3GPP TSG RAN WG2 Meeting #110-e R2-200xxxx

**Electronic meeting,** **1st – 12th June 2020**

**Agenda item:** 6.0.2

**Source:** Intel Corporation, NTT DoCoMo

**Title:** Report of email discussion [Post109bis-e][963][] UE feature list

**Document for:**  Discussion and decision

# Introduction

This contribution discusses the new RAN1 and RAN4 UE capabilities based on the RAN1 and RAN4 LSes and try to form a consensus in RAN2 on the answers to the questions from the RAN1 LS [1]. The document also tries to list any open items on the capabilities from RAN1 and RAN4 to be added to the reply LS. This is in response to the email discussion to be handled for next RAN2#110-e meeting.

* [Post109bis-e][963][NR16] UE Capabilities (Intel, NTT Docomo)

Scope: L1 Radio and Positioning capabilities. Progress the topic, take into account the R1 LS, make a first attempt at CRs, 38306 38331. Identify issues, if any, Reply LS to R1 for issues resolution.   
Intended outcome: Report, Draft CRs, Draft Reply LS to R1.   
Deadline: Next Meeting.

The deadline of this email discussion in into the next meeting, however we suggest having 2 phases:

* Phase 1 until 2020-05-21 23:59 PST for companies to provide their views on the discussion points listed and the drafted CRs to 38.306 and 38.331.
* Phase 2 until 2020-05-28 23:59 PST for companies to provide their views on the updated CRs and the draft LSes.

# Discussion

## Review of the eMIMO UL full power mode-2 Tx operation

RAN1 has requested RAN2’s feedback in the signalling impact from one or two rows in capturing the SRS and TPMI capabilities for UL Full Tx Mode-2 operation from the eMIMO WI.

In Release-15 for codebook based transmission of UL MIMO, the UE can report the type of coherency it has for its Tx chains (due to practical limitation of the power amplifier) as below. The UE can support upto 4 Tx ports.

* Full coherency
* Partial coherency
* No coherency

### Discussion (Confirmation) point – Common understanding of legacy (Rel-15) operation

1. For the UL MIMO based on codebook operation, for each band, the supported TPMIs by the UE are based on the number of UE Tx ports and the type of coherency the UE supports for that band.
2. For the UL MIMO based on codebook operation, the ‘No-coherency’ TPMIs are a subset of ‘partial-coherency’ TPMIs which are in turn, a subset of ‘full-coherency’ TPMIs. If the UE supports partial coherency, the UE is expected to support the TPMIs of ‘No-coherency’. If the UE supports full coherency, the UE is expected to support the all the TPMIs of partial and no-coherency. (We will use the nomenclature “fallback coherency” in this discussion for this).
3. Partial coherency is applicable only for 4 Tx port operation.
4. Transmission using lower number of Tx ports is supported by the UE for a given Tx port capability. The UE can transmit using 2 ports if it supports transmission on 4 ports, and can transmit on 1 port if the UE supports 2 port transmission. (We will use the nomenclature “fallback port config” in this discussion for this).
5. Companies are requested to confirm if they agree with the above for Rel-15. The rapporteur requests the companies to check internally with their RAN1 on the above (to avoid sending an LS explicitly where possible).

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| **Company’s name** | **Agree/Disagree** | **Company’s comments, if any** |
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### Discussion points – Relation of UL full power Tx mode -2 operation with the legacy Rel-15 operation

In case the UE cannot support full coherency, the TPMIs used for Rank 1 transmission result in the UE not being able to transmit with full Tx power (for eg., 23 dBm) and in Rel-16, this is addressed through the eMIMO WI.

Along with the signalling of the UE capabilities on the number of Tx ports and the maximum SRS resources the UE supports, RAN2 is also expected to design the signalling of the TPMIs on which the partial and non-coherent UEs can perform full power transmission.

RAN1 has agreed on the maximum number of SRS resource per set to ‘4’ or ‘2’ (based on UE capability) for UE which support either maximum 2 Tx ports or maximum of 4 Tx ports based on [1]. But the TPMIs the UE can use depends on the maximum Tx port capability and the tables1/2 from [1] lists the allowed TPMIs.

We list below the rapporteur’s understanding on the background behind this topic to get the views on companies in RAN2, as the intention is to use this understanding on drafting a response in the reply LS.

1. The type of coherency supported and signalled in Rel-15 (using the IE *pusch-TransCoherence* per each of the supported band reported in the IE *MIMO-ParametersPerBand)*, is the same for the UE and does not change in the UL full Tx power mode2 transmission.
2. Similarly, the maximum number of Tx ports the UE supports does not change with UL full Tx power transmission.

