

3GPP TSG-RAN Meeting #98-e RP-223448

Electronic Meeting, December 12 – 16, 2022

Agenda item: 9.1.5, 10.1.4, 10.1.5

Source: Moderator (RAN4 Chair)

Title: Email discussion summary for [98e-08-R18-RAN4-SpectrumRelated]

Document for: Information

1 Introduction

In this email thread we will discuss the following topics:

- New WI proposal of MPR requirements for LTE intra-band non-contiguous CA with >35MHz CC gap
- New WI for 900MHz NR band
- New WI for 900MHz LTE band
- New WI for NR TDD band in 1670-1675 MHz
- New WI on Satellite L-/S-Band (except for PC2)
- New basket WI on LTE bands for UE category M1&M2 and/or NB1&NB2 in Rel-18
- New WI on NR CA band combinations with dual SUL bands in Rel-18
- New WI on low band enhancement for handheld UE
- New WI on HPUE with simultaneous 2Tx and 3Tx
- New basket WI proposals for 4Rx

2 Topic #1: WI on MPR requirements for LTE intra-band CA with a CC gap larger than 35 MHz

2.1 Companies' contributions summary

Table 1:

TDoc	Title	Source	Type	AI
RP-223277	Maximum Power Reduction Re-requirements for LTE Intra-band Carrier Aggregation with a Component Carrier gap larger than 35 MHz	Vodafone	WID new	10.1.5
RP-223287	Motivation for MPR requirements for LTE intraband CA with a CC gap larger than 35 MHz	Vodafone	discussion	10.1.4
RP-223365	New WID: MPR requirements for LTE intraband CA with >35 MHz CC gap	Vodafone	WID new	10.1.4

2.2 Initial Round

2.2.1 Comments & responses

The proposed WI was agreeable in RAN#97-e. But because of administration error, it was not formally approved. The WI proposal of RP-223365 is the resubmission with modifications.

Sub-topic 1-1: Any question or comment on the motivation and justifications of the proposal of RP-222824?

Companies are invited to provide the general comments, including comments on the motivation, justification part, whether the WI is needed, how to handle the work, in the follow table.

Observation 1: To support non-contiguous intra-band CA with a sub-band gap greater than 35 MHz, new MPR requirements need to be specified.

Proposal 1: Approve the new WI proposed in RP-223365 to establish MPR requirements for non-contiguous intra-band CA with a sub-band gap of greater than 35 MHz.

Feedback Form 1:

1 – Skyworks Solutions Inc.

In our view it should be feasible to reuse the work done in NR for intra-band non-contiguous ENDC and CA in band 41. One of the key aspect though is whether two PA with 2LO are assumed. even if non-

<p>contiguous ULCA with 1PA/1LO has been specified in R17, it is with the restriction that the gap BW is smaller or equal to the largest CC. It would be useful that the proponent clarifies the need and architecture</p>
<p>2 – Meta Ireland</p> <p>We are similar view with SKW. The RF architecture can be restricted with 2PA and 2LO when sub-band gap is larger than 35MHz.</p>
<p>3 – Nokia Japan</p> <p>We support the WI itself. We, however, agree with comments from companies that sharing following information is very helpful.</p> <ol style="list-style-type: none">1. CA configurations and bandwidth combination sets2. Frequency holdings information (This tells gap range in the end)3. Power class <p>Also, the completion date would not be realistic to set to RAN#99 which means RAN4 has only one meeting.</p>
<p>4 – MediaTek Inc.</p> <p>We are fine with the WI proposal. In addition to comments from other companies, if 90MHz gap is the maximum one, then it could also be reflected in the title (e.g., ... with a gap between 35MHz and 90MHz).</p>

Sub-topic 1-2: Comments and responses on the proposed objectives

The following objectives are proposed in the WID.

_____ Core part _____

The objective of this work item is to specify MPR requirements for intra-band non-contiguous CA with a sub-band gap larger than 35 MHz using CA_41A-41A with a 90 MHz gap as the example band.

_____ Core part _____

Companies are invited to provide comments and responses in the following table.

Feedback Form 2:

<p>1 – Qualcomm Korea</p> <p>It may be helpful to clarify the PC3 power class since this is general MPR. Also, would the MPR be applicable only for 90 MHz gap? Or for the range from 35 to 90 MHz?</p>
<p>2 – Skyworks Solutions Inc.</p> <p>similar question than Qualcomm but on top of that the architecture target (2PA/2LO or 1PA/1LO with restrictions on the gap should be clarified</p>
<p>3 – ZTE Corporation.</p> <p>we would also like to know why the gap is restricted to 90MHz instead of other gap bandwidth. In addition,</p>

<p>could operator help to clarify the practical spectrum allocation status for this band.</p>
<p>4 – Meta Ireland</p> <p>This WID is for LTE intra-band non-contiguous CA_41A-41A with 90MHz sub-band gap as example CA band combination. So we can need more input from interested operators to support the intra-band NC-CA with larger sub-band gap with 35MHz. Also we need to clarify the required power class and RF architecture as mentioned two companies.</p>
<p>5 – MediaTek Inc.</p> <p>As our comment on Subtopic 1-1, the title of the WI could reflect the intended range of the gap.</p>
<p>6 – Huawei Technologies France</p> <p>Huawei: As the proposed rapporteur of this WI, we propose the following evaluation conditions:</p> <ul style="list-style-type: none">- Dual PA architecture <p>*As dual PA is to be implemented then the frequency separation is not an issue and any value can be considered</p> <ul style="list-style-type: none">- PC3- up to 64QAM

Sub-topic 1-3: Comments and responses on impacted/new specifications and target completion date & time budget

Companies are invited to provide comments and responses in the following table.

Feedback Form 3:

<p>1 – Qualcomm Korea</p> <p>The TU proposal seems optimistic. Only 0.5 TU is requested for one meeting. It is expected that numerous simulations and measurements from multiple companies may be required, especially if the MPR is expected to be applicable for the range from 35 to 90 MHz gap.</p>
<p>2 – Skyworks Solutions Inc.</p> <p>0.5TU is optimistic especially depending on potential reuse of the NRCA work. the lowest effort would be for a solution using the 2PA and 2LO approach since it does not have restrictions on gap size</p>
<p>3 – Meta Ireland</p> <p>If RAN4 only focus on the 2PA/2LO RF architecture, then RAN4 just verify the NR intra-band NC-CA requirements for n41 are sufficient or not. If there is no restriction with the RF architecture and power class, then RAN4 need more TU and simulations results.</p>
<p>4 – Nokia Japan</p> <p>As we commented in the 1st inquiry, the completion date of RAN#99 wouldn't be realistic.</p>

5 – MediaTek Inc.

Similar comment on the completion date as Nokia.

2.2.2 Summary

Based on the comments received, there seems no objection to the WI. The companies comments are summarized as follows:

- Clarify UE architecture, i.e., whether 2 PA with 2 LO are assumed or 1PA/1LO is also considered.
- Provide the detailed information about the target band combination
 - CA configurations and bandwidth combination sets
 - Frequency holdings information, including the gap range
 - Power class
 - MCS
- Further discuss the target completion date and TU. Companies thought it is unrealistic to just have one meeting.

2.3 Intermediate Round

2.3.1 Comments & responses

In the intermediate round, the moderator proposes to develop and stabilize the objectives of WI since no objection was received for this work.

Sub-topic #1-2: Comments and responses on the proposed objectives

Based on the comments, the moderator proposes the following modifications on the existing scope and more inputs on the CA configuration and bandwidth combination set, gap range and power class are needed.

————— Core part —————

The objective of this work item is to

- Specify MPR requirements for intra-band non-contiguous CA with a sub-band gap larger than 35 MHz
 - Use CA_41A-41A with a 90 MHz gap as the example band
 - Assume the 2 PA UE architecture with 2 LO
 - Assume power class 3
 - Assume MCS up to 64QAM

- The requirements apply the following CA configurations and bandwidth combinations
 - Intra-band non-contiguous CA with two sub-blocks
 - Gap between two sub-blocks is within the range [larger than 35MHz and smaller than or equal to 90MHz]

———— Core part —————

Companies are invited to provide the comments below.

Feedback Form 4:

1 – Nokia Japan

The direction of the proposal by moderator looks good. We, however, would like to see feedback from the operator about Power Class, MCS and BCS info before closing the discussion. Specifically, regarding MCS, we wonder why do we need to dare to limit MCS up to 64QAM only for this CA configuration?

2 – Meta Ireland

Most proposal from Moderator are good to us. For MCS order, the 256QAM is already supported in LTE system. So we can consider up to 256QAM.

3 – Qualcomm Korea

We would like to understand how the assumption of 2PA/2LO will be implemented into the specification. Will the UE with 1PA/1LO be allowed to take as much power backoff as necessary to meet emissions? Will the UE with 1PA/1LO not be configured for NC CA > 35 MHz? How would the network know, will new signaling be introduced?

4 – Qualcomm Korea

We would like to understand how the assumption of 2PA/2LO will be implemented into the specification. Will the UE with 1PA/1LO be allowed to take as much power backoff as necessary to meet emissions? Will the UE with 1PA/1LO not be configured for NC CA > 35 MHz? How would the network know, will new signaling be introduced?

5 – Apple (UK) Limited

Is the intention that for $W_{gap} \leq 35\text{MHz}$, the existing MPR requirements would apply, and for $90\text{MHz} \geq W_{gap} > 35\text{MHz}$, the new MPR requirements are applied, and there will be no signaling to differentiate PA/LO architectures? It is UE's own implementation choice to meet both MPR requirements if it intends to support UL CA_41A-41A. And there would be no signaling to indicate UE's W_{gap} capability.

6 – ZTE Corporation.

Similar comments as 1st round, the justification for W_{gap} between 35MHz and 90MHz are needed from the operators;

The reason to limit UL MCS to 64QAM should be further clarified;

whether other RF architecture e.g. 1PA/1 LO is allowed and how the network could be aware of such kind of implementation if MPR requirement are quite different than 2PA/2LO, this might need some RAN2 involvement by LS if necessary.

7 – Nokia Japan

Not sure why do we need to tell NW the number of PAs/LOs in case we develop only MPR based on that assumption. There is nothing NW can do based on such a report. In NR, infinite MPR was allowed in case *dualPA-Architecture* was reported. Hence, it depends on if we have two MPR or not... Of course, it is always good to limit the scope, but considering the available time in this RAN, we don't need to determine it now. It's very unfortunate to delay the approval due to that argument.

8 – Nokia Japan

Not sure why do we need to tell NW the number of PAs/LOs in case we develop only MPR based on that assumption. There is nothing NW can do based on such a report. In NR, infinite MPR was allowed in case *dualPA-Architecture* was reported. Hence, it depends on if we have two MPR or not... Of course, it is always good to limit the scope, but considering the available time in this RAN, we don't need to determine it now. It's very unfortunate to delay the approval due to that argument.

9 – VODAFONE Group Plc

We are ok with the moderator proposal. We are also ok with considering MCS up to 256QAM.

10 – VODAFONE Group Plc

We are ok with the moderator proposal. We are also ok with considering MCS up to 256QAM.

11 – MediaTek Inc.

In general, we are fine with Moderator's proposal, except the similar concerns on 256QAM and clarification on the necessity of new cap. signaling in terms of number of PAs/LOs.

12 – HuaWei Technologies Co.

Moderator (RAN4 Chair):

- 1) Could Vodafone respond the Nokia questions about Power Class, MCS and BCS.
- 2) Regarding the signaling, can we go with Nokia suggestion to leave the discussion to working groups? That could be done by sending LS to RAN2 or as Rel-18 feature list as usual business. it may depend on whether RAN4 will finally have two separate MPR requirements for <35MHz gap and wider gap. I think that no expert is so keen on allowing 1PA/1LO.
- 3) We can change MCS to up to 256QAM.
- 4) Regarding ZTE comment on the justification of wider gap, the motivation paper RP-223287 provides some information. In the moderator's view, that corresponds to operator's deployment in different regions. I would like to encourage offline discussions between you and operators. If possible, the response from operator in this email thread is welcome.

The further modification of objectives are as follows.

The objective of this work item is to

Specify MPR requirements for intra-band non-contiguous CA with a sub-band gap larger than 35 MHz

Use CA_41A-41A with a 90 MHz gap as the example band

Assume the 2 PA UE architecture with 2 LO

<p>Assume Power class 3</p> <p>Assume MCS up to 256QAM</p> <p>The requirements apply the following CA configurations and bandwidth combinations</p> <p>Intra-band non-contiguous CA with two sub-blocks</p> <p>Gap between two sub-blocks is within the range larger than 35MHz and smaller than or equal to 90MHz</p> <p>Specify the capability signalling, if needed.</p> <p>Please provide your comment if any. I also encourage the proponent companies to prepare the revised WID for final round discussions.</p>
<p>13 – Skyworks Solutions Inc.</p> <p>In our view if the MPR is developed under the assumption of 2PA/2LO we do not need any signaling nor need to consider restrictions on gap sizes. if a 1PA/1LO implementation can meet that MPR it can declare support for the ULCA combination. however as we have shown for the NR study it would require extremely good image and carrier rejections to be able to meet the in gap emission requirements. I guess the only open point is whether the NW needs to know about the DC positions but I assume that in LTE this is not needed.</p>
<p>14 – VODAFONE Group Plc</p> <p>We support the modified objective by the moderator to use CA_41A-41A with a 90 MHz gap as the example band</p> <p>Assume the 2 PA UE architecture with 2 LO</p> <p>Assume Power class 3</p> <p>Assume MCS up to 256QAM...</p>

Sub-topic 1-3: Comments and responses on impacted/new specifications and target completion date & time budget

Considering to meet the operator’s request and give the sufficient time for discussions, the moderator would like to propose the following TU budget for the following two quarters. The recommended TU allocation follows the same principle for the endorsed RAN4 Rel-18 package TU budget in RP-220068.

Table 2:

RAN	R4RF	R4RD	RAN	R4RF	R4RD	R4RF	R4RD	RAN
98 Dec.22	106	106	99 Mar.23	106bis	106bis	107	107	100 Jun.23
	0.25			0.25		0.25		

Companies are invited to make comments in the table below.

Feedback Form 5:

2.3.2 Summary

Most part of the proposed objectives seem acceptable. Based on the comments, the MCS assumption is changed to upto 256QAM. Companies had different views on the signaling. In the moderator understanding, it may not be clear why and what signaling related to assumption of PA/LO numbers will be defined at the current stage. The moderator does not think the signaling is the stopper to approve the WI. One solution is to add a bullet of "identify and specify the capability signaling if needed". If it was not agreeable, it can be removed and RAN4 could also discuss the potential capability signaling when RAN4 discusses Rel-18 feature list as usual business.

The proposed TU budget in sub-topic #1-3 is agreeable because no comment was received.

2.4 Final Round

2.4.1 Comments & responses

Sub-topic #1-2: Comments and responses on the proposed objectives

Based on the comments, the moderator proposes the following modifications on the existing scope and more inputs on The following objectives are proposed for the review and further modification in the final round. If OK, please proponent prepare the revised WID based on them and circulate the revised version for review.

————— Core part —————

The objective of this work item is to

- Specify MPR requirements for intra-band non-contiguous CA with a sub-band gap larger than 35 MHz
 - Use CA_41A-41A with a 90 MHz gap as the example band
 - Assume the 2 PA UE architecture with 2 LO
 - Assume Power class 3
 - Assume MCS up to 256QAM
 - The requirements apply the following CA configurations and bandwidth combinations
 - Intra-band non-contiguous CA with two sub-blocks
 - Gap between two sub-blocks is within the range larger than 35MHz and smaller than or equal to 90MHz
- Identify and specify the capability signalling, if needed.

————— Core part —————

Companies are invited to provide the comments below.

Feedback Form 6:

1 – Nokia Japan

We support the proposal by a moderator. At this stage, this would be almost maximum that we can do considering that we have only one day for the discussion.

Even though MPR itself would be agnostic to channel bandwidth combination sets, it would be better to clarify if they use existing 0, 1, both or something new. It’s noted that we don’t have intention to block the approval of the WID for that reason.

Please provide the additional comments on the revised WID circulated by the proponents in the table below.

https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/%5B98e-08-R18-RAN4-SpectrumRelated%5D/Rev-RP-223365_New%20WID%20on%20Maximum%20Power%20Reduction%20Requirements%20for%20LTE%20....zip

Feedback Form 7:

3 Topic #2: WI on 900MHz bands

3.1 Companies’ contributions summary

Table 3:

TDoc	Title	Source	Type	AI
RP-222735	New WID for 900MHz NR Band	Anterix	WID new	9.1.5
RP-222734	New WID for 900MHz LTE Band	Anterix	WID new	10.1.5

3.2 Sub-topic #2-1 900MHz NR bands

3.2.1 Initial Round

3.2.1.1 Comments & responses

Sub-topic 2-1-1: Any question or comment on the motivation and justifications of the proposal of RP-222735?

Companies are invited to provide the general comments, including comments on the motivation, justification part, whether the WI is needed, how to handle the work, in the follow table.

Feedback Form 8:

<p>1 – TELECOM ITALIA S.p.A.</p> <p>A question for clarification. Since FCC decisions sometime affect other countries in Region 3, is this band available/planned also in other countries?</p>
<p>2 – Anterix</p> <p>This is only intended for Region 2 and specifically the US market. We do know that based on a positive outcome of this WID that Industry Canada may consider this as part of their 900 MHz allocation for private networks.</p>
<p>3 – Skyworks Solutions Inc.</p> <p>It would be important to clarify if the assumption is that band 8 duplexer can be reused. Is there any requirement (emission mask) that would preclude this?</p>
<p>4 – HUGHES Network Systems Ltd</p> <p>Support these proposals</p>
<p>5 – ZTE Corporation.</p> <p>Similar question as Skyworks, whether the existing duplex for band n8 could be reused for this new band could be further clarified.</p>
<p>6 – Apple (UK) Limited</p> <p>What is the intended UE device type for this frequency band, especially for device supporting PC1?</p>
<p>7 – MediaTek Inc.</p> <p>We would like to understand the request for PC1, since it seems to us that neither motivation nor justification supports this request.</p>
<p>8 – Nokia France</p> <p>The timescale and target completion dates would of course need to be corrected.</p>

Sub-topic 2-1-2: Comments and responses on the proposed objectives

The following objectives are proposed in the WID.

————— Core part —————

The purpose of this work item is to do the following:

- Specify a new 5G NR FDD operating band operating UL: 896 – 901 MHz and DL 935 – 940 MHz that compliments the proposed LTE WID RP-222734 900_Mhz_LTE_US
- To support 5 MHz, 3 MHz channel bandwidths with 15 kHz SCS. NOTE: 3 MHz channel support is dependent on the existing RAN WI RP-222645 NR_FR1_lessthan_5MHz_BW.

- To specify band numbering and core requirements to operate in North America with primary operations in the US.
- Support FCC emission mask of $43+10\log(P)$ for UL and $50+10\log(P)$ for DL. This is to ensure co-existence with adjacent narrowband and broadband networks to avoid interference.
- To specify UE RF requirements for power class 3 (23 dBm) and power class 1 (31 dBm).

Core part

Companies are invited to provide comments and responses in the following table.

Feedback Form 9:

<p>1 – Qualcomm Korea</p> <p>It may be helpful to indicate that PC1 is not intended for smartphone form factor. Is coexistence study required for PC1 to protect adjacent narrowband and broadband networks?</p>
<p>2 – Qualcomm Korea</p> <p>The WID in RP-222735 lists a Performance part, but there are no objectives for the performance part.</p>
<p>3 – T-Mobile USA Inc.</p> <p>It seems unusual to include a power class other than PC3 for a new band Work Item. And, since we currently only have PC1 for public safety band n14, it would probably be best to work the Power Class 1 aspect in the LTE_NR_HPUE_FWVM_REL18 Work Item.</p>
<p>4 – Skyworks Solutions Inc.</p> <p>In our view PC1 would only be applicable to FWA, vehicles or special equipments other than smartphone (and it seems in line with the target application that smartphone are not foreseen for PC1)</p>
<p>5 – AT&T GNS Belgium SPRL</p> <p>We also agree with T-Mobile USA that the Work Item should include PC3 only. Any future HPUE work for the new band should be started after PC3 completion as for all spectrum HPUE work.</p>
<p>6 – Anterix</p> <p>Response to AT&T/Skyworks/T-Mobile: Understood on PC1, this was meant as informational. Will remove and take suggestion to move to LTE_NR_HPUE_FWVM_REL18 Work Item.</p>
<p>7 – Verizon UK Ltd</p> <p>We also agree the T-Mobile USA comments above!</p> <p>In addition, further clarification of the emission mask is needed. Based on the order of FCC-20-67A1, the emission mask should be as below, instead of one specified in current WID.</p> <p>(a) For 900 MHz broadband operations in 897.5-900.5 MHz band by at least $43 + 10 \log (P)$ dB.</p> <p>(b) For 900 MHz broadband operations in the 936.5-939.5 MHz band, by at least $50 + 10 \log (P)$ dB.</p>

8 – HUGHES Network Systems Ltd

Support this proposal for 5 MHz, 3 MHz channel bandwidth (dependent on RAN WI RP-222645). Agreed with T-Mobil to separate PC1

9 – Anterix

For the performance part the following can be added, "Conformance requirements for BS."

10 – ZTE Corporation.

- 1) Regarding the FCC limitation as captured in the objective, we prefer to keep the FCC tdoc as reference instead of copy&paste the FCC requirement directly into the objective. In general, how to define the RF requirement based on the existing regional requirement is part of WID discussions.
- 2) For 3MHz to be supported NR_FR1_lessthan_5MHz_BW, UE types might be different between two WIDs from our understanding. 3MHz proposed for this WID should be for smartphone, however 3MHz in NR_FR1_lessthan_5MHz_BW is targeted for device for vertical industry.
- 3) for PC1 in this new 900MHz band, we are also fine with T-Mobile' s suggestion to handle it in other WID LTE_NR_HPUE_FWVM_REL18.
- 4) for the core part , BS RF requirement is missing. For perf part, the BS conformance testing is missing.
- 5) for the impacted spec, Coexistence requirement with repeater and IAB should be considered as well. Please refer to APT600MHz WID RP-223265.
- 6) the target completion date cannot be RAN96 meeting.

11 – Meta Ireland

PC1 will be remove in this WID or after define new band, the PC1 FWA device can be supported in the operating band. So it can move to WID_LTE_NR_HPUE_FWVM_REL18 after complete this new WID.

12 – CHTTL

It seems like in the FCC Report and Order (FCC-20-67A1), it is stated that "A 900 MHz broadband licensee relying on the safe harbor must base its LTE network on the 3GPP standard release 8 or a later release."

Would like to clarify that does it mean that it is intended to use LTE only on this 900MHz license?

13 – MediaTek Inc.

We are fine with either removal of PC1 or clarification that PC1 is not for smart phones. And for the 3MHz CBW request, it can be removed now from the WID since it is dependent on the less-than-5MHz WI, and once the new band definition is completed, it can be added into the example band list of the less-than-5MHz WI.

14 – Intel Corporation (UK) Ltd

- 1) We share questions from Apple and MediaTek on the target use case and form factor for PC1
- 2) The WID proposes to define 3MHz CBW and includes a note "3 MHz channel support is dependent on the existing RAN WI RP-222645 NR_FR1_lessthan_5MHz_BW". Since RAN4 has not started the work on this topic, we think it would be more straightforward to add 3MHz CBW once sufficient RAN4 progress on Rel-18 for this work item is achieved.

15 – Dish Network

While it may be implied in the objectives, we would prefer the WID includes the following in the scope as - 50dBm/MHz protection level against n5/n26 is not possible without appropriate power reduction measures:

- Address potential BS and UE co-existence issues and specify the required RF requirements for the new band, including A-MPR.

This can be e.g. a sub-bullet to the third bullet.

Sub-topic 2-1-3: Comments and responses on impacted/new specifications and target completion date & time budget

Companies are invited to provide comments and responses in the following table.

Feedback Form 10:

1 – Qualcomm Korea

Target completion dates for Internal TR is RAN #99, but this doesn't align to the TU spreadsheet. The target completion for the existing TS are RAN#96 which is two meetings ago in the past!

2 – Anterix

Thanks for catching this - cut and paste error. Will updated and re-upload with proper TU request and RAN dates.

3 – ZTE Corporation.

Similar comments Qualcomm, for the rest of comments for impacted spec, please see my previous comments for it.

4 – Nokia France

Agree with the above comments.

3.2.1.2 Summary

The following issues or questions were raised during the first round discussions:

- Clarify whether FCC-20-67A1 mean that it intended to use LTE only on this 900MHz licensed spectrum.
- Reusing band 8 Duplexer: Whether band 8 duplexer can be reused, i.e., whether band 8 duplexer can be used as the assumption for this WI
- UE type and power class:
 - Whether the proposed WI should include power class 3 only, and work on power class 1 under WI LTE_NR_HPUE_FWVM_R18 after WI for new 900MHz band with power class 3 is completed?
 - Whether the smartphone should be precluded for power class 1.
- Co-existence study: need to check the emission mask in FCC-20-67A1 and refer to or capture the correct regulation. Add the bullet to clarify the requirements including A-MPR would be needed for co-existence.

- 3MHz channel bandwidth: whether the 3MHz defined in NR_FR1_lessthan_5MHz_BW can apply for 900MHz new band since it is targeted for vertical industry device. Intel comment that 3MHz work can start once sufficient RAN4 progress on Rel-18 for this work item is achieved.
- BS core part and conformance testing: whether BS RF requirement and conformance testing requirements need be added.

3.2.2 Intermediate Round

3.2.2.1 Comments & responses

Sub-topic 2-1-1: Any question or comment on the motivation and justifications of the proposal of RP-222735?

There seems no objection to start this spectrum work. Only one question needs be addressed.

- Clarify whether FCC-20-67A1 mean that it intended to use LTE only on this 900MHz licensed spectrum.

Companies are invited to make comment in the table below.

Feedback Form 11:

<p>1 – Anterix</p> <p>In reponse to CHTTL – Current network deployed are initially using LTE. When the NR_FR1_lessthan_5MHz_BW is available in Rel. 18, then systems will eventually migrate to NR. Thus the spectrum can use LTE or NR or future 3GPP technology including NB-IoT.</p>
<p>2 – CHTTL</p> <p>To Anterix, since in FCC-20-67A1 it is stated that "A 900 MHz broadband licensee relying on the safe harbor must base its LTE network on the 3GPP standard release 8 or a later release." that's why we have the clarification question. Probably it is also waiting for the availability of NR_FR1_lessthan_5MHz_BW? Anyway we dont have issue to start this work, thanks for the reply.</p>
<p>3 – Union Inter. Chemins de Fer</p> <p>Support this proposal for 5 MHz and 3 MHz channel bandwidth with the latter being dependent on RAN WI RP-222645.</p>

Sub-topic 2-1-2: Comments and responses on the proposed objectives

In the intermediate round, the moderator suggests focusing on developing the objectives for the WI.

The following modified objectives are proposed for discussions in the intermediate round. In the impacted specification of the WID, TS 38.133 (RRM specification) is included. Regarding RRM part, in the moderator view, the new band number should be added for table of band group in Section 3.5.2 of 38.133, which will be used to RRM measurement accuracy and test cases and should belong to performance part. Thus the

moderator add the RRM objective to performance part, i.e., Introduce the corresponding RRM requirements, i.e., add the new band for frequency bands grouping.

Core part

The objectives of core part of this work item include:

- Specify a new 5G NR FDD operating band operating with
 - UL: 896 – 901 MHz and DL 935 – 940 MHz
 - To support 5 MHz, 3 MHz channel bandwidths with 15 kHz SCS.
 - NOTE: 3 MHz channel support is dependent on the existing WI of NR_FR1_lessthan_5MHz_BW. The work starts once sufficient RAN4 progress on Rel-18 for this work item is achieved.
- Specify core requirements of co-existence to operate in North America with primary operations in the US.
 - Address potential BS and UE co-existence issues and specify the required RF requirements for the new band, including A-MPR.
 - Support FCC emission mask in FCC-20-67A1 to ensure co-existence with adjacent narrowband and broadband networks to avoid interference.
- Specify UE RF core requirements
 - Assume power class 3 (23 dBm)
 - Study and if feasible, reuse band 8 Duplexer
- Specify necessary BS RF core requirements

Core part

Perf part

The objectives of Perf. part of this work item include:

- Conformance requirements for BS
- Introduce the corresponding RRM requirements, i.e., add the new band for frequency bands grouping.

Perf part

Companies are invited to provide comments and responses in the following table.

Feedback Form 12:

1 – Anterix

We agree with most of the moderator comments and will provide some more information from the previous round.

Anterix Responses To:

- Skyworks & ZTE – Several deployments of Ue and eNodeB using Band 8 duplexors have been completed and are operational. These systems all required independent lab testing to meet FCC specifications and all passed FCC Class2 Permissive Change certification. The assumption is that the existing Band 8 duplexors can be utilized in both Ue and eNodeB.
- Apple & MediaTek – We agree with the suggestion from T-Mobile to move the PC1 request to the LTE_NR_HPUE_FWVM_REL18 Work Item. The private networks deployed are intended for use primarily by power utility companies. The types of devices used will be similar to other critical communications with use of smartphone with VoLTE/VoNR and fixed wireless devices like wireless routers for transformer/DER connectivity. The PC1 form factor is understood to be for fixed wireless devices.
- Nokia – The TU budget was incorrectly cut and pasted. A new TU budget has been uploaded to the Drafts folder.
- Qualcomm, ZTE – we agree that for the performance part, the BS conformance testing should be added and for the core part BS RF requirements could be added and the moderator RRM requirements.
- Verizon – We believe that extending the more stringent OOB requirements to the 5 MHz channel will provide the necessary protection to adjacent bands (e.g. the 800 MHz ESMR specs and emission mask are also $50+10\log(P)$, same as what is proposed). There are no current FCC rules for a 5 MHz emission mask for 900 MHz but utilizing this mask provides margin for adjacent bands.
- ZTE –
 - o We are OK with putting FCC as reference.
 - o Regarding the UE types for this WID and for the NR_FR1_lessthan_5MHz_BW, these are for the same network and it is the same private network that uses multiple Ue form factors with Ue and FWA in LTE and NR. The NR band and the 3 MHz NR WI are for growth from LTE into NR. Details in R4-2220503
 - o As a FDD deployment the use of IAB has not been considered and we don't believe that a coexistence requirement is necessary. We do not think this should be added to the table.
- MediaTek, Intel – We disagree in removing the 3 MHz CBW request but we do agree with the Intel proposal to “add 3MHz CBW once sufficient RAN4 progress on Rel-18 for this work item is achieved.” What the moderator has proposed is fine.
- Dish – We disagree with the addition of power reduction measures. The proposed new bands for LTE and NR are specifically:
 - o WID Band XXX UL: 896 – 901 MHz and DL 935 – 940 MHz
 - o B5 is UL: 824 – 849 MHz and DL 869 – 894 MHz

- o B26 is UL: 814 – 849 MHz and DL 859 – 894 MHz
- o We do not see any overlap of the proposed band and B5 or B26 and thus no reason for the inclusion of A-MPR or other suggested RF requirements.

