TTI and slot sTTI operation need not to be equal.

Proposal 1:

The maximum TA for reduced processing time operation of 1ms TTI, slot and subslot based sTTI operation is defined as by the legacy definition in terms of carrier aggregation operation, i.e. besides $TA \leq TA_{max}$ and $RTD \leq MRTD$ no other restrictions apply.

Agreement: Define two sets of two processing timing assumptions for subslot TTI operation for different maximum TA support.

- Set 1 is defined with minimum timing $n+4$ with $TA1/n+6$ with $TA1+4os$
- Set 2 is defined with minimum timing $n+6$ with $TA2/n+8$ with $TA2+4os$
- FFS if different/same UEs can indicate support for different sets of processing timing assumptions.

Offline consensus: Friday, the following is agreed:

Agreements:

- For subslot TTI operation related to timing advance operation, the UE signals its capability for 2/3os sTTI between set 1 and set 2 for:
 - 1 os CRS based sPDCCH
 - 2 os CRS based sPDCCH
 - DMRS based sPDCCHFFS: UE capability dependent on RS type for data.
- The maximum timing advance supported is:
 - 1 ms, short processing time: 200 us
 - 7os: 310 us

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- 2/3os:
 - TA1: 67 us
 - TA2: 167 us
- In all above TTI length configurations and processing time configurations, the gap between first UL and latest DL carrier is less than $T_{A,max}$ given above (expected impact on 3GPP TS 36.133). Details FFS.

Email approval on LS to RAN4 related to the above agreement and its impact to the RAN4 specifications (Nokia(Klaus), from 18th Oct to 25th Oct)

Proposal 6:
For {2,7} sTTI operation, the UL grant for slot based sPUSCH in slot#x of SF#N can be sent from either one of (downselect at RAN1#90bis)

- Alt 1:
 - For x=0: in sTTI#4 of SF#N-3, sTTI#5 of SF#N-3 or sTTI#0 of SF#N-2
 - For x=1: in sTTI#1, sTTI#2 or sTTI#3 of SF#N-2
- Alt 2: sTTI#3x, sTTI#3x+1 or sTTI#3x+2 of SF#N-2

Note: The UE is expected to only receive one UL grant from the set of 2/3-symbol sTTIs mapped to a single UL slot sTTI.

Proposal 7:
For {2,7} sTTI operation, in terms of HARQ-Ack multiplexing of 2/3OS sPDSCH on 1-slot PUCCH, decide at RAN1#90bis between

- Option 1: HARQ-Ack multiplexing without (temporal/carrier domain) bundling
- Option 2: HARQ-Ack multiplexing with time-domain bundling using DAI FS2 mechanism
 - Detailed bundling mechanism is FFS
 - Carrier domain bundling is FFS

Proposed RAN1 conclusion:

There is no consensus to support fast SRS triggering (i.e. the minimum timing of SRS request to SRS transmission is less than 4 ms) as part of this WI.

R1-1717177	On maximum TA and reduced processing time for short TTI	Ericsson
R1-1717187	On maximum timing advance and processing time and {2,7} issues	Nokia, Nokia Shanghai Bell
R1-1717547	Remaining issues on reduction of maximum TA and processing time	Samsung
R1-1718116	Maximum TA and processing time	Qualcomm Incorporated

6.2.1.4 Other

[R1-1717178](#) Draft CR to 36.300 Ericsson

[R1-1719067](#) Draft LS on updates to TS36.300 for short TTI and short processing time
[R1-1719153](#) Draft LS on updates to TS36.300 for short TTI and short processing time (revision of [R1-1719067](#))

Friday

Decision: [R1-1719153](#) is endorsed and final LS is approved in [R1-1719203](#).

[R1-1718117](#) Link evaluation of DL data transmission under symbol-dependent puncturing/interferenceQualcomm Incorporated

6.2.2 Enhancements to LTE operation in unlicensed spectrum - WID in [RP-170848](#)

[R1-1719122](#) Chairman's notes of AI 6.2.2 Enhancements to LTE operation in unlicensed spectrum Ad-Hoc chair (Nokia)

The document was presented by Timo Lunttila of Nokia.

Decision: The document is endorsed, and content incorporated below.

6.2.2.1 Multiple starting positions in a subframe for DL

[R1-1717113](#) Support for multiple starting positions in a subframe for DL on SCell with frame structure 3 Huawei, HiSilicon

[R1-1717119](#) Multiple starting and ending positions for LAA DL Ericsson Japan K.K.

[R1-1717188](#) On multiple DL starting positions in a subframe for feLAA Nokia, Nokia Shanghai Bell

[R1-1717259](#) Discussion on multiple starting positions for LAA DL LG Electronics

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[R1-1717325](#) On the additional downlink starting positions in a subframe for FS3 Intel Corporation
[R1-1717548](#) Multiple starting positions for DL Samsung
[R1-1718014](#) Discussion on multiple starting positions in a subframe for DL NEC

[R1-1718015](#) Discussion on additional starting positions for DL in LAA Broadcom, Brocade, CableLabs, Comcast, Hewlett Packard Enterprise

Conclusion: no consensus to introduce additional DL starting points

[R1-1718120](#) Multiple starting positions in a subframe in DL Qualcomm Incorporated

6.2.2.2 Multiple starting and ending positions in a subframe for UL

Remaining aspects including control signaling, channel access, etc.

[R1-1717114](#) Support for partial subframe transmission for UL on SCell with frame structure 3 Huawei, HiSilicon
[R1-1717120](#) Remaining issues on multiple starting and ending points for LAA UL Ericsson Japan K.K.

[R1-1717189](#) Multiple starting and ending positions in a subframe for UL Nokia, Nokia Shanghai Bell
[R1-1717260](#) Discussion on multiple starting and ending positions for LAA UL LG Electronics
[R1-1717326](#) Remaining details on uplink starting and ending positions in a subframe for FS3 Intel Corporation
[R1-1717549](#) Multiple starting and ending positions for UL Samsung
[R1-1718018](#) Discussion on additional starting and ending positions for UL in LAA Broadcom, Brocade, CableLabs, Comcast, Hewlett Packard Enterprise
[R1-1718121](#) Multiple starting and ending positions in a subframe in UL Qualcomm Incorporated
[R1-1718164](#) Demodulation of PUSCH in partial subframe transmission NTT DOCOMO, INC.
[R1-1718274](#) Channel access on additional starting position in a subframe for UL on LAA SCell WILUS Inc.

[R1-1718866](#) WF on Mode1 for UL partial subframe Huawei, HiSilicon

Proposals:

- For Mode 1, select one of the options:
 - Opt1: UL grant indicates if the corresponding UL subframe applies Mode 1 or not, i.e., the first slot of the subframe can be punctured depending on LBT outcome
 - FFS if additional overhead is needed in the UL grant.
 - Alt1: add new bit(s) in UL grant for indication
 - Alt2: some joint encoding of the indication bit field. E.g., 2bits for indicating states of R14 operation, Mode 1, Mode 2, and ending partial
 - For multi-subframe scheduling the indication applies to all subframes within the corresponding UL burst.
 - Opt 2: RRC signalling is used to enable/disable Mode 1, i.e., the first slot of the subframe can be punctured depending on LBT outcome
 - For multi-subframe scheduling Mode 1 applies to all subframes.

Email discussion on partial UL subframes until Nov 15th: Huawei (Liyuan)

6.2.2.3 Autonomous uplink access with Frame Structure type 3

6.2.2.3.1 Resource allocation for autonomous UL access

Including e.g. configuration of resources for uplink autonomous access, multiplexing of autonomous and scheduled UL transmissions, and related control signalling

[R1-1717115](#) On resource allocation for AUL Huawei, HiSilicon
[R1-1717121](#) on AUL Support on LAA sCell Ericsson Japan K.K.
[R1-1717261](#) Resource allocation and control signaling for autonomous UL access LG Electronics
[R1-1717327](#) A framework to enable autonomous uplink access Intel Corporation
[R1-1717411](#) Resource allocation for autonomous UL access TCL
[R1-1717550](#) Resource allocation for autonomous UL access Samsung
[R1-1718122](#) Resource allocation for autonomous UL access Qualcomm Incorporated
[R1-1718301](#) Resource allocation for autonomous UL access Lenovo, Motorola Mobility
[R1-1718369](#) Resource Allocation for Autonomous UL Access Nokia, Nokia Shanghai Bell

Email discussion on AUL resource allocation until Nov 15th: Nokia (Timo)

6.2.2.3.2 HARQ for autonomous uplink access

Including necessary enhancements to DL and UL control signaling

- [R1-1717116](#) On HARQ operation for AUL Huawei, HiSilicon
- [R1-1717123](#) on HARQ design for AUL Ericsson Japan K.K.
- [R1-1717241](#) HARQ for Autonomous Uplink Access Nokia, Nokia Shanghai Bell
- [R1-1717262](#) HARQ operation for autonomous UL access LG Electronics
- [R1-1717328](#) Consideration on HARQ for autonomous uplink access Intel Corporation
- [R1-1717551](#) HARQ for autonomous UL access Samsung
- [R1-1718123](#) HARQ for autonomous UL access Qualcomm Incorporated

[R1-1719034](#) WF on HARQ design for AUL Ericsson, Nokia, Lenovo, Motorola Mobility

Agreement: Only Asynchronous HARQ is supported for AUL

Agreement:

- Asynchronous AUL HARQ feedback and retransmissions are supported for AUL transmissions.
 - Timing relationship between AUL transmission and corresponding UL HARQ feedback is not fixed
 - Timing relationship between UL HARQ feedback and corresponding retransmission is not fixed.
 - NOTE : UE does not expect HARQ feedback earlier than 4 subframes after the corresponding AUL transmission

Agreement:

- AUL downlink feedback information ("AUL-DFI") is specified to carry at least AUL HARQ feedback
 - Bitmap with one HARQ-ACK-bit for each AUL-configured HARQ process per TB (FFS: whether spatial bundling is used)
 - The HARQ feedback includes pending feedback for several uplink transmissions from the same UE.
 - RV are not included in the AUL-DFI
 - Align size of DFI with e.g. DCI 0A, or DCI 1C (FFS)
 - Support transmission of AUL-DFI on unlicensed cell as well as any other scheduling cell
 - AUL-DFI shall contain HARQ-ACK feedback for SUL transmissions using AUL-enabled HARQ IDs
 - AUL is not allowed for SUL retransmission
 - AUL-DFI includes a field indicating TPC for PUSCH (2 bits), applicable for both AUL and SUL transmissions
 - e.g. applied similarly as TPC in DCI 3/3A in terms of timing
 - FFS: RNTI for AUL-DFI

Agreement:

- Any HARQ process that is transmitted by SUL is not eligible for AUL retransmissions
 - Applies to SUL first transmissions as well as for scheduled retransmissions of an earlier AUL transmissions of the same TB
 - UE may only use such a HARQ process for AUL if the corresponding AUL-DFI indicated ACK

Agreement:

- Confirm the working assumption that both scheduled and autonomous retransmission are supported for AUL transmissions.
 - Scheduled retransmission is triggered by:
 - Reception of UL grant indicating same HARQ process ID, same TBS, and NDI non-toggled.
 - FFS: the UE behaviour in case of TBS mismatch
 - FFS: timing relationship between SUL retransmission grant and AUL-DFI
 - UE may autonomously retransmit after:
 - Reception of NACK feedback via the AUL-DFI for explicit AUL HARQ feedback
 - No indication is received from eNB (neither rescheduling UL grant nor AUL-DFI) for X subframes since the transmission of a given HARQ process
 - FFS: value of X
 - FFS: whether X is fixed or configurable
 - Note: X is not related to CWS update procedure

Agreement:

- UE determines the HARQ process ID, NDI and RV for Autonomous UL transmissions.
 - FFS RV sequence followed by the UE

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Agreement:

- New UCI for AUL operation:
 - includes at least: HARQ ID, new data indicator, and redundancy version.
 - FFS: CRC attachment and scrambling
 - FFS: indication of UE specific ID
 - is transmitted together with every PUSCH in AUL transmission.

Email discussion on AUL HARQ until Nov 15th: Ericsson (Reem)

6.2.2.3.3 Channel access for autonomous UL access

R1-1719131 WF on CW update for Autonomous UL in FeLAA Broadcom

R1-1717263	Channel access procedure for autonomous UL access	LG Electronics
R1-1717117	On channel access for AUL	Huawei, HiSilicon
R1-1717122	on Channel Access for AUL	Ericsson Japan K.K.
R1-1717242	On Channel Access for Autonomous UL Access	Nokia, Nokia Shanghai Bell
R1-1717329	Consideration on channel access mechanism for autonomous uplink access	Intel Corporation
R1-1717552	Channel access for autonomous UL access	Samsung
R1-1718124	Channel access mechanism for autonomous UL access	Qualcomm Incorporated
R1-1718275	Channel access for autonomous UL transmission in FeLAA	WILUS Inc.
R1-1718300	HARQ and Control Signalling for Autonomous Uplink	Lenovo, Motorola Mobility

Email discussion on AUL channel Access until Nov 15th: Intel (JJ)

6.2.2.3.4 Other

R1-1718125 Miscellaneous aspects Qualcomm Incorporated

6.2.3 3GPP V2X Phase 2 - WID in [RP-171740](#)

R1-1719123 Chairman's notes of AI 6.2.3 3GPP V2X Phase 2 Ad-Hoc chair (Huawei)

The document was presented by Philippe Sartori of Huawei.

Decision: The document is endorsed, and content incorporated below.

6.2.3.1 Carrier Aggregation (up to 8 PC5 carriers)

6.2.3.1.1 Mode-4 support

Including changes to the sensing procedure

Joint or independent sensing:

R1-1717730 On Mode-4 Support for CA Ericsson

Agreement: Any sensing and resource (re)selection procedure uses the Rel-14 PHY UE procedure of determining the subset of resources to be reported to higher layers in PSSCH resource selection in sidelink transmission mode 4. Additional rules for resource exclusion of resources is not precluded after the procedure

Note: T2 values may be discussed, and potentially modified, when discussing latency reduction

R1-1717553 mode-4 support in V2X CA Samsung

Joint or independent resource selection:

R1-1717789	Discussion on carrier aggregation for mode 4 in V2X phase 2	CATT
R1-1718890	WF on CA resource selection	CATT, Samsung
R1-1718936	WF on resource (re)selection for Mode 4 PC5 CA	LGE, Huawei
R1-1719139	WF on carrier selection rules	Huawei, HiSilicon, ZTE, NTT DOCOMO, Nokia, NSB, Samsung, Panasonic

Working assumption:

- For a given MAC PDU, RAN1 assumes that a single carrier is provided by higher layer for its transmission.
- From RAN1 perspective, the following factors can be taken into account for TX carrier selection.
 - CBR
 - UE capability (e.g. number of TX chains, implementation related aspects such as power budget sharing capability, TX chain retuning capability)
- For a given MAC PDU, a single carrier is used for transmission and potential retransmission of this MAC PDU.

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- From RAN1 perspective, once a carrier is selected, the same carrier is used for all MAC PDUs of the same sidelink process at least until resource reselection is triggered for that same sidelink process based on Rel-14 triggering conditions.
 - Note that the UE is not precluded to switch transmission chains between component carriers for different sidelink processes

Note that companies can bring contributions on new triggering conditions for resource (re) selection

Agreement: send LS to RAN2 to inform them of working assumption (Yi-Huawei)

Friday

R1-1719150 [draft] LS to RAN2 on carrier selection for Rel-15 V2X Huawei

Discussion: One commented that the above note was missing – rapporteur → no need including the note, that note is not part of the WA

Decision: The document is endorsed and final LS is approved in R1-1719151

R1-1719028 WF on resource selection procedure for Mode 4 PC5 CA LG Electronics, ZTE, Huawei, Nokia, NSB, NTT DOCOMO, Samsung, Panasonic, CATT, NEC

Conclusion: Continue discussion on whether address the following issue for resource selection for mode-4 CA:

- UE's limited TX capability
 - TX chain switching time
- Half duplex problem
- TX power budget constraint

Agreement: send LS to RAN4 (Alex-Intel) to ask their inputs of the following:

- Switching time for intra-band and inter-band due to TX switching and interruption time at the receiver
- Feasibility of simultaneous transmission on intra-band, non-contiguous carriers. RAN1 requests feedback of impact of MPR and maximum psd imbalance between carriers.

Friday

R1-1719158 [Draft] LS to RAN4 on resource selection for Mode-4 sidelink CA Intel Corporation

Decision: The document is endorsed and final LS is approved in R1-1719159

Carrier selection rules:

- R1-1717775** Discussion on UE behaviour of mode 4 in case of multiple carriers Panasonic
R1-1718036 Mode 4 support in eV2X carrier aggregation Guangdong OPPO Mobile Telecom
R1-1718928 WF on carrier selection rules Huawei, HiSilicon, ZTE, Sanechips, LG Electronics

Power sharing/dropping rules:

- R1-1717330** Sidelink carrier aggregation for mode-4 LTE V2V communication Intel Corporation
R1-1717002 Discussion on sensing and resource (re)selection for carrier aggregation Huawei, HiSilicon
R1-1718929 WF on power sharing issue for Rel-15 CA Huawei, HiSilicon, LG Electronics

Conclusion: discuss further power allocation between carriers/uplink at RAN1#91

- R1-1718126** Carrier Aggregation for V2X Phase 2 Qualcomm Incorporated
R1-1717099 Sensing and resource selection in SL CA ZTE, Sanechips
R1-1717264 Discussion on carrier aggregation in sidelink mode 4 operation LG Electronics
R1-1717415 Resource selection for V2X systems supporting CA ASTRI, TCL Communication Ltd.
R1-1717765 Mode 4 support for V2X carrier aggregation Nokia, Nokia Shanghai Bell
R1-1718081 Discussion on V2X Sidelink CA Scheduling Issues ITRI
R1-1718165 On carrier aggregation using mode 4 resource selection NTT DOCOMO, INC.
R1-1718268 Discussion on carrier aggregation in mode 4 sidelink operation Sony

6.2.3.1.2 Synchronization

- R1-1717766** Discussion on synchronization for V2X carrier aggregation Nokia, Nokia Shanghai Bell
R1-1718037 Synchronization in eV2X carrier aggregation Guangdong OPPO Mobile Telecom
R1-1717100 Synchronization in Sidelink CA ZTE, Sanechips
R1-1717265 Discussion on synchronization for sidelink CA LG Electronics
R1-1718895 WF on synchronization in sidelink CA LG Electronics, NTT Docomo, Nokia, NSB, NEC
R1-1719134 WF on timing for sidelink CA Huawei, HiSilicon, Ericsson, Intel, Qualcomm, ITRI, Samsung, OPPO, ZTE

Working assumption:

- From the transmitting UE perspective, a single synchronization reference is used for all aggregated carriers
 - When a UE transmits multiple MAC PDUs on multiple carriers, timing on all transmission carriers is aligned

R1-1718891 WF on Synchronization for carrier aggregation in eV2X CATT

- R1-1718927** WF on SLSS/PSBCH transmission for sidelink CA Huawei, HiSilicon, ITRI, ZTE, Samsung, CATT, Ericsson, OPPO
- R1-1719141** WF on SLSS/PSBCH transmission and reception in sidelink CA LG Electronics, NTT Docomo, Nokia, NSB, Qualcomm
- R1-1717007** Discussion on synchronization for carrier aggregation on sidelink Huawei, HiSilicon
- R1-1717331** Synchronization aspects for LTE V2V sidelink carrier aggregation Intel Corporation
- R1-1717554** Synchronization in V2X CA Samsung
- R1-1717731** On Synchronization Aspects for PC5 CA Ericsson
- R1-1717790** Discussion on synchronization for carrier aggregation in V2X Phase 2 CATT
- R1-1718082** Discussion on Synchronization for Sidelink Carrier Aggregation in V2X Phase 2 ITRI
- R1-1718166** Discussion on synchronization for carrier aggregation NTT DOCOMO, INC.

6.2.3.1.3 Others

- R1-1717555** Other considerations on V2X CA Samsung
- R1-1717732** On TX carrier selection Ericsson

6.2.3.2 Support for 64-QAM

R1-1718916 WF on rate-matching for Rel-15 V2X LG Electronics, Huawei, HiSilicon, Intel

Agreement:

- For PSSCH, specifications support rate-matching applied over the last symbol for all modulation orders.
 - Rate-matching is applied for all MCSs
 - Use of Rel-15 format is signaled in the SCI (FFS signaling details)

Note: When a Rel-15 UE transmits a message that needs to be received by Rel-14 UEs, it shall use the Rel-14 format.

Agreement: For the last symbol of PSSCH, rate-matching is always applied when the Rel-15 MCS table is used. Puncturing is always applied when the Rel-14 MCS table is used.

Agreement: confirm the WA of last meeting: No change to the 5-bit MCS field in existing SCI-1 is needed to support 64QAM

- R1-1717733** Supporting 64QAM on PC5 Ericsson
- R1-1717332** Support of 64QAM for LTE V2V sidelink communication Intel Corporation
- R1-1717003** Discussion on solving the code rate issue for supporting 64QAM Huawei, HiSilicon
- R1-1717791** Discussion on 64QAM modulation scheme in V2X Phase 2 CATT

Agreement:

- Introduce a modified MCS table, with TBS scaling applied
 - A value of 1 is not precluded for TBS scaling
 - FFS scaling factor value, and if coding rates >0.932 are allowed
 - WA** One scaling factor is applied to all MCS values

Note: for communication of Rel-15 UEs with Rel-14 UEs, the Rel-14 MCS table is used

- R1-1717101** Support for 64 QAM ZTE, Sanechips
- R1-1717266** Discussion on 64QAM support in PC5 operation LG Electronics
- R1-1717556** High order modulation in V2X Samsung
- R1-1717767** On 64QAM for V2X Sidelink Nokia, Nokia Shanghai Bell
- R1-1717773** Discussion on supporting 64QAM modulation for V2X phase 2 Panasonic
- R1-1718038** 64QAM support for eV2X Guangdong OPPO Mobile Telecom
- R1-1718127** Support of 64-QAM for V2X Phase 2 Qualcomm Incorporated

6.2.3.3 Feasibility and gain of PC5 operation with Transmit Diversity

6.2.3.3.1 Transmit diversity solutions

For both PSSCH and PSCCH

- [R1-1718773](#) Transmit Diversity for V2X Phase 2 Qualcomm Incorporated (Revision of [R1-1718128](#))
[R1-1717008](#) Performance evaluation of transmit diversity for eV2X Huawei, HiSilicon
[R1-1717757](#) Low PAPR SFBC for V2X transmit diversity Mitsubishi Electric RCE
[R1-1717734](#) Transmit diversity solutions for Rel-15 PSCCH and PSSCH transmissions Ericsson
[R1-1717792](#) Discussion on Tx diversity schemes in PC5 CATT
[R1-1717267](#) Discussion on transmit diversity support in PC5 based V2X LG Electronics
[R1-1718930](#) WF on two-port Transmit Diversity design Huawei, HiSilicon, Nokia, Nokia Shanghai Bell, ZTE, Sanechips, Ericsson, CATT

Agreement:

- For PSCCH, small delay CDD can be used on PSCCH
 - FFS whether the cyclic delay value is specified or left for UE implementation

- [R1-1719140](#) WF on two-port DMRS design Huawei, HiSilicon, Nokia, Nokia Shanghai Bell, Ericsson
[R1-1717004](#) Transmit diversity solutions for PSSCH and PSCCH Huawei, HiSilicon
[R1-1717102](#) Discussion on transmit diversity for PC5 ZTE, Sanechips
[R1-1717333](#) Candidate transmit diversity schemes for LTE V2V sidelink communication Intel Corporation
[R1-1717557](#) Transmit diversity schemes for PSCCH and PSSCH Samsung
[R1-1717768](#) Transmit diversity schemes for V2X Nokia, Nokia Shanghai Bell
[R1-1717792](#) Discussion on Tx diversity schemes in PC5 CATT
[R1-1718039](#) Transmit diversity scheme in eV2X Guangdong OPPO Mobile Telecom
[R1-1718167](#) Transmission diversity solutions NTT DOCOMO, INC.

6.2.3.3.2 Evaluation results

For both PSSCH and PSCCH

- [R1-1717103](#) Evaluation results of TxD ZTE, Sanechips
[R1-1717334](#) Evaluation of candidate transmit diversity schemes for LTE V2V sidelink communication Intel Corporation
[R1-1717558](#) Evaluation results for Tx diversity for PSSCH Samsung
[R1-1717758](#) Low PAPR SFBC evaluations for V2X Mitsubishi Electric RCE
[R1-1717769](#) Evaluation of transmit diversity schemes for V2X Nokia, Nokia Shanghai Bell
[R1-1717793](#) Evaluations for Tx diversity schemes in PC5 CATT
[R1-1718168](#) Evaluation results for transmission diversity schemes NTT DOCOMO, INC.

6.2.3.3.3 Other

- [R1-1717559](#) Impact of transmit diversity on PC5 interface Samsung
[R1-1717560](#) Control signaling for Tx diversity transmission of PSSCH Samsung
[R1-1717735](#) DMRS design for two port PSSCH transmission Ericsson

6.2.3.4 Other

Latency reduction:

- [R1-1717006](#) Discussion on latency reduction for eV2X Huawei, HiSilicon
[R1-1717106](#) Consideration for latency reduction ZTE, Sanechips
[R1-1717268](#) Discussion on other remaining issues for V2X Phase 2 LG Electronics
[R1-1717335](#) Resource selection latency reduction for LTE V2V sidelink communication Intel Corporation
[R1-1717561](#) Discussion on latency smaller than 20 Samsung
[R1-1717736](#) Reducing time-to-transmit for V2X Ericsson
[R1-1718040](#) Latency reduction for eV2X Guangdong OPPO Mobile Telecom
[R1-1718129](#) Reduction of time between packet arrival and transmission Qualcomm Incorporated
[R1-1718170](#) Reducing the maximum time between packet arrival and selected resource for data transmission NTT DOCOMO, INC.
[R1-1718945](#) WF on reducing the maximum time between packet arrival and resource selected for transmission LG Electronics, ZTE

Resource pool sharing:

- [R1-1717005](#) Discussion on resource pool sharing for eV2X Huawei, HiSilicon

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[R1-1717107](#) Consideration for resource sharing between mode 3 and mode 4 ZTE, Sanechips
[R1-1717217](#) On mode 3 and mode 4 pool sharing NEC
[R1-1717336](#) Sidelink resource pool sharing for eNB-controlled and UE-autonomous V2V transmission modes Intel Corporation
[R1-1717562](#) Resource pool sharing among mode 3/4 UEs Samsung
[R1-1717737](#) Resource pool sharing between mode 3 and mode 4 UEs Ericsson
[R1-1717774](#) Discussion on resource pool sharing between UEs in mode 3 and UEs in mode 4 Panasonic
[R1-1717794](#) Discussion on resource pool sharing between mode 3 and mode 4 CATT
[R1-1718041](#) Resource pool sharing between mode 3 and mode 4 Guangdong OPPO Mobile Telecom
[R1-1718083](#) Discussion on Sharing Resource Pool for eNB-Controlled and UE-Autonomous in V2V Communication ITRI
[R1-1718130](#) Resource pool sharing between Mode 3 and Mode 4 Qualcomm Incorporated
[R1-1718169](#) Resource pool sharing between UEs using mode 3 and UEs using mode 4 NTT DOCOMO, INC.
[R1-1718946](#) WF on resource pool sharing between UEs using Mode 3 and 4 LG Electronics, NTT DOCOMO

Short TTI:

[R1-1717105](#) Discussion on Short TTI for PC5 ZTE, Sanechips
[R1-1717770](#) On sTTI for V2X Sidelink Nokia, Nokia Shanghai Bell
[R1-1717795](#) Discussion on shorten TTI in PC5 CATT
[R1-1717796](#) Evaluations for shorten TTI in PC5 CATT
[R1-1718084](#) Considerations of Short TTI Design for V2X Phase 2 ITRI

6.2.4 Enhancements for high capacity stationary wireless link and introduction of 1024 QAM for LTE - WID in RP-171738

[R1-1719125](#) Chairman's notes of AI 6.2.4 Enhancements for high capacity stationary wireless link and introduction of 1024 QAM for LTE Ad-Hoc chair (Huawei)

The document was presented by Weimin Xiao of Huawei.

Decision: The document is endorsed, and content incorporated below.

[R1-1717413](#) Draft LS on HCS Huawei

Conclusion:

Update the LS to include agreements related to RAN2/4 work such as UE categories, RRC configurations, and UE capability and the mapping of 1024QAM – Huawei (Yubo).

Friday

[R1-1719184](#) Draft LS on HCS Huawei

Decision: The document is endorsed and final LS is approved in [R1-1719317](#)

6.2.4.1 Support for 1024QAM for DL channels

[R1-1717337](#) On support of 1024QAM Intel Corporation
[R1-1717443](#) CQI and MCS table design for 1024QAM ZTE, Sanechips
[R1-1718131](#) Introduction of 1024QAM for PDSCH Qualcomm Incorporated

Agreement: 1024QAM supports peak data rates of at least 120Mbps per layer per 20 MHz CC

[R1-1718990](#) WF on 1024QAM Huawei, HiSilicon, ZTE, Sanechip

Agreements:

- UE capability for support of 1024QAM is reported per band/band combination.
- Introduce new DL UE categories based on a subset of LTE DL Categories 11~20
 - FFS on which DL category/categories.
 - Note: other new UE DL category/categories are not precluded.
- Joint RRC configuration of CQI/MCS table to support 1024QAM is supported for UE.
 - Per CC and per CSI subframe set if configured
 - FFS: Per codeword in addition

Agreements:

- Adopt the following modulation definition for 1024QAM at least for initial transmissions:

$$x = \frac{1}{\sqrt{682}}(1 - 2b_i) \left[16 - (1 - 2b_{i+2}) \left[8 - (1 - 2b_{i+4}) \left[4 - (1 - 2b_{i+6}) [2 - (1 - 2b_{i+8})] \right] \right] \right]$$

$$+ j \frac{1}{\sqrt{682}} (1 - 2b_{i+1}) \left[16 - (1 - 2b_{i+3}) \left[8 - (1 - 2b_{i+5}) \left[4 - (1 - 2b_{i+7}) \left[2 - (1 - 2b_{i+9}) \right] \right] \right] \right]$$

- FFS: whether same is used for re-transmission

Agreement

- Introduce at least 2 new entries in CQI table for 1024 QAM
- For introduction of 1024QAM CQI table:
 - Remove N entries from the 256QAM table.
 - Add N entries for 1024QAM.
- For introduction of 1024QAM MCS table:
 - Remove M entries from the 256QAM table while maintaining (close to) uniformly spaced SE, while keeping the lowest MCS
 - Add M new entries for 1024QAM, with (close to) uniformly spaced SE
 - Including 1 entry to support re-transmission with 1024 QAM

[R1-1717108](#) Discussion on support of DL 1024QAM Huawei, HiSilicon
[R1-1717444](#) CQI table signaling for 1024QAM ZTE, Sanechips
[R1-1718016](#) Design details of 1024QAM Nokia, Nokia Shanghai Bell

6.2.4.2 DMRS overhead reduction

Including at least further details of design considerations for DM-RS overhead reduction using OCC4 for DL SU-MIMO rank3/4 in TM9/10

[R1-1718976](#) **WF on DMRS density reduction** Huawei, HiSilicon, Qualcomm, China Telecom, Nokia, NSB
 Note: Applicable to PDSCH with C-RNTI

[R1-1717109](#) Discussion on DM-RS Overhead Reduction Huawei, HiSilicon
[R1-1717338](#) Overhead reduction for DM-RS Intel Corporation
[R1-1717445](#) Consideration on DMRS Overhead Reduction ZTE, Sanechips
[R1-1717785](#) Remaining issues on DM-RS overhead reduction China Telecommunications
[R1-1718017](#) DL DM-RS overhead reduction Nokia, Nokia Shanghai Bell
[R1-1718132](#) DMRS Overhead reduction Qualcomm Incorporated
[R1-1718262](#) On remaining details for DMRS overhead reduction Ericsson

6.2.5 Even further enhanced MTC for LTE - WID in [RP-171427](#)

[R1-1719126](#) **Chairman's notes of AI 6.2.5 Even further Enhanced MTC for LTE** Ad-Hoc chair (Ericsson)
 The document was presented by Johan Bergman of Ericsson.
Decision: The document is endorsed, and content incorporated below.

6.2.5.1 Reduced system acquisition time

Physical layer aspects of improved cell search and/or system information acquisition performance

[R1-1716968](#) Cell search and system information acquisition improvements in eFeMTC Huawei, HiSilicon
[R1-1716995](#) Reduced system acquisition time for MTC Ericsson
[R1-1717196](#) Further study on system acquisition time reduction for MTC ZTE, SaneChips
[R1-1717220](#) Reducing system acquisition time for eFeMTC Nokia, Nokia Shanghai Bell
[R1-1717270](#) System information acquisition time enhancement in MTC LG Electronics
[R1-1717339](#) System acquisition time reduction for eFeMTC Intel Corporation
[R1-1717563](#) ePSS/eSSS to reduce acquisition time Samsung
[R1-1718133](#) Reduced system acquisition time Qualcomm Incorporated

[R1-1718907](#) **WF on Enhanced PHY Resynchronization for eFeMTC** Ericsson, Nokia, NSB, Sierra Wireless
[R1-1718988](#) **WF on Assessment Assumptions for Enhanced Resynchronization in eFeMTC** Ericsson, Nokia, NSB, Sierra Wireless

Agreements

- Additional assumptions that can be used for evaluation of improved cell search and/or system information acquisition performance for UEs with apriori information (on top of the assumptions for evaluation of reduced system acquisition time already agreed in [R1-1706583](#)):

- Carrier and cell are assumed to be known to the UE.
- The system information is assumed to be unchanged.
- UE power consumption model from the power saving signal evaluation assumptions in [R1-1714992](#)
- RTC timing drift model from the power saving signal evaluation assumptions in [R1-1714992](#)
- Scenarios B and C from the power saving signal evaluation assumptions in [R1-1714992](#)
- Further scenario D: 4-hour Power Saving Mode (PSM)
- Additional evaluation metrics that should be reported if the proponent of a proposed solution think they are relevant and significantly impacted by the proposed solution (on top of the metrics listed in [R1-1706583](#)):
 - Performance impact on legacy UEs
 - UE power consumption impact
 - Inter-cell interference sensitivity
- Additional assumptions that are used in the evaluation should be declared.

6.2.5.2 Early data transmission

Physical layer aspects of support for data transmission during the random access procedure

R1-1716969	On early data transmission for eFeMTC	Huawei, HiSilicon
R1-1716996	Early data transmission for MTC	Ericsson
R1-1717214	On early data transmission for eMTC	ZTE, SaneChips
R1-1717221	Data transmission during random access procedure	Nokia, Nokia Shanghai Bell
R1-1717276	Data transmission during random access procedure in MTC	LG Electronics
R1-1717564	Discussion on early data transmission for eMTC	Samsung
R1-1717869	Early data transmission for eFeMTC	Intel Corporation

Agreements:

- From RAN1 point of view, it is feasible to support early UL data transmission in Msg3 from a BL/CE UE using some TBS value(s) from the TBS range specified for BL/CE UEs in Rel-13 with a maximum total TBS of 1000 bits.
 - Note: For Msg3 for Rel-13 BL/CE UEs, the maximum total TBS is 712 bits in CE mode A and 328 bits in CE mode B.
 - FFS if and how there will also be a larger supported maximum total TBS (than 1000 bits)
 - The detailed value(s) should consider the payload size of early data packets from RAN2.
- From RAN1 perspective, the physical layer design will assume eNB is not required to always provide a grant of a larger TBS for Msg3 and can decide to just provide a grant corresponding to Rel-13 Msg3 TBS instead.

Capture the above agreements in the corresponding NB-IoT LS and ask RAN2 to provide input on what TBS range is needed for the payload sizes considered by RAN2.

Friday: Joint LS with NB-IOT. Approved in R1-1719100 in 6.2.6.

6.2.5.3 Downlink channel power efficiency

Physical signal/channel that can be efficiently decoded or detected prior to decoding MPDCCH/PDSCH

R1-1716970	On 'wake-up signal' for eFeMTC	Huawei, HiSilicon
R1-1716997	Downlink channel power efficiency for MTC	Ericsson
R1-1717210	Power consumption reduction for physical channels for eMTC	ZTE, SaneChips
R1-1717222	Wake-up signal for eFeMTC	Nokia, Nokia Shanghai Bell
R1-1717279	Discussion on the power saving signal/channel in MTC	LG Electronics
R1-1717340	Power saving signal for eFeMTC	Intel Corporation
R1-1717456	Remaining issues for wake-up signal for eFeMTC	vivo
R1-1717565	DL power consumption reduction for eMTC	Samsung
R1-1717763	Idle Mode Power Efficiency Reduction	Sierra Wireless, S.A.
R1-1718065	Considerations on the DL power consumption reduction for eFeMTC	Guangdong OPPO Mobile Telecom
R1-1718135	Efficient monitoring of DL control channels	Qualcomm Incorporated
R1-1718263	Power Saving Signal Evaluations	Sony

Working assumption:

- For idle mode,
 - In specifying a power saving physical signal to indicate whether the UE needs to decode subsequent physical channel(s) for idle mode paging, select a candidate among the following power saving physical signals:
 - 'Wake-up signal or DTX' with new periodic sync signal
 - 'Wake-up signal or DTX' without new periodic sync signal
 - Study till the next meeting how to ensure sufficient sync performance.

- Consider potential synergies with the WI objective on Reduced system acquisition time.
- Consider impacts from mobility.

6.2.5.4 Uplink HARQ-ACK feedback

Design of MPDCCH-based explicit HARQ-ACK feedback, and further input on the benefits and feasibility of early PUSCH termination

- [R1-1716971](#) On HARQ-ACK feedback for PUSCH in eFeMTC Huawei, HiSilicon
[R1-1716998](#) Uplink HARQ-ACK feedback for MTC Ericsson
[R1-1717223](#) Uplink HARQ-ACK feedback in eFeMTC Nokia, Nokia Shanghai Bell
[R1-1717271](#) Discussion on early termination of uplink repetitions for MTC LG Electronics
[R1-1717341](#) HARQ-ACK feedback for eFeMTC UL transmission Intel Corporation
[R1-1717439](#) Discussion on UL HARQ-ACK feedback Lenovo, Motorola Mobility
[R1-1717566](#) Uplink HARQ-ACK feedback for eMTC Samsung
[R1-1718136](#) Uplink HARQ-ACK feedback Qualcomm Incorporated
[R1-1718171](#) Views on UL HARQ-ACK feedback design NTT DOCOMO, INC.
[R1-1718264](#) Explicit uplink HARQ-ACK feedback for eFeMTC Sony

[R1-1718899](#) **WF on early PUSCH termination** ZTE, Sanechips, LGE, Intel, Huawei, HiSilicon, Sony, Lenovo, Motorola Mobility, Ericsson, Nokia, Nokia Shanghai Bell

Agreement:

- Early termination of PUSCH transmission is supported at least in FD-FDD and TDD by the following:
 - MPDCCH for UL grant for scheduling new UL data
 - MPDCCH for explicit HARQ-ACK feedback

[R1-1717197](#) **Further considerations on UL HARQ-ACK feedback for MTC** ZTE, SaneChips

Agreement:

- For explicit HARQ-ACK feedback for early termination of MPDCCH monitoring:
 - Explicit HARQ-ACK feedback for a single UE is carried in a DCI with the same DCI size as DCI format 6-0A/B. The DCI is carried on MPDCCH in UE-specific search space.
- For explicit HARQ-ACK feedback for early termination of PUSCH transmission:
 - Explicit HARQ-ACK feedback for a single UE is carried in a DCI with the same DCI size as DCI format 6-0A/B. The DCI is carried on MPDCCH in UE-specific search space.
 - FFS: Explicit HARQ-ACK feedback for multiple UEs is carried in a DCI

Draft LS to RAN2 in [R1-1719057](#) capturing the agreements (Huiying, ZTE)

Friday

[R1-1719057](#) [DRAFT] LS on Uplink HARQ-ACK feedback to Rel-15 BL/CE UEs ZTE

Decision: The document is endorsed and final LS is [approved in R1-1719057](#)

6.2.5.5 Increased PDSCH spectral efficiency

Remaining details of CQI table for 64QAM support

- [R1-1716999](#) Increased PDSCH spectral efficiency for MTC Ericsson
[R1-1717198](#) Remaining issue on support of 64QAM for unicast PDSCH for MTC ZTE, SaneChips
[R1-1717224](#) Remaining issue on supporting DL 64QAM for eFeMTC Nokia, Nokia Shanghai Bell
[R1-1718265](#) CQI reporting for eFeMTC supporting 64QAM Sony

[R1-1718137](#) **Summary of email discussion on 64-QAM CQI table** Qualcomm Incorporated

Agreement:

- RAN1 to design a solution to configure a UE with CSI reference resource comprising more than one subframe and 64QAM simultaneously.
- RAN1 to discuss the detailed solutions among the following options, where other options are not precluded:
 - Option A: For $csi\text{-}NumRepetitionCE\text{-}r13 > 1$, the UE assumes a CSI reference resource of 1 for 64QAM and $csi\text{-}NumRepetitionCE\text{-}r13 > 1$ for other modulation schemes.
 - Option B: Redesign CQI table to have a more even spread of SNR values.

6.2.5.6 Increased PUSCH spectral efficiency

Design of sub-PRB allocation

R1-1716972	On PUSCH spectral efficiency enhancement	Huawei, HiSilicon
R1-1717000	Increased PUSCH spectral efficiency for MTC	Ericsson
R1-1717199	Detailed sub-PRB allocation design for MTC	ZTE, SaneChips
R1-1717215	Sub-PRB allocation for MTC PUSCH	Sharp
R1-1717225	Design of PUSCH Sub-PRB Allocation	Nokia, Nokia Shanghai Bell
R1-1717342	Design of sub-PRB PUSCH for eFeMTC	Intel Corporation
R1-1717567	Discussion on sub-PRB allocation for eFeMTC	Samsung
R1-1717762	Sub-PRB Design Analysis	Sierra Wireless, S.A.
R1-1717783	Increased PUSCH spectral efficiency for eMTC	China Telecommunications
R1-1718138	Increased PUSCH spectral efficiency	Qualcomm Incorporated
R1-1718266	Sub-PRB transmissions in eFeMTC for improved PUSCH spectral efficiency	Sony

[R1-1718921](#) WF on Sub-PRB for eFeMTC Sierra Wireless, Ericsson, Nokia, NSB, KT Corp, Sony, AT&T, Verizon, Qualcomm

[R1-1719001](#) WF on Sub-PRB Support in Mode A for eFeMTC Sierra Wireless, AT&T, Verizon, Orange, NTT Docomo, Nokia, NSB, Qualcomm, Sony

Agreement:

- Sub-PRB shall be supported at least in CE Mode B
- **Working assumption:** Sub-PRB shall be supported in CE Mode A.
 - RAN1 will prioritize optimization of Sub-PRB for CE Mode B over optimization of Sub-PRB for CE Mode A.
- For Sub-PRB, the maximum total number of (valid) subframes of transmission is:
 - 32 subframes for CE Mode A
 - 2048 subframes for CE Mode B
- FFS: Supported transport block sizes and numbers of repetitions (for each supported CE Mode)
- Sub-PRB rate matching is performed across a resource unit (RU) spanning multiple subframes
 - The RU length depends on number of subcarriers in the Sub-PRB allocation
 - FFS: RE mapping
 - FFS: whether more than one RU is allocated per transport block
- For Sub-PRB, increasing DMRS shall not be supported
- For Sub-PRB allocation in connected mode,
 - The Sub-PRB feature is configured/enabled by RRC signaling
 - The Sub-PRB resource allocation shall be signaled by DCI
- FFS: Support of Sub-PRB allocation in Msg3

[R1-1719000](#) WF#2 on Sub-PRB for eFeMTC Sierra Wireless
Also supported by Ericsson and Sony

Agreement:

- When the Sub-PRB feature is configured/enabled in connected mode in CE mode B,
 - DCI format 6-0B shall support both sub-PRB allocation and allocation of at least 1 PRB.
 - Sub-PRB allocation shall support a maximum TBS of at least [504] bits.

6.2.5.7 Other

R1-1717001	Flexible PDSCH/PUSCH resource allocation for MTC	Ericsson
R1-1719055	WF on Flexible PDSCH-PUSCH resource allocation for MTC	Ericsson, Orange, NTT DOCOMO
R1-1718139	Modulation enhancements for eMTC	Qualcomm Incorporated
R1-1718273	Improved Channel and Timing Estimation for eFeMTC	Fraunhofer IIS

6.2.6 Further enhancements of NB-IoT - *WID* in [RP-172063](#).

[R1-1719127](#) Chairman's notes of AI 6.2.6 Further enhancements of NB-IoT Ad-Hoc chair (Huawei)

The document was presented by Matthew Webb of Huawei.

Decision: The document is endorsed, and content incorporated below.

6.2.6.1 Latency and power consumption reduction

Where solutions are specified, draft CRs to be provided to RAN#78

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6.2.6.1.1 Power consumption reduction for paging and connected-mode DRX

Physical signal/channel that can be efficiently decoded or detected prior to decoding NPDCCH/NPDSCH.

6.2.6.1.1.1 Wake-up signal functions

Including: with or not with DTX; with or not with synchronization function; information conveyed; connected mode DRX, etc.

R1-1716973	On functions of power saving signal	Huawei, HiSilicon
R1-1717207	Power consumption reduction for physical channels for NB-IoT	ZTE, SaneChips
R1-1717272	Discussion on power saving signal/channel function	LG Electronics
R1-1718140	Wake-up signal functions	Qualcomm Incorporated
R1-1717009	Wake-up signal functions	Ericsson
R1-1717226	Functions of wake-up signal	Nokia, Nokia Shanghai Bell
R1-1717343	The function scope of wake-up signal for feNB-IoT	Intel Corporation
R1-1717457	Remaining details on wake-up signal functions for feNB-IoT	vivo
R1-1718062	On wake-up signal functionalities	Guangdong OPPO Mobile Telecom
R1-1718919	WF on power saving signal/channel for connected mode DRX	LG Electronics, Huawei, HiSilicon, ZTE, Sanechips
R1-1718943	Way Forward on wake up signal function	Huawei, HiSilicon
R1-1719012	WF on Wake-up Signal Functions	Ericsson, Samsung, Qualcomm, Intel, Sony

Agreements:

- Working assumption: WUS/DTX is adopted for the power saving signal for IDLE mode paging;
- The UE is configured with a transmission duration of WUS by higher layers
- The WUS signal may be decoded with or without relying on prior synchronization
 - Whether the UE needs to acquire (further) synchronization using NPSS/NSSS to decode the NPDCCH following the WUS is FFS
 - The power saving of using existing synchronization signal to achieve sync and using WUS for synchronization should be compared.
 - For RAN#78 timeline, RAN4 can assume the UE is synchronized prior to the WUS
 - After RAN#78, RAN1 and RAN4 will conduct additional work to allow the assumption that the UE is not synchronized prior to the WUS (with the same WUS signal design) for 144 dB MCL; and will study to allow the assumption that the UE is not synchronized prior to the WUS (with the same WUS signal design) for 154, 164 dB MCL
 - Status of work on 'Relaxed monitoring for cell reselection' in RAN2/4 should be considered

6.2.6.1.1.2 Wake-up signal configurations and procedures

How many UEs and POs the signal applies to; resource allocation; timing relationships to NPDCCH/NPDSCH.

R1-1717208	Discussion on wake up signal configuration for NB-IoT	ZTE, SaneChips
R1-1716985	On configurations and procedures of power saving signal	Huawei, HiSilicon
R1-1717010	Wake-up signal configurations and procedures	Ericsson
R1-1717344	Configurations of wake-up signal for feNB-IoT	Intel Corporation
R1-1717227	Wake-up signal configurations and procedures	Nokia, Nokia Shanghai Bell
R1-1718063	On wake-up signal transmission	Guangdong OPPO Mobile Telecom
R1-1718141	Wake-up signal configurations and procedures	Qualcomm Incorporated
R1-1717568	Discussion on Wake up signal configuraion	Samsung
R1-1717273	Discussion on power saving signal/channel configurations and procedures	LG Electronics
R1-1717922	Avoiding the impact on MME	SoftBank Corp.
R1-1718944	Way Forward on Wake-up signal configurations and procedures	Huawei, HiSilicon

Agreements:

- RAN1 assumes that introduction of WUS does not alter PO/PF definition
- At least in a UE's DRX cycle:
 - WUS supports at least being applied to all the UEs monitoring WUS associated to a PO in a ~~eeH~~ NB-IoT carrier;
 - FFS: eNB can configure WUS being applied to a group of more than one of the UEs associated to a PO in a ~~eeH~~ NB-IoT carrier
 - Send LS to request RAN2 input on feasibility of UE groups for WUS. (Xiaolei, HiSilicon, prepare draft LS in [R1-1719102](#))

Friday

[R1-1719102](#) [Draft] LS on wake-up signal configuration and procedures for NB-IoT and BL/CE UEs in Rel-15
HiSilicon

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Decision: The document is endorsed and final LS is [approved in R1-1719307](#). Consequently, the above agreement is modified as shown.

Working assumption:

- At least in a UE's DRX cycle, how the UE knows the WUS time location, is:
 - A WUS has a time location which is configurable with respect to the associated PO(s) location(s)

Agreements:

- At least in a UE's DRX cycle, one WUS informs UE whether to monitor the PO in a single DRX cycle
- Include in the LS to RAN2, to request input on the feasibility of WUS applying to more than one PO in a PTW for eDRX case

6.2.6.1.1.3 Detailed design of wake-up signal

Design of the physical signal, evaluations, etc.

R1-1716986	On detailed design and evaluations of power saving signal	Huawei, HiSilicon
R1-1717209	Details design of wake up signal for NB-IoT ZTE, SaneChips	
R1-1718142	Wake-up signal design	Qualcomm Incorporated
R1-1717274	Design of power saving signal/channel	LG Electronics
R1-1717345	Wake-up signal design for feNB-IoT	Intel Corporation
R1-1718064	On wake-up signal design	Guangdong OPPO Mobile Telecom
R1-1717228	Considerations for design of wake-up signal	Nokia, Nokia Shanghai Bell
R1-1717011	Detailed design of wake-up signal	Ericsson
R1-1717458	Views on design of wake-up signal for feNB-IoT	vivo

[R1-1718942](#) Way Forward on detailed design of wake up signal Huawei, HiSilicon, LGE

Agreements:

- WUS signal is at least cell-specific;
 - FFS scrambling of WUS including time varying scrambling
- Long ZC sequence based signal is considered as the starting point for WUS signal:
 - FFS: whether the sequence can span over multiple subframes
 - FFS: whether accumulated multiplication is applied between sub-sequences from the long ZC sequence to reduce the impact of frequency error;
 - FFS: Support transmit diversity for NB-IoT WUS
 - FFS: NSSS like signal is used as the wake-up signal

[R1-1718941](#) WF on Wake-up Signal Transmission in NB-IoT Qualcomm, Ericsson

6.2.6.1.2 Data transmission during the random access procedure

Until RAN2 has achieved sufficient progress, companies are encouraged to identify what the physical layer aspects are which need to be considered in the evaluation and design.

R1-1717014	Data transmission during random access procedure for NB-IoT	Ericsson
R1-1717213	On early data transmission for NB-IoT	ZTE, SaneChips
R1-1717229	Data transmission during random access procedure	Nokia, Nokia Shanghai Bell
R1-1717275	Data transmission during random access procedure in NB-IoT	LG Electronics
R1-1717569	Discussion on early data transmission for NB-IoT	Samsung
R1-1717724	Early data transmission in RACH for NB-IoT	Huawei, HiSilicon
R1-1717871	Early data transmission for feNB-IoT	Intel Corporation
R1-1718143	Physical layer aspects of data transmission during random access procedure	Qualcomm Incorporated

[R1-1719014](#) Way Forward on early data transmission in NB-IoT Huawei, HiSilicon (Revision of [R1-1718950](#))

Agreements:

- From RAN1 point of view, it is feasible to support early UL data transmission in Msg3 from an NB-IoT UE using some TBS value(s) from the TBS range specified for NB-IoT in Rel-13 with a maximum total TBS of 1000 bits.
 - FFS if and how there will also be a larger supported maximum total TBS
 - The detailed value(s) should consider the payload size of early data packets from RAN2.

