**3GPP TSG-RAN Meeting # 91-e RP-21xxxx**

**Electronic Meeting, 22 – 26 March, 2021**

**Agenda item:** 9.1.4

**Source:** RAN4 chair (Apple)

**Title:** Email discussion summary of [91E][12][Spectrum\_WIs]

**Document for:** Information

# Introduction

In RAN#91-e, an email thread [91E][12][Spectrum\_WIs] is assigned to discuss the following tdocs: RP-210352, RP-210356, RP-210357, RP-210360, RP-210362, RP-210380, RP-210381, RP-210382, RP-210383, RP-210384, RP-210385, RP-210524, RP-210525, RP-210543, RP-210544, RP-210545, RP-210546, RP-210359.

RP-210543, RP-210544, and RP-210546 are all basket WIs so it is proposed to move them to thread [91E][06][Basket\_WI].

RP-210359 is not exactly a spectrum related WI, but since there is no other email thread, we can have discussions in this thread.

# Discussions and comments

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| **Company** | **Topic #1: Rail Mobile Radio spectrum, i.e. 900MHz and 1900MHz (RP-210352, RP-210356, RP-210357)** |
| Company name | Comments… |
| ZTE | One clarification question for RP-210356/357): are the proposed bands intended for operation up to 500km/h as claimed in RP-210352? If so, it is seemly not covered by defining a spectrum-related WI, but maybe extend the ongoing HST WI instead. More clarifications/discussions may be needed before approval.  |
| Intel | The WI proposes to introduce PC1 support for FDD. There are ongoing studies on HPUE for FDD and the conclusions may need to be taken into account. Suggest focusing on PC3 first. |
| MTK | We have a question for clarification: Do we have frequency overlap with GSM-R? If so, do we need any co-existing study?  |
| OPPO | For clarification, the PC1 UE is smart phone or other UE type? |
| Nokia | To answer ZTE this WI is for defining the bands. HST WI should handle the high speed issues on band agnostic way which then applies also to these bands. |
| Skyworks | For NR PC1 some MPR work might be needed for BW >10MHz because of the higher SU. This may already be needed for n71 PC1.  |
| Huawei | It’s not clear of the objectives in the WI proposals in RP-210356/357 for RMR 900MHz and 1900MHz. The supported channel bandwidth(s) and associated SCS are missing.For BS side, what’s the BS class to be specified? We think the WI should be focused on conductive requirement for NR rather specifying requirement for AAS since AAS is not studied in regulation. For UE side, since PC1 FDD HPUE is under study of a SI in RAN4, it would be better to focus on PC3 and consider PC1 later after there are some conclusions of PC1 SI. ECC Decision (20)02 should be listed as background information in the justification part rather than as an objective in the WID. If there are some specific regional requirements to be considered, especially to be used to define the additional requirements for UE, e.g. A-MPR, the regulations should be clearly described in the WID. More clarifications and revisions are needed for the WID proposals.  |
| Vodafone | It is important that the high power railway devices do not cause negative impacts to existing deployed equipment in bands (n)8 and (n)1.  |
| * + - * 1. **Intermediate summary**
 | Several issues have been raised in the first round and need resolution:1. operation up to 500km/h
2. support of PC1
3. The supported channel bandwidth(s) and associated SCS are missing
4. BS class
5. Coexistence with bands (n)8 and (n)1
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| Company name | Comments… |
| Xiaomi | Share same view with OPPO in the 1st round, the UE type need to be clarified. |
| UIC | Issue 1 - operation up to 500km/h:1. The proposed WIDs are for introduction of Rail Mobile Radio spectrum ranges.
2. The use of HST for the resulting bands is a different subject.

Issue 2 - support of PC1:1. ECC decision (20) 02 limits the use of PC1 for train/vehicle installation (i.e., Cab Radio).
2. Smartphones are excluded from this.
3. Wait until HPUE SI in RAN4 is finished. For the time being, the focus is on PC3 support.

Issue 3 – channel bandwidth(s) and associated SCS:1. Required channel bandwidth(s) is7are listed in #356/#357 which are 5MHz and 10MHz;
2. SCS will be added which is 15kHz for 900MHz and 1900MHz spectrum ranges;

Issue 4 – BS class: 1. Rail Mobile Radio spectrum ranges are for the use of Wide Area Base Stations.