2 – HuaWei Technologies Co.

Moderator (RAN4 Chair): the rapporteur provides the revised WID at https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_08-R18-RAN4-SpectrumRelated%5D/Rev2-RP-222735.zip. Please also review the revised WID.

3 – Apple (UK) Limited

The concern raised by Dish for UE coexistence with B5/n5 and B26/n26 needs to be considered despite the UL carrier does not overlap with B5/B26 DL. Since B8/n8 duplexer is intended to be used for this band, there would be no isolation from the UL in this new band to B5/B26 DL. As a result, it would not be feasible to meet the general -50 dBm/MHz UE coexistence requirement. The coexistence requirement to B5/B26 needs to be relaxed like the protection to adjacent band or substantial A-MPR can be expected.

4 – ZTE Corporation.

To Anterix, for NR 3MHz channel bandwidth to be specified in Rel-18, we have the discussion in the previous RAN1 package approval. Based on the discussion before, it seems that performance degradation due to SSB PRB puncturing is not big issue since coverage is not big concern, we would like to know whether this assumption is still applicable here? UE type is still handheld smartphone instead of vertical industry customized devices, right? We would like to know the exact device types for it instead of against this proposal.

To IAB spec impact, we are talking about the coexistence requirement between new NR/LTE bands and IAB operating in TDD bands instead of supporting IAB in this new NR band, indeed for APT_600MHz, it's the same story over there. Hopefully we have clarified the intention here.

5 – MediaTek Inc.

For 3MHz channel bandwidth, it is still a bit vague on what is "sufficient progress". One possible wording: 3MHz CBW will be added once it is specified in Rel-18 NR_FR1_lessthan_5MHz_BW.

6 – Anterix

To ZTE: Coverage in this band for LTE and NR is very important as large geographic areas and deep in-building (for IoT) are important. For NR the proposed puncturing will have loss at cell edge but we are hoping the study will show power boosting may give us similar performance to NR. Although these are private networks they will utilize a variety of different devices. Many of these will be FWA/wireless routers but there are several use cases with smartphones. The intent is to leverage the existing UE and router design types as the primary devices and in some instances customized devices may be utilized.

For the US market, we are not aware of any sub 1GHz TDD or APT 600 deployment plans that would necessitate IAB studies.

7 – Skyworks Solutions Inc.

We believe that if band 8 duplexer is used, there will be issues meeting the -50dBm/MHz protection level in band 5/26 as there will be no help from the filter. Even with a dedicated filter, the small 2MHz gap between the new band UL and n5/26DL will not allow much help either. The objectives should add band 5/26 DL protection to be studied. For the coex and FCC mask studies it would be good to add that the starting assumption is the reuse of a band 8 duplexer.

8 – HuaWei Technologies Co.

Moderator (RAN4 Chair): there are multiple aspects:

- 1) Protection of B5/B26: the new band UL may impact DL of B5/B26 since B8 duplexer is expected to be reused. As a compromise we may add the bullet under "reusing B8 duplexer" to allow study and specify the protection including MPR, if needed.
- 2) 3MHz: it depends on RAN1 Rel-18 WI. It would be good to wait for RAN1 conclusions. Can we go with Mediatek proposed wording?
- 3) IAB spec: My understanding is that the potential change to introduce new band into IAB spec is not complicated. Following ZTE comment, it would be better to keep IAB spec complete such that all the NR bands are captured there. But I also understand the proponents' view. They may have sufficient reason not to touch IAB since IAB will not be considered for deployment. I would like to suggest skipping IAB spec for this WI. In the future, we can figure out the other way to make IAB spec complete in terms of capturing all the NR bands, e.g., having some TEI CR to introduce all the missing bands.

9 – Anterix

To Apple/Dish/Skyworks: We understand the concern with the duplexer and filtering in assuming the reuse of a Band 8 duplexer. Our concern is in NR primarily as there may be 16 RBs considered and significant puncturing - which equates to a loss in cell edge performance. The blanket use of A-MPR could cause major performance issues but if you can also relax the coexistence OOB in other bands too, then this is reasonable.

10 – Anterix

We are ok with moderator comments 1,2 & 3

11 – HuaWei Technologies Co.

Moderator (RAN4 Chair): based on the comments and update from proponents, please find the proposed objectives below.

_____ Core part _____

The objectives of core part of this work item include:

- Specify a new 5G NR FDD operating band operating with
 - o UL: 896 – 901 MHz and DL 935 – 940 MHz
 - o To support 5 MHz, 3 MHz channel bandwidths with 15 kHz SCS.
- NOTE: 3MHz CBW will be added once it is specified in Rel-18 NR_FR1_less_than_5MHz_BW.

- Support FCC OOB emission mask in FCC-20-67A1 for all the defined channel bandwidths in the proposed band to ensure co-existence with adjacent narrowband and broadband networks to avoid interference.
- Specify UE RF core requirements to operate in North America with primary operations in the US.
 - o Assume power class 3 (23 dBm)
 - o Study and if feasible, reuse band 8 Duplexer
 - Study and if needed, specify the protection for B5 and B26 including MPR.
- Specify necessary BS RF core requirements
- Specify the corresponding RRM requirements, i.e., add the new band for frequency bands grouping.

_____ Core part _____

_____ Perf part _____

The objectives of Perf. part of this work item include:

- Conformance requirements for BS

_____ Perf part _____

Please note that I checked with RRM experts again. RRM objective should belong to Core part. Sorry for mistake. To proponent, I notice that your revision is not aligned with the moderator proposal. Appreciate if you could follow the proposal here for further modification in case there will be misalignment between the final revised WID for approval and the proposals for review in this nwm.

To address the power class 1 issue, the moderator proposes the following proposal:

Proposal for Sub-topic #2-1:

- Consider adding power class 1 for new 900MHz NR band under WI LTE_NR_HPUE_FWVM_R18 after WI for new 900MHz NR band with power class 3 is completed.

Companies are invited to provide comments and responses in the following table.

Feedback Form 13:

<p>1 – Anterix</p> <p>Yes, we agree with this proposal for PC1 under WI LTE_NR_HPUE_FWVM_R18 once PC3 is completed.</p>
<p>2 – Union Inter. Chemins de Fer</p> <p>Agree, this makes it the same approach as for bands n100 and n101 initially under WINR_RAIL_HPUE_n100_n101</p>

Sub-topic 2-1-3: Comments and responses on impacted/new specifications and target completion date & time budget

Issue #2-1-3-1: According the submitted WID, the target completion date is Dec. 2023 (RAN#102) for both core and performance parts. Can it be agreed?

Issue #2-1-3-2: From the moderator perspective, no internal TR is needed. Please confirm it.

Issue #2-1-3-3: Based on ZTE comment, the following specifications should be listed as the impacted spec. Can the list be agreed?

Table 4:

Impacted existing TS/TR <i>{One line per specification. Create/delete lines as needed}</i>			
TS/TR No.	Description of change	Target completion plenary#	Remarks
38.101-1	NR; UE Radio transmission and reception	RAN#102	Core part
38.133	NR; Requirements for support of radio resource management	RAN#102	Core <u>Perf.</u> part
38.104	NR; BS Radio transmission and reception	RAN#102	Core part
38.141-1	NR; Base Station (BS) conformance testing Part 1: Conducted conformance testing	RAN#102	Perf. Part
38.141-2	NR; Base Station (BS) conformance testing Part 2: Radiated conformance testing	RAN#102	Perf. Part
36.104	E-UTRA; BS Radio transmission and reception	RAN#102	Core part
36.141	E-UTRA; BS conformance testing	RAN#102	Perf. Part

37.104	E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) radio transmission and reception	RAN#102	Core part
37.141	E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) conformance testing	RAN#102	Perf. Part
37.105	Active Antenna System (AAS) Base Station (BS) transmission and reception	RAN#102	Core part
37.145-1	Active Antenna System (AAS) Base Station (BS) conformance testing; Part 1: conducted conformance testing	RAN#102	Perf. Part
37.145-2	Active Antenna System (AAS) Base Station (BS) conformance testing; Part 2: radiated conformance testing	RAN#102	Perf. Part
38.174	NR; Integrated access and backhaul radio transmission and reception	RAN#102	Core part
38.176-1	NR; Integrated Access and Backhaul (IAB) conformance testing; Part 1: Conducted conformance testing	RAN#102	Perf. Part
38.176-2	NR; Integrated Access and Backhaul (IAB) conformance testing; Part 2: Radiated conformance testing	RAN#102	Perf. Part
38.106	NR repeater radio transmission and reception	RAN#102	Core part

38.115-1	NR; Repeater conformance testing - Part 1: Conducted conformance testing	RAN#102	Perf. Part
38.115-2	NR; Repeater conformance testing - Part 2: Radiated conformance testing	RAN#102	Perf. Part

Companies are invited to provide comments and responses for issue #2-1-3-1~#2-1-3-3 in the following table.

Feedback Form 14:

<p>1 – Anterix</p> <p>As a smaller FDD band we do now see a use case for our spectrum that utilizes IAB and do not think it should be added in. For other FDD bands that were just approved (e.g. n100 and n101) no such specifications were added to the WID table, this should be a similar type of work item.</p>
<p>2 – ZTE Corporation.</p> <p>Please see the previous comments, we think that it’s the same story as APT_600MHz band n105.</p>
<p>3 – HuaWei Technologies Co.</p> <p>Moderator (RAN4 Chair): to ZTE and all, can we skip IAB spec in this WID to avoid the mis-interpretation? Understood that keeping IAB spec does not mean supporting IAB in this new NR band. But in RAN4 we can consider the other way to keep LTE-NR coexistence complete in IAB spec. Or ZTE experts can reach out to the proponents to elaborate on the reason and address the concern.</p>

3.2.2.2 Summary

Most part of the proposed objectives seem acceptable. The remaining open issues include

- Protection of B5/B26
- 3MHz
- Whether IAB specification should be kept.

The moderator proposes some recommendations in the feedback form. Companies can further check them. And please note the moderator moves RRM from performance part to core part after further checking with RRM experts. It should belong to Core part.

Regarding the target completion date, the proposed Dec. 2023 (RAN#102) for both core and performance parts is agreeable. No internal TR is expected. For the impacted existing specifications, the moderator proposes to remove IAB specifications, i.e., TS38.174, 38.176-1/2 as a compromise.

And the additional **Proposal for Sub-topic #2-1** is agreeable.

Proposal for Sub-topic #2-1:

- Consider adding power class 1 for new 900MHz NR band under WI LTE_NR_HPUE_FWVM_R18 after WI for new 900MHz NR band with power class 3 is completed.

3.2.3 Final Round

Sub-topic 2-1-2: Comments and responses on the proposed objectives

The following objectives are proposed for the review and further modification in the final round. If OK, please proponent prepare the revised WID based on them and circulate the revised version for review.

————— Core part —————

The objectives of core part of this work item include:

————— Core part —————

- Specify a new 5G NR FDD operating band operating with
 - UL: 896 – 901 MHz and DL 935 – 940 MHz
 - To support 5 MHz, 3 MHz channel bandwidths with 15 kHz SCS.
 - NOTE: 3MHz CBW will be added once it is specified in Rel-18 NR_FR1_less than_5MHz_BW.
- Study and specify the co-existence requirements
 - Support FCC OOB emission mask in FCC-20-67A1 for all the defined channel bandwidths in the proposed band to ensure co-existence with adjacent narrowband and broadband networks to avoid interference.
 - Study and if needed, specify the protection for B5 and B26 including MPR.
 - Assume reusing band B8 duplexer
- Specify UE RF core requirements to operate in North America with primary operations in the US.
 - Assume power class 3 (23 dBm)
- Specify necessary BS RF core requirements
- Specify the corresponding RRM requirements, i.e., add the new band for frequency bands grouping.

————— Perf part —————

The objectives of Perf. part of this work item include:

- Conformance requirements for BS

————— Perf part —————

Companies are invited to make comments in the table below.

Feedback Form 15:

1 – Qualcomm Korea

Regarding the objective to study and if feasible reuse the Band 8 duplexer and the sub-bullet study if needed protection for B5 and B26, we would like to understand how to evaluate feasibility and necessity. This seems very open-ended.

2 – Anterix

We understand that the full BW B8 duplexers have some overlap of B8 UL with B26 DL and with B8 UL in B5 DL and support having protections for all networks but feel that clear definition on what is required to be evaluated for the protection and for the duplexer reuse.

- Perhaps changing the language to the following “Address potential BS and UE co-existence issues and specify the required RF requirements for the new band including relaxing the Ue UL SEM for adjacent channels or A-MPR.”
- NOTE: To date there are 13 networks with Band 8 using the network assigned duplexing feature in LTE and we have not seen any issues with B5/26 or in the B8 systems.

For the 3MHz CBW we agree with the existing text.

- If more detail is needed, then changing it to “...added once the RAN4 NR_FR1_lessthan_5MHz_BW WI provides initial 3 MHz CBW specifications”.

We agree with the moderator compromise to remove the IAB specifications from the WID table.

We agree with the moderator proposal for subtopic #2-1 to add power class 1 for new 900MHz NR band under WI LTE_NR_HPUE_FWVM_R18 after WI for new 900MHz NR band with power class 3 is completed.

Please provide the additional comments on the revised WID circulated by the proponents in the table below.

https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/%5B98e-08-R18-RAN4-SpectrumRelated%5D/Rev3-RP-222735_New_WID_for_900_MHz_NR_Band.zip

Feedback Form 16:

1 – Qualcomm Korea

Sorry, I added the comment to the the wrong form above.

Regarding the objective to study and if feasible reuse the Band 8 duplexer and the sub-bullet study if

Feedback Form 17:

Sub-topic 2-2-2: Comments and responses on the proposed objectives

The following objectives are proposed in the WID.

————— Core part —————

The purpose of this work item is to do the following:

- Specify a new E-UTRA/LTE FDD operating band operating UL: 896 – 901 MHz and DL 935 – 940 MHz
- To support 5 MHz, 3 MHz, 1.4 MHz and NB-IoT channel bandwidths with 15 kHz SCS.
- To specify band numbering and core requirements to operate in North America with primary operations in the US.
- Support FCC emission mask of $43+10\log(P)$ for UL and $50+10\log(P)$ for DL. This is to ensure co-existence with adjacent narrowband and broadband networks to avoid interference.
- To specify UE RF requirements for power class 3 (23 dBm) and power class 1 (31 dBm).

————— Core part —————

Companies are invited to provide comments and responses in the following table.

Feedback Form 18:

1 – Qualcomm Korea

Same comments as for the NR work item. Except for the LTE work item, there is a performance objective that reads "Update the related 3GPP E-UTRA technical specifications to include support for the new band, if necessary." It would be better to have something more precise than such a generic objective that could be used anywhere. This generic objective is not much helping to identify the work and track the progress.

2 – T-Mobile USA Inc.

Same comment as for the NR WI: It seems unusual to include a power class other than PC3 for a new band Work Item. And, since we currently only have PC1 for public safety band n14, it would probably be best to work the Power Class 1 aspect in the LTE_NR_HPUE_FWVM_REL18 Work Item.

3 – AT&T GNS Belgium SPRL

Same comment as on NR WI. HPUE work should start after completion of PC3 work. This process is the agreed way for spectrum related work and this WI should not follow a separate process.

4 – Anterix

Similar response NR for AT&T/T-Mobile: Understood on PC1, this was meant as informational. Will remove and take suggestion to move to LTE_NR_HPUE_FWVM_REL18 Work Item.

<p>5 – Verizon UK Ltd</p> <p>Further clarification of the emission mask is needed. Based on the order of FCC-20-67A1, the emission mask should be as below, instead of one specified in the current objectives.</p> <p>(a) For 900 MHz broadband operations in 897.5-900.5 MHz band by at least $43 + 10 \log (P)$ dB.</p> <p>(b) For 900 MHz broadband operations in the 936.5-939.5 MHz band, by at least $50 + 10 \log (P)$ dB.</p>
<p>6 – Anterix</p> <p>To Qualcomm we can add in the "Conformance requirements for BS" to the performance objective.</p>
<p>7 – ZTE Corporation.</p> <p>1) For FCC requirement part, we similar comments as for NR part.</p> <p>2) For the power class part of NB1/NB2 UE, only PC3 is considered and no other PCs to be considered in this band, right?</p> <p>3) For power class part of E-UTRA UE, only PC3 is considered and PC1 would be treated in other WID;</p> <p>4) For subcarrier spacing for NB1/NB2, not sure why other SCS is not considered here? e.g. 3.75kHz single tone case.</p> <p>5) For BS RF core requirement, this could be also added as well.</p>
<p>8 – Apple (UK) Limited</p> <p>What is the intended UE device type for this frequency band, especially for device supporting PC1?</p>
<p>9 – MediaTek Inc.</p> <p>Similar comments to the NR band on PC1.</p>
<p>10 – Dish Network</p> <p>While it may be implied in the objectives, we would prefer the WID includes the following in the scope as -50dBm/MHz protection level against B5/B26 is not possible without appropriate power reduction measures:</p> <p>– Address potential BS and UE co-existence issues and specify the required RF requirements for the new band, including A-MPR.</p> <p>This can be e.g. a sub-bullet to the third bullet.</p>

Sub-topic 2-2-3: Comments and responses on impacted/new specifications and target completion date & time budget

Companies are invited to provide comments and responses in the following table.

Feedback Form 19:

1 – ZTE Corporation.

For the impacted spec part, similar comment as NR part, coexistence requirement between LTE band and repeater/IAB should be also taken into account.

2 – Nokia France

The timescale and target completion dates would need to be corrected.

3.3.1.2 Summary

No objection was received for the proposed WI. Companies' comments are similar to those for new 900MHz NR band. Additionally, Qualcomm commented that the objective of performance part should be more precise. ZTE commented that for SCS for NB1/NB2 why other SCS is not considered, e.g., 3.75KHz single tone.

3.3.2 Intermediate Round

3.3.2.1 Comments & responses

Sub-topic 2-2-2: Comments and responses on the proposed objectives

In the intermediate round, the moderator suggests focusing on developing the objectives for the WI.

The following modified objectives are proposed for discussions in the intermediate round. In the impacted specification of the WID, TS 36.133 (RRM specification) is included. Regarding RRM part, in the moderator view, the new band number should be added for table of band group in Section 3.5.1 of 36.133, which will be used to RRM measurement accuracy and test cases and should belong to performance part. Thus the moderator add the RRM objective to performance part, i.e., Introduce the corresponding RRM requirements, i.e., add the new band to group of bands.

————— Core part —————

The objectives of core part of this work item include:

- Specify a new E-UTRA/LTE FDD operating band operating with
 - UL: 896 – 901 MHz and DL 935 – 940 MHz
 - To support 5 MHz, 3 MHz, 1.4 MHz and NB-IoT channel bandwidths with 15 kHz SCS and 3.75kHz SCS.
- Specify core requirements of co-existence to operate in North America with primary operations in the US.
 - Address potential BS and UE co-existence issues and specify the required RF requirements for the new band, including A-MPR.
 - Support FCC emission mask in FCC-20-67A1 to ensure co-existence with adjacent narrowband and broadband networks to avoid interference.

- Specify UE RF core requirements
 - Assume power class 3 (23 dBm)
 - Study and if feasible, reuse band 8 duplexer
- Specify necessary BS RF core requirements

_____ Core part _____

_____ Perf part _____

The objectives of Perf. part of this work item include:

- Conformance requirements for BS
- Introduce the corresponding RRM requirements, i.e., add the new band to group of bands

_____ Perf part _____

Companies are invited to provide comments and responses in the following table.

Feedback Form 20:

1 – Anterix

Anterix agrees with most of the moderator edits including addition of RRM requirements and BS conformance. Additionally here are responses to:

- ZTE – For NB1/NB2 the initial idea is to use typical requirements used in other NB deployments and not necessarily exclude other SCS or power class considerations. We support the inclusion of 3.75 kHz SCS (UL) and lower power class modules (e.g. 14 or 20 dBm).
- Dish – We disagree with the addition of power reduction measures. The proposed new bands for LTE and NR are specifically:
 - WID Band XXX UL: 896 – 901 MHz and DL 935 – 940 MHz
 - B5 is UL: 824 – 849 MHz and DL 869 – 894 MHz
 - B26 is UL: 814 – 849 MHz and DL 859 – 894 MHz
 - We do not see any overlap of the proposed band and B5 or B26 and thus no reason for the inclusion of A-MPR or other suggested RF requirements.
- Several deployments of Ue and eNodeB using Band 8 duplexors have been completed and are operational. These systems all required independent lab testing to meet FCC specifications and all passed FCC Class2 Permissive Change certification. The assumption is that the existing Band 8 duplexors can be utilized in both Ue and eNodeB and does not necessarily need to be added as an objective.

<p>2 – HuaWei Technologies Co.</p> <p>Moderator (RAN4 Chari): the rapporteur provided the revised WID at https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_08-R18-RAN4-SpectrumRelated%5D/Rev2-RP-222734.zip. I would like to encourage experts to review them and can also make corresponding comments in this feedback form.</p>
<p>3 – Apple (UK) Limited</p> <p>Similar comment above on UE coexistence requirement consideration.</p>
<p>4 – ZTE Corporation.</p> <p>The current version is fine for us. For NB1/NB2, we could start with PC3 firstly.</p>
<p>5 – Union Inter. Chemins de Fer</p> <p>Support this proposal for 5 MHz and 3 MHz channel bandwidth with the latter being dependent on RAN WI RP-222645.</p>
<p>6 – Skyworks Solutions Inc.</p> <p>Same comments on coex and FCC mask than for the NR case</p>

To address the power class 1 issue, the moderator proposes the following proposal:

Proposal for Sub-topic #2-2:

- Consider adding power class 1 for new 900MHz LTE band under WI LTE_NR_HPUE_FWVM_R18 after WI for new 900MHz LTE band with power class 3 is completed.

Companies are invited to provide comments and responses in the following table.

Feedback Form 21:

<p>1 – Anterix</p> <p>Similar to the NR item - Yes, we agree with this proposal for PC1 under WI LTE_NR_HPUE_FWVM_R18 once PC3 is completed.</p>

Sub-topic 2-2-3: Comments and responses on impacted/new specifications and target completion date & time budget

Issue #2-2-3-1: According the submitted WID, the target completion date is June 2023 (RAN#100) for both core and performance parts

Issue #2-2-3-2: From the moderator perspective, no internal TR is needed. Please confirm it.

Issue #2-2-3-3: The following specifications should be listed as the impacted spec.

Table 5:

Impacted existing TS/TR <i>{One line per specification. Create/delete lines as needed}</i>			
TS/TR No.	Description of change	Target completion plenary#	Remarks
36.101	E-UTRA; UE Radio transmission and reception	RAN#100	Core part
36.104	E-UTRA; Base Station (BS) radio transmission and reception	RAN#100	Core part
36.133	E-UTRA; Requirements for support of RRM	RAN#100	Core Perf. part
36.141	E-UTRA; Base Station (BS) conformance testing	RAN#100	Perf part
37.104	E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) radio transmission and reception	RAN#100	Core part
37.105	Active Antenna System (AAS) Base Station (BS) transmission and reception	RAN#100	Core part
37.141	E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) conformance testing	RAN#100	Perf part
38.101-1	NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone	RAN#100	Core part

37.145-1	Active Antenna System (AAS) Base Station (BS) conformance testing; Part 1: conducted conformance testing	RAN#100	Perf part
37.145-2	Active Antenna System (AAS) Base Station (BS) conformance testing; Part 2: radiated conformance testing	RAN#100	Perf part
38.104	NR; Base Station (BS) radio transmission and reception	RAN#100	Core part
38.141-1	NR; Base Station (BS) conformance testing Part 1: Conducted conformance testing	RAN#100	Perf part
38.174	NR; Integrated access and backhaul radio transmission and reception	RAN#100	Core part
38.176-1	NR; Integrated Access and Backhaul (IAB) conformance testing; Part 1: Conducted conformance testing	RAN#100	Perf. Part
38.106	NR repeater radio transmission and reception	RAN#100	Core part
38.115-1	NR; Repeater conformance testing - Part 1: Conducted conformance testing	RAN#100	Perf. Part

Companies are invited to provide comments and responses in the following table.

Feedback Form 22:

1 – Anterix

The RRM addition is fine as the moderator has shown. However, as a smaller FDD band we do now see a use case for our spectrum that utilizes IAB and do not think it should be added in. For other FDD bands that were just approved (e.g. n100 and n101) no such specifications were added to the WID table, this should

be a similar type of work item.
2 – ZTE Corporation. Please see the comments for NR part.
3 – Anterix Anterix Issue #2-2-3-1: We are OK with this date but are open to pushing out to RAN101 if necessary. Issue #2-2-3-2: Agree Issue #2-2-3-3: See above. NOTE: We understand the concern but it may not apply to US market and we're trying to reduce workload. It was not implemented in similar band for RMR900 (band n100) earlier this year and this is a similar WI request.

3.3.2.2 Summary

Most part of the proposed objectives seem acceptable. It is agreed to add 3.75kHz SCS. The remaining issues include

- Protection of B5/B26
- Whether IAB specification should be kept.

The summaries are similar as for NR 900MHz. And please note the moderator moves RRM from performance part to core part after further checking with RRM experts. It should belong to Core part.

Regarding the target completion date, the proposed RAN#100 for both core and performance parts is agreeable. The WI can be extended if it needs more time at the target completion date. So the moderator suggests RAN#100 as the target completion date. No internal TR is expected. For the impacted existing specifications, the moderator proposes to remove IAB specifications, i.e., TS38.174, 38.176-1 as a compromise.

3.4 Final Round

3.4.1.1 Comments & responses

Sub-topic 2-2-2: Comments and responses on the proposed objectives

The following objectives are proposed for the review and further modification in the final round. If OK, please proponent prepare the revised WID based on them and circulate the revised version for review.

_____ Core part _____

The objectives of core part of this work item include:

- Specify a new E-UTRA/LTE FDD operating band operating with

- UL: 896 – 901 MHz and DL 935 – 940 MHz
- To support 5 MHz, 3 MHz, 1.4MHz with 15kHz SCS, and NB-IoT channel bandwidths with 15 kHz SCS and 3.75kHz SCS.
- Study and specify the co-existence requirements
 - Support FCC OOB emission mask in FCC-20-67A1 for all the defined channel bandwidths in the proposed band to ensure co-existence with adjacent narrowband and broadband networks to avoid interference.
 - Study and if needed, specify the protection for B5 and B26 including MPR.
 - Assume reusing band B8 duplexer
- Specify UE RF core requirements to operate in North America with primary operations in the US.
 - Assume power class 3 (23 dBm)
- Specify necessary BS RF core requirements
- Specify the corresponding RRM requirements, i.e., add the new band to group of bands.

_____ Core part _____

_____ Perf part _____

The objectives of Perf. part of this work item include:

- Conformance requirements for BS

_____ Perf part _____

Companies are invited to make comments in the table below.

Feedback Form 23:

<p>1 – Ligado Networks</p> <p>Shouldn't the NB-IoT band objective in the M1/M2/NB1/NB2 basket WID under topic #5? Also, we were told in the June plenary when we tried to introduce NB-IoT for Band 54 that the LTE band work needs to have sufficiently progressed to kick-off NB-IoT/eMTC work under the basket WID. Not sure if that still applies.</p>
<p>2 – Anterix</p> <p>Similar to the NR response. In general we are Ok with the existing language in both WIDs.</p> <p>We understand that the full BW B8 duplexers have some overlap of B8 UL with B26 DL and with B8 UL in B5 DL and support having protections for all networks but feel that clear definition on what is required to be evaluated for the protection and for the duplexer reuse.</p>

- Perhaps changing the language to the following “Address potential BS and UE co-existence issues and specify the required RF requirements for the new band including relaxing the Ue UL SEM for adjacent channels or A-MPR.”
- NOTE: To date there are 13 networks with Band 8 using the network assigned duplexing feature in LTE and we have not seen any issues with B5/26 or in the B8 systems.

3 – HuaWei Technologies Co.

Moderator:

To Ligado, the B54 is the existing band when you proposed the new bandwidths. Thus the new bandwidths for the existing LTE band should be introduced via M1/M2/NB1/NB2 basket WI. For this case, it is a new band, for which we could not use the M1/M2/NB1/NB2 basket WI because the new band does not fit its scope. It would be OK to introduce NB1/NB2 bandwidth together with the introduction of new band. The other alternative way is to introduce the bandwidths via M1/M2/NB1/NB2 basket WI after this proposed WI is finalized. That alternative way would be not preferable.

To Anterix, we can try your language to see if other experts are OK.

4 – HuaWei Technologies Co.

Moderator:

To Anterix, please remove RAN#98e and RAN#99 from the table of expected output and time scale.

5 – Nokia France

We agree with the comment from Huawei. Otherwise fine.

Please provide the additional comments on the revised WID circulated by the proponents in the table below.

https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/%5B98e-08-R18-RAN4-SpectrumRelated%5D/Rev3-RP-222734-New_WID_for_900_MHz_LTE_Band.zip

Feedback Form 24:

1 – Anterix

We agree with the moderator to remove the IAB specifications from the table in section 5.

We agree to keep the RAN#100 target date for completion.

2 – Anterix

The WID proposal has been updated per the latest comments and is available in TSGR_98e/Inbox/Drafts folder under Rev4

Feedback Form 25:

Sub-topic 3-2: Comments and responses on the proposed objectives

The following objectives are proposed in the WID.

_____ Core part _____

The objective of the core part of work item is to:

Specify UE/BS RF requirements for a new NR TDD operating band: BS transmit frequency range: 1670 MHz –1675 MHz, UE transmit frequency range: 1670 MHz–1675 MHz Channel bandwidths of 5 MHz with supported subcarrier spacing of 15 kHz This new NR band is expected to be release independent.

_____ Core part _____

_____ Perf part _____

Specify performance requirements for the new NR TDD operating band n54.

_____ Perf part _____

Companies are invited to provide comments and responses in the following table.

Feedback Form 26:

<p>1 – ZTE Corporation.</p> <p>1) Which release this band is supposed to release independent to? 2) We need one new band instead of n54, right? we need new band number as n10X? similar as APT_600MHz 3) For conformance testing part, we should clarify for BS conformance testing.</p>
<p>2 – Nokia Japan</p> <p>Thanks ZTE for the comments.</p> <p>Regarding 1), our understanding is that the band will be release independent from Rel15 as usual. Hence, 38.307 must not be listed in Impacted existing TS/TR table. Regarding 2), would ZTE clarify the question? LTE Band 54 is specified and n54 has not been used up in NR. Wouldn't it be natural to use the same numbering? Regarding 3), do you happen to be saying that 38.174, 38.176-1, 38.176-2 etc., are missing?</p>
<p>3 – CHTTL</p> <p>for 1) I think what ZTE mentions is that the WID only mentions this new NR band is expected to be release independent, but not mentioning which release it is release independent from. Maybe it can be clarified and updated.</p>

4 – MediaTek Inc.