For eg. (based on points 5 and 6) if the UE support partial coherency for 4 Tx ports and signals as such, the UE also supports partial coherency for full power UL Tx operation. If the UE support only 2 Tx ports and with no coherency, UL full Tx power transmission also is with 2 Tx ports with no coherency.

1. The supported set of TPMIs from Rel-15 (based on the supported maximum number of Tx ports and the type of coherency supported by the UE) do not change due to UL full Tx power transmission
2. The set of TPMIs supported by the UE **for UL full power Tx transmission mode-2** would be a subset of all the TPMIs supported by the UE and for some UEs all the TPMIs supported by the UE are also supported with UL full Tx power transmission (capability 1 type UEs).
3. Even though the UE support of “fallback” coherency and “fallback port config” is expected, **the set of TPMIs for UL full power mode-2** supported by the UE for this “fallback” coherency and “fallback port config” cannot be deduced from the TPMIs for the UL full power Tx mode-2 operation for the “parent” coherency/”parent” port config.
4. With 1-port transmission by the UE, the TPMIs are not applicable and the UEs which support UL full Tx power transmission with mode-2, should support 1-port transmission in mode-2 mandatorily.
5. Companies are requested to provide their views on the above points and the rapporteur repeats the request that the companies check internally with their RAN1 on the above (to avoid sending an LS explicitly just for clarification, where possible).

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| **Company’s name** | **Agree/Disagree on which points** | **Company’s comments, if any** |
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### Discussion points on what the UE should report for mode-2

**If the companies are in agreement with the above points from 2.1.2, the UE capability signalling for mode-2 operation with codebook would need to provide the below for each band the UE supports:**

**For each band:**

* **The type of coherency supported (taken from rel-15 signalling)**
* **The maximum number of Tx ports the UE can support (taken from rel-15 signalling)**
* **(new) (FFS per RAN1) number of Tx ports for mode 2 operation**
* **(new) (FFS per RAN1) the maximum number of SRS resources the UE supports in the resource set for this UL full power mode-2 transmission.**
* **(new) In case of the support of more than 1 Tx port for mode 2 operation, the set of TPMIs the UE supports for this UL full power mode-2 transmission.**
  + **If the UE only supports 1 Tx port (mandatory for mode 2 operation), then TMPIs are not applicable, and so not reported.**
* **The UE can report TMPIs for each of the “fallback” Tx port configuration it supports**

**The above can be provided in an ASN.1 format as below**

tpmiPerPortConfig SEQUENCE {

2Port BIT STRING (SIZE (2)) OPTIONAL,

4PortNonCoherenet ENUMERATED {g0,g1,g2,g3} OPTIONAL,

4PortPartialCoherent ENUMERATED {g0,g1,g2,g3,g4,g5,g6} OPTIONAL

}

**For each mimo-ParametersPerBand,**

fullULTxPowerMode2 SEQUENCE {

maxTxPorts ENUMERATED { 2p, 4p } OPTIONAL, -- absence means 1-port support only

maxNumOfSRS-Resoruces MaxNumOfSRS-Resources OPTIONAL,

supportedTPMI tpmiPerPortConfig OPTIONAL -- preset only if UE supports >1 port

-- other params

}

1. Companies are requested to provide their views on the above points and the rapporteur repeats the request that the companies check internally with their RAN1 on the above (to avoid sending an LS explicitly just for clarification, where possible).

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| **Company’s name** | **Agree/Disagree on which points** | **Company’s comments, if any** |
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### Discussion on RAN2’s view of one-row vs two-row capability signalling

Rapporteur has the below understanding regarding the one-row vs two-row question from RAN1 LS:

The support of TPMIs with full power mode 2 operation is optional for the UE even when the UE supports full Tx power mode-2 operation with more than 1 Tx port.

The option to capture that the UE cannot support any of the TPMIs for >1 Tx port mode-2 operation can be captured with:

**One row:**

fullULTxPowerMode2 SEQUENCE {

……..

maxNumOfSRS-Resoruces MaxNumOfSRS-Resources OPTIONAL,

supportedTPMI tpmiPerPortConfig OPTIONAL

}

tpmiPerPortConfig SEQUENCE {

…..