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- From RAN1 perspective, the physical layer design will assume eNB is not required to always provide a grant of a larger TBS for Msg3 and can decide to just provide a grant for 88 bits instead
- Send LS to RAN2 informing the above (Xiaolei, HiSilicon, [R1-1719100](#)) (including eMTC agreements)

[R1-1719100](#) [Draft] LS on agreements on early data transmission during random access procedure for NB-IoT and BL/CE UEs in Rel-15 HiSilicon [TSG RAN WG1]

Decision: LS is [approved in \[R1-1719100\]\(#\)](#), with the following changes

In Rel-13/14, the TBS for Msg3 is:

- 88 bits for NB-IoT UEs
- Maximum 712 bits for BL/CE UEs in CE mode A
- Maximum 328 bits for BL/CE UEs in CE mode B

In RAN1#90bis, the following were agreed in RAN1 regarding data transmission during the random access procedure for NB-IoT:

- From RAN1 point of view, it is feasible to support early UL data transmission in Msg3 from an NB-IoT UE using some TBS value(s) from the TBS range specified for NB-IoT in Rel-13 with a maximum total TBS of 1000 bits.
 - FFS if and how there will also be a larger supported maximum total TBS
 - The detailed value(s) should consider the payload size of early data packets from RAN2.
- From RAN1 perspective, the physical layer design will assume eNB is not required to always provide a grant of a larger TBS for Msg3 and can decide to just provide a grant for 88 bits instead.

Note that for Msg3 for Rel-13 Cat. NB-I UEs, the maximum total TBS is 88 bits.

RAN1 also agreed the following **agreements** for early data transmission during the random access procedure for BL/CE UEs:

- From RAN1 point of view, it is feasible to support early UL data transmission in Msg3 from a BL/CE UE using some TBS value(s) from the TBS range specified for BL/CE UEs in Rel-13 with a maximum total TBS of 1000 bits.
 - ~~Note: For Msg3 for Rel-13 BL/CE UEs, the maximum total TBS is 712 bits in CE mode A and 328 bits in CE mode B.~~
 - FFS if and how there will also be a larger supported maximum total TBS (than 1000 bits)
 - The detailed value(s) should consider the payload size of early data packets from RAN2.
- From RAN1 perspective, the physical layer design will assume eNB is not required to always provide a grant of a larger TBS for Msg3 and can decide to just provide a grant corresponding to Rel-13 Msg3 TBS instead.

6.2.6.2 Reduced system acquisition time

Where solutions are specified, draft CRs to be provided to RAN#78

[R1-1718134](#) Physical layer aspects of early data transmission Qualcomm Incorporated

6.2.6.2.1 Cell search

[R1-1716980](#) Reduction of NB-IoT synchronization time Huawei, HiSilicon
[R1-1717019](#) On NB-IoT Cell Search Improvement for System Acquisition Time Reduction Ericsson
[R1-1717200](#) Consideration on cell search enhancement for NB-IoT ZTE, SaneChips
[R1-1717230](#) Reducing cell search time for feNB-IoT Nokia, Nokia Shanghai Bell
[R1-1717277](#) Cell search latency enhancement LG Electronics
[R1-1718144](#) Enhancements to cell search Qualcomm Incorporated

6.2.6.2.2 System Information

[R1-1716987](#) Reduction of NB-IoT System Information acquisition time Huawei, HiSilicon
[R1-1717020](#) On MIB-NB and SIB1-NB acquisition time reduction Ericsson
[R1-1717201](#) Improving system information acquisition performance for NB-IoT ZTE, SaneChips
[R1-1717231](#) Reducing system acquisition time for feNB-IoT Nokia, Nokia Shanghai Bell
[R1-1717278](#) System information acquisition latency enhancement LG Electronics
[R1-1717346](#) System information acquisition time reduction for feNB-IoT Intel Corporation
[R1-1718145](#) Enhancements to system information acquisition Qualcomm Incorporated

[R1-1718952](#) WF on System information acquisition improvement LG, Huawei

Also supported by: HiSilicon, Neul

Agreements

- SIB1-NB can be additionally transmitted in subframe(s) other than Rel.13 existing SIB1-NB transmission subframes on the anchor-carrier.
 - Additional SIB1-NBs are transmitted on subframe #3
 - The periodicity of additional SIB1-NB transmissions is 20 ms and in the same radio frame as legacy transmission
 - FFS the supported number(s) of additional transmissions of SIB1-NB

- There is no signalling of the number of additional SIB1-NB transmissions
- The TBS, coding, and modulation of additional SIB1-NB repetitions are the same as the existing ones for Rel.13 SIB1-NB
 - FFS scrambling
- FFS: The sequence of coded bits-to-subframe allocation of additional SIB1-NB transmission can be interleaved compared to the existing SIB1-NB transmission
- When additional SIB1-NBs are transmitted, the subframe(s) carrying additional SIB1-NB(s) can be declared as invalid downlink subframe by downlinkBitmap
 - Rel.15 UEs interpret invalid downlink subframes whose indices are corresponding to additional SIB1-NBs transmissions but not carrying additional SIB1-NB (and NSSS) as valid downlink subframes
- Additional SIB1-NB transmission can be configured by eNB, and the presence of additional SIB1-NB can be indicated by one of unused bits in MIB-NB
- FFS if additional SIB1-NB transmissions are also supported on non-anchor carriers

6.2.6.3 TDD

[R1-1718149](#) Coexistence with NR Qualcomm Incorporated

6.2.6.3.1 Downlink aspects

E.g. DL frame structure, NPSS/NSSS/NPBCH, etc.

[R1-1716982](#) On downlink TDD NB-IoT Huawei, HiSilicon
[R1-1717021](#) On the DL of NB-IoT TDD Ericsson
[R1-1717202](#) Detailed design on downlink aspects to support TDD NB-IoT ZTE, SaneChips
[R1-1717232](#) Downlink aspects of TDD support in NB-IoT Nokia, Nokia Shanghai Bell
[R1-1717280](#) Discussion on DL aspects in TDD NB-IoT LG Electronics
[R1-1717347](#) Design of synchronization signals and system information for TDD support in feNB-IoT Intel Corporation
[R1-1717440](#) Views on TDD downlink aspect for R.15 NB-IoT Lenovo, Motorola Mobility
[R1-1717570](#) Discussion on DL common channel/signal for TDD NB-IoT Samsung
[R1-1718146](#) Downlink aspects of TDD Qualcomm Incorporated
[R1-1718172](#) Views on downlink aspects to support NB-IoT TDD NTT DOCOMO, INC.

Late submission

[R1-1718900](#) WF on system information transmission for TDD NB-IoT ZTE, SaneChips

Agreement:

- TDD UL:DL configuration 0 is not supported in TDD NB-IoT in Rel-15

Working assumption:

- TDD UL:DL configuration 6 is not supported in TDD NB-IoT in Rel-15

Agreements:

- MIB-NB is transmitted on the same NB-IoT carrier as NPSS/NSSS.
- The single NB-IoT carrier for all the other SIBs than SIB1-NB, when not the anchor carrier, is:
 - In a PRB indicated by SIB1-NB with exact signaling design left to RAN2 including whether to signal anything in case these other SIBs are on the anchor carrier

Agreements:

- It is supported that SIB1-NB is transmitted only on the anchor carrier
 - In at least subframe #0 in odd frames
- It is supported that SIB1-NB can be transmitted on non-anchor carrier, FFS details
 - It is necessary to consider SFN wraparound as part of FFS
- Periodicity of SIB1-NB in TDD is the same as FDD (i.e. 2560ms)
- One transport block of SIB1-NB is transmitted over 8 SIB1-NB subframes (i.e. same as FDD)

[R1-1718973](#) Summary on NPSS, NSSS and NPBCH transmission in TDD NB-IoT Huawei, HiSilicon

Agreements:

- For NPSS, NSSS and NPBCH transmission in TDD:
 - NPSS is transmitted on subframe #5 in every radio frame
 - NSSS is transmitted on subframe #0 in every even-numbered radio frame
 - NPBCH is in subframe 9 in every radio frame on the same carrier as NPSS/NSSS.

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[R1-1718974](#) Way Forward on NPSS and NSSS signal design in TDD NB-IoT Huawei, HiSilicon, Qualcomm, Ericsson, Intel, Samsung, IITH, CEWiT, IITM, Tejas Networks, Reliance Jio, Sharp, Lenovo and Motorola Mobility
Also supported by ZTE, SaneChips.

Agreements:

- Confirm the working assumptions from RAN1#90, i.e. NPSS uses the lower 11 subcarriers in one subframe and the same cover code for TDD as FDD.
 - The NPSS and NSSS sequences for TDD are the same as FDD.
 - TDD and FDD NB-IoT are distinguished by the relative location of NPSS and NSSS.

Working assumption to be automatically confirmed if RAN4 reply LS to [R1-1715304](#) does not raise a problem:

- TDD NB-IoT will support all LTE special subframe configurations

6.2.6.3.2 Uplink aspects

E.g. UL frame structure, NPRACH, NPUSCH, etc.

[R1-1717022](#) On the UL of NB-IoT TDD Ericsson
[R1-1717712](#) NPRACH design aspects for the support of TDD NB-IoT CEWiT
[R1-1716983](#) On uplink TDD NB-IoT Huawei, HiSilicon
[R1-1717233](#) Uplink aspects of TDD support in NB-IoT Nokia, Nokia Shanghai Bell
[R1-1717348](#) Discussion on the UL aspects for TDD support in feNB-IoT Intel Corporation
[R1-1717203](#) Detailed design on uplink aspects to support TDD NB-IoT ZTE, SaneChips
[R1-1717216](#) Discussion on NB-IoT TDD-UL Sharp
[R1-1717281](#) Discussion on UL aspects in TDD NB-IoT LG Electronics
[R1-1717571](#) Discussion on UL channel for TDD NB-IoT Samsung
[R1-1717987](#) NPRACH design for NB-IoT TDD IITH
[R1-1718147](#) Uplink aspects of TDD Qualcomm Incorporated
[R1-1719095](#) Way Forward on NPUSCH for NB-IoT TDD Ericsson, LGE

Agreements:

- NPUSCH transmissions with 15 kHz subcarrier spacing are supported in all supported UL/DL configurations for NB-IoT TDD.
- 3.75 kHz is also supported, in UL/DL configurations #1, [#3], #4, with the same definition of NB-slot and resource unit as FDD
- FFS if there any need for any other subcarrier spacing and/or slot structure for TDD
 - This needs to take into consideration the co-existence of NPRACH and NPUSCH.

[R1-1719096](#) WF on TDD NPRACH ZTE, Sanechips, Ericsson

Agreements:

- TDD NPRACH supports at least 3.75KHz subcarrier spacing single-tone with frequency hopping.
 - FFS if also 5 kHz subcarrier spacing is supported e.g. for UL-DL configuration #2
- NPRACH formats using G symbol groups with back-to-back transmission followed by a guard time (FFS guard time duration) are supported for 1, 2, and 3 contiguous uplink subframes
 - An NPRACH format is associated with one value of N (the number of symbols per symbol group) and CP duration
 - G is FFS, and $G \geq 2$
- P (number of symbol groups in a preamble) is even.
 - For the G symbols groups that are transmitted back-to-back with 3.75 kHz subcarrier spacing, 3.75 kHz and 22.5 kHz hopping distances are supported.
 - FFS the details of the hopping pattern
 - FFS the hopping distance and pattern if 5 kHz subcarrier spacing is supported
 - For the hopping between discontinuous transmissions within one preamble
 - FFS hopping distance and hopping pattern
- Cell specific pseudo-random hopping is used between NPRACH preamble repetitions
 - FFS details

6.2.6.3.3 Common aspects

E.g. Relaxations of MCL, latency, capacity targets; UL:DL configurations, special subframe, HARQ, etc.

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R1-1717988	Views on common aspects IITH	
R1-1717204	Detailed design on common aspects to support TDD NB-IoT	ZTE, SaneChips
R1-1717234	Common Aspects of NB-IoT TDD Operation	Nokia, Nokia Shanghai Bell
R1-1717349	Overall design for TDD support in feNB-IoT	Intel Corporation
R1-1717023	On the other aspects of TDD for NB-IoT	Ericsson
R1-1716981	Common aspects for TDD NB-IoT	Huawei, HiSilicon
R1-1717282	Discussion on common aspects in TDD NB-IoT	LG Electronics
R1-1717441	Views on common issue for TDD NB-IoT	Lenovo, Motorola Mobility
R1-1717572	Discussion on NB-IoT TDD configuration	Samsung
R1-1718148	General considerations on TDD design	Qualcomm Incorporated
R1-1719101	WF on TDD configurations	LG Electronics, Ericsson

6.2.6.4 Other

Contributions on other Part A objectives can be submitted here.

R1-1716974	Use cases and design for physical layer scheduling request	Huawei, HiSilicon
R1-1717012	Physical layer scheduling request for NB-IoT	Ericsson
R1-1717206	Detailed design on physical layer SR for NB-IoT	ZTE, SaneChips
R1-1717283	Discussion on Scheduling request in NB-IoT	LG Electronics
R1-1717573	Discussion on scheduling request for NB-IoT	Samsung
R1-1718151	Physical layer scheduling request	Qualcomm Incorporated
R1-1716975	On support of semi-persistent scheduling	Huawei, HiSilicon
R1-1717013	Semi-persistent scheduling for NB-IoT	Ericsson
R1-1717205	Physical layer aspects on SPS in NB-IoT	ZTE, SaneChips
R1-1718173	Views on SPS activation and deactivation mechanism	NTT DOCOMO, INC.
Late submission		
R1-1716976	Remaining details of NB-IoT measurements improvement	Huawei, HiSilicon
R1-1717015	Narrowband measurement accuracy improvements for NB-IoT	Ericsson
R1-1717284	RRM measurement enhancement in NB-IoT	LG Electronics
R1-1717764	Discussion on candidates for measurement improvement for NB-IoT	ZTE, SaneChips
R1-1718153	Improvement of PHY measurements	Qualcomm Incorporated
R1-1716977	NPRACH enhancement for cell radius extension	Huawei, HiSilicon
R1-1717017	NPRACH range enhancements for NB-IoT	Ericsson
R1-1717211	NPRACH range enhancement	ZTE, SaneChips
R1-1718154	NPRACH support for large cell access	Qualcomm Incorporated
R1-1716978	On NPRACH false alarm reduction due to inter-cell interference	Huawei, HiSilicon
R1-1717016	NPRACH false alarm reduction for NB-IoT	Ericsson
R1-1717212	NPRACH reliability enhancement for NB-IoT	ZTE, SaneChips
R1-1717285	Preamble structure for NPRACH enhancement	LG Electronics
R1-1717286	Resource configuration for NPRACH enhancement	LG Electronics
R1-1718155	NPRACH Reliability Enhancement	Qualcomm Incorporated
R1-1716979	On the support of NB-IoT small cell	Huawei, HiSilicon
R1-1717018	NB-IoT small cell support	Ericsson
R1-1718152	Support of small cells	Qualcomm Incorporated
R1-1718150	Modulation enhancements for NB-IoT	Qualcomm Incorporated

6.2.7 Enhanced Support for Aerial Vehicles - SID in RP-171050

[R1-1719128](#) **Chairman's notes of AI 6.2.7 Enhanced Support for Aerial Vehicles** Ad-Hoc chair (Ericsson)

The document was presented by Siva Muruganathan of Ericsson.

Decision: The document is endorsed, and content incorporated below.

6.2.7.1 Baseline Evaluation Results

Baseline performance evaluations for agreed simulation cases and scenarios; Evaluation results presented here for DL and UL.

R1-1717350	Baseline evaluation results for UMa AV	Intel Corporation
R1-1718019	Baseline evaluation results for LTE aeriels	ZTE, Sanechips

[R1-1718872](#) **WF on baseline results** Ericsson, Intel, Sequans

Agreement: Proposals on slides 4-10 of [R1-1718872](#) are agreed with the following changes.

- On Slide 4: Also list Source 2 results for 20% RU

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- On Slide 6: Add the following sentence to the conclusions:
- “The downlink throughput degradation for aerial UEs is more significant than the downlink throughput degradation for terrestrial UEs.”
- On Slide 8: Remove Source 4 from observation for 20% RU

[R1-1718904](#) WF on interference problem statement in the UL of aerial scenarios Huawei, HiSilicon, Ericsson, Sequans

Agreement: Capture the observations in Slides 3-4 of [R1-1718904](#) in TR36.777 with the following clarification:

- Fast fading model used by Source 3 is Alternative 2 from TR36.777.

[R1-1718795](#) Baseline evaluation results for UMa-AV Ericsson (Revision of [R1-1717852](#))
[R1-1718156](#) Baseline performance evaluations for UL and DL Qualcomm Incorporated
[R1-1718256](#) Baseline evaluation for drones Huawei, HiSilicon
[R1-1718295](#) Baseline Evaluation Results for Aerial Vehicles Sequans Communications

6.2.7.2 DL Interference Mitigation

On DL interference mitigation schemes and performance evaluations

[R1-1719047](#) WF on Interference mitigation for aerial vehicles Intel, Sequans, Nokia, Nokia Shanghai Bell

Agreement:

- The throughput performance of the following potential solutions for interference mitigation is further evaluated in RAN1#91
 - Directional Tx/Rx antenna pattern at the Aerial UE, considering the following assumptions on main lobe steering capabilities
 - Incapable of tracking the serving cell LOS direction
 - Capable of tracking the serving cell LOS direction
 - FFS: on feasibility of implementation of tracking the serving cell LOS direction

**[R1-1719050](#) WF on downlink interference mitigation Ericsson, LGE
[R1-1718913](#) WF on downlink interference mitigation Huawei, HiSilicon, Sequans Communications**

Agreement:

- Capture FD-MIMO results and observations from [R1-1719050](#) Slide 3 of [R1-1719050](#) in the TR

Conclusion:

- Further evaluate Rel-13 and Rel-14 coverage extension for aerial UEs in poor downlink SINR for common and control channels
 - Other coverage extension techniques for aerials are not precluded
 - The impact on throughput performance and latency are further analysed/evaluated in RAN1#91
 - FFS on whether power consumption needs to be considered
- The throughput performance and latency of the following network coordination schemes are further evaluated in RAN1 #91 meeting
 - Joint transmission for control, data, associated signals
 - Considering geographical separation of coordinating cells
 - Resource reservation
 - ABS, control/data muting
 - Other options and combinations are not precluded
 - FFS on whether power consumption needs to be considered

Note1: Optionally, the impact of handover and RLF may also be considered in the evaluation

Note 2: Companies are encouraged to provide detailed considerations on the resource usage and reference signal

Further offline discussion on evaluation methodology for coverage extension for aerial UEs – Xingqin (Ericsson)

Friday

[R1-1719030](#) WF on evaluation methodology of coverage extension Ericsson, NTT DOCOMO, Nokia, NSB, Huawei, HiSilicon, ZTE, Sanechips

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Agreement: For evaluation of coverage extension for aerial UEs, companies should state the interference margin used in the evaluation

[R1-1716965](#) Potential DL enhancements for drones Huawei, HiSilicon
[R1-1717351](#) On Interference Mitigation schemes for DL Intel Corporation
[R1-1717868](#) On DL Interference Mitigation Ericsson
[R1-1718157](#) DL interference mitigation schemes Qualcomm Incorporated
[R1-1718267](#) Height parameter and CRS collision for aerial vehicle Sony
[R1-1718296](#) Downlink Interference Mitigation for Aerial Vehicles Sequans Communications

6.2.7.3 UL Interference Mitigation

On UL interference mitigation schemes and performance evaluations

[R1-1719031](#) **WF on uplink interference mitigation** Ericsson, LGE

Agreement:

- Proposals on Slides 3 and 9 are agreed.
- Proposals on Slides 4-7 are agreed with the following changes on Slide 4:
 - FFS: whether solutions on Aerial UE specific P0 may have standard impact (e.g., identification and/or detection of Aerial UE),
 - For solution on Aerial specific P0, note on “This is a standard transparent scheme” is to be removed.
- More power control-based mechanisms for uplink interference mitigation are not precluded and can be further evaluated (i.e., throughput performance) in RAN1#91

[R1-1716966](#) Potential UL enhancements for drones Huawei, HiSilicon
[R1-1717287](#) Interference Mitigation for Aerial Vehicles LG Electronics
[R1-1717352](#) On Interference Mitigation schemes for UL Intel Corporation
[R1-1718796](#) On UL interference mitigation Ericsson (Revision of [R1-1717872](#))
[R1-1717895](#) Discussion on Interference Mitigation for Aerial Vehicles CMCC
[R1-1718020](#) Potential enhancements on UL interference mitigation ZTE, Sanechips
[R1-1718158](#) UL interference mitigation schemes Qualcomm Incorporated
[R1-1718174](#) Views on interference mitigation schemes for aeriels NTT DOCOMO, INC.
[R1-1718297](#) UL Interference Mitigation for Aerial Vehicles Sequans Communications

6.2.7.4 Interference Detection

On interference detection schemes and RSRP statistics for aerial vehicles

[R1-1716990](#) **Interference detection for aerial vehicles** Nokia, Nokia Shanghai Bell
Late submission
[R1-1718762](#) **Downlink interference detection for aerial vehicles** Nokia, Nokia Shanghai Bell
Revision of [R1-1716991](#)
[R1-1718175](#) **Views on interference detection schemes for aeriels** NTT DOCOMO, INC.

[R1-1718896](#) **WF on interference detection** NTT DOCOMO, Ericsson

Conclusion:

- RAN1 has discussed the followings for interference detection:
 - Measurement report with RSRP/CSI-RSRP of serving cell and neighbor cells for interference detection for both downlink and uplink
 - FFS: How many cells can be accurately measured
 - FFS: the case of different Rx and Tx antennas at the UE
 - Note: RAN1 performed simulations assuming ideal RSRP without considering measurement errors.
 - Necessary enhancement on measurement report is up to RAN2
 - interference detection based on SRS or any other uplink signal
 - Note: Simulation results are not provided to RAN1
 - ICIC (OI and HII)
 - Note: Simulation results are not provided to RAN1
 - Measurement reports with RSRQ/RSSI for interference detection

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- Other solutions are not precluded
- Note: further decision on which techniques are feasible requires RAN2 input.
- Note: Solutions above could be jointly used.

R1-1719109 **WF on observations for RSRP statistics in interference detection** **NTT DOCOMO Inc., Nokia, Nokia Shanghai Bell**

Agreement:

Proposals on Slides 2-8 in [R1-1719109](#) are agreed with the additional change and note below:
On slide 2: only RSRP statistics in Appendix are captured in TR, and the observations to be captured to be discussed further.
Note: Sources 1-4 do not use aligned assumptions for their RSRP statistics, and the results may be updated in RAN1#91 with aligned assumptions.

Draft LS to RAN2 on RSRP statistics – Shinpei (NTT DOCOMO)

Friday

R1-1719051 **Summary of RSRP statistics** **NTT DOCOMO**
R1-1719052 **[Draft] LS on RAN1 observation on RSRP statistics for aerial vehicles** **NTT DOCOMO**
Decision: The document is endorsed and final LS is **approved in R1-1719209**.

R1-1716964	Considerations on interference detection for drones	Huawei, HiSilicon	
R1-1717873	On interference detection schemes and RSRP statistics for aerial vehicles		Ericsson
R1-1718021	Simulation results for UL interference mitigation	ZTE, Sanechips	
R1-1718159	Interference detection schemes	Qualcomm Incorporated	
R1-1718298	Interference Detection of Aerial Vehicles	Sequans Communications	
R1-1718763	Uplink interference detection for aerial vehicles	Nokia, Nokia Shanghai Bell	
R1-1718905	WF on RSRP statistics for interference detection	Nokia, Nokia Shanghai Bell	

6.2.7.5 Evaluation Results on Reliability

Present evaluation results of latency for reliability taking into account RAN1 agreements from RAN1#90

R1-1717874 Reliability evaluation of LTE networks with low altitude aerial vehicles Ericsson

R1-1719032 WF on reliability performance of command and control traffic Ericsson, LGE

Agreement: Proposals on Slides 3 and 4 are agreed with the following changes:

- On Slide 3, capture additional note that the requirement on reliability is 99.9% which is achieved with 25 PRBs case for heights of 30m, 50m, 100m, and 300m.

6.2.7.6 Other

R1-1719110 **WF on measurement results** **Ericsson, Qualcomm**

Agreement: RAN1 related measurement results can be captured in the TR

Email Discussion on what type of field measurement results and how to capture in TR – Zhilan (Nokia, NSB)

Email Discussion on TP for Agreements from RAN1#90bis – Siva (Ericsson)

R1-1716967	Positioning for drones	Huawei, HiSilicon	
R1-1717288	Vertical Location for Aerial Vehicles	LG Electronics	
R1-1718797	Preliminary field measurement results on LTE connected aerials		Ericsson

Late submission

6.2.8 UE positioning accuracy enhancements for LTE - WID in [RP-171508](#)

R1-1719130 **Chairman's notes of AI 6.2.8 on UE positioning accuracy enhancements for LTE** **Ad-Hoc chair (Nokia)**

The document was presented by Timo Lunttila of Nokia.

Decision: The document is endorsed, and content incorporated below.

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[R1-1718160](#) Mitigating Movement of a UE during Positioning using IMUs Qualcomm Incorporated

Conclusion: "IMU positioning" has no RAN1 impacts.

[R1-1717771](#) On RAN1 finalization of the WI Ericsson India Private Limited
[R1-1716993](#) Discussion of UE Measurement to Support IMU Positioning Nokia, Nokia Shanghai Bell
[R1-1717118](#) Consideration on additional measurements for IMU positioning Huawei, HiSilicon

6.2.9 Ultra Reliable Low Latency Communication for LTE - WID in [RP-171489](#)

[R1-1719124](#) Chairman's notes of AI 6.2.9 Ultra Reliable Low Latency Communication for LTE Ad-Hoc chair (Ericsson)

The document was presented by Laetitia Falconetti of Ericsson.

Decision: The document is endorsed, and content incorporated below.

[R1-1717191](#) Work plan for Ultra Reliable Low Latency Communication for LTE Ericsson, Nokia, Nokia Shanghai Bell

6.2.9.1 Targeted reliability and latency requirements

Target requirements in terms of reliability and latency combinations for both wide and local area deployments

[R1-1717110](#) Overview of LTE URLLC Huawei, HiSilicon
[R1-1717190](#) On URLLC for LTE target setting Nokia, Nokia Shanghai Bell
[R1-1717289](#) Discussion on reliability and latency requirements for LTE URLLC LG Electronics
[R1-1717451](#) Use cases and target requirements for URLLC Ericsson
[R1-1717574](#) Discussion on KPIs for LTE URLLC Samsung
[R1-1717710](#) Discussion on HURLC requirements and possible solutions ZTE, Sanechips
[R1-1718161](#) Targeted reliability and latency requirements Qualcomm Incorporated

Agreement: URLLC for LTE should target the requirement defined by ITU, i.e., 10⁻⁵ error probability in transmitting a layer 2 PDU of 32 bytes within 1 ms. Additional less stringent requirements can be considered.

Agreement: In addition to (10⁻⁵, 1ms, 32 bytes packet), URLLC for LTE should target the requirement of 10⁻⁴ error probability in transmitting a layer 2 PDU of 32 bytes within 10 ms.

Conclusion:

It is expected that UEs can have URLLC traffic only and can have both eMBB and URLLC traffic.

6.2.9.2 Evaluations scenarios

Including evaluations scenarios and metrics used to verify that the defined reliability and latency requirements are met

[R1-1717111](#) Evaluation assumption and preliminary results for LTE URLLC Huawei, HiSilicon
[R1-1717290](#) Consideration on evaluation assumptions for LTE URLLC LG Electronics
[R1-1717452](#) Evaluation scenarios for URLLC Ericsson
[R1-1717575](#) Discussion on evaluation scenarios for LTE URLLC Samsung
[R1-1717711](#) Evaluation scenarios and assumptions for HURLC ZTE, Sanechips
[R1-1718162](#) Evaluations scenarios Qualcomm Incorporated

Agreements: For LTE URLLC evaluation, reliability is used as metric. The reliability definition from NR in 3GPP TR 38.802 is reused.

- Definition: Reliability is defined as the success probability R of transmitting X bits within L seconds, which is the time it takes to deliver a small data packet from the radio protocol layer 2/3 SDU ingress point to the radio protocol layer 2/3 SDU egress point of the radio interface, at a certain channel quality Q (e.g., coverage-edge).
 - Spectral efficiency should be considered.
 - The latency bound L includes transmission latency, processing latency, retransmission latency and queuing/scheduling latency (including scheduling request and grant reception if any).
- Evaluation method:
 - Use Link level simulation based on ITU methodology (i.e. a step-wise approach)
 - The fulfilment of the reliability target is verified in link level simulations at a reference SINR, i.e. Q, resulting from system level simulations.

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- FFS:
 - The simulation assumptions to derive the reference SINR, i.e. Q
 - The reference SINR is calibrated among companies
 - Other link level simulation methodologies not focussing on the ITU requirement are not precluded.
 - FFS details
 - The error probability should be provided for a range of SNR

NOTE: The ITU evaluation methodology for reliability is defined in section 7.1.5 of “Guidelines for evaluation of radio interface technologies for IMT-2020” from ITU Radiocommunication Study Groups.

Email approval on the system level evaluation assumptions and methodology to compute the reference SINR, Q. The email approval discussion is kicked off at the latest one week before the deadline.

Deadline: 3rd November

Driver: Ericsson (Mårten)

Email discussion on the link level evaluation assumptions taking as basis the NR URLLC assumptions defined in TR38.802. The email discussion should also address the FFS related to other link level methodologies. The email discussion is kicked off at the latest two weeks before the deadline.

Deadline: 15th November

Driver: Huawei (Yubo)

Draft LS to RAN2 informing about the agreements made in this RAN1 meeting related to LTE URLLC. Source: Ericsson [RAN1] (Laetitia)

Friday

[R1-1719070](#) [DRAFT] LS on Ultra Reliable Low Latency Communication for LTE Ericsson

Decision: The document is endorsed and approved in [R1-1719210](#).

6.2.9.3 Other

[R1-1717112](#) Potential enhancements for LTE SR procedure Huawei, HiSilicon

[R1-1717453](#) Techniques for reliability Ericsson

[R1-1717454](#) Evaluation of latency in LTE Ericsson

[R1-1717455](#) Techniques for low latency Ericsson

7 NR - WID in [RP-172115](#)

Refer to RP-172108 for work plan.

RAN1 NR specs: Endorsement of the latest drafts

[R1-1718318](#) TS 38.211 v1.0.2 NR; Physical channels and modulation Ericsson

Decision: The draft TS is endorsed as v1.1.0 in [R1-1719105](#) as baseline for further updates.

[R1-1718782](#) TS 38.213 v1.0.2 NR; Physical layer procedures for control Samsung

Decision: The draft TS is endorsed as v1.1.0 in [R1-1719105](#) as baseline for further updates.

[R1-1718808](#) TS 38.214 v1.0.2 NR; Physical layer procedures for data Nokia

Decision: The draft TS is endorsed as v1.1.0 in [R1-1718811](#) as baseline for further updates.

TS 38.212 (endorsed over email reflector in [R1-1716928](#)) is endorsed as v1.1.0 in [R1-1719105](#) as baseline for further updates.

TS 38.215 (endorsed over email reflector in [R1-1716931](#)) is endorsed as v1.1.0 in [R1-1719105](#) as baseline for further updates.

No change regarding TS 38.201/TS 38.202.

RAN2 maintained TS 38.300

[R1-1718619](#) Draft RAN1 input to TS 38.300 Nokia, Nokia Shanghai Bell

Friday

[R1-1718828](#) Draft RAN1 input to TS 38.300 Nokia, Nokia Shanghai Bell

RAN1 NR specs: next steps

Spec editors to update each spec based on this meeting's agreements and working assumptions by 11/1, for further comments and updates by 11/10

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RRC parameters list

Email discussion/approval of RRC parameters prepared by 11/1, to be commented and updated by 11/10 – Daniel (Ericsson)

UE feature list

R1-1719200 **UE features list for NR** **NTT DOCOMO**

Companies are encouraged to provide comments to Kazuaki offline

eV2X evaluation methodology

Email discussion on eV2X evaluation methodology till next meeting – Hanbyul (LGE)

Email discussion (including whether or not to send)/approval on an LS to send to 5GAA (and others) regarding asking feedback of eV2X evaluation methodology till 10/27 – Hanbyul (LGE)

[R1-1718177](#) Work plan for Rel-15 NR WI NTT DOCOMO, INC.

7.1 Initial access and mobility

[R1-1718680](#) Open issues on RRC parameters for Initial access and mobility Ericsson

7.1.1 Remaining Details on Synchronization signal

Including wideband CC related aspects.

[R1-1718864](#) **Summary of 7.1.1 Remaining Details on Synchronization signal** Ericsson (Revision of [R1-1718788](#))

Decision: The document is noted.

Proposal to confirm the working assumption:

- For indication in RMSI:
 - Alt.1: Group-Bitmap(8 bits) + Bitmap in Group (8 bits)
 - A Group is defined as consecutive SS/PBCH blocks
 - Bitmap in Group can indicate which SS/PBCH block is actually transmitted within a Group, where each Group has the same pattern of SS/PBCH block transmission, and Group-Bitmap can indicate which Group is actually transmitted

Agreement:

- The following working assumption is confirmed:
 - For other channels, the UE assumes SS/PBCH block transmission according to the signalling in RMSI
 - FFS: Confirm for each channel
 - The signalling in RMSI is only for the associated SS/PBCH block

Agreements:

- The network can indicate a set of SS blocks to be measured within the SMTC measurement duration (connected mode only)
 - The indication is per frequency layer
 - The UE is not required to measure SS blocks not indicated as transmitted
 - If there is no indication, the default value is that all SS blocks within the SMTC measurement duration
 - The signaling method is applicable to both intra- and inter-frequency measurements
- For connected mode:
 - The signaling is via RRC and a full bitmap with length L
- For idle mode
 - No indication from gNB
 - Note: this means that all SS blocks within the SMTC measurement duration

Wednesday

[R1-1719016](#) **Summary of 7.1.1 Remaining Details on Synchronization signal** Ericsson

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[R1-1719020](#) WF on PBCH design Qualcomm Inc.
[R1-1718976](#) Way Forward on SSB Intel
[R1-1718989](#) Summary on Number of SS Entries Samsung

Continue discussion offline aiming to converge on whether or not to have PBCH bandwidth reduction, change of # of PSS sequences, etc. and if so, the details (also taking into account other potential impacts, e.g., DM-RS sequence generation, etc.)

Thursday
[R1-1719144](#) Summary of 7.1.1 Remaining Details on Synchronization signal Ericsson

Agreements:

- For both sub-6 and above-6, reduce the PBCH to X PRB per symbol and add Y PBCH PRBs to SSS symbol with no other redesign
 - Working assumption:
 - X=20
 - Y=2*(24-X)
 - Same mapping rule(frequency-first, time-second) for data and DMRS is applied
 - Working assumption: The same DMRS density in the PBCH PRB in the SSS symbols is assumed
 - For sub-6: Single SCS assumption with the exception of bands with LTE/NR DL coexistence and 5 MHz minimum bandwidth (band 5 and band 66)
 - For above-6: RAN1 assumes a single SCS per band. If dual SCS is deemed critically necessary by RAN4 for a band, the total number of hypothesis shall not be increased, or insignificantly increased compared to single SCS
 - After initial cell selection, the UE is expected to find a single SCS per frequency layer
 - (Working assumption) The EPRE offset between SSS RE and PBCH DM-RS RE is 0 dB
- Reply LS to RAN4 – Asbjorn (Ericsson) ([R1-1719162](#))

[R1-1719162](#) [Draft] Reply LS on NR minimum carrier bandwidth and SS block numerology Ericsson

Decision: The document is endorsed and final version approved in [R1-1719163](#).

[R1-1717030](#) Remaining details of Synchronization Signal Design ZTE, Sanechips
[R1-1717048](#) Remaining Details on NR SS Blocks Huawei, HiSilicon
[R1-1717353](#) Remaining Details of SS Blocks Intel Corporation
[R1-1717459](#) Remaining issues for SSB design vivo
[R1-1717576](#) Remaining details on synchronization signal Samsung
[R1-1717713](#) On remaining details of synchronization signal Fujitsu
[R1-1717740](#) Cell searching with multiple SS blocks in wideband CC Spreadtrum Communications
[R1-1717786](#) Multiple SS block transmissions in a wideband carrier ASUSTEK COMPUTER (SHANGHAI)
[R1-1717797](#) Actually transmitted SS block and SS blocks in wideband CATT
[R1-1717925](#) Remaining Details on SS/PBCH block transmission LG Electronics
[R1-1718058](#) Remaining details on SS block transmissions Guangdong OPPO Mobile Telecom
[R1-1718179](#) Discussion on remaining details on NR-SS NTT DOCOMO, INC.
[R1-1718328](#) Remaining issues on SS block MediaTek Inc.
[R1-1718378](#) NR minimum carrier bandwidth and SS block numerology AT&T
[R1-1718458](#) Optimization on the SSB Bitmap in Group indication in RMSI Xiaomi Technology
[R1-1718463](#) On remaining details of SS/PBCH block ITL
[R1-1718472](#) On Remaining Issues of Synchronization Signal InterDigital, Inc.
[R1-1718526](#) Remaining details on synchronization signal design Qualcomm Incorporated
[R1-1718611](#) Remaining details related to SS blocks Nokia, Nokia Shanghai Bell
[R1-1718663](#) Remaining details on SS Blocks Sony
[R1-1718710](#) Remaining Details on Synchronization signal Ericsson

7.1.2 Remaining Details on Broadcast signal/channel

7.1.2.1 Remaining details on NR-PBCH

[R1-1718789](#) Summary of 7.1.2.1 Remaining details on NR-PBCH Ericsson

Agreements:

- (working assumption) NR-PBCH has a payload size of 56 bits (including CRC)
- 10-bit SFN is carried by NR-PBCH
- (working assumption) 4-bit PRB grid offset is carried by NR-PBCH

Agreements:

- A single bit is used in NR-PBCH for indicating the numerology for RMSI, Msg.2/4 for initial access and broadcasted OSI

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- For sub-6GHz
 - 0: 15kHz
 - 1: 30kHz
- For >6GHz
 - 0: 60kHz
 - 1: 120kHz

Proposals:

- **Aim to conclude how to indicate half-frame indication this week**
 - One-bit half frame indication is part of PBCH payload
 - For 3GHz and below, half frame indication is further implicitly signaled as part of PBCH DMRS for max L=4
- Also to concluded DM-RS initialization for PBCH

Wednesday

- Alt.1: One-bit half frame indication is part of PBCH payload
 - For 3GHz and below, half frame indication is further implicitly signaled as part of PBCH DMRS for max L=4
 - Supported by LGE, Huawei, HiSilicon, NTT DOCOMO, ZTE, Sanechips, ITL, Ericsson, InterDigital
 - Object Qualcomm, Samsung, Intel, MotoM, Lenovo, CATT
- Alt.2: One-bit half frame indication is part of PBCH payload
 - Supported by Qualcomm, Samsung, MotoM, Lenovo, CATT, Ericsson, MediaTek, vivo, Xiaomi, OPPO, Nokia, Nokia Shanghai Bell
 - Object LGE, NTT DOCOMO, ZTE, Sanechips, ITL, Intel
- Alt.3: One-bit half frame indication is part of PBCH payload, and when CSI-RS for measurement has a periodicity of 20ms or larger, the UE assumes the network is “synchronous” for the purpose of measurement
 - For 3GHz and below, half frame indication is further implicitly signaled as part of PBCH DMRS for max L=4
 - Supported by Intel, LGE, ZTE, Sanechips, ITL
 - Object Qualcomm, Samsung

Agreements:

- One-bit half frame indication is part of PBCH payload, and when CSI-RS for measurement has a periodicity of 20ms or larger, the UE assumes the network is “synchronous” for the purpose of measurement
 - For 3GHz and below, half frame indication is further implicitly signaled as part of PBCH DMRS for max L=4

Agreement:

- (working assumption) For PBCH 1st scrambling initialization, clarify that $C_{init} = N^{cell_ID}$

Proposal: For PBCH 2nd scrambling initialization, discuss further offline also considering potential impact CORESET for RMSI operation

Wednesday

PBCH 2nd scrambling initialization

- Alt.1: initialization based on cell ID only and is identical in SS/PBCH blocks
 - Supported by Huawei, HiSilicon, vivo, Qualcomm, Nokia, Nokia Shanghai Bell
 - Object MediaTek, LGE
- Alt. 2: initialization based on both cell ID and 3 LSB of SS/PBCH block index
 - Supported by ZTE, Sanechips, Samsung, Sequans, NTT DOCOMO, MediaTek, ITL, InterDigital, Ericsson
 - Object Huawei, HiSilicon

Agreement

- For PBCH 2nd scrambling initialization:
 - initialization based on both cell ID and 3 LSB of SS/PBCH block index

Proposal: Continue offline discussion on DM-RS initialization for PBCH

Thursday

[R1-1719161](#) Summary of 7.1.2.1 Remaining details on NR-PBCH Ericsson

Agreements:

- The initialization for PBCH DMRS is:

$$c_{init} = 2^{11} \cdot (I_{SSB} + 1) \cdot (\lfloor N_{ID}/4 \rfloor + 1) + 2^6 \cdot (I_{SSB} + 1) + \text{mod}(N_{ID}, 4)$$

 - For max L=4, $f_{SSB} = I_{SSB} + 4HF$ where $HF=0$ in the first half frame of a radio frame and $HF=1$ in the second half frame of a radio frame
 - For max L=8, and max L=64 $f_{SSB} = I_{SSB}$

Agreements:

- The 2nd PBCH scrambling is a Gold sequence initialized by cell ID.
 - C_init = [NCell_ID]
 - The X LSB bits of SS block index are used to determine a sequential non-overlapping portion of the sequence.
 - Generate a Gold sequence of length (2^X)*M where M is the number of bits to be scrambled
 - Partition the generated sequence into 2^X non-overlapping portions
 - X LSB bits of SS block index uniquely identify indices of each of the non-overlapping portion of the sequence
 - X = 2 for max L=4, i.e., 1st and 2nd LSB bits of SS block index.
 - X = 3 for max L=8 or 64, i.e., 1st, 2nd and 3rd LSB bits of SS block index

(b2)	(b1)	(b0)	Seq index used for each PBCH
0	0	0	0 ~ M-1
0	0	1	M ~ 2M-1
0	1	0	2M ~ 3M-1
0	1	1	3M ~ 4M-1
1	0	0	4M ~ 5M-1
1	0	1	5M ~ 6M-1
1	1	0	6M ~ 7M-1
1	1	1	7M ~ 8M-1

R1-1717031	Remaining details of NR-PBCH Design	ZTE, Sanechips
R1-1717049	Remaining issues in PBCH	Huawei, HiSilicon
R1-1717218	On half-frame indication	NEC
R1-1717354	Remaining Details of NR PBCH	Intel Corporation
R1-1717460	Remaining aspects on NR-PBCH contents and payload	vivo
R1-1717577	Remaining details on NR-PBCH	Samsung
R1-1717714	On half-radio frame indication	Fujitsu
R1-1717728	Scrambling sequence design for PBCH	Sequans Communications
R1-1717798	Remaining details on NR-PBCH	CATT
R1-1717926	Remaining Details on PBCH design and contents	LG Electronics
R1-1718180	Discussion on remaining details on NR-PBCH and PBCH-DMRS	NTT DOCOMO, INC.
R1-1718329	Remaining details on PBCH-DMRS/data scrambling and PBCH contents	MediaTek Inc.
R1-1718464	On remaining details of NR-PBCH design	ITL
R1-1718473	On Remaining Issues for NR-PBCH	InterDigital, Inc.
R1-1718527	Remaining details on NR-PBCH	Qualcomm Incorporated
R1-1718612	Remaining details on NR-PBCH	Nokia, Nokia Shanghai Bell
R1-1718711	Remaining details on NR-PBCH	Ericsson

- 7.1.2.2 Remaining details on Remaining minimum system information
- [R1-1718772](#) Offline summary for AI 7.1.2.2 Remaining details on Remaining minimum system information
CATT

Agreements:

- UE minimum bandwidth in the context of confinement of RMSI and CORESET containing PDCCH scheduling RMSI is defined as the largest bandwidth that all UEs must support regardless of UE capability, which is at least no less than the SS/PBCH bandwidth.

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- Bandwidth for RMSI and CORESET containing PDCCH scheduling RMSI supports at least the same bandwidth as SS/PBCH (e.g., [24 PRBs]).
- Note: The UE minimum bandwidth will be finally determined by RAN4.
- LS to RAN4 – Ren Da (CATT) ([R1-1718915](#))

Wednesday:

[R1-1718915](#) [draft] LS on UE minimum bandwidth CATT

Decision: The document is endorsed and final LS is approved in [R1-1719033](#), with the following update:

- By updating the action to “RAN1 respectfully asks RAN4 whether RAN4 sees any issues with the above agreements, and if so, to provide guidance accordingly”.

Agreements:

- The initial active DL BWP is defined as frequency location and bandwidth of RMSI CORESET and numerology of RMSI.
 - PDSCH delivering RMSI are confined within the initial active DL BWP

Proposals:

- NR supports FDM transmission between SS/PBCH block and RMSI (CORESET/NR-PDSCH)
 - There is no latency requirement for UE to acquire RMSI if the combined bandwidth for SS/PBCH block and RMSI (CORESET/NR-PDSCH) exceeds the UE capability
- Discuss further considering the impact of indicating RMSI location, applicability of sync acquired from SS/PBCH to RMSI, etc.

Proposals:

- RAN1 makes the down-selection of one of the following alternatives:
 - Alt. 1: UE always assumes the DMRS of NR-PDCCH and NR-PDSCH for RMSI is QCLed with the corresponding SS/PBCH block
 - Alt. 2: UE assumes the DMRS of NR-PDCCH and NR-PDSCH for RMSI is QCLed with the corresponding SS/PBCH block unless indicated otherwise by the network. The indication (1 bit) is included in PBCH of the SS/PBCH block.

Wednesday:

[R1-1719033](#) Offline summary for AI 7.1.2.2 Remaining details on Remaining minimum system information
CATT

Proposals:

- NR supports FDM transmission between SS/PBCH block and RMSI (CORESET/NR-PDSCH), where the sync information acquired from SS/PBCH can be applied to RMSI
 - There is no latency requirement for UE to acquire RMSI if the combined bandwidth for SS/PBCH block and RMSI (CORESET/NR-PDSCH) exceeds the UE capability
- UE assumes the DMRS of NR-PDCCH transmitted in the CORESET for RMSI and the DMRS of NR-PDSCH for RMSI/broadcast OSI is QCLed with the corresponding (cell-defining) SS/PBCH block.
- FFS: the impact of indicating RMSI location, etc.

Thursday

[R1-1719145](#) Offline summary for AI 7.1.2.2 Remaining details on Remaining minimum system information
CATT

Agreements:

- UE assumes the DMRS of NR-PDCCH transmitted in the CORESET for RMSI and the DMRS of NR-PDSCH for RMSI/broadcast OSI is QCLed with the corresponding SS/PBCH block
 - FFS: On the details on the associations between SS blocks and monitoring windows (if introduced) for RMSI CORESETs/broadcast OSI.

Proposals:

- Within an RMSI TTI duration, there are x periodic monitoring window(s) associated with an SS/PBCH block. Each window has duration of y consecutive slot(s).
 - The values of x, y, and the monitoring window periodicity
 - {x, y} = [{1, 1}, {4, 1}, {8, 1}, {1, 2}]
 - FFS other values

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- FFS: whether it is allowed to configure the overlapping monitoring windows associated with different SS/PBCH blocks

Agreements:

- NR supports FDM transmission of QCLed SS/PBCH block and RMSI (CORESET/NR-PDSCH), when
 - there is no latency requirement for UE to acquire RMSI if the combined bandwidth for SS/PBCH block and RMSI (CORESET/NR-PDSCH) exceeds the UE capability, and
 - the number of RMSI CORESETs to monitor within a slot is 1, and
 - the number of slots of a CORESET corresponding to an SS/PBCH block is 1 within a monitoring window for RMSI CORESET (NR-PDCCH)
 - FFS: whether the number of slots of a CORESET corresponding to an SS/PBCH block can be larger than 1

Friday

R1-1719198 Offline summary for AI 7.1.2.2 Remaining details on Remaining Minimum System Information
CATT

Agreements:

- There is an RMSI PDCCH monitoring window associated with an SS/PBCH block, which recurs periodically.
 - Each window has duration of x consecutive slot(s).
 - FFS: x is e.g., 1/2/4
 - FFS: whether x is frequency band dependent
 - FFS: whether x is configured in PBCH.
 - The period, y, of the monitoring window can be the same as or different from the period of the SS/PBCH block burst set.
 - FFS: y is e.g., 10/20/40/80/160 ms
 - FFS: whether y is frequency band dependent
 - FFS: whether y is configured in PBCH
 - FFS: whether y is dependent on RMSI TTI
 - FFS: whether there is a dependency between the period of the monitoring window and the period of the SS/PBCH block burst set.
 - FFS: whether it is allowed to configure the overlapping monitoring windows associated with different SS/PBCH blocks
 - FFS: Monitoring window time offset
- From RAN1's perspective, the considered values of the RMSI TTI for down-selection are 80ms and 160ms.

Proposals:

- The maximum number of bits for CORESET and RMSI timing configuration in PBCH is 8 bits excluding the subcarrier spacing.
- (Working assumption) PBCH contents, except the SSB index, should be the same for all SS/PBCH blocks within an SSB burst set for the same center frequency
- CORESET and RMSI configuration should consider the following properties:
 - bandwidth (PRBs)
 - frequency position (frequency offset relative to SS/PBCH block)
 - A set of OFDM symbol indices in a slot corresponding to a CORESET
 - CORESET transmission periodicity
 - Note that this CORESET may also carry control scheduling other channels
 - RMSI timing configuration (including CORESET monitoring window periodicity)
- Email discussion/approval till 10/27 – Da Ren (CATT)

R1-1717032	Remaining details of RMSI	ZTE, Sanechips
R1-1717050	RMSI Delivery	Huawei, HiSilicon
R1-1717355	RMSI Contents and Delivery Mechanism	Intel Corporation
R1-1717461	Discussion on Remaining Minimum System Information	vivo
R1-1717578	Remaining details on remaining minimum system information delivery	Samsung
R1-1717799	Remaining details on RMSI	CATT
R1-1717862	Discussion on RMSI delivery	Lenovo, Motorola Mobility
R1-1717876	Discussion on common CORESET design	CMCC
R1-1717927	RMSI delivery and CORESET configuration	LG Electronics
R1-1718067	Discussion on the RMSI delivery	Guangdong OPPO Mobile Telecom
R1-1718181	Discussion on remaining details on RMSI delivery	NTT DOCOMO, INC.