We are fine with the WID proposal, and since "operating band" is listed as one of the items in TS 38.307 from Rel-15, we understand that the release independence of any new band definition later than Rel-15 is already there from Rel-15, so it can be removed from the WID, or just clarified as from Rel-15 as Nokia commented.

5 – Ligado Networks

I can clarify release independent from Rel-15 in the revision. With respect to 2) we will use n54 since 54 is used for E-UTRA for the same frequency range. With respect to 3) need more clarification.

Sub-topic 3-3: Comments and responses on impacted/new specifications and target completion date & time budget

Companies are invited to provide comments and responses in the following table.

Feedback Form 27:

1 – ZTE Corporation.

1) For the impacted spec, Coexistence requirement with repeater and IAB should be considered as well. Please refer to APT600MHz WID RP-223265.

2) For the completion date to be 2022, June, I am just wondering whether this is enough since we only have 3 meeting cycles to complete all work.

2 – Ligado Networks

Again, this is an NR version of the E-UTRA band 54 that was just finalized. In terms of completion date, since most of the assessment was performed as part of E-UTRA band 54, we believe that 3 meetings is adequate to complete the work.

4.2.2 Summary

No objection was received for the WI. ZTE commented on the band number and release independency. Nokia responded that it is NR band and the corresponding band number n54 can be used. Regarding release independency, companies clarified that release independency of any new band defined later than Rel-15 has already been supported and the release independency part can be removed from objective. ZTE also commented that more impacted specifications should be included and that 3 meeting cycle is not enough.

4.3 Intermediate Round

4.3.1 Comments & responses

Sub-topic 3-2: Comments and responses on the proposed objectives

In the intermediate round, the moderator suggests focusing on developing the objectives for the WI.

The following modified objectives are proposed for discussions in the intermediate round. In the impacted specification of the WID, TS 38.133 (RRM specification) is included. Regarding RRM part, in the moderator

view, the new band number should be added for table of band group in Section 3.5.2 of 38.133, which will be used to RRM measurement accuracy and test cases and should belong to performance part. Thus the moderator add the RRM objective to performance part, i.e., Introduce the corresponding RRM requirements, i.e., add the new band for frequency bands grouping.

_____ Core part _____

The objective of the core part of work item is to:

- Specify UE/BS RF requirements for a new NR TDD operating band:
 - BS transmit frequency range: 1670 MHz –1675 MHz, UE transmit frequency range: 1670 MHz–1675 MHz
 - Channel bandwidths of 5 MHz with supported subcarrier spacing of 15 kHz
 - [Band number is n54]
- This new NR band is expected to be release independent from Rel-15

_____ Core part _____

_____ Perf part _____

The objectives of Perf. part of this work item include:

- Conformance requirements for BS
- Introduce the corresponding RRM requirements, i.e., add the new band for frequency bands grouping.

_____ Perf part _____

Companies are invited to provide comments and responses in the following table.

Feedback Form 28:

<p>1 – HuaWei Technologies Co.</p> <p>Moderator (RAN4 Chair): the rapporteur uploads the revised WID at https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_08-R18-RAN4-SpectrumRelated%5D/RP-223XXX_Revof_RP-222992_WID_on_Introduction_of_NR_1670_1675MHz. I would like to encourage experts to also review it and make comments on it under this feedback form.</p>
<p>2 – Ligado Networks</p> <p>After offline discussions with the Round 1 commenting companies, a revision that was agreeable has been uploaded in the draft sub-folder for this thread. It adds i) removes the reference to n54 (to be discussed in the working group), ii) adds the repeater and IAB specs as impacted to address the co-existence requirements, iii) refines the objective to clarify release independence from Rel-15 and iv) updates the performance objective to clarify BS conformance testing.</p>

<p>3 – Nokia Japan</p> <p>Moderator’s summary looks good. Regarding addition of RRM into performance part, RRM has been handled in Core in new band WIs like APT600, 6GHz unlicensed etc.. Perhaps, we can keep consistency with them, i.e., RRM is handled as Core as revision.</p>
<p>4 – Ligado Networks</p> <p>If no further are comments received, as indicated by the moderator, I can include the RRM objectives under the performance objective.</p>
<p>5 – Ligado Networks</p> <p>Ok, then I will keep RRM as being handled in Core and add the following bullets under the Core objectives</p> <ul style="list-style-type: none"> - Introduce the corresponding RRM requirements, i.e., add the new band for frequency bands grouping. <p>A revision of the WID has been uploaded</p> <p>https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/%5B98e-08-R18-RAN4-SpectrumRelated%5D/223XXX_Revof_RP-222992_WID_on_Introduction_of_NR_1670_1675MHz_v01_LN.doc</p>
<p>6 – Skyworks Solutions Inc.</p> <p>We do not see any issue of using n54 for this band as it has been done for any NR band reusing an existing LTE band number. It would be confusing to have different numbers for the same band with the same duplex operation.</p>

Sub-topic 3-3: Comments and responses on impacted/new specifications and target completion date & time budget

Issue #3-3-1: According the submitted WID, the target completion date is June 2023 (RAN#100) for both core and performance parts

Issue #3-3-2: The following specifications should be listed as the impacted spec.

Table 7:

Impacted existing TS/TR			
TS/TR No.	Description of change	Target completion plenary#	Remarks
TS 38.101-1	NR: UE Radio transmission and reception	TSG RAN#100 June 2023	Core Part

TS 38.101-5	NR; User Equipment (UE) radio transmission and reception; Part 5: Satellite access Radio Frequency (RF) and performance requirements	TSG RAN#100 June 2023	Core Part
TS 36.104	E-UTRA; BS Radio transmission and reception	TSG RAN#100 June 2023	Core Part
TS 37.104	E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) radio transmission and reception	TSG RAN#100 June 2023	Core Part
TS 37.105	Active Antenna System (AAS) Base Station (BS) transmission and reception	TSG RAN#100 June 2023	Core Part
TS 38.104	NR; BS Radio transmission and reception	TSG RAN#100 June 2023	Core Part
TS 38.133	NR; Requirements for support of radio resource management	TSG RAN#100 June 2023	Perf. Part
TS 36.141	E-UTRA; BS conformance testing	TSG RAN#100 June 2023	Perf. Part
TS 37.141	E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) conformance testing	TSG RAN#100 June 2023	Perf. Part
TS 37.145-1	Active Antenna System (AAS) Base Station (BS) conformance testing; Part 1: conducted conformance testing	TSG RAN#100 June 2023	Perf. Part
TS 37.145-2	Active Antenna System (AAS) Base Station (BS) conformance testing; Part 2: radiated conformance testing	TSG RAN#100 June 2023	Perf. Part

TS 38.141-1	NR; Base Station (BS) conformance testing Part 1: Conducted conformance testing	TSG RAN#100 June 2023	Perf. Part
TS 38.141-2	NR; Base Station (BS) conformance testing Part 2: Radiated conformance testing	TSG RAN#100 June 2023	Perf. Part
38.174	NR; Integrated access and backhaul radio transmission and reception	TSG RAN#100 June 2023	Core part
38.176-1	NR; Integrated Access and Backhaul (IAB) conformance testing; Part 1: Conducted conformance testing	TSG RAN#100 June 2023	Perf. Part
38.176-2	NR; Integrated Access and Backhaul (IAB) conformance testing; Part 2: Radiated conformance testing	TSG RAN#100 June 2023	Perf. Part
38.106	NR repeater radio transmission and reception	TSG RAN#100 June 2023	Core part
38.115-1	NR; Repeater conformance testing - Part 1: Conducted conformance testing	TSG RAN#100 June 2023	Perf. Part
38.115-2	NR; Repeater conformance testing - Part 2: Radiated conformance testing	TSG RAN#100 June 2023	Perf. Part

Companies are invited to provide comments and responses in the following table.

Feedback Form 29:

1 – Ligado Networks

The following additions were made to the table:

Added repeater (38.106, 38.115-1, 38.115-2) and IAB (38.174, 38.176-1, 38.176-2) core and performance specs

Much of the detailed evaluation for this band and the applicable emissions requirements was already performed as part of the corresponding E-UTRA band 54 (LTE_TDD_1670_1675MHz WI). Therefore, the target date of June seems reasonable for completion for this WI.

2 – ZTE Corporation.

Thanks for further clarification from the rapporteur, if this band has already been defined for E-UTRA, then the band number could be reused for NR. I might miss the previous E-UTRA standardization work, sorry about that.

3 – ZTE Corporation.

Thanks for further clarification from the rapporteur, if this band has already been defined for E-UTRA, then the band number could be reused for NR. I might miss the previous E-UTRA standardization work, sorry about that.

4 – Ligado Networks

Ok, I will then revert back to the original acronym as well as update the objectives with the following bullet as suggested by the moderator but without the square brackets:

- Band number is n54

4.3.2 Summary

Most part of the proposed objectives are acceptable. The proponent has prepare the revision of WID. After further checking with RRM experts, the moderator proposes to move RRM part from Perf. part to Core part. Thanks to experts. It was agreed to use band number n54.

The proposed target completion date June 2023 (RAN#100) is agreeable. The proposed impacted specification list in issue #3-3-2 is agreeable.

4.4 Final Round

4.4.1 Comments & responses

Please proponent prepare the almost final version of revised WID. Please companies review it and provide comments if any in the table below.

https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/%5B98e-08-R18-RAN4-SpectrumRelated%5D/RP-223XXX_Revof_RP-222992_WID_on_Introduction_of_NR_1670_1675MHz_v02_LN_LN.doc

Feedback Form 30:

1 – Ligado Networks

The final draft has been published into a new sub-folder, New 1.6GHz WID - Final Draft. The link is provided below.

https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/%5B98e-08-R18-RAN4-SpectrumRelated%5D/%20Final%20Draft/Final_Revof_RP-222992_WID_on_Introduction_of_NR_1670_1675MHz_v01.doc

This is identical to "RP-223XXX_Revof_RP-222992_WID_on_Introduction_of_NR_1670_1675MHz_v02_LN_LN.doc" that was uploaded earlier this morning.

5 Topic #4: NTN bands

5.1 Companies' contributions summary

Table 8:

TDoc	Title	Source	Type	AI
RP-223247	Discussion on IoT NTN new bands	MediaTek Inc.	discussion	10.1.5
RP-222997	New WID on Introduction of the Satellite L-/S-Band (except for PC2 part)	Globalstar, Apple	WID new	9.1.5
RP-223431	New WID on Introduction of the Satellite L-/S-Band	Globalstar, Apple	WID new	9.1.5
RP-222998	Motivation for a New WID on Introduction of the Satellite L-/S-Band (except for PC2 part)	Globalstar, Apple	discussion	9.1.5

5.2 Sub-topic #4-1 IoT NTN LTE bands

5.2.1 Initial Round

5.2.1.1 Comments & responses

Sub-topic 4-1-1: Any question or comment on the motivation and justifications of the proposal?

Companies are invited to provide the general comments, including comments on the motivation, justification part, whether the WI is needed, how to handle the work, in the follow table.

The proposals in RP-223247:

Proposal 1: Companies are invited to provide feedback on the draft WID for the new IoT NTN band.

Proposal 2: Check in March whether RAN4 is ready to start new IoT NTN band specification work, with a view to starting work on the on the proposed band in this document once maintenance is deemed sufficiently stable.

Feedback Form 31:

<p>1 – Skyworks Solutions Inc.</p> <p>For clarification, the satellite L-/S-band is an NTN band not an IoT NTN band so as such we do not see why this band should wait for the completion of IoT NTN.</p>
<p>2 – ZTE Corporation.</p> <p>In the following Feb meeting, it seems that we still needs some further maintenance work for IoT over NTN UE RF. From our understanding, it’s better to start the new bands for both IoT over NTN and NR over NTN after the March, 2023.</p>
<p>3 – Qualcomm Korea</p> <p>We suggest an approach to agree to a new band work item now, but put the work item on hold until March.</p>
<p>4 – Apple GmbH</p> <p>In general we support adding support for the L-/S-band also for the LTE IOT NTN track. And the proposal from Qualcomm looks very reasonable: we can agree the IOT NTN WI this meeting, but the actual start of the WI will be in March (in case if companies prefer having one more meeting cycle to stabilize the LTE IOT UE RF specs).</p> <p>In response to the comment from ZTE, we cannot see why the NR NTN WI should be dependent on the LTE IOT NTN WI. Even though we talk about the same band, these are different technologies with different specs.</p>
<p>5 – Sony Group Corporation</p> <p>For IoT NTN work, we are fine to define a WI but we may need to revisit the starting date in march meeting since there will be some left over issue to be resolved in the maintenance phase.</p>
<p>6 – MediaTek Inc.</p> <p>We are fine to endorse the proposal and come back in March.</p>
<p>7 – THALES</p> <p>OK with QC and MTK suggestions</p>

Sub-topic 4-1-2: Comments and responses on the proposed objectives

The following objectives are proposed in the WID.

————— Core part —————

The objective of this Work Item is to introduce a new FDD band for NB-IoT/eMTC operation over NTN with the objective:

- Specify the following new FDD frequency bands for NB-IoT/eMTC NTN operation:
 - 1610 – 1626.5 MHz in UL, and 2483.5 – 2500 MHz in DL)

This band will be Release-independent from Rel-17 for the UE.

————— Core part —————

————— Perf part —————

The objective of the performance part is to:

- Define SAN conformance requirements.

————— Perf part —————

Companies are invited to provide comments and responses in the following table.

Feedback Form 32:

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Sub-topic 4-1-3: Comments and responses on impacted/new specifications and target completion date & time budget

Companies are invited to provide comments and responses in the following table.

Feedback Form 33:

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5.2.1.2 Summary

The proposals is to add the new LTE bands for NB-Iot/eMTC operation over NTN and is related to the RAN4 work on WI of LTE_NBIOT_eMTC_NTN_req. Thus there would be link between them.

Almost all the companies seemed accept to start the work later after the leftover issues are addressed in the maintenance phase. Regarding how to treat the proposal WI, Qualcomm, Apple, Mediatek, and Sony proposed to approve the WI in this meeting but put it on hold until March, while ZTE prefer to start the introduction of new bands for IoT NTN after March 2023.

5.2.2 Intermediate Round

5.2.2.1 Comments & responses

Sub-topic 4-1-1: Any question or comment on the motivation and justifications of the proposal?

In the intermediate round, the moderator proposed to try to converge on how to handle the proposed WI. There are two alternative approach:

- Alternative 1: Approve the WI on introduction of satellite L-/S-Band for IoT NTN in RAN#98-e and start the work after March 2023.
- Alternative 2: Discuss and approve the WI on introduction of satellite L-/S-Band for IoT NTN in RAN#99-e.

Companies are invited to make comments in the table below.

Feedback Form 34:

1 – HUGHES Network Systems Ltd We prefer alternative 2.
2 – ZTE Corporation. we don't see much difference between alternative 1 and alternative since anyway the discussion would start after the RAN#99 meeting. If we could have stable version for this WID, both alternatives are fine for us, no strong opinions on it.
3 – MediaTek Inc. We are fine with both alternatives with a slight preference to Alt. 2.
4 – Sony Group Corporation we are fine with either option.
5 – Skyworks Solutions Inc. We would prefer alternative 1 but can it be clarified if the NTN part (wo IoT) is agreeable now and can be started? this NTN part should not depend on the NTN IoT completion.

5.2.2.2 Summary

Based on comments from 5 companies, it seems there is no urgency to approve the WI of satellite L-/S-Band for IoT NTN. There is no need to have further discussions. Companies can come back in the future RAN plenary.

There is no need to have the final round discussions.

5.3 Sub-topic #4-2 NTN NR bands

5.3.1 Initial Round

5.3.1.1 Comments & responses

Sub-topic 4-2-1: Any question or comment on the motivation and justifications of the proposal?

Companies are invited to provide the general comments, including comments on the motivation, justification part, whether the WI is needed, how to handle the work, in the follow table.

The proposals in RP-222998:

Proposal: Introduce support for a new NTN band with 1610 – 1626.5MHz UL (L-band) and 2483.5 – 2500 MHz DL (S-band) in the corresponding NTN work item..

Feedback Form 35:

<p>1 – Skyworks Solutions Inc.</p> <p>As supporting company for the WI we support the introduction of a new NTN band with 1610 – 1626.5MHz UL (L-band) and 2483.5 – 2500 MHz DL (S-band)</p>
<p>2 – Nokia France</p> <p>To avoid confusion, the title of sections 5 and 5.3 in this NWM discussion should not include "IoT", since the proposals in 2998 and 3431 are for an NR band. Note also that in my understanding 2997 is replaced by 3431.</p>
<p>3 – MediaTek Inc.</p> <p>We support the WI proposal as supporting company.</p>

Sub-topic 4-2-2: Comments and responses on the proposed objectives

The following objectives are proposed in the WID.

————— Core part —————

The objective of the core part is to:

- Specify a new NTN FDD band with a UE transmitting at 1610-1626.5MHz and SAN transmitting at 2483.5-2500MHz;
- Support channel bandwidths and SCS as presented in Table 4.1-1 below;
- Support channel raster points at step of 100kHz;

NOTE: Support for channel raster points at step of 5kHz can be considered later based on the outcome of the corresponding RAN WG4 for potential channel raster enhancements.

- Support UE Power class 3 (+23dBm);

- Support Power class 2 (+26dBm);

NOTE: Work on Power class 2 will commence based on the RAN#99 decision and will be applicable to other FR1 NTN bands;

- Introduce the corresponding SAN and UE RF core requirements;
- Introduce the corresponding RRM requirements.

Table 4.1-1: Channel bandwidth and SCS system parameters.

Table 9:

SCS (kHz)	Channel bandwidth (MHz)			
15	5	10	15	
30		10	15	

----- Core part -----

----- Perf part -----

The objective of the performance part is to:

- Define conformance requirements for SAN.

----- Perf part -----

Companies are invited to provide comments and responses in the following table.

Feedback Form 36:

<p>1 – Qualcomm Korea</p> <p>Our suggestion is to limit this work item to PC3 and keep the PC2 as a separate discussion. As stated in the WID, there is a desire to have PC2 applicable to all NTN bands, so it is not really within the scope of this WI and there are also details that would need to be understood first (i.e., single PA or dual PA, etc) that are better discussed separate from this WI.</p>
<p>2 – Skyworks Solutions Inc.</p> <p>Although we do not see any specific reason why PC2 could not be supported (especially with the large duplex distance which should avoid any MSD issue) we are fine to start with PC3.</p>
<p>3 – ZTE Corporation.</p> <p>1) Based on the discussion in the previous RAN-97e meeting, for PC2 for NR NTN should be postponed to RAN#99e meeting;</p>

2) For channel raster part, not sure why we need to mentioned the step size as 5kHz□ we still need to follow the 100kHz channel raster for new NTN bands, right?

3) In addition, we are not sure the reason why 60kHz scs is removed, could the proponent further clarify it? it should be noted that 60kHz SCS is one optional feature for FR1 NR UE.

4 – Apple GmbH

@Qualcomm and @ZTE: We do acknowledge the point that PC2 for NTN will be discussed again at RAN#99. Nevertheless, even if PC2 is discussed in a separate thread, there will be cross-dependencies between this WI and potentially new discussion. As a summary, we agree not consider PC2 now in this WI, but it does not mean that we ”limit” the scope of the WI because introduction of PC2 for NTN will concern also this WI.

@ZTE: The WI already mentions 100kHz raster as a starting point. And the reason for mentioning a more flexible raster is to acknowledge RAN4 conclusion that 100kHz raster is too restrictive for bands having irregular channels; anyway this is just a NOTE, not an objective. As for the 60kHz SCS, we cannot see any motivation for 60kHz, there is no use case for a relatively small band residing on a low frequency. As an example, the most recent WI for the APT band does not have the 60kHz SCS either.

5 – Sony Group Corporation

We share a similar view as QC that a separate discussion on supporting PC2 will be better suited, and it is better to limit the WI to PC3 for now.

6 – MediaTek Inc.

We are fine with removal of PC2 for the time being and check it later again.

7 – THALES

As per proposal 4.2 of RAN#97-e chair’s report: *“To be discussed at RAN#99 (March 2023),
- Decision to specify High power UE (e.g. 26 dBm Tx power) for NTN FDD FR1 band(s), i.e. Rx/Tx requirements (This includes the study of relevant coexistence scenarios) [RAN4].”*

Therefore, PC2 should not be part of the discussion/WI scope during this meeting.

Sub-topic 4-2-3: Comments and responses on impacted/new specifications and target completion date & time budget

Companies are invited to provide comments and responses in the following table.

Feedback Form 37:

1 – ZTE Corporation.

SAN conformance testing spec is missing in the impacted spec.

2 – Apple GmbH

@ZTE: Thanks for the comment, the corresponding spec will be added to the next revision of the WI.

5.3.1.2 Summary

Companies supported to define the new NR band with 1610-1626.5MHz UL (L-band) and 2483.5-2500MHz DL (S-band). The moderator would like to apologize for the typo in the titles of sections.

Regarding the scope, there are mainly three issues to be discussed further:

- PC2: firstly, according to guidance of RAN Chair, PC2 should be precluded from the discussions. Secondly, Qualcomm, Skyworks, ZTE, Apple, Sony, Mediatek and Thales can accept not to include PC2 in the WI at least in the meeting. But companies' views on how to handle PC2 in the future would be different.
- Channel raster: ZTE had questions about the step size as 5KHz. Apple responded that 100kHz raster can be used as starting point but considering the discussions for Rel-18 irregular channel bandwidth Apple preferred to keep sufficient flexibility.
- 60KHz SCS: ZTE would like to clarify why 60kHz SCS is precluded in the WI. Apple responded that no motivation of 60kHz SCS is foreseen and there is no use case for relatively small band residing on a low frequency.

Regarding the impacted specifications, ZTE commented that the spec for SAN conformance testing is missing.

5.3.2 Intermediate Round

5.3.2.1 Comments & responses

Sub-topic 4-2-2: Comments and responses on the proposed objectives

In the intermediate round, the moderator proposes to discuss and stabilize the objectives for this new WI. The modified objectives are shown below.

In the moderator view, the new band number should be added for table of band group in Section 3.5.2 of 38.133, which will be used to RRM measurement accuracy and test cases and should belong to performance part. Thus the moderator move the RRM objective to performance part, i.e., Introduce the corresponding RRM requirements, i.e., add the new band for frequency bands grouping.

————— Core part —————

The objective of the core part is to:

- Specify a new NTN FDD band with a UE transmitting at 1610-1626.5MHz and SAN transmitting at 2483.5-2500MHz;
- Support channel bandwidths and SCS as presented in Table 4.1-1 below;
- Support channel raster points at step of 100kHz
 - [NOTE: Support for channel raster points at step of 5kHz can be considered later based on the outcome of the corresponding RAN WG4 for potential channel raster enhancements.]
- Support UE Power class 3 (+23dBm);
- Support Power class 2 (+26dBm);
 - NOTE: Work on Power class 2 will commence based on the RAN#99 decision and will be applicable to other FR1 NTN bands;
- Introduce the corresponding SAN and UE RF core requirements;
- Introduce the corresponding RRM requirements.

Table 4.1-1: Channel bandwidth and SCS system parameters.

Table 10:

SCS (kHz)	Channel bandwidth (MHz)			
15	5	10	15	
30		10	15	

_____ Core part _____

_____ Perf part _____

The objective of the performance part is to:

- Define conformance requirements for SAN.
- Introduce the corresponding RRM requirements, i.e., add the new band for frequency bands grouping.

_____ Perf part _____

Companies are invited to make comments in the table below.

Feedback Form 38:

<p>1 – Apple GmbH</p> <p>Thew revised WID has been uploaded to the server: ftp://ftp.3gpp.org/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/%5B98e-08-R18-RAN4-SpectrumRelated%5D/NTN%223485_LSband_WID%20v02.doc</p> <p>We removed the explicit objective for PC2, but decided to keep the related NOTE as a logical pointer for the upcoming discussion at RAN#99.</p> <p>Other minors changes are: fixed acronym, fixed performance part objectives and the list of the impacted performance specs.</p>
<p>2 – ZTE Corporation.</p> <p>For 60kHz SCS, we are still not convinced by the Apple’s feedback since in Rel-17 60kHz scs is also supported in both 38.108 and 38.101-5 spec . Since this is one optional feature, could we still keep it over there and leave it to the market decision at the end.</p>
<p>3 – Apple GmbH</p> <p>@ZTE: We will add 60kHz SCS and will upload the revised version v03 (but as stated earlier we do not see any need for that, especially for the NTN links).</p>
<p>4 – Apple GmbH</p> <p>The revised WID is uploaded to the server, v03: ftp://ftp.3gpp.org/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/%5B98e-08-R18-RAN4-SpectrumRelated%5D/NTN%223485_LSband_WID%20v03.doc</p>

Sub-topic 4-2-3: Comments and responses on impacted/new specifications and target completion date & time budget

Issue #4-2-3-1: According the submitted WID, the target completion date of core part is September 2023 (RAN#101) and the target completion date of Perf part is December 2023 (RAN#102). Can we agree on the proposed target dates?

Issue #4-2-3-2: Include internal TR in WID. Can we agree on it?

Issue #4-2-3-3: The following specifications should be listed as the impacted spec. Can we agree on the list?

Table 11:

Impacted existing TS/TR {One line per specification. Create/delete lines as needed}			

TS/TR No.	Description of change	Target completion plenary#	Remarks
TS 38.101-5	NR; User Equipment (UE) radio transmission and reception; Part 5: Satellite access Radio Frequency (RF) and performance requirements	RAN#101 (Sep 2023)	Core
TS 38.133	NR; Requirements for support of radio resource management	RAN#101 (Dec 2023)	Perf part
TS 38.108	Support for a new NTN band	RAN#101 (Sep 2023)	Core
TS 38.181	NR; Satellite Access Node conformance testing NTN specific characteristics	RAN#101 (Dec 2023)	Perf part

Companies are invited to make comments in the table below.

Feedback Form 39:

<p>1 – ZTE Corporation.</p> <p>Thanks for the further updates, we are fine with latest version from moderator.</p>
<p>2 – ZTE Corporation.</p> <p>Thanks for the further updates, we are fine with latest version from moderator.</p>

5.3.2.2 Summary

The proponents provided the revised version based on the moderator proposal by keeping the Work on UE Power class 2 can commence based on the RAN#99 decision. The revised WID is agreeable since no further comment is received. And as request by ZTE, 60KHz SCS is kept.

One additional comment from the modetaor is that the RRM objective should be moved from performance part to core part after checking with RRM experts to be aligned with other spectrum items. Sorry for wrong memory.

The proposed target completion date is agreeable. The internal TR will be included. For the impacted specifications, the proponent made some modifications in the latest version of revised WID. Encourage companies to check them.

5.3.3 Final Round

Please review the latest version of revised WID at

https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/%5B98e-08-R18-RAN4-SpectrumRelated%5D/NTN%20LS%20band/draft_RP-223485_LSband_WID%20v03.doc

If any further comments on the WID, please provide your comments in the table below.

Feedback Form 40:

1 – Apple GmbH

The latest version of the WID v04 is here:

ftp://ftp.3gpp.org//tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/%5B98e-08-R18-RAN4-SpectrumRelated%5D/NTN%20LS%20band/draft_RP-223485_LSband_WID%20v04.doc

The RRM requirements are moved back to the core part as noted by the moderator.

6 Topic #5: WI on LTE bands for UE Cat-M1/M2 and NB1&NB2

6.1 Companies' contributions summary

Table 12:

TDoc	Title	Source	Type	AI
RP-222824	LTE bands for UE category M1&M2 and/or NB1&NB2 in Rel-18	Ericsson	WID new	10.1.5

6.2 Initial Round

6.2.1 Comments & responses

Sub-topic 5-1: Any question or comment on the motivation and justifications of the proposal of RP-222824?

Companies are invited to provide the general comments, including comments on the motivation, justification part, whether the WI is needed, how to handle the work, in the follow table.

Feedback Form 41:

<p>1 – Apple (UK) Limited</p> <p>Please clarify whether this is a basket WID where only band specific requirements are to be specified.</p>
<p>2 – Nokia Japan</p> <p>We support this WI. To Apple, our understanding is that this is a basket WI.</p>

Sub-topic 5-2: Comments and responses on the proposed objectives

The following objectives are proposed in the WID.

_____ Core part _____

Specify and modify core requirements (e.g. UE power class, Additional Maximum Power Reduction (A-MPR), Reference sensitivity, blocking performance) and specifications for the LTE bands listed in the table below to support UE category M1&M2 and/or UE category NB1&NB2 in a release-independent way:

Table 13:

Band	UE cat.	REL-indep. From	contact name, company	contact email	status (new, ongoing, completed, stopped)
Band 54	Cat-M1	Rel-13	Ojas Choksi	Ojas.Choksi@liganew.com	New
Band 54	Cat-M2	Rel-14	Ojas Choksi	Ojas.Choksi@liganew.com	New
Band 54	NB1/NB2	Rel-15	Ojas Choksi	Ojas.Choksi@liganew.com	New

_____ Core part _____

_____ Perf part _____

Specify and modify performance requirements and specifications for the LTE bands listed in the table of clause 4.1 to support UE category NB1&NB2 and category M1&M2 in a release-independent way.

_____ Perf part _____

Companies are invited to provide comments and responses in the following table.

Feedback Form 42:

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Sub-topic 5-3: Comments and responses on impacted/new specifications and target completion date & time budget

Companies are invited to provide comments and responses in the following table.

Feedback Form 43:

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6.2.2 Summary

Apple questioned whether it is a basket WI. Nokia confirmed it. No comment on objectives was received. The moderator will propose to approve the WI RP-222824.

No intermediate round is needed for Topic #5.

7 Topic #6: WI on CA band combinations with dual SUL bands

7.1 Companies' contributions summary

Table 14:

TDoc	Title	Source	Type	AI
RP-222955	Motivation for NR CA band combinations with dual SUL bands	China Telecom	discussion	9.1.5
RP-223075	New WID: NR CA band combinations with dual SUL bands in Rel-18	CMCC	WID new	9.1.5
RP-223076	Motivation on NR CA band combinations with dual SUL bands in Rel-18	CMCC	discussion	9.1.5

7.2 Initial Round

7.2.1 Comments & responses

Sub-topic 6-1: Any question or comment on the motivation and justifications of the proposal?

Companies are invited to provide the general comments, including comments on the motivation, justification part, whether the WI is needed, how to handle the work, in the follow table.

