**3GPP TSG RAN WG1 #117 R1-2405346**

**Fukuoka City, Fukuoka, Japan, May 20th – 24th, 2024**

**Source: Moderator (OPPO)**

**Title: Summary #1 on Rel-19 asymmetric DL sTRP/UL mTRP**

**Agenda Item: 9.2.4**

**Document for: Discussion and Decision**

# Introduction

This document summarizes remaining issues proposed in company contributions of AI 9.2.4 for the following objective in Rel-19 WI of NR MIMO Phase 5:

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| 1. Specify enhancement for asymmetric DL sTRP/UL mTRP deployment scenarios, assuming intra-band intra-DU non-co-located mTRP scenarios, without changing existing cell definition or defining a new cell (e.g. UL-only cell), assuming the Rel-17/18 unified TCI framework and fully reusing the legacy QCL/UL spatial relation rules, targeting FR1 and FR2
	1. Two closed-loop PC adjustment states for SRS, both separate from PUSCH; and pathloss offset configurations for pathloss calculation to UL TRP(s), when the pathloss RS is from DL sTRP.
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# Issues for Discussions

## Pathloss Offset

Table 1-1 summary of pathloss offset

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| **#**  | **Issue** |
| 1.1 | **Indicating PL offset for PDCCH-order PRACH**:A few Alts were listed for indicating PL offset for PDCCH-order PRACH:

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| **Agreement**Consider and down-select one from the following alts for indicating a PL offset for PDCCH-order PRACH transmission at least for FR1.* Alt1: RRC configures multiple PL offset values in PRACH-Config and PDCCH-order DCI indicates one of them through one DCI field.
* Alt2: PDCCH order DCI indicates one PL offset value
* Alt3: The PL offset associated with one of the indicated joint/UL TCI state for UL TRP in unified TCI framework is applied on the PDCCH-order PRACH transmission
* Alt4: The PDCCH order DCI indicates one TCI state associated with a PL offset and the associated PL offset is applied on the PRACH transmission.
* Alt5: RRC configures one PL offset value for PRACH and the PDCCH order DCI indicates whether this PL offset value is applied on PRACH transmission or not.

Note: Other alternatives are not precluded |

Samsung proposed one more Alt in tdoc:* Alt6: A list of PL offset configurations is configured by RRC in BWP/CC and each PL offset configuration contains one PL offset value and ID. A new field in PDCCH order DCI indicates one of PL offset configurations where each codepoint of the new field is associated with a PL offset configuration. A MAC-CE can update a PL offset value included in a PL offset configuration. After MAC-CE update on a certain PL offset configuration, the updated PL offset value is applied to a codepoint of the new field associated with the PL offset configuration. The PL offset for PRACH transmission is 0 dB when a codepoint is not associated with any of PL offset configuration.

And ETRI proposed two more Alts:* Alt7: RRC configures a list of pre-defined PL offset configurations and PDCCH-order DCI indicates one of them through one DCI field as well as a differential PL offset index/value through another DCI field to transmit the PRACH preamble.
* Alt8: RRC configures a list of PL offset configurations each of which is associated with a joint/UL TCI state and PDCCH-order DCI indicates one of joint/UL TCI states to transmit the PRACH preamble.

Companies’ views are:* Alt1: InterDigital, Intel, ZTE, China Telecom, CATT, Panasonic, Fujitsu, Xiaomi, DCM,
* Alt2: InterDigital, Fujitsu, Nokia, Transsion (2nd),
* Alt3: Spreadtrum, Lenovo, Ericsson, Transsion(1st), OPPO, Nokia, Sharp, QC,
* Alt4: InterDigital, Huawei/HiSilicon, Nokia
* Alt5: vivo, NEC
* Alt6: Samsung
* Alt7: ETRI
* Alt8: ETRI

Mod: Alt1 and Alt3 receives most of the supports. Alt3 requests PRACH to follow the PL offset associated with the indicated TCI state for UL TRP. Alt1 gives more flexibility since there is no dependency on the TCI state/PL offset applied on PUSCH. As commented by some companies, they can provide independent control of PRACH power control, not need to be tied with the current beam on PUSCH. And Alt1 is supported by slightly more companies than Alt3. I would suggest to move forward with Alt1 **Proposal 1.1:** For indicating a PL offset for PDCCH-order PRACH transmission at least for FR1, support Alt1:* Alt1: RRC configures multiple PL offset values in PRACH-Config and PDCCH-order DCI indicates one of them through one DCI field
* FFS: the details of DCI field design.
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| 1.2 | **How to configure/indicate the association between PL offset and joint/UL TCI state:**

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| **Agreement**For the association between PL offset and joint/UL TCI state, consider and down-select one from the following Alts:* Alt1a: One PL offset value is configured in a joint or UL TCI state by RRC only
* Alt1b: One PL offset value is configured in a joint or UL TCI state by RRC. A MAC CE can update the PL offset value(s) for joint or UL TCI state(s).
* Alt2a: A list of PL offset configurations is configured by RRC in BWP/CC and each PL offset configuration contains one PL offset value. One new RRC parameter is introduced in a joint or UL TCI state to indicate one of the configured PL offset configurations.
* Alt2b: A list of PL offset configurations is configured by RRC in BWP/CC and each PL offset configuration contains one PL offset value. One new RRC parameter is introduced in a joint or UL TCI state to indicate one of the configured PL offset configurations. A MAC CE can update the association between a joint or UL TCI state and PL offset configuration
* Alt3: A list of PL offset configurations is configured by RRC in BWP/CC and each PL offset configuration contains one PL offset value. A MAC CE can activate/indicate one PL offset configuration for each activated joint or UL TCI state. In each joint or UL TCI state, the initial PL offset value is 0dB.
* Alt4: A list of PL offset values is provided in a joint or UL TCI state by RRC. Each PL offset value is applied to a corresponding measured PL range.