4PortNonCoherenet ENUMERATED {**not\_supported,** g0,g1,g2,g3} OPTIONAL,

4PortPartialCoherent ENUMERATED {**not\_supported,** g0,g1,g2,g3,g4,g5,g6} OPTIONAL

}

**Two rows:**

fullULTxPowerMode2 SEQUENCE {

……..

maxNumOfSRS-Resoruces MaxNumOfSRS-Resources OPTIONAL,

supportedTPMI tpmiPerPortConfig OPTIONAL

}

tpmiPerPortConfig SEQUENCE {

…..

4PortNonCoherenet CHOICE{ not\_supported BOOLEAN, ENUMERATED { g0,g1,g2,g3} } OPTIONAL,

4PortPartialCoherent CHOICE{ not\_supported BOOLEAN, ENUMERATED {g0,g1,g2,g3,g4,g5,g6} } OPTIONAL

}

In rapporteur’s view, both options are not needed, and we can use the “optionality” part of ASN.1 fields to capture the samething as shown below:

**Simpler way:**

tpmiPerPortConfig SEQUENCE {

2Port BIT STRING (SIZE (2)) **OPTIONAL, -- absence mean no TPMIs are supported.**

4PortNonCoherenet ENUMERATED {g0,g1,g2,g3} **OPTIONAL, -- absence mean no TPMIs are supported.**

4PortPartialCoherent ENUMERATED {g0,g1,g2,g3,g4,g5,g6} **OPTIONAL -- absence mean no TPMIs are supported.**

}

1. Companies are requested to provide their views on the rapporteur’s interpretation of one-row vs two-row vs simpler way options, or if the rapporteur has completely mis-understood this.

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| **Company’s name** | **Which way:**  **One row/two row/simpler way/other?** | **Company’s comments, if any** |
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## Review of the 2-step RACH MsgB size in relation to Msg4/Msg2

In RAN1 LS[1], RAN1 requests RAN2 feedback on the below:

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| * For NR UE features for 2 step RACH, RAN1 discussed on some possible FGs and RAN1 see the need of RAN2 input on following point.   + RAN1 respectfully ask RAN2 to further discuss if msgB payload size could be relatively comparable with msg4, or significantly larger than the max possible payload size of msg2, given that there are Rel-15 UE capabilities for limitation on max # of unicast PDSCHs including msg4 per slot per CC and current RAN1 specification has no limitation on modulation order for PDSCH scheduled by DCI with msgB-RNTI (unlike msg2 PDSCH scheduled by DCI with RA-RNTI). RAN1 may further investigate the need to have such limitation, if the payload size of msgB is typically not large, e.g. similar as msg2.   **ACTION:** For 2 step RACH, RAN1 respectfully ask RAN2 to further discuss if msgB payload size could be relatively comparable with msg4, or significantly larger than the max possible payload size of msg2, given that there are Rel-15 UE capabilities for limitation on max # of unicast PDSCHs including msg4 per slot per CC and current RAN1 specification has no limitation on modulation order for PDSCH scheduled by DCI with msgB-RNTI (unlike msg2 PDSCH scheduled by DCI with RA-RNTI). |

### Discussion point

In general, the above discussion in RAN1 relates to the UE capability for number of MSGBs per slot/MSGB window as mentioned in the LS.

To analyze the MsgB payload size, we can start with the discussion below :

#### MSGB payload size

In the case of 2-step RACH, for MSGB (i.e. message addressed to MSGB-RNTI), the fallbackRAR is exactly the same size as the legacy RAR. The successRAR can be slightly larger but is still not in the order of MSG4. So, when multiple UEs are multiplexed in MSGB, and if there is no RRC message included (for any of these UEs), then, the overall size of the MSGB is comparable (i.e. similar) to the legacy case (i.e. similar to MSG2 – the only potential difference coming from the slightly larger successRAR size compared to the fallbackRAR for each of the UE in MSGB).

If RRC payload is included, then there will be no multiplexing in MSGB (i.e. MSGB is addressed to a single UE). Hence, although the size is comparable with MSG4 of a single UE, the overall size of MSGB is still limited because of the requirement to not multiplex multiple UEs with RRC message in a given MSGB..

**Observation 1:** MsgB size is generally comparable in size (i.e. NOT significantly larger compared) to that of Rel-15 Msg2 Although MSGB size can be same as MSG4 for a single UE case when the RRC payload is included, it should be noted that there is no multiplexing of multiple UEs for this scenario.

#### Limitation on max unicast PDSCHs including MsgB/4

RAN1’s concern is on the case where the UE may run into issues in decoding multiple PDSCHs where one of them also contains MsgB as part of 2-step RACH.Observation 3: The maximum number of unicast PDSCHs that the UE can decode is based on the UE capability, and the NW cannot schedule multiple PDSCHs for the UE without the knowledge of this UE capability.