The proposals in RP-222955:

Proposal 1: Add the following combinations in the new WID on NR CA band combinations with dual SUL bands:

Table 15:

NR CA configuration	Uplink CA configuration
CA_SUL_n78A-n81A_SUL_n78A-n84A	SUL_n78A-n81A, SUL_n78A-n84A, CA_n78C, CA_n84A-n81A
CA_SUL_n78A-n80A_SUL_n78A-n84A	SUL_n78A-n80A, SUL_n78A-n84A, CA_n78C, CA_n80A-n84A
CA_SUL_n78A-n89A_SUL_n78A-n81A	SUL_n78A-n89A, SUL_n78A-n81A, CA_n78C, CA_n81A-n89A

Feedback Form 44:

<p>1 – CATT</p> <p>We support the band combinations.</p>
<p>2 – Apple (UK) Limited</p> <p>For the above intended CA configurations notations, it is unclear whether there are two contiguous or two non-contiguous carriers in n78, while from the proposed UL configuration n78C, it can only be two contiguous carriers in n78. So for the intra-band case, a better notation may be needed in order to indicate the exact configuration instead of relying on the UL configuration to indirectly indicate the configuration. For example, if n78C is not specified in the UL, it would not be possible to figure out what the DL configuration is in n78, such as n78C or n78(2A). Please also make sure all the fallback configurations have also been specified, for example, SUL_n78A-n89A has not been specified in Rel-17 (please clarify if it has been specified in Rel-18 but pending on the availability of the Rel-18 specifications), same for SUL_n78C-n81A, SUL_n78C-n89A.</p>
<p>3 – Huawei Technologies France</p> <p>We support the band combination proposal.</p> <p>To Apple's comments, we didn't see n78C in the band combination proposal? Some clarification would</p>

be helpful for the comments. As for SUL_n78A-89A, we see it has already been requested in the Rel-18 SUL basket WI. Similar case for other SUL band combinations in this WI proposal. In our understanding, if the combinations have been requested already, they can be considered in other WI proposal, but the completion of the specific band combination depends on the fallback combo, which is the way already adopted in previous releases.

4 – China Telecom Corporation Ltd.

To Apple:

Thanks Apple for the careful checking. Please find our replies below:

- 1) SUL_n78A-n89A has been included in the Rel-18 basket WID, as also commented by Huawei, please check the RAN4 endorsed WID in R4-2219564.
- 2) There is no SUL_n78C-n81A or SUL_n78C-n89A in the requested combinations.
- 3) For the notation, we are open for further improvement on it. One possible option is to add a column on the DL CA configuration. We can further discuss other options in the next round, or can discuss in RAN4 when drafting the CRs.

Observation 1: In RAN1/2 specification, inter-band CA with one NUL band and one SUL band configured on each serving cell has already been supported in Rel-15.

Proposal 2: From RAN4 RF requirements and procedure perspective, the handling of the basket WI on CA with dual-SUL should be same with all other CA/DC basket WIs on increasing the number of bands in RAN4, and the corresponding band combination specific requirements should be release independent from Rel-15.

—
The proposals in RP-223076.

Feedback Form 45:

Sub-topic 6-2: Comments and responses on the proposed objectives

The following objectives are proposed in the WID.

————— Core part —————

The objectives of the core part are as follows:

- Specify the PC3, PC2 band-combination specific RF requirements for the listed CA configurations with dual SUL bands including at least
 - Applicable frequencies if necessary
 - Applicable bandwidths and bandwidth sets if necessary
- Analyse combinations that have self-desensitization due to following reasons:
 - TX Harmonic and/or intermodulation overlap of receive band

- TX signal overlap of receiver harmonic frequency
- TX frequency being in close proximity of one of the receive bands
- Any other identified reasons such that insufficient cross band isolation, harmonic mixing
- For the combination where self-desensitization exists, specify at least needed
 - $\Delta T_{IB, c}$ and $\Delta R_{IB, c}$
 - Reference sensitivity exceptions including MSD test cases
 - Exceptions to the out-of-band blocking requirement

The NR inter-band CA band combination configurations with dual SUL bands are defined in Table 1 below:

Table 1: NR Inter-band CA with dual SUL bands

Table 16:

NR CA configuration	Uplink CA configuration	Power Class	contact name, company	Contact email	other supporting companies (min. 3)	status (new, on-going, completed, stopped)
CA_SUL_n41A-SUL_n95A-SUL_n98A	ASUL_n41A-SUL_n79A-SUL_n98A SUL_n79A-SUL_n98A CA_n41A-n79A CA_n95A-n98A	PC3, PC2	Xiaoran ZHANG, CMCC	zhangxiaoran@chinamobile.com	CBN, Huawei, HiSilicon	New
CA_SUL_n41A-SUL_n98A-SUL_n95A	ASUL_n41A-SUL_n98A SUL_n79A-SUL_n95A CA_n41A-n79A CA_n95A-n98A	PC3, PC2	Xiaoran ZHANG, CMCC	zhangxiaoran@chinamobile.com	CBN, Huawei, HiSilicon	New
CA_SUL_n41A-SUL_n83A-SUL_n98A	ASUL_n41A-SUL_n83A SUL_n79A-SUL_n98A CA_n41A-n79A CA_n83A-n98A	PC3, PC2	Xiaoran ZHANG, CMCC	zhangxiaoran@chinamobile.com	CBN, Huawei, HiSilicon	New

CA_SUL_n41A-SUL_n41A-n83A_SUL_n79A-n95A	ASUL_n41A-n83A SUL_n79A-n98A CA_n41A-n79A CA_n83A-n95A	PC3, PC2	Xiaoran ZHANG, CMCC	zhangxiaoran@chinamobile.com	CBN, Huawei, HiSilicon	New
CA_SUL_n78A-SUL_n78A-n84A	ASUL_n78A-n84A SUL_n78A-n84A CA_n78C CA_n84A-n81A	PC3, PC2	Lei GAO, China Telecom	gaol8@chinatelecom.com	China Unicom, Huawei, HiSilicon	New
CA_SUL_n78A-SUL_n78A-n84A	ASUL_n78A-n84A SUL_n78A-n84A CA_n78C CA_n80A-n84A	PC3, PC2	Lei GAO, China Telecom	gaol8@chinatelecom.com	China Unicom, Huawei, HiSilicon	New
CA_SUL_n78A-SUL_n78A-n89A_SUL_n78A-n81A	ASUL_n78A-n89A SUL_n78A-n81A CA_n78C CA_n81A-n89A	PC3, PC2	Basaier Jialade, China Unicom	base-jld@chinaunicom.com	China Telecom, Huawei, HiSilicon	New

----- Core part -----

----- Perf part -----

Specify the necessary performance requirements such as release independence in TS 38.307.

----- Perf part -----

Companies are invited to provide comments and responses in the following table.

Feedback Form 46:

1 – China Mobile Com. Corporation

As proponent of this WID, after some offline discussion, we update the WID in :
https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/%5B98e-08-R18-RAN4-SpectrumRelated%5D/r

223075.docx

In the updated WID, we remove the UL CA configuration with two SUL carriers. I believe the WID should be less controversial. Please comment based on the updated WID in the above link. Your comments and questions are welcome.

2 – China Telecom Corporation Ltd.

Thanks CMCC for the updated WID.

From the core specification and operator demand perspectives, we don't think these updates are necessary. But if this is the only possible way to move forward in this meeting, we are fine to accept this revision.

3 – CATT

We support the WID.

4 – Apple (UK) Limited

1. Based on the diagrams shown in Figure 1 in R4-223076, it looks like there would be UL Tx switching among 4 UL bands (2 NUL bands and 2 SUL bands). This looks to be the new feature which is currently being developed in Rel-18 multi-carrier enhancement WID. Please clarify if this is the intended operation scenario.

2. In the proposed UL configurations, since only two UL bands are configured at a time, the operation would be no different from inter-band CA with single SUL. For example, for CA_SUL_n41A-n98A_SUL_n79A-n95A, if SUL_n41A-n98A is configured for UL, the operation would be no different from CA_n79A_SUL_n41A-n98A. Is this the correct understanding?

5 – Nokia Japan

For clarification, e.g., in the following UL configurations are listed with the target power class of 2 and 3.

SUL_n41A-n83A

SUL_n79A-n98A

CA_n41A-n79A

Do power class 2 and 3 apply to all the three configurations? n83 currently doesn't have power class 2. If so, shouldn't we finish SUL_n41A-n83A for PC2 first?

6 – China Mobile Com. Corporation

To Apple: This band combination proposal is independent of Rel-18 UL Tx switching, the UL configurations can be configured by RRC.

In our view, the proposed band combination is quite different from the existing band combination with single SUL. The reasons are:

Take CA band combination CA_SUL_n41A-n98A_SUL_n79A-n95A as an example, uplink can be transmitted on one of the four uplink carriers if this CA band combination is configured to UE. However, if following the existing band combination, UE can only be configured with either band combination CA_n79A_SUL_n41A-n98A or CA_n41A_SUL_n79A-n95A. So at one configuration, UE can only use one SUL carrier. If network would like to configure UE with another SUL carrier for load balancing and sufficient spectrum utilization, we need first do PCell change or handover, then SCell addition. The procedure is quite complex compared to configuration of CA_SUL_n41A-n98A_SUL_n79A-n95A. So in our

view, there are fundamental difference between CA configuration with two SUL cells and the existing CA configuration with one SUL.

To Nokia: For SUL band combination, the power class follows single band. So my understanding is that existing SUL band combination basket did not capture the PC discussion. In existing spec, there are already some SUL bands supporting PC2. If my memory is correct, these were introduced in the UL MIMO basket WI. We are OK either to complete the related SUL PC2 in some existing WIs or complete the related SUL PC2 in this WI.

7 – CHTTL

For the baskets, normally the status of the next level fallbacks are listed and provided in the request table, maybe it can also be considered here to make sure the fallback combinations as comment by Apple.

Note that for the R18 non-HPUE baskets approved in June, the scope is limited to PC3 based on the chair's arrangement.

8 – Huawei Technologies France

We support the WID proposal.

For the comments from Apple, we share similar view with CMCC that the WI proposal is spectrum related, which is similar to other band combination basket, which is not dependent with the Rel-18 Tx switching discussion. That's the reason in this RAN meeting, the WI proposal is handled under the RAN4 spectrum thread.

Regarding power class, as discussed in RAN4 for the rule of basket WI, there is no conclusion that PC2 cannot proposed together with PC3. The limitation is requirements for PC2 cannot be finished earlier than those for PC3. If specific band has no PC2 yet, we think it could be requested in other existing basket WI firstly, i.e. UL MIMO bands WI as mentioned by CMCC.

9 – China Unicom

We are fine with the WID updates made by CMCC.

We share the similar view that the proposed band combinations do not involve Tx switching scenarios, and the related fallback combinations is already being discussed under existing RAN4 WI.

10 – China Telecom Corporation Ltd.

Reply to Apple's comment (comment #4):

We think the Tx switching across 4 bands in MC_enh WI is a separate discussion from the basket WID. This basket WID is based on the Rel-15 core specifications and semi-static configuration of the different UL configurations.

For the difference with the existing band combinations, we share the same view with CMCC.

Sub-topic 6-3: Comments and responses on impacted/new specifications and target completion date & time budget

Companies are invited to provide comments and responses in the following table.

Feedback Form 47:

7.2.2 Summary

No objection to WI was received. Apple commented on the notation related to two contiguous or non-contiguous carriers in n78. The proponents replied that no SUL band combination with n78C is requested. In the moderator view, it would be better to discuss the notation in WI phase in the working group.

Regarding the objectives, Apple asked the clarification of intended operation scenario and UL configurations. The proponents responded that the proposed band combination is independent of Rel-18 UL Tx switching across 3/4 uplink bands in MC WI and this basket WI is based on Rel-15/16 core specifications and semi-static configuration of different UL configurations. In the moderator's view, the UL CA configuration provided in the table capturing the operators' requests seem quite clear, i.e., no 3/4 UL band configuration is proposed.

Apple commented on fallback mode. And CHTTL commented that the status of the next level fallbacks should be listed in the request table to make sure that the fallback combinations are available when the requested combinations are finalized. The moderator proposes the proponents check the availability of fall back mode. The fall back mode should be finalized no later than the proposed combinations.

Nokia commented on whether power class 2 and 3 apply to all the three configurations. CHTTL commented that according to previous guidance the scope of non-HPUE basket WIs should be limited to PC3. The proponents clarify that for SUL band combinations the power class follows the single band and PC2 has already been supported for some SUL band combinations. Huawei commented that PC2 and PC3 can be proposed together. But the proponent can compromise. The moderator would like to suggest the clarify the application of PC2 and PC3 for the proposed uplink configurations and keep the existing PC2 configuration for SUL combination and leave the new HPUE configuration to other WIs.

7.3 Intermediate Round

7.3.1 Comments & responses

Sub-topic 6-2: Comments and responses on the proposed objectives

In the intermediate round, the moderator proposes to focus on the objectives of this WI. The rapporteur have updated the objectives at https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/%5B98e-08-R18-RAN4-SpectrumRelated%5D/r223075.docx.

The modified objectives are proposed below.

————— Core part —————

The objectives of the core part are as follows:

- Specify the PC3, PC2 band-combination specific RF requirements for the listed CA configurations with dual SUL bands including at least
 - Applicable frequencies if necessary

- Applicable bandwidths and bandwidth sets if necessary
- Analyse combinations that have self-desensitization due to following reasons:
 - TX Harmonic and/or intermodulation overlap of receive band
 - TX signal overlap of receiver harmonic frequency
 - TX frequency being in close proximity of one of the receive bands
 - Any other identified reasons such that insufficient cross band isolation, harmonic mixing
- For the combination where self-desensitization exists, specify at least needed
 - $\Delta T_{IB, c}$ and $\Delta R_{IB, c}$
 - Reference sensitivity exceptions including MSD test cases
 - Exceptions to the out-of-band blocking requirement

The NR inter-band CA band combination configurations with dual SUL bands are defined in Table 1 below:

NOTE: the fall back combinations/configurations should be finalized no later than the proposed NR CA configurations.

Table 1: NR Inter-band CA with dual SUL bands

Table 17:

NR CA configuration	Uplink CA configuration	Power Class	contact name, company	Contact email	other supporting companies (min. 3)	status (new, ongoing, completed, stopped)
CA_SUL_n41A-SUL_n79A- n95A_SUL_n79A- n98A	ASUL_n41A- n95A SUL_n79A- n98A CA_n41A- n79A CA_n95A- n98A	PC2 applica- ble for n95 and n98 of SUL combi- nations; PC3 appli- cable for CA_n41A- n79A	Xiaoran ZHANG, CMCC	zhangxiao- ran@chinamobile.com	CBN, Huawei, HiSilicon	New
CA_SUL_n41A-SUL_n79A- n98A_SUL_n79A- n95A	ASUL_n41A- n98A SUL_n79A- n95A CA_n41A- n79A CA_n95A- n98A	PC2 applica- ble for n95 and n98 of SUL combi- nations; PC3 appli- cable for CA_n41A- n79A	Xiaoran ZHANG, CMCC	zhangxiao- ran@chinamobile.com	CBN, Huawei, HiSilicon	New

CA_SUL_n41A- n83A_SUL_n79A- n98A	ASUL_n41A- n83A SUL_n79A- n98A CA_n41A- n79A CA_n83A- n98A	PC2 applicable for n98 of SUL_n79A-n98A; PC3 applicable for other uplink configurations	Xiaoran ZHANG, CMCC	zhangxiaoran@chinamobile.com	CBN, Huawei, HiSilicon	New
CA_SUL_n41A- n83A_SUL_n79A- n95A	ASUL_n41A- n83A SUL_n79A- n95A CA_n41A- n79A CA_n83A- n95A	PC2 applicable for n95 of SUL_n79A-n95A; PC3 applicable for other uplink configurations	Xiaoran ZHANG, CMCC	zhangxiaoran@chinamobile.com	CBN, Huawei, HiSilicon	New
CA_SUL_n78A- n81A_SUL_n78A- n84A	ASUL_n78A- n81A SUL_n78A- n84A CA_n78C CA_n84A- n81A	PC2 applicable for CA_n78C; PC3 applicable for other uplink configurations	Lei GAO, China Telecom	gaol8@chinatelecom.cn	China Unicom, Huawei, HiSilicon	New
CA_SUL_n78A- n80A_SUL_n78A- n84A	ASUL_n78A- n80A SUL_n78A- n84A CA_n78C CA_n80A- n84A	PC2 applicable for CA_n78C; PC3 applicable for other uplink configurations	Lei GAO, China Telecom	gaol8@chinatelecom.cn	China Unicom, Huawei, HiSilicon	New
CA_SUL_n78A- n89A_SUL_n78A- n81A	ASUL_n78A- n89A SUL_n78A- n81A CA_n78C CA_n81A- n89A	PC2 applicable for CA_n78C; PC3 applicable for other uplink configurations	Basaier Jialade, China Unicom	basejld@chinaunicom.com	China Telecom, Huawei, HiSilicon	New

_____ Core part _____

_____ Perf. part _____

Specify the necessary performance requirements such as release independence in TS 38.307.

_____ Perf. part _____

Companies are invited to provide comments in the table below.

Feedback Form 48:

1 – QUALCOMM JAPAN LLC.

We are generally supportive of the updated WID, we would like to thank the proponents for taking into account our comments. It might be good to clarify in the WID through some note that operation with 2 SUL that are active simultaneously is not in scope. This might not be obvious from the CA combo denomination.

2 – China Mobile Com. Corporation

Thanks for momderator’s summary. We are fine with the note on fall back configurations:

NOTE: the fall back combinations/configurations should be finalized no later than the proposed NR CA configurations.

For the PC issues, in my view, except for n80, n81, n83, n84 related SUL configurations, other UL configurations support both PC2 and PC3 already. So I update the applicable PCs in the revised WID. Please find the revised v2 in:

https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/%5B98e-08-R18-RAN4-SpectrumRelated%5D/r223075_v2.docx

To Qualcomm: Thanks for your support. Since the 2 SUL CA are removed from the UL CA configurations, I think it is quite clear that this is not within the scope, right?

3 – Apple (UK) Limited

We would like to follow up with our question in first round discussion that n78C should be the configuration for the proposed intra-band CA with dual SUL such as CA_SUL_n78A-n89A_SUL_n78A-n81A since CA_n78C is specified as one of the UL configuration. It is not clear to us why Huawei commented ”we didn’t see n78C in the band combination proposal” and China Telecom commented ”There is no SUL_n78C-n81A or SUL_n78C-n89A in the requested combinations”? Shouldn’t SUL_n78C-n81A and SUL_n78C-n89A be the fallback combinations of CA_SUL_n78A-n89A_SUL_n78A-n81A? Please clarify.

4 – Nokia Japan

After seeing response from CMCC, ”UL configuration CA configuration” in table 1 must not be true. Configuration is e.g., CA_SUL_n41A-n95A_SUL_n79A-n98A apart from how it is notated, and UE can use only one of SUL_n41A-n95A, SUL_n79A-n98A, CA_n41A-n79A at a given time, right?

If the above is the intention, the table may look confusing and clarification is needed, though the table notation things can be discussed in RAN4. Still at least it’s better to make sure what we are going to specify with more clarification in the WID.

5 – Apple (UK) Limited

Thanks to Nokia for raising this question. We also had the same question in the first-round discussions. It is also our understanding that only one pair of UL configuration can be configured at a given time. To use the other UL pairs, UL reconfiguration would be required.

6 – China Mobile Com. Corporation

To Nokia and Apple: only one UL configuration can be configured at a given time, shouldn't this be a common understanding? I checked the band combinations in other basket WIs, the UL configurations are listed in the column and no special clarifications are added.

7 – China Mobile Com. Corporation

To Nokia and Apple: only one UL configuration can be configured at a given time, shouldn't this be a common understanding? I checked the band combinations in other basket WIs, the UL configurations are listed in the column and no special clarifications are added.

8 – Huawei Technologies France

We support the further revised WID by CMCC, which is clear for the supported power class for the UL configurations.

To Apple's comments, we think SUL_n78C-n81A and SUL_n78C-n89A are not the fallback combination of CA_SUL_n78A-n89A_SUL_n78A-n81A though those could be possible configurations, since they are not requested by the operators. For each SUL band combination there is a n78 carrier, but n78 CCs are in different cells, thus for NUL, there could be n78C intra-band configuration.

Regarding comments for UL configuration to be configured at a given time, there are a lot of cases with more than one UL configuration for inter-band CA in current TS 38.101-1 5.5A.3. We don't have ambiguity for the cases in the existing spec, similar principle is also applicable for the UL configurations proposed in this WID.

9 – CHTTL

Normally the information of "Supported next level fallback modes including initial status when requesting (in DL and UL)" is provided in the request table.

In addition, the "BCS" table is also provided which we missed to comment in the first round. (*sorry about it)

Note that such information is also provided in the NR_SUL_combos_R18 baskets.

So once the proposed configurations are stable, probably those information also can be further provided in the WID?

10 – China Telecom Corporation Ltd.

Response to Apple comment (Comment #3):

Taking CA_SUL_n78A-n89A_SUL_n78A-n81A for example, in the WID, the requested UL configurations are SUL_n78A-n89A, SUL_n78A-n81A, CA_n78C, i.e., SUL_n78C-n81A and SUL_n78C-n89A are not included as UL configuration.

So, for the fallback combination, from the uplink aspect, SUL_n78C-n81A and SUL_n78C-n89A are also not be included.

Response to Nokia comment (Comment #4):

In the existing spec for 4-band CA (section 5.5A.3.3 of TS 38.101-1: Configurations for inter-band CA (four bands)), the same way as in the WID is used, and we don't see any ambiguity here.

Response to CHTTL comment (Comment #9):

We can add the BCS table in the next round.

11 – Ericsson LM

Thanks for the revised proposed WID. We understand that the revised table intends to remove the CA with 2 SUL, however, the objective still mentions ”.. CA configurations with dual SUL bands including at least..”

Also, the changes using ”SUL cell” or ”dual SUL cells”, create confusion.

It seems the information that addresses controversial issues are in the table. It should be also reflected clearly in the text (titles, justifications and objectives) to avoid any unnecessary discussions in different working groups. Therefore, we suggest to remove ”dual SUL bands/cells” from the WID (including title).

12 – Nokia Japan

To CMCC, then, spec is broken. Your logic builds on the assumption that the existing spec is right. You commented that ”Take CA band combination CA_SUL_n41A-n98A_SUL_n79A-n95A as an example, uplink can be transmitted on one of the four uplink carriers if this CA band combination is configured to UE”. Then, configuration is always CA_SUL_n41A-n98A_SUL_n79A-n95A.

13 – China Unicom

We support the revision provided by CMCC.

If there is any other comment on the modification of title and justification of the revised WID, please provide comments in the table below.

Feedback Form 49:

Sub-topic 6-3: Comments and responses on impacted/new specifications and target completion date & time budget

Issue #6-3-1: According the submitted WID, the target completion date is December 2023 (RAN#102) for both Core and Perf. parts. Can we agree on the proposed target dates?

Issue #6-3-2: Include internal TR in WID. Can we agree on it?

Issue #6-3-3: The following specifications should be listed as the impacted spec. Can we agree on the list?

Table 18:

Impacted existing TS/TR <i>{One line per specification. Create/delete lines as needed}</i>			
TS/TR No.	Description of change	Target completion plenary#	Remarks
38.101-1	Add NR CA combinations with dual SUL bands	#102	Core part
38.307	Add release independent requirements for NR CA combinations with dual SUL bands	#102	Perf. part

Companies are invited to provide comments for Issue #6-3-1~#6-3-3 in the table below.

Feedback Form 50:

Sub-topic 6-4: Whether to have separate WID or merge it to the existing WI of NR_SUL_combos_R18

MCC commented offline and questioned if the new proposal can be merged into the existing WI of NR_SUL_combos_R18. Companies are invited to provide comments on it in the table below.

Feedback Form 51:

1 – China Mobile Com. Corporation

In our view, this is better to be separate. Even though existing NR_SUL_combos_R18 does not restrict the number of SUL bands. But CA with two SUL cells is new proposal in RAN4. The notations and how to write the band combinations need to be discussed and may not follow existing approach.

2 – Huawei Technologies France

The existing SUL basket WI including both SA and NSA, while the new proposal from operators is targeted for SA. In addition, different power classes are considered in the new WI proposal, which is different from the SUL basket WI.

3 – China Unicom

We support to have a separate WI for reasons mentioned in comments above. The potential deployment of proposed combinations are targeted for 5G SA network, and with different UL power classes.

4 – China Telecom Corporation Ltd.

We prefer a separate WI for the 2-SUL band combinations.

The existing NR_SUL_combos_R18 WI was firstly proposed in Rel-16, and then extended to Rel-17 and Rel-18 to accommodate new band combinations from operators and only covers band combinations with single SUL band.

5 – Ericsson LM

Thanks for the updated WID (ver2) and for removing the dual SUL band combos.

However the WID still contains dual SUL bands/cells, which will cause confusion. So we suggest to remove dual band/dual cell in the WID as shown below our proposed updates:

Title: NR CA band combinations with ~~dual-SUL~~ cells in Rel-18

Acronym: NR_CA_R18_~~dual-SUL~~

- Specify the PC3, PC2 band-combination specific RF requirements for the listed CA configurations with ~~dual-SUL bands~~ including at least

- The NR inter-band CA band combination configurations with ~~dual-SUL bands~~ are defined in Table 1 below:

6 – CATT

We support to have a separate WI since it is a new proposal and needs to consider the different aspects from the existing single SUL band combination. For the WID title, we understand it would be better to keep "dual SUL" to reflect the character of the CA configuration and avoid confusion with the existing R18 SUL band combos WI. But have no strong view.

7 – Huawei Technologies France

To Ericsson's comments, we didn't see confusion for the updated WID. Dual cell with SUL in each cell is proposed in the WID, which is an obvious difference with combinations proposed in the existing SUL basket WI. In our view, removing dual SUL will cause confusion and ambiguity indeed.

7.3.2 Summary

Most part of the proposed objectives in the intermediate round are agreeable. The remaining issues which need more discussions include

- Combinations with n78C as fallback and check the fallback mode.
- Clarification about “UL CA configuration” notation in Table 1
- Whether Dual SUL cells should be changed.

Encourage companies to have further discussions on those issues. The moderator suggests to check the availability of fallback combinations with n78C for the newly requested band combinations. For UL CA configuration, can we change it to UL CA configuration or SUL configuration? Regarding whether Dual SUL cells should be changed, companies need more discussions in the final round.

The proposed target completion date is agreeable. The internal TR should be included. And the list of impacted specifications is agreeable.

Regarding whether to have separate WID or merge it into the existing WI of NR_SUL_combo_R18, 7 companies made the comments. Companies thought that the CA with two SUL cells is new such that the notation of such band combination may need discussions, the different power classes are included and only SA mode is considered, which are different from the existing WI of NR_SUL_combo_R18. So 6 companies proposed to have a separate WI.

7.4 Final Round

7.4.1 Comments & responses

The remaining issue needs to be further check is whether to keep dual SUL cells in the WID.

Questions for issue #6 in the final round

- Can the wording of dual SULcells be kept in the WID?

Feedback Form 52:

1 – China Telecom Corporation Ltd.

We should keep the “dual SUL cells” in the WI title. Otherwise, how can we differentiate this WI with the existing one covering single SUL cell? or does it mean operators can also add band combinations with more than 2 SUL cells under this WI in the future?

For other RAN4 CA/DC basket WIs (without SUL band/cell), adding the number of bands in the WI title is a usual approach to differentiate different WIs.

Technically, we also don’t understand what’s the issue by using “dual SUL cells”.

2 – China Mobile Com. Corporation

We agree with China Telecom that if we remove the dual SUL cells and use NR_CA_R18_dual-SUL, then it is the same as existing SUL basket WI. And dual SUL cells is revised from dual SUL bands, since simultaneous transmission of 2SUL band is not included. In the proposed band combination, it is clear that there are two SUL cells, so we do not see any confusion.

3 – CATT

Support to keep dual SUL cells in the WID.

4 – QUALCOMM JAPAN LLC.

It would be useful not to use "dual SUL" since it can create confusion. It could also mean that a cell has NUL and two SULs configured to it.

Also, we should add a note to the WID that two SULs cannot be configured at the same to avoid any confusion

5 – Huawei Technologies France

We support to keep dual SUL cells in the current WID, which shows difference with the existing Rel-18 SUL basket WI. Agree with China Telecom that clear indication of supported bands is the usual way adopted for many basket WIs. If companies think there is no need to limit the SUL to two cells, we suggest to use multi-SUL cells instead.

6 – China Unicom

We support to keep the "dual SUL" term in the WID, which accurately reflects the characteristics of the proposed band combinations in the objective part.

7 – China Mobile Com. Corporation

To Qualcomm: we would like to clarify that it is "dual SUL cells" not "dual SUL bands". Also there is no cell with one NUL and two SULs from RAN1/2 perspective. So we do not think there will be any confusion. If companies do not like the word "dual", can we say **CA band combination with multiple SUL cells**?

And regarding the proposed Note, the 2 SUL band combinations are already removed. We think it is already clear enough.

8 – China Mobile Com. Corporation

In order to make progress and compromise, maybe we leave the WI title as it is, i.e. **NR CA band combinations with dual SUL cells in Rel-18**. Meanwhile, add a note2 in the objective part as follows:

NOTE 2: No simultaneous transmission on the two SUL bands according to Table 1(the configuration table).

I upload a new version to add the note, companies please check:

https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/%5B98e-08-R18-RAN4-SpectrumRelated%5D/223075_v5_rm_CTC_CMCC.docx

9 – Ericsson LM

Thanks to CMCC for the clarification. Based on the proposed Note 2, we have question for clarification:

- Does it mean the UE can still switch between 2 SUL bands.
- If the above is correct then does it mean that the UE can be simultaneously configured with 2 or more UL configurations involving different SUL bands. As an example can the UE be configured with both of these at the same time but will transmit using one of them at the same time?

- SUL_n41A-n95A

- SUL_n79A-n98A

10 – China Mobile Com. Corporation

To Ericsson: As we explained, this band combination proposal is independent of Rel-18 feature. In our view, UE cannot be configured with more than one UL configurations at the same time and transmit using any one of them at the same time. To be specific to your example, with the added note, no simultaneous transmission on the two SUL bands, I think this should be clear.

11 – China Telecom Corporation Ltd.

Response to Ericsson:

The new band combinations in the WI and Rel-18 feature are separate discussions.

The situation is the same with 4 bands CA configuration. For one CA configuration with 4 bands, e.g., CA_n1-n2-n3-n4, the UL CA configuration can be CA_n1-n2, CA_n3-n4, and others. This CA configuration is introduced based on Rel-15 RAN1/2 specification, and is discussed separately with the Rel-18 feature.

Nothing new with the 4-band configuration containing 2-SUL cells here.

Please companies check the latest version of WID at

https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/%5B98e-08-R18-RAN4-SpectrumRelated%5D/revise%20RP-223075_v2.docx

Please the proponents inform the group if the further revision is uploaded. And please make comments in the table below, if any.

Feedback Form 53:

1 – China Mobile Com. Corporation

https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/%5B98e-08-R18-RAN4-SpectrumRelated%5D/revise%20RP-223075_v2.docx

I further update the WID, the changes are:

1. change the "SUL bands" to "SUL cells" in the objective part.
2. remove the last band combination based on the intermediate comment
3. A excel is provided to capture the BCS and other detailed information of the requested band combinations. Companies please check

4. TU sheet is provided. Companies please check.

2 – China Telecom Corporation Ltd.