Issue 5 - Coexistence with bands (n)8 and (n)1:ECC decision (20)02 clarifies following subjects:1. 900MHz
2. 1900MHz
3. Annex 2.1/3.1 “The Block-Edge-Mask (BEM) is developed on the basis that detailed coordination and cooperation agreements would not be required to be in place prior to network deployment.”
4. Technical conditions for RMR cab-radio and other than cab-radios;
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| Telecom Italia | Thanks UIC for the clarifications. We suggest adding in the scope of the two Work Items the following objectives:* The Block-Edge-Mask (BEM) is developed on the basis that detailed coordination and cooperation agreements would not be required to be in place prior to network deployment.
* Negative impacts to existing deployed equipment in bands (n)8 and (n)1 shall be avoided
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| ZTE | Issue 1: Operation up to 500km/hWhen calculating maximum Doppler in an HST scenario under a certain target speed, it is dependent on the carrier frequency, so HST scenario support is not purely band agnostic. We are fine with the bands definition, but it is highly recommended to clarify how to complete HST support works at these two bands if intended to do so. |
| Intel | Issue 1: we think issue is not relevant to the WIDIssue 2: Clarification from UIC is fine |
| Vodafone | Thank you, UIC, for the clarifications.We agree on the WI objectives suggested by Telecom Italia. |
| Huawei | One issue is missing in the intermediate summary as commented in the 1st round, the WI should be focused on conductive requirement for NR rather specifying requirement for AAS since AAS is not studied in regulation yet. Some revisions are needed for the objective based on comments in 1st and intermediate round.  |

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| **Company** | **Topic #2: Introduction of FR2 FWA UE with maximum TRP of 23dBm for band n259 (RP-210362, RP-210360)** |
| Company name | Comments… |
| ZTE | We are fine with the proposal. |
| KDDI | We support the proposal and fine with the draft WID.  |
| Qualcomm | We support this proposal |
| vivo | We support the proposed WI. |
| Intel | We support the proposal. In case it is decided to introduce the PC5 for other bands (based on topic 5), then it is preferable to combine all topics into the same WI.  |
| Ericsson  | We are fine with the WID |
| OPPO | Support |
| Huawei | We support to extend PC5 for other FR2 bands, and we also have a WI proposal of FWA PC5 UE for bands n261 and n262, see Topic #6. We are open to have a merged version of these two WI proposals. |
| **Intermediate summary** | No technical issue was raised. The open issue is should this WI be merged with RP-210545? |
| Company name | Comments… |
| Qualcomm | If some operator supports addition of n262, it should be merged here. |
| Xiaomi | We think maybe more general rule should be made to deal with these similar WIDs that having the same feature but for different bands. |
| Intel | Recommend merging all PC5 objectives into a single item.  |
| KDDI | We don't have strong opinion with regard to individual WIs or merged WI, but we can agree with Xiaomi comment, having general rule is beneficial. |
| Huawei | It can be further discussed among WID proponents.  |

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| **Company** | **Topic #3: High power UE (power class 1.5) for NR band n79 (RP-210380, RP-210381)** |
| Company name | Comments… |
| ZTE | We support the proposed WI to meet market demands. |
| Qualcomm | No concern with this work, but instead of a separate work item, it may be more efficient to include this within the ongoing work item for PC1.5 in Band n77/n78. Is this for FWA, handset, or both? Is there a priority? |
| vivo | Support |
| Nokia | Qualcomm’s comment for combining this to PC1.5 in Band n77/n78 makes sense. |
| * + - * 1. CMCC
 | Band n77/n78 is the same frequency, the ongoing work item for PC 1.5 in band n77/n78 is not a basket WI. Following the existing procedure, it is not appropriate to add n79 to n77/n78 WI. This WI has not restriction on the UE type, both FWA and hansdset are considered. |
| CATT | We support this WI to meet the operator’s market demand. Basket WI approach is a good proposal, but I am not sure whether it is straight forward starting from this meeting. Maybe Basket WI approach is better for future requests rather than from this one? |
| Ericsson | We are ok with the objectives and support the WI. |
| OPPO | Support this WI.  |
| Skyworks | Since there is no AMPR involved, we think that it would be easier to add n79 to the currently running PC1.5 WI for n77/78. |
| Huawei | We support the WI proposal. For the band specific WI, the regulatory requirements are different for different regions. Mixing them up may not be clear for tracking the discussion. We support to have this WI agreed in this RAN meeting.  |
| **Intermediate summary** | Two issues have been raised in the first round and need resolution:1. UE types. Can the types of UEs be spelled out in the WID?
2. Whether to have a separate WI or merge it to existing WI PC1.5 WI for n77/78
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| Company name | Comments… |
| * + - * 1. Qualcomm
 | * + - * 1. We believe merging into the existing work on n77/78 is the simplest solution. Will simplify handling and bureaucratic work in RAN4 and plenary. There is no problem if a WI treats the same feature for multiple bands but is not formally a basket.
 |
| CMCC | 1. We think there is no need to put restriction on UE types in the WID.
2. Existing n77/n78 WI is for the same frequency 3.5GHz, not a basket WI for PC1.5. n79 is a different frequency, and should be handled in a separate WI following the current procedure. And if there is other request on PC 1.5, how do we handle this? The n77/n78 WI will become an endless WI.