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However, it is still possible that the NW would not know the UE that has attempted 2-step RACH, if the preamble is decoded by the NW but the MsgA content with the UE ID could not be decoded. Further, for initial access, the network may not yet have the UE capability. Hence, it is unclear how the network can make use of such UE capability in terms of maximum PDSCH decoding.

**Observation 2:** The network may not know the UE ID (e.g. in the fallback case) and the network may not yet have the UE capability (in initial access cases), In these scenarios, the NW cannot ensure that PDSCHs scheduled for the UE would not exceed the UE capability (i.e. the signalled capability seems not useful).

#### Discussion on the response to RAN1

##### RAN2 view on the MsgB size comparsion

1. Companies are requested to confirm if they agree with the below observations and provide comments if they do not agree.
2. MsgB size is generally comparable in size (i.e. NOT significantly larger compared) to that of Rel-15 Msg2 Although MSGB size can be same as MSG4 for a single UE case when the RRC payload is included, it should be noted that there is no multiplexing of multiple UEs for this scenario..
3. The network may not know the UE ID (e.g. in the fallback case) and the network may not yet have the UE capability (in initial access cases), In these scenarios, the NW cannot ensure that PDSCHs scheduled for the UE would not exceed the UE capability (i.e. the signalled capability seems not useful).

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| **Company’s name** | **Agree/Disagree** | **Company’s comments, if any** |
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##### RAN2 view on the MsgB size comparsion

Rapporteur has ventured a draft response to RAN1 and assuming RAN2 is in general ok with observations in 2.2.1.4.1, rapporteur requests company views on the draft response.

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| **Draft Response to RAN1 on this topic:**  MSGB size is generally comparable in size (i.e. NOT significantly larger compared) to that of Rel-15 Msg2. Although MSG-B size can be same as MSG4 for a single UE case when the RRC payload is included, it should be noted that there is no multiplexing of multiple UEs for this scenario.  The network may not know the UE ID (e.g. in the fallback case) and the network may not yet have the UE capability (in initial access cases), In these scenarios, the NW cannot ensure that PDSCHs scheduled for the UE would not exceed the UE capability (i.e. the signalled capability is not useful). |

1. Companies are requested to provide their view on the content of the draft reply LS.

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| **Company’s name** | **Agree/Disagree** | **Company’s comments, if any** |
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## Review of the NR-DC cell grouping

In RAN1 LS[1], RAN1 requests RAN2 feedback on the below:

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| * RAN1 lists NR-DC power-sharing features as FG18-1/1a/1b. Apart from them, RAN1 see the need of following:   + RAN2 to introduce an FG that indicates support of asynchronous operation     - RAN1 will discuss whether this FG is mandatory or optional   + RAN2 to discuss whether or not to introduce an optional FG that indicates supported cell-grouping configurations for a BC where the UE supports NR-DC operation     - If the UE reports a cell-grouping configuration in which MCG cell(s) and SCG cell(s) are in the same FR, the UE must support FG18-1 (FG18-1a/1b are optional). * The capability signalling structure is up to RAN2.   The requirements for sync-DC and async-DC are up to RAN4.  **ACTION:** For MR-DC/CA enhancements, RAN1 respectfully ask RAN2 to introduce an FG for indicating support of asynchronous NR-DC operation and to discuss whether to introduce an optional FG for indicating supported cell-grouping configurations for a BC where the UE supports NR-DC operation. |

### Discussion point

In LTE DC, RAN2 introduced LTE DC cell grouping using the below IEs. But the signaling using the below is limited to 5 bands for LTE DC.

supportedCellGrouping-r12 **CHOICE** {

threeEntries-r12 **BIT STRING (SIZE(3))**,

fourEntries-r12 **BIT STRING (SIZE(7))**,

fiveEntries-r12 **BIT STRING (SIZE(15))**

} **OPTIONAL**

In NR, there is no limitation as such, and theoretically the UE can report 32 bands in a NR band combination, and so NR signaling allows upto 1024 unique bands from which the 32 bands can be reported.

If we try to address the NR cell grouping using the LTE approach, the signaling has the potential to explode with the BIT-STRING size of “thirtyOneEntries” going up to SIZE 2^32 -1

supportedNR-DC-CellGrouping-r16 **CHOICE** {

threeEntries-r16 **BIT STRING (SIZE(3))**,

fourEntries-r16 **BIT STRING (SIZE(7))**,

fiveEntries-r16 **BIT STRING (SIZE(15)),**

**<<skipped parts>>**

**…………**

thirtyOneEntries-r16 **BIT STRING (SIZE(858993458))**

} **OPTIONAL**

1. Companies are requested to provide their view on the below:

Should RAN2 design the signalling of NR DC cell grouping for NR BCs.? Please comment on the view taken.