Thanks CMCC for the further updated WID.

We slightly updated the WID and the BCS table in:

https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/%5B98e-08-R18-RAN4-SpectrumRelated%5D/V223075_v4_rm_CTC.docx

https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/%5B98e-08-R18-RAN4-SpectrumRelated%5D/V22XXXX%C2%A0New%C2%A0WID%C2%A0NR%C2%A0CA%C2%A0band%C2%A0combinations%C2%A0with%5B18_r3_CTC.xlsx

For the WID:

In Table 1, following moderator’s suggestion, changed “UL CA configuration” to “UL CA configuration or SUL configuration”.

For the BCS table:

Updated the CBW for n80 and n84, according to the CBW in the corresponding fallback configuration.

3 – CHTTL

Thank you CMCC and China Telecom for the consideration and the updated excel. The excel format looks good, and probably the subclass can be further discussed in RAN4.

One minor question that if the complete information of the configuration table is provided in the excel sheet. Does the table in the WID still need to be maintained?

8 Topic #7: New WIs related to 2Tx/3Tx and 4Rx

8.1 Companies’ contributions summary

Table 19:

TDoc	Title	Source	Type	AI
RP-223026	Motivation of low band enhancement for handheld UE	OPPO	discussion	9.1.5
RP-223029	R18 New WI on low band enhancement for handheld UE	OPPO, China Telecom, China Unicom, CMCC, NTT DoCoMo, Orange, Telecom Italia, T-Mobile USA, Vodafone, Verizon	WID new	9.1.5

RP-223260	New WID on 4Rx support for NR FR1 bands in Rel-18	ZTE, Sanechips	WID new	9.1.5
RP-223361	Motivation for HPUE with simultaneous 2Tx and 3Tx	Apple	discussion	9.1.5
RP-223362	Rel-18 New WI on HPUE with simultaneous 2Tx and 3Tx	Apple	WID new	9.1.5

8.2 Sub-topic #7-1 New WI on low band enhancement for handheld UE

8.2.1 Initial round

8.2.1.1 Comments & responses

Sub-topic 7-1-1: Any question or comment on the motivation and justifications of the proposal?

Companies are invited to provide the general comments, including comments on the motivation, justification part, whether the WI is needed, how to handle the work, in the follow table.

Observation 1: In low frequency bands, handheld UE only support 1T/2R in current RAN4 spec.

Observation 2: Low frequency bands have smaller CBW/spectrum and less UL/DL MIMO layers compare to mid/high bands which makes the throughput is low.

Observation 3: The feasibility of implementing 4 low band antennas in handheld UE is questioned in the past.

Observation 4: For the commercialized n28 4Rx smartphone, the antenna efficiency can be achieved with good performance, and OTA improvement is about 2.5dB.

Observation 5: For the commercialized n28 4Rx smartphone, the antenna correlation and isolation can be kept within normal antenna design targets.

Observation 6: For the commercialized n28 4Rx smartphone, field test shows big improvements comparing to existing 2Rx UE especially in cell edge and extreme conditions.

Proposal 1: It is proposed to introduce 2Tx (UL MIMO) with PC3/PC2 and 4Rx for handheld UE in low frequency bands.

Feedback Form 54:

<p>1 – T-Mobile USA Inc.</p> <p>We support Proposal 1.</p>
<p>2 – Telstra Limited</p> <p>Support proposal 1</p>
<p>3 – Verizon UK Ltd</p> <p>We support proposal 1!</p>
<p>4 – Bell Mobility</p> <p>Support proposal 1</p>
<p>5 – China Telecom Corporation Ltd.</p> <p>Support Proposal 1.</p>
<p>6 – QUALCOMM JAPAN LLC.</p> <p>We support this proposal, it will need to be clarified what exactly is needed in the specifications. 4Rx is already introduced for some low bands with a note that FWA form factor is targeted</p>
<p>7 – Guangdong OPPO Mobile Telecom.</p> <p>To Qualcomm question:</p> <p>In the WID it clarifies that at least delta Rib for 4Rx needs to be re-evaluated, since the frontend/antenna assumptions for it would be different from FWA form factor.</p>
<p>8 – Apple (UK) Limited</p> <p>1. In our view, even 4Rx for LB has only been specified for FWA, it does not really prevent handheld UE from supporting it as there is no signaling to differentiate handheld UE and FWA. On the other hand, ΔRIB_{4R} has already been specified for n8, n28, and n71. We do not think the value would be different between handheld UE and FWA from conductive requirements perspective, and same for n5. Therefore, for introducing 4Rx support for existing NR bands, a basket WID as proposed by ZTE may be sufficient.</p> <p>2. For LB 2Tx, it is likely no new requirement is needed for PC3. And for PC2, the requirements for the intended bands (n5, n8, n28, n71) can be fully covered by the existing PC2 FDD band WID. Once the PC2 with 2Tx requirements are specified for these bands, they can be easily added to the UL MIMO support band list in the specifications. Therefore, in our view, this objective is already included in the Rel-18 basket WID for PC2 FDD bands.</p>
<p>9 – vivo Communication Technology</p> <p>The discussions on UL MIMO and 4Rx should be separated. In our understanding, there are already two on-going spectrum WIs that are related and at least partially overlapped with these scopes.</p> <p>First is High power UE (power class 2) for NR FR1 FDD single band (RP-222967), in which low FDD bands including n5/n8/n28/n71 are already included to study PC2 requirements, including both 1Tx/2Tx architecture. The 2Tx requirements here would actually also applicable to UL-MIMO case based on previous</p>

experience. Second one is introducing new bands support 2Tx UL MIMO (NR_bands_UL_MIMO_R18 RP-223352), in the WID, n28 UL MIMO has already been introduced for PC3, with the restriction for FWA form factor. In this condition, we think evaluate and extending the current WI scope may be more appropriated even it is deemed necessary, and do not think a new WI to do the same thing is needed.

So, for 2TX UL MIMO, we do not think new WI is needed in Rel-18.

Then, regarding 4Rx, first of all it is quite clear that the 4Rx supporting n8/n28/n71 in 38.101-1 Table 7.3.2-2 is for FWA form factor. If RAN4 introduce 4Rx for smartphone UE, then some generic requirements should be defined first, we believe this working scope belongs to **NON-Spectrum proposals**.

In addition, we perform some measurement of a smartphone formfactor supporting 4Rx n28, to study the correlation and efficiency of low band.

We performed the ECC measurement to evaluate the antenna correlation between different antenna pairs at band n28, with the following results:

Table 1. Average ECC results between respective antenna pair measured under Free Space condition

N28 Antenna Pairs

- 4_3 ECC 0.5~0.8
- 4_2 ECC 0.3~0.5
- 4_1 ECC 0.3~0.5
- 3_2 ECC > 0.8
- 3_1 ECC > 0.8
- 2_1 ECC > 0.8

It should be highlighted that some **ECC values** are larger than 0.5, **even above 0.8**, from antenna performance perspective, the spatial correlation between the antenna element is very large, then the corresponding gain for throughput would be limited. Based on the above measurements, we believe the low band 4 antenna performance within a smartphone formfactor **can NOT be kept within normal antenna design targets** (i.e. 0.5 ECC).

Furthermore, we also perform the antenna efficiency measurements, as shown in table below

Table 2. Rx Antenna Efficiency (FS) for different antenna (dB)

- Antenna#3 Efficiency (FS) -8 ~ -6**
- Antenna#4 Efficiency (FS) -10 ~ -8**
- Antenna#1 Efficiency (FS) -10 ~ -8**
- Antenna#2 Efficiency (FS) <-12dB**

As shown in table 2, some values of the antenna efficiency range are below typical UE performance, which may not bring clear Rx performance gain.

In our understanding, one of root cause of the high correlation between antenna pair is low frequency. Spatial diversity gain of high correlated antenna pairs will certain decreased. On the other hand, we also observe the improvement room for antenna efficiency are still existed by designing dedicated antennas for low frequency. In other word, in consideration of performance gain, it is not clear whether increasing number of receiving antenna is better design choice comparing with increasing the antenna efficient of existing 2Rx architecture.

In short, we believe 4Rx for smartphone is non-spectrum topic and It is premature to consider the Low Band 4Rx in Rel-18.

10 – Guangdong OPPO Mobile Telecom.

To Apple comment:

1. Regarding the necessity of specifying a feature in 3GPP or purely based on UE implementation and no spec for it, we may prefer to define it in 3GPP to have better inter-operability between UE and NW. Though FWA is defined in 3GPP for the low bands, but as we all known, FWA is not a very popular and not even mobile devices, many countries, and operators even don't consider/use this kind of UE in their NW deployments. Therefore, the spec supports FWA doesn't mean is enough for handheld UE. If this can be applied, then there is meaningless to mandatory 4Rx in high TDD bands while keep 2Rx optional for vehicular UE, since NW cannot differentiate them then any handheld UE can implement 2Rx in these 4Rx mandatory bands. Apparently this should not be the case.

Then regarding the delta-Rib, it is too early to say the FWA can be applied to smartphone. The RFFE and formfactor restriction may have some impact to it based on the feedbacks received from some companies in the pre-meeting discussions. And in our view, this kind of low band general issues should be discussed dedicatedly rather than put them in a basket. After general issues solved probably basket can be considered.

2. For the UL MIMO part, it is not complex one, and before drafting the WID proposal, we have done some offline checking with the potential overlapping/impact baskets and its rapporteurs. The status is that these baskets were not intended to handle low bands for handheld UE since it even didn't introduced in general.

11 – Guangdong OPPO Mobile Telecom.

To vivo comment:

1. About the UL MIMO, similar reply as to Apple. And additionally, UL MIMO basket is now only covers the FWA in low bands.

2. About the low bands 4Rx, it is interesting comment, and some feedback below:

- This WI is for low band enhancement, how this is not a spectrum related issue even there is general evaluation for low bands?
- For the evaluation results, thanks for providing these data. As discussed before meeting, we may have different view on this but we respect your view on the feasibility of 4Rx. This shouldn't be used to prevent good UE to support the optional 4Rx capability. Our real commercial UE test results in the lab/field can be found in RP-223026, hope this could help for better understanding.

12 – Nokia Japan

For UL MIMO, given that band specific requirements are only Tx/D related ones (meaning that once PC2 single FDD band requirements for a band are ready, only what we need to do is put the band in UL MIMO output power table), we tend to agree with using PC2 FDD single band WI by extending the scope.

For 4Rx, apart from delta RxIB, 4Rx, we need clarification on handling delta TRxSRS. Do we define the same requirements for delta TRxSRS up to 4Rx regardless of UE types? If the answer is yes, only what we need to do is delta RxIB value for smartphone. And what we need to do values and frequency boundary where different values are applicable. Then, it may not be a basket WI. It's noted that currently, we have not differentiated the value in terms of UE types, i.e., smartphone or CPE for up to txry (y is up to 4). Now we have 8Rx where we have an agreement that "define one set of 8Rx requirements for CPE/FWA/vehicular/industrial devices. It doesn't say anything about smartphone. And in 8Rx discussion, we are focusing on value assuming CPE device. That is why aforementioned question arised.

13 – Samsung Electronics Co.

In our understanding, 2Tx and 4Rx feature can help the LB performance of the handheld device only if a UE support the limited bands or layers currently. We have to understand what a good UE supports advanced features, and how many bands and MIMO layers are supported in the UE before saying that the proposed features are beneficial. Looking at the motivation/justification part, we see nothing about the impact to legacy performance with bands, band combinations nor other RATs. The impact would be inevitable unless an operator has LB only, or the device only supports NR FR1 because of the LB characteristic and size limitation by the regulatory requirement (e.g., SAR). We do believe that there would be limited market demand given the trade-off with legacy performance of other bands having larger bandwidths and user experience.

Therefore, even if there is indeed system benefit and market demand, RAN4 at least needs further study of its feasibility and benefit based on such provisional trade-off in the future.

14 – Guangdong OPPO Mobile Telecom.

To Nokia: Thanks for your comments. Regarding the delta SRS IL, the discussion in 8Rx is based on CPE/FWA form factor at least in our evaluations for example the trace loss difference between antennas, etc. For handheld UE, probably smaller trace loss can be applied, but meanwhile more bands are supported by handheld UE which makes the RFFE are more complex, whether the same or different values can be applied is FFS.

For the 4Rx, in Rel-15 we also provided evaluations but it was based on n78 and n79, the impact of low bands was not considered since no handheld UE support 4Rx at that time. How to treat the low bands with 4Rx in delta SRS IL aspect probably need more evaluation from UE architectures.

15 – Guangdong OPPO Mobile Telecom.

To Samsung: Thanks for your comments. The test results are from our commercial smartphone, which means all the bands' OTA performance have already passed the certifications.

16 – China Mobile Com. Corporation

We support proposal 1 to define 2Tx/4Rx for low band smart phone.

17 – China Unicom

We support proposal 1 to introduce 2Tx (UL MIMO) with PC3/PC2 and 4Rx for handheld UE in low frequency bands.

18 – Meta Ireland

It is depend on how many bands of LTE/NR are supported in smart phone device. We are same view with Samsung and vivo for 2Tx in low frequency band. Also current 4Rx feasibility is for FWA device not to the smartphone type UE due to the different formfactor. Currently RAN try to not to increase the workload

each RAN WGs. This is quite to burden study the feasibility according to real measured data (e.g. space correlation coefficient and T-put benefits in low band) from interested companies. we prefer to study in Rel-19 for 2Tx or 4Rx WIs in lower band.

19 – ZTE Corporation.

1) For UL MIMO with PC3, this is somehow overlapped with Rel-18 UL MIMO from our understanding. However with the clarification from OPPO, it seems that Huawei led Rel-18 UL MIMO is targeted for FWA, we would like to know where we have such kind of declaration or restrictions in the WID.

2) For UL MIMO with PC2, we think that this would proceed with FDD PC2 WID firstly.

3) For 4Rx part, as mentioned by other companies, this might be overlapping with basket 4Rx WID RP-223260. In the current request for the support of 4Rx in certain bands in the basket WID, whether it's for FWA device only or no limitation, this should be clarified during the request. In other words, the current agreeable objective didn't preclude the smartphone to be considered in this WID. However if RAN/RAN4 could make the consensus to split the discussion for 4Rx in FWA and smartphone for less than 1GHz in the different WIDs, the companies should be clear where to request 4Rx to be supported in certain bands. If necessary, we could also do the adjustment based on RAN/RAN4 agreement.

20 – VODAFONE Group Plc

We support proposal 1

21 – NTT DOCOMO INC.

We support proposal 1

22 – Huawei Technologies France

As rapporteur company for Rel-18 UL MIMO bands, we'd like to clarify that the WI is not limited to FWA. From Rel-17, there were bands studied in the WI without any limitation. Specifically for n28, it was added in Rel-17 WI targeted for handheld UE, but due to limited time to complete the study and concern by some companies, the band is moved to the Rel-18 with limitation for FWA. But clearly, the WI is generic for different UE types. And both PC3 and PC2 are considered in the WI objective. We see there some overlapping for the proposed WI and existing WIs, where to have the study for these lower frequency bands if agreeable can be further discussed and clarified.

23 – Ericsson France S.A.S

Regarding the 2TX, as commented by other companies for PC2 it can be captured in the FDD PC2 WID in principle. Regarding 4RX for smartphone, if it is straightforward and similar to FWA then it could be added to the basket. Otherwise if a smartphone has different characteristics that need studying then the SI would be non-spectrum. Same comment if 2TX for smartphone would differ from the existing WI scope. In principle we are OK with these features, but we need to take care of RAN4 workload. We note that both topics were considered during the RAN4 package discussion but not adopted at that time.

24 – Google Inc.

Similar to Vivo, Samsung and Meta. In our understanding, it is challenging for UE to have more antenna space for additional low band 2Rx when supporting both FR1 and FR2 simultaneously. If reuse existing band antenna(such as MHB or UHB) to support the additional low band 2Rx, it would also impact the legacy bands performance. We think it is premature to consider the low band 4Rx for handheld UE in Rel-18.

25 – Sony Group Corporation

We share similar view as Vivo, Samsung, Meta and Google that some study on the feasibility of supporting 4Rx would be needed, which may lead to a non-spectrum related SI as commented by Ericsson.

26 – Beijing Xiaomi Mobile Software

Generally we are ok with the proposal, but share the simialr concern as Ericsson.

Observation 7: UE with 2PAs in mid/high frequency band, but when it is configured with inter-band combination, then only one PA is activated in mid/high band, the total UL throughput is degraded due to total BW becomes smaller.

Observation 8: UE with 2Tx in one SIM, but when two SIMs are activated then there is only 1Tx per SIM which leads to performance degradation for each SIM.

Observation 9: When limit the 3Tx scenario to “1Tx @low band + 2Tx @mid/high band with each band 1CC and the total power PC3 or PC2 or PC1.5”, the spec impact was analyzed and believed no spec impact, however, no consensus on this.

Proposal 2: It is proposed to introduce the 3Tx capability with limitation of “1Tx @low band + 2Tx @mid/high band with each band 1CC and the total power PC3 or PC2 or PC1.5”.

Feedback Form 55:

1 – T-Mobile USA Inc.

We support Proposal 2.

2 – Telstra Limited

Support proposal 2

3 – Verizon UK Ltd

We support proposal 2 for FWA devices!

4 – Bell Mobility

Support proposal 2

5 – China Telecom Corporation Ltd.

Support proposal 2. To our understanding, this proposal is for handled UE as well.

6 – QUALCOMM JAPAN LLC.

We are supportive of further advancing UE features, however, it should be clarified what needs to be done in the specifications.

7 – Guangdong OPPO Mobile Telecom.

To Qualcomm question:

The 3Tx band combinations listed in the WID are especially for low band 1Tx + mid/high band 2Tx, and for this kind of band combination the spec changes would be small as long as the total power class is already defined in the spec. So the changes will be to add reference of UL MIMO/TxD requirements to current inter-band UL CA/EN-DC requirement clauses where currently it only refers to single port requirements.

However, if new features added to the 3Tx for example new power classes, or higher powers, then the spec change would be more than that.

8 – Apple (UK) Limited

We in general support this objective. On the other hand, if we can focus on the 2-band 3Tx concurrent operation for UL enhancement without including the above LB enhancement objective, the 3Tx feature would not be constrained by the need to always have one LB in the combination.

9 – vivo Communication Technology

The 3Tx related proposals have been discussed as a non-spectrum related topic and dropped based on RAN chair guidance in the endorsed RP-220068, after several rounds of RAN-P meetings.

In our understanding, **3Tx is a new UE feature and architecture not discussed in RAN4, this should be a non-spectrum topic**. Most importantly, RAN4 shall follow the clear boundary between spectrum related topic and non-spectrum related topics.

In short, 3Tx proposal is a **non-spectrum topic** and has been dropped in Rel-18 after many discussions. Especially, it is well understood **R18 schedule is quite tight**. As proposed by many operators in R18 timeline discussions we suggest not to upscoping Rel-18 workload for any non-spectrum related topics and further consider it maybe in future release.

10 – Guangdong OPPO Mobile Telecom.

To Apple: Thanks for your comment, and we understand the 3Tx power that it can bring, however, the reason to make the proposal focus on the low band + mid/high bands in this version can be found in vivo comments.

11 – Guangdong OPPO Mobile Telecom.

To vivo: The 3Tx proposal here in the WID is cutted much from the original 3Tx considering the limited TUs and RAN4 work loads. Now it is focused on low bands and its band combinations which is spectrum centric issue rather than a general feature for all bands/band combinations. We understand the Rel-18 schedule issue thus in the WID we were not intended to make this proposal big and long.

12 – Samsung Electronics Co.

Some observations are saying that 3Tx working simultaneously is not precluded in current spec, which implies 2Tx requirement could be reused and the spec impact with 3T introduction is minimal. However, when it comes to the practical UE implementation, it definitely needs more consideration on the device heat, battery consumption, space limitation, antenna isolation from our understanding. As of now, we have not seen anything about them for handheld UE.

Perhaps introducing 3Tx for FWA is more practical as commented by Verizon.

13 – Nokia Japan

We support the direction while we are open to discuss the necessity of a new WI. RAN4 specs have defects. Though we agree with OPPO's comment, e.g., clarification on inter band UL CA is needed. This, however, is not only applicable to dual UL. The current spec doesn't have requirements for DL CA with TxD or UL MIMO since it just refers to Table 6.2.1-1 only...If we fix all the defects, we expect that we can get what we want in the end. Or even more, e.g., 2Tx@band A + 2Tx@band B even will be possible. In any case, we think that what we need to do is at most some clarification if any, but it may not be very specific to this objective. Overall, we support the direction, but it may be better to take a step back and see the whole picture on what the current specifications are missing.

14 – China Mobile Com. Corporation

We support proposal 2.

15 – LG Electronics Deutschland

We are fine with Proposal 2 but as commented by other companies, it is our understanding that spectrum WI should not have a general UE TRX RF task but band or band-combination-related tasks with dTib/dRIB in the core. So it seems necessary this aspect needs to be clarified.

16 – China Unicom

We support proposal 2.

17 – Meta Ireland

The simultaneous 3Tx can be supported in inter-band CA/DC. However, RAN also need to consider the device battery consumption and heating problems to support 3Tx operations in smart phone device. So the 3Tx shall focus on the FWA/CPE/Vehicular devices as mentioned Samsung and Verizon.

18 – ZTE Corporation.

Regarding the proposals to focus on 3Tx on FWA device, we might need more discussion for it since this is totally new proposal mentioned by companies' comments. We need to respect the commercial market demand firstly as proposed by chairman.

19 – VODAFONE Group Plc

We support proposal 2

20 – Ericsson France S.A.S

We are generally OK and supportive for 3TX in 2 bands. However, it would be good to clarify the spec impact. If it can be introduced with relatively minor changes, similar to FWA then it could be merged with the following proposal. IF more study is needed or more power class work then although we support, we are concerned about adding more RAN4 workload, which is really non-spectrum.

21 – Huawei Technologies France

We are ok with proposal 2 to introduce 3Tx with two bands. Given concern from some companies for the handheld UE, we are fine to study FWA UE type in Rel-18.

22 – NTT DOCOMO INC.

We support proposal 2.

But if companies have concerns on real implementation perspective, one way is to differentiate the discussion for PC3/2 and PC1.5. A smaller power class has less impact on UE heating and power consumption issue. And spec impact and technical analysis may be also different between PC3/2 and PC1.5.

23 – Google Inc.

Similar to Samsung and Meta. For handheld UE, it needs to consider more about thermal issue and battery consumption for 3Tx. Support 3Tx should focus on the FWA/CPE/Vehicular devices.

24 – Sony Group Corporation

In general, we are okay with 3Tx for FWA application. However, there seems to be some ambiguity between spectrum and non-spectrum WI here, which we would like to get some clarification first.

25 – Guangdong OPPO Mobile Telecom.

To google:

Thanks for the comments. as UE vendor, we also concerns about the thermal issue or battery consumptions but our understanding is that this is pure UE implementation specific issues can be carefully considered in implementation which might not prevent all UEs to support 3Tx.

26 – Guangdong OPPO Mobile Telecom.

To Sony:

Thanks for the comments. This is for spectrum since this is for dedicated low frequency bands not general feature for all kinds of bands/band combinations.

Sub-topic 7-1-2: Comments and responses on the proposed objectives

The following objectives are proposed in the WID.

————— Core part —————

The objective of this work item is to enhance handheld UE performance.

1. Enhancements for single low frequency band (<1GHz)

- Study and specify requirements for UE with 4Rx antennas, e.g. delta $R_{IB,4R}$
- Study and specify requirements for UE with PC3 or PC2 UL MIMO
- Low frequency bands include n28, n8, n5, n71

2. Enhancements for Low FDD band (<1GHz) + Mid/High TDD band combinations

- Two bands with inter-band UL CA or EN-DC are considered with below limitations:
 - In each band only 1CC included

- The Tx capability considered is 1Tx in FDD band, and 2Tx UL MIMO/TxD in TDD band
- The following power capabilities will be considered
 - PC3 low FDD band 1Tx + PC2 mid/high TDD band 2Tx, total power class is PC2 or PC2 with increased power capability
 - PC3 low FDD band 1Tx + PC1.5 mid/high TDD band 2Tx, total power class is PC1.5
 - PC3 low FDD band 1Tx + PC3 mid/high TDD band 2Tx, total power class is PC3 or PC2
 - Study and if necessary clarify/specify applicable UE RF requirements
 - Introduce 0us switching period for Tx switching
 - Example frequency band combinations include CA_n28A-n41A, CA_n8A-n78A, CA_n28A-n78A

Core part

Companies are invited to provide comments and responses in the following table.

Feedback Form 56:

<p>1 – Telstra Limited</p> <p>We agree with the objectives and request n26 is included to the low frequency bands of interest, ie in addition to n28, n8, n5, n71</p>
<p>2 – Verizon UK Ltd</p> <p>We agree with the objectives!</p>
<p>3 – China Telecom Corporation Ltd.</p> <p>We support the objectives.</p>
<p>4 – CATT</p> <p>Objective #1 seems to be overlapped with RP-223260 and objective #2 has overlapping with RP-223361. Suggest to merge the overlapped proposals.</p>
<p>5 – QUALCOMM JAPAN LLC.</p> <p>As stated, we do support to have such additions to the specifications.</p> <p>For Objective#1: this seems to be a good candidate for a basket WI, it would be good to clarify what exactly needs to be done in the specifications. The 2nd bullet on PC3 and PC2 UL MIMO is related to 4Rx or not? this is a bit confusing right now and in our understanding PC3 and PC2 UL MIMO are already supported in the specifications, potentially just new bands need to be added.</p> <p>For Objective#2: it should be clarified what needs to be done in the specifications. It seems to us that all the parts are already there, there are requirements for PC2 with UL MIMO and UE can declare support for it in one of the UL CCs in a band combination. It would be good to have clear objectives on what is needed</p>

so that RAN4 does not waste valuable time in discussing what has to be done. What is the intention of this bullet? "Introduce 0us switching period for Tx switching". this WI proposal does not seem to be related to Tx switching.

6 – Guangdong OPPO Mobile Telecom.

To Qualcomm questions:

As replied in previous question, in the WID it clarifies that at least delta Rib for 4Rx needs to be re-evaluated, since the frontend/antenna assumptions for it would be different from FWA form factor. This was raised by several companies before meeting, and might be not proper to be treated directly in a basket WI due to these are general issues for low bands.

For the low band 2Tx UL MIMO, it is an independent feature. It is expected the spec changes for this feature is small.

For the 3Tx part, as replied in previous question, the 3Tx band combinations listed in the WID are especially for low band 1Tx + mid/high band 2Tx, and for this kind of band combination the spec changes would be small as long as the total power class is already defined in the spec. So the changes will be to add reference of UL MIMO/TxD requirements to current inter-band UL CA/EN-DC requirement clauses where currently it only refers to single port requirements. However, if new features added to the 3Tx for example new power classes, or higher powers, then the spec change would be more than that.

The 0us Tx switching can be considered as an enhancement that 3Tx can support inherently when UE would like to do Tx switching for example when UE would like to limit the Tx capability a little bit due to power consumptions, etc.

7 – Apple (UK) Limited

As we commented above, the LB 4Rx can be covered by the basket WID proposed in RP-223260 and the LB 2Tx is already covered in the existing Rel-18 basket WID for PC2 FDD bands. For the 2-band with 3Tx concurrent operation, we have the similar proposal in RP-223361 with slightly wider scope where the configurations would not be constrained by always having one LB in the combinations. We are open to work with OPPO to consolidate the 2-band 3Tx feature into one WID.

8 – vivo Communication Technology

As we discussed in the sub-topics 7-1-1, we think UL MIMO is already at least partially discussed under discussion in WI HPUE_NR_FR1_FDD_R18 (RP-222967) and NR_bands_UL_MIMO_R18 (RP-223352), the 2TX UL MIMO scope should be removed.

For 4Rx, this should be a non-spectrum proposal, and the ECC is quite large and antenna efficiency is also low, currently we do not see much gain to increase the low band antennas instead of improving existing 2 antennas performance.

For 3Tx topic, clearly this is non-spectrum proposal.

9 – Guangdong OPPO Mobile Telecom.

To Apple: Thanks for your comments. As feedback in previous item, the low bands 4Rx for handheld UE is something new in general which might be not proper to be handled by a basket WI considering the low bands common issues could be handled in general instead of per band discussed in baskets.

For the 3Tx part, we are also ok to consider more scenarios as long as it is agreeable to the group.

10 – Guangdong OPPO Mobile Telecom.

To vivo: Thanks for your comments. Similar feedback can be found in previous issue and also the feedback to Apple. Generally in our view after cutting the scope of 3Tx and limited to low bands enhancements, it is already spectrum centric discussion rather than a general feature for all bands/band combinations.

11 – Samsung Electronics Co.

As commented earlier, the first objective for 2Tx/4Rx should be removed from this WID for further discussion and study. Regarding the second objective for 3Tx, it can be considered that the objective is focusing on FWA device only.

12 – Nokia Japan

We don't think that "Introduce 0us switching period for Tx switching" is needed. This looks confusing. UE with 3Tx(1Tx+2Tx) concurrent transmission must be able to do 0 us switching as its performance as default.

13 – Guangdong OPPO Mobile Telecom.

To Nokia: Thanks for your comment. We agree that 3Tx UE is able to do 0us Tx switching as default, the problem probably is how to make it be aware/reported to NW. Currently, if UE want to do Tx switching, it has to choose one from 35us, 140us, or 210us and no 0us Tx switching capability value can be used. That's why this item is added.

14 – China Unicom

We support the current objectives.

15 – LG Electronics Deutschland

As commented in the Feedback form 27, it is our understanding that spectrum WI should focus on the band or band-combination. Some of the objectives proposed have the possibility to touch UE TRX RF core, e.g. Tx switching time which needs technical discussion in RAN4 RF session. Other than that, we are fine with the proposals.

16 – Meta Ireland

As mentioned in Topic #7-1, we are same understanding with Samsung, vivo and LGE.

17 – ZTE Corporation.

Regarding the Tx switching part, we share similar view as Nokia, it might be confusing. There should be no Tx switching at all for concurrent 3Tx transmission. what's the problem without Tx switching report for 3Tx? For Rel-15 inter-band UL CA, we also don't have any Tx switching period indication to the network.