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R1-1718330	Further discussion on RMSI transmission	MediaTek Inc.
R1-1718379	Remaining details of RMSI delivery	AT&T
R1-1718474	On Remaining Issues of Remaining Minimum System Information Delivery	InterDigital, Inc.
R1-1718528	Remaining system information delivery consideration	Qualcomm Incorporated
R1-1718613	On Remaining System Information Delivery	Nokia, Nokia Shanghai Bell
R1-1718664	Remaining details on remaining minimum system information	Sony
R1-1718712	Remaining details on Remaining minimum system information	Ericsson

7.1.2.3 Other system information delivery

[R1-1718792](#) Summary on A.I. 7.1.2.3: Remaining details on other system information delivery Samsung

Agreements:

- The following parameters for broadcast OSI CORESET are explicitly signaled in the corresponding RMSI.
 - SI window configuration, e.g., time offset, duration, and periodicity
- The following parameters for broadcast OSI CORESET are the same as those for the corresponding RMSI CORESET.
 - frequency location, bandwidth, and numerology
 - FFS: whether above parameters are identical for RMSI CORESETs configured by PBCH in all SS/PBCH blocks which defines a cell from UE perspective.
- FFS: other parameters

Agreement:

- For connected mode UEs, non-broadcast on-demand (i.e. dedicated) OSI transmission is up to gNB scheduling, i.e., no specific handling for non-broadcast on-demand (i.e. dedicated) OSI CORESET

R1-1717033	OSI Delivery	ZTE, Sanechips
R1-1717579	Remaining details on other system information delivery	Samsung
R1-1717800	OSI delivery	CATT
R1-1717863	Discussion on OSI delivery	Lenovo, Motorola Mobility
R1-1717928	Other system information delivery	LG Electronics
R1-1718068	Discussion on the on demand SI	Guangdong OPPO Mobile Telecom
R1-1718331	Further discussion on OSI delivery	MediaTek Inc.
R1-1718380	Remaining details of OSI delivery	AT&T
R1-1718475	On Other System Information Delivery	InterDigital, Inc.
R1-1718529	Other system information delivery consideration	Qualcomm Incorporated
R1-1718614	On Other System Information Delivery	Nokia, Nokia Shanghai Bell
R1-1718713	Other system information delivery	Ericsson

7.1.3 Paging design

[R1-1718771](#) Summary on Paging Huawei, HiSilicon

Agreements:

- At least Option 1 (*Paging scheduling DCI followed by Paging Message*) is supported
 - From RAN1 perspective, paging scheduling DCI and Paging Message are ~~sent at least~~^{always sent} in the same slot
 - From RAN1 perspective, NR supports LTE-like UE grouping where UE is specifically configured of its PO/slot. This is considered part of Option 1.
 - Details of UE grouping are up to RAN2
- LS to RAN2 to inform the above agreements – Teck (Huawei)

[R1-1718926](#) [Draft] LS on NR Paging Mechanisms Huawei

Discussion: Above agreement is ammended as shown.

Decision: The document is endorsed and final LS is **approved in R1-1719164** with the following update:

- Update the note to “Note that in RAN1#86bis, the following agreements were made:
 - NR supports at least same-slot and cross-slot scheduling for DL.”

Agreement: Paging Message numerology is the same as RMSI.

Proposals:

- At least some parameters for Paging scheduling CORESET are explicitly signaled

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- RAN1 understands this includes at least periodicity for the UE to monitor the paging scheduling CORESET
- Up to RAN2 to decide whether such information is in RMSI or OSI
- The following parameters for Paging scheduling CORESET are the same as those for the corresponding RMSI CORESET.
 - frequency location, bandwidth, and numerology
 - FFS: whether above parameters are identical for RMSI CORESETs configured by PBCH in all SS/PBCH blocks which defines a cell from UE perspective.
- FFS: other parameters

Thursday

Agreements:

- At least some parameters for Paging Occasions are explicitly signaled.
 - RAN1 understands this includes at least periodicity for the UE to monitor the paging scheduling DCI.
- Up to RAN2 to decide whether the above such information is in RMSI or OSI
- FFS: whether to support FDM of Paging Occasions and it's configuration

R1-1709037 Offline summary for AI 7.1.3 on Paging for NR Huawei, HiSilicon

Agreements:

- UE may assume QCL between SS Blocks, Paging DCIs and Paging Messages
 - FFS: The details on the associations between SS blocks and possible subsets of Paging DCI/Messages.

Agreements:

- NR supports both slot and non slot based PDSCH transmissions for Paging delivery
 - For the non-slot based transmission, 2, 4 and 7 OFDM-symbol duration for the Paging PDSCH is supported
- FFS: Support of non-slot for PDCCH for Paging delivery

[R1-1717034](#) Paging design ZTE, Sanechips
[R1-1717052](#) Finalization of NR Paging Huawei, HiSilicon
[R1-1717219](#) Discussion on NR paging NEC
[R1-1717356](#) NR Paging Design Intel Corporation
[R1-1717462](#) Remaining details on NR paging design vivo
[R1-1717580](#) Paging design Samsung
[R1-1717726](#) Reduced overhead paging design Sequans Communications
[R1-1717750](#) Paging consideration Spreadtrum Communications
[R1-1717772](#) Discussion on paging design for NR Panasonic
[R1-1717801](#) NR Paging Channel CATT
[R1-1717877](#) Discussion on NR paging design CMCC
[R1-1717929](#) Paging design in NR LG Electronics
[R1-1718059](#) On NR paging design and transmission Guangdong OPPO Mobile Telecom
[R1-1718182](#) Discussion on NR paging design NTT DOCOMO, INC.
[R1-1718332](#) Further discussion on paging design MediaTek Inc.
[R1-1718358](#) NR paging based on paging indication InterDigital, Inc.
[R1-1718530](#) Paging design consideration Qualcomm Incorporated
[R1-1718615](#) Paging in NR Nokia, Nokia Shanghai Bell
[R1-1718695](#) NR paging design Motorola Mobility, Lenovo
[R1-1718714](#) Paging design Ericsson
[R1-1718758](#) Design Considerations for Paging in NR Convida Wireless LLC

7.1.4 Physical random access channel and random access procedure

[R1-1718261](#) Wrong naming of coupling loss IAESI, Thales, Fairspectrum, VTT

7.1.4.1 Remaining details on PRACH formats

[R1-1718770](#) Summary of AI 7.1.4.1, Remaining details on PRACH formats ZTE, Sanechips

Agreements:

- Confirm working assumption of cyclic shift values for preamble format 3
- Confirm working assumption, L = 139 is adopted as the sequence length for the RACH Preamble Formats using the short sequence

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Agreement: For FDD, RACH resources can be mapped onto UL slots irrespective of the time locations of SS/PBCH block

Wednesday

R1-1718932

Summary of AI 7.1.4.1, Remaining details on PRACH formats **ZTE, Sanechips**

Agreements:

- NR-RACH configurations can be specified using a table similar to LTE, this table is index by the *PRACH Config Index*
- Frequency multiplexed PRACH transmission occasions use the same *PRACH Config Index*
- NR strives to minimize the number of bits needed for the RACH configuration
 - Use 8-bits as the starting point
 - FFS: If SCS and formats are part of the table

Agreements:

- The slot duration for PRACH resource mapping for short preamble formats (i.e., L=139) is based on the RACH Msg1 numerology, i.e. SCS.
- The slot duration for PRACH resource mapping for long preamble formats (i.e., L=839) is based on 15kHz SCS

Agreements:

- The pattern given by the *PRACH Config Index* repeats every RACH Configuration Period
 - The density and duration within each configuration period are FFS
 - Including the possibility of in every slot
- RACH Configuration Period:
 - (**working assumption**) 10/20/40ms
 - FFS 80ms/160ms
 - FFS if the same values will be used for above and below 6GHz
- FFS the details in terms of how the pattern and configuration period are specified (e.g., via a table, via a formula, etc.)

Proposals:

- For TDD, NR supports the actual transmitted SS blocks (based on RMSI) for RACH resource configurations,
 - Use available symbols in a slot that contains SS blocks based on PRACH formats
 - Only the second half of a slot that contains SS blocks can be configured for RACH
 - FFS: Consider switching between DL/UL
 - FFS: If additional symbols in a slot that contain an SS blocks are not used for uplink transmissions.

Proposals:

- Down-select among the following three alternatives within this week:
 - Alt1: Support consecutive mapping of RACH resources within a slot
 - Alt2: Support non-consecutive mapping of RACH resources within a slot
 - Alt3: Support both consecutive and non-consecutive mapping of RACH resources within a slot

Thursday

R1-1719114

Summary of AI 7.1.4.1, Remaining details on PRACH formats **ZTE, Sanechips**

Agreements:

- One PRACH format is configured for a cell
 - FFS the impact BWP/SUL
 - For PRACH formats based on short sequence length
 - Format A and format B is considered as a package for the PRACH configuration, configures either format A/B or format C
 - If format A/B is configured, the last PRACH resource within a RACH slot uses the format B and other PRACH resources within the RACH slot uses format A
 - At least support only format B4 within a RACH slot, in the case of a single PRACH occasion within a RACH slot
 - FFS Support a PRACH format taken from A0/A1/A2/A3 within a RACH slot

Agreements:

- NR at least supports RACH configuration that have the same starting symbol in all RACH slots

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- Values of starting symbol: 0, 2
 - FFS other values

Agreements:

- For TDD, RACH configurations maps RACH resources onto slots irrespective of the time locations of actually transmitted SS/PBCH block
 - In the case that an actually transmitted SS/PBCH block overlap with a RACH resource within a RACH configuration period, define rules for which RACH resources that are still valid
 - FFS: the rules (no RRC signalling involved in defining the rules)
 - Also consider the DL/UL switching points
 - Also consider potential impact due to semi-static DL/UL configuration and/or dynamic SFI
 - Note: RAN1 strives to minimize the impact of the time location of the SS/PBCH block to the RACH configuration table design

Friday
R1-1719175 Summary of AI 7.1.4.1, Remaining details on PRACH formats ZTE, Sanechips

Agreements:

- RACH PRB allocation is the PRBs allocated to RACH within a RACH slot
- NR supports the following numbers of subcarriers as guard band:
 - Note: Generation of any additional guard band is up to gNB implementation

PRACH sequence length (L)	PRACH SCS (kHz)	UL SCS (kHz)	RACH PRB allocation size	Number of subcarriers as guard band
839	1.25	15	6	25
839	1.25	30	3	25
839	1.25	60	2	313
839	5	{15,30,60}	24,12,6	25
139	15	{15,30}	12, 6	5
139	15	60	3	5
139	30	{15,30,60}	24,12,6	5
139	60	{60,120}	12,6	5
139	120	{60, 120}	24,12	5

Email discussion/approval on UL initial BWP – Byoung-Hoon (LGE)

R1-1717035	PRACH formats and Resource Configuration	ZTE, Sanechips
R1-1717053	Capacity shortfall solution for agreed NR PRACH formats	Huawei, HiSilicon
R1-1717357	Remaining details of PRACH formats	Intel Corporation
R1-1717581	Remaining details on PRACH formats	Samsung
R1-1717802	Further details on NR RACH format	CATT
R1-1717878	Discussion on RACH configuration	CMCC
R1-1717930	Discussion on PRACH preamble format details	LG Electronics
R1-1718183	Discussion on remaining details on PRACH formats	NTT DOCOMO, INC.
R1-1718302	Remaining details on PRACH formats	Nokia, Nokia Shanghai Bell
R1-1718476	On PRACH Formats for Capacity Enhancement and Beam Management	InterDigital, Inc.
R1-1718531	Remaining details on PRACH formats	Qualcomm Incorporated
R1-1718715	Remaining details on PRACH formats	Ericsson

7.1.4.2 Remaining details on RACH procedure

R1-1718923	Summary of Remaining Details on RACH Procedure	Qualcomm Inc.
R1-1718937	Summary of Remaining Details on RACH Procedure	Qualcomm Inc.

Proposals:

- At least support one-to-one and many-to-one mapping between SS blocks and RACH transmission occasion
 - SS Block to RACH preamble index mapping in scenarios where many-to-one mapping between SS blocks and RACH transmission occasion is NOT supported
- FFS: One-to-many mapping between SS block and RACH transmission occasions

Proposal:

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- RACH burst set period is a time duration containing time instances for RACH transmission occasions after which the pattern of RACH transmission occasion associated to one SS block gets repeated.

Proposal:

- NR supports non-slot and slot based PDSCH/PUSCH transmission but only slot based PDCCH transmission during RACH procedure in Rel-15

Wednesday
[R1-1719025](#) Summary of Remaining Details on RACH Procedure Qualcomm Inc.

Agreements:

- Let X be the number of PRACH transmission occasions in the RACH configuration period which are associated (by the SSB to RACH resource association rule) with the actually transmitted SS blocks in the SS burst set period.
 - X can be greater than, equal to or smaller than the number of actually transmitted SS blocks in the SS burst set

Agreements:

- For contention-based random procedure, after the UE selects one PRACH transmission occasion for Msg1 transmission, the UE is not allowed to select another one before the expiration of RAR window for the same Msg 1 transmission in Rel-15

Agreements:

- NR supports both slot based PDCCH, PDSCH and PUSCH, and non-slot based PDSCH/PUSCH transmissions for Msg2/Msg3/Msg4 transmission
 - For the non-slot based transmission, 2, 4 and 7 OFDM-symbol durations for the PDSCH/PUSCH is supported
 - FFS the handling of PDCCH for non-slot based transmissions
 - FFS Time gap during RACH procedure applied to non-slot based transmissions
 - Note: Whether to support simultaneous uplink transmission of slot and non-slot based transmission from UE's perspective will be finalized in the control channel session

Agreements:

- Bit field length of RAPID is fixed in the spec.
- (**working assumption**) Bit field length of RAPID is 6 bits.
 - RAN1 is discussing if 8 bits should be considered for bit field length of RAPID
 - FFS the impact of SUL
 - FFS: How RACH occasion is conveyed to UE
- LS to send to RAN2 – Nazmul ([R1-1719036](#))

Friday
[R1-1719036](#) [draft] LS on response to RACH agreements CATT

Decision: The document is endorsed and **approved in [R1-1719036](#).**
MCC to correct sourcing to RAN1

Agreement: Maximum size of TA command for RAR is 12 (as a **working assumption**) bits.

Discuss further offline how to rely the LS regarding TA granularity – Nazmul (QC)

Thursday
[R1-1719160](#) Summary of Remaining Details on RACH Procedure Qualcomm Inc.

Agreements:

- Assuming N preamble indices are available in one RACH transmission occasion:
 - If only one SSB is mapped to only one RACH transmission occasion, each RACH transmission occasion has preamble index 0 to N-1
 - FFS other cases

Agreements:

- If many SSBs are mapped to one RACH transmission occasion, NR supports at least a mapping from different SSBs to non-overlapping subsets of RACH preamble indices within one RACH transmission occasion.
 - FFS: Mapping to overlapping subsets

Agreements:

- UE may assume that the DMRS of PDCCH and the DMRS of PDSCH conveying Msg2 are QCL'ed with the SS block that the UE selected for RACH association and transmission
- UE may assume that the DMRS of PDCCH conveying Msg3 retransmission grant is QCLed with the SS block that the UE selected for RACH association and transmission

Agreements:

- If there is no beam reporting in RACH message 3, UE may assume that the DMRS of PDCCH and the DMRS of PDSCH conveying Msg4 are QCL'ed with the SS block that the UE selected for RACH association and transmission
 - FFS: Whether to support beam reporting in Msg3
 - FFS: If and how beam reporting in RACH message 3 impacts message 4 Tx QCL assumption

Agreement: NR supports asynchronous adaptive HARQ retransmissions for RACH message 3.

Agreements:

- HARQ process ID for Msg3 PUSCH retransmission is fixed in the spec.
 - HARQ process ID for Msg3 PUSCH retransmission is fixed as 0 index.

Proposal: For the timing advance in RAR, its granularity of depends on tone spacing of Msg3.

Agreement: SCS of Msg1 of PDCCH triggered CFRA is same as the SCS of Msg1 of contention based random access

Proposals:

- Subcarrier spacing of Msg2 of PDCCH triggered CFRA is the same as the SCS of the PDCCH order.
- Samsung proposal: SCS of Msg2 of PDCCH ordered CFRA follows the SCS of the UE's active bandwidth part.

Friday
R1-1719197 Summary of Remaining Details on RACH Procedure Qualcomm Inc.

Agreements:

- NR supports gNB configuring the number of preambles for actually transmitted SS blocks.
 - FFS: Same value for all SS blocks or different value for different SS blocks
 - FFS: The range of the number of preambles – email discussion/approval till 11/27 – Nazmul (Qualcomm)

Agreements:

- For ZC type RACH preamble sequence, if only one SSB is mapped to only one RACH transmission occasion,
 - RACH preamble indices are in order of:
 - Increasing cyclic shifts of a root index and then
 - Increasing logical root index

Proposals:

- NR down-selects from following options:
 - Alt 1: Preamble indices for CBRA and CFRA for one SSB are mapped consecutively in one RACH transmission occasion.
 - Alt 2: Preamble indices for CBRA and CFRA for one SSB are not mapped consecutively in one RACH transmission occasion
- Email discussion/approval (at least target potential RRC impact related approval) till 10/27 – Nazmul (Qualcomm)

Agreements:

- NR supports RACH configuration in RMSI containing 1 bit to convey SCS of Msg3
 - In sub-6 GHz, subcarrier spacing of Msg3 can be either 15 or 30 kHz
 - In over-6 GHz, subcarrier spacing of Msg3 can be either 60 or 120 kHz

Working assumption:

- For the timing advance in RAR, its granularity depends on:
 - Subcarrier spacing of the first uplink transmission after RAR
 - Supported by: Ericsson, CATT, Mediatek, ZTE, Sanechips, Huawei, Hisilicon, Qualcomm, LGE, NTT DOCOMO

Table 3. Granularity of [12] bits TA command

Subcarrier Spacing (kHz) of the first uplink transmission after RAR	Unit
15	16*64 Ts
30	8*64 Ts
60	4*64 Ts
120	2*64 Ts

Note: $T_s = 1/(64 * 30.72 * 10^6)$ seconds.

R1-1719215 [Draft] LS reply to RAN4 on UE timing advance adjustment step size Huawei

Decision: For email approval till 10/20.

- [R1-1717036](#) Remaining details of RACH procedure ZTE, Sanechips
 - [R1-1717051](#) Remaining Issues in RACH Procedure Huawei, HiSilicon
 - [R1-1717358](#) NR RACH procedures Intel Corporation
 - [R1-1717582](#) Remaining details on PRACH procedure Samsung
 - [R1-1717715](#) Discussion on RA procedure Fujitsu
 - [R1-1717803](#) Further details on NR 4-step RA Procedure CATT
 - [R1-1717931](#) RACH Procedure LG Electronics
 - [R1-1718004](#) Remaining details on RACH procedure ETRI
 - [R1-1718052](#) Discussion on NR 4-Step Random Access Procedure Guangdong OPPO Mobile Telecom
 - [R1-1718184](#) Discussion on remaining details on RACH procedure NTT DOCOMO, INC.
 - [R1-1718303](#) Remaining details on PRACH procedure Nokia, Nokia Shanghai Bell
 - [R1-1718764](#) Numerology for Msg2 and Msg4 for RRC_CONNECTED UEs PANASONIC
- Revision of [R1-1718314](#)
- [R1-1718340](#) Remaining details on RACH procedure MediaTek Inc.
 - [R1-1718359](#) RACH configuration of Multiple Msg1 transmissions before the end of a monitored RAR window InterDigital, Inc.
 - [R1-1718381](#) Remaining details of RACH Procedure and RACH Configuration AT&T
 - [R1-1718532](#) PRACH procedure considerations Qualcomm Incorporated
 - [R1-1718665](#) Considerations on RACH Procedure Sony
 - [R1-1718696](#) Remaining details on random access procedure Motorola Mobility, Lenovo
 - [R1-1718716](#) Remaining details on RACH procedure Ericsson

7.1.5 Mobility procedure

7.1.5.1 Remaining details on measurement for mobility management

Including both SS block and CSI-RS related aspects

[R1-1718877](#) Monday Offline Summary and Remaining Issues for 7.1.5.1 Samsung

Agreement: Keep the terminologies as in TS38.215 for the following measurement quantities:

- SS-RSRP
- SS-RSRQ

Agreements:

- CSI reference signal received quality (CSI-RSRQ) is defined as the ratio $(N \times \text{CSI-RSRP}) / \text{CSI-RSSI}$, where N is the number of resource blocks in the CSI-RSSI measurement bandwidth. The measurements in the numerator and denominator are made over the same set of resource blocks.
 - FFS: Additional support of the following. The measurements in the numerator and denominator can be made over potentially different sets of resource blocks. In other words, the CSI-RSSI measurement BW can be differently configured from the CSI-RS measurement BW.

Agreements:

- Secondary synchronization signal reference signal received quality (SS-RSRQ) is defined as the ratio $N \times (\text{SS block RSRP}) / (\text{NR carrier RSSI})$, where N is the number of RB's of the NR carrier RSSI measurement bandwidth. The measurements in the numerator and denominator are made over the same set of resource blocks.

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- FFS The measurements in the numerator and denominator can be made over potentially different sets of resource blocks. In other words, the SS-RSSI measurement BW can be differently configured from the SS measurement BW.

Agreements:

- SS received signal strength indicator (SS-RSSI), comprises the linear average of the total received power (in [W]) observed in OFDM symbols of measurement time resource(s), in the measurement bandwidth, over N number of resource blocks from all sources, including co-channel serving and non-serving cells, adjacent channel interference, thermal noise etc.
 - Measurement time resource(s) are confined within SMTC window duration(s).

Agreement: The SMTC configuration provided for IDLE mode per frequency carrier corresponds to one of the two SMTC configurations for the CONNECTED mode for the same carrier frequency.

Agreements:

- At least single-port CSI-RS resources, following the same design already agreed for BM, can be configured to be used for L3 mobility
- CSI-RS for L3 mobility is separately configured from that for BM

Agreement: No consensus to support additional periodicity values for CSI-RS for L3 mobility

Wednesday

R1-1719017

Monday Offline Summary and Remaining Issues for 7.1.5.1

Samsung

Agreements:

- Default RSSI time-domain measurement resource is supported, where a pre-determined (i.e., fixed in the spec) set of OFDM symbols are used taking into account OFDM symbols associated with detected SSBs
 - FFS details
- A set of slots for RSSI time-domain measurement resource can be explicitly configured per frequency carrier by OSI for IDLE, by RRC for CONNECTED. A set of OFDM symbols in the configured slot are used taking into account OFDM symbols associated with detected SSBs.
 - This is supported at least for intra-frequency measurement for both IDLE and CONNECTED; and inter-frequency measurement for CONNECTED
 - FFS the applicability for IDLE mode inter-frequency measurement
 - FFS details

R1-1719019 [Draft] LS Reply on RSRP Measurements for Mobility in NR **Huawei, Ericsson**

Decision: The document is endorsed and final LS is **approved in R1-1719040** with the following updates:

- various UE measurements **capabilities**
- Appending the following sentence in the 2nd paragraph “**However, RAN1 has not concluded whether or not the Antenna Connector should be used as measurement reference points. In addition, RAN1 believes that the measurement reference points should be decided by RAN4.**”
- Update action to “**RAN1 would respectfully ask RAN4 to provide guidance with respect to the measurement reference points.**”

Thursday

R1-1719163

Thursday Offline Summary and Remaining Issues for 7.1.5.1

Samsung

Agreements:

- L3 mobility CSI-RS is based on the CSI-RS configuration framework for the BM
 - FFS the details, e.g., tailoring some or all the BM parameters (e.g., resource settings, resource sets, and resources; and corresponding parameters) for L3 mobility needs

Friday

R1-1719208

Friday Offline Summary and Remaining Issues for 7.1.5.1

Samsung

Agreements:

- CSI received Signal Strength Indicator (CSI-RSSI), comprises the linear average of the total received power (in [W]) observed only in OFDM symbols of measurement time resource(s), in the measurement bandwidth, over N number of resource blocks from all sources, including co-channel serving and non-serving cells, adjacent channel interference, thermal noise etc.

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- o Measurement time resource(s) for CSI-RSSI corresponds to OFDM symbols containing L3 mobility CSI-RS.

Agreement: IMR for SSS based RS-SINR shall be down-selected from the following alternatives:

- Alt 1: PBCH DMRS
- Alt 2: The RS used for RSRP measurement (i.e., SSS + potentially PBCH DMRS)
- No RRC impact is expected

Agreement: IMR for CSI-RS based RS-SINR for RRM shall be down-selected (if any) from the following alternatives:

- Alt 1: CSI-RS REs used for the RSRP measurement
- Alt 2: interference is measured on the same OFDM symbol for which corresponding CSI-RS is mapped
- No RRC impact is expected

[R1-1717037](#) Remaining details of RRM measurements ZTE, Sanechips

[R1-1717054](#) Remaining details on NR RRM measurement based on SS block and CSI-RS for L3 mobility Huawei,

HiSilicon

[R1-1717359](#) RRM Measurements for NR Intel Corporation

[R1-1717463](#) Views on remaining details of RRM measurements vivo

Withdrawn

[R1-1717583](#) Remaining issues on the NR mobility Samsung

[R1-1717741](#) Discussion on the association between the SMTC and the measurement object Spreadtrum Communications

[R1-1717804](#) Mobility Management based on SS block and CSI-RS measurements CATT

[R1-1717879](#) Discussion on RSSI measurement for RSRQ and interference measurement for RS-SINR CMCC

[R1-1717932](#) Remaining Details on L3 measurement and mobility management LG Electronics

[R1-1718060](#) Remaining details on NR RRM measurement Guangdong OPPO Mobile Telecom

[R1-1718185](#) Discussion on remaining details on measurement for mobility management NTT DOCOMO, INC.

[R1-1718320](#) Discussion on Measurement for Mobility Management MediaTek Inc.

[R1-1718382](#) Measurements for L3 mobility based on SS block and CSI-RS AT&T

[R1-1718533](#) Remaining details on measurement for mobility management Qualcomm Incorporated

[R1-1718616](#) Measurements for mobility management Nokia, Nokia Shanghai Bell

[R1-1718671](#) On RRM Measurements in wideband CC Sony

[R1-1718697](#) SS/PBCH block based measurement in wideband carrier Motorola Mobility, Lenovo

[R1-1718717](#) Remaining details on measurement for mobility management Ericsson

7.1.5.2 Radio link monitoring for mobility management

[R1-1718794](#) Summary of Discussion for NR Radio Link Monitoring Intel Corp.

Agreements:

- The IS/OOS threshold pair index to be used by a UE is explicitly indicated by RRC
 - o IS/OOS threshold pair index corresponds to a specific IS/OOS threshold pair (to be defined by RAN4)
 - o FFS on default IS/OOS threshold pair index

Agreements:

- At least single-port CSI-RS resources, following the same design already agreed for BM, can be used for RLM
 - o FFS configuration details, especially w.r.t. interaction with those configured for BM

Proposals:

- For RLM purpose, UE assumes QCL relationship between PDCCH transmitted in a CORESET and RS configured for the CORESET with respect to spatial, average gain, delay and Doppler parameter set

Proposals:

- At least two transmission/measurement bandwidths are defined for CSI-RS for RLM
 - o one equal to the minimum bandwidth of the carrier, and
 - o one additional larger bandwidth

Agreements:

- Discuss further offline on the maximum # of indicated CSI-RS resources & SS blocks to be used for RLM
- In case of SS/PBCH block based RLM, the RLM-RS resources are UE-specifically RRC configured, where among L SS Blocks for a given frequency band, each SS block to be used for RLM can be individually indicated

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- FFS signalling details (e.g., via bitmap, via SS block index)
 - Note: this depends on the max # of SS blocks for RLM

Wednesday
[R1-1718977](#) Summary of Discussion for NR Radio Link Monitoring Intel Corp.

Agreements:

- RLM-RS based on CSI-RS can be separately configured from CSI-RS for BM.
 - Framework for signaling CSI-RS for RLM would use the same signaling framework for signaling CSI-RS for BM.
 - FFS: additional updates of CSI-RS for RLM based on updates of CSI-RS in BM
 - Note: Network can choose to re-use of some or all of CSI-RS resources for BM for CSI-RS for RLM.

Agreements:

- NR supports configuration of at most X number of RLM-RS (CSI-RS and/or SSB) resources for a UE
 - final value of X to be determined in the next meeting and ($X \leq 8$)
 - Note: in the deployment scenario where BM is needed, the BM processing and reporting are a pre-requisite for the network to select up to X RLM-RSs.
 - FFS: whether to have different number for sub 6 and above 6 GHz

Thursday
[R1-1719048](#) Summary of Discussion for NR Radio Link Monitoring Intel Corp.

Proposals:

- Further discussion offline on how to interpret “Each RLM-RS resource should correspond to a single type of RLM-RS”
 - Alt 1) UE is only configured with a single type (between SSB or CSI-RS) of RLM-RS for all RLM-RSs
 - Supported by: Qualcomm, Samsung, Mediatek, ZTE, Vivo, OPPO, Intel
 - Alt 2) UE can be configured with any types of RLM-RS for each RLM-RSs
 - Periodicity of the RLM-RSs belong to two different RS types can have different values.
 - Maximum number of RLM-RSs regardless of RS type that can be configured for a UE is X (refer to agreement regarding maximum number of configurable RLM-RS).
 - Note: that only 1 IS/OOS report per RLM reporting period even if two types of RLM-RS is configured.
 - Supported by: Nokia, Ericsson, Huawei, HiSilicon, Panasonic, LGE

Friday
[R1-1719169](#) Summary of Discussion for NR Radio Link Monitoring Intel Corp.

Agreements:

- Rel-15 NR will not provide additional signaling (other than the configuration of RLM-RS(s) resource(s)) for the purpose of interference and noise (IN) measurement for RLM.
- Rel-15 NR will not provide configuration of additional resource(s) for the purpose of IN measurement for RLM.
- RAN1 continues discussions on which (existing) resource(s) can be and/or cannot be used for IN measurement for RLM.
 - Note that this does not necessarily mean the NR specification will specify UE behavior on use of resources for IN measurement for RLM.

Agreements:

- For guidance for RAN4 testing & requirement purposes:
 - UE may assume that configured RLM-RS and the “hypothetical” DMRS of the “hypothetical” PDCCH for RLM has QCL relationship with respect to spatial, average gain, delay and Doppler parameters.
- Draft LS in R1-1719216.

[R1-1719216](#) [DRAFT] LS on QCL assumption for RLM Reference Signal Intel

Decision: The document is endorsed and **approved in [R1-1719216](#).**

Email discussion/approval on potential RRC impact till 10/27 – Daewon (Intel)

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R1-1717038	RLM in NR	ZTE, Sanechips
R1-1717055	Remaining details on Radio link monitoring in NR	Huawei, HiSilicon
R1-1717360	Radio Link Monitoring for NR	Intel Corporation
R1-1717464	IMR configuration for Radio link monitoring in NR	vivo
R1-1717584	Radio link monitoring	Samsung
R1-1717742	Discussions on the IS and OOS counting procedure	Spreadtrum Communications
R1-1717805	NR Radio Link Monitoring	CATT
R1-1717933	Discussion on Radio Link Monitoring in NR	LG Electronics
R1-1718061	Remaining details on NR radio link monitoring	Guangdong OPPO Mobile Telecom
R1-1718186	Discussion on remaining details on radio link monitoring for mobility management	NTT DOCOMO, INC.
R1-1718321	Discussion on Radio Link Monitoring	MediaTek Inc.
R1-1718383	Radio link monitoring procedure and thresholds	AT&T
R1-1718534	Radio link monitoring consideration	Qualcomm Incorporated
R1-1718617	Radio Link Monitoring in NR	Nokia, Nokia Shanghai Bell
R1-1718718	Radio link monitoring for mobility management	Ericsson

7.1.6 Other

R1-1717056	On numerology determination during initial access	Huawei, HiSilicon
R1-1717057	On initial active bandwidth part	Huawei, HiSilicon
R1-1717465	SSB collision issues	vivo
R1-1717585	RAR contents	Samsung
R1-1717586	Discussion on RACH capacity enhancement	Samsung
R1-1717587	Discussion on MSG. 3 tx timing determination	Samsung
R1-1717588	Discussion on RACH configuration	Samsung
R1-1717589	Assisted information for MSG. 3 tx beam determination	Samsung
R1-1717590	RAR detection for contention-free random access	Samsung
R1-1718768	Discussion on additional RACH resource for contention free RACH	Samsung
Revision of R1-1717591		
R1-1717592	RRM for wider bandwidth operations	Samsung
R1-1717593	Remaining details on power control during RACH procedure	Samsung
R1-1717761	Additional synchronization provision	Ericsson
R1-1717901	Remaining issues on PRACH for SUL	Huawei, HiSilicon
R1-1717934	Discussion on PRACH preamble for capacity enhancement	LG Electronics
R1-1718618	On different deployments and SS SCS combinations	Nokia, Nokia Shanghai Bell
R1-1718719	Multiple Preamble transmissions	Ericsson
R1-1718720	Remaining details on NR-RACH capacity	Ericsson
R1-1718721	On intra-frequency measurement gaps	Ericsson

7.2 MIMO

[R1-1719118](#) **Chairman's notes of AI 7.2 NR MIMO** Ad-Hoc chair (Samsung)

The document was presented by Younsun Kim of Samsung.

Decision: The document is endorsed, and content incorporated below.

7.2.1 Multi-antenna scheme

Physical control channel related issues are to be discussed in the agenda item for scheduling/HARQ aspects.

[R1-1718681](#) Open issues on RRC parameters for Multi-antenna scheme Ericsson

[R1-1719042](#) NR UL MIMO Offline Session Notes Ericsson

7.2.1.1 Remaining details on codeword mapping

[R1-1718798](#) Summary of Open Issues on Layer Mapping Samsung

Agreement: No additional CW-layer correspondence is supported, at least in Rel-15, for >4 layers

Conclusion:

There is no consensus on supporting 2-CW layer mapping in addition to agreed 1-CW mapping, for 2, 3, and 4 layers for completion by December, 2017

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[R1-1718991](#) WF on RE mapping for DFT-SOFDM with intra-slot FH Samsung, Nokia, NSB, Ericsson, Intel Corporation, MediaTek, Interdigital, CATT, ITRI, ETRI, KT Corporation, Acorn Technologies, Panasonic, Bouygues Telecom

Working Assumption

- For DFT-SOFDM for single codeblock with intra-slot frequency hopping, only Option 1 is supported:
- The RE mapping is performed with the following order:
 - Frequency-first mapping followed by time and sub-slot: the modulated symbols are first mapped across sub-carriers, then across DFT-SOFDM symbols within a sub-slot, then across sub-slots (occupying different sets of PRBs)
- FFS: DFT-SOFDM for multiple codeblock with intra-slot frequency hopping

[R1-1719022](#) WF on RE mapping for DFT-s-OFDM with frequency hopping NTT DOCOMO, AT&T, ZTE, Sanechips, vivo, Sharp, Sony, NEC, Motorola, Lenovo, Softbank, Mitsubishi, Deutsche Telekom, China Telecom, Fujitsu, CHTTL

Possible Agreement:

For each of the following channels, c_{init} used for data scrambling will at least depend on UE specifically configured scrambling ID (scrambling ID is C-RNTI by default)

- PDSCH
- PUSCH

More offline discussion

Email discussion on the parameters for determination of c_{init} for data scrambling until Oct 27 – Mattias (Ericsson)

[R1-1718187](#) Remaining details on CW mapping NTT DOCOMO, INC.
[R1-1718384](#) Codeword to layer Mapping for DFTsOFDM with Frequency Hopping AT&T
[R1-1717361](#) Remaining details on CW to MIMO layer mapping Intel Corporation

[R1-1717295](#) Remaining details of codeword mapping in NR Huawei, HiSilicon
[R1-1717416](#) Remaining details of codeword mapping ZTE, Sanechips
[R1-1717466](#) On remaining details of codeword mapping vivo
[R1-1717594](#) Finalizing Layer Mapping Samsung
[R1-1717806](#) On codeword mapping CATT
[R1-1717865](#) Remaining details of codeword mapping for DFT-s-OFDM Lenovo, Motorola Mobility
[R1-1717935](#) Discussion on codeword mapping LG Electronics
[R1-1718335](#) Remaining details on codeword mapping MediaTek Inc.
[R1-1718424](#) Further details on CW mapping Ericsson
[R1-1718535](#) Remaining issues on CW to layer mapping Qualcomm Incorporated
[R1-1718666](#) Discussions on additional CW-to-Layer correspondences Sony

7.2.1.2 Codebook based transmission for UL

[R1-1718856](#) Summary of Issues and WFs on Codebook based transmission for UL Intel

[R1-1718897](#) WF on 4Tx UL codebook for DFTs-OFDM LG Electronics, CATT, Intel, Nokia, NSB

Agreement:

- At least for the case where single SRS resource is configured and for DFT-S-OFDM, support additional 4Tx rank 1 codebook below

Codebook index	Number of layers $\nu=1$							
16 – 23	$\frac{1}{2} \begin{bmatrix} 1 \\ 0 \\ 1 \\ 0 \end{bmatrix}$	$\frac{1}{2} \begin{bmatrix} 1 \\ 0 \\ -1 \\ 0 \end{bmatrix}$	$\frac{1}{2} \begin{bmatrix} 1 \\ 0 \\ j \\ 0 \end{bmatrix}$	$\frac{1}{2} \begin{bmatrix} 1 \\ 0 \\ -j \\ 0 \end{bmatrix}$	$\frac{1}{2} \begin{bmatrix} 0 \\ 1 \\ 0 \\ 1 \end{bmatrix}$	$\frac{1}{2} \begin{bmatrix} 0 \\ 1 \\ 0 \\ -1 \end{bmatrix}$	$\frac{1}{2} \begin{bmatrix} 0 \\ 1 \\ 0 \\ j \end{bmatrix}$	$\frac{1}{2} \begin{bmatrix} 0 \\ 1 \\ 0 \\ -j \end{bmatrix}$
24 – 27	$\frac{1}{2} \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \end{bmatrix}$	$\frac{1}{2} \begin{bmatrix} 0 \\ 1 \\ 0 \\ 0 \end{bmatrix}$	$\frac{1}{2} \begin{bmatrix} 0 \\ 0 \\ 1 \\ 0 \end{bmatrix}$	$\frac{1}{2} \begin{bmatrix} 0 \\ 0 \\ 0 \\ 1 \end{bmatrix}$	-	-	-	-

- Send an LS to RAN4 to inform that RAN1 has agreed to support the above UL codebook (codebook indices 16–27) for 4TX UEs and request feedback from RAN4 (ex: MPR) on feasibility – Peter (will comeback on Thursday)

Thursday

[R1-1718994](#) Draft LS on NR UL codebook for 4Tx Qualcomm

Decision: The document is endorsed and final LS is approved in [R1-1719044](#).

Agreements:

- For 4 Tx with wideband TPMI, use at least single stage DCI
 - FFS for 2 stage DCI
- For wideband TPMI, for NR 4 Tx codebook for CP-OFDM, downselect one of:
 - Alt 1: Rel-10 UL, possibly with additional entries:
 - Alt 2: Rel-15 DL, possibly with additional entries:
 - Alt 3: Rel-8 DL, possibly with additional entries
- Evaluate performance of candidate codebooks & decide by RAN1#91

Agreements:

- NR supports 3 levels of UE capability for UL MIMO transmission
 - Full coherence
 - All ports can be transmitted coherently
 - Partial coherence
 - Port pairs can be transmitted coherently
 - Non-coherence
 - No port pairs can be transmitted coherently
- TPMI codewords from the codebook are used by gNB accordingly

Proposal

For TPMI size,

- By RAN1#91, downselect to one alternative among:
 - Alt 1: Restrict codewords from 2 or 4 Tx codebooks, reducing TPMI bitwidth:
 - Alt 1.1 From RRC configuration, UE can be configured with a table that maps codepoints to codewords in a table
 - Alt 1.2 Restriction is determined according to UE coherence capability
 - Alt 2: Use same TPMI size for coherent, non-coherent, and partially coherent operation
 - Note: Alt 2 has no RRC impact
- The alternative selected in RAN1#91 should not have RRC impact

More offline discussion

[R1-1719152](#) WF on uplink Codebook Subset Restriction MediaTek, Intel, ZTE, Sanechips, AT&T, III, CHTTL, Lenovo, Motorola Mobility, OPPO, Huawei, HiSilicon, Samsung
Email discussion on TPMI size until Oct 27, Weidong (MediaTek)

Agreement:

- For 1 SRS resource
 - Full coherence
 - All ports corresponding to ports in an SRS resource can be transmitted coherently

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- Non-coherence
 - All ports corresponding to ports in an SRS resource are not transmitted coherently
- Partial coherence
 - Ports pairs corresponding to ports in an SRS resource can be transmitted coherently

Agreement:

- In RAN1#91, decision will be made whether, in addition to codebook based transmission using one SRS resource, codebook based transmission using multiple SRS resource including non-coherent inter-SRS resource transmission is supported
 - Non-coherent inter-SRS resource transmission:
 - FFS: use of two DCI, with one TPMI per DCI
 - One TPMI/TRI per SRS resource is signaled
 - Note: Indication of selection of multiple SRS resources was agreed

[R1-1718477](#) TPMI Indication for Frequency Selective UL Precoding InterDigital, Inc.
[R1-1717807](#) Further discussion on codebook based transmission for UL CATT
[R1-1718024](#) Remaining issues on UL codebook design Guangdong OPPO Mobile Telecom

[R1-1717362](#) Remaining issues on codebook based UL transmission Intel Corporation
[R1-1717417](#) Codebook based UL transmission ZTE, Sanechips
[R1-1717467](#) Discussion on codebook based UL transmission vivo
[R1-1717595](#) Codebook-Based UL Transmission Samsung
[R1-1717864](#) Discussion on Codebook based UL transmission Lenovo, Motorola Mobility
[R1-1717936](#) Discussion on codebook based transmission for UL LG Electronics
[R1-1718188](#) Codebook design for uplink NTT DOCOMO, INC.
[R1-1718237](#) Codebook based transmission for UL MIMO Huawei, HiSilicon
[R1-1718385](#) On UL MIMO with Codebook AT&T
[R1-1718425](#) Codebook Based UL MIMO Ericsson
[R1-1718507](#) UL Codebook Based Transmission and Codebook Design Nokia, Nokia Shanghai Bell
[R1-1718536](#) Codebook based UL transmission Qualcomm Incorporated
[R1-1718780](#) Codebook based transmission for UL MediaTek Inc.
[R1-1718962](#) WF on antenna group signaling MediaTek, Nokia, NSB, Intel
[R1-1718963](#) WF on SRS resource/port permutation MediaTek Inc.

7.2.1.3 Non-codebook based transmission for UL

[R1-1718871](#) Summary of issues on UL non-codebook based transmission Nokia, Nokia Shanghai Bell

Agreement:

- Only wideband SRI is supported in Rel-15 for non-codebook based UL transmission
 - The above does not preclude frequency selective precoding on SRS

[R1-1718917](#) WF on DL measurement RS indication for non-codebook based transmission for UL MIMO Huawei, HiSilicon, Intel, Nokia, NSB, Ericsson, DCM

[R1-1719166](#) WF on DL measurement RS indication for non-codebook based transmission for UL MIMO Huawei, HiSilicon, Intel, Nokia, Nokia Shanghai Bell, Ericsson, DOCOMO, MediaTek, CATT, LG Electronics, Spreadtrum, China Telecom, OPPO, Sharp, KT Corporation, Lenovo, Motorola Mobility, Samsung, Deutsche Telekom

Agreements:

- Support indicating DL measurement RS for UE to calculate UL candidate precoders for precoded AP-SRS resource via DCI
 - The DL measurement RS is a CSI-RS for CSI acquisition
 - Specify the following mechanism for DCI signalling:
 - Using the same field for AP-SRS resource triggering
 - Association between triggering state, triggered SRS resource(s) and the CSI-RS resource ID is higher layer configured
- Support indicating DL measurement RS for UE to calculate UL candidate precoders for precoded P/SP-SRS resource via higher layer signalling
 - The DL measurement RS is a CSI-RS for CSI acquisition
- AP-SRS(s) association with P(>1)-port AP-CSI-RS:

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- AP-CSI-RS can be transmitted in the same slot as the DCI containing AP-SRS trigger.
- The AP-SRS(s) is transmitted X symbols after AP-CSI-RS.
 - FFS: The scope of X and whether the AP-SRS and AP-CSI-RS can be in the same slot
- AP/SP/P-SRS(s) association with P(>1)-port P/SP-CSI-RS
 - Timing of UL precoder calculation based on the associated CSI-RS is up to UE implementation

[R1-1719185](#) WF on Multiple SRI & SRS Resource Transmission Ericsson, ZTE, Sanechips, Huawei, HiSilicon,
Intel, MediaTek, Samsung, CATT, Nokia, NSB
[Email discussion on SRS grouping until Oct 27, Mark \(Ericsson\)](#)

[R1-1717296](#) Non-codebook based transmission for UL MIMO Huawei, HiSilicon
[R1-1717753](#) PUSCH precoder determination for non-codebook-based UL MIMO transmission Spreadtrum
Communications
[R1-1717596](#) Discussion on Non-Codebook-Based UL Transmission Samsung
[R1-1717363](#) Remaining issues on non-codebook based UL transmission Intel Corporation
[R1-1717418](#) Non-Codebook based UL transmission ZTE, Sanechips
[R1-1717468](#) Discussion on non-codebook based UL transmission vivo
[R1-1717808](#) Further discussion on non-codebook based transmission for UL CATT
[R1-1717937](#) Discussion on non-codebook based transmission for UL LG Electronics
[R1-1718025](#) Further discussion on uplink non-codebook transmission Guangdong OPPO Mobile Telecom
[R1-1718189](#) Non-codebook based transmission for uplinkNTT DOCOMO, INC.
[R1-1718386](#) On Non Codebook based UL MIMO AT&T
[R1-1718426](#) Non-Codebook Based UL MIMO Ericsson
[R1-1718478](#) On Non-Codebook UL Transmission InterDigital, Inc.
[R1-1718508](#) Non-codebook based UL-MIMO transmission Nokia, Nokia Shanghai Bell
[R1-1718537](#) Non-codebook based UL transmission Qualcomm Incorporated

7.2.1.4 PRB bundling for DL

[R1-1718958](#) Summary of Issues on DL PRB Bundling vivo

Agreement: UE is configured with PRB bundling size(s) per BWP

Agreement: For broadcast PDSCH, multi-cast PDSCH, and unicast PDSCH before RRC configuration, PRB bundling size is 2

[R1-1719072](#) Summary of Offline Discussions on DL PRB Bundling vivo

Agreement: 1-bit DCI field for indication of PRB bundling size can be configured to be present by RRC

[R1-1719147](#) WF on usage of 1 bit DCI InterDigital, LGE, Samsung, Vivo, CATT, NTT Docomo, Qualcomm,
ZTE, Sanechips, Ericsson, IITH, IITM, CEWiT, Tejas Networks, Convida Wireless, Sharp, Mitsubishi, IITL, KRRI,
Huawei, HiSilicon, Panasonic, KT

Agreements:

- When 1-bit DCI field is present, the following configuration is supported
 - Candidate values: {2, 4, scheduled BW}
 - FFS: support 1 as an additional candidate value
 - The DCI bit field indicated “1”: select one value from one or two RRC configured candidate values
 - When two candidate values are configured, one value is implicitly determined
 - FFS details of implicit determination (e.g., scheduled BW, RBG-based, subband size, PDCCCH REG bundling size, BWP, DMRS pattern, etc.)
 - The DCI bit field indicated “0”: select one RRC configured candidate value
 - When a UE is configured with RBG=2, the UE is not expected to be configured with PRG=4

[R1-1717364](#) On PRB bundling for DL Intel Corporation
[R1-1718427](#) PRB bundling for DL Ericsson
[R1-1718509](#) On remaining issues on PRB bundling Nokia, Nokia Shanghai Bell
[R1-1717297](#) PRB bundling size for DL data precoding Huawei, HiSilicon
[R1-1717419](#) On PRB Bundling ZTE, Sanechips

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R1-1717469	Discussion on PRB bundling for DL	vivo
R1-1717597	PRB bundling for NR DMRS	Samsung
R1-1717809	PRB bundling for DL transmission	CATT
R1-1717938	Discussion on PRB bundling	LG Electronics
R1-1718479	Discussion on Dynamic PRG Size Indication	InterDigital, Inc.
R1-1718538	Discussion on PRB bundling for DL	Qualcomm Incorporated

7.2.1.5 Other

[R1-1718755](#) Summary of offline discussion on UL MIMO Open Issues Ericsson

Agreement:

- For non-codebook based UL transmission, a total of up to 4 SRS ports can be indicated by SRI(s) using one DCI field

Agreement:

- Confirm the following working assumption:
 - For non-codebook based precoding, each SRS resource contains one port

Agreement:

- For single SRS resource case with CP-OFDM with 2 ports
 - Use Alt 1 from RAN1#90: include TPMIs 4 & 5 for rank 1 and TPMI 2 for rank 2, except the scale factor is FFS

R1-1717298	Rate matching for data channels	Huawei, HiSilicon
R1-1717365	On antenna calibration signal	Intel Corporation
R1-1717420	Discussion on rate matching	ZTE, Sanechips
R1-1717421	On Transmission Setting	ZTE, Sanechips
R1-1717598	Discussion on DL/UL multi-TRP/-panel supports	Samsung
R1-1717599	Continuous precoding for NR DMRS in time domain	Samsung
R1-1717600	CSI Feedback Overhead Reduction for NCJT	Samsung
R1-1717601	Discussion on transmission parameter sets	Samsung
R1-1717602	Discussion on transition between NR network coordination schemes	Samsung
R1-1718026	Discussion on UL transmission mode design	Guangdong OPPO Mobile Telecom
R1-1718423	Differential Rank Indication for Multi-subband UL MIMO	Huawei, HiSilicon
R1-1718428	Scrambling for data channels	Ericsson
R1-1718429	Single Antenna and Antenna Selection UL Transmission	Ericsson
R1-1718430	Uplink Transmission on Non-homogeneous Arrays	Ericsson
R1-1718480	On PDSCH rate matching for NR	InterDigital, Inc.
R1-1718734	UL MIMO Signaling Details	Ericsson

7.2.2 CSI acquisition and beam management

[R1-1718682](#) Open issues on RRC parameters for CSI acquisition and beam management Ericsson

7.2.2.1 CSI measurement

[R1-1718910](#) Summary of CSI measurement ZTE, Sanechips

Agreement:

For ZP CSI-RS based IMR, following combinations of P/SP/AP CMR and IMR are supported

- For semi-persistent CSI reporting,

	PR CMR	SP CMR	AP CMR
PR IMR	YES	NO	NO
SP IMR	NO	YES	NO
AP IMR	NO	NO	NO

- For aperiodic CSI reporting,

	PR CMR	SP CMR	AP CMR
PR IMR	YES	NO	NO
SP IMR	NO	YES	NO

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AP IMR	NO	NO	YES
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Agreement:

- At least the following patterns are supported for ZP CSI-RS for IMR:
 - One pattern from (2,1), (2,2), (4,1)

R1-1719005 **Offline Summary of CSI measurement** ZTE, Sanechips

Agreement: Configuration of resources for rate matching is separate from configuration of resources for interference measurement.

Working Assumption:

- For ZP CSI-RS based IMR, support (2,2) and (4,1) which are configurable by RRC signalling
 - Note: Study until next meeting whether support of both (2,2) and (4,1) are both necessary. If not, RRC configurability will be removed.