Other alternatives are not precluded. |

Samsung proposed one more Alt:* Alt5: A list of PL offset configurations is configured by RRC in BWP/CC and each PL offset configuration contains one PL offset value and ID. Each joint or UL TCI state is associated with a PL offset configuration where the association is based on RRC configuration. A MAC-CE can update a PL offset value included in a PL offset configuration. After MAC-CE update on a certain PL offset configuration, the updated PL offset value is applied to all TCI state(s) associated with the PL offset configuration. The PL offset is 0 dB when a TCI state is not associated with any of PL offset configurations

**Panasonic proposed one more Alt:*** Alt6: One PL offset value is configured in a joint or UL TCI state by RRC. The network updates either the pathloss offset value by RRC reconfiguration, or an UL-pow-offset by MAC-CE update such that:

 UL Tx power = DL pathloss + pathloss offset + UL-pow-offsetCompanies’ views are:* Alt1a: Huawei/HiSilicon
* Alt1b: InterDigital, MTK, Spreadtrum, Apple, Intel, Sony, Ericsson(?), LG, Fujitsu, Xiaomi, NEC, Nokia, DCM (2nd), QC, Google
* Alt2a: Intel, vivo,
* Alt2b: InterDigital, MTK, Lenovo, CATT, LG, TCL, Fujitsu, Xiaomi (1st prefer), ETRI (with one more PL offset differential), Transsion, Sharp, DCM(1st), ASUSTeK, OPPO (2nd)
* Alt3: InterDigital, ZTE, China Telecom, OPPO, Sharp, ASUSTeK, Transsion
* Alt4: InterDigital, Google (2nd)
* Alt5: Samsung
* Alt6: Panasonic

Mod: Majority companies support either Alt1b and/or Alt2b. My understanding is they can provide the exactly same function, the only difference is control signalling design. It seems to be an down-selection between Alt1b and Alt2b and Alt1b is supported by slightly more companies than Alt2b, and the design of Alt1b is more aligned with the configuration design of PL RS in TCI state. Suggest move forward with Alt1b.**Proposal 1.2:**For the association between PL offset and joint/UL TCI state, support Alt1b:* Alt1b: One PL offset value is configured in a joint or UL TCI state by RRC. A MAC CE can update the PL offset value(s) for joint or UL TCI state(s).
* Alt2b: A list of PL offset configurations is configured by RRC in BWP/CC and each PL offset configuration contains one PL offset value. One new RRC parameter is introduced in a joint or UL TCI state to indicate one of the configured PL offset configurations. A MAC CE can update the association between a joint or UL TCI state and PL offset configuration

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| 1.3 | **Power control formulas with PL offset:**Nokia and MTK discussed how to update the UL power calculation formulas in 38.213 when a TCI state associated with PL offset is applied on PUSCH/PUCCH/SRSMod: That is an essential problem we should make conclusion.**Proposal 1.3:** * When a joint/UL TCI state associated with a PL offset with value is applied on a PUSCH transmission, the UE determines the PUSCH transmit power as:

 * When a joint/UL TCI state associated with a PL offset with value is applied on a PUCCH transmission, the UE determines the PUCCH transmit power as:
* When power control parameters contained in one joint/UL TCI state associated with a PL offset with value are applied on a SRS transmission, the UE determines the SRS transmit power as:

Note: How to capture that is up to the editor. Note: can take only non-negative values.FFS: the value range and candidate values of PL offset value |
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| 1.4 | **PHR calculation with PL offset:**DCM and Fujitsu proposed to update PHR calculation formula for Type1 PH Report with application of PL offsetMod: this is an essential problem we need conclusion. We also need to make conclusion on the calculation of Type 3 calculation. **Proposal 1.4a:** To calculate a Type 1 PHR based on an actual PUSCH transmission,if a joint/UL TCI state associated with a PL offset with value is applied on this PUSCH transmission, the UE determines the Type 1 PHR as:* Note: How to capture that is up to the editor.
* FFS Type 1 PHR calculation based on reference PUSCH when including PL offset.

**Proposal 1.4b:** To calculate a Type 3 PHR based on an actual SRS transmission,if a joint/UL TCI state associated with a PL offset with value is applied on this SRS transmission, the UE determines the Type 3 PHR as:* Note: How to capture that is up to the editor.
* FFS Type 3 PHR calculation based on reference SRS when including PL offset.
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| 1.5 | **How to determine the PL offset at gNB side:**Companies provided views on how to calculate/determine the value of PL offset at the NW side. Some companies suggested that can be up to NW implementation. Some companies proposed to study the solutions, e.g., SRS transmission, to facilitate that and some companies proposed to discuss whether spec impact in needed for PL offset measurement in FR2.Mod: This issue was discussed in last meeting and here is the latest version of proposal from last meeting according to the comments received in draft folder. I would suggest we start with this version.**Proposal 1.5:**Study whether/how to facilitate gNB’s determination of the value of PL offset from specification point of view |
| 1.6 | **UL PL and updating**We have the following FFS on UL PL in previous agreements:

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| * + FFS: The UE can update UL PL in a way that new UL PL = current UL PL + an update delta indicated by the NW.
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Companies provided the following views on the FFS:* Support: Sony, QC, NEC,Xiaomi,
* Not support: MTK, Apple,

Mod: The views seem to be controversial. QC provided a detailed solution for this method in the tdoc. So, I would like make an proposal based on QC’s version:**Proposal 1.6:** Support to update a UL PL for a joint/UL TCI state as follows:* When this joint/UL TCI state is activated and it is not in the current active TCI state list, a UL PL is calculated as: UL PL = PL estimated from DL PL RS – the value of PL offset.
* When this joint/UL TCI state is activated and it is in the current active TCI state list, the UE updates the UL PL as: new UL PL = current UL PL + the updated delta indicated by the NW.
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| 1.7 | **TCI framework configuration**Companies proposed to clarify the configuration of rel17/18 TCI framework for this UL mTRP deployment scenario. Furthermore, Also, companies (Intel, Samsung, Ericsson) proposed to consider/investigate a mixed mode of joint TCI state + UL TCI state for this asymmetric deployment scenario.**Proposal 1.7a**: For the asymmetric DL sTRP/UL mTRP deployment scenario, * When rel-17 unified TCI/ICBM is configured:
	+ For FR1: one joint TCI state or one DL TCI state + one UL TCI state can be mapped to one DCI codepoint
	+ For FR2: one DL TCI state + one UL TCI state can be mapped to one DCI codepoint.
* When rel-18 unified TCI is configured:
	+ For FR1: up to two joint TCI states or one DL TCI state + up to two UL TCI state can be mapped to one DCI codepoint.
		- Note: When two joint TCI states are indicated, the 1st joint TCI state is applied on DL transmission and both joint TCI states can be applied on UL transmissions
	+ For FR2: one DL TCI state + up to two UL TCI states can be mapped to one DCI codepoint.