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| **Company’s name** | **Agree/Disagree** | **Company’s comments, if any** |
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1. Companies are requested to provide their view on the below:

If the signalling size is a concern, is RAN2 ok with asking RAN1 and RAN4 on any constraints in the NR DC cell grouping that can bring the signalling size down?

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| **Company’s name** | **Agree/Disagree** | **Company’s comments, if any** |
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## Review of the NR V2X band signaling

In RAN1 LS[1], RAN1 requests RAN2 feedback on the below:

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| * For 5G\_V2X\_NRSL-Core:   + For FG 15-19 RAN1 still has to decide whether it is a basic FG.   + For FG 15-23 RAN1 still has to decide whether it is also a basic FG for UEs not supporting mode 1.   + Support for 256-QAM transmission in an FR should be decided by RAN4.   + RAN1 concluded that RAN4 should decide any UE capability related decisions in regard to 256 QAM sidelink reception support in Rel. 16 V2X for both FR1 and FR2   + The notes for some RAN1 FGs for NR V2X refer to “a band indicated with only the PC5 interface in 38.101-1 Table 5.2E-1”. These notes use Table 5.2E-1 as example to illustrate how a given FG applies to bands where a UE can be operated according to the terms of the associated note(s). RAN1 kindly asks RAN4 and RAN2 to decide the appropriate manner of referencing such bands in a forward compatible manner that doesn’t require maintenance of specifications when new bands without expected network deployment emerge.   **ACTION:** In NR V2X, RAN1 kindly asks RAN4 and RAN2 to decide the appropriate manner of referencing bands without expected network deployment in a forward compatible manner that doesn’t require maintenance of specifications when new bands for NR V2X without expected network deployment emerge. |

### Discussion point

1. Companies are requested to provide their view on the below:

It is rapporteur’s understanding that RAN1 are asking whether it is feasible to define FG support in release-independent manner for the supported bands.

1. In NR Uu case, it has been RAN2 assumption that RAN4 band support is release independent meaning that if/when a certain band is introduced in Rel-16, the Rel-15 UE can also support it as long as this UE indicates the support of this band in UE capability.
2. If RAN4 frequency bands continue to be introduced in a release independent manner, the current Sidelink frequency bands support signaling should be able to handle this.

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| **Company’s name** | **Agree/Disagree** | **Company’s comments, if any** |
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## DAPS capabilities

RAN2 have agreed below capacities based on previous RAN1/RAN4 LSs:

**Per Band, per BC:**

intraBandInterFreqDiffSCS-DAPS

intraBandIntraFreqDiffSCS-DAPS

-intraFreqDAPS-r16;

**Per BC:**

-asyncDAPS-r16

-interFreqDAPS-r16

-interFreqDiffSCS-DAPS-r16

-singleUL-TransmissionDAPS-r16

supportedNumberTAG-DAPS

uplinkPowerSharingDAPS

pdcch-BlindDetectionSource

pdcch-BlindDetectionTarget

### Discussion points based on feature groups items from RAN1

#### DAPS HO (FG 21-1)

For the indicated support of intra-frequency DAPS-HO for a given [band] and indicated support of inter-frequency DAPS-HO for a given [band combination].

1. Indicates support of simultaneous DL reception of PDCCH and PDSCH from source and target cell in DAPS-HO
2. Indicates support of PDCCH blind decoding capability in the first MCG and second MCG.

Based on rapporteur’s understanding:

21-1 has been covered by the capabilities intra freq DAPS and inter freq DAPS (agreed in RAN2), and we do not need to introduce new capabilities but only add the description for intraFreqDAPS and interFreqDAPS.

**Proposal for discussion**: Do not introduce new capability for 21-1, only add description of 21-1 for intraFreqDAPS and interFreqDAPS.

Companies are requested to provide their view on the proposal.

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| **Company’s name** | **Agree/Disagree** | **Company’s comments, if any** |
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#### UE power sharing for DAPS (FG 21-2)

RAN2 have agreed

8: Baseline is UplinkPowerSharingDAPS-HO, pdcch-BlindDetectionMCG1-UE and pdcch-BlindDetectionMCG2-UE are introduced as per BC capabilities.

However as agreed in RAN1, UE power sharing capabilities are split into 3 sub-capabilities.