<p>18 – Ericsson France S.A.S</p> <p>For the first objective on single band, see previous comments. If the requirements are similar to FWA then existing WI and the proposed 4RX basket can accommodate the work; otherwise ”study and specify” does not sound spectrum related and we need to take care of RAN4 workload.-</p> <p>For the second objective on 2 bands, if the spec changes are small and the scope is existing power classes then it could be considered. Probably the explicit bullet about switching time is not needed as it may cause confusion.</p>
<p>19 – Huawei Technologies France</p> <p>For 2T and 4R objectives, considering the overlapping with other WIs, some clarification is needed.</p> <p>For 3T with two bands, regarding the case of PC3 low FDD band 1Tx + PC3 mid/high TDD band 2Tx, especially for PC3 2T, is it a fallback mode for PC2 2T?</p> <p>For objective of ”Introduce 0us switching period for Tx switching”, we don’t think it is necessary.</p>
<p>20 – Guangdong OPPO Mobile Telecom.</p> <p>To ZTE and Huawei on the Tx switching:</p> <p>The original intention is to give UE more flexibility to apply or not apply Tx switching even it has 3Tx chain capability, but we are fine to consider alternatives if companies think this is not preferable.</p>
<p>21 – Guangdong OPPO Mobile Telecom.</p> <p>To Huawei on the 3T:</p> <p>PC3 FDD 1T+PC3 TDD 2T was proposed for unlicence related band combinations, it was considered as a separate band combination. Whether it can be considered as fallback of PC2 2T we are open to it.</p>
<p>22 – Guangdong OPPO Mobile Telecom.</p> <p>To Ericsson on the ”study and specify”:</p> <p>Thanks for the comments, our understanding is tha the ”study and specify” part can be considered as a compromise to ease the concerns from companies. But the spec impact is small as long as the 3Tx band combinations are limited to existing power classes.</p>
<p>23 – Google Inc.</p> <p>We have same view as Samsung.</p>

Sub-topic 7-1-3: Comments and responses on impacted/new specifications and target completion date & time budget

Companies are invited to provide comments and responses in the following table.

Feedback Form 57:

8.2.1.2 Summary

22 companies made comments for 2Tx/4Rx and 3Tx enhancements for lower bands. 9 operators supported the proposed 2Tx/4Rx enhancement for lower band. 12 vendors expressed different views on the scope and how to handle the proposal.

The open issues based comments are listed as follows:

- 2Tx with PC3 and PC2 for smartphone for lower bands (<1GHz)
 - Overlapping with UL-MIMO basket WI: proponent think that the existing UL-MIMO basket WI covers only FWA type of UE, while other companies think it can cover all types of UE with different power classes.
 - Overlapping with PC2 FDD band basket WI: companies think that the existing PC2 FDD band basket WI can be extended to cover the proposed lower bands.
 - QC would like to clarify the relation between the support of 2Tx and the support of 4Rx. The proponent replied that 2Tx UL-MIMO on lower bands is a separate feature from 4Rx.
 - Telstra proposed to add n26.
- 4Rx for lower bands (<1GHz)
 - Overlapping with ZTE proposal RP-223260 of 4Rx basket WI: the potential solution proposed is to limit ZTE 4Rx basket WI for bands >1GHz while restricting OPPO' WI to </=1GHz.
 - UE type: should the enhancement be limited to FWA type of UE.
 - Requirements which need be specified:
 - Delta_RIB: may need discuss the impact of smartphone form factor on the requirements and evaluate whether the same values could be applied to different UE types.
 - Delta_TRxSRS: need study whether the same values could be applied for smartphone and FWA type of UEs.
 - Telstra proposed to add n26.
- 3Tx enhancement in 2 bands
 - Clarify the detailed scope: Qualcomm asked to make the objectives clear. The proponent clarify the potential changes and thought the changes would be small. Nokia commented that we should take a step back and see the whole picture on what the current specifications are missing
 - UE type: whether it is for FWA or for both FWA and smartphone
 - No need to limit the feature to case with one lower band in the combination. The proponent responded that the proponent wants to reduce the workload in Rel-18.

- 3Tx is a new feature and should be non-spectrum related topic
 - More consideration on the device heat, battery, space limitation, antenna isolation should be taken into account. NTT DOCOMO propose to differentiate the discussion for PC3/2 and PC1.5 to address the concerns. The proponent thought the issues can be addressed by proper implementation.
 - Overlapping with Apple proposal in RP-223361. Apple commented that RP-223361 has a wider scope.
 - No need to include “introduce 0us switching period for Tx switching”
 - Huawei commented that for 3T with two bands, regarding the case of PC3 low FDD band 1Tx + PC3 mid/high TDD band 2Tx, especially for PC3 2T, is it a fallback mode for PC2 2T? The proponent responded that PC3 FDD 1T+PC3 TDD 2T was proposed for unlicence related band combinations but open to discussions.
- Impact on the performance of UE on legacy bands: there would be performance impact on the legacy band performance, which should be considered when claim the feasibility and benefit.
 - RAN4 workload and whether it is non-spectrum related work: some companies think that the study would be needed, and the potential study make the work be non-spectrum related and also had concern on RAN4 workload. Some companies proposed to consider the enhancement in Rel-19.

8.2.2 Intermediate round

8.2.2.1 Comments & responses

In the intermediate round, the moderator would like to discuss the sub-topic #7-1, #7-2 and #7-3 in one place. Because there are overlapping scopes between the new proposals and between the proposed WIs and the existing WIs, the first issue to be addressed is on how to organize the work. Then because of the high workload in RAN4 and limited TU, the scope should be down-selected based on the companies’ proposals. So some high level agreements on the scope of new WIs would be needed. Finally, the detailed objectives can be developed.

The moderator would like to propose the following proposals for discussions in the intermediate round.

Proposal 1 for Topic #7:

- PC3 or PC2 UL-MIMO with 2Tx for the low bands <1GHz
 - How to handle PC3 or PC2 UL-MIMO with 2Tx for low bands <1GHz
 - PC3 or PC2 UL-MIMO with 2Tx for band n28, n8, n5, n71 and n26 can be captured in the existing basket WI of NR_bands_UL_MIMO_R18
 - (Note: PC2 for n28, n8, n5, n71, n26 have already been included in WI of NR_PC2_UE_FDD_R18. PC3 UL-MIMO for n28, n8 are included in the existing WI of NR_bands_UL_MIMO_R18. There are no restriction on the UE types in either NR_PC2_UE_FDD_R18 or NR_bands_UL_MIMO_R18.
 - Include low frequency band n28, n8, n5, n71, n26

- Both handheld UE and FWA UE should be considered
 - NOTE: the support of 2Tx is not coupled with support of 4Rx

Companies are invited to provide comments for Proposal 1 and responses in the following table.

Feedback Form 58:

<p>1 – T-Mobile USA Inc.</p> <p>We support the proposal.</p>
<p>2 – Guangdong OPPO Mobile Telecom.</p> <p>We are ok with the 2T for low bands be introduced in UL MIMO basket WIs, but we would like to make it clear that 2Tx is agreed to be introduced in Rel-18 for low band handheld UE. This is just to avoid the repeated discussion of the concerns like benefits, feasibility, costs, etc. which lead to impossible of introducing such feature in the basket WI in the end.</p>
<p>3 – Apple (UK) Limited</p> <p>We agree that LB 2Tx can be covered by the existing two WIDs NR_bands_UL_MIMO_R18 and NR_PC2_UE_FDD_R18. PC3 can be directly introduced via NR_bands_UL_MIMO_R18 basket WID without new band specific requirements. The PC2 band specific requirements (2Tx REFSSENS and A-MPR) will be developed in NR_PC2_UE_FDD_R18. Once the band specific requirements for 2Tx are specified, the band can be added to the UL MIMO supporting band list via NR_bands_UL_MIMO_R18 basket WID.</p>
<p>4 – Nokia Japan</p> <p>We basically support the proposal. We just emphasize that as Apple commented, tight coordination b/w the two WIs is essential. Otherwise, we'll see the introduction of low bands UL MIMO without having proper requirements...The procedure must be captured in both of the WIs like band combo WIs.</p>
<p>5 – Telstra Limited</p> <p>We are happy with the moderators proposal</p>
<p>6 – QUALCOMM JAPAN LLC.</p> <p>We support the categorization made by the moderator. We agree that existing WIDs can be re-used. Why do we need PC3 with UL-MIMO? In our understanding, using two PC5 PAs would not be a common case so this could be dropped. What is needed is PC2.</p>
<p>7 – LG Electronics Deutschland</p> <p>We are fine with the moderator's proposal to incorporate the 2Tx PC2 or PC3 UL-MIMO into the existing UL-MIMO basket and PC2 FDD basket and thus try not to increase the RAN4 workload.</p>
<p>8 – Telstra Limited</p> <p>Further to our last comment, for 2Tx handling, we agree with Oppo that a clear statement of intent be added to capture this requirement and avoid further repeated discussions.</p>

<p>9 – Spark NZ Ltd</p> <p>we support the comment of Oppo</p>
<p>10 – TELECOM ITALIA S.p.A.</p> <p>We support with the addition of the comment made by Oppo</p>
<p>11 – ZTE Corporation.</p> <p>We are also fine with moderator’s proposal and Apple’s further procedure suggestion for these related WIDs.</p>
<p>12 – vivo Communication Technology</p> <p>For PC2, 2Tx requirements for low bands have not been finalized. We need to consider the overlap between two RAN4 WIs and decide how to manage the work in RAN4.</p>
<p>13 – China Mobile Com. Corporation</p> <p>We are fine with moderator proposal. In previous RAN4 meeting, we propose to add UL-MIMO PC3 for n28, however, companies commented that a restriction note on FWA should be added. Hope RAN plenary can endorse this way forward, so that we can bring CR to remove the restriction.</p>
<p>14 – KDDI Corporation</p> <p>We support with the addition of the comment made by Oppo</p>
<p>15 – Huawei Technologies France</p> <p>We support the moderator’s proposal and clarification by OPPO. With such clarification agreed in RAN meeting, some revision for the existing UL MIMO bands WID is needed to lift the limitation for UE type for some proposed bands. For the low bands to be captured in the NR_PC2_UE_FDD_R18 WI, normal procedure of requesting operating bands with enough supporting companies should still be followed.</p>
<p>16 – vivo Communication Technology</p> <p>In RAN4 agreed WF for single band HPUE FDD R4-2217121, it stated that ”Analyses on both 1Tx and 2Tx requirements are considered at current stage”. So, we think we would not say 2Tx low band is agreed to be introduced. This depends on whether the final 2Tx requirements can be agreed to be added into spec or not.</p>
<p>17 – Samsung Electronics Co.</p> <p>We are OK with moderator’s proposal as a compromise. That would be that the PC2 for LB FDD with UL MIMO can reuse 2Tx (TxD) requirement once the later one has been specified in NR_PC2_UE_FDD_Re118 WI. However, if we decide to utilize the current basket WIs, the same principle, “way of working” captured in the UL MIMO basket WI, should apply also. For example, the request shall be submitted on RAN4 reflector before the submission deadline based on the request. In that sense, we would like to propose to think about capturing the example bands in this meeting.</p>

18 – China Telecom Corporation Ltd. We support the moderator’s proposal and clarification by OPPO.
19 – Ericsson France S.A.S OK with the proposal
20 – Orange we support the comment from OPPO
21 – Beijing Xiaomi Mobile Software We are ok with the proposal
22 – CATT OK with the proposal.
23 – MediaTek Inc. We are fine with Moderator’s proposal to reuse the existing WIDs and minimize admin. overhead.
24 – VODAFONE Group Plc We support with the addition clarification by Oppo.
25 – CHTTL in general ok

Proposal 2 for Topic #7:

- 4Rx enhancement
 - How to handle 4Rx enhancement
 - Option 1: two WIs
 - Revise RP-223260 (ZTE) to capture the bands > 1GHz
 - Revise RP-223029 (OPPO) to capture the bands <1GHz
 - Option 2: one WI
 - Use RP-223260 (ZTE) with necessary modification to capture all the bands to support 4Rx.
 - Include low frequency bands (<1GHz) of n28, n8, n5, n71, n85, n26 and middle band of n25 (>1GHz).

- UE type for low bands (<1GHz)
 - Option 1: depend on operator requests
 - Option 2: FWA only
 - Option 3: both FWA and handheld UE
- Requirements to be defined
 - Specify 4Rx REFSENS requirements including $\Delta R_{IB,4R}$ for the target bands
 - Specify the necessary requirements of DT_{RxsRS} for the target bands

Companies are invited to provide comments for Proposal 2 and responses in the following table.

Feedback Form 59:

<p>1 – T-Mobile USA Inc.</p> <p>For 4 Rx we support Option 2. Seems more efficient to have a single WI. For bands < 1 GHz we support Option 1: Depends on operator request.</p>
<p>2 – Guangdong OPPO Mobile Telecom.</p> <p>For the 4Rx enhancement, our understanding is that the low bands 4Rx for handheld UE is still under general spectrum definition stage, after the generally analysis and requirement definition then the basket can be introduced. From this point of view, we prefer two separate WIs:</p> <ul style="list-style-type: none">- one is current ZTE basket WI cover <2.7GHz bands but for <1GHz bands only cover FWA- the other is UE general requirement evaluation/definition in <1GHz range for handheld UE type <p>After this handheld UE 4Rx requirement is clear and done for the listed bands, then more bands can be introduced later on in ZTE basket WI for example by removing the FWA limitation. This is our understanding of the relation between general spectrum and basket WI which has been adopted in other spectrum related WIs like many HPUEs with one general WI to evaluate common issues then basket to cover other bands/band combinations.</p>
<p>3 – ZTE Corporation.</p> <p>After reviewing the initial round discussion for 4Rx part, the major concern is how to handle the 4Rx on handheld UE operating less than 1GHz. whether this could be captured in ZTE basket WID RP-223260 or OPPO WID RP-223029. Honestly speaking, basket WID might be not appropriate place to discuss the feasibility issue for handheld UE as mentioned by some UE vendors. Based on above considerations, we are fine with OPPO's update to add the note.</p> <p>In short, we are fine to have separated WID.</p> <p>For ZTE basket WID, to add the applicability note to indicate that only FWA is considered for less than 1GHz and both handheld UE and FWA could be considered between 1GHz and 2.6GHz.</p>

For OPPO WID, to add the feasibility study for 4Rx on handheld UE for less than 1GHz; In addition, the supported band should depend on the operator request;

4 – ZTE Corporation.

The updated WID has been uploaded into the inbox, if you have any further suggestions or comments, please feel free to let me know.

https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/%5B98e-08-R18-RAN4-SpectrumRelated%5D/F223260_New%20WID%20on%204Rx%20support%20for%20NR%20FR1%20bands%20in%20Rel-18.zip

5 – Guangdong OPPO Mobile Telecom.

Thanks ZTE for the revision, we are ok with the notes.

6 – Guangdong OPPO Mobile Telecom.

The updated content of RP-223029 is also uploaded to inbox under spectrum related folder, which keeps the 4R for low band handheld UE and remove 2T. Your comments are welcomed.

https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/%5B98e-08-R18-RAN4-SpectrumRelated%5D/F223029%20R18%20New%20WI%20on%20low%20band%20enhancement%20for%20handheld%20UE.doc

7 – Apple (UK) Limited

Thanks to ZTE for the revision on the 4Rx basket WID proposal. Unfortunately, the "Note 1: it is not required for network to distinguish between smartphone and FWA UE types. Define the proper requirements for different UE types." would sound contradicting by itself. It is not clear to us what it means "Define the proper requirements for different UE types". Is the intention to define different requirements between FWA and smartphone? If there is no signaling to differentiate different UE types, what would be the reason to define different requirements? In our view, this basket WID should be rather straightforward. The **ARIB,4R** has already been specified for bands in different frequency ranges. The new requested bands can simply be added to Table 7.3.2-2 based on their frequency range. There is no need to introduce new requirement at all in this basket WID.

8 – Telstra Limited

For handling of 4Rx: option 2, a single WID seems more efficient but no strong preference

For UE type: we are ok with option 1, depends on operator requests. Option 3 is also ok if that becomes the majority view.

9 – QUALCOMM JAPAN LLC.

For handling of 4Rx, we also think that Option 2(single WID) is more efficient.

For the UE types, we should also consider handheld devices.

Using a basket WI should be fine because most of the parameters we are talking about will be band specific.

10 – LG Electronics Deutschland

We don't have a strong position on the 4Rx WI number but slight preference to the single WID not to increase the number of WI in Rel-18 too much. For the UE types, we prefer to consider both FWA and Handheld UE. Even though there is no low-layer signaling to differentiate the FWA and Handheld, there could be high-layer (e.g. application layer) signaling to do that. That's why there is 2Rx vehicular UE exception for Refsens in 4Rx mandated bands.

11 – Spark NZ Ltd

we support the comments by Oppo

12 – TELECOM ITALIA S.p.A.

Same view as T-Mobile USA:

For 4 Rx we support Option 2. Seems more efficient to have a single WI.

For bands < 1 GHz we support Option 1: Depends on operator request

13 – TELECOM ITALIA S.p.A.

Sorry, please do not consider the comment above. **Revised comment:**

For 4 Rx we are ok to have separate Work Items (option 1)

For bands < 1 GHz we support Option 1: Depends on operator request

14 – TELECOM ITALIA S.p.A.

Sorry, please do not consider the comment above. **Revised comment:**

For 4 Rx we are ok to have separate Work Items (option 1)

For bands < 1 GHz we support Option 1: Depends on operator request

15 – Nokia Japan

Apart from which is better, what OPPO proposed looks following the current procedure meaning that baskets don't discuss other than band specific requirements.

Regarding ZTE's WID, we suggest removing NOTE 1. This is basket so that any values are just put into one of the three rows in Table 7.3.2-2 unless a new number(s) is found. And regarding NOTE 2, what is the intention of "could be considered"? Just remove "for operating frequency between 1GHz and 2.6GHz, both handheld UE and FWA could be considered". This just invites a question like Apple. We don't have different requirements for FWA/handleld UEs. We just follow it in the basket.

For OPPO's WID, total power class is understandable, but we propose to replace it with "CA power class or EN-DC power class".

16 – Guangdong OPPO Mobile Telecom.

To Nokia comment on the total power class:

Thank you for the good suggestion, we agree it is more precise with "CA power class or EN-DC power class".

17 – China Unicom

For 4Rx enhancement, we support OPPO’s proposal to have 2 separate WIs. One basket WI focuses on only band-specific requirements, the other WI evaluates/defines 4Rx for handheld UEs for sub-1GHz spectrum. We are fine with the revised WIDs prepared by ZTE and OPPO in draft folder.

18 – vivo Communication Technology

As commented by many companies in the first round, the feasibility of 4Rx antenna in handheld UE is still unclear, and the corresponding performance gain should be further studied. Although we are defining the conductive RF requirements, similar to 700/800/900 work, the antenna feasibility should be studied and confirmed first for smartphone. In addition, based on our measurement results of smartphone low band 4Rx ECC and antenna efficiency can not meet normal antenna design requirements, we really doubt the actual performance gain.

So, we should limit the UE type as FWA only in the WI.

19 – ZTE Corporation.

To Apple and Nokia,

Regarding the NOTE 1, this is the outcome of last RAN#97e discussion to address the signalling issue for FWA and Handheld UE. In addition, this could leave some flexibility in RAN4 to specify different requirements for handheld UE and FWA if possible for less than 1GHz. The reasons why we might have different requirement is due to the implementation difficulties and form factor difference. etc between FWA and handheld UE from our understanding. For operating frequency between 1GHz and 2.6GHz, since the requirement for FWA and handheld UE is the same as far, maybe NOTE 1 is not needed.

In short, it’s also fine to remove the NOTE 1 to avoid the confusion from companies.

To Nokia,

Regarding the second sentence in NOTE 2 is to clarify the both FWA and handheld UE could be considered in this basket WID instead of defining different requirements for it. We are fine to remove the 2nd sentence if companies are clear how to define the requirement for UEs between 1GHz and 2.6GHz.

Please find the updated objective as following:

- Specify the 4Rx REFSENS requirement for NR FR1 bands
- o Support of 4Rx for the bands <2.6GHz added in this WI is optional
- o Note 1: for operating frequency less than 1GHz, only FWA is considered.

The updated WID is also uploaded into the inbox.

https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/%5B98e-08-R18-RAN4-SpectrumRelated%5D/F223260_New%20WID%20on%204Rx%20support%20for%20NR%20FR1%20bands%20in%20Rel-18.docx

20 – China Mobile Com. Corporation

We are OK to have single WI. For the UE type, we prefer to have both FWA dn handheld UE.

21 – KDDI Corporation

We are OK to have single WI. For the UE type, we prefer to have both FWA and handheld UE.

22 – Huawei Technologies France

We are fine with OPPO's proposal. The study for the listed low bands supporting 4Rx could be carried out in the new WI.

23 – Meta Ireland

For 4Rx feature, we prefer to single WID.

For the UE types, RAN firstly define REFSSENS requirements for FWA device and the feasibility study is needed for smartphone device.

Also fine with Note 1 from ZTE as Note 1: for operating frequency less than 1GHz, only FWA is considered.

24 – Guangdong OPPO Mobile Telecom.

The Rev2 of RP-223029 has been uploaded to inbox which include the 4Rx for <1GHz handheld UE.

Please find the revised version as below, and if you have comments please let me know:

https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/98e-08-R18-RAN4-SpectrumRelated/Rev2/ RP-223029 R18 New WI on low band enhancement for handheld UE

25 – Samsung Electronics Co.

As we commented in the initial round, we still doubt the feasibility and the whole system benefit for UE equipped with 4 antennas in low bands. We prefer to focus on 3Tx feature in this WI. However, for the compromise, we can also live with the 4Rx option as FWA only until we find its feasibility and benefit for handheld UE. In addition, as commented by Apple, we see no necessity to define two sets of requirements for delta RIB, 4R for FWA and handheld UE given that our previous agreement for FWA 8Rx in RAN4#105 meeting as below. We also agreed that the vehicular UE has the same antenna isolation as handheld UE.

- Define one set of 8Rx requirements for CPE/FWA/vehicular/industrial devices

26 – Guangdong OPPO Mobile Telecom.

To Samsung comment:

Thanks for your comments, and also understand your concern on the 4Rx in low bands for handheld UE. In current WID it is "study" before specify, hope this can solve your concern a little bit.

For the one set requirement for different types of UE, ideally it is, but may need further discussion as the 8Rx has done where one set requirement is defined for these large size non-handheld UEs after discussions on comparison of different UE types.

27 – Sony Group Corporation

For the number of WI, we slightly prefer single WI but no strong opinion. For the UE type, we agree with the comments from other companies that the feasibility of handheld UE need to be studied first, while FWA devices seems more feasible to be started with.

28 – China Telecom Corporation Ltd.

Based on the discussion, for 4Rx support at < 1 GHz in handled UE, it seems not clear whether the requirements for FWA can be directly reused, and a study phase is proposed. We don't think it is appropriate to include a study phase in the 4Rx basket WID.

So, we prefer OPPO and ZTE's suggestion, i.e.,

- For the 4Rx basket WID, cover < 1 GHz FWA and 1-2.6 GHz FWA & handled UE
- For the other WI, cover the study on 4Rx with < 1 GHz handled UE.

29 – Orange

We prefer 2 separate WIs. Smartphone is an essential target, hence we would be fine with either option 1 or 3. In terms of target frequency bands, we would also add n20.

30 – Ericsson France S.A.S

If handheld UE 4RX requirements are expected to differ from FWA and need study then we agree with the comment of China Telecom that there should be two WI; a basket with a restriction on UE type below 1GHz and a study on 4RX for handheld below 1GHz.

With regard to the study, in principle we are OK technically, but in our understanding this should be treated as a non-spectrum WI. We would like to see a proposal for the TU budget for the non-spectrum part on the table, split for TX and RX. A decision should then be made on whether it is feasible and desirable to add this work to the RAN4 non-spectrum workload considering other proposals (e.g. 3TX). (Our expectation is that the 3TX workload is likely smaller than the RX study).

31 – Beijing Xiaomi Mobile Software

We prefer to have a separate WI and ok with oppo's proposal, as some general issues shall be studied for 4Rx handheld UE, which is not suitable to be handled in the basket WID.

32 – CATT

For 4Rx feature, slightly prefer to have a single WI and both UE types can be considered.

33 – CHTTL

Since there might be some general discussion and analysis for the 4Rx for handheld UE <1GHz, we are ok to treat this case in separate WID as proposed by OPPO.

But our understanding is the listed frequency band for consideration for handheld needs to be supported for FWA firstly? (or at least requested?)

34 – Skyworks Solutions Inc.

For 4RX the requirement is already captured in Table 7.3.2-2 in 38.101-1 and covers all possible frequency bands with only the FWA note for the <1GHz bands. So in our view if <1GHz is still for FWA only there is no general work needed and a single basket Wi is sufficient. Regarding the <1GHz smartphone 4Rx it is still clear that some smartphone form factor do not enable 4 low band antennas. even flip/fold phones may not have good 4Rx capability when closed. In any case if specific smartphone 4Rx RAN4 work would be

needed, either the 2.7dB currently agreed for FWA applies and then the work is just to amend that FWA note or a different number is studied and then signaling would be required to distinguish FWA vs Smartphone requirement. So even if there is a separate WI for "non FWA <1GHz 4Rx" it should clarify the objective and potential need for signaling depending on whether or not the <1GHz 2.7dB value can be reused or not.

Proposal 3 for Topic #7:

- 3Tx in 2 bands and other enhancement for HPUE with 2Tx or 3Tx
 - How to handle enhancement of 3Tx in 2 bands
 - Merge RP-223029 (OPPO) and RP-223362 (Apple) into one WI for enhancement of 3Tx in 2 bands to including the scenarios as follows
 - PC2:
 - PC3 FDD band 1Tx + PC2 TDD band 2Tx
 - PC3 FDD band 1Tx + PC3 TDD band 2Tx
 - PC3 TDD band 1Tx + PC3 TDD band 2Tx
 - PC3
 - PC3 FDD band 1Tx + PC3 TDD band 2Tx
 - Discuss and address the generic requirements including the following scenarios under the objective of the power domain enhancements of WI of NR_cov_enh2
 - Increasing UE power high limit feature
 - PC3 FDD band 1Tx + PC2 TDD band 2Tx
 - PC3 TDD band 1Tx + PC2 TDD band 2Tx
 - No update of objective of WI of NR_cov_enh2 is needed
 - (Moderator note: this part is not spectrum related and should be handled in a non-spectrum related WI)
 - Include the band combinations of CA_n28A-n41A, CA_n8A-n78A, CA_n28A-n78A ...
 - UE types for those band combinations
 - FWA only
 - Limited to PC2 and PC3, and the proposals related PC1.5 can be discussed in future
 - (moderator note: following Ericsson comment to make it spectrum related item and reduce the workload)

- Scenarios to be considered
- Requirement to be defined
 - Specify the necessary UE RF requirements
 - FFS on the detailed objectives
 - NOTE: try to minimize the specification impacts

Companies are invited to provide comments for Proposal 3 and responses in the following table.

Feedback Form 60:

<p>1 – T-Mobile USA Inc.</p> <p>We support the proposal, but would prefer to include PC1.5. Our primary interest in 3 Tx is for TDD PC1.5 plus FDD 23 dBm, so we'd prefer to include PC1.5 rather than discuss it in the future. PC2 would be a step down from what we already have today for a single band.</p>
<p>2 – Guangdong OPPO Mobile Telecom.</p> <p>According to the guidance from moderator and speed up discussion, the updated content of RP-223029 is uploaded to inbox under spectrum related folder, which updates the 3Tx as above items. Your comments are welcomed.</p> <p>https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/98e-08-R18-RAN4-SpectrumRelated/Rev1/ RP-223029 R18 New WI on low band enhancement for handheld UE.doc</p>
<p>3 – Guangdong OPPO Mobile Telecom.</p> <p>According to the guidance from moderator and speed up discussion, the updated content of RP-223029 is uploaded to inbox under spectrum related folder, which updates the 3Tx as above items. Your comments are welcomed.</p> <p>https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/98e-08-R18-RAN4-SpectrumRelated/Rev1/ RP-223029 R18 New WI on low band enhancement for handheld UE.doc</p>
<p>4 – Guangdong OPPO Mobile Telecom.</p> <p>According to the guidance from moderator and speed up discussion, the updated content of RP-223029 is uploaded to inbox under spectrum related folder, which updates the 3Tx as above items. Your comments are welcomed.</p> <p>https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/98e-08-R18-RAN4-SpectrumRelated/Rev1/ RP-223029 R18 New WI on low band enhancement for handheld UE.doc</p>

5 – Guangdong OPPO Mobile Telecom.

Sorry for the repeated sending, it is just stuck when click the "Post", the above feedback from OPPO side is same.

6 – Apple (UK) Limited

We are fine with moderator's proposal on the 3Tx in 2-band for UL enhancement with reduced scope from the original two WIDs to address companies' concern on the workload, though in our view even with PC1.5, the workload should still be manageable.

Thanks to OPPO's revision from the original WID. If the 3Tx feature would be based on this WID revision, we propose to remove the LB 4Rx part. Also based on moderator's suggestion, the 3Tx feature would be intended for FWA only in this WID which would contradict with the revised WID title.

As we commented in first round discussions, the Δ RIB,4R has already been specified for LB, though for FWA, it does really not prevent handheld UE from supporting 4Rx in LB. In our view, the difference between FWA and handheld UE is mainly on the OTA performance, but not on the conductive performance. We do not think when RAN4 defined Δ RIB,4R, the FWA form factor has really been considered. On the other hand, if FWA and handheld UE conductive performance difference is that important, why the difference would only be considered for LB, but not for MB, HB, and UHB? Doesn't FWA also use MB, HB, and UHB? In our view, this practice would instigate a poor precedent that more new requirements would be intended to differentiate FWA and handheld UE in future which could really complicate the specifications and bring more workload for RAN4. Such potential impact should really be carefully considered.

7 – QUALCOMM JAPAN LLC.

We support also including the combos with PC1.5, especially PC3+PC1.5. We do not believe this would lead to a lot of additional work, most of the work needed seems to be the same for all combinations, based on the comments seen so far.

Thank you Oppo for uploading the revised WID, please see some comment below:

1. We also believe the 4Rx part should be removed since it will be handled based on Proposal 2.
2. It would be good to list the impact to the requirements. So far the answer to this question was just about including cross-references. This could be listed in the reqs.
3. Is there a need for PC3 with 2Tx? this could be dropped for now if workload is a real concern and combinations with PC1.5 should be added

8 – LG Electronics Deutschland

We are fine with the moderator's proposal. For the requirement to be defined, reminding this is spectrum WI, the requirement should be minimal and need to be clear in the WID.

9 – Guangdong OPPO Mobile Telecom.

To Apple comment:

Thanks for your comments! In our view whether 4Rx LB for smartphone and for FWA can be different or same pending further discussion, it might be premature to assert there is no difference, etc.

10 – Telstra Limited

We are concerned about downscoping of this proposal and restriction to FWA devices only. Handheld UE is our primary interest and would like it included in scope of the proposal.

Also, we would like to request CA_n26A-n78A is added to the existing frequency band combinations.

11 – TELECOM ITALIA S.p.A.

Same view as Telstra on the form factor:

We are concerned about downscoping of this proposal and restriction to FWA devices only. Handheld UE is our primary interest and would like it included in scope of the proposal.

For the rest ok in general with the moderator's proposal (and ok to PC1.5)

12 – Guangdong OPPO Mobile Telecom.