**Proposal 1.7b**: To facilitate the asymmetric DL sTRP/UL mTRP deployment scenario, support a mixed TCI mode of joint TCI state + UL TCI state for FR1 and FR2 additionally:* A joint TCI state + a UL TCI state can be mapped to a DCI codepoint,
* The indicated UL TCI state is applied on UL transmission towards the UL TRP.
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Table 1-2: Company input for Issues 1.x

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| **Company**  | **Comments** |
| Mod00 | Please share your views/inputs on the issues 1.x |
| Samsung | **Proposal 1.1/1.2**: As we mentioned in our tdoc, at least two aspects we need to consider:1) Common PL offset can be applied to all UL channel/signals (PUCCH, PUSCH, SRS, PRACH)- We think that if a UL transmission is toward to a certain UL TRP, then same PL offset shall be applied for all PUCCH, PUSCH, PRACH, and SRS since PL offset is related to pathloss value which is common for the same UL TRP.2) Efficient utilization on MAC-CE updating functionality- If we consider MAC-CE, we would like to consider how to utilize this updating functionality as efficient as possible, e.g., simultaneous update for PL offsets on multiple TCI states. Considering 1), introducing PL offset configuration(s) which can be applied to all UL channel/signal commonly is beneficial. In that sense, we are fine if “RRC configured multiple PL offsets” in Proposal 1.1 and “A list of PL offset configurations” in Alt2b of Proposal 1.2 are same.Considering 2), if we consider Alt2b in Proposal 1.2, then if a new value which cannot be covered by current PL offset configurations is needed, then RRC reconfiguration is necessary. Also, based on MAC-CE in Alt2b, relationship between one TCI state and one PL offset configuration can be updated.Hence, we would like to suggest Alt5 and Alt6 for Proposal 1.1 and 1.2, respectively.Both Alt5 and Alt6 for Proposal 1.1 and 1.2, respectively, consider common PL offset configuration(s) which each of PL offset configuration(s) includes a PL offset value, and MAC-CE can update the value of PL offset configuration(s), then based on the MAC-CE, all TCI states associated with the PL offset configuration can be updated with a new PL offset value simultaneously, and it can be also applied to PRACH transmission.**Proposal 1.3:** Support. The intention we understand is to apply PL offset directly to pathloss value.**Proposal 1.4a:** Support.**Proposal 1.4b:** We think that more discussion is needed. Our understanding is that Type 3 PHR is reported in a UL carrier in a serving cell when PUSCH-config is not provided, but now we consider UL TRP where there is no DL transmission, then it does not make sense without PUSCH configuration in this scenario.**Proposal 1.5:** We are fine.**Proposal 1.6:** Not support. Based on this proposal, gNB shall manage both UL PL and updated delta indicated by the NW. Also, for updated delta, an additional indication is necessary from gNB, and one more field on top of PL offset indication field (now it is discussed in Proposal 1.1) is needed for PDCCH order triggered PRACH transmission since joint/UL TCI state is not applied to PRACH transmission.**Proposal 1.7a:** We are fine. **Proposal 1.7b:** We are fine with further discussion. |
| Spreadtrum | Proposal 1.1: Not support. We prefer one unified solution for all UL channels/signals. In current specification, PL RS for PDCCH order triggered CFRA can be DL RSs of TCI state of PDCCH order, i.e., PL RS for PDCCH order triggered CFRA can be associated with TCI state. There exists dependence between power of PRACH and TCI state. Thus, we prefer Alt3.Proposal 1.2: SupportProposal 1.3: OkProposal 1.4a: OkProposal 1.4b: OkProposal 1.5: It is up to gNB’s implementation. But we are fine for study if there is time.Proposal 1.6: Not support. Not clear why (PL – delta) can not work for the case when this joint/UL TCI state is activated and it is in the current active TCI state list.Proposal 1.7a: OkProposal 1.7b: We are fine with the discussion. |
| Panasonic | Proposal 1.1:We support this proposal mainly because this has been only agreed for FR1 so far since TCI state information is irrelevant. But it would be better to first discuss whether indicating a PL offset for PDCCH-order PRACH transmission will be supported for FR2 as well, in order to have a unified design for FR1 and FR2. Proposal 1.2: We think that Pathloss offset should be RRC configured. But the MAC-CE would carry a parameter that is used to update the UL transmission power rather than updating the pathloss offset itself. We proposed the following: * Alt6: One PL offset value is configured in a joint or UL TCI state by RRC. The network updates either the pathloss offset value by RRC reconfiguration, or an UL-pow-offset by MAC-CE update such that:

 UL Tx power = DL pathloss + pathloss offset + UL-pow-offsetWe also see that in section 1.6, UL power update is discussed. The right way is to discuss the latter before 1.2. Alternatively, we can only agree to **Alt 1a** at this stage while awaiting further discussion. Proposal 1.3:We do not support. We need to discuss how to use the PL offset in UL power update first. Proposal 1.5:We support. This is an important discussion, and it needs to come before Proposal 1.2 discussion. Proposal 1.6:We would like to understand how this design would fit with Proposal 1.2 alternatives.Proposal 1.7: This is not needed. Also, it is out of scope. |
| MediaTek | **P1.2:** Support, we are fine with either Alt1b or Alt2bAlt1a and Alt2a should be precluded since MAC-CE based update is not supported. In our view, support of MAC-CE based update of PL offset for TCI state(s) is beneficial, which can be used for the high-mobility UEs. However, RRC-only configuration without MAC-CE based update should also work for the low-mobility UEs. In this sense, we think either Alt1b or Alt2b can be supported. For Alt3, MAC-CE is mandated to be used for providing the PL offset for a joint or UL TCI state. However, RRC-only update should be sufficient for the low-mobility UEs. It is not necessary to mandate the using of MAC-CE. On the other hand, Alt3 only allows PL offset to be configured to an activated TCI state. However, for UL transmissions not applying the indicated TCI state, NW still can configure joint/UL TCI states to these UL transmissions, where the joint/UL TCI states may not be activated.For Alt4, it is unclear how to determine the PL offset based on the measured PL.For Alt5, we don’t see the difference compared with Alt2b.For Alt6, we don’t see the difference compared with Alt1b.**P1.3**: OK**P1.4a/b**: OK. We think the same change can be applied to virtual Type1 PH calculation. At least for two PHR mode, there is an association between a reference PUSCH transmission and a joint/UL TCI state.**P1.6**: Not support. We don’t see the need since it provides the same functionally as TPC command.**P1.7a**: We don’t see the need to agree on this proposal, which is already supported by current spec for Rel-17 and Rel-18 unified TCI frameworks.**P1.7b**: Not support. This is out-of-scope. |
| Xiaomi | Proposal 1.1: we are fine with the proposal, also we think an aligned configuration can be considered for PUSCH/PUCCH/SRS and PRACH.Proposal 1.2: ok. Proposal 1.3: okProposal 1.4: okProposal 1.5: We think it is up to gNB implementation, but fine to study further.Proposal 1.6: Added our support to the list. We don’t support the proposal. There is no benefit to support both update methods, we prefer to only update the pathloss offset value more than the updated delta described in the current FFS, which is more aligned with configuration of the pathloss offset to simplify the implementation.Proposal 1.7a: fine with the proposal.Proposal 1.7b: fine with further discussion. |
| OPPO | **Proposal 1.1: Not support.** Firstly, if we go with Alt1, we are going to have two separate configurations of PL offsets. One for PDCCH-order PRACH particularly, the other for PUCCH/PUSCH/SRS. But those PL offsets toward the same UL TRP should be the same. The common PL offsets among all UL channels/signals makes sense. Secondly, since RAN1 already agreed that the PL offset can be associated with UL/joint TCI state, we should follow this design principle, i.e. extending the association between UL/joint TCI state and PL offset(s) to PRACH, rather than defining a new mechanism. Last but not least, Alt1 demands a new DCI field whereas Alt3 doesn’t require to change DCI format. **Proposal 1.2: Not support.** For Alt 1b, it allows MAC CE to override the RRC configured PL offset value(s). That seems not the intended function of MAC CE, i.e. updating the association between PL offset(s). We add our second preference on Alt2b. Hopefully the pros and cons among those alternatives can be more carefully discussed. **Proposal 1.3: Support.** **Proposal 1.4a and 1.4b: Support.****Proposal 1.5: Fine to study.****Proposal 1.6: Not support.**In our understanding, the UL PL estimation can be determined by two factors, i.e. DL PL RS and PL offset. Either factor can be updated by RRC and/or MAC CE. We are reluctant to introduce another way to update UL PL with the same purpose. Not to mention that similar approach, e.g. TPC command from NW adjusting Tx power of UE, already exists. **Proposal 1.7: Not support.**The WID says “assuming the Rel-17/18 unified TCI framework and fully **reusing** the legacy QCL/UL spatial relation rules, targeting FR1 and FR2”, rather than enhancing unified TCI framework. There is no mixed mode of joint and separate DL/UL TCI state.  |
| Huawei, HiSilicon | **Proposal 1.1:** We can support this for the sake of progress.**Proposal 1.2:** Not support. As discussed in our t-doc, we still have serious concern regarding the MAC-CE update/indication of PL offset due to the following reasons:* 1. If the UE movement/rotation is substantial, a new UL TCI would need to be indicated anyways. Since each UL TCI state is associated with a PL offset, this means that the used PL offset value would also be updated and a further update of the PL offset in MAC-CE seems unjustified.
	2. The claimed advantage of updating PL offset in MAC-CE compared to RRC is speculative since there was no simulation results or even concrete analysis to demonstrate that the lower latency of PL offset update in MAC-CE can result in an improved UL channel/signal reception at the UL TRP. Note that a few simulation results were provided in previous two meetings to show that the gap between the PL towards the UL TRP and the anchor DL TRP could be very large. However, we have not seen any analysis to demonstrate that a low-latency PL offset update in MAC-CE is required when PL offset gap is large.

 * 1. PL estimate towards the UL TRP is comprised of two components:
		1. Component-A: DL PL estimate associated with the DL TRP which, itself, is obtained through a L3 filtering of the DL PL-RS RSRP; and
		2. Component-B: PL offset value that is signaled by NW and should be subtracted from Component-A (DL PL estimate).

Since Component-A is L3 filtered, it is not dynamically responsive to UE movements. Therefore, a “low-latency” indication of Component-B in MAC-CE would not make the overall PL estimate towards the UL TRP to be dynamically responsive to the UE movements and the corresponding PL changes towards the UL TRP: For a mobile UE, regardless of whether Component-B is signaled in RRC or MAC-CE, PL estimation error towards the UL TRP is mainly governed by the estimation error in Component-A. This is especially true in most practical scenarios where Component-A is considerably larger than Component-B.Also, for Alt2b, one RRC parameter configures a group of PL offsets and another RRC parameter in UL or joint TCI state associates one of the PL offsets to the TCI state. We think that Alt2b may be an overdesign for a simple problem. It is not clear why two different RRC parameters should be involved for such association as each PL offset value can be directly included in the UL or joint TCI state.**Proposal 1.3:** OK in principle with the following additional note:“-Note: can take only non-negative values.”Above note clarifies that UE transmits to UL TRP only if the total PL towards UL TRP is less than the PL towards the main TRP. **Proposal 1.4 and 1.4b:** OK in principle. However, PL offset value should also be considered in triggering conditions of PHR. For instance, according to 38.321 Clause 5.4.6, PHR can be triggered if the change in PL is more than a threshold (see the bottom of this comment). RAN1 should ensure that the text used in 38.321 for triggering conditions accounts for PL offset as well. Therefore, we suggest to add the following FFS to both Proposal 1.4 and 1.4b:-FFS: Whether or not PHR triggering conditions in 38.321 need to be modified to account for PL offset.

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| 38.321 Clause 5.4.6A Power Headroom Report (PHR) shall be triggered if any of the following events occur:- *phr-ProhibitTimer* expires or has expired and the path loss has changed more than *phr-Tx-PowerFactorChange* dB for at least one RS used as pathloss reference for one activated Serving Cell of any MAC entity of which the active DL BWP is not dormant BWP since the last transmission of a PHR in this MAC entity when the MAC entity has UL resources for new transmission;[…] |

**Proposal 1.5:** Not support. We agree with multiple other companies that is up to gNB implementation and we seriously doubt that such study would result in a specified solution. Therefore, agreeing on Proposal 1.5 seems to only result in a waste of offline/online time.**Proposal 1.6:** Not support. Different alternatives on how to indicate PL offset are listed in the RAN1 116b agreement (brought also at the top of issue#1.2). We don’t see how the second bullet is aligned with any of the listed alternatives nor the logic behind it (why the first bullet may not work for the case that is covered by the second bullet). Finally, it is not clear for us what “When this joint/UL TCI state is activated and it is [not] in the current active TCI state list” in the two bullets mean. **Proposal 1.7a:** Not support.We don’t see the need for this proposal. We already have the following two agreements that give us the whole picture.