R1-1719186 **WF on aperiodic CSI-RS triggering** ZTE, Sanechips, Samsung, LG Electronics, NTT DOCOMO, Qualcomm, Intel, ASTRI, Verizon, KDDI, IITH, CEWiT, IITM, Tejas Networks, CHITL, Sharp, NEC, MediaTek, KT Corporation, Nokia, NSB

Working Assumption:

- Aperiodic CSI-RS is triggered by RRC+DCI or RRC+MAC-CE+DCI
 - If number of RRC configured resource sets across all CCs is less than 2^N , RRC+DCI is used. Otherwise, RRC+MAC-CE+DCI is used.
 - FFS on the value of N
 - The triggering is done per CSI-RS resource set

Email discussion on the value of N for aperiodic CSI-RS is triggering until 27th of Oct – Ruyue (ZTE)

Agreement: For non-PMI feedback, support the following port index indication method:

- Port index indication is signaled to UE for RI/CQI calculation in non-PMI feedback
 - Port index indication per CSI-RS resource is configured by RRC to select the CSI-RS port(s) used for RI/CQI calculation per rank
 - Identity matrix is assumed by UE on the selected CSI-RS ports for RI/CQI calculation
 - N ports are selected for rank N
 - The CSI-RS resource can be dynamically selected for CSI reporting in CSI framework

R1-1719178 **WF on NZP CSI-RS based interference measurement** Huawei, HiSilicon, Qualcomm, Ericsson, IITH, Intel, Spreadtrum, OPPO, China Unicom, vivo, Interdigital, IITM, Deutsche Telekom, CeWiT, KDDI, NEC, Vodafone, CMCC, Sharp, Tejas Networks, ASUSTeK, Softbank, Sony, CATR, China Telecom, IIL, Mitsubishi, ZTE, Sanechips, CATT, Samsung

Agreement:

- A set of NZP CSI-RS resource(s) is configured to a UE for channel and interference measurements, where
 - A subset of the set of NZP CSI-RS resource(s) are for channel measurement and another subset of the set of NZP CSI-RS resource(s) are for interference measurement
 - Network indicates via DCI the subset of NZP CSI-RS resource(s) for channel measurement and the subset of CSI-RS resource(s) for interference measurement
 - FFS: Whether the DCI indication is the dynamic triggering of one or multiple CSI reporting setting(s) or not
 - FFS: some CSI-RS resource(s) from two NZP CSI-RS resource subsets can be overlapped or not
 - UE assumes each port of channel measurement NZP CSI-RS resource(s) corresponds to a desired layer if no PMI and RI feedback

R1-1718539 Details of CSI measurement Qualcomm Incorporated

R1-1717939 Discussion on CSI measurement LG Electronics

R1-1717422 Remaining details on CSI measurement ZTE, Sanechips

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R1-1717299	Channel and interference measurement for CSI acquisition	Huawei, HiSilicon
R1-1717366	Remaining issues on interference measurement for CSI	Intel Corporation
R1-1717470	Discussion on CSI measurement	vivo
R1-1717603	Discussions on CSI measurements	Samsung
R1-1717754	NZP CSI-RS for interference measurement	Spreadtrum Communications
R1-1717810	Remaining issues on reciprocity based operation	CATT
R1-1718053	Discussion on CSI Measurement	Guangdong OPPO Mobile Telecom
R1-1718190	Views on CSI measurement for NR	NTT DOCOMO, INC.
R1-1718387	Remaining details on CSI measurements for NR	AT&T
R1-1718431	On CSI measurement	Ericsson
R1-1718660	Considerations on interference measurement	Sony
R1-1718706	On the channel reciprocity support for CSI acquisition	Nokia, Nokia Shanghai Bell

7.2.2.2 CSI reporting

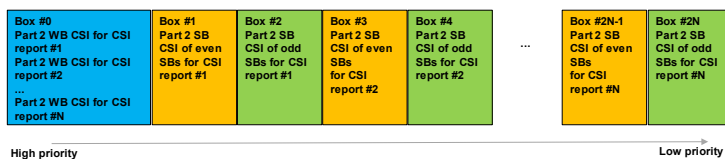
[R1-1718956](#) Summary of views on CSI reporting (agenda item 7.2.2.2) Ericsson

[R1-1718886](#) WF on omission rules for partial Part 2 reporting ZTE, Sanechips, Ericsson, MediaTek, Samsung, NTT DOCOMO, ASTRI, CATT
Also supported by Nokia, NSB

Agreement:

For NR CSI reporting on PUSCH, Part 2 information bits of partial subbands can be omitted.

- Support the following priority rule to omit partial Part 2, where the priority level goes from high to low from Box #0 to Box #2N, and the omission granularity is one box in the following picture
 - N is the number of CSI reports in one slot
 - The CSI report numbers correspond to the order in the CSI report configuration



- Down-select one of the following Alts for CQI calculation in RAN1#91
 - Alt 1: Subband CQI for each omitted subband is calculated assuming PMI in the nearest subband(s) with Part 2 reporting
 - Alt 2: Subband CQI for each omitted subband is calculated assuming PMI in this subband

[R1-1718955](#) WF for Subband Size for CSI Samsung, Ericsson, ZTE, Sanechips

Agreement:

- For a given bandwidth of the active bandwidth part, a UE can be configured with one out of two subband sizes via higher layer signaling
- The two possible values are described as follows

Carrier bandwidth part (PRBs)	Subband Size (PRBs)
24 – 60	[6], [12]
61 – 100	8, [16]
101 – 150	[10], [20]
151 – 200	12, [24]
201 – 275	16, [32]

[R1-1718869](#) WF on remaining details on Codebook Subset Restriction for Type I Single-Panel codebook Ericsson, Intel Corporation, Samsung, CATT, LG Electronics

Agreement:

- For Type I SP, rank 3-4 codebooks for 16, 24, and 32 ports
 - Use single bitfield to determine restricted $\tilde{v}_{l_2,m}$ depending on restricted $v_{l_1,m}$
 - $\tilde{v}_{l_2,m}$ is restricted if at least one of $v_{2l+1,m}$, $v_{2l-1,m}$, $v_{2l,m}$ is restricted

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- FFS: Introduction of inter-group co-phasing restriction

Agreement:

- The RI payload depends on the rank restriction signalling.
 - LTE approach for rank restriction using a bitmap of size-8, where bit $i \in 0, \dots, 7$ indicates if rank $r = i + 1$ is allowed to be reported

R1-1718870 **WF for remaining details on aperiodic CSI on PUCCH** **Ericsson**

Also supported by Nokia, NSB

Agreement:

- At most RI=2 is allowed to be reported for a CSI report setting configured with Type II codebook

Possible Agreement:

One Resource Setting used for P/SP/AP CSI can only contain one resource set

- Above applies only for CSI acquisition

More offline discussions

Emails discussion on resource setting for P/SP/AP CSI until Oct 27 – Sebastian (Ericsson)

Agreement: Support the following encoding for first part of Type II report

- Separate fields: Each field is encoded separately

Conclusion:

Continue discussion in RAN1#91 on the following:

- BWP for which CSI is reported is determined by the active BWP in the time location of the CSI reference resource

R1-1719142 **Offline session notes CSI reporting (AI 7.2.2.2)** **Ericsson**

Agreement:

- For A-CSI on short PUCCH with single CSI report, downselect from the following:
 - Alt 1:
 - The CSI report is triggered with CSI request field in DL-related DCI
 - UE-specific or UE-group-specific DCI is to be discussed in control channel session
 - PUCCH resource indicator field in DL-related DCI indicates the PUCCH resource for the triggered CSI report from a set of higher-layer configured PUCCH resources
 - Alt 2:
 - Use UE-specific UL-related DCI, CSI request field triggers a CSI report. It is indicated in the CSI Report Setting if PUCCH or PUSCH is used
 - Alt 3:
 - Use UE-specific UL-related DCI, indication on if PUCCH or PUSCH is used is determined by bit in DCI

Email discussion to down-select among the 3 alternatives for A-CSI on short PUCCH with single CSI report

- Until Oct 27 – Sebastian (Ericsson)

Agreement:

NR at least supports the following periodicities for P/SP CSI reporting

- {5, 10, 20, 40, 80, 160, 320} slots
- Details on restriction on periodicity as a function of subcarrier spacing is to be concluded in RAN1#91 (including whether or not to support)

Agreement:

- At least for when Type I CSI collides with Type I CSI and Type II CSI collides with Type II CSI
 - The following priority order for CSI periodicity types applies
 - Aperiodic CSI > P-CSI
 - Aperiodic CSI > SP-CSI
 - Note: Study further on the priority between SP-CSI and P-CSI
 - CSI on PUSCH has priority over CSI on PUCCH
 - Only one CSI periodicity type is piggybacked on PUSCH
 - Lower priority CSI is dropped when there is a collision

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- Aperiodic CSI on PUCCH is dropped if there is a collision with PUSCH
- TBD in RAN1#91 If the above applies for Type I CSI collides with Type II CSI as well

Agreement:

- Adopt the following refined subband sizes:

Carrier bandwidth part (PRBs)	Subband Size (PRBs): 1 st value, 2 nd value
24 – 60	4, [8]
61 – 100	8, [16]
101 – 200	[12], [24]
201 – 275	16, [32]

- The 2nd subband size values in brackets are to be confirmed or refined in RAN1#91

Email discussion on semi-persistent CSI on PUSCH

- Until Oct 27 – Sebastian (Ericsson)

R1-1717367	Remaining issues on CSI reporting Intel Corporation
R1-1718337	Remaining details for CSI reporting MediaTek Inc.
R1-1718432	On remaining details of CSI reporting Ericsson
R1-1717300	Details of CSI reporting on PUCCH/PUSCH Huawei, HiSilicon
R1-1717423	Remaining details on CSI reporting ZTE, Sanechips
R1-1717471	Discussion on CSI reporting vivo
R1-1717604	CSI Reporting and UCI Multiplexing Samsung
R1-1717811	Remaining issues on CSI reporting CATT
R1-1717940	Discussions on CSI reporting LG Electronics
R1-1718191	Remaining Issues on Feedback Design for CSI Type I and Type II NTT DOCOMO, INC.
R1-1718481	Remaining issues on CSI reporting InterDigital, Inc.
R1-1718510	Remaining details on CSI reporting for Type II and Type I codebook Nokia, Nokia Shanghai Bell
R1-1718540	On Type I and Type II CSI reporting Qualcomm Incorporated

7.2.2.3 Beam measurement and reporting

Including Beam Indication, UL beam management

[R1-1718920](#) Beam management offline discussion summary Qualcomm

Agreement: Support at least the explicit approach for the update of spatial QCL reference in a TCI state.

- FFS: Additional support for implicit update.
- Note: In the explicit approach, the TCI state is updated using either RRC or RRC + MAC-CE based approach
- Note: In the implicit approach, when a set of aperiodic CSI-RS resources are triggered, the triggering DCI includes a TCI state index which provides spatial QCL reference for the triggered set of CSI-RS resources. Following the measurement, the spatial QCL reference in the RS set corresponding to the indicated TCI state is updated based on the preferred CSI-RS determined by the UE. Other operations of implicit approaches are not precluded.

Agreement:

- NR adopts the SRS Tx beam indication, i.e., by a SRS resource or by a DL RS
 - The DL RS supported at least include CSI-RS and SSB.
- NR supports the indication of at least the spatial relations between the DL RS and the UL SRS Tx beam via at least the following mechanisms.

Spatial parameter	Reference RS	Target RS	Signalling mode
Spatial	SSB/CSI-RS (at least P-CSI-RS and SP - CSI-RS), P-SRS FFS: AP-CSI-RS, SP-SRS	P SRS	RRC
Spatial	SSB/CSI-RS(at least P-CSI-RS and SP - CSI-RS), P-SRS/ SP-SRS FFS:AP-SRS, AP-CSI-RS	SP-SRS	RRC + MAC-CE

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Spatial	SSB/CSI-RS (at least P-CSI-RS and SP-CSI-RS), P-SRS, SP-SRS, AP-SRS Working assumption: AP-CSI-RS	AP SRS	RRC or RRC+MAC CE for configuration, indication with DCI
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FFS: The use of spatial relation across CCs and/or BWPs.

R1-1719009 Way forward on beam reporting based on CSI-RS for BM with repetition ZTE, Sanechips, ASTRI, Ericsson, NTT DOCOMO

Agreement:

Working assumption from RAN1#90 is confirmed:

- For beam management CSI-RS, NR supports higher layer configuration of a set of single-symbol CSI-RS resources where
 - The set configuration contains an information element (IE) indicating whether repetition is “on/off”
- Note: In this context, repetition “on/off” means:
 - “On”: The UE may assume that the gNB maintains a fixed Tx beam
 - “Off”: The UE can not assume that the gNB maintains a fixed Tx beam
- Note: This does NOT necessarily mean that the CSI-RS resources in a set occupy adjacent symbols

Furthermore, the following details are agreed

- CSI-RS resources in the resource set are TDMed if repetition is ON
 - If repetition is ON, The UE does not expect different values for the following parameters across different CSI-RS resources within a resource set
 - Transmission periodicity
 - Number of antenna port subject to RAN4 decision
 - FFS for other parameters

Agreement:

NR supports the following configurations for beam management where a resource set is formed from multiple beam management CSI-RS resources and is contained within a resource setting:

- Single resource set with repetition = “OFF”
 - UE reports CSI-RS resource indicator(s) within this resource set for CRI feedback
- Single resource set with repetition = “ON”
 - UE does not report CRI
- FFS: Further support additional configuration by down selection from the following two alternatives:
 - (a) Multiple resource sets, all with repetition = “ON”
 - UE reports CSI-RS resource set indicator(s) for CRI feedback
 - FFS: Whether set ID(s) are local within a resource setting or global across all resource settings
 - (b) Multiple equal-size resource sets, all with repetition = “OFF”
 - UE reports distinct local CSI-RS resource indicator(s) within one or more resource sets. The UE can assume that the gNB applies the same Tx beams in the same order for each of the sets
- Note: Not all configurations are applicable for P1/P2/P3
- FFS: Dimensioning of the bit width of the UCI field which can carry either CRI(s) or CSI-RS resource set indicator(s)

R1-1719059 WF on Beam Management Samsung, CATT, Huawei, HiSilicon, NTT Docomo, MediaTek, Intel, OPPO, Spreadtrum, AT&T, InterDigital, CHTTL, KDDI, LG Electronics, Sony, China Unicom, Ericsson, VIVO, China Telecom, Qualcomm, National Instruments, Vodafone

Also supported by Verizon

Agreement:

The contents of **R1-1719059** are approved with the following clarifications and modification

- Slide 2: (Modification) Add N=3
- Slide 3: (Clarification) For uplink BM, multiple SRS resource sets can be configured
- For all slides: (Clarification) RRC parameter list refers to SRS resource set and previous agreements refer to SRS groups. Both are the same thing.

R1-1719064 WF on beam reporting Qualcomm, NTT DoCoMo, Ericsson, ZTE, Huawei, AT&T, Samsung, LGE, Intel, Nokia, NSB, Sharp

Agreement:

- For L1-RSRP and/or beam resource indicators (e.g. CRI or SSB index) reporting for beam management, support the following UL channels:
 - Short/long PUCCH

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- PUSCH
- Support the following reporting types for beam mgmt. on the above channels
 - For Periodic, support long PUCCH and short PUCCH
 - Semi-persistent – support all channels
 - Aperiodic – support PUSCH and short PUCCH

R1-1719010 **WF on DL beam indication** **ZTE, Sanechips, LGE, CATT, ASTRI**
Also supported by Intel, Spreadtrum, OPPO, vivo, AT&T

R1-1719190 **WF on DCI Field Size for TCI** **Ericsson, Samsung, Intel, OPPO, CATT, ZTE, Sanechips, LGE**

Agreement:

- Down-select to one of the following 2 options for the DCI field size for TCI in RAN1#91
 - Alt-1: Fixed number of bits [2 or 3] bits
 - Alt-2: A higher layer signaling parameter indicates the number of bits (2 or 3)

R1-1719170 **WF on beam management parameters** **Qualcomm, Ericsson, Intel, LGE, Samsung, Huawei, HiSilicon, Nokia, NSB**

Emails discussion to finalize the parameter list for BM

- Until Oct 27 – Sundar (Qualcomm)

R1-1718192 Further Views on NR Beam Management NTT DOCOMO, INC.
R1-1718433 On beam indication, measurement, and reporting Ericsson
R1-1718541 Beam management for NR Qualcomm Incorporated
R1-1717301 Beam measurement and reporting Huawei, HiSilicon
R1-1717368 Discussion on Beam Management Intel Corporation
R1-1718482 Remaining issues on beam management InterDigital, Inc.

R1-1717313 Beam indication with low-overhead TCL
R1-1717424 Discussion on beam management ZTE, Sanechips
R1-1717472 Discussion on beam measurement, beam reporting and beam indication vivo
R1-1717605 On Beam Management, Measurement and Reporting Samsung
R1-1717716 Discussion on beam indication Fujitsu
R1-1717743 Beam measurement, report, and indication Spreadtrum Communications
R1-1717812 Consideration on DL beam management CATT
R1-1717813 Consideration on DL beam failure recovery CATT
R1-1717866 Discussion of beam measurement and reporting Lenovo, Motorola Mobility
R1-1717880 Considerations on beam reporting and beam indication CMCC
R1-1717897 Discussion on UL Beam Management ASUSTEK COMPUTER (SHANGHAI)
R1-1717941 Discussion on DL/UL beam management LG Electronics
R1-1718009 Considerations on L1-RSRP reporting NEC
R1-1718054 Discussion on Remaining Issues of Beam Management Guangdong OPPO Mobile Telecom
R1-1718075 Discussion on beam indication ITRI
R1-1718333 DL and UL Beam management MediaTek Inc.
R1-1718388 Beam Measurement and Reporting AT&T
R1-1718511 Beam Indication, Measurements and Reporting Nokia, Nokia Shanghai Bell
R1-1718662 Considerations on UL beam management Sony

7.2.2.4 Mechanism to recover from beam failure

R1-1718878 Summary for Remaining issues on Beam Failure Recovery MediaTek
R1-1718933 Offline discussion summary on Beam Failure Recovery MediaTek

Agreement:

- gNB response is transmitted via a PDCCH addressed to C-RNTI
 - FFS: DCI format for gNB response
- Dedicated CORESET(s) is applied for monitoring gNB response for BFRQ. The CORESET is down-selected from the following two alternatives:
 - Alt 1: the same CORESET (s) as before beam failure
 - Alt 2: dedicatedly configured CORESET for beam failure recovery.

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R1-1718982 Way Forward on Candidate Beam Identification for Beam Failure Recovery Huawei, HiSilicon, LGE, Intel, Interdigital AT&T, vivo, Spreadtrum, Lenovo, Motorola Mobility Sharp, KT Corporation, OPPO, ZTE, SaneChips, Nokia, Nokia Shanghai Bell, China Telecom
Also supported by Convida Wireless, WILUS Inc, Fujitsu

Agreement:

Specification supports the CSI-RS + SS block case for the purpose of new candidate beam identification

- The above case is configured by gNB
- Note: a dedicated PRACH resource is configured to either an SSB or a CSI-RS resource
- Following two scenarios are supported when a UE is configured with CSI-RS + SSB
 - Scenario 1: PRACHs are associated to SSBs only
 - In this scenario, CSI-RS resources for new beam identification can be found from the QCL association to SSB(s).
 - Scenario 2: Each of the multiple PRACHs is associated to either an SSB or a CSI-RS resource
- FFS: multiple SSB can be associated with the same uplink resource.

CATT has concerns on the above agreement that it may not be an essential feature for beam failure recovery

Working Assumption:

- Beam failure detection is determined based on the following quality measure:
 - Hypothetical PDCCH BLER

R1-1719174 WF on Beam Failure Recovery MediaTek, Intel, Huawei, HiSilicon, ZTE, Sanechips, CHTTL

Agreement:

- A beam recovery request can be transmitted if the number of consecutive detected beam failure instance exceeds a configured maximum number
 - (Working assumption) If hypothetical PDCCH BLER is above a threshold, it is counted as beam failure instance
 - Note: Beam failure is determined when all serving beams fail
 - The candidate beam can be identified when metric X of candidate beam is higher than a threshold
 - FFS: metric X
 - 1 or 2 threshold values are introduced
 - If 2 thresholds are introduced, one is for SSB and the other is for CSI-RS
 - One of the following alternatives will be down-selected in RAN1#91
 - Alt-1: Fixed value
 - Alt-2: Configurable value by RRC signaling
 - RAN2 should specify the RRC signaling to configuration of the threshold
 - Note: for beam failure detection, the UE should aware the transmission power offset between CSI-RS and DMRS of PDCCH
 - FFS other details.

Agreement:

- For gNB to uniquely identify UE identity from a beam failure recovery request transmission
 - A PRACH sequence is configured to UE

Working Assumption:

- At least the following parameters should be configured for dedicated PRACH resources for beam failure recovery
 - Per UE parameters
 - Preamble sequence related parameters
 - E.g., root sequence, cyclic shift, and preamble index
 - Maximum number of transmissions
 - Maximum number of power rampings
 - Target received power
 - Retransmission Tx power ramping step size
 - Beam failure recovery timer
 - Per dedicated PRACH resource parameters
 - Frequency location information
 - Time location, if it is only a subset of all RACH symbols (e.g., PRACH mask)
 - Associated SSB or CSI-RS information
 - Note: as a starting point, use initial access preamble transmission mechanism and parameters. If any issue is identified, new mechanism can be introduced.

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- No further RRC signalling for above UE parameters is required if reusing the same parameter as initial access

Email discussion to discuss the remaining beam failure recovery issues in slides 8, 9, 10 of R1-1719174
- Until Oct 27, Chia-Hao (MediaTek)

R1-1718334	Design details on beam failure recovery	MediaTek Inc.
R1-1718193	Views on Beam Recovery	NTT DOCOMO, INC.
R1-1718434	Basic beam recovery	Ericsson
R1-1717942	Discussion on beam failure recovery	LG Electronics
R1-1717302	Beam failure recovery design details	Huawei, HiSilicon
R1-1717369	Remaining issues on beam failure recovery	Intel Corporation
R1-1717425	Discussion on beam recovery	ZTE, Sanechips
R1-1717473	Discussion on beam failure recovery	vivo
R1-1717606	Beam failure recovery	Samsung
R1-1717867	Discussion of beam failure recovery	Lenovo, Motorola Mobility
R1-1718010	Discussions on Beam Failure Recovery	NEC
R1-1718055	Discussion on Beam Recovery Mechanism	Guangdong OPPO Mobile Telecom
R1-1718389	Beam Recovery for Full and Partial control channel failure	AT&T
R1-1718414	Discussion on mechanisms for beam failure recovery	Sharp
R1-1718457	Views on Beam Recovery Mechanism	National Instruments Corp.
R1-1718469	Views on remaining issues of beam failure recovery	CHTTL
R1-1718483	Remaining issues on beam failure recovery	InterDigital, Inc.
R1-1718512	Beam Recovery in NR	Nokia, Nokia Shanghai Bell
R1-1718542	Beam recovery procedures	Qualcomm Incorporated
R1-1718658	Considerations on beam recovery	Sony

7.2.2.5 CQI and MCS

[R1-1718849](#) Summary for CQI and MCS AT&T

Agreement:

Two separate CQI tables are supported for eMBB

- One for maximum modulation order is 256-QAM
- One for maximum modulation order is 64-QAM
- The target BLER for CQI tables is 10%
- Note: RRC signalling is used by gNB to select one of the above two tables

Agreement:

- N separate CQI table(s) are supported for URLLC
 - Downselect the value of N between 1 or 2
- Two target BLER are supported for URLLC
 - Note: RRC signalling is used by gNB to select one of the two target BLER
 - Note: The configuration of target BLER or CQI table is part of CSI report setting

Agreement:

- For CQI table of maximum modulation order of 64QAM, the CQI table from LTE Rel-8 is reused
- For CQI table of maximum modulation order of 256QAM, a CQI field size of 4 bits is supported
 - FFS on the details of the CQI table

Agreement:

- Two independent CQI fields are supported for WB CQI when two CWs is applied
 - Note: Differential WB CQI is not used for the two CWs

Agreement:

For NR PDSCH MCS table, support two separate 5 bit tables for 64QAM and 256QAM and RAN1 will strive to reuse as many entries as possible

- The 64QAM MCS table should be default unless the UE is configured to use 256QAM MCS table
- RRC signalling is used to choose between the two MCS tables

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Agreement

For NR PUSCH MCS table (in case of CP-OFDM), support two separate 5 bit tables for 64QAM and 256QAM and RAN1 will strive to reuse as many entries as possible

- The 64QAM MCS table should be default unless the UE is configured to use 256QAM MCS table
- RRC signalling is used to choose between the two MCS tables

Agreement

For NR PUSCH MCS table (in case of DFT-s-OFDM), support two separate 5 bit tables for 64QAM and 256QAM and RAN1 will strive to reuse as many entries as possible

- The MCS table will include entries for $\pi/2$ BPSK
- The 64QAM MCS table should be default unless the UE is configured to use 256QAM MCS table
- RRC signalling is used to choose between the two MCS tables
- Note: In the case a UE supports only up to 16QAM, the default table should be used

Agreement

The following fields are used in defining the MCS table:

- MCS index and a corresponding modulation order and target code rate $\times [1024]$

R1-1718194	Views on MCS and MCS tables	NTT DOCOMO, INC.
R1-1718543	Consideration for MCS table	Qualcomm Incorporated
R1-1717607	CQI Definition	Samsung
R1-1717303	CQI and MCS design	Huawei, HiSilicon
R1-1717370	CQI/MCS for NR	Intel Corporation
R1-1717426	On CQI and MCS	ZTE, Sanechips
R1-1717474	Discussion on CQI and MCS	vivo
R1-1717943	Discussion on CQI and MCS tables	LG Electronics
R1-1718163	CQI and MCS Tables for $\pi/2$ BPSK PUSCH	IITH
R1-1718390	On Adaptive CQI and MCS Table configuration for NR	AT&T
R1-1718435	Further Discussion on CQI and MCS	Ericsson
R1-1718513	Consideration on new MCS and CQI table for NR	Nokia, Nokia Shanghai Bell

7.2.2.6 Other

R1-1717427	Enhancements on CSI framework	ZTE, Sanechips
R1-1717428	Details and evaluation results on beam reporting	ZTE, Sanechips
R1-1717429	Details and evaluation results on beam indication	ZTE, Sanechips
R1-1717430	Details of UL beam management	ZTE, Sanechips
R1-1717608	CSI Acquisition and Beam Management Framework	Samsung
R1-1717609	CSI Reporting for Reciprocity Operation	Samsung
R1-1717610	Discussion on Tx beam grouping configuration for multi-panel TRP and multi-TRP	Samsung
R1-1717611	Discussion on CSI-RS Resource Allocation	Samsung
R1-1717612	Discussion on beam indication for PDSCH	Samsung
R1-1717613	Port selection codebook for beamformed CSI-RS	Samsung
R1-1717614	Extension of Type I multi-panel codebook	Samsung
R1-1717615	Differential reporting of Type II CSI	Samsung
R1-1717616	On higher rank Type II CSI	Samsung
R1-1717617	On codebook subset restriction	Samsung
R1-1717618	L1 RSRP reporting for beam management	Samsung
Late submission		
R1-1717619	Discussions on service specific CSI for NR	Samsung
R1-1717620	Discussion on beam indication for UL transmission	Samsung
R1-1717621	Discussion on cross-carrier beam management	Samsung
R1-1717622	DL beam management configuration	Samsung
R1-1717623	Discussion on joint CLI measurement and beam management	Samsung
R1-1717624	QCL associations for beam management RS	Samsung
R1-1717625	L1-RSRP measurement duration	Samsung
R1-1717626	Parameters for beam management	Samsung
R1-1717627	On beam indication	Samsung
R1-1717814	General CSI framework for CSI acquisition and beam management	CATT
R1-1717815	Details on interference measurement	CATT
R1-1718008	Discussion on beam measurement and reporting	ETRI

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R1-1718195	Investigation on beam pattern design for beam management	NTT DOCOMO, INC.
R1-1718196	Performance investigation on beam reporting	NTT DOCOMO, INC.
R1-1718238	Beam indication for control and data channels	Huawei, HiSilicon
R1-1718239	Seamless beam failure recovery in a holistic mechanism	Huawei, HiSilicon
R1-1718240	Network-side beam failure detection and new candidate beam identification	Huawei, HiSilicon
R1-1718241	Beam indication for network-based beam failure recovery	Huawei, HiSilicon
R1-1718242	Full reciprocity based CSI acquisition mechanism	Huawei, HiSilicon
R1-1718243	CSI acquisition details for hybrid CSI	Huawei, HiSilicon
R1-1718244	Encoding of Type I and Type II CSI parameters	Huawei, HiSilicon
R1-1718245	Remaining issues for codebook subset restriction	Huawei, HiSilicon
R1-1718415	CSI framework for NR	Sharp
R1-1718436	Details of CSI framework	Ericsson
R1-1718437	Signaling Overhead Analysis for CSI framework	Ericsson
R1-1718438	On Dynamic Triggering for CSI Reports and CSI-RS	Ericsson
R1-1718439	A comparison of CSI-RS activation schemes based on MAC CE and DCI	Ericsson
R1-1718440	Further details of measurement restriction	Ericsson
R1-1718441	Performance impact of inactive antenna ports	Ericsson
R1-1718442	On semi-persistent CSI reporting on PUSCH	Ericsson
R1-1718443	On aperiodic and semi-persistent CSI reporting on PUCCH	Ericsson
R1-1718444	NR CSI Computation Capability	Ericsson
R1-1718445	Frequency parameterization for Type II CSI codebook	Ericsson
R1-1718456	Further Details of Beam Failure Handling	National Instruments Corp.
R1-1718544	Details of CSI framework	Qualcomm Incorporated
R1-1718667	Considerations on CSI framework	Sony
R1-1718698	Discussion on higher rank Type II codebook and feedback overhead reduction	Motorola Mobility, Lenovo
R1-1718735	Details of CSI feedback for Transparent PDSCH Tx	Ericsson
R1-1718736	On codebook subset restriction	Ericsson
R1-1718737	CSI feedback for multi-TRP	Ericsson
R1-1718738	On multi-panel codebook extension	Ericsson
R1-1718739	On BLER specific CSI feedback	Ericsson
Withdrawn		
R1-1718740	Multi-cell beam recovery	Ericsson
R1-1718741	Beam management in C-DRX	Ericsson
R1-1718742	Performance of beam management without beam indication	Ericsson
R1-1718743	Analysis of beam indication signalling options	Ericsson
R1-1718744	Details of SS beam reporting framework	Ericsson
R1-1718745	Interactions between beam recovery and beam management	Ericsson
R1-1718746	On common beam for PDSCH and PDCCH	Ericsson
R1-1718747	On UL beam indication	Ericsson
R1-1718748	CQI reporting for URLLC	Ericsson
R1-1718757	Simulation results on system performance vs. CSI subband size	Ericsson
R1-1718759	Performance evaluation for beam coordination considering dynamic TDD	China Unicom

7.2.3 Reference signals and QCL

Highest priority in NR MIMO agenda items

R1-1717924	RS design for pi/2 BPSK PUSCH	IITH
R1-1717986	PT-RS usage for Phase/frequency and Doppler/channel correction	IITH
R1-1718683	Open issues on RRC parameters for Reference signals and QCL	Ericsson
R1-1719073	WF on pre-DFT RS	IITH, Mitsubishi, Deutsche Telekom, AT&T, IITM, CEWiT, Tejas Networks,

Reliance Jio

Also supported by Qualcomm, IDC, National Instruments, KDDI, Softbank

Conclusion

Companies are encouraged to study if chunk based pre-DFT RS $K > 4$ can be supported for enhanced channel estimation of DFT-S-OFDM PUSCH in future NR MIMO related study/work items

- FFS: values of K and other details (K is the number of samples in a chunk)

7.2.3.1 Multiplexing of different types of RSs

R1-1718851	Summary for remaining issues of RS multiplexing	Huawei, HiSilicon
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Agreement:

When SS block and PDSCH are scheduled in the same symbols, DMRS and SS block can be in a same symbol.

- Above applies at least for the case where DMRS and SS block are not overlapping in the frequency domain
- Above applies at least for the case where SS block and DMRS are spatially QCL-ed
- Above applies at least for the case where the same subcarrier spacing is used for SS block and DMRS

Agreement:

Multiplexing schemes for TRS with DMRS/PDSCH/PDCCH/SS block follow the multiplexing schemes for CSI-RS with DMRS/PDSCH/PDCCH/SS block.

R1-1718987 Summary of offline for RS multiplexing Huawei, HiSilicon

Agreement:

A CSI-RS resource can be configured on RBs outside CORESET in CORESET symbols from UE perspective.

- Above applies at least for the case where PDCCH and CSI-RS are spatially QCL-ed, and FFS for multi-panel UEs
- FFS: Use case when the above is applicable (ex: CSI reporting for wideband and partial band)
- Note: CSI-RS BW discussion should be taken into account
- Above at least applies for non-slot based cases

Above feature is supported for slot-based transmissions as well

Agreement:

A CSI-RS resource can be configured on RBs outside PBCH RBs in the symbols containing SS block from UE perspective.

- Above applies at least for the case where SS block and CSI-RS are spatially QCL-ed, FFS for multi-panel UEs.
 - FFS: If non-QCLed, study UE's behavior
- Note: CSI-RS BW discussion should be taken into account. If beam management is agreed, the requirement on minimum BW for CSI acquisition and beam management may be different.
- Above applies at least for the case where the same subcarrier spacing is used for SS block and CSI-RS
- Down select following alternatives:
 - Alt.1 Above applies for the cases: CSI-RS used for beam management and CSI acquisition
 - Alt.2 Above applies for the cases: CSI-RS only used for CSI acquisition
 - Alt.3 Above applies for the cases: CSI-RS only used for beam management

[R1-1717475](#) On multiplexing of different types of RSs vivo
[R1-1717371](#) On multiplexing of different RS types Intel Corporation

[R1-1717304](#) Multiplexing different types of RSs for DL and UL Huawei, HiSilicon
[R1-1717431](#) Discussion on multiplexing of different RSs ZTE, Sanechips
[R1-1717628](#) Discussion on DL/UL RS multiplexing Samsung
[R1-1717744](#) Consideration on DL RS multiplexing Spreadtrum Communications
[R1-1717816](#) Consideration on RS multiplexing CATT
[R1-1717881](#) Discussion on multiplexing of different types of RSs CMCC
[R1-1717944](#) On multiplexing of different types of RSs LG Electronics
[R1-1718027](#) Discussion on RS multiplexing Guangdong OPPO Mobile Telecom
[R1-1718350](#) On RS multiplexing MediaTek Inc.
[R1-1718391](#) Multiplexing different type of RSs AT&T
[R1-1718446](#) On multiplexing of RS types Ericsson
[R1-1718514](#) On multiplexing of different RS types Nokia, Nokia Shanghai Bell
[R1-1718545](#) On multiplexing of different types of RSs Qualcomm Incorporated

7.2.3.2 Remaining details on CSI-RS

R1-1718841 Summary of remaining issues on CSI-RS Huawei, HiSilicon

Agreement:

The starting subcarrier of a CSI-RS component RE pattern

- For 1 port CSI-RS, there is no restriction
- For Y=2, is constrained to be one among even subcarriers, in the given PRB (indexed from 0)
- For Y=4, is constrained to be one among subcarriers 0, 4, 8, in the given PRB (indexed from 0)

Agreement:

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At least {8, 9, 10, 11}-th OFDM symbol in a slot structure can be configured for CSI-RS transmission, in addition to the {6, 7, 13, 14}-th OFDM symbol. Note: the symbol locations assume that symbol indexing starts at 1.

- FFS: Other OFDM symbols

[R1-1718947](#) **Summary of offline discussions on CSI-RS** Huawei, HiSilicon

Agreement:

Support configuring CSI-RS resource on BWP with a transmission BW equal to or smaller than the BWP. When the CSI-RS BW is smaller than the BWP, support at least the case that CSI-RS spans contiguous RBs in the granularity of N RBs, where the value of N is FFS.

- When CSI-RS BW is smaller than the corresponding BWP, it should be larger than X RBs (FFS: value of X)
- FFS: Whether the value of X is same or different for beam management and CSI acquisition
- FFS: The value of X may or may not be numerology-dependent

Agreement:

NR supports the following CSI-RS transmission periodicities

- {5, 10, 20, 40, 80, 160, 320, 640} slots
- FFS: Restriction on periodicity as a function of subcarrier spacing

Agreement:

Support assigning CSI-RS port index within a CDM group first, then across CDM groups (analogous to LTE). FFS: order of CDM groups, e.g., frequency first or time first.

Conclusion:

Companies are encouraged to review the list of open issues in [R1-1718947](#) and other CSI-RS open issues especially those with impact to RAN2

- Email discussion until 27th of Oct on CSI-RS open issues with RAN2 impact to be coordinated by Xi (Huawei)

Agreement:

For each of the following RSs, c_init used for sequence generation will at least depend on UE specifically configured scrambling ID by RRC configuration

- DL: DMRS, CSI-RS resource
 - FFS: Support of multiple IDs for DMRS
- UL: DMRS(for CP-OFDM), PTRS(for DFT-s-OFDM)

[R1-1718882](#) **WF on Remaining details on CSI-RS design** LG Electronics, Samsung, CATT, MediaTek Inc
Also supported by IDC

R1-1717629	Remaining details on CSI-RS	Samsung
R1-1718546	Discussion on CSI-RS design	Qualcomm Incorporated
R1-1718447	Details on CSI-RS design	Ericsson
R1-1717305	CSI-RS design in NR	Huawei, HiSilicon

R1-1717372	Remaining details on CSI-RS	Intel Corporation
R1-1717432	On CSI-RS for CSI acquisition and beam management	ZTE, Sanechips
R1-1717476	Discussion on CSI-RS	vivo
R1-1717817	Remaining issues on CSI-RS	CATT
R1-1717945	On CSI-RS design	LG Electronics
R1-1718028	Discussion on CSI-RS design	Guangdong OPPO Mobile Telecom
R1-1718197	Remaining details on CSI-RS	NTT DOCOMO, INC.
R1-1718392	On the details of CSI-RS design	AT&T
R1-1718515	Remaining issues on CSI-RS design	Nokia, Nokia Shanghai Bell

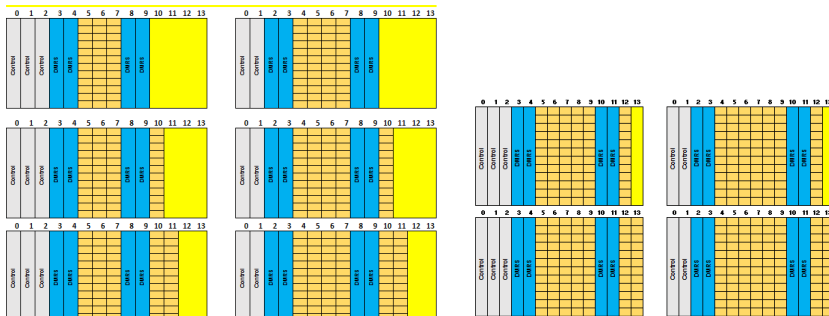
7.2.3.3 Remaining details on DMRS

Including remaining details of $\pi/2$ -BPSK for PUSCH

[R1-1718810](#) **Remaining issues on NR DM-RS** Qualcomm

Agreement:

- For slot-based scheduling, for PDSCH, for the 2-symbol front-load DMRS, the 2-symbol additional DMRS symbol is configured in
 - the {9th-10th} symbol
 - for PDSCH spanning to the 10th or 11th or 12th symbol of the slot
 - the {11th-12th} symbol
 - for PDSCH spanning to the 13th or 14th symbol of the slot



Agreement

- For the 2-symbol non-slot based scheduling, no additional DMRS can be configured
- For the 4-symbol non-slot based scheduling, no additional DMRS can be configured
- For the 7-symbol non-slot based scheduling, one additional DMRS can be configured
- FFS: Location of the front-loaded DMRS

R1-1719182 Remaining issues on NR DM-RS Qualcomm

Emails discussion on the DMRS of 2/4/7-symbol for non-slot based scheduling

- Until Oct 27 – Alex (Qualcomm)

Agreement

- For the location of the first position of front-load DMRS for PUSCH without frequency hopping, support at least the following:
 - The first OFDM symbol with respect to the scheduled data contains the first symbol of front-load UL DMRS
 - Study further when this is applied; E.g., in case of a mixed DL/UL slot from network perspective, or for PUSCH starting from the Xth symbol with X>1, etc.
 - The 3rd or 4th symbol of the slot contains the first symbol of front-load DMRS
 - At least same location for UL and DL is supported
 - Study further whether the first position of front-load DMRS for PUSCH can be different than the first position of front-load DMRS for PDSCH.
 - Study further when this is applied. E.g., in case of a UL only slot from network perspective, or for PUSCH starting the 1st symbol, etc.
- FFS: Further restrictions (if any) of FDMing DMRS and PUSCH due to UE processing timeline

R1-1718969 Remaining issues on NR DM-RS Qualcomm

Agreement

For the PUSCH without a hop when the first symbol of the front-load DMRS is located in the 3rd or 4th symbol of the slot

- reuse DL DMRS locations for UL DMRS with respect to the additional DMRS symbols and reuse the scenarios they are applied with respect to the last PUSCH symbol.
- Note: This applies to both NCP and ECP whenever applicable.

For RAN1#91: Study further until next meeting whether NR should support in addition to a comb-2 DMRS structure, a DMRS structure with RPF=1 for DFT-s-OFDM.

Agreement

Any configured DMRS port indication table supports SU-MIMO scheduling.

The maximum number of ports per UE in SU-MIMO

- DMRS configuration type 1 with 1-symbol DMRS

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- 4 for DL, 4 for UL
- DMRS configuration type 1 with 2-symbol DMRS
 - 8 for DL, 4 for UL
- DMRS configuration type 2 with 1-symbol DMRS
 - 6 for DL, 4 for UL
- DMRS configuration type 2 with 2-symbol DMRS
 - 8 for DL, 4 for UL

Agreement:

The maximum number of orthogonal ports per UE in MU-MIMO for

- DMRS configuration type 1 with 1-symbol DMRS
 - 2 for DL
- DMRS configuration type 1 with 2-symbol DMRS
 - 4 for DL
- DMRS configuration type 2 with 1-symbol DMRS
 - 4 for DL
- DMRS configuration type 2 with 2-symbol DMRS
 - 4 for DL

Proposal:

For $\pi/2$ BPSK PUSCH, RS design should be such that PAPR of RS is similar to data

- The design should also consider cross correlation properties with NR/LTE DMRS, BLER, and effect of spectrum shaping

Email discussion on RS design based on $\pi/2$ BPSK for DFT-s-OFDM

- Until Oct 27 – Kiran (Indian Institute of Tech (H))

Agreement:

For the PN sequence for CP-OFDM, QPSK modulated DMRS is derived from the

- Alt. 1: length-31 Gold sequence (as in LTE)
- Alt. 2: length-63 Gold sequence

Agreement:

A UE is configured for the number of front-load DMRS symbols for PUSCH and PDSCH DMRS with the following signaling method:

- The maximum number is configured with higher-layer signaling and the actual number with DCI using DMRS-table-based indication

Agreement:

At least the following information is included in DCI as part of downlink DMRS port assignment:

- Scheduled downlink DMRS ports
- Potential presence of co-scheduled downlink DMRS CDM groups for rate matching
 - FFS: Whether the presence of co-scheduled downlink DMRS port(s) within the assigned downlink DMRS CDM group is supported or not
 - There are no dedicated bits for rate matching around DMRS CDM group(s)

At least the following information is included in DCI as part of uplink DMRS port assignment for CP-OFDM:

- Scheduled uplink DMRS ports
- Uplink DMRS CDM groups for rate matching
 - There are no dedicated bits for rate matching around DMRS CDM group(s)

Agreement:

A UE in MU-MIMO should be scheduled ports first within a specific CDM group, and then across CDM groups from UE perspective

- The ports within the same CDM group should be QCL-ed
- The above applies for the case of single TRP

Agreement:

- For DMRS for DFT-s-OFDM PUSCH with a hop, at least one DMRS symbol is included in each hop.
- For DMRS for DFT-s-OFDM PUSCH with a hop, at least support the first DMRS of the 2nd hop to be located on the first symbol of the PUSCH within that hop.
 - FFS: another case for the location first DMRS of the 2nd hop in cases of collision with reserved resources on the uplink.

Agreement

For DMRS for DFT-s-OFDM PUSCH with a hop, support first DMRS of the 1st hop to be located on the

- The first OFDM symbol with respect to the scheduled data contains the first symbol of front-load UL DMRS
 - Study further when this is applied; E.g., in case of a mixed DL/UL slot from network perspective, or for PUSCH starting from the Xth symbol with X>1, etc.
- FFS: The 3rd or 4th symbol of the slot contains the first symbol of front-load DMRS for the 1st hop
 - At least same location for UL and DL is supported
 - Study further whether the first position of front-load DMRS for PUSCH can be different than the first position of front-load DMRS for PDSCH.
 - Study further when this is applied. E.g., in case of a UL only slot from network perspective, or for PUSCH starting the 1st symbol, etc
- FFS: another case for the location first DMRS of the 1st hop in cases of collision with reserved resources on the uplink.

[R1-1718965](#) WF on DMRS configuration for MU-MIMO LG Electronics, Qualcomm, Ericsson, Nokia, Nokia Shanghai Bell, Panasonic, Samsung, CATT, Intel, ZTE, Sanechips

[R1-1719187](#) WF on DMRS configuration for MU-MIMO LG Electronics, Qualcomm, Ericsson, Nokia, Nokia Shanghai Bell, Panasonic, Samsung, CATT, Intel, ZTE, Sanechips, Huawei, HiSilicon, MediaTek, AT&T, NTT DOCOMO, vivo

Agreement

- In Rel. 15, at least for PDSCH, a UE is not expected to assume co-scheduled MU-UE(s) with different DMRS configuration with respect to the followings:
 - The actual number of front-loaded DMRS symbol(s)
 - The number of additional DMRS
 - The DMRS symbol location
 - DMRS configuration type.

[R1-1718516](#) On remaining issues of DM-RS for NR physical data channels Nokia, Nokia Shanghai Bell

[R1-1717630](#) Remaining details on DMRS Samsung

[R1-1718547](#) Remaining details on DMRS Qualcomm Incorporated

[R1-1717310](#) Signaling of DMRS ports for SU/MU-MIMO Huawei, HiSilicon

[R1-1717373](#) On the remaining details of DM-RS Intel Corporation

[R1-1717433](#) Remaining details on DL DMRS and UL DMRS ZTE, Sanechips

[R1-1717477](#) Remaining details on DMRS design vivo

[R1-1717745](#) Remaining issues on DMRS for CP-OFDM Spreadtrum Communications

[R1-1717818](#) Remaining issues on DMRS CATT

[R1-1717853](#) Remaining issues on DMRS Lenovo, Motorola Mobility

[R1-1717946](#) On DMRS design LG Electronics

[R1-1718002](#) Discussion on DMRS design ETRI

[R1-1718011](#) Remaining issues on DMRS configurations NEC

[R1-1718198](#) Remaining details on DM-RS NTT DOCOMO, INC.

[R1-1718271](#) Discussion on remaining details of DMRS design KT Corp.

[R1-1718351](#) On remaining details of downlink DMRS MediaTek Inc.

[R1-1718367](#) On remaining details of NR DL DMRS Panasonic

[R1-1718393](#) Remaining details for DMRS design AT&T

[R1-1718448](#) Details on DMRS design Ericsson

[R1-1718466](#) Views on DL DMRS designs Mitsubishi Electric Corp

[R1-1718525](#) Remaining details on DL DMRS for NR IITL

[R1-1718547](#) Remaining details on DMRS Qualcomm Incorporated

7.2.3.4 Remaining details on PT-RS

[R1-1718845](#) Summary of PTRS open issues Ericsson

[R1-1718998](#) JOINT WF on PTRS Huawei, HiSilicon, Intel, Samsung, ZTE, Sanechips, ITH, CEWiT, IITM, Tejas Networks, Reliance Jio, Panasonic, InterDigital, Mitsubishi, National Instruments, NEC, LG Electronics, NTT DOCOMO, KT, AT&T, Ericsson, Nokia, NSB, OPPO, AT&T, MediaTek, CMCC, Qualcomm, CATT, Vodafone

The contents of [R1-1718998](#) are agreed

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[R1-1719018](#) WF on pre-DFT PT-RS pattern for DFTsOFDM Mitsubishi Electric, Ericsson, Nokia, NSB, IITH, IITM, CeWit, Tejas Networks, Reliance Jio, Spreadtrum, Sony, CMCC, Interdigital, Huawei, HiSilicon, AT&T, Samsung, ZTE, Sanechips, Sharp, vivo, Lenovo, Motorola Mobility, NEC, Vodafone, CHTTL, National Instruments, CATT, Intel, LG Electronics, Qualcomm

Agreement:

- For chunk-based pre-DFT PTRS insertion for DFTsOFDM with X chunks of size $K=\{2,4\}$, support the following
 - For $K=2$, the samples in DFT domain are divided in X intervals, and the chunks are located in each interval in samples n to $n+K-1$ where the n is FFS
 - For $K=4$, the samples in DFT domain are divided in X intervals, where in the first interval the chunk is placed in the Head (first K samples), in the last interval the chunk is placed in the Tail (last K samples), and in the rest of intervals the chunk is placed in the middle of each of the two intervals
 - For PTRS for DFT-s-OFDM, support a RRC parameter « *UL-PTRS-frequency-density-transform-precoding* » indicating a set of thresholds $T=\{N_{RB0}, n=0,1,2,3,4\}$, per BWP that indicates the values of X and K the UE should use depending on the scheduled BW according to the table below

Scheduled BW	X x K
$N_{RB0} < N_{RB} \leq N_{RB1}$	2x2
$N_{RB1} < N_{RB} \leq N_{RB2}$	2x4
$N_{RB2} < N_{RB} \leq N_{RB3}$	4x2
$N_{RB3} < N_{RB} \leq N_{RB4}$	4x4
$N_{RB} > N_{RB4}$	Yx4

- FFS default UE behaviour before RRC configuration, if needed
- FFS value of Y (if different than 4)
- FFS whether thresholds are MCS dependent
- Note: N_{RB0} can be equal to 0; when N_{RB0} is larger than 0, no PTRS is present for allocations less than or equal to N_{RB0}
- Note: The use of a specific pattern can be disabled by setting $N_{RBI}=N_{RBI+1}$ on the corresponding line in the previous table
- Possible PTRS presence/absence is configured through an RRC parameter « *UL-PTRS-present-transform-precoding* »
- Time-domain PTRS density is configured by an RRC parameter « *UL-PTRS-time-density-transform-precoding* » where supported time densities are $L_{\{PT-RS\}}=\{1,2\}$
 - Note: Time-domain pattern depends on DM-RS positions using the same principle as agreed for CP-OFDM PTRS mapping
- FFS: Whether to introduce ($K=1$, $X=16$) and the impacts on existing design. If supported, $K=\{1,2,4\}$ is supported and the following applies
 - The samples in DFT domain are divided in X intervals, and the chunks ($K=1$) are located in the middle of each interval
 - ($K=1$, $X=16$) applies when $N_{RB4} < N_{RB} \leq N_{RB5}$, and Yx4 applies for $N_{RB} > N_{RB5}$

[R1-1717478](#) Discussion on the remaining details on PT-RS vivo
[R1-1718484](#) Remaining issues on PT-RS InterDigital, Inc.
[R1-1717306](#) Further details of PTRS Huawei, HiSilicon

[R1-1717374](#) Remaining details on PT-RS Intel Corporation
[R1-1717434](#) Remaining details on PT-RS ZTE, Sanechips
[R1-1717631](#) Discussion on PT-RS Samsung
[R1-1717746](#) Remaining issues on PT-RS Spreadtrum Communications
[R1-1717760](#) On chunk-based for UL DFTsOFDM waveform Mitsubishi Electric RCE
[R1-1717779](#) PT-RS design Panasonic Corporation
[R1-1717819](#) Remaining issues on PT-RS CATT
[R1-1717854](#) Remaining issues on PTRS Lenovo, Motorola Mobility
[R1-1717882](#) Discussion on PT-RS design CMCC
[R1-1717947](#) On PT-RS design LG Electronics
[R1-1718012](#) Remaining issues on PTRS configurations NEC
[R1-1718072](#) PT-RS support for pi/2 BPSK PUSCH IITH
[R1-1718199](#) Remaining details on PT-RS NTT DOCOMO, INC.
[R1-1718449](#) Details on PT-RS design Ericsson
[R1-1718517](#) On remaining details of PT-RS design Nokia, Nokia Shanghai Bell
[R1-1718548](#) PTRS considerations Qualcomm Incorporated

7.2.3.5 Remaining details on SRS

Including SRS carrier based switching

[R1-1718774](#) Summary of SRS Sony

Agreement: NR supports a single SRS bandwidth table consist of multiple value of C_SRS and 4 values of B_SRS.

Agreement: The frequency domain starting position of a SRS allocation (analogous to K0_P in LTE) is UE specifically configurable such that it is aligned on a common grid with 4 PRB granularity defined on a wideband CC from network perspective

- Note: This can enable alignment of SRS resources of different UEs with partially overlapped BWPs multiplexed on the same comb

Agreement: NR support for a maximum of 12 CS for comb 4 and a maximum at least 8 CS for comb 2.

- FFS: configuration of fewer than the maximum number defined cyclic shifts

Agreement: NR supports intra-slot and inter-slot frequency hopping within a BWP.