Our preference is also handheld UE, we don't see there is strong demands for FWA on 3Tx, if there is we are ok to consider it in addition to handheld UE rather than replace handheld UE with FWA.

13 – Nokia Japan

We suggest the objective should see the entire picture. For instance, if PC3(1Tx FDD)+PC1.5(2Tx TDD) is considered, we assume that PC3(1Tx FDD)+PC2(2Tx TDD) and PC3(1Tx FDD)+PC3(2Tx TDD) are needed as fallback.

So, at least one set is a following. Then, the requirements for them will be specified with a consistency.

PC3(1Tx FDD)+PC1.5(2Tx TDD)

PC3(1Tx FDD)+PC2(2Tx TDD)

PC3(1Tx FDD)+PC3(2Tx TDD)

14 – China Unicom

Thanks OPPO for the WID revision, we are fully supportive to the WI.

We also share similar views with operators that primary interest for 3Tx feature is for handheld UE. As 4Tx is already under discussion in R18 FR1 enhancement WI for FWA/CPE devices, it is not clear whether 3Tx for FWA is still needed or not. So we would like to suggest to target 3Tx feature for smart phones.

15 – vivo Communication Technology

First of all, we agree with Moderator's first round summary that we need to consider "RAN4 workload and whether it is non-spectrum related work".

In our understanding, the listed CA scenarios would have impact on new generic Tx requirements with the introduction of 2Tx in one band, though no study and agreements have been reached in RAN4 yet.

Based on the **agreed spectrum v.s non-spectrum boundary in previous RAN-P conclusions, we believe this should be non-spectrum WI scope** and doubt non-spectrum topic can still be discussed given the Rel-18 workload raised on Monday GTW session.

Even for existing power class, RAN4 still need to check whether generic requirements are impacted or missing, based on last RAN4 meeting discussions.

Therefore, we think it is premature to consider 3Tx feature before RAN4 has common understanding and full picture of specs impacts. And as commented by many companies we also have concerns on UE heating and power consumption issue.

Overall, we think this is a non-spectrum work, and should be limited to FWA only, if considered by RAN.

16 – China Mobile Com. Corporation

We are OK with including PC1.5, but have concern on restricting the UE type to FWA only. Handheld UE should be the target for this 3Tx work.

17 – Guangdong OPPO Mobile Telecom.

The Rev2 of RP-223029 has been uploaded to inbox with following changes:

- the total power class to "CA power class or EN-DC power class" as suggested by Nokia
- added the total power class PC1.5 = PC3 FDD 1T+PC1.5 TDD 2T, as suggested by some companies

Please find the revised version as below, and if you have comments please let me know:

https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/98e-08-R18-RAN4-SpectrumRelated/Rev2
RP-223029 R18 New WI on low band enhancement for handheld UE

18 – Guangdong OPPO Mobile Telecom.

The Rev2 of RP-223029 has been uploaded to inbox with following changes:

- the total power class to "CA power class or EN-DC power class" as suggested by Nokia
- added the total power class PC1.5 = PC3 FDD 1T+PC1.5 TDD 2T, as suggested by some companies

Please find the revised version as below, and if you have comments please let me know:

https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/98e-08-R18-RAN4-SpectrumRelated/Rev2
RP-223029 R18 New WI on low band enhancement for handheld UE

19 – ZTE Corporation.

Based on the previous discussion and justification, this WID should be targeted for smartphone instead of FWA only.

20 – Meta Ireland

We support Moderator proposals. RAN workload should be considered for non-spectrum related issues. For the UE type, we focus on the FWA device. For the total PC 1.5, we can support the power combinations with PC3 FDD 1Tx +PC1.5 TDD 2Tx.

21 – Guangdong OPPO Mobile Telecom.

To vivo:

In our understanding the spectrum and non-spectrum difference in the previous agreement is that as long as it is "introduce band-specific and/or band combination specific requirements without impacting generic RF core requirements". Currently the scope is only for specific bands or band combinations, and no new general requirements to be defined.

22 – Samsung Electronics Co.

We support moderator’s suggestion which is only consider PC2 and PC3 to balance the workload in Rel-18 as a compromise. However, we see that the FWA restriction for 3T has not been reflected in the updated WID yet.

23 – vivo Communication Technology

In Proposal 3, it says ”Discuss and address the generic requirements...” Not clear why this is not non-spectrum.

we share similar view with Samsung, FWA restriction should be clearly reflected.

24 – Guangdong OPPO Mobile Telecom.

To vivo:

Thanks for your comments. Probably further comments can based on the Rev2 of RP-223029 where it is more clean wording as announced by chair on reflector.

25 – Guangdong OPPO Mobile Telecom.

To Samsung comment:

Thanks for your comments. We understand restricting the UE type to FWA can solve some companies concern, however, this also will deviate far from the supporting companies of this WID. If there is strong demands for FWA, it can be added to handheld UE rather than replace it. We can discuss further on this point.

26 – Orange

We also have concerns on the scope being limited to FWA. The main interest from our side is for handheld UE / smartphones.

27 – China Telecom Corporation Ltd.

For the UE type, we think it is beneficial to include handled UE. For FWA, we have already considered 4Tx in Rel-18, it is not so attractive to add 3Tx, given that the number of FWA devices in the market is much smaller than that of handle devices.

28 – Ericsson France S.A.S

In general we are OK with this work, including PC1.5 and smartphone. However, the work is non-spectrum and a check should be made on the RAN4 workload. It would be useful to review TU estimates split as (i) no PC1.5, no smartphone, (ii) PC1.5, no smartphone, (iii) PC1.5, smartphone included. Most likely (i) and (ii) will not be a large workload; we would like to understand the workload estimate for smartphone better.

29 – Guangdong OPPO Mobile Telecom.

To Ericsson comment on TU issue:

In our understanding, for 3Tx, there is no much difference from requirement point of view for Smartphone and FWA and also TU.

30 – CH TTL

In general we are supportive of this work.

In general handheld UE is more attractive to us as same reason as China Telecom, but we also understand the concern from some companies.

If we consider FWA only for now, people might propose to consider handheld UE in the future, so would like to know the possibility of the feasibility.

Thanks OPPO for the updated draft WID, regarding the 3T part, as now the restriction of the 1Tx to the low band under the 1Tx+2Tx is removed, we hope to include CA/DC_3A_n77/78A as an example of mid FDD 1Tx +high TDD 2Tx combination if possible.

And probably the listed combinations are still considered as "example" combinations? as we think probably the main work is for the general part discussion.

31 – Skyworks Solutions Inc.

We still support adding PC1.5 case with FDD PC3+TDD PC1.5. Regarding concern about power consumption, thermal aspects...it only may be an issue for the PC1.5 inter-band with increased power capability which is optional and thus can be handled case by case by the UE design. so we do not see additional work needed compared to the other cases. only the 2L MSDs related to the PC1.5 UL would need to be considered and we have already agreed for PC2 that MSD is not revised for the increased power case.

We believe the R17 framework easily supports the PC1.5 cases.

We suggest that the 3Tx WI (reusing Apples version as a starting point) is separated from the 4Rx WI(s) as there are no links between the two and would not require the same experts.

8.2.2.2 Summary

Proposal 1 for Topic #7:

In principle, the proposal is acceptable for companies.

OPPO, Telstra, Spark, Teletcom Italia, KDDI, Huawei, proposed to clearly state that 2Tx is agreed to be introduced in Rel-18 for low band handheld UE, while vivo thought that whether 2Tx requirement for a low band is introduced depends on the introduction of 2Tx requirements. Apple and Nokia proposed to clarify the procedure for the existing basket WIs of UL-MIMO bands and PC2 FDD.

To Qualcomm, the band needs be added to Table 6.2D.1-1 of TS 38.101-1 in order to support UL-MIMO. In that table, PC3 is the baseline for UL-MIMO feature. Some low bands are not included in that table. Such PC3 with UL-MIMO for some bands is still needed. To vivo, Apple's comments #3 provided the clear procedure for the two WIs. Samsung proposed to follow the procedure of basket WI to only capture the example bands in this meeting.

Proposal 2 for Topic #7:

- 4Rx enhancement
 - How to handle 4Rx enhancement

- Option 1: two WIs
 - Revise RP-223260 (ZTE) to capture the bands > 1GHz
 - Revise RP-223029 (OPPO) to capture the bands <1GHz
- Option 1a: two WIs (OPPO, ZTE, Spark, Telecom Italia, China Unicom, Huawei, China Telecom, Orange, Ericsson, Xiaomi, CHTTL,
 - Revise RP-223260 (ZTE) to capture the bands <2.7GHz and bands <1GHz for FWA
 - Revise RP-223029 (OPPO) to capture the bands <1GHz for handheld UE including feasibility study for 4Rx handheld UE
- Option 2: one WI (T-Mobile USA, Telstra, Qualcomm, LGE, CMCC, KDDI, Meta, Sony, CATT)
 - Use RP-223260 (ZTE) with necessary modification to capture all the bands to support 4Rx.
- Include low frequency bands (<1GHz) of n28, n8, n5, n71, n85, n26 and middle band of n25 (>1GHz).
- UE type for low bands (<1GHz)
 - Option 1: depend on operator requests (T-Mobile USA, Telstra, Telecom Italia, Orange)
 - Option 2: FWA only (vivo, Meta, Samsung)
 - Option 3: both FWA and handheld UE (Telstra, Qualcomm, LGE, CMCC, KDDI, Orange, CATT)
- Requirements to be defined
 - Specify 4Rx REFSENS requirements including $\Delta R_{IB,4R}$ for the target bands
 - Specify the necessary requirements of DT_{RxSRS} for the target bands

On how to organize the project(s) companies had the diverse views. 11 companies supported to have the separate WIs for FWA and handheld UEs for low bands, while 9 companies supported a single one. Considering the discussions for device type and that some companies proposed to have feasibility study, and because the basket WI is not suitable to accommodate the “study”, the moderator recommends the separate WI approach.

Regarding the UE types, 4 companies supported option 1, 7 companies supported option 2 and 3 companies asked for FWA only. Thus based on majority companies’ view, the moderator would like to suggest considering 4Rx handheld UE for low bands in Rel-18.

In addition, Skyworks proposed to include signalling design objective. CHTTL proposed the procedure to have FWA first before working on handheld. Regarding Objectives, there were comments on NOTES in ZTE revised WID, Orange proposed to add n20. Those comments seemed already be captured in the revised WIDs.

Proposal 3 for Topic #7:

T-Mobile USA, Meta, Skyworks proposed to keep 3Tx with PC1.5. Apple, Qualcomm and Skywork proposed to remove 4Rx from OPPO revised WID. Telstra, Telecom Italia, OPPO, China Unicom, CMCC, Orange proposed to keep handheld UE, while Vivo, Meta and Samsung.

On how to organize the work, companies still had different views. The most controversial issue is whether to work on both handheld and FWA or just focusing on FWA. As compromise, can we first have some study on handheld UE until a checking point and then decide whether the handheld UE should be included in the WI?

The rest part of proposal seems OK.

8.2.3 Final round

8.2.3.1 Comments & responses

The proposals are modified based on the comments as below and just keep the key part of propose. The other details are left for review of revised WIDs.

Proposal 1 for Topic #7:

- PC3 or PC2 UL-MIMO with 2Tx for the low bands <1GHz can be introduced in Rel-18 for low band handheld UE
 - How to handle PC3 or PC2 UL-MIMO with 2Tx for low bands <1GHz
 - Band n5 and n26 with PC3 UL-MIMO need be added in the existing basket WI of NR_band_UL_MIMO_R18
 - Band n28, n8, n5, n71 and n26 with PC2 UL-MIMO can be added in the existing basket WI of NR_band_UL_MIMO_R18 after the PC2 requirements are finalized for those bands.
 - (Moderator Note: PC2 for n28, n8, n5, n71, n26 have already been included in WI of NR_PC2_UE_FDD_R18. PC3 UL-MIMO for n28, n8 are included in the existing WI of NR_bands_UL_MIMO_R18. There are no restriction on the UE types in either NR_PC2_UE_FDD_R18 or NR_bands_UL_MIMO_R18. n71 with PC3 has been introduced in TS 38.101-1)
 - Add the following procedures in WI of NR_band_UL_MIMO_R18 and WI of NR_PC2_UE_FDD_R18
 - The PC2 band specific requirements including 2Tx REFSSENS and A-MPR need be developed in NR_PC2_UE_FDD_R18.
 - Once the band specific requirements for 2Tx are specified, the band can be added to the UL MIMO supporting band list via NR_bands_UL_MIMO_R18 basket WID.
 - Both handheld UE and FWA UE should be considered
 - NOTE: the support of 2Tx is not coupled with support of 4Rx

And the rapporteurs of WI of NR_band_UL_MIMO_R18 RP□223352 and WI of NR_PC2_UE_FDD_R18 RP□222967 need update the WID accordingly.

Please make comments on the modified propose 1 for Topic #7 if any.

Feedback Form 61:

<p>1 – QUALCOMM JAPAN LLC.</p> <p>We are fine with the moderator proposal. Will this be formally documented somehow?</p>
<p>2 – T-Mobile USA Inc.</p> <p>We support the moderator’s proposal.</p>
<p>3 – vivo Communication Technology</p> <p>We suggest to slightly refine the wording to make it more clear, “Band n28, n8, n5, n71 and n26 with PC2 UL-MIMO can be added in the existing basket WI of NR_band_UL_MIMO_R18 after the PC2 requirements with 2Tx architecture are finalized for those bands”.</p>
<p>4 – LG Electronics Deutschland</p> <p>We are OK with the current proposal from the moderator.</p>
<p>5 – Spark NZ Ltd</p> <p>We support Moderator proposal</p>
<p>6 – KDDI Corporation</p> <p>We support the moderator’s proposal</p>
<p>7 – Telstra Limited</p> <p>Support the proposal</p>

Proposal 2 for Topic #7:

- 4Rx enhancement
 - How to handle 4Rx enhancement
 - Option 1a: two WIs
 - Revise RP-223260 (ZTE) to capture the bands <2.7GHz and bands <1GHz for FWA
 - Revise RP-223029 (OPPO) to capture the bands <1GHz for handheld UE including feasibility study for 4Rx handheld UE

- Include low frequency bands (<1GHz) of n28, n8, n5, n71, n85, n26, n20 and middle band of n25 (>1GHz).
- UE type for low bands (<1GHz)
 - Option 3: both FWA and handheld UE

Please make comments on the modified propose 2 for Topic #7 if any.

Feedback Form 62:

<p>1 – Apple (UK) Limited</p> <p>We propose to only have basket WID to add new bands for 4Rx support with <1GHz bands targeted for FWA and postpone LB 4Rx for handheld UE to a dedicated Rel-19 study item. This will give UE vendors more time to study and evaluate the antenna performance in a highly constrained handheld UE form factor and allow them to make more meaningful contributions.</p>
<p>2 – Guangdong OPPO Mobile Telecom.</p> <p>We support moderator proposal. The LB for handheld UE have clear market demands and majority support, we see no reason to postpone it to Rel-19 especially considering now there already some UE support it in the market as showned in the contributions this meeting.</p>
<p>3 – China Telecom Corporation Ltd.</p> <p>We support the moderator proposal.</p>
<p>4 – QUALCOMM JAPAN LLC.</p> <p>We support to start the work on LB 4Rx for handheld UEs also. Postponing to Rel.19 would mean ~2.5 years delay which is a very long time.</p> <p>We think have a single basket is simpler but we can accept multiple WIDs as long as the categorization is very clear.</p>
<p>5 – T-Mobile USA Inc.</p> <p>We support the moderator’s proposal.</p>
<p>6 – Meta Ireland</p> <p>We are similar view with Apple. The study on feasibility for 4Rx in LB is necessary for smartphone type UE. Hence we prefer to focus on the FWA firstly for 4Rx in LB WID in Rel-18. The smart phone type UE will many impact to add multiple Rx antennas and others in the small space to support multiple LTE/NR operating bands with LB/HB/UHB. This feature can further discuss how to achieve the larger space correlation and diversity gain based on the multiple results within variable UE RF architectures from UE vendors.</p>

7 – LG Electronics Deutschland

We are fine with the proposal from the moderator. For 4Rx LB Handheld, as stated in the latest WID, we prefer to focus on FWA as normative work and Handheld as a study phase and we can post a check point to decide whether to change this study to normative work or not.

8 – vivo Communication Technology

First of all, many thanks to moderator's summary and proposal. We also agree that 4Rx topic and 3Tx feature should be two separate WIs' working scope, given 4Rx for new bands can be spectrum proposal, but 3Tx new feature is clearly a non-spectrum proposal.

Regarding 4Rx objectives, we tend to share similar views with Apple that for smartphone formfactor increasing the number of antennas from 2 to 4 for <1GHz, is much more challenging than that for bands>2.6GHz. Focus on FWA is preferred.

One clarification question for Option 1a is, all the FWA 4Rx work will be in ZTE's 4Rx basket WI, and proposed handheld UE 4Rx <1GHz will be in a new project (SI/WI)? We still have concerns on introducing 4Rx low band for smartphone, it is better to be considered as potential Rel-19 working scope to given more time for UE vendors.

9 – ZTE Corporation.

We are also fine with moderator' s proposal. In addition, 2.7GHz should be updated to 2.6GHz which might be one typo from OPPO in the intermediate round comments;

To VIVO's question, yes, for less than 1GHz, we only consider the FWA in the basket WID and leave the handheld UE to be discussed in another WID.

10 – Spark NZ Ltd

we support moderator proposal and we support to specify 4Rx for handheld UE in rel 18

11 – Samsung Electronics Co.

We appreciate moderator's hard work to make a harmonized solution to move forward. We are generally fine to have the first discussion on the LB 4Rx and two bands 3Tx in RAN4 as OPPO proposed. However, all the proposed features need the check of the feasibility and legacy band impact carefully before specifying requirements since it definitely has critical impacts to the current UE design especially for the one supporting advanced features already as other UE vendors have commented. Although we still have concerns, we are OK to start study as moderator suggested for 3Tx with the check point. However, for 4Rx, it also needs to start with FWA only to see the feasibility and impact first. In our view, that's the possible way companies can compromise in this meeting.

12 – MediaTek Inc.

We respect OEM vendors' decision.

<p>13 – Guangdong OPPO Mobile Telecom.</p> <p>To Samsung comment:</p> <p>Thanks for your compromise of the 3Tx with study the requirements for handheld UE and check point.</p> <p>For the 4Rx, if we focus on FWA actually it already discussing 8Rx in FR1 enhancement WI, seems the 4Rx FWA is not needed considering there is no size limitation?</p>
<p>14 – Beijing Xiaomi Mobile Software</p> <p>We are fine with the proposal from the moderator.</p>
<p>15 – TELECOM ITALIA S.p.A.</p> <p>We are fine with the moderator’s proposal.</p> <p>And we request to specify support for handhelds in Rel 18. This is in any case an optional feature, and as stated by some companies there are already handhelds supporting 4Rx</p>
<p>16 – China Unicom</p> <p>We support moderator’s proposal, and support to specify 4Rx for handheld UE in Rel-18.</p>
<p>17 – KDDI Corporation</p> <p>We support the moderator’s proposal</p>
<p>18 – NTT DOCOMO INC.</p> <p>We support the moderator’s proposal.</p>
<p>19 – Telstra Limited</p> <p>Same view as Spark & TIM, ok with the proposal 2 and request addition in Rel-18</p>
<p>20 – Orange</p> <p>We support the proposal, and we believe it is essential to have 4 Rx for handheld UEs in Rel-18</p>
<p>21 – Google Inc.</p> <p>Similar view as Apple, Meta, LG and Vivo. In our understanding, it is challenging to have LB RX3/RX4 coexisted with legacy LTE/FR1 antenna and FR2 antenna system. It needs more time to study LB 4RX antenna performance(such as antenna correlation and isolation). Hence, we agree with companies’ view that it would be better to postpone LB 4Rx for handheld UE to a dedicated Rel-19 study item.</p>
<p>22 – CHTTL</p> <p>We support</p>

Proposal 3 for Topic #7:

- 3Tx in 2 bands and other enhancement for HPUE with 2Tx or 3Tx
 - How to handle enhancement of 3Tx in 2 bands
 - Merge RP-223029 (OPPO) and RP-223362 (Apple) into one WI for enhancement of 3Tx in 2 bands with PC2, PC3 and PC1.5
 - Discuss and address the generic requirements including the following scenarios under the objective of the power domain enhancements of WI of NR_cov_enh2
 - Increasing UE power high limit feature
 - PC3 FDD band 1Tx + PC2 TDD band 2Tx
 - PC3 TDD band 1Tx + PC2 TDD band 2Tx
 - (Moderator note: this part is not spectrum related and should be handled in a non-spectrum related WI)
 - UE types for those band combinations
 - Include FWA
 - Study the requirements for handheld UE form factor, and set the checking point to decide whether to include the handheld UE in WI based on the outcome of study.

Please make comments on the modified propose 3 for Topic #7 if any.

Feedback Form 63:

1 – Apple (UK) Limited

We propose to focus on 3Tx feature in this WID and postpone the LB 4Rx objective to a dedicated Rel-19 study item as we comments above. For the "Increasing UE power high limit feature", there is no new general requirement needed for PC3+PC2 combinations. Is it really necessary to handle them in a separate non-spectrum WID?

2 – Guangdong OPPO Mobile Telecom.

Thanks moderator for the summary and proposal. Generally we are ok, but for the UE type part we see clear majority supporting specify handheld UE in the 3Tx, alternative probably is as below:

- **Include both handheld UE and FWA, which UE type applies to each band depends on operator's request**

3 – Guangdong OPPO Mobile Telecom.

In the updated version of merged WID, we would propose to keep both alternatives for further check companies view. The Rev3 can be found in inbox->drafts->[98e-08...]->low band enhancement folder.

Targeting UE type:

- **Alt1:** Specify UE RF requirements for FWA. Study the applicable requirements for handheld UE and further check in [RAN#99] whether to specify applicable UE RF requirements in Rel-18
- **Alt 2:** Include both handheld UE and FWA, which UE type applies to each band depends on operator's request

4 – QUALCOMM JAPAN LLC.

For the power domain enhancements, we still think we should have PC3 FDD + PC1.5 TDD, these are combinations of high value to operators. PC3+PC2 is already defined, what is the need to put it in a different WI?

We support to have both handheld UEs and FWA

5 – China Telecom Corporation Ltd.

Thanks Moderator for the big efforts.

Given the discussion in the first two rounds, we are ok to treat FWA and handled UE separately.

Just one comment, we think the controversial issue is whether or not the 3Tx requirements can be applicable for handled UE, and if applicable, the same set of requirements will be used for FWA and handled UE (to directly reuse the existing 1Tx and 2Tx requirements for the two bands respectively).

So, maybe we can update the sentence as follows:

Specify UE RF requirements for FWA. Study **whether or not the requirements can be applicable to** the applicable requirements for handheld UE and further check in [RAN#99] whether to specify applicable UE RF requirements in Rel-18

6 – T-Mobile USA Inc.

We support the moderator's proposal. We prefer Alt. 2 from OPPO but could live with Alt. 1.

7 – Meta Ireland

For 3Tx feature of 2 inter-band CA band combinations, we can support the moderator proposal. Also we are fine to add the power combination with Total PC1.5 power combos = PC3 FDD + PC1.5 TDD as mentioned QC.

8 – vivo Communication Technology

Many thanks for moderator's good summary and great efforts. Given 3Tx working scope has been confirmed as non-spectrum proposal, RAN should discuss the workload and whether new non-spectrum proposal is permitted or not.

On the other hand, regarding the detailed objectives, in the first bullet, "enhancement of 3Tx in 2 bands with PC2, PC3 and PC1.5" means this is a general new feature enhancement of **ALL** CA combination with one band support TxD or UL-MIMO but not band-combination specific. **The first bullet part is not purely spectrum and also non-spectrum related.** The overall spec impact of 3Tx is more than just limited to increasing power high limit but many generic requirements, e.g. for the simultaneous uplink in 2 bands case Inter-band UL CA MPR requirements in clause 6.2A.2.3 of 38.101-1, there is following requirements:

"For inter-band carrier aggregation with uplink assigned to two NR bands, the requirements in clause 6.2.2 apply for each uplink component carrier. "

It should be noted that the requirements in clause 6.2.2 are defined specifically for one antenna connector case, and the 2Tx requirements were defined in other dedicated clauses 6.2D.2 and 6.2G.2 for UL MIMO and Tx Diversity respectively. These are clearly generic requirements, and there are also many other similar cases.

Regarding the second bullet, the general enhancement of 23+26 to 2Tx in one band is clearly an up-scoping of RAN1 Rel-18 NR coverage enhancement WI (based on Rel-17 increasing UE power high limit WI outcome), which is clearly not mainstream behavior in this meeting. It is still not clear what would be the impact and it is possible not just limited to what Rel-17 had revised.

In summary, due to unclear workload and generic requirements specification impacts, we think the overall work in Proposal 3 for **3Tx related scope should be started with FWA formfactor as a dedicated non-spectrum WI.**

9 – LG Electronics Deutschland

We are OK with the moderator's proposal and for the options provided from OPPO, we think Alt.1 is a kind of compromise proposal and can go with Alt. 1.

10 – Guangdong OPPO Mobile Telecom.

To vivo: Curious about your comment, we understand your concern of handheld UE and also your keep saying non-spectrum, but where is the conclusion about this? We didn't aware of it, please clarify...

11 – Spark NZ Ltd

we support moderator proposal

12 – ZTE Corporation.

we are also fine to support the PC1.5 power class=PC3 FDD+PC1.5 TDD. In addition, we prefer to focus on the smartphone since the justification from companies are from smartphone instead of FWA. We are also fine with both if majority view is to have both to be studied.

13 – Nokia Japan

We support an alternative of Alt 1 from China Telecom. Alt 2 doesn't look reasonable since we don't know if differentiation of handheld and CPE devices is needed or not at this moment.

14 – Nokia Japan

As commented in the previous enquiry, we think an alternative of Alt 1 from China Telecom would look better. Alt 2 doesn't make sense since we don't know if the differentiation of handheld and CPE devices at this moment. Regarding the original Alt 1, we don't see the necessity of capturing revisit the applicability in a specific RAN, i.e., RAN#99. A next action just depends on the outcome of the study.

15 – Beijing Xiaomi Mobile Software

We think the moderator's proposal is a good compromise considering the first two round discussion. We support the moderator's proposal.

16 – TELECOM ITALIA S.p.A.

considering this is an optional feature, we have the same view as T-Mobile USA:

We support the moderator's proposal. We prefer Alt. 2 from OPPO but could live with Alt. 1.

17 – China Unicom

We are okay moderator's proposal. For the UE types part, we support to specify 3Tx for handheld UE in Rel-18.

18 – Huawei Technologies France

Thanks moderator's great efforts. We are ok with the moderator's proposal.

19 – KDDI Corporation

We are ok with the moderator's proposal.

20 – MediaTek Inc.

Thanks for Moderator and all for the efforts. At this stage, we are fine with the objectives for FWA, not for handheld UE, but we are open to check it in RANP#99. And there are two important aspects that the RF requirements here mean band combination specific RF requirements, and there should be no RAN2 specs impact either. By considering these all together, we suggest the revision as below (Revision also uploaded to the server as Rev3.1 RP-223029 R18 New WI on low band enhancement for handheld UE_HW_MediaTek):

1 Targeting UE type:

Specify UE RF requirements for FWA.

1 Specify requirements for 3Tx, e.g. clarify the applicable requirements for the band which support UL MIMO in inter-band UL CA or inter-band EN-DC

Note 1: Revisit in RAN#99 whether or not to apply the FWA RF requirements to handheld UE.

Note 2: RF requirements in this WID mean band combination specific RF requirements.

Note 3: No RAN2 specs impacts are allowed.

21 – vivo Communication Technology

To OPPO: non-spectrum is clearly stated within moderator note in Proposal 3.

22 – Guangdong OPPO Mobile Telecom.

To vivo: The proposal 3 moderator note is for the "coverage enhancement part", not the whole. And the coverage enhancement part is not included in the 3Tx current scope. Hope we can align understanding at this point.

23 – NTT DOCOMO INC.

We support to include handheld UE.

An alternative is to differentiate PC as we commented in 1st round.

For PC3/2/1.5, FWA is included.

For PC3/2, Handheld UE is included.

<p>For PC1.5 handheld UE, study whether or not the requirements can be applicable to handheld UE in Rel-18.</p> <p>A smaller power class has less impact on UE heating and power consumption issue. And spec impact and technical analysis may be also different between PC3/2 and PC1.5.</p>
<p>24 – Telstra Limited</p> <p>We support the moderators proposal. We prefer Alt 2.</p>
<p>25 – Orange</p> <p>we are fine with the proposal except that we also support the specification of 3Tx for handheld UEs in Rel-18</p>
<p>26 – Google Inc.</p> <p>For 3Tx, we still care about power consumption and thermal. We can compromise to Alt 1.</p>
<p>27 – Sony Group Corporation</p> <p>We appreciate the great effort from Moderator and proponent on the summary and revised WI. For 3 Tx, we can compromise to revisit for handheld UE in the future meeting, e.g., alt.1</p>
<p>28 – T-Mobile USA Inc.</p> <p>We support having 3Tx for both FWA and handheld. The reason for handheld is to allow a smoother transition between low band PC3 and mid band spectrum PC1.5 on TDD without RRC reconfiguration.</p>

Please comment on the latest version of revised WID of RP-223029 (OPPO) for 4Rx handheld U and 3Tx in 2 bands at https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/%5B98e-08-R18-RAN4-SpectrumRelated%5D/Rev2%20RP-223029%20R18%20New%20WI%20on%20low%20band%20enhancement%20for%20handheld%20UE.doc

Feedback Form 64:

<p>1 – Guangdong OPPO Mobile Telecom.</p> <p>The latest version V3.1 has been uploaded to cover the feedbacks in 2nd round. It can be found in: inbox->drafts->[98e-08...]->low band enhancement folder. Comments are welcomed.</p>
<p>2 – QUALCOMM JAPAN LLC.</p> <p>Thank you for the updated WID. We made a few clarifications and included some comments in a revision. https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/%5B98e-08-R18-RAN4-SpectrumRelated%5D/Rev2%20RP-223029%20R18%20New%20WI%20on%20low%20band%20enhancement%20for%20handheld%20UE_QC.doc</p> <p>Will also summarize here the comments:</p> <p>There are no EN-DC combinations included in the WID, some combinations should be included or EN-DC should be removed.</p> <p>Our understanding is that PC3 TxD is not supported so for the cases with PC3 2Tx it would be good to</p>

clarify that only UL-MIMO is targeted.

Overall, we do not see combinations that include PC3 with 2Tx being of high interest. Our assumption is that if 2Tx are being implemented, the power class will be PC2 in that band. These combinations could be left out and combinations with PC3+PC1.5 with power increase should be considered. These combinations will be a lot more useful to operators.