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| **Agreement**For the asymmetric DL sTRP/UL mTRP deployment scenarios, separate DL/UL TCI state mode of Rel-17/18 unified TCI framework can be configured for both FR1 and FR2.* Joint TCI state mode can be configured at least for FR1

**Agreement**For FR1, a joint TCI state can be associated with a PL offset.[…] |

**Proposal 1.7b:** Not support. This is out of the WID scope as it defines the mix of joint and separate UL/DL TCI that are not supported in Rel-18.  |
| Lenovo | Proposal 1.1: Not Support. We think UL PL is related to the distance between a UL TRP and the UE, it shall be common for all UL channels/signals to a same UL TRP. We prefer to use a unified solution, i.e. Alt 3, to indicate PL offset for the PDCCH-order PRACH transmission.Proposal 1.2: We support Alt2b.Proposal 1.3: Support.Proposal 1.4a and 1.4b: Support.Proposal 1.5: Support to further study.Proposal 1.6: Not support since the proposal 1.2 is not agreed yet, we can discuss it after Proposal 1.2 is determined.Proposal 1.7a: Support.Proposal 1.7b: Not support since it does not follow the unified TCI framework in R17/18 which is out of scope. |
| NEC | **Proposal 1.1:** We can accept alt 1 if it is the majority view.**Proposal 1.2:** support. **Proposal 1.3:** support**Proposal 1.4a and 1.4b:** support**Proposal 1.5:** support**Proposal 1.6:** support**Proposal 1.7a and 1.7b:** support |
| ZTE | **Proposal 1.1:** Support. For Alt3, it can be a potential way to reach out that PL offset(s) for PRACH/PUSCH/PUCCH/SRS towards the same UL TRP is the same, but we think it can also be guaranteed by gNB implementation even go with Alt1.**Proposal 1.2:** We can be supportive for progress if the following update can be captured in Alt1b for clarification, due to RRC-based indication should be the baseline and different PL offset values of different UL TRPs should be guaranteed in RRC-level. **Proposal 1.2:**For the association between PL offset and joint/UL TCI state, support Alt1b:* Alt1b: One PL offset value is configured in a joint or UL TCI state by RRC, where different PL offset values can be configured to different joint or UL TCI states. A MAC CE can update the PL offset value(s) for joint or UL TCI state(s).
* Alt2b: A list of PL offset configurations is configured by RRC in BWP/CC and each PL offset configuration contains one PL offset value. One new RRC parameter is introduced in a joint or UL TCI state to indicate one of the configured PL offset configurations. A MAC CE can update the association between a joint or UL TCI state and PL offset configuration

Subsequently, note that PL offset is applied to the estimation derived from DL PL-RS directly, we prefer to support Alt1b, which is consistent with DL PL-RS configuration under unified TCI framework (i.e., *pathlossReferenceRS-Id-r17* configured in *TCI-State* or *TCI-UL-State*). By comparison, Alt2 is similar to PC parameters other than PL-RS under unified TCI framework (i.e., *p0-r17*, *alpha-r17* and *closedLoopIndex-r17* provided by Uplink-powerControl-r17 first and then associated with *TCI-State* or *TCI-UL-State*).**Proposal 1.3:** Support without the newly added note. Generally, we understand it is intuitive and common that the value of should be non-negative. However, negative value of can also be used. For example, even if UE moves to closer to DL TRP but under the coverage of UL TRP, it can be possible that UL transmission still towards UL TRP in such case, which depends on NW scheduling especially when considering interference in addition to Rx power of UL transmission in TRP. To our understanding, the newly added note is captured in the FFS part, which can be further discussed, though.**Proposal 1.4:** Support.**Proposal 1.5:** Fine to study, though we think it is up to gNB implementation.**Proposal 1.6:** We tend to postpone the discussion after the outcome of Proposal 1.2.**Proposal 1.5:** Fine to study, though we think it is up to gNB implementation.**Proposal 1.7a:** Support. Although there may be no spec impact as mentioned by companies, it can be beneficial to reach out common understanding (e.g., a conclusion) on how to interpret TCI state indication in asymmetric DL sTRP/UL mTRP deployment scenario.**Proposal 1.7b:** Not support, it deviates from the WID that “…assuming the Rel-17/18 unified TCI framework and fully reusing the legacy QCL/UL spatial relation rules”. |
| QC | **Proposal 1.1:** Not support. We prefer Alt.3 because of the following reasons:* As already commented by multiple companies, Alt.1 requires separate PL offset configuration between PRACH and PUCCH/PUSCH/SRS. The benefit to have this separate configuration is not justified.
* For Alt.1, to have accurate PL offset. The RRC configured PL offset needs to be finer enough which requires large PDCCH order DCI overhead. However, the reserved bits in PDCCH order DCI are limited.
* In addition, if we are to go with Alt.1, we would suggest to first discuss and decide whether PDCCH order PRACH is supported for FR2, since for FR2, additional fields may be required to provide some guidance for Tx beam determination for PRACH. However the required bits for Alt.1 may impact the design for FR2 if it is to be supported later. However, for Alt.3, a unified solution can be applied to both FR1 and FR2.

**Proposal 1.2:** Support.One difference between Alt.1b and Alt.2b is whether the list of PL offset values is configured per BWP/CC. The benefit of configuring this list of PL offset values is not justified but this would increase the RRC overhead. In addition, the range of PL offset values and how to quantize the PL offset values are common to all BWP/CCs which can be predefined like legacy L1-RSRP or L3-RSRP. In addition, we are also fine with Alt.1a as long as we can support UE to update UL PL in a way that new UL PL = current UL PL + an update delta indicated by the NW this is because we need a mechanism to update the UL Tx power due to the UE movement.**Proposal 1.3:** Ok to discuss but this should be discussed after proposal 1.6.**Proposal 1.4:** Similar as proposal 1.3, this should be discussed after proposal 1.6. In addition, for Type-3 PHR, in legacy this is applied when PUSCH is not configured, e.g., SRS carrier switching. But for asymmetric DL/UL, this is the case where PUSCH is configured. It is unclear why PL offset is needed for the Type-3 PHR for SRS.**Proposal 1.5:** Support.**Proposal 1.6:** Support.**@Samsung** Network doesn’t have to send both PL offset and updated delta together. PL offset is used to get an initial UL PL for a TCI state. Once UL PL for a TCI state is obtained, network only need to send update delta which is applied on top of the current UL PL for this TCI state. Regarding comments on PRACH, the UL PL associated with a TCI state can be applied so additional field as you mentioned is not needed.**@Panasonic** Alt.6 as you proposed is one way if MAC CE based PL offset update is not supported. If MAC CE based PL offset is supported, then whether to apply the PL offset or updated delta is based on whether the joint/UL TCI state is in the current active TCI state list. Note that the active TCI state list update delay is specified in RAN4. When UE receives a TCI activation MAC CE, the UE maintains an active TCI state list, and UE may receive a next TCI activation MAC CE to update the active TCI state list and the switching delay for TCI state list update is specified in RAN4 spec. Therefore, if UE receives a TCI activation MAC CE indicating a TCI state switch, before switching, the target TCI state may be in the current active TCI state list or not. If it is already in the current active TCI state list, that means UE already maintained an UL PL associated with this TCI state, so the UE can update the UL PL on top of the current UL PL. If the target TCI state is not in the current active TCI state list, the UE may not have an UL PL associated with this TCI state, the UE needs to derive the UL PL based on measured DL PL and PL offset associated with this TCI state. **@ MediaTek** The existing TPC command is already used for other purpose. The updated delta is intended to have more accurate PL compensation by adjusting the UL PL per TCI state.**@OPPO** Please see our replies to SS and MediaTek.**@Huawei** Please see our replies to Panasonic. In addition, this can address your concern c) in proposal 1.2 since the updated delta is applied on the current UL PL rather than the L3-filtered RSRP. So it can reflect the UL PL change more accurately.**@ Lenovo** Supporting the FFS part doesn’t rely on the result of proposal 1.2. Of course we are fine to further discuss the details on how to achieve the FFS.**Proposal 1.7a:** We don’t think this is needed since it is already supported based on Rel.17/Rel.18 unified TCI framework. But we are fine if majority companies think clarification is needed.**Proposal 1.7b:** Not support. |