- FFS: if the same hopping formula as in LTE can be used
- FFS: aperiodic/semi-persistent/periodic SRS for each hopping type (intra-/inter-slot)
- FFS: number of OFDM symbols per SRS resource for each hopping type (intra-/inter-slot)
- FFS: Whether independent ON/OFF configurations for intra-slot and inter-slot frequency hopping for one SRS resource

Agreement: NR supports gNB to configure SRS resource in time domain only by UE-specific parameters, e.g., by {SRS-SlotConfig, SRS-ResourceMapping}

[R1-1718980](#) Summary of SRS Sony

Agreement:

NR supports 17 unique rows in LTE for SRS BW <=96 PRBs.

In addition to 17 unique rows in LTE, additional rows for <=96 PRBs is not prohibited.

Agreement: For group and sequence hopping, both group hopping and sequence hopping are supported as in LTE

[R1-1718985](#) WF on prioritization between SRS and short PUCCH transmission in case of collision Mitsubishi Electric, LG, ZTE, Sanechips, Nokia, NSB, Sony, InterDigital, Ericsson
Also supported by Samsung and Intel

Agreement:

- In the case of collision of SRS and short PUCCH carrying only CSI report/beam failure recover request, support the prioritization rules in the table below:
 - The channel listed in the entries below are prioritized

	Aperiodic SRS	Semi-persistent SRS	periodic SRS
sPUCCH with aperiodic CSI report only	No rule**	sPUCCH	sPUCCH
sPUCCH with semi persistent CSI report only	SRS	sPUCCH	sPUCCH
sPUCCH with periodic CSI report only	SRS	sPUCCH	sPUCCH
sPUCCH with beam failure recover request*	sPUCCH	sPUCCH	sPUCCH

- In case SRS is dropped, dropping can be partial in time domain, i.e., only those OFDM symbols that collide with short PUCCH

*If short PUCCH is supported for beam failure recovery request and collision between short PUCCH with beam failure recovery request and aperiodic/semi persistent/periodic SRS occurs, prioritize short PUCCH

** UE can assume that this collision will not occur

[R1-1718993](#) Way Forward on SRS Switching among CCs and Bandwidth Parts Huawei, HiSilicon, AT&T, CMCC, Samsung, Softbank, Vodafone

Agreement:

- Specify NR SRS switching among CCs similar to Rel-14 LTE SRS carrier-based switching design including

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- Periodic/aperiodic/semi-persistent SRS on a CC without PUCCH/PUSCH configured
- TA (through PRACH) on TAG without PUSCH/PUCCH configured
- Power control separated from that of PUSCH
- Group common DCI for aperiodic SRS triggering and TPC
- DL/UL interruptions and collision handling due to SRS switching

R1-1718968 **WF on SRS for NR** Ericsson, Qualcomm, Huawei, HiSilicon, ZTE, Sanechips, Mitsubishi, Sony, Nokia, NSB, NTT Docomo, AT&T, China Unicom, China Telecom, Vodafone, Intel, Samsung, Verizon
 Slides 13, 14, 15 in [R1-1718968](#) are **agreed**.

Agreement:

- An X-port SRS resource spans $N = 1, 2$, or 4 adjacent OFDM symbols within the same slot where all X ports are mapped to each symbol of the resource
 - When frequency hopping only is configured, the X ports are mapped to potentially different sets of subcarriers in each OFDM symbol of the resource, depending on the hopping pattern
 - For $N = 4$, frequency hopping + repetition can be configured where the X ports are mapped to a different set of subcarriers in the second pair OFDM symbol(s) of the resource
 - Note: Symbol pairs are adjacent
 - Note: same comb is assumed for different sets of subcarriers
 - Note: hopping pattern is within the tree structure defined by a given C_{SRS} , B_{SRS} , and b_{hop}
 - Note: When repetition only is configured, the mapping is covered by previous agreement in RAN1#90:
 - “Each of the X ports are mapped to the same set of subcarriers in the same set of PRBs in the N SRS symbols.”
 - NCP SRS resource definition is reused for ECP
- FFS: SRS transmission repetition within a slot can be at different power levels to account for relative phase discontinuities from multiple UE Tx chains

Agreement:

The following SRS bandwidths are supported in NR:

	$B_{SRS} = 0$		$B_{SRS} = 1$		$B_{SRS} = 2$		$B_{SRS} = 3$	
C_{SRS}	$m_{SRS,0}$	N_0	$m_{SRS,1}$	N_1	$m_{SRS,2}$	N_2	$m_{SRS,3}$	N_3
0	4	1	4	1	4	1	4	1
1	8	1	4	2	4	1	4	1
2	12	1	4	3	4	1	4	1
3	16	1	4	4	4	1	4	1
4	16	1	8	2	4	2	4	1
5	20	1	4	5	4	1	4	1
6	24	1	4	6	4	1	4	1
7	24	1	12	2	4	3	4	1
8	28	1	4	7	4	1	4	1
9	32	1	16	2	8	2	4	2
10	36	1	12	3	4	3	4	1
11	40	1	20	2	4	5	4	1
12	48	1	16	3	8	2	4	2
13	48	1	24	2	12	2	4	3
14	52	1	4	13	4	1	4	1
15	56	1	28	2	4	7	4	1
16	60	1	20	3	4	5	4	1
17	64	1	32	2	16	2	4	4
18	72	1	24	3	4	6	4	1
19	72	1	36	2	12	3	4	1
20	76	1	4	19	4	1	4	1
21	80	1	40	2	20	2	4	5
22	88	1	44	2	11	4	4	1
23	96	1	32	3	16	2	4	4
24	96	1	48	2	24	2	4	6

25	104	1	52	2	4	13	4	1
26	112	1	56	2	28	2	4	7
27	120	1	60	2	20	3	4	5
28	120	1	40	3	8	5	4	2
29	120	1	24	5	12	2	4	1
30	128	1	64	2	32	2	4	8
31	128	1	64	2	16	4	4	4
32	128	1	16	8	8	2	4	2
33	132	1	44	3	4	11	4	1
34	136	1	68	2	4	17	4	1
35	144	1	72	2	36	2	4	9
36	144	1	48	3	24	2	12	2
37	144	1	48	3	16	3	4	4
38	144	1	16	9	8	2	4	2
39	152	1	76	2	4	19	4	1
40	160	1	80	2	40	2	4	10
41	160	1	80	2	20	4	4	5
42	160	1	32	5	16	2	4	4
43	168	1	84	2	28	3	4	7
44	176	1	88	2	44	2	4	11
45	184	1	92	2	4	23	4	1
46	192	1	96	2	48	2	4	12
47	192	1	96	2	24	4	4	6
48	192	1	64	3	16	4	4	4
49	192	1	24	8	8	3	4	2
50	208	1	104	2	52	2	4	13
51	216	1	108	2	36	3	4	9
52	224	1	112	2	56	2	4	14
53	240	1	120	2	60	2	4	15
54	240	1	80	3	20	4	4	5
55	240	1	48	5	16	3	8	2
56	240	1	24	10	12	2	4	3
57	256	1	128	2	64	2	4	16
58	256	1	128	2	32	4	4	8
59	256	1	16	16	8	2	4	2
60	264	1	132	2	44	3	4	11
61	272	1	136	2	68	2	4	17
62	272	1	136	2	44	4	4	11
63	272	1	16	17	8	2	4	2

[R1-1719149](#) Offline discussion on SRS configuration table CATT

Agreement

- LTE SRS configuration tables are starting point for NR SRS configuration table design.
- At least 2, 5, 10, 20, 40, 80, 160, 320 slots periodicity are supported for 15KHz SCS
 - FFS on additional periodicities for other numerologies

FFS: supported slot offset for each supported numerology

[R1-1717435](#) Discussion on SRS design for NR ZTE, Sanecips
[R1-1717307](#) UL SRS design for beam management and CSI acquisition Huawei, HiSilicon
[R1-1718467](#) Views on SRS designs Mitsubishi Electric Corp

[R1-1717375](#) Discussion on SRS for NRI Intel Corporation

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R1-1717479	Discussion on SRS design vivo
R1-1717632	Remaining details on SRS Samsung
R1-1717820	Further discussion on remaining issues on SRS CATT
R1-1717948	On SRS design and related operations LG Electronics
R1-1718029	Further discussion on SRS design for NR Guangdong OPPO Mobile Telecom
R1-1718200	Discussions on NR SRS Design NTT DOCOMO, INC.
R1-1718338	Remaining details on SRS MediaTek Inc.
R1-1718450	Details on SRS design Ericsson
R1-1718485	Remaining issues on SRS InterDigital, Inc.
R1-1718518	Remaining details on SRS design in NR Nokia, Nokia Shanghai Bell
R1-1718549	Remaining details on SRS Qualcomm Incorporated
R1-1718659	Considerations on SRS design Sony

7.2.3.6 Remaining details on TRS

[R1-1718857](#) Summary of TRS remaining details MediaTek Inc.

Agreement

Following TRS BWs are supported in NR

- min(BWP, ~50RBs)
- FFS: BWP

UE is not expected to receive TRS outside the BWP

TRS RB position is configured by gNB

Agreement: TRS can be configured on a carrier or on an active BWP when SS block is not present

Conclusion:

Periodic SS burst and periodic TRS burst can be arranged such that the UE can utilize one SS burst and one TRS burst for AGC adjustment and T/F tracking before DRX ON

- No further specification impact may be necessary

[R1-1719148](#) Summary of TRS offline discussion MediaTek

Agreement

- For $N=2+2$, $X=2$, TRS symbols have the same symbol positions in the two consecutive slots
- DMRS and TRS are at least TDMed from UE perspective
- One of the following symbol positions per slot can be configured by RRC,
 - Option 1: symbol 4 and 8 (symbol index starts from 0)
 - Option 2: symbol 5 and 9
 - Option 3: symbol 6 and 10
 - Note 1: Potential down selection can be done until next meeting. It is not limited to select only one option
 - Note 2: RRC signaling to configure TRS as above can be related to the existing RRC signaling for DMRS, CSI-RS, etc.
 - Note 3: It is not precluded to have additional options

[R1-1719133](#) WF on TRS design MediaTek

Agreement

- TRS can be configured as one-port CSI-RS resource(s) with the agreed parameters on St, Sf, N, B, X and Y
 - FFS on one or multiple resources
 - Note: TRS is also supported in above-6GHz
 - FFS on the parameters X, N, St
 - FFS: TRS periodicity
 - For below 6GHz, TRS periodicity 10ms, 20ms, 40ms and 80ms are supported
 - For RAN4 information, 10ms is introduced for high speed train scenario
 - Note: It is up to the editor to capture the periodicity in units of slots
 - TRS BW can be equal to BW of BWP
 - UE is not expected to be simultaneously configured with TRS BW equal to BWP and TRS periodicity of 10ms if the BWP is larger than 50 RBs
 - FFS on CSI-RS measurement restriction functionality can be configured between TRS bursts
 - $Sf=4$
 - FFS: Additional Sf values
 - for below 6GHz

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- FFS on X=1

[R1-1718352](#) On remaining details of TRS MediaTek Inc.
[R1-1718451](#) Details on TRS design Ericsson
[R1-1717747](#) Remaining issues on TRS Spreadtrum Communications
[R1-1718550](#) Remaining issues on TRS Qualcomm Incorporated

[R1-1717308](#) Reference signal for fine time and frequency tracking Huawei, HiSilicon
[R1-1717376](#) Remaining Details on TRS Intel Corporation
[R1-1717436](#) Remaining details on TRS ZTE, Sanechips
[R1-1717480](#) Discussion on TRS vivo
[R1-1717633](#) Remaining details on TRS Samsung
[R1-1717949](#) Discussion on fine time/frequency tracking of channel LG Electronics
[R1-1718519](#) Remaining details of TRS design Nokia, Nokia Shanghai Bell

7.2.3.7 Remaining details on QCL

[R1-1718863](#) Summary of QCL Nokia, Nokia Shanghai Bell

Agreement:

- Observation 1 QCL after RRC for below 6GHz
- SSB → TRS: Doppler shift, average delay
 - Support type B

Agreement: SP CSI-RS is activated with RRC + MAC CE

Agreement: The following P/SP/AP CSI-RS signaling options are supported:

QCL parameter	Reference RS	Target RS	Signalling mode	Reference RS and Target RS should belong to the same CC/BWP or not
Spatial	SSB	P CSI-RS	RRC	Can be on different CCs/BWPs
Spatial	SSB	SP CSI-RS	SP CSI-RS activation signal	Can be on different CCs/BWPs
Spatial	P CSI-RS	Another P CSI-RS	RRC	Can be on different CCs/BWPs
Spatial	SSB or P/SP CSI-RS	AP CSI-RS	RRC or RRC+MAC CE for configuration, indication with DCI	Can be on different CCs/BWPs

[R1-1719069](#) Summary of offline discussions on QCL Nokia, Nokia Shanghai Bell

Working Assumption: After RRC for above 6 GHz

- SSB → [TRS - if is supported for above 6GHz] w.r.t average delay, Doppler shift, spatial RX parameters
- SSB → CSI-RS for BM w.r.t. [average delay, Doppler shift], spatial RX parameters
- SSB → CSI-RS for CSI w.r.t. [average delay, Doppler shift], spatial RX parameters
- SSB → DMRS for PDCCH (before TRS is configured) w.r.t. [average delay, Doppler shift, delay spread, Doppler spread], spatial RX parameters
- SSB → DMRS for PDSCH w.r.t. [average delay, Doppler shift, delay spread, Doppler spread], spatial RX parameters
- CSI-RS for BM → DMRS for PDCCH w.r.t. [average delay, Doppler shift, delay spread, Doppler spread], spatial RX parameters
- CSI-RS for BM → DMRS for PDSCH w.r.t. [average delay, Doppler shift, delay spread, Doppler spread], spatial RX parameters
- CSI-RS for CSI → DMRS for PDSCH w.r.t. average delay, Doppler shift, delay spread, Doppler spread, [spatial RX parameters]
- CSI-RS for BM → CSI-RS for CSI w.r.t. spatial RX parameters

[R1-1719186](#) WF on aperiodic CSI-RS triggering ZTE, Sanechips, Samsung, LG Electronics, NTT DOCOMO, Qualcomm, Intel, ASTRI, Verizon, KDDI, ITH, CEWiT, ITH, Tejas Networks, CHTTL, Sharp, NEC, MediaTek, KT Corporation, Nokia, NSB

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[R1-1718452](#) Details on QCL Ericsson
[R1-1717377](#) On QCL for NR Intel Corporation
[R1-1718769](#) Remaining details on QCL Nokia, Nokia Shanghai Bell (Revision of [R1-1718520](#))

[R1-1717309](#) Details of QCL assumptions and related RS design considerations Huawei, HiSilicon
[R1-1717437](#) QCL design for UL and DL MIMO ZTE, Sanechips
[R1-1717481](#) Discussion on QCL vivo
[R1-1717634](#) Remaining details on QCL Samsung
[R1-1717821](#) On QCL for NR CATT
[R1-1717950](#) Discussion on QCL for NR LG Electronics
[R1-1718057](#) Discussion on Remaining Issues of QCL Guangdong OPPO Mobile Telecom
[R1-1718201](#) Remaining Issues on QCL Design for NR NTT DOCOMO, INC.
[R1-1718394](#) on the remaining details of QCL configuration AT&T
[R1-1718486](#) Remaining issues on QCL InterDigital, Inc.
[R1-1718551](#) Discussion on QCL Qualcomm Incorporated

7.2.3.8 Other

[R1-1717635](#) Discussion on DMRS port scheduling for UL MIMO reception Samsung
[R1-1717636](#) PTRS design for 40 GHz and higher frequency bands Samsung
[R1-1717637](#) Evaluations on pre-DFT PTRS insertion Samsung
[R1-1718069](#) Beam association relationship between data and control channels Guangdong OPPO Mobile Telecom
[R1-1718202](#) Views on DM-RS for mini-slot NTT DOCOMO, INC.
[R1-1718246](#) SRS antenna switching Huawei, HiSilicon
[R1-1718247](#) Evaluation results of DMRS design for DL/UL data channel Huawei, HiSilicon
[R1-1718248](#) Common UL/DL DMRS design Huawei, HiSilicon
[R1-1718249](#) Considerations on UE-specific RS Sequence Design Huawei, HiSilicon
[R1-1718250](#) DMRS design for URLLC Huawei, HiSilicon
[R1-1718251](#) SRS switching among CCs and bandwidth parts Huawei, HiSilicon
[R1-1718453](#) Antenna port mapping tables Ericsson
[R1-1718454](#) On the collision between DMRS and DC subcarrier Ericsson
[R1-1718455](#) CM evaluations of DMRS for pi/2 BPSK Ericsson
[R1-1718552](#) Discussion on Bursty Interference Measurement Resources Qualcomm Incorporated
[R1-1718553](#) Evaluation of DMRS design Qualcomm Incorporated
[R1-1718599](#) Control of UE beamforming in RRC_CONNECTED ASUSTEK COMPUTER (SHANGHAI)
[R1-1718749](#) Further evaluations on DMRS Ericsson
[R1-1718750](#) Further evaluations on PTRS for CP-OFDM Ericsson
[R1-1718751](#) Further evaluations on PTRS for DFT-s-OFDM Ericsson
[R1-1718752](#) On SRS bandwidth table design Ericsson
[R1-1718753](#) Further details on CSI-RS Design Ericsson
[R1-1718754](#) Evaluations on TRS bandwidth Ericsson

7.2.4 Other

Including MIMO calibration

[R1-1717638](#) Beamforming Gain for Spatial Channels with Angular Spread Samsung
[R1-1717639](#) Discussion on feasibility of mobile mmWave Samsung
[R1-1717640](#) Evaluation results for dense urban on 30GHz frequency band Samsung
[R1-1718076](#) Calibration results for NR MIMO system level calibration ITRI
[R1-1718339](#) Codebook based uplink MIMO performance evaluation MediaTek Inc.

7.3 Scheduling/HARQ aspects

7.3.1 Physical downlink control channel

[R1-1718684](#) Open issues on RRC parameters for DL control channel Ericsson

Proposals:

- Conclude on the CORESET relationship to BWP and whether the frequency domain allocation is based on BW part or some other BW
- Conclude starting symbol signaling for CORESET(s)
- Conclude how to put limits on the distribution of the number of blind decodes
- Conclude on parameter ranges for configuration of CORESETs and the possible number of configured CORESETs

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- Conclude on the maximum number of search spaces in a CORESET
- Finalize aspects related to RRC signaling including the search space configuration, the tables for the SFI information and associated signaling in the group common PDCCH
- Conclude on DCI format to be able to finalize the RRC signaling details for it

Decision: The document is noted.

7.3.1.1 PDCCH structure

Remaining details on REG, CCE, RS, interleaving, RE mapping, etc.

R1-1718833 Summary of key aspects for PDCCH structure NTT DOCOMO

Decision: The document is noted.

Agreements:

- Support for a UE, configurable ID for PDCCH DMRS at least for the initialization of DMRS sequence/scrambling.
 - FFS: whether this is used also for other purpose.
 - FFS details including the applicability of configurable ID

R1-1717039 Further details on PDCCH structure ZTE, Sanechips

Observation 1: For NR-PDCCH with interleaving CORESETs and a DMRS density of 1/4th, narrow band DMRS has similar performance as wide band DMRS.

Proposal 1: Wide band DMRS is not supported in NR.

Proposal 2: A block inter-leaver with configurable rows should be supported for NR-PDCCH for variety levels of tradeoff between transmit diversity and channel estimation gain.

- The interleaving unit is a REG bundle.
- Pre-coding granularity more than one REG bundle should be supported at least for interleaved NR-PDCCH.

Decision: The document is noted.

R1-1717061 On NR-PDCCH structure Huawei, HiSilicon

R1-1717378 Remaining details of NR PDCCH structure Intel Corporation

R1-1717483 NR PDCCH structure vivo

R1-1717641 On PDCCH Structure Samsung

R1-1717822 On PDCCH structure CATT

- Proposal: Confirm the working assumption
 - For a CORESET, precoder granularity in frequency domain is:
 - Configurable between i) equal to the REG bundle size in the frequency domain; or ii) equal to the number of contiguous RBs in the frequency domain within the CORESET
 - For ii), DMRS is mapped over all REGs within the CORESET.
- Proposal: Both rectangular interleaver and LTE PDCCH interleaver are sufficient to achieve diversity gain. From the complexity perspective, we slightly prefer rectangular interleaver for NR PDCCH.
- Proposal: Orthogonal MU-MIMO can be supported with 1/4 DMRS overhead by applying either frequency domain or time domain OCC depending on the CORESET duration.
- Proposal: For non-orthogonal MU-MIMO is generated based on the UE identity and a cell-specific or beam-specific ID.
- Observation: The two-step interleaver design seems to target overlapping CORESETs with similar configuration and its operation is somewhat equivalent to configuring several smaller CORESETs.

Decision: The document is noted.

R1-1717883 Discussion on DMRS design for NR-PDCCH CMCC

R1-1717951 Discussion on PDCCH structure LG Electronics

R1-1718042 On NR PDCCH structure design Guangdong OPPO Mobile Telecom

R1-1718077 Discussion on DMRS location for PDCCH ITRI

R1-1718203 Remaining issues of NR-PDCCH structure NTT DOCOMO, INC.

R1-1718322 Remaining issues on PDCCH structure MediaTek Inc.

R1-1718487 Remaining issues of PDCCH structure InterDigital, Inc.

R1-1718554 Remaining issues on PDCCH structure Qualcomm Incorporated

Proposal 1: Frequency-first CCE-to-REG mapping is also supported with multi-symbol CORESET.

Proposal 2: REG bundling size = 2 and 6 are supported with frequency-first CCE-to-REG mapping for multi-symbol CORESET.

Proposal 3: Confirm the working assumption that

Proposal 4: When wideband DMRS is configured for a CORESET,

- DMRS for all the search spaces within the CORESET is based on Cell ID.

When wideband DMRS is not configured for a CORESET,

- DMRS for CSS within the CORESET is based on Cell ID.

- DMRS for UESS within the CORESET is UE-specifically configured.

Proposal 5: Do not introduce orthogonal MU-MIMO DMRS for NR DL control channel.

Observation 1: Configuring overlapping Coresets with different length can support efficient PDCCH resource reuse for PDSCH.

Proposal 6: For 1-symbol and 2-symbol time first CORESET, the aggregation level of 1, 2, 4, 8 is adopted. For a 3-symbol time first mapping CORESET, the aggregation level of 1, 3, 6, 12 is adopted. A larger aggregation level is FFS.

Proposal 7: Adopt alternative 3 (2-step interleaving) with X=12 RBs to support better overlapping coreset coexistence.

- Alt.3: Two-step interleaver
 - First interleaving is within X REG bundles where the interleaving unit is a REG bundle
 - Second interleaving is within the CORESET where the interleaving unit is [6] RBs
 - The first interleaver can take the PDCCH or EPDCCH interleaver as the starting point.
 - The second interleaver is down select between following two options:
 - Alt.3-1: Random interleaver with the PDCCH interleaver as the starting point
 - Alt.3-2: A block interleaver

Decision: The document is noted.

[R1-1718601](#) Remaining details of PDCCH construction Nokia, Nokia Shanghai Bell

[R1-1718799](#) On NR-PDCCH Structure Ericsson (Revision of [R1-1718627](#))

Proposal: When interleaving is used to map CCEs to REGs, the interleaver $f(\cdot)$ operating on REG bundles is

$$f(i) = \left(i \bmod N_{SEG}^{CS} \right) \left(\frac{N_{RB}^{SEG}}{L / N_{SYM}^{CS}} \right) + \left\lfloor i / N_{SEG}^{CS} \right\rfloor,$$

where, L is the number of REGs in a REG bundle, N_{SEG}^{CS} is the number of segments in the CORESET, N_{SYM}^{CS} is the number of OFDM symbols in the CORESET and N_{RB}^{SEG} is the number of (contiguous) PRBs in a segment.

Proposal: For a CORESET, precoder granularity in frequency domain is configurable between the following two options:

- equal to the REG bundle size in the frequency domain
 - equal to the number of contiguous RBs in the frequency domain within the CORESET
- FFS: Whether DMRS is mapped over all REGs within the CORESET when a NR-PDCCH is transmitted with option ii

Proposal:

- A UE assumes three DM-RS REs per REG in REs 2, 6 and 10 in a PRB with REs numbered from 0 to 11 in all REGs in which DMRS is transmitted for both interleaved and non-interleaved REG-to-CCE mapping.
- DMRS sequence generation is done as in LTE based on Gold sequences.

Decision: The document is noted.

[R1-1718699](#) On PDCCH structure Motorola Mobility, Lenovo

Thursday

[R1-1719049](#) Proposal on PDCCH interleaver NTT DOCOMO

Decision: The document is noted.

RAN1 Chair recommendation: RAN1 needs to decide on interleaver, between the two proposed alternatives in [R1-1719049](#).

Alt.1 supported by ZTE, Sanechips, Intel, NTT DOCOMO, Nokia, Nokia Shanghai Bell, MediaTek, LGE, Samsung, OPPO, CATT, MotM, Lenovo

Alt.2 supported by InterDigital, Qualcomm, Huawei, HiSilicon, vivo

Agreements

- NR support the following interleaver
 - The number of rows A configured from $\{2, 3, \text{and } 6\}$, and the number of columns (P/A) , where P is the number of interleaving unit for the given CORESET, and write in the row and read in the column
 - No any further permutation is introduced
 - Cyclic shift of the interleaving unit is applied based on the configurable ID which is independent parameter from the configurable ID for DMRS

Friday

Agreement

- Confirm the WA: DMRS is evenly distributed within a REG
 - DMRS REs are #1, #5, #9

Agreements:

- DMRS sequence is a Gold sequence as in LTE
 - Note: in case if new Gold sequence is introduced for NR, this would be revisited
 - DMRS sequence for NR-PDCCH is obtained according to a reference point in frequency domain.
 - FFS the reference point

Agreements:

- Confirm the WA with the following clarifications (**in red**):
- For **each** CORESET, precoder granularity in frequency domain is:
 - Configurable between i) equal to the REG bundle size in the frequency domain; or ii) equal to the number of contiguous RBs in the frequency domain within the CORESET
 - For ii), DMRS is mapped over all REGs within CORESET.
 - **RAN1 assumes that CORESET for PDCCH scheduling RMSI can be configured with Option i)**
 - **In Option ii) UE may assume DMRS is present in all REGs within the set of contiguous RBs of the CORESET where and when at least one REG of a candidate is mapped.**

7.3.1.2 Search space

Including CORESET configuration, common vs. UE-specific search space design details, number of blind decodes, multi-beam operation, etc.

R1-1718834 Summary of key aspects for search space NTT DOCOMO

Decision: The document is noted.

Agreement:

- Confirm the WA 'Re-use NR DL RA Type 0 basis in units of 6 RBs, where no restriction on the maximum number of segments for a given CORESET' with the following clarifications:
 - This is for the case when the CORESET is configured by at least UE-specific RRC signalling.
 - FFS the RB indexing for resource allocation especially considering interaction with DL BWP
 - Details of resource allocation should take into account the interaction with DL BWP – FFS details

Agreements:

- For slot-based scheduling;
 - Confirm the following working assumption with updates:
 - The first DMRS position either on symbol #2 or symbol #3 is configured by PBCH
 - Maximum time duration of a CORESET is 2 symbols if the first DMRS position of a PDSCH with slot-based scheduling is on symbol #2, and is 3 symbols otherwise.
 - The starting OFDM symbol of a CORESET can be symbol #0, #1, or #2, in a slot.
 - However, the ending OFDM symbol of a CORESET is not later than symbol #2 in a slot.

Agreements:

- In a given CORESET, two types of search spaces (e.g., UE-common search space and UE-specific search space) can have different periodicities for a UE to monitor
 - FFS details of the corresponding search spaces

Discussion further offline whether or not to introduce UE capability related to the max number of blind decodes interacting with time (per slot, periodicity of monitoring, etc.) and with frequency (e.g., # of carriers configured for a UE)

Friday: Above is for email discussion/approval till 10/27 - Fred (NTT DOCOMO)

Thursday

R1-1719027 Proposal on hash function NTT DOCOMO

Decision: The document is noted.

Proposals:

- Alt.1 take the first bullet of [R1-1719027](#)
- Alt.2 take the same hash function of LTE EPDCCH as the hash function of NR-PDCCH

Agreement

- Take the same hash function of LTE EPDCCH as the hash function for NR-PDCCH
 - Further refinements can be further considered till next meeting if necessary

Friday

Agreements:

- One set of the following parameters determines a set of search spaces
 - A set of aggregation levels
 - The number of PDCCH candidates for each aggregation level
 - PDCCH monitoring occasion for the set of search spaces

Agreements:

- At least for cases other than initial access, to identify a set of search spaces, following parameters are configured by UE-specific RRC signaling:
 - The number of PDCCH candidates for each aggregation level of {1, 2, 4, 8, [16]}
 - One value from {0, 1, 2, 3, 4, 5, 6, 8}
 - PDCCH monitoring occasion for the set of search spaces
 - One value of from {1-slot, 2-slot, [5-slot], [10-slot], [20-slot]} (at least 5 values)
 - One or more value(s) from 1st symbol, 2nd symbol, ..., 14th symbol within a monitored slot
 - Each set of search spaces associates with a CORESET configuration by RRC signaling

Email discussion/approval till 10/27 – Fred (NTT DOCOMO)

- For a given CORESET, an association among the following is given where FFS: how to achieve
 - A search space set
 - A DCI format size
 - RNTI
- FFS: Configuration of CORESET periodicity/offset

R1-1717062	CORESET configuration and search space design	Huawei, HiSilicon
R1-1717379	CORESETs and search spaces in NR	Intel Corporation
R1-1717484	Remaining issues on search space design	vivo
R1-1717511	CORESET configuration and Search space for NR-PDCCH	ZTE, Sanechips
R1-1717642	On Search Space Design	Samsung
R1-1717717	Multi-beam operation for NR-PDCCH	Fujitsu
R1-1717748	Discussion on search space design	Spreadtrum Communications
R1-1717823	NR PDCCH search space	CATT
R1-1717884	Discussion on PDCCH search space	CMCC
R1-1717952	Discussion on search space design	LG Electronics
R1-1718043	Discussion of search space design	Guangdong OPPO Mobile Telecom
R1-1718204	Search space design for NR-PDCCH	NTT DOCOMO, INC.
R1-1718283	Configuration of CORESET and search space design	Panasonic
R1-1718323	Discussions on search space and CORESET designs	MediaTek Inc.
R1-1718395	Polar code considerations for search space design	AT&T
R1-1718488	Search space design and CORESET configuration	InterDigital, Inc.
R1-1718555	Remaining issues on control resource set and search space	Qualcomm Incorporated
R1-1718602	On the CORESET configuration and search space design	Nokia, Nokia Shanghai Bell
R1-1718628	On Configuration of Control Resource Sets and Search Space	Ericsson

7.3.1.3 Remaining details on group-common PDCCH

Proposal:

- For the set of possible slot formats for SFI (single-slot & multi-slot), discuss further offline to come up with a table containing the possible entries

Agreement:

- For GC-PDCCH monitoring, confirm the working assumption
 - UE can be configured to monitor SFI in group common PDCCH for a SCell on a different cell

Proposals:

- For cross cell GC-PDCCH monitoring, support the following – need to take into account BWP
 - The same SFI can be applicable to more than one CC
 - Different SFI fields in one GC-PDCCH can be applied to different CCs
 - Different SFI fields in different GC-PDCCH can be applied to different CCs

Thursday

Agreements:

- For cross cell GC-PDCCH monitoring, support by RRC configuration for a UE the following:
 - The same SFI can be applicable to more than one cell
 - Different SFI fields in one GC-PDCCH can be applied to different cells
 - FFS interaction with multiple BWP configuration per cell

Agreements:

- The UE is not expected to have conflict on link (DL or UL) direction between that of dynamic SFI and that of UE specific data (UE specific DCI triggered PDSCH, PUSCH (grant-based), and PUCCH with A/N for a PDSCH) in Rel-15
 - Note: a link direction denoted as “unknown” in dynamic SFI is not deemed as in conflict with DL or UL

Agreements:

- The single slot format table supports up to two D/U switching points per slot
 - Zero switching point: 14 DL symbols, or 14 unknown symbols, or 14 UL symbols.
 - One D/U switching point of all combinations: Start with zero or more DL symbols, end with zero or more UL symbols, and with unknown symbols in between, where there is at least one unknown symbol and one DL or UL symbol.
 - Two D/U switching points within a slot: The first 7 symbols start with zero or more DL symbols, ends with at least one UL symbol at symbol #6 with zero or more unknown symbols in between. The second 7 symbols starts with one or more DL symbols and ends with zero or more UL symbols with zero or more unknown symbols in the middle.
 - Note: This single slot format table will be captured in RAN1 spec. In Rel.15, RAN1 will specify up to $X < [256]$ entries, but the RRC signaling need to consider future compatibility with more entries and from RAN1 perspective, a total of [256] entries in the RRC signalling is necessary (with only X entries specified in Rel-15 in RAN1)

Agreements:

- gNB configures a per serving cell GC-PDCCH (for dynamic SFI) monitoring periodicity of K slots (based on GC-PDCCH numerology), up to 8 choices
 - $K = 1, 2, 5, 10, 20$
 - FFS other values

Agreements:

- For the UE specific single-slot/multi-slotset SFI table configuration
 - Each entry of the table indicates a sequence of configured single-slot slot formats
 - Note if the sequence length is 1, the entry is a single-slot slot format
 - Note if the sequence length is more than one, the entry is a multi-slot slot format
 - Note that it is possible all the slots in a multi-slot slot-format can have the same slot format
 - Note The entries in the table can be of different length including a mix of single slot SFI and multi-slot SFI
 - The length of each entry in the table is FFS, e.g., multiple of configured GC-PDCCH monitoring period, a fraction of the configuration GC-PDCCH monitoring period, etc.

Agreements:

- GC-PDCCH for dynamic SFI monitoring
 - For same cell GC-PDCCH monitoring: UE is required to monitor at most one GC-PDCCH per spatial QCL per configuration period carrying dynamic SFI in the active BWP in the cell
 - The coreset(s) is located in the first 1/2/3 symbols in a slot
 - Configuration of GC-PDCCH for UE to monitor is FFS especially considering interaction with BWP configuration
 - Note: This is not intended to address the case of multi-TRP which is deprioritized before Dec.
 - FFS when configure the GC-PDCCH monitoring for dynamic SFI, the gNB will configure the payload length of GC-PDCCH and an index of the location in DCI for dynamic SFI

Friday

Above agreements is modified as follows:

Agreements:

- GC-PDCCH for dynamic SFI monitoring
 - For same cell GC-PDCCH monitoring: UE is required to monitor at most one GC-PDCCH per spatial QCL per configuration period carrying dynamic SFI in the active BWP in the cell
 - The coreset(s) is located in the first 1/2/3 symbols in a slot

- Configuration of GC-PDCCH for UE to monitor is FFS especially considering interaction with BWP configuration
- Note: This is not intended to address the case of multi-TRP which is deprioritized before Dec.
- When configuring the GC-PDCCH monitoring for dynamic SFI, the gNB will configure the payload length
- When configuring the GC-PDCCH monitoring for dynamic SFI for a serving cell, the gNB will configure the location of the bits used for the dynamic SFI in the payload

R1-1719172 Offline discussion on GC-PDCCH carrying SFI Qualcomm Inc.

Proposals:

- For the blind decoding of GC-PDCCH carrying SFI, the GC-PDCCH blind decoding is configured with one decoding candidate at a configured starting CCE with a configured aggregation level in a CSS or group-CSS in a configured coresets
- On overwriting rules across semi-static DL/UL assignment, dynamic SFI, DCI, etc
 - Need to decide the overwriting rules between
 - Semi-static DL/UL assignment (including states DL, UL, unknown)
 - Dynamic SFI (indicated in GC-PDCCH with states DL, UL, and unknown)
 - UE specific data transmission (UE specific DCI triggered PDSCH, PUSCH, and PUCCH with A/N for a PDSCH)
 - FFS: Broadcast transmission (sync, PRACH, RAR,...)
 - FFS: SPS transmission
 - Measurement: Measurement related signals semi-statically configured by RRC (eg. periodic/semi-persistent CSI-RS for CSI report, periodic CSI report, periodic/semi-persistent SRS) where a DL or UL direction will be assumed
 - FFS: CSI-RS for RRM, TRS, etc
 - FFS: Other signals, measurements, and monitoring (including configured coresets monitoring)
 - Consider the following directions of potential overwriting in Rel. 15:
 - States from semi-static DL/UL assignment overwritten by measurement, dynamic SFI, or UE specific data
 - State from measurement overwritten by dynamic SFI or UE specific data
 - Dynamic SFI overwritten by UE specific data
 - For the states from semi-static DL/UL assignment
 - “Unknown” in semi-static DL/UL assignment can be overwritten by measurement, dynamic SFI, and UE specific data
 - DL/UL in semi-static DL/UL assignment cannot be overwritten to the other direction (DL to UL or UL to DL) by measurement, dynamic SFI and UE specific data
 - DL/UL in semi-static DL/UL assignment cannot be overwritten by “unknown” by dynamic SFI
 - For the states from measurement in symbols not under DL/UL from semi-static DL/UL assignment:
 - DL/UL direction implied by measurement can be overwritten by unknown in dynamic SFI
 - UE behavior will be the cancellation of the measurement or measurement related transmission
 - DL/UL direction implied by measurement can be overwritten by UL/DL from dynamic SFI
 - UE behavior will be the cancellation of the measurement or measurement related transmission
 - DL/UL direction implied by measurement can be overwritten by UE’s own UE-specific data if the UE specific data implies the other direction
 - UE behavior will be the cancellation of the measurement or measurement related transmission
 - UE will follow the DCI for UE-specific data transmission and reception
 - For the states in dynamic SFI in symbols not under DL/UL from semi-static DL/UL assignment (Already agreed in other agreements and only include for completeness)
 - UL/DL in dynamic SFI cannot be overwritten by UE specific data
 - UE will treat it as an error case when UE specific data and dynamic SFI imply different transmit directions
 - Unknown in dynamic SFI can be overwritten by UE specific data (change to DL or UL)
 - UE will follow the DCI for UE-specific data transmission and reception
- When a configured GC-PDCCH carrying dynamic SFI is not detected (detection erasure event)
 - UE assumes “unknown” dynamic SFI is received for all symbols in the current monitoring period

Email discussion/approval till 10/27 – Jing (Qualcomm)

Agreements:

- For the cell-specific higher layer signalling on semi-static DL/UL assignment, the transmission indication is in pattern of DL-unknown-UL. The signaling include:
 - For DL resources indication, the signaling include:
 - Number of full DL slot(s) (x1) at the beginning of the period. Values for x1 include {0,1,..., (Number of slots in a UL-DL switching periodicity)}
 - Number of DL symbol(s) follow the full DL slots (x2). Values for x2 include {0,1,..., 13}

- For UL resource indication, the signaling include:
 - Number of full UL slot(s) (y1) at the end of the period. Values for y1 include {0,1,..., (Number of slots in a UL-DL switching periodicity)}
 - Number of UL symbol(s) (y2) preceeds full UL slots. Values for y2 include {0,1,..., 13}
- The resource(s) in a period between DL and UL segments are unknown resources.
- FFS The UE does not receive and not transmit on 'Unknown' resources in cell-specific higher layer signalling if not otherwise indicated.

Agreements:

- For the UE-specific higher layer signalling on semi-static DL/UL assignment,
 - The signaling includes the indication as per slot basis, the signalling includes:
 - Number of DL symbol(s) (y3) in the beginning of slot No.x3
 - Values for x3 include {1,..., (Number of slots in a UL-DL switching periodicity)}
 - Values for y3 include {0,1,...,13,14}
 - Number of UL symbol(s) (y4) in end of slot No.x4
 - Values for x4 include {1,..., (Number of slots in a UL-DL switching periodicity)}
 - Values for y4 include {0,1,...,13,14}
 - The resource(s) in a slot without DL/UL indication are unknown resource(s).
 - FFS the UE does not receive and not transmit on 'Unknown' resources in UE-specific higher layer signalling if not otherwise indicated.
 - FFS At most single DL/UL switching point exists in a UL-DL switching periodicity.

Agreement: GC-PDCCH for SFI is associated with a SFI RNTI by configuration

R1-1717063	Remaining details of group-common PDCCH	Huawei, HiSilicon
R1-1717380	On group-common PDCCH	Intel Corporation
R1-1717485	Design of group-common PDCCH	vivo
R1-1717512	Remaining details on group-common PDCCH	ZTE, Sanechips
R1-1717643	On UE-Group Common PDCCH	Samsung
R1-1717782	Slot format indicator in Group-common PDCCH	Apple Inc.
R1-1717824	Remaining design aspects of slot format indication	CATT
R1-1717885	Discussion on Signalling and UE behavior for DL and UL transmission assignment	CMCC
R1-1717953	Discussion on group common PDCCH	LG Electronics
R1-1718000	Discussion on group-common PDCCH	ETRI
Withdrawn		
R1-1718044	Discussion of Group Common PDCCH	Guangdong OPPO Mobile Telecom
R1-1718078	UE behavior in unknown resource	ITRI
R1-1718205	Remaining details on group-common PDCCH	NTT DOCOMO, INC.
R1-1718276	Remaining issues on group-common PDCCH for NR	WILUS Inc.
R1-1718284	Remaining details on group-common PDCCH	Panasonic
R1-1718324	Design of GC PDCCH	MediaTek Inc.
R1-1718396	Remaining details on group common PDCCH	AT&T
R1-1718461	Discussion on the remaining issues of group common PDCCH	Xiaomi Technology
R1-1718489	On Group-Common PDCCH Structure and Contents	InterDigital, Inc.
R1-1718556	Remaining issues on slot format indication	Qualcomm Incorporated
R1-1718600	Discussion on GC PDCCH	ASUSTEK COMPUTER (SHANGHAI)
R1-1718603	On the remaining aspects of group-common PDCCH in NR	Nokia, Nokia Shanghai Bell
R1-1718629	On Group-Common PDCCH	Ericsson
R1-1718668	On remaining details on group-common PDCCH	Sony
R1-1718700	On group-common PDCCH	Motorola Mobility, Lenovo

7.3.1.4 DCI contents and formats

[R1-1718630](#) Summary of e-mail Discussion on DCI Contents Ericsson

Decision: The document is endorsed as starting point for further discussion.

[R1-1718785](#) Summary of 7.3.1.4 (DCI contents and formats) Ericsson

Decision: The document is noted.

Agreements:

- For multiple DCI formats with the same DCI size of a same RNTI, an explicit identifier is included in the respective DCI format to distinguish them

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- Note: the same DCI size may come from a few (but not a large number of) zero-padding bits at least in UE-specific search space

Proposals:

- The “fallback DCI” for DL and the “fallback DCI” for UL have the same size
- FFS The “fallback DCI” has the same size at that of the DCI used for common messages (e.g. paging, RMSI scheduling)

Proposal: For RNTI used for NR PDCCH, the number of bits is 16

Friday

Email discussion/approval on DCI contents/formats till next meeting – Stefan (Ericsson)

R1-1718630	Summary of e-mail Discussion on DCI Contents	Ericsson
R1-1717064	DCI contents and formats in NR	Huawei, HiSilicon
R1-1717486	DCI format size and blind decoding	vivo
R1-1717644	DCI Contents and Formats	Samsung
R1-1717825	Discussion on NR DCI formats	CATT
R1-1717886	Discussion on NR DCI format design	CMCC
R1-1717954	Further discussion on DCI formats	LG Electronics
R1-1718045	Considerations on DCI formats and DCI contents	Guangdong OPPO Mobile Telecom
R1-1718285	Discussion on DCI formats	Panasonic
R1-1718325	Discussions on DCI formats in NR	MediaTek Inc.
R1-1718557	Discussion on DCI related issues	Qualcomm Incorporated
R1-1718604	On DCI formats, DCI content and the configurability of DCI fields in NR	Nokia, Nokia Shanghai Bell
R1-1718722	DL HARQ feedback for UL grant free transmission	Sequans Communications

7.3.1.5 Other

R1-1717065	Dynamic and semi-static DL/UL resource partition	Huawei, HiSilicon
R1-1717084	UE procedure of PDCCH monitoring for URLLC	Huawei, HiSilicon
R1-1717086	PDCCH reliability for URLLC	Huawei, HiSilicon
R1-1717088	DCI design for URLLC	Huawei, HiSilicon
R1-1717381	Ultra-reliability for NR PDCCH	Intel Corporation
R1-1717487	DCI contents and design	vivo
R1-1717488	Discussion on ultra-reliable design for PDCCH	vivo
R1-1717513	Supporting Multi-beam in NR-PDCCH	ZTE, Sanecips
R1-1717645	On UE Power Savings	Samsung
R1-1717646	PDCCH Design for URLLC	Samsung
R1-1717647	Remaining Aspects for PDCCH	Samsung
R1-1717751	On the resource sharing between NR-PDCCH and NR-PDSCH	Spreadtrum Communications
R1-1717781	Control information for UE power saving	Apple Inc.
R1-1717887	Discussion on coverage enhancement transmission of PDCCH	CMCC
R1-1717902	Resource multiplexing between PDCCH and PDSCH	Huawei, HiSilicon
R1-1717903	Design considerations for UE power saving	Huawei, HiSilicon
R1-1717955	Discussion on DL control with ultra-reliability requirement	LG Electronics
R1-1718046	PDCCH for URLLC	Guangdong OPPO Mobile Telecom
R1-1718206	DL control channel design for URLLC	NTT DOCOMO, INC.
R1-1718360	Considerations for ultra-reliable DCI transmission	InterDigital, Inc.
R1-1718422	Consideration on physical downlink control channel for URLLC	CATR
R1-1718558	Advanced Grant Indication for UE Power Saving	Qualcomm Incorporated
R1-1718605	On the URLLC specific aspects for DL control channel	Nokia, Nokia Shanghai Bell
R1-1718606	On the usage of PDCCH DMRS as a complementary synchronization signal in DL	Nokia, Nokia Shanghai Bell
R1-1718631	On PDCCH for Ultra-Reliable Transmission	Ericsson

7.3.2 Physical uplink control channel

R1-1718685	Open issues on RRC parameters for UL control channel	Ericsson
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7.3.2.1 PUCCH structure in short-duration

R1-1718862	Summary of PUCCH structure in short-duration (7.3.2.1)	Ericsson	(Revision of R1-1718812)
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Decision: The document is noted.

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7.3.2.1.1 Short-PUCCH for UCI of up to 2 bits

Focus on short-PUCCH on a OFDM symbol.

Conclusion:

- Summarize the performance of the new length-12 sequences (also considering at least DM-RS for long PUCCH and DM-RS for DFT-s-OFDM based PUSCH for mod order >BPSK) and compare with LTE sequences ([R1-1718844](#)). Aim to decide on the set of sequences within this week

Agreement:

- In Rel-15, only length 12 sequences are supported for short PUCCH for up to 2 bits (PUCCH format 0) and long PUCCH for up to 2 bits

Agreements:

- For HARQ-ACK transmission using short PUCCH for up to 2 bits
 - In case of 1-bit HARQ-ACK only:
 - The distance between the two cyclic shifts within a PRB is 6
 - In case of 2-bit HARQ-ACK only
 - The distance between any two adjacent cyclic shifts within a PRB is 3
 - In case of 1-bit HARQ-ACK & SR (positive or negative)
 - FFS
 - In case of 2-bit HARQ-ACK & SR (positive or negative)
 - FFS

Agreements:

- In case of SR due at the same time with other UCI, the physical layer can only transmit one SR at any given time
 - If multiple SR are triggered prioritization of which SR should be transmitted is decided by RAN2

Proposal:

- In addition to the already agreed short PUCCH resources in the last and second last symbols, additional short PUCCH resources can be configured in other symbols of a slot.

Thursday Agreement:

- In addition to the already agreed short PUCCH resources in the last and second last symbols, additional short PUCCH resources can be configured in other symbols of a slot
 - FFS whether or not such a configuration is conditioned on non-slot based operation

CATT: concern with the FFS – don't understand the condition

RAN1 chair – let's put it offline

[R1-1717514](#) On short PUCCH for up to 2 bits UCI ZTE, Sanechips

- Observation 1: If the cyclic shifts of one UE can be assigned into multiple RBs, benefits can be achieved on link level performance, forward compatibility, multiplexing capacity and high reliability of {NACK to ACK} for URLLC.
- Proposal 1: For sequence based short PUCCH, the cyclic shifts of one UE for HARQ-ACK transmission can be assigned into multiple RBs.
- Proposal 2: For sequence based short PUCCH, the cyclic shifts and RBs can be RRC configured for ACK/NACK states and dynamically selected by DCI.
- Proposal 3: Support the multiplexing of UEs in one RB for HARQ-ACK transmission in sequence-based short PUCCH.
- Proposal 4: The multiplexing of the sequence based PUCCH with other UL signal(s) should be adopted.
- Proposal 5: When positive SR and 2-bit HARQ-ACK are to be transmitted in sequence based short PUCCH, HARQ-ACK bundling is applied. 2 Channel resources (RB + sequence) are configured for SR.
- Proposal 6: L1 signaling to dynamically release or enable the SR resources should be considered for SR configuration in NR.
- Proposal 7: Each root sequence of CGSs for short PUCCH should be with low CM. The cross-correlations among root sequences should be kept low.

Decision: The document is noted.

Wednesday:

[R1-1718949](#) WF on new NR CG sequences for PUCCH Intel Corporation, Qualcomm Inc., Huawei, HiSilicon, CATT, KT Corporation, WILUS Inc., Acorn Technologies, Samsung

Agreements:

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- The sequences on slide 4 in [R1-1718949](#) are adopted as the set of length-12 base sequences for short PUCCH for up to 2 bits and DM-RS for long PUCCH for UCI of up to 2 bits, except the entries 2/3/10/11 which are supported as baseline
 - Refinement of entries of 2/3/10/11 can be done till this Friday
 - Companies are encouraged to further check 2/3/10/11 and possibly new sequences as proposed in [R1-1719002](#) for entries 2/10/11 combined with entry 3 in [R1-1719003](#)
 - If no additional consensus can be reached by Friday regarding possibly having new sequences for entries 2/3/10/11, the sequences in [R1-1718949](#) for entries 2/3/10/11 will be agreed.

Thursday

Agreements:

- For short PUCCH for up to 2 UCI bits, the base sequence can be hopped for transmission of PUCCH in different slots
 - The base sequence hopping can be enabled or disabled by cell-specific RRC parameters via RMSI.
 - Hopping pattern is at least based on a configurable ID
 - FFS on details of the hopping pattern
 - The ID has a bitwidth of [10] bits
 - FFS on cyclic shift hopping
 - No RRC signaling impact

Friday

Wednesday agreements on CG sequences are modified as follows:

Agreement: The sequences on slide 4 in R1-1718949 are adopted as the set of length-12 base sequences for short PUCCH for up to 2 bits and DM-RS for long PUCCH for UCI of up to 2 bits

R1-1717066	Short PUCCH for UCI of up to 2 bits	Huawei, HiSilicon
R1-1717382	Short PUCCH for UCI of up to 2 bits	Intel Corporation
R1-1717489	Design of short-PUCCH for UCI up to 2 bits	vivo
R1-1717648	Short PUCCH for UCI of 1 or 2 Bits	Samsung
R1-1717826	On short PUCCH design for up to two UCI bits	CATT
R1-1717920	Sequence design for short PUCCH up to 2 bits	IITH
R1-1717956	Design of short PUCCH for UCI of up to 2 bits for NR	LG Electronics
R1-1718032	Short-PUCCH for up to 2 UCI bits	Guangdong OPPO Mobile Telecom
R1-1718207	Short-PUCCH for UCI of up to 2 bits	NTT DOCOMO, INC.
R1-1718253	Discussion on 1-symbol short-PUCCH for UCI of up to 2 bits	Panasonic Corporation
R1-1718277	Discussion on multiplexing of HARQ-ACK and SR on Short PUCCH	WILUS Inc.
R1-1718304	Remaining details of short PUCCH for UCI up to 2 bits	Nokia, Nokia Shanghai Bell
R1-1718490	Evaluation of CGS candidates for PUCCH	InterDigital, Inc.
R1-1718559	Channelization of 1-symbol short PUCCH with 1 or 2 bits payload	Qualcomm Incorporated
R1-1718632	On the Design of 1-Symbol PUCCH for up to 2 bits	Ericsson

7.3.2.1.2 Short-PUCCH for UCI of more than 2 bits

Focus on short-PUCCH on a OFDM symbol.