If PC3 with 2Tx is still maintained than there should be some combinations with NR-U, in our understanding that would be the only case of interest.

3 – Guangdong OPPO Mobile Telecom.

To Qualcomm:

I am sorry for the confusion. The Rev2 was the version for discussion in intermediate round, the updated version after that is **Rev3.1 in the dedicated low band enh folder** under [98e-08-xxxx]. Comments can be based on that version.

The changes seems all have been covered:

1. EN-DC band combinations is requested by CHTTL and added
2. PC3 total power class is removed
3. PC3+PC1.5 is added

4 – vivo Communication Technology

Based on the several rounds of discussions, it is clear that 4Rx is within spectrum-related topic scope, but 3Tx scopes are non-spectrum and also related to Rel-18 WI up-scoping. Therefore, the discussions should be clearly separated, but not in the single one.

5 – Guangdong OPPO Mobile Telecom.

To vivo:

To better understand your concern, is it correct understanding that currently your concern now is only about how to organize the work rather than the technical contents?

6 – Spark NZ Ltd

we support revision 3.1 of the WID RP-223029 provided by Oppo

7 – Telstra Limited

As indicated earlier in the week, we strongly support the introduction of low band 4Rx for handheld UE in Rel-18.

Regarding enhancements of 3Tx, we prefer "Alt 2: Include both handheld UE and FWA, which UE type applies to each band depends on operator's request".

We are fine with the rest of Rev3.1 RP-223029 as proposed by Oppo.

8 – Meta Ireland

In version 3.1, we support objectives 2 for 3Tx for band combinations with two inter-bands. For 4Rx feature in low band in objective 1 , we just support the FWA UE type as mentioned in 4Rx topic in final round. In Rel-19, RAN can study on the 4Rx feasibility in low band for handheld UE based on the interested companies results from variable UE vendors.

9 – LG Electronics Deutschland

For 3Tx, we prefer Alt.1 i.e. to have a study phase for handheld UE and by setting check-point at RAN#99, we can decide whether to proceed with normative work or defer this to Rel-19.

10 – China Unicom

Thanks for revision. We support Rev3.1 prepared by OPPO.

Regarding 3Tx feature, we prefer Alt2: Include both handheld UE and FWA, which UE type applies to each band depends on operator's request.

11 – Huawei Technologies France

Thanks for the draft WID, we'd like to add one band combination for 3T with 2 bands.

https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/%5B98e-08-R18-RAN4-SpectrumRelated%5D/L223029%20R18%20New%20WI%20on%20low%20band%20enhancement%20for%20handheld%20UE_HW.doc

12 – Ericsson France S.A.S

For 3TX, we think it would be prudent to take alt.1 and double check in RAN#99 whether there are any issues for the handheld UE.

Regarding the 4RX, the objective does not contain any feasibility study for handheld UEs below 4GHz which contradicts proposal 2/option 1a on 4RX in the discussion above . In our understanding, feasibility study should be captured in the objectives.

One procedural comment; capturing the list of bands and contacts makes the WID look like a basket. Our understanding is that this WID is not a basket, but can of course be followed by a basket to add other bands. If that is the shared understanding, maybe to avoid confusion it may be better to simply list the bands (same list) as example bands

13 – Guangdong OPPO Mobile Telecom.

To Ericsson comment:

For the study part, no problem to revert back to study and specify which is the original wording, and removed due to concerns on the study part.

For the bands/band combinations, the list is for information purpose since comments received on which company raised the request, and would like to capture it to give more information to their product team, etc. With a table to list the information can make it more clear.

14 – Guangdong OPPO Mobile Telecom.

The Rev 3.2 has been uploaded for further discussion covering the comments received above and add more supporting companies.

<p>15 – CHTTL</p> <p>Thanks for the update, ok with Rev 3.2 and as one of the supporting company</p>
<p>16 – Bell Mobility</p> <p>Agree with Ericsson need to be clear this is not a basket and the list of combos is not extensive. Propose to change the wording to ” Examples of frequency band combinations considered in this WI is in table 4.1-2 with the contact information inside”. Bell Mobility has interest in other combos (CA_n66A-n77A) not listed and our understanding is this will be part of a basket later. We prefer Alt 2: Include both handheld UE and FWA, which UE type applies to each band depends on operator’s request”.</p>

Please comment on the latest version of revised WID of RP-223260 (ZTE) at

https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_98e/Inbox/Drafts/%5B98e-08-R18-RAN4-SpectrumRelated%5D/Rev1_RP-223260_New%20WID%20on%204Rx%20support%20for%20NR%20FR1%20bands%20in%20Rel-18.docx

Feedback Form 65:

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8.2.4 Extended round

The comments from companies are captured in the table.

Table 20:

Comments on revised WID RP-223029	
Objective	Comments

LB 4Rx	<p>Apple: We propose to postpone the LB 4Rx studies for handheld UE to a dedicated Rel-19 study item. Many companies already raised the concern on the challenges of implementing 3 or 4 LB antenna into smartphone form factor without compromising the antenna performance, including the primary antenna as compared to 2Rx design. Postponing the objective to Rel-19 would allow UE vendors more time to study and evaluate the antenna performance in a highly constrained handheld UE form factor and be able to make more meaningful contributions.</p> <p>Meta: Same view with Apple. The 4Rx in Low band feature for Handheld device quite premature to directly treat as WID. We prefer ID in Rel-19. And 4Rx in LB for FWA device can study and specify the related RF requirements in Rel-18.</p> <p>Qualcomm: We support this objective.</p>
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2-band 3Tx

Apple:

- We are fine with the proposed PC2 configurations.
- For PC3 (1Tx) + PC2 (2Tx), we think the "Increasing UE power high limit" feature can be leveraged, or the PC2 (2Tx) maximum output power would be downgraded when transmitting simultaneously with PC3 1Tx. We expect the specifications work is rather minimal. But we are also fine to take it as the next step.
- On the PC1.5 side, we think technically we should include 1Tx PC2 (TDD) + 1Tx PC2 (TDD) as the basis before moving up to PC1.5 with 3Tx. It can be easily done by simply adding the example band combinations of UL CA_n41A-n77A and DC_40A-n78A to UE power class tables.
- For PC3 + PC1.5 and PC2 + PC1.5, we think the "Increasing UE power high limit" feature can also be considered for PC1.5. But we are fine to take it as next step.
- We are okay to start with FWA as baseline and then transition to handheld UE later.

Meta: We support this Objectives

Qualcomm:

We could also live without PC3 FDD+PC3 TDD, PC3 with 2Tx is of low interest, in our understanding, especially for TDD. We also think that PC3+PC1.5 with increased power could be in the scope but we can agree to do it later to limit the work.

ZTE:

We also support to include the PC3/2+PC1.5 and 1Tx PC2 (TDD) + 1Tx PC2 (TDD) with increasing power into this scope.

Moderator:

The proposal in the final round is to discuss the objectives for increasing power in Rel-18 WI of NR_cov_enh2. The reason is that there is objective in WI of NR_cov_enh2, i.e.,

Enhancements to realize increasing UE power high limit for CA and DC based on Rel-17 RAN4 work on "Increasing UE power high limit for CA and DC", in compliance with relevant regulations (RAN4, RAN1)
And in the moderator view, the objective of increasing power should be the non-spectrum related.

If the proposal from moderator was agreed, the HPUE combinations of companies can be discussed directly under WI of NR_cov_enh2 without changing of the objective of WI of NR_cov_enh2.

But looking at experts' comment, it seems that companies propose to add "increasing power limit" in OPPO WI. If so, there would be overlapping between two WIs.

Vivo:

I think one of the reasons for removing increase UE

Overall	<p>Apple: If we agree to remove the LB 4Rx objective, the WID title can be revised to “R18 new WI on UL enhancement for inter-band UL CA and EN-DC”.</p> <p>Meta: 4Rx in LB feature: RAN can start the objective for FWA firstly in Rel-18. 2Tx for 2 bands : Support</p> <p>Qualcomm: We support the WID, please include Qualcomm Incorporated as a supporting company</p> <p>Moderator: The moderator would like to try to modify the proposal 1~3 according to comments above in the extended round. But still the diverse views are observed. The modified proposals may not reflect everyone’s comment and we can discuss the proposals during GTW. Hope that we have enough time.</p>
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8.3 Sub-topic #7-2 New WI on on HPUE with simultaneous 2Tx and 3Tx

8.3.1 Initial Round

8.3.1.1 Comments & responses

Sub-topic 7-2-1: Any question or comment on the motivation and justifications of the proposal?

Companies are invited to provide the general comments, including comments on the motivation, justification part, whether the WI is needed, how to handle the work, in the follow table.

Observation 1: Many existing UEs are already hardware capable of supporting PC2+PC2 in TDD+TDD band combinations.

Observation 2: Many existing UEs are already hardware capable of supporting inter-band combinations with simultaneous 1Tx transmission in one band (TDD or FDD) and 2Tx transmission in the other band (TDD) for UL MIMO or Tx diversity.

Observation 3: For TDD+TDD combination under simultaneous 2Tx operation, there would not be DL reception in both bands, therefore the 2UL IMD issue does not need to be considered.

Observation 4: For inter-band UL combinations, the Tx requirements are basically per-band based, and the RF characteristic for UL MIMO or Tx diversity with 1CC is virtually no different from 1Tx.

Therefore, no new Tx requirement is expected for the intended 3Tx UL configurations.

Observation 5: On the Rx requirements side, for PC2 and PC2 with “increasing UE power high limit”, there would be no difference from the existing inter-band UL combinations with 2Tx.

Observation 6: For PC1.5 and PC1.5 with “increasing UE power high limit”, there would not be any new Rx requirement for TDD+TDD combinations.

Observation 7: The only potential new Rx requirements to be developed are for PC1.5 and PC1.5 with “increasing UE power high limit” for FDD+TDD combinations.

Proposal: RAN to approve a new WID on HPUE with simultaneous 2Tx and 3Tx comprising the proposed objectives in section 3.

Feedback Form 66:

<p>1 – T-Mobile USA Inc.</p> <p>We support the proposal. Could be merged with other proposals.</p>
<p>2 – Skyworks Solutions Inc.</p> <p>Even if there is some overlap in the two proposals, this proposal is more complete and precise in terms of applicable cases. As a supporting company we prefer that the 2Tx/3Tx is separate from the other aspect and is based on proposal in RP-223361</p>
<p>3 – Telstra Limited</p> <p>Support the proposal. Ok to keep separate from other proposals</p>
<p>4 – Verizon UK Ltd</p> <p>We agree and support the proposal !</p>
<p>5 – Bell Mobility</p> <p>We support the proposal</p>
<p>6 – Guangdong OPPO Mobile Telecom.</p> <p>Generally we are ok with high power enhancements especially for 3T which is also part of our proposals in RP-223029.</p> <p>For the whole 3T feature, we slightly prefer to start with a comparingly smaller case, i.e. low band + mid/high band, considering the PAs in UE frontend is usually separate for low bands and mid/high bands and enabling 3T doesn't cause much difficulties, though the other cases were also considered in our previous proposals.</p>
<p>7 – China Telecom Corporation Ltd.</p> <p>In general, we are supportive of the proposal. For 3Tx, the overlapping with Topic 7-1 needs to be addressed. In addition, we support to introduce 0 us switching period for Tx switching (which is the easiest usage scenario for 3Tx UE) as proposed in the WID in Topic 7-1.</p>

8 – CATT

The proposal has overlapping with RP-223029, suggest to merge the overlapped WI.

9 – QUALCOMM JAPAN LLC.

WE are supportive of further expanding support for UEs with higher power. The observations are a bit confusing because it is stated that no new requirements are needed for most of the proposals. It seems that the WI would only be needed for combinations of PC1.5 and PC1.5. It would be good to clarify what exactly is needed in the specifications and have a WI with clear objectives.

Also, some of the proposals are similar to the proposal in Topic #7 so these could be merged.

10 – vivo Communication Technology

Similar comments as we share in Topic 7:

The 3Tx related proposals have been discussed as a non-spectrum related topic and dropped based on RAN chair guidance in the endorsed RP-220068, after several rounds of RAN-P meetings.

In our understanding, **3Tx is a new UE feature and architecture not discussed in RAN4, this should be a non-spectrum topic**. Most importantly, RAN4 shall follow the clear boundary between spectrum related topic and non-spectrum related topics. proposals.

In short, 3Tx proposal is a non-spectrum topic and has been dropped in Rel-18 after many discussions. Especially, it is well understood R18 schedule is quite tight. As proposed by many operators in R18 timeline discussions we suggest not to upscoping Rel-18 workload for any non-spectrum related topics and further consider it maybe in future release.

11 – Apple (UK) Limited

Thanks to companies for the valuable comments and the supports for this proposal.

To Qualcomm's question on what is exactly needed in the specifications, we think first we need to introduce PC1.5 feature for inter-band UL CA/DC with 2Tx to set up the foundation for the 3Tx feature which involves PC1.5 in one band and PC3 or PC2 in the other band. The easiest approach is to first introduce a PC2 (TDD) + PC2 (TDD) combination for PC1.5 in the specifications. Despite there is no new requirement to be developed for such combination, the new configuration and power class still needs to be added to the specifications.

On the general 2-band 3Tx concurrent operation side, we tend to agree that technically the current specifications do not prevent UE from indicating its capability in supporting 2UL inter-band CA with UL MIMO in one band or even in both bands. However, RAN4 specifications also do not explicitly enable simultaneous 3Tx feature as the general consensus up to Rel-17 is that there is at most 2Tx can be active at the same time. The 3Tx operation currently would be based on UL switching between two bands, meaning that 2UL with concurrent 3Tx is currently not allowed. The WI is meant to explicitly enable this feature in the specifications despite there may not be new requirement for PC3, PC2 and PC1.5 for TDD+TDD. Otherwise, the concurrent 3Tx operation in 2 UL bands may never be scheduled by the network, but only switched UL can be scheduled. With regard to how the concurrent 3Tx feature can be explicitly specified in the specifications, one way is to add a new clause 6.2H.2 Transmitter power for inter-band UL CA with UL MIMO to capture the UL configurations and power class which support concurrent 3Tx operation. But exactly how the concurrent 3Tx feature is captured in RAN4 specifications can be further discussed during the WI phase.

Lastly, there is a need to define the 2UL MSD framework for PC3 FDD band + PC1.5 TDD band before the basket WID. The framework can be based on PC1.5 or PC1.5 with “increasing UE power high limit” feature where the latter may be of higher interest. To proceed with this feature, PC1.5 for inter-band UL CA/DC needs to be specified first or at least in parallel.

As there are some similarity with the 3Tx objective in RP-223029, we are open to work with OPPO to merge the 3Tx feature into one WID.

12 – Huawei Technologies France

In general, we are ok with 3T for 2 operating bands. But non-spectrum related proposal should have less impact on the whole workload in RAN4. Since it is similar to proposal in topic #7, we prefer to discuss 3T in one place.

13 – Samsung Electronics Co.

I have to provide our similar view as Sub-topic 7-1. In addition, perhaps introducing 3Tx for FWA is more practical way or demand we can have it now.

14 – China Unicom

We support the 3Tx UE enhancements.
There are some potential overlappings with Topic#7.

15 – Meta Ireland

2Tx is not critical for HPUE. 3Tx can be applied in FWA device firstly and need to feasibility study of the trade-off between battery consumptions & heating problem and benefits of coverage & T-put improvements. Also we need not to increase the RAN WGs work load in Rel-18 anymore.

16 – Nokia Japan

If we have a new WI on these aspects, it's better to merge OPPO's one and Apple's one. We basically support the ideas, but we need to differentiate which objectives requires technical analysis and which one requires just clarifications. The scope needs to be clarified, e.g., PC2+PC2 TDD+TDD, given that each of the TDD bands may support UL MIMO, why do we need to limit the total number up to 3Tx?

17 – NTT DOCOMO INC.

We support the proposal.
But if companies have concerns on real implementation perspective, one way is to differentiate the discussion for PC3/2 and PC1.5. A smaller power class has less impact on UE heating and power consumption issue. And spec impact may be also different between PC3/2 and PC1.5.

18 – Ericsson France S.A.S

For the PC3/2, if the spec impact is small then it is good to create the 3TX capability. For the PC1.5, the spec impact is somewhat larger and we should take care on RAN4 workload. We should merge 3TX proposals to a single WI.

19 – Google Inc.

We have same view as Samsung.

Sub-topic 7-2-2: Comments and responses on the proposed objectives

The following objectives are proposed in the WID.

————— Core part —————

The objective of this work item is to enhance handheld UE performance.

1. Introduction of PC1.5 for TDD (PC2) + TDD (PC2) inter-band UL CA or DC

- Investigate and specify, if needed, any new general UE RF requirement to support the configuration.
- Specify, if needed, any band combination specific UE RF requirement to support the following example band combination.
- Example band combination, CA_n41A-n77A

2. 2-band inter-band UL CA or DC with simultaneous 3Tx

- PC2
 - PC3 TDD 1Tx + PC3 TDD 2Tx (example band combination: CA_n41A-n77A)
 - PC3 FDD 1Tx + PC3 TDD 2Tx (example band combinations: CA_n3A-n78A, CA_n41A-n71A)
- PC2 with “increasing UE power high limit” feature
 - PC3 TDD 1Tx + PC2 TDD 2Tx (example band combination: CA_n41A-n77A)
 - PC3 FDD 1Tx + PC2 TDD 2Tx (example band combinations: CA_n3A-n78A, CA_n41A-n71A)
- PC1.5
 - PC2 TDD 1Tx + PC2 TDD 2Tx (example band combination: CA_n41A-n77A)
- PC1.5 with “increasing UE power high limit” feature
 - PC3 TDD 1Tx + PC1.5 TDD 2Tx (example band combination: CA_n41A-n77A)
 - PC3 FDD 1Tx + PC1.5 TDD 2Tx (example band combinations: CA_n3A-n78A, CA_n41A-n71A)
 - PC2 TDD 1Tx + PC1.5 TDD 2Tx (example band combination: CA_n41A-n77A)

- Investigate and specify, if needed, any new general UE RF requirement to support the above configurations.
- Specify, if needed, any band combination specific UE RF requirement to support the above example band combinations.

Core part

Companies are invited to provide comments and responses in the following table.

Feedback Form 67:

<p>1 – QUALCOMM JAPAN LLC.</p> <p>As we commented on the previous items that are related, we should clarify what exactly is newly needed in the specifications. The "power increases" such as PC3 + PC1.5 could be defined generally and the power increase would apply automatically to the example band combination also. In our understanding, this would be the only thing missing in the current specifications.</p> <p>Why would there be a need to differentiate TDD vs. FDD for the component bands?</p>
<p>2 – vivo Communication Technology</p> <p>For bullet 1, in our understanding, any new general requirements would belong to non-spectrum WI.</p> <p>For bullet 2 objectives, same comments as 7-2-1, we believe 3Tx proposal is a non-spectrum topic and has been dropped in Rel-18 after many discussions. Especially, it is well understood R18 schedule is quite tight. As proposed by many operators in R18 timeline discussions we suggest not to upscoping Rel-18 workload for any non-spectrum related topics and further consider it maybe in future release</p>
<p>3 – Huawei Technologies France</p> <p>For bullet 1, if there could be new general UE RF requirement to support the configuration as proposed, we think a spectrum related WI is not appropriate. Usually, the spectrum WI is to define the band/band combination specific requirements.</p> <p>For bullet 2, we feel "increasing UE power high limit" should be general feature, which can be amended to cover all possible band combinations, but no need to request one by one. We don't big difference for FDD and TDD band combinations. On the other hand, we think that too many cases are proposed, which could significantly increase the workload in RAN4. We also agree with vivo that clear boundary of spectrum related and non-spectrum related topics should be considered. Additionally, the 3T with 2 bands is a similar proposal as that discussed in topic #7. Better to focus on discussion in topic #7 firstly.</p>
<p>4 – Meta Ireland</p> <p>We prefer not to add these new simultaneous 3Tx band combinations if RAN4 do not clear agreement for the usage and necessity. Also it will raise issue to define new power class to support PC3+PC1.5 and PC2+PC1.5 band combinations. This is not spectrum related issues.</p>
<p>5 – ZTE Corporation.</p> <p>For increasing power limit for inter-band UL CA, it should be applicable for all appropriated band combination.</p>

In addition, based on agreed WF for higher power limits increasing in Rel-18, it seems that only inter-band PC3 UL CA with PC3 for band 1 band PC5 for band 2 is considered. If we go further as proposed in bullet 2, then scope would be increased a lot. We are open to further discussion if the workload is manageable.

6 – Ericsson France S.A.S

We should take care to remain within the scope of a spectrum WI. Potentially the objectives could be refined to PC3/2

7 – Beijing Xiaomi Mobile Software

For objective 1, we are ok. For objective 2; From our perspective, the scope is a bit too large, we also have concern on the workload. if needed, we prefer to not include the part of increasing high power limit, because current R17 increasing high power limit only focus on 2PA case, how to apply this feature to 3PA case needs FFS.

Sub-topic 7-2-3: Comments and responses on impacted/new specifications and target completion date & time budget

Companies are invited to provide comments and responses in the following table.

Feedback Form 68:

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8.3.1.2 Summary

19 companies made the comments. 7 operators supported the proposed WI scope. On top of the technique comments made in sub-topic #7, Skyworks thought Apple proposal is more completed and precise and prefer to it. Nokia commented why to limit the total number up to 3Tx for PC2 TDD + PC2 TDD given that each of TDD band can support UL-MIMO. Ericsson had concern on the impact of PC1.5 on the RAN4 workload.

Regarding the objectives, Qualcomm commented that the only missing part is the power increases. Huawei had concern on the workload and thought that bullet 1 and increasing power belong to the non-spectrum related topics. Ericsson propose to limit the scope to PC3/2. Xiaomi also had concern on the workload caused by the big scope of objective 2.

Most companies proposed to merge OPPO 3Tx proposal and Apple proposed WI.

8.3.2 Intermediate round

Because there is overlapping between Sub-topic #7-2 and Sub-topic #7-1, the moderator would like to put them in one place to organize the intermediate round discussions. Please refer to the section 8.2.2 for intermediate round discussion.

8.3.3 Final round

Refer to Section 8.2.3.

8.4 Sub-topic #7-3 New WID on 4Rx support for NR FR1 bands (<2.6GHz) in Rel-18

8.4.1 Initial Round

8.4.1.1 Comments & responses

The proposed WI was agreeable in RAN#97-e. But because of administration error, it was not formally approved. The WI proposal of RP-223260 is the resubmission.

Sub-topic 7-3-1: Any question or comment on the motivation and justifications of the proposal?

Companies are invited to provide the general comments, including comments on the motivation, justification part, whether the WI is needed, how to handle the work, in the follow table.

Feedback Form 69:

1 – TELECOM ITALIA S.p.A. We support the approval of the Work Item
2 – T-Mobile USA Inc. We support the Work Item.
3 – Verizon UK Ltd We also support the work item!
4 – China Telecom Corporation Ltd. We support the WID.
5 – CATT Support the WID.
6 – QUALCOMM JAPAN LLC. What is the relationship between this WID and the Objective #1 in the low band enhancement for handheld UEs?
7 – vivo Communication Technology In our understanding, this WI is introducing 4Rx support for FWA form factor, so we support this WID.
8 – Huawei Technologies France In general, we are ok with the basket WI proposal. For low bands < 1GHz, whether both handheld UE and FWA UE are included should be clarified.
9 – China Unicom We support the WID.

10 – Nokia Japan We support specifying performance requirements for the objective, but we need to discuss coordination with other WIs, e.g., if this is merged with OPPO’s one or not.
11 – VODAFONE Group Plc We support the WID
12 – Beijing Xiaomi Mobile Software Support the WID

Sub-topic 7-3-2: Comments and responses on the proposed objectives

The following objectives are proposed in the WID.

_____ Core part _____

- Specify the 4Rx REFSENS requirement for NR FR1 bands
 - Support of 4Rx for the bands <2.6GHz added in this WI is optional
 - Note: it is not required for network to distinguish between smartphone and FWA UE types. Define the proper requirements for different UE types.

_____ Core part _____

_____ Perf. part _____

This Perf. Part WI is to specify the Perf. Part requirements:

- Required changes to be added to release independence TS 38.307 if any.

_____ Perf. part _____

_____ Way of working _____

The new request adding 4Rx for the FR1 bands smaller than 2.6GHz should be submitted on RAN4 reflector before tdoc submission deadline to the next RAN4 meeting (1 week before the meeting).

The basket WI will then be updated with the new requests (section 4.1.3, Table 4.1.3-1) and submitted to next RAN4 meeting for endorsement, before submission to RAN meeting for approval.

When the work is completed, all draft CRs related to one request will be submitted in the same RAN4 meeting to check consistency. If they are endorsed, the basket WI Rapporteur will merge all draft CRs from all requests in big CRs (one per TS specification).

After the RAN4 meeting preceding a RAN meeting, those big CRs will be sent on RAN4 reflector for email approval (1 week) and, if agreed, they will be submitted to following RAN meeting.

Companies are invited to provide comments and responses in the following table.

Feedback Form 70:

<p>1 – TELECOM ITALIA S.p.A.</p> <p>We support the approval of the Work Item. Priority could be given to bands n28, n3 and n1</p>
<p>2 – Guangdong OPPO Mobile Telecom.</p> <p>Some clarification in the scope probably is needed based on offline discussions. The 4Rx here is intended for FWA for the bands below 1GHz, and the smartphone 4Rx as a general issue is to be introduced in the 8.2 part. Potential changes can be considered as below:</p> <p>Specify the 4Rx REFSENS requirement for NR FR1 bands</p> <ul style="list-style-type: none">- Support of 4Rx for the bands <2.6GHz added in this WI is optional- Note: it is not required for network to distinguish between smartphone and FWA UE types. Define the proper requirements for different UE types, <u>and for the bands below 1GHz only consider FWA device type.</u>
<p>3 – Qualcomm Korea</p> <p>For clarification, the modified note indicates it is not necessary for the network to distinguish between smartphone and FWA. Does this mean we will not include any signaling of the UE type? If there is no signaling and there are different sets of requirements, how would RAN5 know which sets of requirements to test against?</p>
<p>4 – Skyworks Solutions Inc.</p> <p>again we do not understand the <2.6GHz since 4Rx is already supported optionally down to >1.8GHz (n1, n2, n3, n30, n40, n7, n34, n38, n39, n41, n66, n70) and for FWA <1GHz (n8, n28, n71). more clarification is needed for the objectives</p>
<p>5 – Guangdong OPPO Mobile Telecom.</p> <p>To Qualcomm question: Current spec already have several such cases like "NOTE 1: This table is targeted to large FWA form factor with 20 dB or above antenna isolation", or 2Rx exception for Vehicular devices. There is no problem in requirement application and RAN5 can test based on UE declaration.</p>
<p>6 – China Telecom Corporation Ltd.</p> <p>We support the objectives!</p> <p>For the comment #2 from OPPO, in addition to < 1GHz FWA UEs, we think 1 to 2.6GHz handled and FWA UEs can also covered in this basket WI.</p> <p>For <1GHz handled UE with 4Rx, since the feasibility study is needed, it can be discussed in a separate WI.</p>

For the comment #3 from QC, we share OPPO's view in comment #5.

For the comment #4 from Skyworks, this WID is to accommodate the additional requests from operators. In the last RAN plenary, the technical contents of the WID are stable and the WID was intended to be approved, but postponed due to the lack of the completion date.

7 – ZTE Corporation.

To OPPO, in the current request for the support of 4Rx in certain bands in the WID, whether it's for FWA device only or no limitation, this should be clarified during the request. In other words, the current agreeable objective didn't preclude the smartphone to be considered in this WID. At the current stage, we still prefer to keep it as it is since this is agreeable during the last RAN-P meeting.

Of course, if RAN/RAN4 could make the consensus to split the discussion for 4Rx in FWA and smartphone for less than 1GHz in the different WIDs, the companies should be clear where to request 4Rx to be supported in certain bands. If necessary, we could also do the adjustment based on RAN/RAN4 agreement.

8 – ZTE Corporation.

To TELECOM ITALIA, the current 38.101-1 has already support the 4Rx for band n28, n1 and n3.

9 – ZTE Corporation.

To Qualcomm, this has been discussed in the previous RAN-P meeting and we also agree with OPPO and China Telecom that RAN5 could test the device based on the UE declaration.

10 – ZTE Corporation.

To Skyworks, based on the previous RAN discussions, 4Rx for high bands (e.g. above 2.6GHz in FR1) should be baseline, therefore it would be more meaningful to focus on the bands less than 2.6GHz in which 4Rx is not supported yet to explore its performance benefit.

11 – CATT

Similar view as ZTE, this WI clearly says there is no need to distinguish smartphone and FWA, and smartphone is not precluded to be considered. It seems no reason to separate smartphone only for <1GHz which will cause confusion during WI discussion.

12 – vivo Communication Technology

We believe this WI was agreeable in last RAN meeting because the scope is focused on FWA device type. We do not think smartphone requirements for <1GHz should be considered in this WI.

13 – Huawei Technologies France

We think the original intention of the WI proposal is a general basket, which is not established for specific UE type for specific operating bands. For frequency bands < 1GHz, seems common understanding is that the feasibility of supporting 4Rx should be studied firstly. But where and when to have this kind of study is not clear yet. For low bands, the relation of this basket WI proposal and the new proposal by OPPO should be clarified.

14 – Apple (UK) Limited

We are okay with the new WID proposal if there are demands for more bands to support 4Rx, with the clarification that for bands < 1 GHz, 4Rx operation is targeted for FWA form factor. Also as we commented above, there is no need to have a separate WID for LB 4Rx as the requirements can already be covered in this basket WID.

Sub-topic 7-3-3: Comments and responses on impacted/new specifications and target completion date & time budget

Companies are invited to provide comments and responses in the following table.

Feedback Form 71:

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8.4.1.2 Summary

12 companies made the comments. Almost all the companies can support the WI. Qualcomm commented on the relation between this WID and OPPO proposal of Objective 1 in their WID. Huawei also would like to clarify whether both handheld UE and FWA UE are included in this WI. Nokia commented whether this WI should be merged with OPPO's.

Regarding the objectives, OPPO proposed to clarify this WI is for bands below 1GHz only considering FWA device type. Qualcomm commented on the note not to differentiate UE type and how RAN5 differentiate different device. In the moderator and proponents' view, this aspect has been discussed in last RAN and the test can be done depending on declaration. Skyworks had comments on the limitation of <2.6GHz. China Telecom suggested the separate WI for <1GHz handheld UE with 4Rx since the feasibility study would be needed. ZTE commented that the scope is not limited to FWA only and which UE type needs be considered depending on the operators' requests. ZTE preferred to keep the WID as it is since it was agreeable in the last RAN.

8.4.2 Intermediate round

Because there is overlapping between Sub-topic #7-3 and Sub-topic #7-1, the moderator would like to put them in one place to organize the intermediate round discussions. Please refer to the section 8.2.2 for intermediate round discussion.

8.4.3 Final round

Refer to Section 8.2.3.