## Closed-loop PC for SRS

Table 2-1 summary of closed-loop PC for SRS

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| --- | --- |
| **#**  | **Issue** |
| 2.1 | **DCI format 1\_1/0\_1 indicating TPC for SRS CLPC adjustment states:**Regarding whether to additionally support using DCI format 1\_1 or 0\_1 to indicate TPC command for SRS CLPC adjustment states, the views provided in the contributions are:* Support: ZTE, China Telecom, Sharp, DCM, Google, Ericsson
* Not support: MTK, Huawei/HiSilicon, Spreadtrum, vivo, Lenovo, CATT, Xiaomi, OPPO,

**Proposal 2.1**: Support to use DCI format 1\_1 and 0\_1 to indicate TCP command for SRS CLPC adjustment states of Rel19:* FFS the detailed DCI field design, e.g., introduce 1-bit state indicator and 2-bit TPC command, DCI format 1\_1 without DL assignment.
 |
| 2.2 | **Configure the ‘mode’ of two SRS CLPC adjustment states**Companies proposed to introduce configuration parameter to indicate there are two SRS CLPC adjustment states in one BWP/CC.Mod: We do need one RRC parameter to indicate that there are two SRS CLPC adjustment states in one CC**Proposal 2.2:** Introduce a new RRC parameter per BWP/CC to indicate that two SRS CLPC adjustment states are configured for SRS in a BWP/CC |
| 2.3 | **Starting bit of a block in DCI format 2\_3**Companies (Samsung, Lenovo) proposed to extend the range of start bit of a block in DCI format 2\_3. Per current spec, the starting bit position of each block in DCI 2\_3 is configured as follows:

|  |
| --- |
| SRS-TPC-CommandConfig ::= SEQUENCE {startingBitOfFormat2-3 INTEGER **(1..31)** OPTIONAL, -- Need RfieldTypeFormat2-3 INTEGER (0..1) OPTIONAL, -- Need R...,[[startingBitOfFormat2-3SUL INTEGER (1..31) OPTIONAL -- Need R]]} |

For two SRS CPLC adjustment states in Rel19, 1-bit indicator field is introduced in DCI format 2\_3. Thus, the block size is increased and the range of start bit defined in rel18 might not be sufficient. Samsung proposed to increase it from 31 to 45.**Proposal 2.3**: In Rel-19, the value range of starting bit of block in DCI format 2-3 is extended from 1~31 to 1~X.* FFS the value of X
 |
| 2.4 | **SRS not configured with any TCI state**Companies proposed to study how to determine the PL offset and/or one of the rel19 SRS CLPC adjustment states for SRS resource when the SRS is not configured/indicated with any TCI state.Mod: In rel-19, as in previous agreement, the PL offset and rel19 SRS CLPC adjustment states is indicated to SRS through TCI state. Under the unified TCI framework, when the SRS resource set is not provided with *followUnifiedTCI-StateSRS* and the SRS resource with lowest ID in that set is not provided with a TCI state, the UE might not be able to obtain the PL offset and one of the SRS CLPC adjustment states at this case. Furthermore, not only these two new PC parameters, all the existing PC parameters and PL RS cannot be obtained. However, I am not sure this case happens in the unified TCI framework. To avoid that, the gNB can make sure there is always an available TCI state through at least providing a TCI state to the SRS resource with the lowest ID when the SRS set is not provided with *followUnifiedTCI-StateSRS.* **Proposal 2.4:** * Study how to apply PL offset for SRS resource set when the SRS resource set is not configured with TCI state
* Study how to apply one of the Rel-19 SRS CLPC adjustment states for SRS resource set when the SRS resource set is not configured with TCI state
 |