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| 21-2 | Basic UE power sharing for DAPS HO | Support of semi-static power sharing mode1 |
| 21-2a | Semi-static UL power sharing mode 2 for DAPS HO | Support of semi-static power sharing mode 2 |
| 21-2b | Dynamic UL power sharing for DAPS HO | Support of dynamic power sharing |

**Proposal for discussion**: Add separate capabilities for 21-2, 21-2a and 21-2b as per BC capability.

Companies are requested to provide their view on the proposal.

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| **Company’s name** | **Agree/Disagree** | **Company’s comments, if any** |
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#### UL transmission cancellation: indicates support of cancelling UL transmission to the source cell (FG 21-2d)

Since this is a new capability, a separate UE capability should be introduced in RAN2. But we may remove it if finally, RAN1 do not agree this new capability.

**Proposal for discussion**: Add ul-TransCancellationDAPS as per UE capability, and it is FR1/FR2 diff. May be revised based on RAN1 conclusion.

Companies are requested to provide their view on the proposal.

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#### PDCCH blind detection for MCG1 and MCG2

RAN2 have agreed

8: Baseline is UplinkPowerSharingDAPS-HO, pdcch-BlindDetectionMCG1-UE and pdcch-BlindDetectionMCG2-UE are introduced as per BC capabilities.

However, based on latest RAN1 table, PDCCH blind detection capabilities have been removed since RAN2 agreed there is no SCells during DAPS HO.

**Proposal for discussion:** pdcch-BlindDetectionSource and pdcch-BlindDetectionTarget **are not needed based on RAN1 latest capability table.**

Companies are requested to provide their view on the proposal.

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| **Company’s name** | **Agree/Disagree** | **Company’s comments, if any** |
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### Discussion points based on feature groups items from RAN4

The information from RAN4 is cited here:

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| 5-1 | Support of intra-frequency DAPS HO | 1. Support of synchronous DAPS handover for intra-frequency case 2. Support of asynchronous DAPS handover for intra-frequency case |
| 5-2 | Support of inter-frequency DAPS HO | 1. Support of synchronous DAPS handover for inter-frequency case 2. Support of asynchronous DAPS handover for inter-frequency case |
| 5-3 | Support of simultaneous UL transmission | 1. Support of simultaneous UL transmission for DAPS handover for intra-frequency case 2. Support of simultaneous UL transmission for DAPS handover for inter-frequency case |
| 5-4 | Support of multi TAG | 1. Support of different TAGs in source and target cells for intra-frequency case 2. Support of different TAGs in source and target cells for inter-frequency case |
| 5-5 | Support of different SCS-s in source and target cells for combination | 1. Support of different SCS-s in source and target cells for intra-frequency case 2. Support of different SCS-s in source and target cells for inter-frequency case |

Based on the information from RAN4, separate capabilities are needed for intraFreq and interFreq for below capabilities:

-sync DAPS (new);

-async DAPS;

-simultaneous UL transmission (new, RAN2 only have single Ul transmission);

-MultiTAG;

-different SCGs

**Proposal for discussion:** introduce new capabilities syncDAPS and simultaneous UL transmission based on RAN4 latest capability table.

Companies are requested to provide their view on the proposal.

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| **Company’s name** | **Agree/Disagree** | **Company’s comments, if any** |
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To support separate capabilities for intraFreq/interFreq, we need to split below capabilities:

**Per Band, per BC:**

intraBandInterFreqDiffSCS-DAPS

intraBandIntraFreqDiffSCS-DAPS

**Per BC:**

-asyncDAPS-r16

-interFreqDAPS-r16

-interFreqDiffSCS-DAPS-r16

-singleUL-TransmissionDAPS-r16

supportedNumberTAG-DAPS

MultiUL-TransmissionDAPS

syncDAPS

**Proposal for discussion:** introduce separate capabilities for intraFreq and interFreq as below:

**Per Band/per BC (for intraFreq capabilities), I.e. put under** BandParameters-v16xy**:**

intraFreqDiffSCS-DAPS-r16;

intraFreqAsyncDAPS-r16

intraFreqSyncDAPS-r16

intraFreqSingleUL-TransmissionDAPS-r16

intraFreqMultiUL-TransmissionDAPS-r16

intraFreqSupportedNumberTAG-DAPS-r16 (Note, it is not needed for interFreq since RAN2 agreed to “Reuse CA capability “supportedNumberTAG” for DAPS handover.)