We prefer to approve the WI proposal in this meeting. And whether to create a basket WI can be further discussed driven by contributions. And we do have concern to merge n79 to existing n77/n78 WI. |
| Xiaomi | We support this WI and no strong view on whether to combine them in this meeting.But we think maybe more general rule should be made to deal with these similar WIDs having the same feature but for different bands. |
| ZTE | 1. UE types are up to Operators’ demands
2. We support a separate WI are approved in this meeting, and discussion on basket approach for similar requests can be left to RAN4.
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| Huawei | We think that it would be better to have separate WI to accommodate different regulatory requirements for the operating band.  |

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| **Company** | **Topic #4: High power UE (power class 2) for NR band n34 and n39 (RP-210382, RP-210383, RP-210384, RP-210385)** |
| Company name | Comments… |
| ZTE | We support the proposed WI-s to meet market demands |
| Qualcomm | No concern with this work, but from organizational perspective should a basket WI be created? |
| Vivo | Support |
| Intel | Agree with QC that basket WI can be a good alternative. |
| Nokia | Support basket WI idea. |
| * + - * 1. CMCC
 | There are already some TDD bands in FR1 supporting power class 2. We are wondering whether it is worthwhile to create a basket WI since not much work left for TDD bands HPUE. We prefer to approve the proposed HPUE Wis. |
| CATT | We support this WI to meet the operator’s market demand. Basket WI approach is a good proposal, but I am not sure whether it is straight forward starting from this meeting. Maybe Basket WI approach is better for future requests rather than from this one? |
| Ericsson | We are ok with the objectives and support the WI. |
| OPPO | Support the WI. Maybe basket can be considered in the future Wis, there already some Wis for each band. |
| Skyworks | Basket WI approach is preferred since general requirement is already done for TDD and the only additional work is related to potential A-MPR. |
| Huawei | We support the WI proposal. To meet the operator demanding, we think that basket WI may not be helpful. In the basket thread, we are also discussing some drawbacks of basket. Thus dedicated WI for this RANP is preferred by us as well.  |
| **Intermediate summary** | No technical issue was raised. The open issue is should a basket WI be adopted, given the basket WI approach is being discussed in this meeting? |
| Company name | Comments… |
| * + - * 1. Qualcomm
 | * + - * 1. A basket would be preferable, would simplify handling in the future.
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| CMCC | We think basket WI approach is not appropriate for PC2 single TDD band HPUE. Basket WI approach is more suitable for the introduction of band combinations since the number of combs is not uncontrollable. In the current spec, TDD bands n40, n41, n77, n78, n79 already support PC2. Only a few TDD bands are not supported PC2, including n34 and n39. Hence, we don’t think it is worthwhile to create a basket WI only for a few bands. Also, the basket idea for single band HPUE was just raised by comments in this plenary meeting. In order to not delay the work, we prefer to approve the proposed Wis. Whether to create basket WI can be further discussed driven by contributions. |
| Xiaomi | We support these Wis and no strong view on whether to combine them in this meeting.But we think maybe more general rule should be made to deal with these similar WIDs having the same feature but for different bands. |
| ZTE | Considering the need of the work and that there are very few TDD bands left without HPUE, the benefits of going for a basket WI seems not that much, so we support the way as it is proposed. |
| Huawei | Considering the commercial demand from operator, there is no need to wait for the basket WI proposal. We support the WI. |