Table 2-2: Company input for Issues 2.x

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| --- | --- |
| **Company**  | **Comments** |
| Mod00 | Please share your views/inputs on the issues 2.x |
| Samsung | **Proposal 2.1:** Not support. We think that current DCI format 2\_3 is enough. Based on a single DCI format 2\_3, TPC command value for multiple CCs can be updated (of course updating only a CC is possible), but not possible by DCI format 1\_1 or 0\_1 which needs multiple DCIs.**Proposal 2.2:** Support.**Proposal 2.3:** Support.**Proposal 2.4:** Not support. Based on Rel-17 rule for power control, if SRS resource set does not follow the indicated TCI state, the power control parameter for the SRS resource set is based on the power control parameter configuration in the TCI state from the SRS resource with the lowest ID in the set. Hence, our understanding is that it is mis-configuration from gNB side.This issue was proposed in AI 7 for Rel-17 CR in RAN1#116bis (R1-2402356) but rejected. |
| Spreadtrum | Proposal 2.1: Not support. In legacy, only DCI format 2\_3 is to indicate TPC command for SRS. Until now, there is no issue. That is unclear why other formats other than 2\_3 are specially needed for asymmetric DL/UL scenario. In addition, open loop power control has been enhanced for SRS in asymmetric DL/UL scenario, which can match with the requirement. The necesarity is not clear.Proposal 2.2: SupportProposal 2.3: SupportProposal 2.4: Not support. Share the same view with Samsung. |
| Panasonic | Proposal 2.1: Do not support. Enhancement to 2\_3 is enough. Proposal 2.4: Do not support. This issue should not be fixed in this agenda item.  |
| MediaTek | **P2.1**: Not support. Support only DCI format 2\_3 should be sufficient, which is dedicated to TPC command indication when SRS power control is not tied with the one for PUSCH in legacy.**P2.2:** OK**P2.3:** Support**P2.4:** Not support. The use case that NW configures SRS neither to follow unified TCI nor without any TCI state is unclear. |
| Xiaomi | Proposal 2.1: Not support. Proposal 2.2: fine. Proposal 2.3: fine to support.Proposal 2.4: fine with the proposal. We think this issue has been considered during the discussion of the previous agreement on the configuration of the CLPC adjustment state. We prefer SRS resource set always be configured with *followUnifiedTCI-StateSRS* which is guaranteed by the gNB at least for this scenario. |
| OPPO | **Proposal 2.1: Not support.**Given DCI 2\_3 supported for two CLPC adjustment states, it seems reductant to enable this feature for other DCI formats. **Proposal 2.2: Fine.****Proposal 2.2: Okay.****Proposal 2.4: Not support.** This corner case situation (neither to be configured with *followUnifiedTCI-StateSRS* nor an available TCI state for SRS resource with lowest ID) can be avoided by NW implementation. We don’t have to worry about it. |
| Huawei, HiSilicon | **Proposal 2.1:** Not support.Since WID only considers TPC enhancements for SRSs with *separateClosedLoop* and the TPC of any SRS that is requested in DCI 0\_1/1\_1 and is configured with *separateClosedLoop* still follows a TPC command in DCI 2\_3, there is no TPC enhancement to be done in DCI format 0\_1 or 1\_1. In other words, such enhancements are out of the scope of the WID.**Proposal 2.2:** Support**Proposal 2.3:** Needs further discussion. We think the following issues should be clarified first: 1) Does the extension of the value range of *startingBitOfFormat2-3* only applies to Asymmetric UL/DL scenario or all SRS with separate CLPC? 2) Why the value range is extended to 45 while the max size of DCI 0\_1 is 44 bits (at least for unshared spectrum); 3) If the range extension only applies to Asymmetric UL/DL scenario, then the minimum size of each block is not 2 bits but 3 bits (0 bit SRS request + 2 bits TPC + 1 bit closed-loop indicator field). This needs to be considered in setting the maximum of the value range. **Proposal 2.4:** Not support.As mentioned by FL and multiple companies, this is a corner case that can be avoided by NW implementation.  |
| Mod | Re 2.3, company has concern on the particular value of 45. So I revise the proposal to including FFS on the value.  |
| Samsung | @Huawei/Mod: Regarding Proposal 2.3, we would like to provide some answers on the corresponding questions.1) Whether value range extension is only applicable to asymmetric MTRP case or not- Our initial intention is to extend value range, in general purpose, not only for asymmetric MTRP case, but also other R19 UEs who can monitor DCI format 2\_3, in order to utilize whole bitwidth of DCI format 2\_3. Since it is group common DCI, we believe that it is beneficial to be applied all UEs who can monitor regardless of asymmetric MTRP case. But if companies think it should be limited on the UE who is operated in asymmetric MTRP case, it is also fine to us to limit for that case, but then the actual benefit would be limited. Then, as Huawei mentioned, the minimum block size would be 3 bits (2 bits for TPC command field + 1 bit for closed loop indicator).2) Why the value range is extended to 45 while the max size of DCI 1\_0 is 44 bits (at least for unshared spectrum)- As Huawei mentioned, it is true that 44 bits was decided as the maximum size of DCI 1\_0 in Rel-15 for licensed spectrum. Then, it is extended as 46 bits further, considering shared spectrum and FR2-2. Considering the minimum block size as 2 bits and maximum size of DCI 1\_0 as 46 bits, we proposed the value range as 1 ~ 45.3) If the range extension only applies to Asymmetric UL/DL scenario, then the minimum size of each block is not 2 bits but 3 bits (0 bit SRS request + 2 bits TPC + 1 bit closed-loop indicator field).- Yes, we agree with you. If we only consider this value range extension on asymmetric MTRP case, then the minimum block size would be 3 bits. Then, depending on the case whether this enhancement is only applicable to UE operating in asymmetric MTRP case or not, it is summarized as follows:- 1 ~ 45 bits, if value range extension is applied to all Rel-19 UEs who can monitor DCI format 2\_3- 1 ~ 44 bits, if value range extension is only applied to Rel-19 UEs who can support asymmetric MTRP caseAlso, we think that whether operating band is shared spectrum or not does not matter. This is because, in a given value range, gNB can configure a certain value to a UE based on the UE’s information. We can only consider what the maximum starting bit location could be. |
| Lenovo | Proposal 2.1: Not support. Since DCI format 2\_3 has already been agreed to indicate TPC command for SRS when two separate SRS power control adjustment states are configured, we don’t see the need to specify other methods for the same purpose.Proposal 2.2: Support.Proposal 2.3: Support.Proposal 2.4: Not support.Share same view as FL, this issue can be avoided by gNB. |
| NEC | **Proposal 2.1:** A typo to correct ~~TCP~~TPC command**Proposal 2.2:** Support**Proposal 2.4:**Regardless whether the proposal is needed or not, firstly we would like to check that if SRS is not configured/indicated with any TCI state, and if the SRS resource with lowest ID is provided with a TCI state (and also associated with one PL offset), will the PL offset be applied to the SRS? In other words, whether PL offset is also considered as PC parameter? If so, maybe this needs an agreement to reflect. |
| ZTE | **Proposal 2.1:** Support. Basically, we understand companies doubts on the necessity of this proposal when considering that DCI format 2\_3 has been already support, which is more typical to be used for separate CLPC of SRS as in the legacy. In spite of that, we also sympathize that some companies (especially for operators/vendors) do have difficulties for deploying DCI format 2\_3 so far. Hence, we think at least supporting DCI format 1\_1/0\_1 can be beneficial for the deployment of asymmetric DL sTRP/UL mTRP scenario in the future commercial market.**Proposal 2.2:** Support.**Proposal 2.3:** Agree with FL’s assessment and companies. |
| QC | **Proposal 2.1**: Not support. Using DCI 1\_1/1\_0 is not efficient considering the increased DCI overhead and limited range of TPC command. **Proposal 2.2**: Support. It would be good to clarify the SRS CLPC adjustment states are separate from PUSCH below:* Proposal 2.2: Introduce a new RRC parameter per BWP/CC to indicate that two SRS CLPC adjustment states both are separate from PUSCH are configured for SRS in a BWP/CC