**Per BC (for interFreq capabilities), i.e. put under** CA-ParametersNR-v16xy**:**

interFreqDiffSCS-DAPS-r16

interFreqAsyncDAPS-r16

interFreqSyncDAPS-r16

interFreqSingleUL-TransmissionDAPS-r16

interFreqMultiUL-TransmissionDAPS-r16

Companies are requested to provide their view on the proposal.

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| **Company’s name** | **Agree/Disagree** | **Company’s comments, if any** |
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**Proposal for discussion:** Uplink power sharing capabilities are not contained in RAN4 table and so far it is per BC capability, it would be good to check whether separate capabilities are needed for intraFreq and interFreq:

Companies are requested to provide their view on the proposal.

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| **Company’s name** | **Separate capabilities for intra/inter or not?** | **Company’s comments, if any** |
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## Positioning Capabilities

### NR ECID

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| 13. NR Positioning | [13-12] | [NR E-CID DL SSB RRM measurements with LPP support for NR Positioning] | 1. [NR E-CID DL SSB RRM measurements with LPP support for NR Positioning] |
| 13. NR Positioning | [13-12a] | [NR E-CID DL CSI-RS RRM measurements with LPP support for NR Positioning] | 1. [NR E-CID DL CSI-RS RRM measurements with LPP support for NR Positioning] |

In current TS37.355, RAN2 has introduced all of them as below, and no new capability is needed.

nr-ECID-MeasSupported -r16 BIT STRING { ssrsrpSup (0),

ssrsrqSup (1),

csirsrpSup (2),

csirsrqSup (3) (SIZE(1..8)),

**Proposal for discussion**: NR E-CID capability in RAN1 table has been covered in LPP specification, no change is needed.

Companies are requested to provide their view on the proposal.

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| **Company’s name** | **Agree/Disagree** | **Company’s comments, if any** |
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### DL AoD, DL TDOA, Multi RTT

Based on the features listed in RAN1 table, for DL AoD, DL TDOA, Multi RTT, there are three parts of capabilities:

* PRS resources capability (13.1 Common DL PRS Processing Capability and positioning method specific PRS resources capability 13.2, 13.3, 13.4), QCL capabilities (13.7, 13.7a) and measurement reports capability (13.5, 13.6, 13.11).

**Proposal for discussion:** In LPP, define common DL PRS processing capability for 13.1 and can be indicated under per positioning method capability reporting, e.g. NR-DL-TDOA-ProvideCapabilities

Companies are requested to provide their view on the proposal.

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| **Company’s name** | **Agree/Disagree** | **Company’s comments, if any** |
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**Proposal for discussion:** In LPP, define QCL capability for 13.7, 13.7a and can be indicated under per positioning method capability reporting, e.g. NR-DL-TDOA-ProvideCapabilities

Companies are requested to provide their view on the proposal.

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| **Company’s name** | **Agree/Disagree** | **Company’s comments, if any** |
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**Proposal for discussion:** In LPP, define separate capabilities for positioning method specific DL PRS capability for 13.2, 13,3 and 13.4

Companies are requested to provide their view on the proposal.

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| **Company’s name** | **Agree/Disagree** | **Company’s comments, if any** |
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**Proposal for discussion:** In LPP, define separate capabilities for positioning method specific Measurement Report capability for 13.5, 13,6 and 13.11

Companies are requested to provide their view on the proposal.

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| **Company’s name** | **Agree/Disagree** | **Company’s comments, if any** |
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13.5a, 13.6a and 13.11a, Support of inter-frequency measurement, can be covered by the number of positioning layer UE supports in 13.2, 13.3 and 13. 4.

**Proposal for discussion:** 13.5a, 13.6a and 13.11a are not needed since they are covered by 13.2, 13.3 and 13.4.

Companies are requested to provide their view on the proposal.

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| **Company’s name** | **Agree/Disagree** | **Company’s comments, if any** |
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### SRS capabilities

As indicated in RAN2 list, SRS capabilities are split into

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| --- | --- |
| 13-8 | SRS Resources for Positioning |
| 13-8a | Support of Aperiodic SRS Resources for positioning |
| 13-8b | Support of Semi-persistent SRS Resources for positioning |
| 13-9 | OLPC for SRS for positioning based on PRS from the serving cell |
| 13-9a | OLPC for SRS for positioning based on SSB from neighbouring cells |
| 13-9b | OLPC for SRS for positioning based on PRS from the neighbouring cells |
| 13-9c | OLPC for SRS for positioning based on CSI-RS from serving cell |
| [13-9d] | [OLPC for SRS for positioning based on SSB from serving cell] |
| [13-9e] | [PathLoss estimate maintenance] |
| 13-10 | Spatial relation for SRS for positioning based on SSB from the serving cell |
| 13-10a | Spatial relation for SRS for positioning based on CSI-RS from the serving cell |
| 13-10b | Spatial relation for SRS for positioning based on PRS from the serving cell |
| 13-10c | Spatial relation for SRS for positioning based on SRS |
| 13-10d | Spatial relation for SRS for positioning based on SSB from the neighbouring cell |
| 13-10e | Spatial relation for SRS for positioning based on PRS from the neighbouring cell |
| [13-10f] | [Spatial relation maintenance] |