Agreements:

- For short-PUCCH for UCI of more than 2 bits
 - Only contiguous PRB allocation within a symbol is supported in release-15
 - In addition to RRC configuration, the number of PRBs can be additionally determined based on the following:
 - As a function of UCI payload size
 - Dynamic indication via DCI
 - FFS the detailed determination method
 - FFS the set of supported PRBs

Agreements:

- For short-PUCCH for UCI of more than 2 bits, the LTE PN sequence generator is used for scrambling of the encoded bits and generation of DM-RS for the PUCCH
 - Note: can be revisited if new Gold sequences are introduced

Proposals:

- Simultaneous transmission of HARQ-ACK bits and CSI feedback with/without SR with PUCCH format 2 is supported
 - Support both

- Case 1: separately encode the CSI feedback and the HARQ-ACK bits with and without SR
 - FFS resources for CSI and HARQ-ACK (w/ & w/o SR)
- Case 2: jointly encode the CSI feedback and the HARQ-ACK bits with and without SR
 - FFS the applicable scenarios for case 1 and case of the above
- Also need to consider other PUCCH formats and the case of UCI on PUSCH
- Check offline also whether different CSI types for P-CSI are allowed to be transmitted in the same PUCCH or not

Thursday agreements:

- Simultaneous transmission of HARQ-ACK bits and CSI feedback with/without SR with PUCCH format 2 is supported by RRC configuration
 - FFS details
 - There is no additional RRC signaling involved in regarding how encoding is done for CSI/HARQ-ACK/SR
 - Note that whether some UCI is dropped or not is not considered as part of the encoding in the above bullet

R1-1717067	Short PUCCH for UCI of more than 2 bits	Huawei, HiSilicon
R1-1717383	Short PUCCH for UCI of more than 2 bits	Intel Corporation
R1-1717490	Design of short-PUCCH for UCI of more than 2 bits	vivo
R1-1717649	Short PUCCH for UCI of more than 2 Bits	Samsung
R1-1717827	On short PUCCH design for more than two UCI bits	CATT
R1-1717957	Design of short PUCCH for UCI of more than 2 bits for NR	LG Electronics
R1-1718208	Short-PUCCH for UCI of more than 2 bits	NTT DOCOMO, INC.
R1-1718305	On remaining details of short PUCCH for UCI of more than 2 bits	Nokia, Nokia Shanghai Bell
R1-1718560	Channelization of 1-symbol short PUCCH with more than 2 bits payload	Qualcomm Incorporated
R1-1718633	On the Design of 1-Symmol PUCCH for more than 2 bits	Ericsson

7.3.2.1.3 Support of short-PUCCH over 2 OFDM symbols

Further discussion offline especially w.r.t. whether or not there is RRC impact

R1-1717068	Short PUCCH over 2 OFDM symbols	Huawei, HiSilicon
R1-1717384	2-symbol NR PUCCH	Intel Corporation
R1-1717491	Support of short-PUCCH over 2 OFDM symbols	vivo
R1-1717650	Short PUCCH over 2 OFDM Symbols	Samsung
R1-1717958	Support of short PUCCH over 2 OFDM symbols for NR	LG Electronics
R1-1718209	Support of short-PUCCH over 2 OFDM symbols	NTT DOCOMO, INC.
R1-1718306	On remaining aspects of 2-symbol short PUCCH design	Nokia, Nokia Shanghai Bell
R1-1718491	On HARQ-ACK and SR multiplexing on Short-PUCCH	InterDigital, Inc.
R1-1718561	Channelization of 2-symbol short PUCCH	Qualcomm Incorporated
R1-1718634	On the Design of 2-Symbols PUCCH	Ericsson

7.3.2.2 PUCCH structure in long-duration

[R1-1718821](#) Summary of issues in AI 7.3.2.2. PUCCH structure in long duration Huawei, HiSilicon

Decision: The document is noted.

For FH for long-PUCCH for UCI of up to 2 bits & more than 2 bits, to have more detailed analysis (performance, complexity, multiplexing, etc.) – to revisit later this week

Wednesday:

Agreement: For long PUCCH for UCI of up to 2 bits and long PUCCH for UCI of more than 2 bits: for duration of 4-14 symbols, frequency-hopping is enabled/disabled by RRC UE-specifically.

7.3.2.2.1 Long-PUCCH for UCI of up to 2 bits

Focus on long-PUCCH within a slot.

[R1-1717069](#) Long PUCCH for UCI of up to 2 bits Huawei, HiSilicon

Proposal 1: For structures of NR long PUCCH with up to 2 bits, frequency hopping should locate at the middle of N-symbol long PUCCH:

- When N is even, the end of first frequency-hop is at symbol $(N/2-1)$;
 - When N is odd, the end of first frequency-hop is at symbol $((N+1)/2-1)$ or $((N-1)/2-1)$;
- Note: the start of symbol index of long PUCCH is from 0.

Proposal 2: For structures of NR long PUCCH with up to 2 bits, different length of time domain OCC is applied depending on the number of symbols for the long PUCCH:

- If frequency hopping is enabled,
 - OCC multiplexing capacity is 1 for 7-symbol;
 - OCC multiplexing capacity is 2 for 11-symbol;
- If frequency hopping is disabled,
 - OCC multiplexing capacity can be configured by gNB.

Decision: The document is noted.

R1-1717515 On long-PUCCH for up to 2 bits ZTE, Sanechips

- Observation 1: All Alt1~4 have close performance in almost all the number of symbols (4 ~ 14), except that the number of symbols is 6.
- Observation 2: When the number of symbols is 6 for long PUCCH, Alt3 and Alt4 are significantly better than Alt1 and Alt2 in very high speed scenarios.
- Proposal 1: The duration of long PUCCH can be smaller than the available UL symbols in a slot.
- Proposal 2: The frequency hopping should be configurable.
- Proposal 3: If long PUCCH with 1~2bits UCI is enabled for frequency hopping, DM-RS is located in all the even symbols in each hop, where the symbol is indexed from the start of the hop of value 0.
- Proposal 4: For 1~2 bits PUCCH format with different lengths, various types of multiplexing should be encouraged to study in order to enhance PUCCH multiplexing capability and make full use of resources.
- Proposal 5: $\text{Floor}(\text{Ceiling}(N/2)/2) \times 2(\text{Alt4})$ should be selected as the frequency hopping point determination function for long PUCCH with 1 to 2 bits UCI.

Decision: The document is noted.

R1-1718562 Long PUCCH design with 1 or 2 bits UCI payload Qualcomm Incorporated

Proposal 1: NR should use the same set of sequences in short PUCCH and long PUCCH for transmission of up to 2 UCI bits on one PRB.

Proposal 2: Consider the sequences in table 1 as CGS sequences for 1 RB in short and long PUCCH transmission of up to 2 bits of UCI.

Proposal 3: For a long PUCCH with N symbols to carry 1 or 2 bits UCI, if hopping is enabled, the hopping boundary is determined as follows

- $N/2-1$ where $\text{mod}(N,4)=2$; $\text{floor}(N/2)$ otherwise

Decision: The document is noted.

Proposals:

- For long PUCCH with duration of 4-14 symbols, frequency-hopping is enabled/disabled by RRC
 - If frequency hopping is enabled, the OCC multiplexing capacity for 7-symbol long PUCCH is 1, and for 11-symbol long PUCCH is 2.
 - If frequency hopping is disabled, at least OCC multiplexing capacity of 2 and 3 are supported.

Wednesday:

Working assumption:

- For long-PUCCH for UCI of up to 2 bits, if frequency hopping is enabled, the OCC multiplexing capacity for 7-symbol long PUCCH is 1, and for 11-symbol long PUCCH is 2.

Agreements:

- For long-PUCCH for UCI of up to 2 bits, if frequency hopping is disabled, OCC multiplexing capacity of 2,3,4,5,6,7 are supported.
 - For each duration of long PUCCH for UCI of up to 2 bits, there is only one OCC multiplexing capacity

Agreement:

- OCC multiplexing capacity for each long PUCCH duration for long-PUCCH for UCI of up to 2 bits is given as follows:

Long-PUCCH duration N	OCC Multiplexing capacity M	
	with hopping	without hopping
4	1	2
5	1	2
6	1	3
7	[1]	3
8	2	4
9	2	4
10	2	5
11	[2]	5
12	3	6
13	3	6
14	3	7

Thursday

Agreements:

- For long PUCCH for up to 2 UCI bits, the base sequence can be hopped for transmission of PUCCH in different slots
 - The base sequence hopping can be enabled or disabled by cell-specific RRC parameters via RMSI
 - Note this parameter for hopping is the same as the one used for short PUCCH for up to 2 UCI bits
 - Hopping pattern is at least based on a configurable ID
 - FFS on details of the hopping pattern
 - The ID has a bitwidth of [10] bits
 - FFS on cyclic shift hopping
 - No RRC signaling impact

Agreements:

- If frequency hopping is enabled for long PUCCH for UCI of up to 2 bits and more than 2 bits, hopping boundary is determined by long PUCCH duration/start symbol of long PUCCH
 - No RRC configuration is involved in determining the hopping boundary

Agreements:

- For long PUCCH, reuse LTE OCC code for OCC length =2,3,4,5
 - FFS OCC code for OCC length =6,7
- Note: For long PUCCH for UCI of up to 2 bits,
 - If FH is enabled, support OCC length on DMRS = number of DMRS symbol in each hop, support OCC length on UCI = number of UCI symbol in each hop
 - If FH is disabled, support OCC length on DMRS = number of DMRS symbol in the long PUCCH, support OCC length on UCI = number of UCI symbol in the long PUCCH

[R1-1717385](#) Long PUCCH for up to 2 UCI bits Intel Corporation
[R1-1717492](#) Design of long-PUCCH for UCI of up to 2 bits vivo
[R1-1717651](#) Long PUCCH for UCI of 1 or 2 Bits Samsung
[R1-1717828](#) Remaining details of long PUCCH for up to 2 UCI bits CATT
[R1-1717860](#) Long PUCCH design for UCI of up to 2 bits Lenovo, Motorola Mobility
[R1-1717921](#) Sequence design for long PUCCH up to 2 bits IITH
[R1-1717959](#) Design of long PUCCH for UCI of up to 2 bits for NR LG Electronics
[R1-1718005](#) RE mapping for PUCCH of 1 or 2 bits ETRI
[R1-1718210](#) Long-PUCCH for UCI of up to 2 bits NTT DOCOMO, INC.
[R1-1718254](#) Channel structure and frequency-hopping details of long-PUCCH for UCI of up to 2 bits Panasonic Corporation
[R1-1718307](#) Remaining details of Long PUCCH with small UCI payload Nokia, Nokia Shanghai Bell
[R1-1718397](#) On long PUCCH for UCI up to 2 bits AT&T
[R1-1718635](#) On the Design of Long PUCCH for up to 2 bits Ericsson

7.3.2.2.2 Long-PUCCH for UCI of more than 2 bits

Focus on long-PUCCH within a slot.

Agreement:

- For long PUCCH for UCI of more than 2 bits
 - Reuse DMRS sequences of DFT-S-OFDM PUSCH if it occupies more than one PRB

Agreements:

- For the case of length-12 sequences, the same set of sequences are used for at least for the following:
 - DM-RS for long PUCCH for UCI of up to 2 bits,
 - DM-RS for long PUCCH for UCI of more than 2 bits,
 - DM-RS for long-PUCCH over multiple slots,
 - DM-RS for DFT-S-OFDM PUSCH with modulation order higher than BPSK
 - FFS other cases (e.g., short PUCCH for UCI of up to 2 bits, data symbols for long PUCCH, etc.)

Proposal:

- Reuse LTE design of bit-level scrambling for long PUCCH for UCI of more than 2 bits

Proposals:

- Support Pre-DFT-OCC as the UCI structure for long PUCCH with moderate payload
- Support at least multiplexing capacity of 2 users for long PUCCH with moderate payload using one PRB in Rel-15

Thursday Proposals:

- Support Pre-DFT-OCC as the UCI structure for long PUCCH for UCI of more than 2 bits with moderate payload
 - FFS: DMRS structure between CDM and IFDM
 - Considering the impact on channel estimation and power imbalance among UEs
- Support multiplexing capacity of 2 and 4 users for long PUCCH for UCI of more than 2 bits with moderate payload using one PRB in Rel-15
 - FFS design of OCC
 - No RRC signalling is necessary

Friday

Agreement:

- For long-PUCCH for UCI of more than 2 bits, the LTE PN sequence generator is used for scrambling of the encoded bits
 - Note: can be revisited if new Gold sequences are introduced

Agreements:

- Support Pre-DFT-OCC as the UCI structure for long PUCCH for UCI of more than 2 bits with moderate payload
 - FFS: DMRS structure between CDM and IFDM
 - Considering the impact on channel estimation and power imbalance among UEs
 - It will be denoted as a new format
- Support multiplexing capacity of 2 and 4 users for long PUCCH for UCI of more than 2 bits with moderate payload using one PRB in Rel-15
 - FFS design of OCC
 - No RRC signalling is necessary

Agreements:

- For long PUCCH for UCI of more than 2 bits
 - If frequency hopping is enabled, the number of DMRS symbols (between 1-2 symbol) per hop for long PUCCH duration per hop $> X$ is configurable by RRC UE-specifically
 - RRC Bit-width is 1 bit
 - X is fixed in the spec w/o RRC impact
 - FFS the value X
 - The location of DMRS is pre-defined within long PUCCH in each hop based on number of DMRS per hop and duration of the hop.

Email approval on the disabled frequency hopping case related to the above agreements till 10/27 – Hua (Huawei)

WF on pi/2 BPSK based long PUCCH carrying more than 2 UCI bits

For long duration PUCCH carrying more than 2 bits:

- Use pi/2 BPSK modulation, spectrum shaping can be used similar to pi/2 BPSK PUSCH

Email discussion/approval of the above till 10/27 – Hua (Huawei)

R1-1717070	Long-PUCCH for UCI of more than 2 bits	Huawei, HiSilicon
R1-1717386	Long PUCCH for more than 2 UCI bits	Intel Corporation
R1-1717493	Design of long-PUCCH for UCI of more than 2 bits	vivo
R1-1717516	On long-PUCCH for more than 2 bits	ZTE, Sanechips
R1-1717652	Long PUCCH for UCI of more than 2 Bits	Samsung
R1-1717759	On pre-DFT additional RS insertion for long PUCCH	Mitsubishi Electric RCE
R1-1717829	Design of long PUCCH formats with different multiplexing capacities	CATT
R1-1717861	Long PUCCH design for UCI of more than 2 bits	Lenovo, Motorola Mobility
R1-1717923	On use of pi/2 BPSK modulation for long PUCCH with more than 2 bits UCI	IITH
R1-1717960	Design of long PUCCH for UCI of more than 2 bits for NR	LG Electronics
R1-1718211	Long-PUCCH for UCI of more than 2 bits	NTT DOCOMO, INC.
R1-1718257	Design of long-PUCCH for UCI of more than 2 bits	Panasonic Corporation
R1-1718308	On the remaining details of long PUCCH for UCI more than 2 bits	Nokia, Nokia Shanghai Bell
R1-1718398	On long PUCCH for more than 2 bits	AT&T
R1-1718416	DMRS and multiplexing methods for NR long PUCCH with more than 2 bits	Sharp
R1-1718421	Considerations on long PUCCH for UCI of more than 2 bits	CATR
R1-1718563	Long PUCCH design with more than 2 bits UCI payload	Qualcomm Incorporated
R1-1718636	On the Design of Long PUCCH for more than 2 bits	Ericsson

7.3.2.2.3 Support of long-PUCCH over multiple slots

Agreements:

- For long PUCCH over multiple slots, at least support the case that the duration of long PUCCH in each slot is the same
 - FFS the case of different durations in different slots

Proposals:

- Each slot in the multiple slots for long-PUCCH over multiple slots is always contained with a slot
- For long PUCCH with more than 2 bits over multiple slots, all UCI bits are intended to be conveyed in each slot

Thursday Agreements:

- Each slot in the multiple slots for long-PUCCH over multiple slots is always contained with a slot
- For long PUCCH with more than 2 bits over multiple slots, all UCI bits are encoded and transmitted in each slot

Agreements:

- For long PUCCH over multiple slots, inter-slot hopping is supported by configuration
 - FFS details
- For long PUCCH over multiple slots, the intra-slot hopping and inter-slot hopping are not enabled at the same time for a UE

Proposals:

- For long PUCCH over multiple slots configured with inter-slot hopping
 - Alt 1:
 - Only one hop is supported for a long PUCCH
 - The frequency hopping boundary is at the middle of the slots and is given by ceiling ($N/2$), where N is the number of slots for the long PUCCH over multiple slots
 - Alt 2:
 - Hopping is performed every slot
 - FFS the definition of slots (slots under the spanning of the PUCCH, or the actually transmitted slots)

Friday

Agreements:

- For long PUCCH over multi-slots, for the case duration of long PUCCH in each slot is the same, the number of slots with long PUCCH transmission is configurable in a UE-specific manner
 - Up to 4 possible RRC configured numbers, detailed values FFS

R1-1717071	Support of long-PUCCH over multiple slots	Huawei, HiSilicon
R1-1717387	Long PUCCH over multiple slots	Intel Corporation
R1-1717494	Design of long-PUCCH over multiple slots	vivo
R1-1717517	Support of long-PUCCH over multiple slots	ZTE, Sanechips
R1-1717653	Multi-Slot Long PUCCH Transmission	Samsung

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R1-1717830	Design of multi-slot PUCCH transmission	CATT
R1-1717961	Support of long PUCCH over multiple slots for NR	LG Electronics
R1-1718006	Long-PUCCH over multiple slots	ETRI
R1-1718212	Support of long-PUCCH over multiple slots	NTT DOCOMO, INC.
R1-1718258	Discussion on support of long-PUCCH over multiple slots	Panasonic Corporation
R1-1718309	Long PUCCH over multiple slots	Nokia, Nokia Shanghai Bell
R1-1718341	Discussion on support of long-PUCCH over multiple slots	MediaTek Inc.
R1-1718399	On long PUCCH over multiple slots	AT&T
R1-1718417	Structure of NR long PUCCH over multiple slots	Sharp
R1-1718564	Long PUCCH over multiple slots	Qualcomm Incorporated
R1-1718637	On Support of Long PUCCH Over Multiple Slots	Ericsson

7.3.2.3 UCI multiplexing

For both PUSCH with CP-OFDM waveform and PUSCH with DFT-s-OFDM waveform, PUCCH-PUSCH multiplexing, etc.

[R1-1718807](#) Summary of remaining issues for UCI multiplexing on PUSCH Qualcomm Incorporated

Agreements:

- For grant based UL transmission, use DAI based mechanism similar to LTE to indicate UE the number of ACK bits for ACK piggyback on PUSCH.
 - FFS details of DAI mechanism
 - FFS: how to enhance DAI mechanism to support CBG based transmission

Agreements:

- Regarding handling the possibility of DL assignments later than UL grant, to down-select between:
 - Alt 1: Limit to up to X ACK bits for later DL assignments. ACK bits for later DL assignments puncture PUSCH
 - X=2 for slot-based scheduling
 - FFS X for non-slot based scheduling
 - Alt 2: Uplink grant indicates number of ACK/NACK bits including past and estimated future DL assignments. UE computes ACK/NACK resources based on indicated number of ACK/NACK bits
 - FFS other details
- If no consensus can be achieved by the end of this week, the following will be agreed:
 - In Rel-15, do not support the case when DL assignments are later than UL grant mapped to the same time instance for HARQ-ACK transmission on PUSCH

Post meeting agreement: Since no additional consensus was reached by Friday regarding down-selection of Alt 1 and Alt 2, the following is confirmed:

- In Rel-15, do not support the case when DL assignments are later than UL grant mapped to the same time instance for HARQ-ACK transmission on PUSCH

Conclusion:

- Discuss further offline to support a single or two mapping mechanisms when ACK is piggybacked on PUSCH, including the possibility of configurability of two mechanisms are supported
 - E.g., map ACK to REs across as many symbols (excluding DMRS symbol) as possible, map ACK to localized REs in time-domain around DMRS, frequency-first-time-second vs. time-first-frequency-second, impact of PUSCH hopping (if any), etc.

Agreement:

- For ACK piggybacked on PUSCH, map ACK to distributed REs across PUSCH allocated RBs
 - Details FFS

Conclusion:

- Discuss further offline to support a single or two mapping mechanisms when CSI is piggybacked on PUSCH, including the possibility of configurability of two mechanisms are supported
 - E.g., map CSI to REs across as many symbols (excluding DMRS symbol) as possible, map CSI to localized REs in time-domain around DMRS, frequency-first-time-second vs. time-first-frequency-second, impact of PUSCH hopping (if any), etc.

Agreement:

- For CSI piggybacked on PUSCH, map CSI to distributed REs across PUSCH allocated RBs

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- Details FFS

Agreements:

- For CSI piggybacked on PUSCH, support splitting CSI mapping (at least for some CSI) into two parts, where the two parts are mapped differently
 - FFS details (e.g., grouping of different CSI types and map them into different REs, which types of CSI, etc.)
 - FFS impact of frequency hopping (if any)

Agreements:

- For dynamically scheduled PUSCH transmission, a plurality sets of beta_offset values can be configured by RRC signalling, and PDCCH can dynamically indicate an index to a set.
 - Each set contains a plurality of entries, each corresponding a respective UCI type (including two-part CSI when applicable)
 - FFS the case when the index is not present in DCI
- The beta_offset is used to compute the amount of REs for each respective UCI on PUSCH similar to LTE
- The set of beta_offset values for each respective UCI use the respective set of values as in LTE as a baseline
 - The values are subject to refinement especially taking into account different UL waveforms, different UCI multiplexing mechanisms (puncturing vs. rate matching), etc.
- FFS impact of UL MIMO
- The number of sets of beta_offset values is to be down-selected between 2 or 4
 - Implying 1 or 2 bits in DCI respectively

Friday

Proposal: Down-select from the following 2 alternatives

- **Alternative 1:** different RE mapping rule between ACK puncture and rate-match PUSCH
 - When HARQ-ACK puncture PUSCH, map HARQ-ACK to REs across as many symbols (excluding DMRS symbol) in both freq hops if applicable. HARQ-ACK puncture should avoid puncture PT-RS.
 - When HARQ-ACK rate-matching PUSCH, map HARQ-ACK to localized REs around DMRS in time domain in both freq hops if applicable. HARQ-ACK should rate-match around PT-RS
 - When there is additional DMRS other than front loaded DMRS, map HARQ-ACK around all DMRS symbols.
- **Alternative 2:** The same mapping rule is applied regardless of HARQ-ACK puncture or rate match PUSCH
 - Map HARQ-ACK to REs across as many symbols (excluding DMRS symbol)

Email discussion/approval till 10/27 – Yi (Qualcomm)

Agreements:

- If freq hop is disabled for PUSCH, CSI piggybacked on PUSCH follows freq first mapping rule
 - FFS details
- FFS the case when hopping is enabled

Email approval on how to configure beta_offset till 10/27 – Yi (Qualcomm)

R1-1717072	On UCI multiplexing	Huawei, HiSilicon
R1-1717388	UCI embedding and PUSCH/PUCCH multiplexing	Intel Corporation
R1-1717495	On UCI multiplexing	vivo, Potevio
R1-1717518	UCI multiplexing on PUSCH	ZTE, Sanechips
R1-1717654	On UCI Multiplexing in PUSCH	Samsung
R1-1717831	Multiplexing of UCI and UL data on PUSCH	CATT
R1-1717962	Considerations on UCI and UL channel multiplexing for NR	LG Electronics
R1-1718033	Multiplexing of short-PUCCH	Guangdong OPPO Mobile Telecom
R1-1718213	UCI multiplexing	NTT DOCOMO, INC.
R1-1718259	Discussion on UCI multiplexing	Panasonic Corporation
R1-1718278	Remaining issues on UCI multiplexing for NR	WILUS Inc.
R1-1718310	On multiplexing of UCI	Nokia, Nokia Shanghai Bell
R1-1718342	Discussion on UCI multiplexing	MediaTek Inc.
R1-1718418	Simultaneous PUCCH and PUSCH transmission and collision handling	Sharp
R1-1718492	On UCI resource mapping on PUSCH	InterDigital, Inc.
R1-1718565	Multiplexing of PUCCH and PUSCH	Qualcomm Incorporated

R1-1718638 On UCI on PUSCH Ericsson

7.3.2.4 Resource allocation for PUCCH

R1-1718922 Summary of offline discussions for PUCCH resource allocation until 10th Oct. morning OPPO
(Revision of R1-1718787)

- Agreements:
- For both slot-based and non-slot based DL transmissions, and for indentifying PUCCH resource for HARQ-ACK with more than 2-bit UCI, at least following parameters can be jointly configured in one or multiple set(s) (if supported) of PUCCH resource(s) and indicated by the PUCCH resource indicator in DCI:
 - Starting symbol in the slot;
 - Number of symbols;
 - FFS: If only a single configurable value for long PUCCH in the set of PUCCH resource(s).
 - FFS: It is configured for one for multiple PUCCH formats.
 - Starting PRB;
 - FFS granularity: PRB, RBG, or subband.
 - FFS: Number of PRBs.
 - FFS: Code resources.
 - Only a limited number of values is configurable for each parameter in the set of PUCCH resource(s).
 - FFS: Configurable values.
 - FFS: Some of above parameters can be partly implicitly derived.
 - FFS: Possible joint encoding for some of above parameters.

- Proposals:
- Discuss further offline whether or not to support multiple sets of PUCCH resource(s), and if supported, how to indicate
 - Discuss further offline within each set of PUCCH resource(s), whether or not both short PUCCH and long PUCCH resources can be included in the same set of PUCCH resources

- Agreements:
- The PUCCH resource for SR only transmission is semi-statically configured.
 - The PUCCH resource for P-CSI only transmission is semi-statically configured
 - FFS PUCCH resource allocation for semi-persistent CSI

- Thursday
- Proposals:
- For PUCCH resource, a UE can be configured with:
 - Alt 1: One PUCCH resource set for up to 2 bits. Another PUCCH resource set for UCI of more than 2 bits
 - Supported by: NTT DOCOMO, CATT, ZTE, Samsung, Panasonic, MediaTek
 - Alt 2: One **or more** PUCCH resource set for each format
 - Supported by: Nokia, ZTE, OPPO, Qualcomm, Samsung, LGE

- Proposals:
- Different sets of PUCCH resources can be configured to convey HARQ-ACK for slot-based and HARQ-ACK for non-slot-based PDSCH respectively.

Friday

R1-1719168 Summary of offline discussions for PUCCH resource allocation until 13th Oct. morning OPPO

Email discussion/approval on how UE selects one PUCCH resource set from multiple configured PUCCH resource sets till 10/27 – Jia (OPPO)

Email discussion/approval of the following table 10/27 – Jia (OPPO)

		PUCCH Format 0	PUCCH Format 1	PUCCH Format 2	PUCCH Format 3	PUCCH Format 4	Comm ents
Number of slots	Configurability	N.A.	Configured	N.A.	Configured		
	Value range	N.A.	1, 2, 4, 8	N.A.	1, 2, 4, 8		
Starting symbol	Configurability	Configured in resource set		Configured in resource set			
	Value range	0 – 13 (FFS: another value indicating implicit derivation)		0 – 13 (FFS: another value indicating implicit derivation)			

Number of symbols in the slot	Configurability	Configured in resource set		Configured in resource set			
	Value range	1, 2, 4 – 14 (FFS: another value indicating implicit derivation)		1, 2, 4 – 14 (FFS: another value indicating implicit derivation)			
Index for identifying starting PRB	Configurability	Configured in resource set		Configured in resource set			
	Value range	0 - [274]		0 - [274]			
Number of PRBs	Configurability	N.A.	N.A.	Configured in resource set			
	Value range	N.A. (Default is 1)	N.A. (Default is 1)	1 – [16]			
FFS: Frequency resource of 2nd hop if frequency Hopping is enabled							RAN1 needs to further study the necessity.
Index of initial cyclic shift	Configurability	Configured in resource set		N.A.	N.A.	N.A.	
	Value range	0 – 11		N.A.	N.A.	N.A.	
Index of time-domain OCC	Configurability	N.A.	Configured in resource set	N.A.	N.A.	N.A.	
	Value range	N.A.	0 - 6	N.A.	N.A.	N.A.	
[Length of Pre-DFT OCC]	Configurability	N.A.	N.A.	N.A.	N.A.	Configured in resource set	
	Value range	N.A.	N.A.	N.A.	N.A.	1, [2], [4]	
[Index of Pre-DFT OCC]	Configurability	N.A.	N.A.	N.A.	N.A.	Configured in resource set	

[R1-1717073](#) Resource allocation for PUCCH Huawei, HiSilicon
[R1-1717389](#) Resource allocation for PUCCH Intel Corporation
[R1-1717496](#) Resource allocation for NR PUCCH vivo
[R1-1717519](#) NR PUCCH resource allocation ZTE, Sanechips
[R1-1717655](#) Resource Allocation for PUCCH Transmissions Samsung
[R1-1717749](#) Considerations on PUCCH resource allocation for NR Spreadtrum Communications
[R1-1717832](#) On PUCCH resource allocation CATT
[R1-1717888](#) Subband-based resource allocation for NR PUCCH CMCC
[R1-1717963](#) Considerations on PUCCH resource allocation for NR LG Electronics
[R1-1718007](#) Resource allocation for PUCCH ETRI
[R1-1718047](#) Resource allocation for PUCCH Guangdong OPPO Mobile Telecom
[R1-1718214](#) Resource allocation for PUCCH NTT DOCOMO, INC.
[R1-1718260](#) Discussion on resource allocation for uplink control channel Panasonic Corporation
[R1-1718311](#) PUCCH Resource Allocation Nokia, Nokia Shanghai Bell
[R1-1718400](#) Waveform Selection mechanisms for DFTsOFDM AT&T
[R1-1718493](#) On resource allocation for PUCCH InterDigital, Inc.
[R1-1718566](#) Resource allocation for PUCCH Qualcomm Incorporated
[R1-1718639](#) On PUCCH Resource Allocation Ericsson
[R1-1718702](#) PUCCH resource allocation Motorola Mobility, Lenovo
[R1-1718723](#) Resource allocation for PUCCH to support URLLC Sequans Communications

7.3.2.5 Other

[R1-1717094](#) Discussion on UCI feedback for URLLC Huawei, HiSilicon
[R1-1717390](#) Configurations of various long PUCCH lengths Intel Corporation
[R1-1717391](#) Transmit diversity for PUCCH Intel Corporation
[R1-1717392](#) On UL control channel design aspects for URLLC Intel Corporation
[R1-1717520](#) Analysis of URLLC reliability for uplink control channel ZTE, Sanechips
[R1-1717656](#) PUCCH Design for URLLC Samsung
[R1-1717657](#) Performance Results for Long PUCCH Samsung
[R1-1717658](#) Performance Results for UCI and Data Multiplexing Samsung
[R1-1717659](#) BSI Reporting on PUCCH Samsung
[R1-1717660](#) Multiplexing PUSCH with Short PUCCH or SRS Samsung
[R1-1717661](#) PUCCH resource configuration for bandwidth restricted UE Samsung
[R1-1717964](#) Discussion on UL control with ultra-reliability LG Electronics
[R1-1718215](#) UL control channel design for URLLC NTT DOCOMO, INC.

R1-1718312	Discussion on UCI transmission for URLLC	Nokia, Nokia Shanghai Bell
R1-1718361	Considerations for ultra-reliable UCI transmission	InterDigital, Inc.
R1-1718567	SR design for GF/GB UL URLLC transmission	Qualcomm Incorporated
R1-1718626	Considerations for UCI for URLLC III	
R1-1718640	On Transmit Diversity for PUCCH	Ericsson
R1-1718641	On PUCCH Multiplexing from the Same or Different UEs	Ericsson
R1-1718642	On Simultaneous Transmission of PUCCH and PUSCH	Ericsson
R1-1718643	On PUCCH for Ultra-Reliable Transmission	Ericsson
R1-1718730	Considerations on frequency hopping for PUCCH	KT Corp.

7.3.3 DL/UL data scheduling and HARQ procedure

[R1-1718686](#) Open issues on RRC parameters for DL/UL data scheduling and HARQ procedure Ericsson

7.3.3.1 DL/UL resource allocation

Including TBS aspects

[R1-1718906](#) Summary of 7.3.3.1 (DL/UL resource allocation) Ericsson (Revision of [R1-1718786](#))

- Agreements:
- For both slot and mini-slot, the scheduling DCI can provide an index into a UE-specific table giving the OFDM symbols used for the PDSCH (or PUSCH) transmission
 - starting OFDM symbol and length in OFDM symbols of the allocation
 - FFS: one or more tables
 - FFS: including the slots used in case of multi-slot/multi-mini-slot scheduling or slot index for cross-slot scheduling
 - FFS: May need to revisit if SFI support non-contiguous allocations
 - At least for RMSI scheduling
 - At least one table entry needs to be fixed in the spec

Wednesday:

[R1-1718983](#) Summary of offline on AI 7.3.3.1(DL/UL resource allocation) Ericsson

Agreement: For every TB-level (re-)transmission, the UE is able to determine the TB size from the DCI information in that transmission only

- Agreements:
- The TBS is determined based on the actual # of available REs compared with a plurality of reference # of REs
 - FFS the details, including the # of reference REs and other factors for TBS determination

Proposal: For resource allocation type 0 for DL and UL, the RBG size is determined based on the size of the corresponding BWP

- Thursday**
- Proposals – to be concluded Friday
- For resource allocation type 0 for DL and UL, the RBG size is given by UE-specific RRC configuration per BWP from the agreed set of possible RBG values
 - For a given BWP size, only two possible values which is illustrated in the table below:
 - For the two possible values configured for a given BWP size, the two possible values are irrespective of slot vs. non-slot based scheduling – to conclude Alt 1 vs. Alt 2 on Friday
 - Alt 1: the value can be separately configured for slot-based vs. non-slot based scheduling
 - Alt 2: the value is configured to be the same for slot vs. non-slot based scheduling
 - The value for DL RBG vs. UL RBG is the same if the DL BWP size is the same as the UL BWP size
 - FFS the default value before RRC configuration (to be chosen from the two values for a BWP size)
 - FFS whether or not there is an issue before RRC configuration vs. after RRC configuration when the RBG size changes, along with the potential impact on DCI size change

$X_0 - X_1$ RBs	RBG size 1	RBG size 2
$X_1+1 - X_2$ RBs	RBG size 3	RBG size 4

- Agreements:
- For the fallback DCI, only resource allocation type 1 is supported
 - At least with PRB-level granularity

- FFS other granularity(ies)
- Discuss further offline on how to perform frequency hopping based resource allocation, and whether or not to support frequency-distributed resource allocation (e.g. using VRB, etc.) especially w.r.t. whether or not RRC signalling is involved or not
- Friday: Email discussion/approval till 10/27 – Stefan (Ericsson)

Thursday
R1-1719144

Summary of 7.3.3.1 (DL/UL resource allocation) Ericsson

- Agreements:
- Calculate an “intermediate” number of information bits $N_{RE} \cdot v \cdot Q_m \cdot R$ where
 - v is the number of layers,
 - Q_m is the modulation order, obtained from the MCS index
 - R is the code rate, obtained from the MCS index
 - N_{RE} is number of resource elements
 - $N_{RE} = Y \cdot \#PRBs_scheduled$
 - When determining N_{RE} (number of REs) within a slot
 - Determine $X = 12 \cdot \#OFDM_symbols_scheduled - X_d - X_{oh}$
 - $X_d = \#REs_for_DMRS_per_PRB$ in the scheduled duration
 - X_{oh} = accounts for overhead from CSI-RS, CORESET, etc. One value for UL, one for DL.
 - X_{oh} is semi-statically determined
 - Quantize X into one of a predefined set of values, resulting in Y
 - [8] values
 - Should allow for reasonable accuracy for all transmission durations
 - May depend on the number of scheduled symbols
 - FFS: floor, ceiling or some other quantization
 - Note: quantization may not be needed
 - FFS: Quantization step should ensure the same TB size can be obtained between transmission and retransmission, irrespective of the number of layers used for the retransmission. otherwise X_d has to be independent of the number of layers
 - Obtain the actual TB size from the intermediate number of information bits according to the channel coding decisions

Friday
R1-1719167

Summary of 7.3.3.1 (DL/UL resource allocation) Ericsson

Agreements:

	Config 1	Config 2
$X_0 - X_1$ RBs	RBG size 1	RBG size 2
$X_1+1 - X_2$ RBs	RBG size 3	RBG size 4
...	...	...

- RRC selects config 1 or config 2
 - One config (config 1) is the default until RRC configures otherwise
 - The numbers ‘RBG size’ in the table are fixed in the spec
 - The number of rows should be no more than [4-6]
 - Same table for DL and UL
 - The configuration for DL & UL is separate
 - Same RBG size irrespective of the duration (slot vs. non-slot)
- R1-1717040

R1-1717078

R1-1717152

R1-1717393

R1-1717497

R1-1717662

R1-1717718

R1-1717833

R1-1717965
- Considerations on resource allocation issues ZTE, Sanechips
DL/UL resource allocation and TB size determination Huawei, HiSilicon
DL/UL Resource Allocation schemes for NR NEC
On resource allocation and TBS determination in NR Intel Corporation
On DL/UL resource allocation vivo
DL/UL Resource Allocation Samsung
Discussion on frequency domain resource allocation Fujitsu
PDSCH and PUSCH resource allocation CATT
Discussion on resource allocation and TBS determination LG Electronics

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R1-1718048	Resource allocation for PDSCH/PUSCH	Guangdong OPPO Mobile Telecom
R1-1718216	DL/UL resource allocation	NTT DOCOMO, INC.
R1-1718286	DL/UL resource allocation	Panasonic
R1-1718353	TB size determination and channel coding considerations	MediaTek Inc.
R1-1718494	On remaining details of data resource allocation	InterDigital, Inc.
R1-1718568	DL/UL resource allocation	Qualcomm Incorporated
R1-1718620	On resource allocation for PDSCH and PUSCH in NR	Nokia, Nokia Shanghai Bell
R1-1718644	On DL/UL Resource Allocation	Ericsson
R1-1718703	On resource allocation RBG size	Motorola Mobility, Lenovo

7.3.3.2 DL/UL scheduling and HARQ management

Including scheduling and HARQ timing taking into account gNB/UE processing time, # HARQ processes, HARQ payload considerations, HARQ multiplexing/bundling, etc.

[R1-1718826](#) Summary of DL/UL scheduling and HARQ management Qualcomm Inc.

Agreements:

- The timing between DL data transmission and acknowledgement is determined based on 0 or [2] bits in DCI
 - For both slot and non-slot scheduling, the timing provides the indication to determine the slot and the symbol(s) for the HARQ-ACK transmission
 - In case of [2]-bits, FFS the actual set of values for slot-based scheduling and non-slot based scheduling, respectively
 - In case of 0-bit, FFS how to determine the single timing (e.g., UE capability dependent, whether or not to have RRC configuration, the interactions with different cases (e.g., initial access), etc.)
 - FFS whether or not to have separate information fields or a same information field for HARQ-ACK resource determination and HARQ-timing determination

Conclusion:

- Discuss further offline how to determine HARQ-ACK payload size when two or more PDSCH transmissions are associated with a single UL transmission using PUCCH or PUSCH (e.g., semi-static determination, dynamic determination based on DAI mechanism similar to LTE, etc.)

Agreements:

- NR supports HARQ-ACK bundling in spatial domain for a NR-PDSCH transmission
 - FFS details (e.g., whether or not to have RRC configuration, whether to apply to CBG-based HARQ-ACK or not, etc.)

Agreements:

- Maximum number of TAGs is 4 for a UE
- Only non-contention based random access for sTAGs

Wednesday:

Agreement:

- For NR non-CA, both semi-static and dynamic HARQ-ACK codebook are supported by configuration
 - Note: the “by-configuration” is also applicable to the CA case

Agreements:

- Dynamic HARQ-ACK codebook (per PUCCH group) for the case without CBG configuration
 - HARQ-ACK codebook determination based on counter DAI and total DAI
 - Use LTE as starting point
 - FFS details

Agreements:

- For HARQ-ACK spatial bundling:
 - Support higher layer configuration for spatial-domain bundling per PUCCH group
 - Bundling is per cell, and same configuration applies to all the cells
 - FFS whether or not to support HARQ spatial bundling in a dynamic manner

Thursday

Agreements:

- Finalize Table 1 as the *baseline UE processing time* capability in NR Release 15 at least for slot-based scheduling in the non-CA case with single numerology for PDCCH, PDSCH, and PUSCH.
- Finalize Table 2 as the *aggressive UE processing time* capability in NR Release 15 at least for slot-based scheduling in the non-CA case with single numerology for PDCCH, PDSCH, and PUSCH.
 - FFS: if reduced processing time is achieved with a semi-statically reduced bandwidth and throughput capability relative to the peak rate supportable by the UE.
- Further determine (N1,N2) processing times for two UE capabilities in carrier aggregation, mixed numerology, higher order modulation cases, and for mini-slot scheduling.
- For a given configuration and numerology, a UE indicates only one capability for N1 (or N2) based on the corresponding entry for N1 (or N2) from either Table 1 or Table 2.
 - FFS: if multiple capabilities can be reported with different throughput constraints for N1 (or N2).

Table 1. UE Processing Time and HARQ Timing (Capability #1)

Configuration	HARQ Timing Parameter	Units	15 KHz SCS	30 KHz SCS	60 KHz SCS	120 KHz SCS
Front-loaded DMRS only	N1	Symbols	[8]	[10]	[14]	[14-21]
Front-loaded + additional DMRS	N1	Symbols	[13]	[13]	[17]	[21]
Frequency-first RE-mapping	N2	Symbols	[9]	[11]	[17]	[31]

Table 2. UE Processing Time and HARQ Timing (Capability #2)

Configuration	HARQ Timing Parameter	Units	15 KHz SCS	30 KHz SCS
Front-loaded DMRS only	N1	Symbols	[2.5-4]	[2.5-6]
Front-loaded + additional DMRS	N1	Symbols	[12]	[12]
Frequency-first RE-mapping	N2	Symbols	[2.5-6]	[2.5-6]

[R1-1717041](#) HARQ-Ack multiplexing and bundling ZTE, Sanechips
[R1-1717075](#) HARQ timing, multiplexing, bundling, processing time and number of processes Huawei, HiSilicon
[R1-1717394](#) Remaining details of scheduling and HARQ in NR Intel Corporation
[R1-1717498](#) UE processing time and HARQ timing vivo
[R1-1717663](#) HARQ Management and Feedback Samsung
[R1-1717719](#) Discussion on HARQ-ACK codebook Fujitsu
[R1-1717834](#) Discussion on HARQ management and HARQ-ACK feedback CATT
[R1-1717855](#) On HARQ-ACK multiplexing and bundling Lenovo, Motorola Mobility
[R1-1717889](#) Discussion on timing design with semi-static DL/UL assignment CMCC
[R1-1717966](#) Considerations on HARQ process and feedback for NR LG Electronics
[R1-1718034](#) Discussion on HARQ-ACK transmission Guangdong OPPO Mobile Telecom
[R1-1718217](#) DL/UL scheduling and HARQ management NTT DOCOMO, INC.
[R1-1718279](#) Discussion on HARQ-ACK multiplexing for NR WILUS Inc.
[R1-1718287](#) HARQ-ACK codebook for CBG-based transmission Panasonic
[R1-1718326](#) HARQ-ACK and UL scheduling timing relationship MediaTek Inc.
[R1-1718362](#) HARQ timing and management InterDigital, Inc.
[R1-1718401](#) HARQ management for mini-slots AT&T
[R1-1718468](#) Number of HARQ processes for co-existence with TD-LTE NEC
[R1-1718470](#) HARQ ACK multiplexing for NR HTC Corporation
[R1-1718569](#) UE processing time and HARQ management Qualcomm Incorporated
[R1-1718621](#) Remaining aspects of HARQ management Nokia, Nokia Shanghai Bell
[R1-1718645](#) On HARQ Management Ericsson
[R1-1718707](#) UE-based HARQ-ACK bundling for NR Sequans Communications

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7.3.3.3 CBG-based (re)transmission

[R1-1718861](#) Summary of proposals on CBG based retransmission LGE

Discuss further offline on HARQ-ACK codebook size jointly consider HARQ timing/CA/non-CA cases

Friday
R1-1719171 Summary of proposals on CBG based retransmission LGE

Agreements:

- In single CW configuration, the maximum configurable number of CBGs per TB is 8
- The possible max number of CBGs per TB is 2, 4, 6, 8
- In multiple CW configuration, the maximum configurable number of CBGs per TB is 4
- In multiple CW configuration, the configured maximum number of CBGs per TB is the same between TBs

Agreements:

- For the case when the semi-static HARQ-ACK codebook with HARQ-ACK multiplexing which includes HARQ-ACK corresponding to all the CBGs (including the non-scheduled CBG(s)) is used,
 - NACK is reported for all the CBGs if TB CRC check is not passed while CB CRC check is passed for all the CBs
 - NACK is mapped for the empty CBG index if the number of CBs for a TB is smaller than the configured maximum number of CBGs

Agreements:

- When UE is configured with CBG based retransmission, for the PDSCH scheduled by PDCCH using fallback DCI, TB level HARQ-ACK feedback is used at least for the case without HARQ-ACK multiplexing
 - FFS whether this operation is applied even for the case with HARQ-ACK multiplexing
 - Note: this means that fallback DCI does not support CBG level HARQ-ACK feedback

Conclusion:

- Discuss further DCI composition for supporting CBG based retransmission in terms of CBGTI, CBGFI, and NDI
 - No RRC impact is expected

Email discuss/approval of the above issue until 11/3 – Sukchel (LGE)

[R1-1717042](#) On the support of TB-based HARQ A/N fallback for CBGs ZTE, Sanechips
[R1-1717074](#) On CBG-based (re)transmission Huawei, HiSilicon
[R1-1717395](#) Details of CBG-based transmissions for NR Intel Corporation
[R1-1717499](#) Support of CBG-based (re)transmission vivo
[R1-1717664](#) CBG-Based UL/DL Retransmissions Samsung
[R1-1717720](#) Discussion on HARQ-ACK feedback for DL CBG based (re-)transmission; Fujitsu
[R1-1717835](#) Remaining aspects of CBG-based operation CATT
[R1-1717856](#) Remaining issues on CBG-based (re)transmission Lenovo, Motorola Mobility
[R1-1717967](#) Considerations on CBG based retransmission for NR LG Electronics
[R1-1718035](#) Discussion on CBG-based (re)transmission Guangdong OPPO Mobile Telecom
[R1-1718079](#) Discussion on the remaining issues of CBG-based (re)transmission ITRI
[R1-1718218](#) Signalling design for CBG-based (re)transmission NTT DOCOMO, INC.
[R1-1718270](#) On HARQ and CBG-based retransmission KT Corp.
[R1-1718280](#) Remaining issues on CBG-based transmission for NRWILUS Inc.
[R1-1718288](#) CBG-based (re)transmission Panasonic
[R1-1718313](#) On CBG-based (re-)transmission Fraunhofer HHI
[R1-1718363](#) CBG-based (re)transmission InterDigital, Inc.
[R1-1718402](#) Remaining details for CBG based re (transmissions) AT&T
[R1-1718419](#) Discussion on CBG-based (re)transmission Sharp
[R1-1718471](#) Remaining issues on CBG-based (re)transmission HTC Corporation
[R1-1718570](#) CBG-based (re-)transmission Qualcomm Incorporated
[R1-1718622](#) On remaining aspects of CBG based transmissions Nokia, Nokia Shanghai Bell
[R1-1718646](#) On CBG Based Transmissions and Retransmissions Ericsson
[R1-1718669](#) DL control signalling for CBG-based (re)transmission Sony
[R1-1718672](#) Remaining issues on CBG-based (re)transmission China Telecommunications
[R1-1718708](#) CBG A/N multiplexing for CA and cross-slot scheduling Sequans Communications

7.3.3.4 UL data transmission procedure

Including details for single/multiple SR configurations, aspects related to with and without grants, etc.

[R1-1718957](#) Email discussions on UL transmission procedures NTT DOCOMO (Revision of [R1-1718814](#))

Agreements:

- For UL transmission with grant,
 - By UE-specific RRC signaling, a UE can be configured with UL waveform that is different from the one configured by RMSI for Msg3. Once configured;
 - When the non-fallback DCI schedules the PUSCH transmission, the UE uses the UL waveform configured by the UE-specific RRC signaling; when the fallback DCI schedules the PUSCH transmission, the UE uses the UL waveform configured by RMSI for the PUSCH transmission.
 - If the UE is not configured with UL waveform that is different from the one configured by RMSI for Msg3;
 - The UE uses the UL waveform configured by RMSI for the PUSCH transmission.
 - FFS: whether the fallback DCI is based on DCI format/size or on search space.
 - RMSI informs single waveform to the UE

Agreements:

- For Type 1 and Type 2 UL transmission without grant,
 - By UE-specific RRC signaling, a UE can be separately configured with UL waveform that is different from the one configured by RMSI for Msg3.
 - Note: even if the UE is configured with Type 1 and Type 2 UL transmission without grant, the UE may transmit PUSCH that is scheduled by UL grant, in which case the UL waveform determination for UL transmission with grant is used.

Thursday
[R1-1719156](#) Proposals for SR configuration NTT DOCOMO

- Proposals:
- For each “SR configuration”, the following should be indicated via RRC
 - A configuration index (that corresponds to a periodicity and offset) which identifies the slots/symbols to be used for SR at least for the case when periodicity is larger than a slot

- Proposals:
- At least support following Table as the periodicity of resources for SR and for UL transmission without UL grant
 - FFS other values with taking into account the alignment with 14 symbols
 - x=FFS (e.g., 1 and/or 2) – to decide next meeting
 - NOTE: Periodicity of SR is configured independently from periodicity of UL transmission without UL grant
 - FFS the resource for UL transmission without UL grant

Subcarrier spacing (kHz)	Supported periodicities [ms]
15	x symbols, 7 symbols, 1,2,5,10,20,40,80
30	x symbols, 7 symbols, 0.5,1,2,5,10,20,40,80
60	x symbols, 7 symbols (6 symbols for ECP), 0.25,0.5,1,2,5,10,20,40,80
120	x symbols, 7 symbols, 0.125,0.25,0.5,1,2,5,10,20,40,80

INL sustained their offline objection to the low periodicity values in the table
Ask for a lowest periodicity of X OFDM symbols and have X be FFS.
INL commented that since URLLC issues are being deferred to phase 2, RAN1 can deal with these issues after December.

Friday
[R1-1719195](#) Proposals for SR configuration NTT DOCOMO

Agreements:

- For each “SR configuration”, the following is indicated via RRC
 - A periodicity and offset which identify the slots/symbols to be used for SR
 - FFS the offset for the SR periodicity shorter than one slot for a given SCS
- Non-periodic SR solutions to meet URLLC latency requirements are not precluded
- Slide 4 in [R1-1719195](#) is agreed

Agreements:

- At least support following periodicities of resources for UL transmission without UL grant

- o FFS other values with taking into account the alignment with 14 symbols

Subcarrier spacing (kHz)	Supported periodicities [ms]
15	2 symbols, 7 symbols, 1, 2, 5, 10, 20, 32, 40, 64, 80, 128, 160, 320, 640
30	2 symbols, 7 symbols, 0.5, 1, 2, 5, 10, 20, 32, 40, 64, 80, 128, 160, 320, 640
60	2 symbols, 7 symbols (6 symbols for ECP), 0.25, 0.5, 1, 2, 5, 10, 20, 32, 40, 64, 80, 128, 160, 320, 640
120	2 symbols, 7 symbols, 0.125, 0.25, 0.5, 1, 2, 5, 10, 20, 32, 40, 64, 80, 128, 160, 320, 640

[R1-1719201](#) Proposals for frequency hopping (FH) for PUSCH NTT DOCOMO

Proposals:

- Frequency hopping is supported for CP-OFDM based NR-PUSCH transmission with contiguous RB allocation
 - At least intra-slot frequency hopping is supported for 14 symbol slot case
- For UL transmission with grant, intra-slot FH hopping can be enabled/disabled by UL grant.
- For PUSCH with grant, at least following are supported and configured by OSI:
 - Inter-slot FH without intra-slot FH.
 - Inter-slot FH + intra-slot FH.