**Proposal 2.3**: Ok with the proposal. **Proposal 2.4**: Not support. For the *SRS-config* IE in TS 38.331, it says “*The network does not configure SRS specific power control parameters, alpha (without suffix), p0 (without suffix) or pathlossReferenceRS if unifiedTCI-StateType is configured for the serving cell*”, that means network needs to configure at least one TCI state for SRS power control. Note that if there is no any TCI state configured for SRS, not only the PL offset, closed loop index, but also other PC parameters e.g., P0, alpha, PL-RS are undefined. On the other hand, given the fact that network configures at least one TCI state for SRS power control, one potential issue is that the source RS in the TCI state is mandatory in current spec. For BM SRS in asymmetric DL/UL scenario, network may not know which Tx beam to indicate w/o any DL RS from the UL TRP and UE doesn’t know which Tx beam to use. In this case, the source RS in the TCI state seems unnecessary. We’d like to propose to study the following:* Study whether the source RS in the TCI state configured for BM SRS can be absent.
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## Others

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| --- | --- |
| **#**  | **Issue** |
| 3.1 | **2TA for asymmetric DL sTRP/UL mTRP**The following companies proposed or consider to extend the 2TA feature of rel18 to the asymmetric DL sTRP/UL mTRP scenarios in Rel-19:* InterDigital, Intel, Samsung, vivo, ZTE, China Telecom, Sony, Ericsson, Nokia, DCM

ZTE and China Telecom provided SLS results of uplink propagation delay difference to show the necessity of 2TAs for this deployment scenario.Mod: supporting 2TA seems to be essential to make the asymmetric UL mTRP scenario work.**Proposal 3.1**: To fulfil the asymmetric DL sTRP/UL mTRP deployment scenarios, support two TAs for single DCI based multi-TRP/panel and single TRP.* Reuse Rel-18 specification of two TA for multi-DCI based multi-TRP/panel and remove the restriction that *coresetPoolIndex* needs to be configured.
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Table 2-3: Company input for Issues 3.x

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| **Company**  | **Comments** |
| Mod00 | Please share your views/inputs on the issues 3.x |
| Samsung | Support. We think that this is an essential feature for completing asymmetric MTRP scenario. |
| Spreadtrum | Out of scope |
| MediaTek | We are open. However, it would be proper to introduce this feature in Rel-19 MIMO through RAN plenary decision. |
| Xiaomi | Support with a WID revision. |
| Lenovo | Out of scope. |
| NEC | Open to it. |
| ZTE | Support. Although we understand it is not explicitly stated in the WID, it is essential for the practical deployment of asymmetric DL sTRP/UL mTRP scenario in reality. Otherwise, the vast majority of uplink performance cannot be guaranteed unfortunately or the network has to deploy intensive UL TRPs (i.e., micro nodes) for this scenario to meet the timing error limit Te in both FR1 and FR2. |
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# Proposals for Online Discussion

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# Contributions in RAN1#117

1. R1-2403849 Discussion on Rel-19 Asymmetric mTRP Operation InterDigital, Inc.
2. R1-2403903 Enhancement for asymmetric DL sTRP/UL mTRP scenarios MediaTek Inc.
3. R1-2403947 Enhancements for asymmetric DL sTRP/UL mTRP scenarios Huawei, HiSilicon
4. R1-2403984 Enhancements for asymmetric DL/UL scenarios Intel Corporation
5. R1-2404022 Enhancements for asymmetric DL sTRP/UL mTRP scenarios Spreadtrum Communications
6. R1-2404111 Views on Rel-19 asymmetric DL sTRP/UL mTRP scenarios Samsung
7. R1-2404173 Discussion on asymmetric DL sTRP/UL mTRP scenarios vivo
8. R1-2404242 Discussion on enhancements for asymmetric DL sTRP/UL mTRP scenarios ZTE, China Telecom
9. R1-2404280 Enhancements for asymmetric DL sTRP/UL mTRP Apple
10. R1-2404339 Enhancement for asymmetric DL sTRP/UL mTRP scenarios Lenovo
11. R1-2404397 Views on asymmetric DL sTRP/UL mTRP scenarios CATT
12. R1-2404424 Discussion on enhancements for asymmetric DL sTRP/UL mTRP scenarios China Telecom, ZTE
13. R1-2404452 Discussion on enhancement for asymmetric DL sTRP/UL mTRP scenarios CMCC
14. R1-2404476 "Enhancement for Asymmetric DL sTRP/UL mTRP Scenarios " Panasonic
15. R1-2404496 Enhancement for asymmetric DL sTRP/UL mTRP scenarios Sony
16. R1-2404532 Enhancement for asymmetric DL sTRP UL mTRP scenarios Ericsson
17. R1-2404553 Discussions on asymmetric DL sTRP/UL mTRP scenarios LG Electronics
18. R1-2404568 Discussion on asymmetric DL sTRP/UL mTRP scenarios TCL
19. R1-2404590 Discussion on UL-only mTRP operation Fujitsu
20. R1-2404614 Discussion on enhancement for asymmetric DL sTRP/UL mTRP scenarios Xiaomi
21. R1-2404658 Discussion on enhancements for asymmetric DL sTRP and UL mTRP scenarios NEC
22. R1-2404771 Discussion on asymmetric DL sTRP and UL mTRP operation ETRI
23. R1-2404815 Discussion on enhancements for asymmetric DL sTRP/UL mTRP scenarios Transsion Holdings
24. R1-2404885 Enhancements on asymmetric DL sTRP/UL mTRP scenarios OPPO
25. R1-2404921 Enhancement for asymmetric DL sTRP/UL mTRP scenarios Nokia
26. R1-2404973 Enhancement for asymmetric DL sTRP/UL mTRP scenarios Sharp
27. R1-2405038 Discussion on enhancement for asymmetric DL sTRP/UL mTRP scenarios NTT DOCOMO, INC.
28. R1-2405151 Enhancement for asymmetric DL sTRP and UL mTRP deployment scenarios Qualcomm Incorporated
29. R1-2405188 Discussion on asymmetric DL sTRP and UL mTRP ASUSTeK
30. R1-2405272 Discussion on enhancement for asymmetric DL sTRP and UL mTRP scenarios Google