**Proposal for discussion:** In RRC, group capabilies for SRS resources (13.8, 13. 8a, 13.8b), OLPC (13.9, 13.9a....) and spatial relation (13.10, 13.10a...) separately, i.e. separate SRS resources capability, OLPC SRS capability and spatial relation SRS capability.

Companies are requested to provide their view on the proposal.

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| **Company’s name** | **Agree/Disagree** | **Company’s comments, if any** |
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One question is still open in LPP discussion, i.e. whether SRS capabilities are needed in LPP. To our understanding, it can help the LMF to know what level of resources the UE can support for UL related positioning methods, and can make proper decision accordingly.

Proposal for discussion, what SRS capabilities are needed for LMF:

* + Part 1: SRS resources capabilities (13.8, 13. 8a, 13.8b); and/or?
  + Part 2: OLPC capabilities (13.9, 13.9a....); and/or
  + Part 3: spatial relation capabilities (13.10, 13.10a...)
  + Part 4: others?

Companies are requested to provide their view on twhat SRS capabilities are needed for LMF?

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| **Company’s name** | **Part 1, 2, 3, 4** | **Company’s comments, if any** |
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## Other items

Please list any items from any WI that RAN2 needs to discuss or need to get information from RAN1/RAN4 regarding the UE feature list.

Rapporteur would like to bring to the attention of companies that the UL Tx switching references in the LS are not treated in this email discussion, as RAN2 has agreed on the below email discussion to handle the UL Tx switching aspects.

**[Post109bis-e][045][R16 Other] UL TX Switching-NR\_FR1 (China Telecom)**

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| --- | --- |
| **Company’s name** | **Company’s comments** |
| Intel | For FG 18-4/4a/4b, RAN1 has earlier agreed (atleast for 18-4) that the dormancy support should be per-UE, but in the latest LS, it is FFS with the option of being per-BC as well. We would like to discuss in RAN2 and check with RAN1 on the fallback support of this, if it is per BC.  Option-1: The UE is expected to support dormancy for all fallback BCs of the BC on which the UE reports the support.  Option-2: The UE does not need to support, and the UE can repeat the lower order BCs to inform the NW about the (lack of) dormancy support. In such a case, the configuration can become tricky in cases where the NW has to switch between BCs where the dormancy support toggles.  We prefer option-1, and would like to inform RAN1 about our assumption on the support of dormancy in fallback BCs, and get their confirmation.  For FG 17-1, 17-2 in CLI\_RIM, what is to be interpreted by the NW if the UE supports RSSI or SRS-RSRP based measurements, but does not provide the maximum number of resources the UE can be configured with. Should the UE mandatorily provide a value? Or absence implies a value?  For 18-8, RAN1 LS states that HARQ-ACK codebook spatial multiplexing is to be defined per PUCCH group, while Rel-15 signalling already provides this per PUCCH group (using *spatialBundlingHARQ-ACK*). Further clarification is needed on what is meant by RAN1  For 18-2,2a-2b,3,3a, the FGs are meant to be for LTE PCell for EN-DC operation. They can be captures in LTE ASN.1 (36.331/306) or in NR ASN.1 (38.331/306). Currently we listed them in NR ASN.1 Company views are requested to this approach. |
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# Report summary

*<If needed, to be updated when doing the summary>*

1. *<If needed, to be updated when doing the summary>*.

# Conclusion

The proposals captured are the following:

**Proposal 1.** *<If needed, to be updated when doing the summary>*.

# References

1. R1-2003072 R1-2003072 LS on Rel-16 RAN1 UE features lists for NR
2. R1-2003073 R1-2003073 Rel16\_RAN1\_UE features NR\_afterR1#100bisE.
3. R4-2005192 R4-2005192 LS on Rel-16 RAN4 UE features lists for LTE and NR\_v1-clean
4. R4-2005193 R4-2005193 Rel-16 RAN4 UE feature list