Email discussion/approval till 10/27 – Lihui (NTT DOCOMO)

[R1-1719196](#) Offline outcome for UL GF NTT DOCOMO

Proposals:

- For UL transmission without grant, for a TB transmission with K repetitions
 - The repetitions follow an RV sequence
 - RV sequences for both CC and IR should be supported, i.e., the pattern with the same RV value is a special case of RV sequence
 - The RV sequence is configured by RRC at least for Type 1.
- For UL transmission without UL grant, for each configuration
 - The number of HARQ processes is explicitly configured by RRC
 - Each configuration can have multiple HARQ processes

Email discussion/approval till 10/27 – Lihui (NTT DOCOMO) – including any other potentially missing RRC parameters related issues

R1-1717091	UL data transmission procedure with and without UL grant	Huawei, HiSilicon
R1-1717104	High overhead in low periodicity PUCCH-SR and the advantages of Underlay SR	Idaho National Laboratory
R1-1717396	UL data transmission procedures in NR	Intel Corporation
R1-1717442	Remaining details of UL transmission without grant	ZTE, Sanechips
R1-1717665	Procedures for UL Transmissions	Samsung
R1-1717721	Discussions on HARQ for UL data transmission without grant	Fujitsu
R1-1717836	On UL transmission procedures	CATT
R1-1717859	On UL transmission procedures to reduce latency and enhance reliability	Lenovo, Motorola Mobility
R1-1717890	Discussion on scheduling for SPS and UL waveform determination	CMCC
R1-1717968	Discussion on UL data transmission procedure	LG Electronics
R1-1718003	Some considerations on UL grant-free transmission	ETRI
R1-1718066	Discussion on the UL waveform indication method	Guangdong OPPO Mobile Telecom
R1-1718085	On physical signaling of uplink grant-free transmission	ITRI
R1-1718219	UL data transmission procedures	NTT DOCOMO, INC.
R1-1718230	Remaining issues on UL transmission without grant	NEC
R1-1718289	UL data transmission procedure	Panasonic
R1-1718354	On UL data transmission without grant design and configuration	MediaTek Inc.
R1-1718420	Type 2 Transmission without UL Grant: L1 Signaling Is Needed	Sharp
R1-1718459	Data transmission and HARQ-ACK feedback for URLLC	Shenzhen Coolpad Technologies
R1-1718465	Discussion on Grant-Free UL transmission	ITL
R1-1718495	On remaining details of UL data transmission without grant	InterDigital, Inc.
R1-1718571	UL data transmission procedures	Qualcomm Incorporated
R1-1718623	UL transmission without grant	Nokia, Nokia Shanghai Bell
R1-1718647	On UL Data Transmission Procedures	Ericsson
R1-1718670	Discussion on the waveform determination of UL transmission	Sony
R1-1718724	UL Transmission without Grant	Sequans Communications
R1-1718725	Resource Configuration and HARQ RV details for Uplink Grant Free	TCL Communication

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R1-1718733 Withdrawn	On Support of UL Grant-Free and Grant-Based Configured Access	Fraunhofer IIS
R1-1718760 Withdrawn	On Support of UL Grant-Free and Grant-Based Configured Access	Fraunhofer IIS
R1-1718761	On Support of UL Grant-Free and Grant-Based Configured Access	Fraunhofer IIS

7.3.3.5 Soft-buffer management for NR

Including multi-carrier aspects within NR and DC with LTE

[R1-1718813](#) Summary for 7.3.3.5 Intel Corporation

Agreements:

- For DL, limited buffer rate matching (LBRM) is supported and is applied per HARQ process.
 - NR limits transmit buffer corresponding to a largest TBS coded at rate R_{LBRM} .
 - $R_{LBRM} = \frac{1}{2}$ is supported.
- Largest TBS for LBRM for DL should at least take into account UE capability
 - Details FFS (e.g., based on UE signalling, gNB configuration w.r.t. highest mod order, etc.)
 - Note: this does not prevent the possibility of defining a single largest TBS used for LBRM in Rel-15

Agreement:

- Dynamic sharing of soft buffer is possible for DL reception by UE implementation
 - No spec impact

Friday

[R1-1719251](#) Summary for 7.3.3.5 Intel Corporation

Email discussion on the issues raised in 9251 till 10/27 – Ajit (Intel)

R1-1717045	Considerations for soft-buffer management	ZTE, Sanechips
R1-1717076	Soft buffer management	Huawei, HiSilicon
R1-1717397	Soft-buffer management in NR	Intel Corporation
R1-1717501	Soft-buffer management for NR	vivo
R1-1717666	Soft Buffer Management	Samsung
R1-1717837	Soft buffer management for NR	CATT
R1-1717969	Discussion on soft buffer management for NR	LG Electronics
R1-1717994	On Transmit Buffer and Soft Buffer Management	Ericsson
R1-1718080	Soft Buffer Handling for CBG-based (re)transmission	ITRI
R1-1718220	Views on soft-buffer management for NR	NTT DOCOMO, INC.
R1-1718349	On HARQ buffering	MediaTek Inc.
R1-1718572	Soft buffer management	Qualcomm Incorporated
R1-1718624	On the HARQ soft buffer handling	Nokia, Nokia Shanghai Bell

7.3.3.6 Multiplexing data with different transmission durations

[R1-1718820](#) Summary of multiplexing data with different transmission durations vivo

Agreements:

- The time duration of the reference downlink resource for pre-emption indication equals to the monitoring periodicity of the group-common DCI carrying the pre-emption indication
 - In TDD, at least the semi-statically configured UL symbols are excluded from the reference downlink resource
 - Note: This means the reference downlink resource only includes the DL or unknown symbols given by semi-static configuration within the semi-statically configured time duration of the reference downlink resource.
 - FFS for the handling of reserved resource especially at RE level

Conclusion

- Discuss further offline on the possibility of having RRC configured frequency region of the reference downlink resource considering impact of UE-specific BWP configuration, granularity of configurations, etc.

Agreements:

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- For minimum monitoring periodicity of pre-emption indication:
 - At least slot level monitoring periodicity of preemption indication is supported
 - FFS to additionally support other cases (e.g. non-slot level monitoring)

Agreements:

- For slot level monitoring periodicity, UE is not required to monitor preemption indication for a slot in which PDSCH is not scheduled
- UE is not required to monitor preemption indication in DRX slots
- UE is not required to monitor preemption indication for the deactivated DL BWP
- Note: not necessarily all of the above bullets will have spec impacts

Proposal: DCI for preemption indication and DCI for SFI are distinguished by different RNTIs

Agreement: The HARQ timeline for a PDSCH transmission is not affected by preemption indication.

Proposal: A UE can be separately configured with preemption indication and CBG based (re)transmission

Friday

Agreements:

- No consensus to introduce an explicit RRC configuration for frequency region of the reference downlink resource for pre-emption indication in Rel-15
- (working assumption) the frequency region of the reference downlink resource for pre-emption indication is the active DL BWP

Agreements:

- A fixed payload size (excluding CRC and potential reserved bits) of the group-common DCI carrying the downlink pre-emption indication (PI), in the format of a bitmap is used to indicate preempted resources within the semi-statically configured DL reference resource
 - The bitmap indicates for one or more frequency domain parts ($N \geq 1$) and/or one or more time domain parts ($M \geq 1$)
 - There is no RRC configuration involved in determining the frequency or time-domain parts
 - The following combinations are supported and predefined $\{M, N\} = \{14, 1\}, \{7, 2\}$
 - A combination of $\{M, N\}$ from this set of possible $\{M, N\}$ is indicated 1bit by RRC configuration for a UE

R1-1717043	On preemption indication	ZTE, Sanechips
R1-1717081	On pre-emption indication for DL multiplexing of URLLC and eMBB	Huawei, HiSilicon
R1-1717398	Multiplexing of different data channel durations	Intel Corporation
R1-1717502	Multiplexing data with different transmission durations	vivo
R1-1717667	Indication of Preempted Resources in DL	Samsung
R1-1717722	On eMBB and URLLC multiplexing	Fujitsu
R1-1717838	Remaining details of pre-emption indication	CATT
R1-1717848	Multiplexing of UL eMBB and URLLC in NR	ASUSTEK COMPUTER (SHANGHAI)
R1-1717970	Remaining issues on pre-emption indication for downlink	LG Electronics
R1-1717999	Discussion on DL preemption indication	ETRI
R1-1718013	Discussion on DL preemption indication	NEC
R1-1718049	Multiplexing between slot-based and symbol-based transmissions and pre-emption indication	Guangdong
OPPO Mobile Telecom		
R1-1718221	Multiplexing data with different transmission durations	NTT DOCOMO, INC.
R1-1718281	Remaining issues on pre-emption indication and UE behavior	WILUS Inc.
R1-1718403	Scheduling aspects of mini-slots	AT&T
R1-1718462	Discussion on the design of DL preemption indication	CATR
R1-1718496	On UL multiplexing of data with different transmission durations	InterDigital, Inc.
R1-1718573	URLLC DL pre-emption and UL suspension indication channel design	Qualcomm Incorporated
R1-1718648	On Multiplexing Data with Different Transmission Durations	Ericsson
R1-1718657	Myths and remaining issues in Pre-emption Indicator	Sony
R1-1718701	Discussion on PUSCH/PUCCH and UCI multiplexing	Motorola Mobility, Lenovo
R1-1718705	On open issues for DL preemption	Sequans Communications
R1-1718731	Remaining details on preemption indication	KT Corp.

7.3.3.7 Other

R1-1717058	On uplink data scheduling and hopping	Huawei, HiSilicon
R1-1717059	On data channel scrambling	Huawei, HiSilicon
R1-1717060	Discussion on the UE category	Huawei, HiSilicon
R1-1717082	Support of URLLC for TDD	Huawei, HiSilicon
R1-1717083	On supporting ultra reliability in a resource efficient way	Huawei, HiSilicon
R1-1717085	Summary on open issues for non-slot-based transmission	Huawei, HiSilicon
R1-1717087	PDSCH reliability for URLLC	Huawei, HiSilicon
R1-1717089	Discussion on UL multiplexing of eMBB and URLLC	Huawei, HiSilicon
R1-1717090	Consideration on subsequent transmission after pre-emption	Huawei, HiSilicon
R1-1717092	HARQ feedback indication design for UL grant-free transmission	Huawei, HiSilicon
R1-1717093	Link adaptation and CSI reporting for URLLC transmission	Huawei, HiSilicon
R1-1717095	Discussion on over-the-air time synchronization for URLLC	Huawei, HiSilicon
R1-1717153	Frequency hopping for NR UL PUSCH	NEC
R1-1717399	On link adaptation enhancements to support URLLC	Intel Corporation
R1-1717503	Discussion on scheduling and HARQ for URLLC reliability	vivo
R1-1717521	Ultra-reliable part of URLLC for scheduling/HARQ procedure	ZTE, Sanechips
R1-1717668	Flushing Indication of Preempted Resources for TB-based re-transmission	Samsung
R1-1717669	Average User Plane Latency for Pre-emption based Multiplexing in DL	Samsung
R1-1717670	Multiplexing Transmissions with Different Durations	Samsung
R1-1717671	Scheduling/HARQ Procedures for URLLC	Samsung
R1-1717672	Indication of Preempted Resources in UL	Samsung
R1-1717673	On Granularity of Pre-emption Indicator in DL	Samsung
R1-1717674	On SS Block/PDSCH/DMRS Multiplexing	Samsung
R1-1717857	HARQ design for uplink grant-free transmission	Lenovo, Motorola Mobility
R1-1717971	Discussion on scheduling and HARQ procedure for URLLC	LG Electronics
R1-1718222	Scheduling and HARQ procedures for URLLC	NTT DOCOMO, INC.
R1-1718315	Early HARQ for URLLC	Fraunhofer HHI
R1-1718355	On repetition scheme for UL transmission without grant	MediaTek Inc.
R1-1718356	On use of scrambling for UL transmission without grant	MediaTek Inc.
R1-1718364	Supporting downlink SPS in NR	InterDigital, Inc.
R1-1718497	URLLC UL grant-free transmission under Multi-TRP	III
R1-1718574	Timing advance for different numerology	Qualcomm Incorporated
R1-1718575	UL URLLC Capacity Based on URLLC and eMBB dynamic multiplexing	Qualcomm Incorporated
R1-1718576	MPR issue with distributed RB allocation in UL	Qualcomm Incorporated
R1-1718577	Uplink Resource for SR	Qualcomm Incorporated
R1-1718578	Short PUSCH transmission in UL short duration	Qualcomm Incorporated
R1-1718579	Scheduling data in slots containing SS blocks in multi-beam scenario	Qualcomm Incorporated
R1-1718610	Discussion on URLLC transmitted in same or different numerology resources	ASUSTEK COMPUTER (SHANGHAI)
R1-1718649	On FDD Support for NR	Ericsson
R1-1718650	On Supporting High Reliability for Data Transmissions	Ericsson

Withdrawn

7.3.4 Other aspects on carrier aggregation and bandwidth parts

R1-1717500	UL data transmission procedure	vivo
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7.3.4.1 Other aspects on bandwidth Parts

R1-1718901	Summary of Bandwidth Part Operation	MediaTek
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Agreements:

- For paired spectrum, DL and UL BWPs are configured separately and independently in Rel-15 for each UE-specific serving cell for a UE
 - For active BWP switching using at least scheduling DCI, DCI for DL is used for DL active BWP switching and DCI for UL is used for UL active BWP switching
 - FFS whether or not to support a single DCI switching DL and UL BWP jointly
- For unpaired spectrum, a DL BWP and an UL BWP are jointly configured as a pair, with the restriction that the DL and UL BWPs of such a DL/UL BWP pair share the same centre frequency but may be of different bandwidths in Rel-15 for each UE-specific serving cell for a UE
 - For active BWP switching using at least scheduling DCI, DCI for either DL or UL can be used for active BWP switching from one DL/UL BWP pair to another pair

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- Note: there is no additional restriction on DL BWP and UL BWP pairing
- Note: this applies to at least the case where both DL & UL are activated to a UE in the corresponding unpaired spectrum

Agreement:

- For a UE, a configured DL (or UL) BWP may overlap in frequency domain with another configured DL (or UL) BWP in a serving cell

Conclusion:

- Discuss offline regarding the set of parameters that a UE is configured with for each DL BWP and for each UL BWP for a serving cell (including RRC configuration impact)

Agreements:

- For each serving cell, the maximal number of DL/UL BWP configurations is
 - For paired spectrum: 4 DL BWPs and 4 UL BWPs
 - For unpaired spectrum: 4 DL/UL BWP pairs
 - For SUL: 4 UL BWPs

Agreements:

- For paired spectrum, support a dedicated timer for timer-based active DL BWP switching to the default DL BWP
 - A UE starts the timer when it switches its active DL BWP to a DL BWP other than the default DL BWP
 - A UE restarts the timer to the initial value when it successfully decodes a DCI to schedule PDSCH(s) in its active DL BWP
 - FFS other cases
 - A UE switches its active DL BWP to the default DL BWP when the timer expires
 - FFS other conditions (e.g. interaction with DRX timer)
- For unpaired spectrum, support a dedicated timer for timer-based active DL/UL BWP pair switching to the default DL/UL BWP pair
 - A UE starts the timer when it switches its active DL/UL BWP pair to a DL/UL BWP pair other than the default DL/UL BWP pair
 - A UE restarts the timer to the initial value when it successfully decodes a DCI to schedule PDSCH(s) in its active DL/UL BWP pair
 - FFS other cases
 - A UE switches its active DL/UL BWP pair to the default DL/UL BWP pair when the timer expires
 - FFS other conditions (e.g. interaction with DRX timer)
- FFS the range and granularity of the timer

Proposals:

- Support scheduling DCI with “zero” assignment (i.e. without scheduling downlink or uplink transmission) for active DL/UL BWP switching
 - For DL scheduling DCI, UE is expected to send positive HARQ-ACK for zero-size PDSCH transmission
 - FFS implicit or explicit indication of “zero” assignment, and the corresponding details

Thursday

Agreements:

- For an Scell, RRC signaling for Scell configuration/reconfiguration indicates the first active DL BWP and/or the first active UL BWP when the Scell is activated
 - NR supports Scell activation signaling that doesn't contain any information related to the first active DL/UL BWP
- For an Scell, active DL BWP and/or UL BWP are deactivated when the Scell is deactivated
 - Note: it's RAN1 's understanding that Scell can be deactivated by an Scell timer

Agreements:

- For an Scell, a UE can be configured with the following:
 - a timer for timer-based active DL BWP (or DL/UL BWP pair) switching, along with a default DL BWP (or the default DL/UL BWP pair) which is used when the timer is expired
 - The default DL BWP can be different from the first active DL BWP
- For Pcell, the default DL BWP (or DL/UL BWP pair) can be configured/reconfigured to a UE
 - If no default DL BWP is configured, the default DL BWP is the initial active DL BWP

Agreement: In a serving cell where PUCCH is configured, each configured UL BWP includes PUCCH resources

Discuss further offline on the interaction between CSS vs. BWP, especially whether or not the UE needs to perform re-tuning (also consider mmw related CORESET aspects)

Proposals:

- For RRC connected mode in Scell, a PRB offset is indicated for each BWP for common PRB indexing, where PRB offset is relative to the lowest PRB of the respective BWP
- Also discuss the caes for initial access, and RRC connected mode in Pcell

Discuss the possible BWP configuration and sizes

- Agreements:**
- For a UE, DCI format size itself is not part of RRC configuration irrespective of BWP activation & deactivation in a serving cell
 - Note: DCI format size may still depend on different operations and/or configurations (if any) of different information fields in the DCI

Friday

- Agreements:**
- In Pcell, for a UE, common search space for at least RACH procedure can be configured in each BWP
 - FFS whether or not there are any additional UE behavior that needs to be specified
 - In a serving cell, for a UE, common search space for group-common PDCCH (e.g. SFI, pre-emption indication, etc.) can be configured in each BWP

- Agreements:**
- A DL (or UL) BWP is configured to a UE by resource allocation Type 1 with granularity as follows
 - Granularity of starting frequency location: 1 PRB
 - Granularity of bandwidth size: 1 PRB
 - Note: The above granularity doesn't imply that a UE shall adapt its RF channel bandwidth accordingly

- Agreements:**
- A UE is RRC signaled an offset between PRB 0 for common PRB indexing and a reference location
 - For DL in Pcell, the reference location is the lowest PRB of the cell-defining SSB
 - For UL in Pcell of paired spectrum, the reference location is the frequency location of the UL indicated in the RMSI
 - For Scell, the reference location is the frequency location indicated in the SCell configuration
 - For SUL, the reference location is the frequency location indicated in the SUL configuration
 - Note: For UL of unpaired spectrum, the reference location is the same with the DL of the unpaired spectrum.
 - Note: the PRB 0 is intended for scrambling initialization, reference point for BWP configuration, etc.
 - The range of offset values should be >276*4, with the detailed values FFS

R1-1717077	Remaining issues on bandwidth part	Huawei, HiSilicon
R1-1717400	Remaining details for bandwidth parts	Intel Corporation
R1-1717504	Remaining details for bandwidth part operation	vivo
R1-1717675	On Bandwidth Part Operation	Samsung
R1-1717839	Remaining aspects of BWP operation	CATT
R1-1717972	Remaining issues on bandwidth parts	LG Electronics
R1-1718050	Remaining issues on bandwidth part configuration and activation	Guangdong OPPO Mobile Telecom
R1-1718223	Remaing issues on bandwidth parts for NR	NTT DOCOMO, INC.
R1-1718327	Remaining details on bandwidth part operation in NR	MediaTek Inc.
R1-1718365	Remaining details of BWP	InterDigital, Inc.
R1-1718404	Remaining details for bandwidth parts	AT&T
R1-1718523	On bandwidth parties	Ericsson
R1-1718580	Open issues on BWP	Qualcomm Incorporated
R1-1718607	On remaining aspects of BWPs	Nokia, Nokia Shanghai Bell
R1-1718765	Discussion on relation between (group) common control channels and DL BWP	Panasonic

Late submission

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7.3.4.2 Other aspects on carrier aggregation

Including dual connectivity (if any), SUL

[R1-1718781](#) Summary on CA Aspects Samsung

Agreements:

- The following working assumption is confirmed:
 - In case of cross-carrier scheduling, UESS search spaces for the scheduling cell and for the scheduled cell(s) are separated by offset(s) if they are in the same CORESET
 - The offset(s) depends on CIF
 - FFS details
 - FFS the case of same DCI size (whether to have shared search space or not)

Agreements:

- When a UE is configured for cross-carrier DL/UL scheduling, CIF is present in DL/UL scheduling DCIs for both the serving cell under self-scheduling and the serving cells being cross-carrier scheduled
 - FFS whether CIF is present or not in other DCI cases

Thursday

Discuss further offline regarding how to activate/deactivate Scells (MAC CE vs. DCI based)

Discuss further offline regarding whether or not CBG based HARQ-ACK feedback would have RRC impact or not

Discuss further offline whether or not to support SRS cell switching before Dec.

Discuss further offline whether LTE-like max code rate mechanism is to be used for NR UCI feedback

Friday

Proposals:

- Option #1
 - NR supports Scell activation via DCI signaling
 - FFS for deactivation
 - FFS interactions between Scell deactivation timer and BWP timer
- Option #2:
 - NR supports Scell activation/deactivation via MAC CE signalling
 - Optionally,
 - BWP switching DCI to switch bandwidth part can be used to activate Scell
 - FFS details
- Option #3:
 - NR supports Scell activation/deactivation via MAC CE signalling only

Email discussion/approval till 10/27 (Peter A., Qualcomm)

Agreements:

- 'Semi-static' HARQ-ACK codebook (per PUCCH group) is at least determined by
 - Configured number of DL Cells
 - The max number of TBs based on configuration for each DL cell
 - Configured number of CBGs per TB per configured DL cell
 - FFS: Handling of different numerology between UL and DL
 - Details FFS
- Dynamic HARQ-ACK codebook (per PUCCH group) with CBG configuration at least for one serving cell
 - Details FFS

Proposals:

- A configurable max coding rate is used for a UE to determine how to feedback UCI on PUCCH
 - FFS details how to use the configuration. The LTE mechanism is the baseline

Email discussion/approval till 10/27 (Aris – Samsung)

R1-1717080	Other issues on NR CA and DC including SRS switching and SUL	Huawei, HiSilicon
R1-1717401	Remaining aspects for carrier aggregation	Intel Corporation
R1-1717505	On NR carrier aggregation	vivo
R1-1717522	PUCCH transmission in case of Carrier Aggregation	ZTE, Sanechips
R1-1717676	CA Operation Aspects	Samsung

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R1-1717840	Remaining aspects of CA operation	CATT	
R1-1717858	HARQ-ACK codebook size determination for CA with different numerologies	Lenovo, Motorola Mobility	
R1-1717891	Discussion on design of msg2 for SUL	CMCC	
R1-1717973	Discussion on carrier aggregation for NR	LG Electronics	
R1-1718224	Views on other aspect on carrier aggregation	NTT DOCOMO, INC.	
R1-1718405	Remaining details for carrier aggregation	AT&T	
R1-1718581	Open issues on CA	Qualcomm Incorporated	
R1-1718608	On remaining aspects of NR CA/DC	Nokia, Nokia Shanghai Bell	
R1-1718651	On Carrier aggregation related aspects	Ericsson	

7.3.5 Rate matching aspects for NR DL and UL

Including PDCCH vs. PDSCH, RS related rate matching/puncturing, considerations for LTE/future compatible related matching/puncturing, etc.

[R1-1718827](#) Summary of open issues related to rate-matching in NR Nokia, Nokia Shanghai Bell

Conclusion:

- Discuss further offline to come up with framework on how rate matching/puncturing should be done at least for NR-PDSCH & NR-PUSCH especially in terms of signalling details (granularity in time-domain and frequency-domain), considering different important use cases (LTE/NR co-existence, RS/channels/CORESETs defined in NR, etc.).
 - The applicable use cases can be clarified with notes, but not necessarily part of the proposed signalling details

Thursday

Agreements:

- On a RE level, NR-PDSCH of SCS 15kHz can be rate-matched around the following resources:
 - LTE CRS
 - Rate-matching resource can be semi-statically configured (using LTE v_shift and up to 4 CRS antenna port(s)) for a NR UE
- A UE is not expected to handle the case where NR-PDSCH DMRS REs are over-lapping, even partially, with any RE(s) indicated by the rate-matching configuration.

Agreements:

- On the RB-symbol level, UE can be configured with one or multiple DL resource set(s), each resource set configuration includes a first bitmap of RB granularity and a second bitmap of OFDM symbols within a slot for which the first bitmap applies (i.e. the intersection of two bitmaps).
 - These resource set(s) can be identified as resource sets(s) for which the PDSCH is or is not mapped based on the L1 signalling.
 - FFS whether or not the presence of the information field to indicate the resource set is RRC configurable – conclude by Friday
 - FFS whether a resource set is applicable in every slot or not (e.g., via a periodic configuration, etc.)
 - Conclude by Friday whether or not there is RRC impact
 - FFS the case of one DCI scheduling multi-slot transmission
 - Note: covers future/backward compatible resource, parts of CORESETs, multiple CORESETs
 - FFS L1 signaling is GC PDCCH or scheduling DCI
- CORESET(s) configured to a UE for monitoring can be included in resource set(s)
 - If included, the entire CORESET is assumed for rate matching when applicable
 - These resource set(s) can be identified as resource sets(s) for which the PDSCH is or is not mapped based on the L1 signalling.
- FFS the configuration details of rate matching for semi-static case (w/o L1 signalling)

Proposals:

- NR-PUSCH can be rate-matched around the following UL resource sets:
 - Resource set can be configured at least in the last 6-symbols
 - PUSCH symbols is contiguous after rate matching
 - FFS: Can be non-contiguous
 - FFS: continuous set of RBs at least in the last 6 symbol of the slot
- UL resource set(s) can be identified as resource sets(s) for which the NR-PUSCH is or is not mapped based on the L1 signalling
 - FFS: whether L1 signalling is covered by RA time-domain signalling
 - FFS the configuration details of rate matching for semi-static case (w/o L1 signalling)
- Note: For the purpose of NR and LTE SRS, short PUCCH

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Proposals:

- On the RB-symbol level, for semi-static configuration of a rate-matching resource
 - Configure a first bitmap of RBs
 - Configure a second bitmap of [14, 28 or 56] symbols (i.e. 1 2 4 slot(s)) in time for which the first bitmap applies
 - Configure a third bitmap indicating, in units of second bitmap, the units for which time-frequency units configured by the first and the second bitmaps apply, for the duration of min(40ms,[1, 5, 10, 20 or 40] units)
 - The rate-matching resource set configuration repeats in time.
 - FFS: remaining details of configuration for rate-matching resource sets with and without L1 signalling.

For email approval till 10/27 (including per cell vs. per BWP, max # resource sets, DCI field presence or not and/or by configuration or not)

[R1-1717044](#) On Dynamic resource sharing ZTE, Sanechips
[R1-1717079](#) Remaining issues on reserved resources Huawei, HiSilicon
[R1-1717402](#) On RE mapping for NR Intel Corporation
[R1-1717403](#) Rate matching aspects for NR DL and UL Intel Corporation
[Withdrawn](#)
[R1-1717482](#) Discussion on rate matching for DL and UL vivo
[R1-1717677](#) On Rate Matching Samsung
[R1-1717723](#) Discussion on PDSCH rate matching Fujitsu
[R1-1717841](#) Details of rate matching for PDSCH and PUSCH CATT
[R1-1717974](#) Discussion on rate matching for PDSCH/PUSCH LG Electronics
[R1-1718030](#) On PDSCH and PUSCH Rate matching Guangdong OPPO Mobile Telecom
[R1-1718225](#) Rate-matching aspects for DL and UL NTT DOCOMO, INC.
[R1-1718282](#) Discussion on dynamic resource sharing for NR WILUS Inc.
[R1-1718290](#) Resource reservation for NR DL and UL Panasonic
[R1-1718406](#) Rate matching aspects of LTE-NR coexistence and further details on resource sets AT&T
[R1-1718522](#) On matching transmissions to available resources Ericsson
[R1-1718582](#) On PDSCH and PUSCH RE mapping Qualcomm Incorporated
[R1-1718609](#) On rate-matching in NR Nokia, Nokia Shanghai Bell
[R1-1718661](#) Reserved resources for NR coexistence with LTE-M Sony

7.3.6 Other

Including remaining aspects related to forward compatibility (if any)

[R1-1717506](#) On NR reserved resource vivo
[Withdrawn](#)
[R1-1717678](#) On UL Transmission Timing Aspects Samsung
[R1-1717679](#) Triggered UCI Transmissions Samsung
[R1-1717904](#) Coexistence of different UE types on a wideband carrier Huawei, HiSilicon
[R1-1717905](#) Bandwidth part activation and adaptation Huawei, HiSilicon
[R1-1718051](#) On resource reservation Guangdong OPPO Mobile Telecom
[R1-1718597](#) Forward Compatibility Design Considerations Qualcomm Incorporated
[Late submission](#)
[R1-1718687](#) Open issues on RRC parameters for CA, BWP and rate matching aspects Ericsson

7.4 Channel coding

[R1-1719254](#) Chairman's notes of AI 7.4 Channel coding Ad-Hoc chair (Nokia) (rev of [R1-1719116](#))

The document was presented by Matthew Baker of Nokia.

Decision: The document is endorsed, and content incorporated below.

7.4.1 LDPC code

7.4.1.1 Remaining issues of bit-level interleaver

[R1-1718346](#) Remaining issues on bit-level interleaver MediaTek Inc.
[R1-1718673](#) Reverse order mapping for retransmissions Nokia, Nokia Shanghai Bell
[R1-1717680](#) Bit-reversal mapping in bit-level interleaver Samsung
[R1-1717404](#) Remaining issues of LDPC bit-level interleaver Intel Corporation

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R1-1718375	Bit mapping to modulation symbols	Huawei, HiSilicon
R1-1718408	On bit reversal in bit-level interleaver	ZTE, Sanechips
R1-1717975	On bit reverse mapping of LDPC	LG Electronics
R1-1717682	Coding chain for data channel	Samsung
R1-1717989	Remaining Issues of Channel Interleaver for LDPC Codes	Ericsson
R1-1718583	Bit-level interleaving	Qualcomm Incorporated

Late submission

Agreements:

- Reverse mapping is not supported.
- Working assumption is confirmed that interleaver is located after the whole rate matching functionality including repetition

7.4.1.2 RV order for special cases

[R1-1717405](#) LDPC RV ordering for special cases Intel Corporation

Observations:

- If performance is the priority, {0,2,3,1} should be used.
- If self-decodability is the priority, it should be taken into account that the upper limit of the code rate at which each RV is self-decodable is in the following order: 0>3>2>1

Agreement:

- The default RV order is {0,2,3,1} for cases where RV index is not explicitly signalled or otherwise specified and there is no ambiguity about which instance of a transmission occurred, for both BG1 and BG2

Conclusion for other cases, e.g. grant-free and unlicensed:

- The respective session should determine the requirements (ambiguity, number of repetitions, self-decodability, existence of configuration signalling) and RV(s) should then be determined accordingly in the channel coding session.

R1-1717990	RV Order for LDPC HARQ	Ericsson
R1-1717681	RV order for special case	Samsung
R1-1718498	Performance Evaluation of RV Order	InterDigital, Inc.
R1-1718409	On RV order for special cases	ZTE, Sanechips
R1-1718674	Default RV order	Nokia, Nokia Shanghai Bell
R1-1717976	RV order for special cases	LG Electronics
R1-1718584	Considerations for RV order	Qualcomm Incorporated
R1-1718347	On RV order for special cases	MediaTek Inc.
R1-1718376	RV order for LDPC codes	Huawei, HiSilicon

7.4.1.3 Other

Including confirmation of Working Assumptions on segmentation and BG selection.

Including handling highest code rate supportable by each BG with acceptable performance

Max code rate for BG1

R1-1717406	Remaining issues for LDPC BG usage and segmentation	Intel Corporation
Section 4		
R1-1717683	Highest code rate supportable by BG1	Samsung
R1-1718676	Highest code rates for LDPC base graphs	Nokia, Nokia Shanghai Bell
R1-1717991	Highest Code Rate Supported by LDPC Codes	Ericsson
R1-1717977	Remaining issues in LDPC code	LG Electronics
Section 2.2		
R1-1718410	Remaining issues of segmentation and BG selection	ZTE, Sanechips
Section 4		
R1-1718348	Remaining issues on BG applications for NR	MediaTek Inc.
Section 2		

Values proposed: 0.935, 0.9375, 0.949, 0.95, 0.9565, 0.96, 0.97

Agreement:

- UE can skip decoding with BG1 when the effective code rate is > 0.95.

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Observation:

- BG1 performance is good for 256QAM up to 0.9375, and for QPSK up to 0.9565.

BG selection and segmentation

[R1-1717993](#) Application of BG1 and BG2 for NR Data Channel Ericsson
[R1-1718997](#) Highest code rate supportable by BG2 Samsung (Revision of [R1-1717684](#))
[R1-1718377](#) Base graph usage for small block lengths Huawei, HiSilicon

Section 2

[R1-1718348](#) Remaining issues on BG applications for NR MediaTek Inc.

Section 3

Agreement:

- For block lengths $K \leq 308$:
 - BG2 is used for all code rates

[R1-1717686](#) Discussion on BG2 segmentation Samsung

[R1-1717406](#) Remaining issues for LDPC BG usage and segmentation Intel Corporation

Section 2

Proposals::

- Alt 1: Zero padding is added during segmentation if there are cases where the relevant BG does not support the required TBS.
- Alt 2: Cases are not supported where the TBS determination procedure cannot achieve the criterion that TBS plus TB-CRC can be factored into the number of CBs multiplied by the CBS (before addition of LDPC encoding filler bits).
- Alt 3: Transport block sizes that are supported by BG2 are also supported by BG1, and the maximum number of code block sizes supported by BG2 is at most two.
- Alt 4: Transport block sizes that are supported by BG1 are also supported by BG2, and zero padding is added during segmentation if necessary.

Agreement: TBSs are byte-aligned

Agreement:

The first Working Assumption from RAN1#90 AI 6.1.4.1.2 and the first Working Assumption from NR AH#3 AI 6.4.1.3 are combined and agreed as modified below:

- For initial transmissions with code rate $R_{\text{init}} > 1/4$, BG2 is not used when $TBS > 3824$
 - If the FFS on UE capabilities w.r.t. support of both BGs is resolved such that it is possible that a UE does not support BG1, then the above bullet only applies if the UE supports BG1.
- BG2 is used for initial transmissions with code rate $R_{\text{init}} \leq 1/4$ for all TBS supported at that code rate
 - For BG2 with TBSs larger than 3824, the TB is segmented into CBs no larger than 3840
- TBS determination for all code rates shall ensure that no zero padding is necessary with BG1 segmentation; TBS determination shall also strive to achieve no zero padding also with BG2 segmentation; any special cases are only permitted for BG2.
 - If needed for BG2 segmentation, zero padding is added during segmentation, with the padding being placed at the beginning of the first code block prior to CB-CRC calculation; padding bits are transmitted.

FFS: Byte- or something-alignment of CB sizes.

[R1-1717992](#) TB Size and Code Block Segmentation for NR Data Channel Ericsson
[R1-1718675](#) Remaining details of CB segmentation Nokia, Nokia Shanghai Bell
[R1-1718410](#) Remaining issues of segmentation and BG selection ZTE, Sanechips

Sections 2&3

[R1-1718499](#) LDPC Base Graph Selection for Small Code Blocks InterDigital, Inc.

[R1-1717977](#) Remaining issues in LDPC code LG Electronics

Section 2.1

[R1-1717842](#) BG selection for NR data channel CATT

Nominal code rate determination from DCI

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[R1-1718377](#) Base graph usage for small block lengths Huawei, HiSilicon
Section 3

Question: How to determine the BG of the initial transmission, including when segmentation with BG2 is applied?

Problem: How to let the receiver identify the BG on a retransmission when the MCS is changed such that the BG selection would differ from the initial transmission when initial PDCCH assignment is missed, followed by DTX->NACK error?

Options:

- Alt 1: Explicit indication of BG in DCI
 - o Most robust solution, fixes all error cases
 - o But increases overhead
 - o LG, ZTE, Nok, Fuji, CATT, MTK
- Alt 2: Determine TBS and BG from MCS field in DCI, and either:
 - o Intel, Sams, DCM, Eri, QC, HW,
 - o a) apply additional* restrictions to the MCS set of all retransmissions to ensure that the TBS calculation results in the same BG selection as for the initial transmission
 - o b) enable TBS and BG to be derived from the MCS field unambiguously for both initial and retransmissions, without additional* restrictions on the MCS set for retransmissions

* additional meaning on top of the restrictions that would anyway apply if the BG was explicitly known.

Study further until RAN1#91. (Can check on Friday if consensus around a solution emerges.)

Friday: No change.

[R1-1717685](#) Code rate definition for BG selection Samsung
[R1-1717406](#) Remaining issues for LDPC BG usage and segmentation Intel Corporation
Section 3
[R1-1718585](#) Considerations for BG2 segmentations Qualcomm Incorporated
Late submission

7.4.2 Polar code

7.4.2.1 Remaining issues of code construction

Frozen bit values, scrambling, CRC masking

[R1-1717407](#) Remaining issues for Polar code construction Intel Corporation
Sections 3,4
[R1-1718343](#) On UE-specific scrambling design for DL control MediaTek Inc.
[R1-1718368](#) Linear Codeword Scrambling to Support Early Termination on DCI Blind Detection and other Modes of Block Discrimination Coherent Logix

Observations:

- No loss of ET opportunities compared to the case of no masking is foreseen by masking the RNTI onto the last N_{RNTI} CRC bits, provided that $N_{\text{RNTI}} \leq 17$.
- No significant loss of ET opportunities compared to the case of no masking is foreseen by masking the RNTI onto the last N_{RNTI} CRC bits, provided that $N_{\text{RNTI}} \leq 21$.
- Masking RNTI on the distributed CRC bits:
 - o if the UE is configured to monitor only 1 RNTI:
 - may increase the ET possibilities in the case of a valid codeword for another RNTI being received
 - o if the UE is configured to monitor >1 RNTI:
 - reduces possibilities for ET
 - may require decoder to maintain two decoding trees in some implementations.

Agreement:

- RNTI is masked onto the last N_{RNTI} CRC bits on the PDCCH, where N_{RNTI} is the number of bits of the RNTI
- Working Assumption that N_{RNTI} is 16 bits.
 - o Prepare a draft LS to RAN2 ([R1-1719086](#) – Yufei – [approved in R1-1719094](#)) to let them know that RAN1's channel coding design for PDCCH is capable of carrying RNTIs on the DCI up to at least 17 bits, and possibly up to 21 bits, asking RAN2 to inform RAN1 when they have decided the necessary RNTI length.
 - Check the LS in the control channel session in case additional information should be included before sending it.

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Note that this preserves the ET gains in cases of interference that is effectively AWGN or QPSK constituting an invalid codeword.
Working assumption: no additional UE-specific scrambling motivated by channel coding; can be revisited on Thursday or at RAN1#91 if it is shown that valid codeword interference occurs sufficiently frequently to cause significant overall loss in ET gain (in which case, the following examples of scrambling may be considered, provided that the number of required blind decodes is not increased: u-domain or c-domain or before mapping to modulation symbols, or payload scrambling after CRC calculation but before CRC attachment).

Observations on scrambling:

- When input to decoder is effectively AWGN or random QPSK, there is no difference in ET gain between cases with and without UE-ID-based u-domain scrambling
- Pros and cons of scrambling:
 - When input to decoder is another valid codeword, scrambling gives ET benefits in cases of high SINR to the unintended UE
 - May increase latency (different opinions)

[R1-1718677](#) Frozen bit values and scrambling Nokia, Nokia Shanghai Bell
[R1-1718504](#) **Simplified UE-Specific Scrambling for DL Control** Tsosun Algorithm
[R1-1718370](#) UE-ID and value of frozen bits for Polar code Huawei, HiSilicon
[R1-1718884](#) Consideration of UE ID scrambling for DCI Qualcomm Incorporated
Revision of [R1-1718586](#)
[R1-1717997](#) RNTI and Scrambling for DCI Ericsson
[R1-1718226](#) UEID scrambling design for Polar codes NTT DOCOMO, INC.
[R1-1717687](#) UE-specific scrambling for downlink control channels Samsung
[R1-1718407](#) On Setting the values of Frozen bit locations for Polar codes AT&T
[R1-1717978](#) Scrambling of downlink control channel LG Electronics
[R1-1717752](#) RNTI scrambling for PDCCCH Polar code Spreadtrum Communications
[R1-1718500](#) On UE Specific Scrambling InterDigital, Inc.
[R1-1717995](#) Remaining Issues of Polar Code Construction for UCI and DCI Ericsson
[R1-1717843](#) Scrambling for Control CATT
Late submission

7.4.2.2 Remaining details of DL channel interleaver

[R1-1718860](#) Performance evaluation of DL channel interleaver LG Electronics (Revision of [R1-1717979](#))
[R1-1718893](#) Channel bit interleaver for DL control MediaTek Inc. (Revision of [R1-1718344](#))
[R1-1718371](#) DL Channel interleaver Huawei, HiSilicon
[R1-1717844](#) Interleaver design for NR DL control channel CATT
[R1-1718501](#) On Downlink Channel Interleaver InterDigital, Inc.
[R1-1717996](#) **On Downlink Channel Interleaver for Polar Codes** Ericsson
[R1-1717688](#) Design of channel interleaver for downlink control channels Samsung
[R1-1718678](#) Downlink Channel Interleaver for Polar codes Nokia, Nokia Shanghai Bell
[R1-1718411](#) Performance evaluation of downlink channel interleaver ZTE, Sanechips

Proposed Agreement:

- Adopt the interleaver only for the AL=1 case.
- Use simple rectangular block interleaver

Objections from Intel, Ericsson, Docomo, Samsung

Conclusion: DL channel interleaver is not adopted.

[R1-1718587](#) Considerations on downlink interleaver design Qualcomm Incorporated
Late submission

7.4.2.3 Other

Segmentation for large UCI

[R1-1718914](#) Segmentation of Polar code for large UCI ZTE, Sanechips (Revision of [R1-1718412](#))

Agreement:

- UCI segmentation into two segments with equal segment sizes (with a single zero-padding bit inserted at the beginning of the first segment if needed) is used for certain ranges of K (before segmentation) and R, e.g. $K \geq \text{threshold}$ (e.g. 352) and $R \leq \text{threshold}$ (e.g. 0.4)
 - exact values FFS until RAN1#91

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- CRC appended to the first segment is calculated based on the first segment only
- CRC appended to the second segment uses the same polynomial as for the first segment, and is calculated based on the second segment only

R1-1717407	Remaining issues for Polar code construction	Intel Corporation
Section 5		
R1-1718372	Segmentation for Polar codes	Huawei, HiSilicon
R1-1718589	Segmentation design for large UCI	Qualcomm Incorporated
Miscellaneous		
R1-1718227	Polar coding for CSI reporting	NTT DOCOMO, INC.
R1-1718413	Joint coding scheme for UCI	ZTE, Sanechips
R1-1717689	Polar code construction for short UCI	Samsung
R1-1718506	On nFAR for UL code construction	Huawei, HiSilicon
R1-1718588	Consideration nFAR determination for uplink	Qualcomm Incorporated

7.4.3 PBCH

R1-1718373	Polar code for PBCH and soft combining	Huawei, HiSilicon
R1-1717690	Polar code construction for PBCH	Samsung
R1-1717998	Polar Code Design for NR-PBCH	Ericsson
R1-1718959	WF on polar code construction for PBCH	Ericsson, Qualcomm

Agreement from RAN1#89:

- Polar coding is adopted for NR-PBCH
 - Using same polar code construction as for the control channel
 - $N_{max} = 512$

Clarification of the above agreement

- Reuse Polar code design of PDCCH, i.e., 24-bit D-CRC with the associated interleaver.

Agreement

- Working assumption from RAN1#89 is confirmed, that the data, including time index if carried by NR-PBCH, is transmitted explicitly

R1-1719136	WF on bit-field order for NR PBCH	Ericsson, Mediatek
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Next steps:

Study further until RAN1#91 the order of the PBCH fields, considering whether one or more PBCH fields that have known bit values in certain scenarios are placed in a specific order to enable potentially improved PBCH decoder performance/latency (with the CRC being calculated based on the order of the payload after this ordering)

- Examples of field(s) to be considered in particular include:
 - SS block time index;
 - SFN bits (e.g. for handover cases when the SFN is known a priori);
 - reserved bits
- Note that backward compatibility problems in future releases should be avoided.

R1-1718345	PBCH coding design	MediaTek Inc.
R1-1718524	Scrambling sequence design for PBCH	Sequans Communications
R1-1718590	PBCH design using Polar codes	Qualcomm Incorporated
R1-1718679	Remaining details of PBCH	Nokia, Nokia Shanghai Bell
R1-1717845	Discussion on Polar codes for PBCH	CATT
R1-1717980	Coding aspects of PBCH transmission	LG Electronics

7.4.4 Other

R1-1717727	Essential enhancement to rate matching of Reed Muller code	Sequans Communications
R1-1718374	Channel coding for URLLC	Huawei, HiSilicon
R1-1718505	Channel Coding for URLLC	Tsfun Algorithm

RAN1#91 **WF on coding for 6G** Accelercomm, CATT, Coherent Logix, Ericsson, Fujitsu, HiSilicon, Huawei, Intel, InterDigital, LG, MediaTek, Nokia, NSB, NTT Docomo, Orange, Qualcomm, Samsung, Sanechips, Sony, Tsfun, Xilinx, ZTE, Satoshi

With this proposal, 6G is now complete as well as 5G.

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7.5 NR-LTE co-existence

[R1-1719119](#) Chairman's notes of AI 7.5 NR-LTE co-existence Ad-Hoc chair (Nokia)

The document was presented by Matthew Baker of Nokia.

Decision: The document is endorsed, and content incorporated below.

[R1-1717780](#) TDM single uplink transmission in NR NSA and comparison to dual uplink Apple Inc.

[R1-1718178](#) Remaining issues on single uplink transmission NTT DOCOMO, INC.

Proposal:

- When the UE is configured with multiple UL carriers on different frequencies (where there is at least one LTE carrier and at least one NR carrier of a different carrier frequency), UE operating on only one of the carriers at a given time among a pair of LTE and NR can optionally be configured with UE-specific subframe offset for the LTE carrier for the HARQ timing of the DL-reference UL/DL configuration for Case 1 (DL-reference UL/DL configuration defined for LTE-FDD-SCell in LTE-TDD-FDD CA with LTE-TDD-PCell).

Agreement:

- For Case 1, FDD timing configuration (i.e., periodicity and offset) is applied to LTE PRACH and SRS on LTE UL carriers.
- The UE is not required to support transmission of LTE PRACH or SRS transmission which does not coincide with the configured HARQ-ACK transmission occasions

[R1-1718521](#) On single-UL transmission and DL/UL TDM Ericsson

Agreements:

- DL/UL TDM (to avoid self-interference due to harmonics) is a network decision on a per-UE basis
 - No RRC configuration signalling is provided to the UE for this purpose (except FFS for the LTE RRC signalling to configure Case 1 HARQ timing)
 - UEs can be scheduled for NR or LTE uplink transmission in an arbitrary slot
 - UEs can be scheduled for NR or LTE downlink transmission in an arbitrary slot
- For the case of a UE configured with multiple uplink carriers (regardless of SUL or not) but where the UE is assumed to only operate on one uplink carrier at a time:
 - No RRC configuration signalling is provided to the UE for this purpose (except for the LTE RRC signalling to configure Case 1 HARQ timing)
 - UEs can be scheduled for uplink NR transmission in an arbitrary slot
 - The UE behaviour in case of being simultaneously scheduled on LTE and NR uplinks is not specified

[R1-1717410](#) Remaining issues of NR-LTE coexistence Intel Corporation

[R1-1718460](#) Discussion on the Pattern Type for Harmonic Interference Handling China Telecommunications

[R1-1717507](#) Remaining issues on UE self-interference handling vivo

[R1-1718775](#) Further discussion on the solution to the NR-LTE self-interference Guangdong OPPO Mobile Telecom

[R1-1718934](#) WF on SUL operations Huawei, HiSilicon, Vodafone, China Mobile, Orange, Deutsche Telekom, China Telecom, China Unicom, vivo

Note following agreements from RAN2:

Agreements for SUL operation in connected mode:

- 1 When SUL is configured there are 2 ULs configured for one DL of the same cell. (FFS how much configuration is provided for the 2 ULs)
- 2 At any point in time, each serving cell has at most one PUSCH for transmission

Options for further discussion on RRC signalling to configure SUL

- 1 RRC configured 2 ULs (one if a full UL configuration and 2nd is just SRS configuration). RRC reconfiguration to provide a full UL configuration for a different carrier is used to switch UL data between 2 different ULs.
- 2 RRC configures 2 UL. Signalling (e.g. DCI or MAC CE) is defined to enable UE to switch between the 2 different UL configurations, or 2 use both ULs



=> Offline to progress the FFS and to try to conclude between the 2 options. Can consider any RAN1 progress made during this week. (Offline discussion #22, Huawei)

Comeback session on Wednesday:

Clarification of agreements

- 1 In any slot, one PUSCH is used for transmission for a single serving cell (i.e. associated to a single DL). This excludes simultaneous transmission on 2 PUSCH within a single slot but does not restrict switching between the two PUSCH based on L1 /MAC/RRC signalling options.
- 2 RAN2 consider that it is up to RAN1 to decide where PUCCH is transmitted
- 3 Option 2 is clarified to "RRC configures 2 UL. Signalling (e.g. DCI or MAC CE) is defined to enable UE to switch between the 2 different UL configurations, to use both ULs but not schedule them simultaneously based on agreement 1 above"
- 4 Final decision to use MAC CE signalling would be a RAN2 decision.
- 5 Final decision to use L1 signalling would be a RAN1 decision.
- 6 There is no RAN2 motivation to adopt DCI signalling.

R1-1719112 **WF on SUL operation** **Huawei, HiSilicon**

Proposals:

- UE specific RRC signaling is used to configure one of the following cases for potential PUSCH transmission on the SUL carrier and the non-SUL UL carrier in a SUL band combination
 - Case 1: PUSCH is only transmitted on the SUL carrier
 - i.e. the UE is not expected to receive UL grant for PUSCH on the non-SUL UL carrier
 - Case 2: PUSCH is only transmitted on the non-SUL UL carrier
 - i.e. the UE is not expected to receive UL grant for PUSCH on the SUL carrier
 - Case 3: PUSCH is transmitted on both the SUL carrier and non-SUL UL carrier
 - A carrier indicator field in the UL grant is used to indicate where the corresponding PUSCH is transmitted, i.e. on the SUL carrier or the non-SUL UL carrier
 - There is one active BWP on the SUL carrier and one active BWP on the non-SUL UL carrier
 - Note: Simultaneous PUSCH transmission on the SUL carrier and non-SUL UL carrier is not supported according to existing RAN2 agreement
- The above two UE specific RRC signalings for PUCCH and PUSCH are independent
- SRS related RRC parameters are independently configured for SRS on the SUL carrier and SRS on the non-SUL UL carrier
 - SRS can be configured on the SUL carrier and non-SUL UL carrier, irrespective of the carrier configuration for PUSCH and PUCCH

LG alternative: For UEs in RRC Connected, only one UL carrier is activated for PRACH/PUSCH/PUCCH, which can be switched between SUL and non-SUL by RRC signalling.

Agreement:

- UE specific RRC signalling (re-)configures the location of the PUCCH, either on the SUL carrier or on a non-SUL UL carrier in a SUL band combination
 - The default location of the PUSCH is the same carrier as used by PUCCH
- UE specific RRC signalling may (de-)configure that PUSCH may be dynamically scheduled on the other (i.e. non-PUCCH) carrier in the same cell as the SUL
 - In this case, a carrier indicator field in the UL grant is used to indicate dynamically whether the PUSCH is transmitted on the PUCCH carrier or on the other carrier
 - Note: Simultaneous PUSCH transmission on the SUL carrier and non-SUL UL carrier is not supported according to existing RAN2 agreement
 - FFS in DCI discussion whether the SUL CIF is always present
 - There is one active BWP on the SUL carrier and one active BWP on the non-SUL UL carrier
- SRS related RRC parameters are independently configured for SRS on the SUL carrier and SRS on the non-SUL UL carrier in the SUL band combination
 - SRS can be configured on the SUL carrier and non-SUL UL carrier, irrespective of the carrier configuration for PUSCH and PUCCH

R1-1718948 WF on PUSCH transmission with SUL ZTE, Sanechips, China Telecom, CATR, Huawei, vivo, China Unicom

[R1-1717691](#) On LTE-NR Coexistence Samsung
[R1-1717981](#) Remaining issues in NR LTE coexistence LG Electronics
[R1-1717097](#) HARQ/CSI feedback and scheduling timing for SUL Huawei, HiSilicon

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[R1-1718503](#) Remaining issues in NR-LTE coexistence ZTE, Sanechips
[R1-1717154](#) RACH procedure towards SUL carrier NEC

[R1-1718694](#) Transmission switching time between SUL carrier and NR TDD carrier CMCC
[R1-1718939](#) **WF on switching time between SUL carrier and NR TDD carrier** CMCC, China Telecom, Orange,
China Unicom, Nokia, Nokia Shanghai Bell, Huawei, HiSilicon, ZTE, Sanechips, Deutsche Telekom
For discussion in RAN4.

[R1-1717849](#) Remaining issues on LTE/NR coexistence CATT
[R1-1718688](#) Open issues on RRC parameters for NR-LTE co-existence Ericsson

Friday

[R1-1719194](#) **WF on UL TDM in single Tx EN-DC** Qualcomm, Vodafone

Decision: For email discussion/approval till 10/27 – Peter (Qualcomm)

7.6 UL power control

[R1-1719117](#) **Chairman's notes of AI 7.6 UL Power control** Ad-Hoc chair (Samsung)

The document was presented by Younsun Kim of Samsung.

Decision: The document is endorsed, and content incorporated below.

7.6.1 NR power control framework

[R1-1718883](#) **Offline summary for AI 7.6 NR UL power control** ZTE

Agreement: For N closed-loop power control processes, i.e., $f_c(i,l)$, for NR PUSCH power control for serving cell c, the following working assumption is confirmed:

- N is up to 2

Agreement: For closed loop power control process, $f(i)$ in case of accumulative TPC command mode can be reset by RRC reconfiguration of $P_{0,c}$ and α

Agreements:

- Support PH calculation for PUSCH transmission
 - Calculation for current transmission
 - FFS: Calculation for non-current transmission
- $$PH_c = P_{\max,c}(i) - \left\{ 10 \log_{10}(M_{\text{PUSCH},c}(i)) + P_{0,c}(j) + \alpha_c(j) \cdot PL_c(k) + \Delta_{TF,c}(i) + f_c(i,l) \right\}$$

Agreements: Confirm the following working assumption:

- For NR-PUSCH
 - Absolute TPC command mode is supported.
 - FFS on K_{PUSCH}

[R1-1719008](#) **Offline summary for AI 7.6 NR UL power control** ZTE

Agreement

Support the following PUSCH power control in NR:

$$P_{\text{PUSCH},c}(i) = \min \left\{ P_{\max,c}(i), \left\{ 10 \log_{10}(M_{\text{PUSCH},c}(i)) + P_{0,c}(j) + \alpha_c(j) \cdot PL_c(k) + \Delta_{TF,c}(i) + f_c(i,l) \right\} \right\}$$

- For the pathloss measurement RS indication.
 - k is indicated by beam indication for PUSCH (if present)
 - A linkage between PUSCH beam indication and k which is index of downlink RS resource for PL measurement is pre-configured via high layer signal
 - Only one value k is RRC configured in UE specific way if PUSCH beam indication is not present
- Value of $P_{0,c}$ is composed by cell specific component and UE specific component
 - At least three cell specific component values of $P_{0,c}$ can be configured
- α is 1 by default before UE specific configuration
 - Candidate values are the same as in LTE
- j can be configured for the following aspects
 - grant-based PUSCH, grant-free PUSCH and PUSCH for msg 3
 - PUSCH beam indication (if present) for grant-based PUSCH

- FFS: logical channel of PUSCH
- slot sets (if supported)
- **Working assumption:** for two uplinks of SUL band combination
- If N=2 (number of closed loop process) is configured for UE, l can be configured for the following aspects
 - PUSCH beam indication (if present) for grant-based PUSCH
 - slot sets (if supported)
 - grant-free PUSCH and grant based PUSCH
 - FFS: logical channel(s) carried by PUSCH
 - **Working assumption:** for two uplinks of SUL band combination
- FFS: whether delta_{TF} takes into account received SNR target difference between DFT-s-OFDM and CP-OFDM or not.
- Capturing the agreement in the NR specification is up to the editor

R1-1718902 **WF on PHR** **NTT DOCOMO, InterDigital, Nokia, NSB, Samsung**

Agreement:

- Support P_{max,c} reporting for PHR corresponding to NR PUSCH only transmission

Above is supported at least for sub-6GHz.

Agreement:

- Support one PHR format: PH and P_{max,c}
 - FFS: PHR reporting restriction for short UE timeline cases (ex: reporting virtual PHR)

R1-1718996 **WF on timeline impact of PHR** **Qualcomm**

R1-1718940 Reply LS on power sharing for LTE-NR Dual connectivity **RAN4**

R1-1719063 [draft] Response LS on power sharing for LTE-NR Dual connectivity **LG**

LS approved in **R1-1719045**

Agreement:

- Support closed power control commands by downlink DCI for PUCCH power control and by uplink grant for PUSCH power control
 - FFS: SRS
- Support closed power control commands by group common DCI with TPC-PUSCH-RNTI, TPC-PUCCH-RNTI, TPC-SRS-RNTI

Agreement: Support 2 bits TPC command for accumulative power control and absolute power control

R1-1719132 **Offline summary for AI 7.6 NR UL power control** **ZTE**

Working Assumption:

- Support $P_{\text{max},c}(i)$, $P_{0_PUCCH}(F)$, $PL_c(k)$, $g(i)$ for NR PUCCH power control in slot i for serving cell c .

$$P_{PUCCH}(i) = \min \left\{ P_{\text{MAX},c}(i), P_{0_PUCCH} + PL_c(k) + 10 \log_{10} (M_{PUCCH,c}(i)) + \Delta_{F_PUCCH}(F) + \Delta_{PUCCH_TF,c}(i) + g(i) \right\} [\text{dBm}]$$
 - F is the index of PUCCH formats, e.g., $F = 0$ for PUCCH format 0, $F = 1$ for PUCCH format 1, $F = 2$ for PUCCH format 2, $F = 3$ for PUCCH format 3
 - P_{0_PUCCH} is a parameter composed of the sum of a parameter $P_{0_NOMINAL_PUCCH}$ configured by higher layers and a parameter $P_{0_UE_PUCCH}$ configured by higher layers.
 - k is the index of RS resource(s) for pathloss measurement is RRC configured
 - Multiple values of k can be configured by RRC signalling
 - *FFS: Other approaches not requiring RRC configuration for the determination of k*
 - FFS: exact $P_{\text{max},c}(i)$ definition and notation for above 6 GHz
 - Full path-loss compensation for NR PUCCH power control
 - Note: $10 \cdot \log_{10}(M_{PUCCH,c}(i))$ should be deleted
 - Note: P_{0_PUCCH} should be revised to $P_{0_PUCCH}(b)$
 - Note: $g(i)$ should be revised to $g(i,l)$
 - Multiple $P_{0_PUCCH}(b)$ can be configured by RRC signalling
- Support up to 2 closed-loop power control processes, i.e., l
 - The closed-loop control process is configured by RRC signalling
 - Reset trigger by RRC re-configuration of $P_{0_}$, FFS: beam changing, etc.

- Only accumulative TPC command
- Support $\Delta_{\text{PUCCH_TF},c}(i)$ to reflect at least UCI payload size, UCI type (e.g., SR, HARQ, CSI), different coding gains, PUCCH format, coding schemes and different effective coding rates:
 - FFS: details on $\Delta_{\text{PUCCH_TF},c}(i)$
 - Whether $\Delta_{\text{PUCCH_TF},c}(i)$ includes $M_{\text{PUCCH},c}(i)$
 - $M_{\text{PUCCH},c}(i)$ is related to the PUCCH BW in slot i , FFS on the details
 - FFS: whether $\Delta_{\text{PUCCH_TF},c}(i)$ takes into account received SNR target difference between DFT-s-OFDM and CP-OFDM or not.

R1-1719189 Offline summary for AI 7.6 NR UL power control ZTE

$$P_{\text{SRS},c}(i) = \min \left\{ P_{\text{CMAX},c}(i), \left[P_{\text{SRS_OFFSET},c}(m) + 10 \log_{10}(M_{\text{SRS},c}(i)) + P_{0,c}(j) + \alpha_c(j) \cdot PL_c(k) + h_c(i,l) \right] \right\}$$

- For power control for SRS transmission at least for CSI acquisition tied with PUSCH power control, support at least $P_{\text{CMAX},c}(i)$, $P_{\text{SRS_OFFSET},c}(m)$, $M_{\text{SRS},c}(i)$, $P_{0,c}(j)$, $\alpha_c(j)$, $PL_c(k)$, $h_c(i,l)$ for power control of SRS resource set
 - In case SRS power control is tied with corresponding PUSCH power control,
 - $h_c(i,l) = f_c(i,l)$
 - $P_{0,c}(j)$, $\alpha_c(j)$, $PL_c(k)$ are shared with the corresponding PUSCH power control
 - i is slot number
 - j is the index of open-loop parameter
 - m is the index of power offset
 - k is the index of RS resource(s) for pathloss measurement
 - FFS details of $P_{0,c}(j)$
 - $P_{\text{SRS_OFFSET},c}(m)$ is RRC configured
 - FFS: $P_{\text{SRS_OFFSET},c}(m)$ can be configured separately for SRS for CSI acquisition and beam management
 - $M_{\text{SRS},c}$ is related to the SRS transmission BW, FFS on the details
 - The value of $M_{\text{SRS},c}$ should be kept unchanged in the same slot
 - l is the index of close-loop power control process
 - SRS transmission power within the slot(s) of the SRS resource set is the same
 - FFS: for UL power control, how to support SRS transmission with different beam within the same slot
 - FFS how to support beam management SRS for multiple slots.
 - FFS: exact $P_{\text{CMAX},c}(i)$ definition and notation for above 6 GHz
 - FFS the linkage between $\{j,m,k,l\}$ of SRS and $\{j,k,l\}$ of PUSCH

Email discussion until Oct 27 – Hyunseok (Samsung)

R1-1718903 WF on LTE-NR power sharing NTT DOCOMO, InterDigital, CATT, Fujitsu, AT&T

Also supported by Nokia, NSB, Orange

R1-1719113 WF on power offset of SUL Huawei, HiSilicon

Also supported by Orange

Working Assumption:

- For PRACH/PUSCH/PUCCH/SRS on an SUL carrier associated with a NR DL/UL carrier, the maximum pathloss including penetration loss difference between two UL carriers to be compensated is 76 dB.
 - 76dB can be revisited in RAN1#91 if there is a technical issue
 - Note: This maximum number is based on the assumption that the downlink carrier frequency can be up to 70GHz

R1-1719177 [DRAFT] LS on power headroom report DOCOMO

R1-1717311 General considerations on UL power control design Huawei, HiSilicon
R1-1717438 On NR power control ZTE, Sanecips
R1-1717408 Remaining Details On UL Power Control Framework Intel Corporation
R1-1717508 Remaining issues on NR UL power control vivo
R1-1717692 On UL Power Control Samsung
R1-1717738 Discussion on Power Offset for SUL China Telecommunications
R1-1717846 NR Power Control Aspects CATT

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R1-1717892	Discussion on power control framework	CMCC
R1-1717917	Power control on different SRS groups	ASUSTEK COMPUTER (SHANGHAI)
R1-1717919	Discussion on NR power control framework	Panasonic Corporation
R1-1717983	Discussion on UL power control for NR	LG Electronics
R1-1718031	Uplink power control for NR	Guangdong OPPO Mobile Telecom
R1-1718228	Power control framework for PUSCH	NTT DOCOMO, INC.
R1-1718502	On NR Power Control Framework	InterDigital, Inc.
R1-1718592	Power control and PHR for NR	Qualcomm Incorporated
R1-1718625	UL power control and PHR	ITL
R1-1718652	NR power control framework	Ericsson
R1-1718692	Discussion on NR power control framework	Nokia, Nokia Shanghai Bell
R1-1718704	On NR Power control	Motorola Mobility, Lenovo

7.6.2 Other

Including any remaining details for power sharing

R1-1717693	On UL Power Sharing for Multi-Cell Transmissions	Samsung
R1-1718654	Power headroom reporting	Ericsson
R1-1717312	Power control for CA and DC	Huawei, HiSilicon
R1-1717409	Remaining aspects on power sharing between LTE and NR	Intel Corporation
R1-1717694	On PHR Requirements and Calculation	Samsung
R1-1717739	Discussion on Power Sharing for NR-LTE co-existence	China Telecommunications
R1-1717847	Network Assist Dynamic Power Sharing Mechanism	CATT
R1-1717906	Power offset range for SUL	Huawei, HiSilicon
R1-1717984	Discussion on remainin details on dynamic power sharing for LTE-NR DC	LG Electronics
R1-1718056	Discussion on PHR and other Issues for LTE-NR Dual Connectivity	Guangdong OPPO Mobile Telecom
R1-1718229	LTE-NR power sharing mechanism	NTT DOCOMO, INC.
R1-1718252	General considerations on power headroom calculation and reporting	Huawei, HiSilicon
R1-1718366	Power Control Modes for NR DC and NR CA	InterDigital, Inc.
R1-1718653	Further details on beam specific power control	Ericsson
R1-1718655	Further details on closed loop power control	Ericsson
R1-1718656	Further discussion on Power control for SUL	Ericsson
R1-1718689	Open issues on RRC parameters for UL power control	Ericsson
R1-1718693	Considerations on Power headroom report in NR	Nokia, Nokia Shanghai Bell

7.7 Aspects related to FDD

[R1-1718960](#) Summary for A17.7 - Aspects related to FDD ZTE, Sanechips (rev of [R1-1718783](#))

Decision: The document is noted.

Agreements:

- Same scheduling framework is supported for paired and non-paired spectra
 - Note: This applies to both slot based and non-slot (mini-slot) based scheduling
 - Note: This includes that data transmission can be indicated with start symbol and duration
 - Note: this also includes SFI
- Same HARQ framework is supported for paired and non-paired spectra
 - Dynamic HARQ management is supported in the same way for both paired and non-paired spectra
 - All PUCCH formats are supported for both paired and non-paired spectra
- Unless necessary, no intention to distinguish paired vs. non-paired spectra in the relevant specifications

Wednesday

Agreements:

- It is already possible to have an offset between DL and UL by using UL TA.
 - No additional specification impact is necessary
 - Note: the finalizing the UL TA range of values will take into account the need of the offset

Conclusion:

- The UL carrier information is already in RMSI
 - No additional spec impact is necessary

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[R1-1717098](#) Some NR FDD design aspects Huawei, HiSilicon
[R1-1717412](#) On NR FDD Intel Corporation
[R1-1717695](#) FDD Operation Samsung
[R1-1717850](#) FDD Related Aspects CATT
[R1-1717982](#) Discussion on FDD support in NR LG Electronics
[R1-1718357](#) Aspects related to FDD MediaTek Inc.
[R1-1718593](#) FDD Design Considerations Qualcomm Incorporated

[R1-1717098](#) Some NR FDD design aspects Huawei, HiSilicon
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[R1-1717850](#) FDD Related Aspects CATT
[R1-1717982](#) Discussion on FDD support in NR LG Electronics
[R1-1718357](#) Aspects related to FDD MediaTek Inc.
[R1-1718593](#) FDD Design Considerations Qualcomm Incorporated

7.8 Other

Including handling RAN plenary LS in [R1-1716676](#)

[R1-1719129](#) Chairman's notes of AI 7.8 on Channel Model - Other Ad-Hoc chair (Nokia)

The document was presented by Matthew Baker of Nokia.

Decision: The document is endorsed, and content incorporated below.

Channel Modelling

[R1-1717851](#) Correction on 3D-InH channel model in TR 36.873 CATT, CATR, Huawei, ZTE

Decision: Agreed in [R1-1719087](#) 36.873CR0034R1 with corrected release on the cover sheet (Rel-12).

[R1-1717900](#) Correction on 3D-InH channel model in TR 38.901 CATT

Decision: CR0022 to 38.901 Rel-14, F is agreed.

[R1-1717870](#) Correction on car penetration loss in TR 38.901 CATT, CATR, Huawei, Keysight, ZTE

Withdrawn.

[R1-1718756](#) On the channel model CR for car penetration loss Ericsson

UE Categories & Capabilities

[R1-1718690](#) On UE categories for NREricsson

Agreement:

- Agree in principle to define a simple formula to send to RAN plenary to derive approximate maximum data rates, based on at least max TBS (normalised to a particular unit of time). Check details until RAN1#91, including identifying exactly which parameters should be included in the formula.

[R1-1717314](#) On UE categories and capabilities in NR Intel Corporation

Conclusions:

- Continue discussion on any RAN1-specific aspects (e.g. where UE's peak rate may be lower than the calculated peak rate, and any relation to soft buffer sizes) at RAN1#91.
- Other aspects should be left to RAN2.

[R1-1718596](#) UE Categories Qualcomm Incorporated

Late submission

V2X

[R1-1717293](#) Summary of email discussion [90-30] on eV2X evaluation methodology LG Electronics

[R1-1717291](#) Preliminary analysis of vehicle antenna pattern for V2X LG Electronics

[R1-1717292](#) Draft TR 37.885 Study on evaluation methodology of new Vehicle-to-Everything V2X use cases for LTE and NR LG Electronics

[R1-1717916](#) NR V2X channel modeling Huawei, HiSilicon, Spirent, Keysight, Cohere Technologies

[R1-1717918](#) eV2X Phase III Channel Modeling Cohere Technologies

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Late submission

NOMA

[R1-1717896](#) Discussion on the effect of EVM to non-linear receiver for NoMA CMCC

Unlicensed spectrum operation

[R1-1717899](#) LBT Considering Beamforming in Unlicensed Spectrum ASUSTEK COMPUTER (SHANGHAI)
[R1-1717911](#) High level consideration on NR unlicensed band operation Huawei, HiSilicon
[R1-1717912](#) NR Numerology on unlicensed bands HuaWei Technologies Co., Ltd
[R1-1717913](#) NR Frame structure on unlicensed bands Huawei, HiSilicon
[R1-1717914](#) Coexistence and Channel access for NR unlicensed band operations Huawei, HiSilicon
[R1-1717915](#) NR standalone operation on unlicensed bands Huawei, HiSilicon
[R1-1718231](#) Technology Components for Unlicensed Operation Ericsson Japan K.K.
[R1-1718232](#) On Physical Layer Design Policies for Unlicensed Operation of NR Ericsson Japan K.K.
[R1-1718233](#) On NR Operation in the 60 GHz Unlicensed Band Ericsson Japan K.K.
[R1-1718234](#) On Channel Access Mechanisms for NR in Unlicensed Spectrum Ericsson Japan K.K.
[R1-1718235](#) On Autonomous UL Transmissions for NR in Unlicensed Spectrum Ericsson Japan K.K.
[R1-1718236](#) Discussion of Multi-Antenna and Highly Directional Beam-Forming for Operation in Unlicensed Spectrum
Ericsson Japan K.K.

Non-terrestrial networks

[R1-1718317](#) Considerations on satellite channel model - updates THALES
[R1-1718319](#) Considerations on HAPS channel model THALES
[R1-1719024](#) Outcomes of the 1st NTN channel modelling workshop Thales, Hugues Network Systems, Dish Network

ITU Self-evaluation

[R1-1718709](#) IMT-2020 self-evaluation: On eMBB spectral efficiency Ericsson
[R1-1718726](#) IMT-2020 self evaluation: mMTC connection density for LTE-MTC and NB-IoT Ericsson
[R1-1718727](#) IMT-2020 self-evaluation: Peak data rate and peak spectrum efficiency evaluations for NR
Ericsson
[R1-1718728](#) IMT-2020 self-evaluation: CP latency in NREricsson
[R1-1718729](#) IMT-2020 self-evaluation: UP latency in NREricsson

Miscellaneous

[R1-1717509](#) Measurement results and analysis on UE power consumption vivo
[R1-1717510](#) NR UE power saving vivo
[R1-1717776](#) Discussion on symbol alignment in NR duplex Panasonic
[R1-1717777](#) Discussions on intended DL/UL direction configuration via Xn signalling Panasonic
[R1-1717778](#) Discussions on UE-to-UE interference measurement and report Panasonic
[R1-1717907](#) UE-to-UE measurement for cross-link interference mitigation Huawei, HiSilicon
[R1-1717908](#) Timing alignment on cross-link Huawei, HiSilicon
[R1-1717909](#) UL Power control for cross-link interference mitigation Huawei, HiSilicon
[R1-1717910](#) Remaining issues on ECP Huawei, HiSilicon
[R1-1718001](#) Discussion on dynamic TDD and cross-link interference measurement in high-speed train scenario
ETRI
[R1-1718594](#) Low PAPR Modulation Qualcomm Incorporated

Positioning

[R1-1718691](#) On Rel. 15 NR positioning measurements Ericsson

Agreement:

- Introduce the measurement definitions in Section 2 of [R1-1718691](#) into TS 38.215
- For RSTD, should identify in the measurement titles that these are E-UTRAN measurements.

8 Elections

The candidatures received for the Vice Chairmanship prior to meeting start are indicated below:

Name	Company / Partner
Dr. Havish Koorapaty	Ericsson LM / ETSI

Dr. Kazuaki Takeda	NTT DOCOMO INC. / ARIB
Dr. Hanbyul Seo	LG Electronics Inc. / TTA

Monday 9th Oct.
The position of Vice Chairman had three candidates, as listed above.

Observers: Sharat Chandler (AT&T), Jean-Aicard Fabien (USDoC), Woo-Jin Choi (KT Corp.).

The result of the first ballot for the VC position was as follows:

candidate	votes for	percent	71 % ?
Dr. Kazuaki Takeda	67	25,000%	NO
Dr. Havish Koorapaty	154	57,463%	NO
Dr. Hanbyul Seo	47	17,537%	NO
ABSTAIN or spoiled	0	0,000%	
total votes cast:	268	100,000%	
total returned papers	268		
number of proxy votes cast:	115		
number of non-returned papers	52		

Both Dr. Kazuaki Takeda (NTT DOCOMO, ARIB) and Dr. Hanbyul Seo (LG Electronics, TTA) then decided to step down.

Dr. Havish Koorapaty (Ericsson LM, ETSI) was therefore appointed to the position of WG RAN1 Vice Chairman.

9 Closing of the meeting

RAN1 chair thanked all the delegates for their hard work, with a particular attention to the feature leads. He acknowledged the commitment of all to cooperate and achieve progress despite challenges and obstacles (many parallel offline sessions, lack of meeting rooms).
Special thanks were given to Matthew Baker and his contributions to RAN1 since 2009 as chairman and vice-chair.
He also welcomed Havish Koorapaty as the new elected vice chairman, looking forward to the upcoming challenging years.
Final words to tell RAN1, though still a lot needs to be achieved by November meeting, that all should be proud of what RAN1 is doing as a group.

Meeting was closed at 17:15.
See you all in Reno.

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Annex A: List of Tdocs at RAN1 #90bis

Please see excel file attached to this report

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Annex B: List of CRs agreed at RAN1 #90bis

[illegible]

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Annex C-1: List of Outgoing LSs from RAN1 #90bis

TDoc #	Title	Source	Release	Related WIs	Reply to	To	Cc	Original LS	Reply in
R1-1718829	Reply LS on mixed numerologies FDM operation	RAN1, Intel	Rel-15	NR_newRAT-Core		RAN4			
R1-1719039	LS on UE minimum bandwidth	RAN1, CAIT	Rel-15	NR_newRAT-Core		RAN2, RAN			
R1-1719040	LS Reply on RSRP Measurements for Mobility in NR	RAN1, Huawei, Ericsson	Rel-15	NR_newRAT-Core		RAN4			
R1-1719044	LS on NR UL codebook for 4Tx	RAN1, Qualcomm	Rel-15	NR_newRAT-Core		RAN2			
R1-1719045	Response LS on power sharing for LTE-NR Dual connectivity	RAN1, LG Electronics	Rel-15	NR_newRAT-Core		RAN2			
R1-1719084	LS on 2Gbps category	RAN1, Qualcomm	Rel-14	TEI14		RAN2			
R1-1719090	LS on TBS for TDD special subframe for BL/CE UE without repetition	RAN1, Ericsson	Rel-13	LTE_MTCe2_L1-Core		RAN2			
R1-1719091	LS on MBSFN subframe configuration in handover signalling for eMTC	RAN1, Qualcomm	Rel-13	LTE_MTCe2_L1-Core		RAN2			
R1-1719093	LS on Comb 2 SRS enhancements for BL/CE UEs	RAN1, Qualcomm	Rel-14	LTE_feMTC-Core		RAN2			
R1-1719094	LS on Supportable RNTI length on DCI	RAN1, Ericsson	Rel-15	NR_newRAT-Core		RAN4	RAN2		
R1-1719103	LS on agreements on early data transmission during random access procedure for NB-IoT and BL/CE UEs in Rel-15	RAN1, HiSilicon	Rel-15	NB_IOTenh2-Core, LTE_eMTC4-Core		RAN2			
R1-1719151	LS to RAN2 on carrier selection for Rel-15 V2X	RAN1, Huawei	Rel-15	LTE_eV2X-Core	R4-1709187	RAN4			
R1-1719154	LS reply on SPS for short TTI	RAN1, Huawei	Rel-15	LTE_sTTIandPT-Core	R3-173439	RAN3			
R1-1719159	LS to RAN4 on resource selection for Mode-4 sidelink CA	RAN1, Intel Corporation	Rel-15	LTE_eV2X-Core		RAN2			
R1-1719164	LS on NR Paging Mechanisms	RAN1, Huawei	Rel-15	NR_newRAT-Core		RAN2			
R1-1719165	Reply LS on NR minimum carrier bandwidth and SS block numerology	RAN1, Ericsson	Rel-15	NR_newRAT-Core		RAN2			
R1-1719203	Reply LS on NR L1 processing chain	RAN1, NTT DOCOMO	Rel-15	FS_NR_CU_DU_LLS		RAN2			
R1-1719204	LS on higher layer signalling for special subframe configuration 10	RAN1, CMCC	Rel-14	LTE_UL_CAP_enh-Core		RAN2			
R1-1719205	LS on updates to TS36.300 for short TTI and short processing time	RAN1, Ericsson	Rel-15	LTE_sTTIandPT-Core		RAN2			
R1-1719206	LS on agreements on UL HARQ-ACK feedback in Rel-15 LTE eMTC	RAN1, ZTE	Rel-15	LTE_eMTC4-Core	S2-176689	SA2, RAN4	RAN2		

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TDoc #	Title	Source	Release	Related WIs	Reply to	To	Cc	Original LS	Reply in
R1-1719207	LS on wake-up signal configuration and procedures for NB-IoT and BL/CE UEs in Rel-15	RAN1, Hisilicon	Rel-15	NB_IOTenh2-Core, LTE_eMTC4-Core	R2-1709800	RAN2			
R1-1719209	LS on RAN1 observation on RSRP statistics for aerial vehicles	RAN1, NTT DOCOMO	Rel-15	FS_LTE_Aerial		RAN2, RAN4			
R1-1719210	LS on Ultra Reliable Low Latency Communication for LTE	RAN1, Ericsson	Rel-15	LTE_HRLLC-Core		RAN4			
R1-1719211	Response LS on simultaneous transmission and/or reception over EPC/E-UTRAN and 5GC/NR	RAN1, Intel	Rel-15	5GS_Ph1, NR_newRAT-Core		RAN4			
R1-1719214	LS on response to RACH agreements	RAN1, CATT	Rel-15	NR_newRAT-Core		RAN2, RAN			
R1-1719217	LS on HCS	RAN1, Huawei	Rel-15	LTE_1024QAM_DL-Core		RAN4			
R1-1719218	LS on QCL assumption for RLM Reference Signal	RAN1, Intel	Rel-15	NR_newRAT-Core		RAN2			

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Annex C-2: List of Incoming LSs from RAN1 #90bis

TDec #	Title	Source	Release	Related WIs	Reply to	To	Cc	Original LS	Reply in
R1-1716944	LS on CSG support in NB-IoT	RAN2, Nokia	Rel-15	NB_IOTenh2-Core		RAN3, RAN4	RAN1	R2-1709705	
R1-1716945	Reply LS on Relay UE discovery	RAN2, Nokia	Rel-15	FS_fed2D IoT relay wearable	R1-1709621	RAN1		R2-1709782	
R1-1716946	Response LS to RAN1 on P2X	RAN2, LG Electronics	Rel-14	LTE_V2X-Core	R1-1709334	RAN1		R2-1709948	
R1-1716947	Reply LS on QoS support over PC5	RAN2, Nokia	Rel-15	FS_fed2D IoT_relay_wearable	S2-173877	SA2	RAN1	R2-1709949	
R1-1716948	Reply LS on sPDCCH monitoring in sTTI	RAN2, Ericsson	Rel-15	LTE_sTTIandPT-Core	R1-1703579	RAN1		R2-1709951	
R1-1716949	LS on UE GNSS RTK measurement for high accuracy positioning	RAN2, Nokia	Rel-15	LCS_LTE_acc_enh-Core		RAN4	RAN1	R2-1709961	
R1-1716950	LS on RAN2 agreements on Enhancements to LTE operation in unlicensed spectrum	RAN2, Nokia	Rel-15	LTE_unlic-Core		RAN1		R2-1709967	
R1-1716951	LS on SPS and SR for sTTI	RAN2, Huawei	Rel-15	LTE_sTTIandPT-Core		RAN1		R2-1709972	
R1-1716952	LS on latency requirement for Aerial Vehicles	RAN2, NTT DOCOMO	Rel-15	FS_LTE_Aerial		RAN1		R2-1709974	
R1-1716953	Reply LS on LTE Rel-14 UE feature list for MUST	RAN4, MediaTek inc.	Rel-14	LTE_MUST	R1-1704123	RAN2	RAN1	R4-1708704	
R1-1716954	LS reply on TM10 / FD-MIMO UE capability signalling	RAN4, Intel Corporation	Rel-14	LTE_EBF_FDMIMO-Core	R2-1702346	RAN2	RAN1	R4-1708730	
R1-1716955	LS on effect of SRS switching in TDD + FDD CA	RAN4, Qualcomm	Rel-14	LTE_SRS_switch-Core		RAN1	RAN2	R4-1708772	
R1-1716956	LS on new UE power class for Rel-15 eMTC	RAN4, Ericsson	Rel-15	LTE_eMTC4-Core		RAN2	RAN1	R4-1708835	
R1-1716957	LS on Rel-14 RAN4 UE feature list	RAN4, Intel Corporation	Rel-14	TEI14		RAN2	RAN1, RAN3	R4-1709180	
R1-1716958	Reply LS on support of CACC and platooning applications by 3GPP systems	SA1, LG Electronics	Rel-15	LTE_eV2X-Core		SAE DSRC Technical Committee	SA2, RAN2, RAN1, SAE Cellular V2X Technical Committee	S1-173531	
R1-1716959	LS on FS_REAR study outcome	SA2, Huawei	Rel-15	FS_fed2D IoT_relay_wearable	R2-1703967	RAN, RAN1, RAN2, RAN3	SA3, CTI	S2-176446	
R1-1716960	LS on RAR reception for NB-IoT	RAN2, Nokia	Rel-14	NB_IOTenh-Core		RAN1		R2-1709902	
R1-1716961	LS on scenarios of multiple SSB	RAN4, Huawei	Rel-15	NR_newRAT-Core		RAN2	RAN1	R4-1709890	

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TDoc #	Title	Source	Release	Related WIs	Reply to	To	Cc	Original LS	Reply in
R1-1716962	LS on RSSI Definition in Signal Quality Measurements for Mobility in NR	RAN4, Ericsson	Rel-15	NR_newRAT-Core		RAN1	RAN2	R4-1709910	
R1-1716963	Reply LS to RAN2 for NR UE categories and UE capabilities	RAN4, Ericsson	Rel-15	NR_newRAT-Core	R2-1709979	RAN2	RAN, RAN1	R4-1710079	
R1-1718940	Reply LS on power sharing for LTE-NR Dual connectivity	RAN4, LG Electronics	Rel-15	NR_newRAT-Core		RAN1		R4-1709968	
R1-1719192	LS to RAN1 on SCell activation and deactivation	RAN2, OPPO	Rel-15	NR_newRAT-Core		RAN1			
R1-1719193	LS to RAN1 on SPS and Grant-free	RAN2, Samsung	Rel-15	NR_newRAT-Core		RAN1			

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Annex D: List of Approved updated WIDs

None

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Annex E: List of draft TSs/TRs agreed at RAN1 #90bis

Tdoc Number	Title	Source	Conclusion/Decision

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Annex F:	List of actions
-	Outgoing LS
-	CR approval
-	Miscellaneous
[90b-LTE-01]:	
Discuss whether PUCCH format 4/5 must be configured if a UE is configured with more than 5 CCs.	
Email discussion until 28 th October – Alberto (Qualcomm)	
[90b-LTE-02]	
R1-1718967 slide 3 bullet 2 Yi Shi (Huawei)	
[90b-LTE-03-xx]	
Rapporteurs to have summary of agreements for feCoMP by 10/20 [90b-LTE-03-Rapporteur]	
Editors to provide initial draft CRs for feCoMP by 11/15, to be commented and to update by 11/21 [90b-LTE-03-xxx], where xxx is the spec #	
[90b-LTE-04]	
Email approval on reached offline consensus at RAN1#90bis (Ericsson (Mårten), From 16 th Oct to 20 th Oct)	
[90b-LTE-05]	
Email approval on list of physical layer related RRC parameters including sending an LS to RAN2 (Ericsson(Mårten), From 20 th Oct to 27 th Oct)	
[90b-LTE-06-xxx]	
Rapporteur to update the summary of agreements by 10/14 [90b-LTE-06-Rapporteur]	
Editors to provide updated CRs by 10/19, to be commented on and update by 10/24 [90b-LTE-06-xxx], where xxx is the spec #	
[90b-LTE-07]	
Email approval on details of sDCI formats (LGE(Kyuhwan), from 20 th of Oct to 3 rd of Nov)	
[90b-LTE-08]	
Email approval on remaining details of sPDCCH design and search space (Huawei(Chengyan), from 20 th of Oct to 3 rd of Nov)	
[90b-LTE-09]	

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- Email discussion on remaining details of sPDCCH multiplexing with data (Nokia(Karol), from 20th Oct to 3rd of Nov)
- [90b-LTE-10]
 Email approval on remaining details of sPUCCH design (including HARQ-ACK bundling for {2,7}), (ZTE(Xianghui), from 20th of Oct to 3rd of Nov)
- [90b-LTE-11]
 Email discussion of remaining details of CSI reporting (Qualcomm(Kianoush), from 20th of Oct to 3rd of Nov)
- [90b-LTE-12]
 Email approval on remaining issues of sPUSCH/sPUCCH PC + sTTI/TTI collisions (LGE(Hyunho), from 20th of Oct to 3rd of Nov)
- [90b-LTE-13]
 Email approval on remaining details of sPDSCH/sPUSCH design, UCI mapping on sPUSCH (Huawei(Yubo), 20th Oct to 3rd of Nov)
- [90b-LTE-14]
 Email approval on remaining issues for 1 ms + FS2 (sTTI and 1 ms) + FS3 (Samsung(Jeongho), from 20th Oct to 3rd of Nov)
- [90b-LTE-15]
 Email approval on UL HARQ RTT for FS2 including sending an LS to RAN2 (Ericsson(Laetitia), from 18th of Oct to 25th of Oct)
- [90b-LTE-16]
 Email approval on SPS details (Huawei(Yubo), 27th of Oct until 10th of Nov)
- [90b-LTE-17]
 Email approval on LS to RAN4 related to the above agreement and its impact to the RAN4 specifications (Nokia(Klaus), from 18th Oct to 25th Oct)
- [90b-LTE-18]
 Email discussion on partial UL subframes Nov 15th: Huawei (Liyuan)
- [90b-LTE-19]
 Email discussion on AUL resource allocation Nov 15th: Nokia (Timo)
- [90b-LTE-20]
 Email discussion on AUL HARQ Nov 15th: Ericsson (Reem)
- [90b-LTE-21]
 Email discussion on AUL channel Access Nov 15th: Intel (JJ)

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- [90b-LTE-22]
Email Discussion on what type of field measurement results and how to capture in TR till 10/27 – Zhilan (Nokia, NSB)
- [90b-LTE-23]
Email Discussion on TP for Agreements from RAN1#90bis till 10/27 – Siva (Ericsson)
- [90b-LTE-24]
Email approval on the system level evaluation assumptions and methodology to compute the reference SINR, Q. The email approval discussion is kicked off at the latest one week before the deadline.
Deadline: 3rd November
Driver: Ericsson (Mårten)
- [90b-LTE-25]
Email discussion on the link level evaluation assumptions taking as basis the NR URLLC assumptions defined in TR38.802. The email discussion should also address the FFS related to other link level methodologies. The email discussion is kicked off at the latest two weeks before the deadline.
Deadline: 15th November
Driver: Huawei (Yubo)
- [90b-NR-01-xxx]
Editors to update CRs based on this meeting's agreements and working assumptions by 11/1, to be commented and updated by 11/10 [90b-NR-01-spec#]
Email discussion/approval of RRC parameters prepared by 11/1, to be commented and updated by 11/10 – Daniel (Ericsson) [90b-NR-01-RRC]
- [90b-NR-02]
Email discussion on eV2X evaluation methodology till next meeting – Hanbyul (LGE)
- [90b-NR-03]
Email discussion (including whether or not to send)/approval on LS to send 5GAA (and others) regarding asking feedback of eV2X evaluation methodology till 10/27 – Hanbyul (LGE)
- [90b-NR-04]
Proposals:
- The maximum number of bits for CORESET and RMSI timing configuration in PBCH is 8 bits excluding the subcarrier spacing.
 - (Working assumption) PBCH contents, except the SSB index, should be the same for all SS/PBCH blocks within an SSB burst set for the same center frequency
 - CORESET and RMSI configuration should consider the following properties:
 - bandwidth (PRBs)
 - frequency position (frequency offset relative to SS/PBCH block)
 - A set of OFDM symbol indices in a slot corresponding to a CORESET

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- CORESET transmission periodicity
 - Note that this CORESET may also carry control scheduling other channels
- RMSI timing configuration (including CORESET monitoring window periodicity)
 - Email discussion/approval till 10/27 – Da Ren (CATT)

- [90b-NR-05]
Email discussion/approval on UL initial BWP – Byoung-Hoon (LGE)
- [90b-NR-06]
[R1-1719215](#) [Draft] LS reply to RAN4 on UE timing advance adjustment step size Huawei
Email approval till 10/20
- [90b-NR-07]
 - FFS: The range of the number of preambles – email discussion/approval till 11/27 – Nazmul (Qualcomm)
- [90b-NR-08]
 - Email discussion/approval (at least target potential RRC impact related approval) till 10/27 – Nazmul (Qualcomm)
- [90b-NR-09]
Email discussion/approval on potential RRC impact till 10/27 – Daewon (Intel)
- [90b-NR-10]
Email discussion on the parameters for determination of c_init for data scrambling until Oct 27 – Mattias (Ericsson)
- [90b-NR-11]
Email discussion on TPMI size until Oct 27, Weidong (MediaTek)
- [90b-NR-12]
Email discussion on SRS grouping until Oct 27, Mark (Ericsson)
- [90b-NR-13]
Email discussion on the value of N for aperiodic CSI-RS is triggering until 27th of Oct – Ruyue (ZTE)
- [90b-NR-14]
Emails discussion on resource setting for P/SP/AP CSI until Oct 27 – Sebastian (Ericsson)
- [90b-NR-15]
Email discussion to down-select among the 3 alternatives for A-CSI on short PUCCH with single CSI report

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- Until Oct 27 – Sebastian (Ericsson)
- [90b-NR-16]
Email discussion on semi-persistent CSI on PUSCH
- Until Oct 27 – Sebastian (Ericsson)
- [90b-NR-17]
Emails discussion to finalize the parameter list for BM
- Until Oct 27 – Sundar (Qualcomm)
- [90b-NR-18]
Email discussion to discuss the remaining beam failure recovery issues in slides 8, 9, 10 of R1-1719174
- Until Oct 27, Chia-Hao (MediaTek)
- [90b-NR-19]
- Email discussion until 27th of Oct on CSI-RS open issues with RAN2 impact to be coordinated by Xi (Huawei)
- [90b-NR-20]
Emails discussion on the DMRS of 2/4/7-symbol for non-slot based scheduling
- Until Oct 27 – Alex (Qualcomm)
- [90b-NR-21]
Email discussion on RS design based on pi/2 BPSK for DFT-s-OFDM
- Until Oct 27 – Kiran (Indian Institute of Tech (H))
- [90b-NR-22]
Email discussion/approval till 10/27 whether or not to introduced UE capability related to the max number of blind decodes interacting with time (per slot, periodicity of monitoring, etc.) and with frequency (e.g., # of carriers configured for a UE) - Fred (DCM)
- [90b-NR-23]
Email discussion/approval till 10/27 – Fred (DCM)
- For a given CORESET, an association among the following is given where FFS: how to achieve
 - A search space set
 - A DCI format size
 - RNTI
 - FFS: Configuration of CORESET periodicity/offset
- [90b-NR-24]

Proposals:

- For the blind decoding of GC-PDCCH carrying SFI, the GC-PDCCH blind decoding is configured with one decoding candidate at a configured starting CCE with a configured aggregation level in a CSS or group-CSS in a configured coreset
- On overwriting rules across semi-static DL/UL assignment, dynamic SFI, DCI, etc
- Need to decide the overwriting rules between
 - Semi-static DL/UL assignment (including states DL, UL, unknown)
 - Dynamic SFI (indicated in GC-PDCCH with states DL, UL, and unknown)
 - UE specific data transmission (UE specific DCI triggered PDSCH, PUSCH, and PUCCH with A/N for a PDSCH)
 - FFS: Broadcast transmission (sync, PRACH, RAR,...)
 - FFS: SPS transmission
 - Measurement: Measurement related signals semi-statically configured by RRC (eg. periodic/semi-persistent CSI-RS for CSI report, periodic CSI report, periodic/semi-persistent SRS) where a DL or UL direction will be assumed
 - FFS: CSI-RS for RRM, TRS, etc
- Consider the following directions of potential overwriting in Rel. 15:
 - States from semi-static DL/UL assignment overwritten by measurement, dynamic SFI, or UE specific data
 - State from measurement overwritten by dynamic SFI or UE specific data
 - Dynamic SFI overwritten by UE specific data
- For the states from semi-static DL/UL assignment
 - “Unknown” in semi-static DL/UL assignment can be overwritten by measurement, dynamic SFI, and UE specific data
 - DL/UL in semi-static DL/UL assignment cannot be overwritten to the other direction (DL to UL or UL to DL) by measurement, dynamic SFI and UE specific data
- DL/UL in semi-static DL/UL assignment cannot be overwritten by “unknown” by dynamic SFI
- For the states from measurement in symbols not under DL/UL from semi-static DL/UL assignment:
 - DL/UL direction implied by measurement can be overwritten by unknown in dynamic SFI
 - UE behavior will be the cancellation of the measurement or measurement related transmission
 - DL/UL direction implied by measurement can be overwritten by UL/DL from dynamic SFI
 - UE behavior will be the cancellation of the measurement or measurement related transmission
 - DL/UL direction implied by measurement can be overwritten by UE’s own UE-specific data if the UE specific data implies the other direction
 - UE behavior will be the cancellation of the measurement or measurement related transmission
 - UE will follow the DCI for UE-specific data transmission and reception
- For the states in dynamic SFI in symbols not under DL/UL from semi-static DL/UL assignment (Already agreed in other agreements and only include for completeness)
 - UL/DL in dynamic SFI cannot be overwritten by UE specific data
 - UE will treat it as an error case when UE specific data and dynamic SFI imply different transmit directions
 - Unknown in dynamic SFI can be overwritten by UE specific data (change to DL or UL)
 - UE will follow the DCI for UE-specific data transmission and reception
- When a configured GC-PDCCH carrying dynamic SFI is not detected (detection erasure event)
 - UE assumes “unknown” dynamic SFI is received for all symbols in the current monitoring period

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- Email discussion/approval till 10/27 – Jing (Qualcomm)
- [90b-NR-25]
Email discussion/approval on DCI contents/formats till next meeting – Stefan (Ericsson)
- [90b-NR-26]
Email approval on the disabled frequency hopping case related to the above agreements till 10/27 – Hua (Huawei)
- [90b-NR-27]
WF on pi/2 BPSK based long PUCCH carrying more than 2 UCI bits
For long duration PUCCH carrying more than 2 bits:
 - Use pi/2 BPSK modulation, spectrum shaping can be used similar to pi/2 BPSK PUSCH
- Email discussion/approval of the above till 10/27 – Hua (Huawei)
- [90b-NR-28]
Proposals:
 - Down-select from the following 2 alternatives
 - Alternative 1: different RE mapping rule between ACK puncture and rate-match PUSCH
 - When HARQ-ACK puncture PUSCH, map HARQ-ACK to REs across as many symbols (excluding DMRS symbol) in both freq hops if applicable. HARQ-ACK puncture should avoid puncture PT-RS.
 - When HARQ-ACK rate-matching PUSCH, map HARQ-ACK to localized REs around DMRS in time domain in both freq hops if applicable. HARQ-ACK should rate-match around PT-RS
 - When there is additional DMRS other than front loaded DMRS, map HARQ-ACK around all DMRS symbols.
 - Alternative 2: The same mapping rule is applied regardless of HARQ-ACK puncture or rate match PUSCH
 - Map HARQ-ACK to REs across as many symbols (excluding DMRS symbol)
- Email discussion/approval till 10/27 – Yi (Qualcomm)
- [90b-NR-29]
 - Email discussion/approval on how UE selects one PUCCH resource set from multiple configured PUCCH resource sets till 10/27 – Jia (OPPO)
- [90b-NR-30]
 - Email discussion/approval of the following table 10/27 – Jia (OPPO)
- [90b-NR-31]

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Discuss further offline on how to perform frequency hopping based resource allocation, and whether or not to support frequency-distributed resource allocation (e.g. using VRB, etc.) especially w.r.t. whether or not RRC signalling is involved or not – Email discussion/approval till 10/27 – Stefan (Ericsson)

[90b-NR-32]

- Discuss further DCI composition for supporting CBG based retransmission in terms of CBGTI, CBGFI, and NDI
 - No RRC impact is expected
- Email discussion/approval of the above issue until 11/3 – Sukehel (LGE)

[90b-NR-33]

Proposals:

- Frequency hopping is supported for CP-OFDM based NR-PUSCH transmission with contiguous RB allocation
 - At least intra-slot frequency hopping is supported for 14 symbol slot case
- For UL transmission with grant, intra-slot FH hopping can be enabled/disabled by UL grant.
- For PUSCH with grant, at least following are supported and configured by OSI:
 - Inter-slot FH without intra-slot FH.
 - Inter-slot FH + intra-slot FH.
- Email discussion/approval till 10/27 – Lihui (DCM)

[90b-NR-34]

Proposals:

- For UL transmission without grant, for a TB transmission with K repetitions
 - The repetitions follow an RV sequence
 - RV sequences for both CC and IR should be supported, i.e., the pattern with the same RV value is a special case of RV sequence
 - The RV sequence is configured by RRC at least for Type 1.
- For UL transmission without UL grant, for each configuration
 - The number of HARQ processes is explicitly configured by RRC
 - Each configuration can have multiple HARQ processes
- Email discussion/approval till 10/27 – Lihui (DCM) – including any other potentially missing RRC parameters related issues

[90b-NR-35]

Email discussion on the issues raised in 9251 till 10/27 – Ajit (Intel)

[90b-NR-36]

Proposals:

- Option #1
 - NR supports Scell activation via DCI signaling
 - FFS for deactivation
 - FFS interactions between Scell deactivation timer and BWP timer

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- Option #2:
 - NR supports Scell activation/deactivation via MAC CE signalling
 - Optionally,
 - BWP switching DCI to switch bandwidth part can be used to activate Scell
 - FFS details
 - Option #3:
 - NR supports Scell activation/deactivation via MAC CE signalling only
 - Email discussion/approval till 10/27 (Peter A., Qualcomm)
- [90b-NR-37]
Proposals:
- A configurable max coding rate is used for a UE to determine how to feedback UCI on PUCCH
 - FFS details how to use the configuration. The LTE mechanism is the baseline
 - Email discussion/approval till 10/27 (Aris – Samsung)
- [90b-NR-38]
Proposals:
- On the RB-symbol level, for semi-static configuration of a rate-matching resource
 - Configure a first bitmap of RBs
 - Configure a second bitmap of [14, 28 or 56] symbols (i.e. 1 2 4 slot(s)) in time for which the first bitmap applies
 - Configure a third bitmap indicating, in units of second bitmap, the units for which time-frequency units configured by the first and the second bitmaps apply, for the duration of min(40ms,[1, 5, 10, 20 or 40] units)
 - The rate-matching resource set configuration repeats in time.
 - FFS: remaining details of configuration for rate-matching resource sets with and without L1 signalling.
- For email approval till 10/27 (including per cell vs. per BWP, max # resource sets, DCI field presence or not and/or by configuration or not)

[90b-NR-39]
R1-1719194 WF on UL TDM in single Tx EN-DC Qualcomm Inc
Email discussion/approval till 10/27 – Peter (Qualcomm)

[90b-NR-40]
Email discussion until Oct 27 – Hyunseok (Samsung)

[90b-NR-41]: Email approval on how to configure beta_offset till 10/27 – Yi (Qualcomm)

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Annex G: List of participants at RAN1 #90bis

Please see excel file attached to this report

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Annex H: TSG RAN WG1 meetings in 2017 – 2018

TITLE	TYPE	DATES	LOCATION	CTRY
<u>3GPPRANI#91</u>	<u>WG</u>	27 Nov – 01 Dec 2017	Reno	US
<u>3GPPRANI-AH-1801</u>	<u>AH</u>	22 – 26 Jan 2018	Vancouver	Canada
<u>3GPPRANI#92</u>	<u>WG</u>	26 Feb – 2 Mar 2018	Athens	Greece
<u>3GPPRANI#92bis</u>	<u>WG</u>	16 – 20 Apr 2018	TBD	China
<u>3GPPRANI#93</u>	<u>WG</u>	21 – 25 May 2018	TBD	Korea
<u>3GPPRANI#94</u>	<u>WG</u>	20 – 24 Aug 2018	Gothenburg	Sweden
<u>3GPPRANI#94bis</u>	<u>WG</u>	8 – 12 Oct 2018	TBD	China
<u>3GPPRANI#95</u>	<u>WG</u>	12 – 16 Nov 2018	TBD	US

MEETING TYPES			
AH = Ad Hoc	ST = Startup Meeting	RG = Rapporteurs Group	
JM = Joint	WG = Working Group	SG = Steering Group	
PM = Preparatory Meeting	CM = Chairmen's meeting	TG = Task Group	
RM = Resolution Meeting	OR = Ordinary	XO = Extraordinary	

End of document