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| **Company** | **Topic #5: LTE/NR downlink and uplink spectrum sharing from UE perspective in Band 1/n1 (RP-210524, RP-210525)** |
| Company name | Comments… |
| ZTE | We support the proposed WI. |
| Apple | This looks to be a new feature. Is there any implication or specifications impact to other working groups? |
| China Telecom | Thanks for the question from Apple. We have checked that the only impact to other WG is the additional UE capability signaling in RAN2. |
| Qualcomm | This seems to be DL and UL sharing from the UE perspective in the same channel. This was discussed before but is not currently supported. This cannot be handled as a spectrum item, should be handled as a separate WID and discussed. |
| Nokia | This item is supported by Nokia but it should not be treated as a spectrum item. |
| OPPO | The impact to other group and UE implementations need to be considered carefully. And is the intention to introduce in Rel-17 or Rel-18 since this is non-spectrum WI? |
| China Telecom 2 | This WI has no impact on other WG excepting RAN2 capability signaling, and also only covers operator’s deployment need in band 1/n1, so we submitted it as a spectrum proposal, which is similar to several other spectrum proposals. We understand this EN-DC combination is different from the existing ones, that’s why we didn’t try to add it the existing basket WIs. |
| Huawei | We think that the WI is not spectrum only. DL sharing from UE perspective would have RAN1 and RAN2 impact, which needs the agreements involving all the working group since 3GPP has made the agreement before. We would like to have better understanding on the use case, timeline of deployment, complexity for both UE and network before specifying this feature. |
| **Intermediate summary** | The main issue raised seems to be that this WI is not a spectrum WI. If so, further guidance from RAN chair is needed how to handle it. Also, impact on other WG can be further discussed. |
| Company name | Comments… |
| * + - * 1. Qualcomm
 | * + - * 1. We agree with the summary, this item needs separate discussion.
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| China Telecom | If we look at the objectives in the WID, the only spec impact is UE receiver requirements (i.e., maximal power difference from LTE and NR in this band combination) and UE capability signaling, so we are not convinced why it cannot be treated as a spectrum WI.Regarding the other RAN1/2 impact, actually we have checked and have not found any other RAN1/2 impact. It would be helpful if company can elaborate what is the potential RAN1/2 impact?  |
| Apple | We agree with moderator’s summary. We do not think the WID is as simple as only defining the maximum power difference from LTE and NR and also we are not sure what is the meaning of that, power difference or PSD difference? On the other hand, if LTE and NR are running at different channel bandwidth in TDM, that means the UE needs to dynamically switch its channel bandwidth and LO frequency. Is this purely RAN4 aspect?  |
| ZTE | We tend to agree that we can treat the proposed WI as a spectrum WI since it is only specific to band 1/n1 and no new technical element is created, but we are fine to seek for clear guidance from RAN chair in this week in order to avoid potential similar discussions in RAN4. |
| Intel | Agree that this is not a simple spectrum item and generic requirements need to be defined. Aspects of DL sharing from UE perspective as well as UL FDM between LTE/NR from UE perspective need dedicated studies. |

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| **Company** | **Topic #6: addition of PC5 to Band n261 and n262 (RP-210545)** |
| Company name | Comments… |
| ZTE | One clarification question: is the proposed PC5 to n261 and n262 used only for FWA purpose? |
| T-Mobile USA | We also added PC5 to the revised with for n262 in RP-210705. It should not be in both WIDs. If PC5 for n262 is toing to be NR\_FR2\_PC5\_NewBand then we will need to revise RP-210705.  |
| Apple | n261 is US only band and PC1 for FWA has been defined. Not sure why we need another power class for FWA in the same band. Is there any operator’s request on PC5 for this band? |
| Qualcomm | Before agree to this objective it would be useful to know if there is demand from carriers with n261 and n262 spectrum for this type of product. PC1 can be used in these bands, in our understanding |
| Intel | We are overall ok with the proposal to extend PC5 use case to additional bands. Agree with T-Mobile USA that a single item shall be used for PC5 |
| Ericsson | We support to add PC5 to the WID |
| OPPO | Ok with the WI. |
| Huawei | The proposal of PC5 for these bands is also targeted for FWA scenario. Band n261 is part of Band n257, it can be used and broadcasted in system information for spectrum allocated within that part. Since n261 is relative narrow compared with n257, if the allocated frequency range of operator is within Band n261 spectrum, the Tx/Rx performance on Band n261 would be better compared with the whole Band n257. We expect introducing n261 for PC5 would be helpful to Japanese FR2 network. To T-Mobile USA, we think that a dedicate PC5 WI for n262 would be better for the power class included in a band WI.  |
| **Intermediate summary** | Several issues have been raised in the first round and need resolution:1. If PC5 is needed for band n261?
2. Will PC5 for n262 be added in this WI or in RP-210705?
3. Should this WI merged with RP-210360?
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| Company name | Comments… |
| * + - * 1. Qualcomm
 | * + - * 1. We still haven’t seen any operator interested in n261. these items should be driven by operator interest, we should not create additional work with a clear market demand. We should keep the other proposal and add n262 there is there is interest.
 |
| T-Mobile USA | 2) We think it would be best to remove PC5 from the n262 WID in RP-210705.  |
| Apple | As we commented in initial round discussions, is there any interest in PC5 for n261? Same question for n262 if T-Mobile USA is not interest in PC5 for n262, any other operators are interested in PC5 for n262?  |
| Huawei | As we explained in 1st round, n261 is part of n257, which would have better performance than the whole band and it can bring benefit to operator hold the spectrum inside of n261.Whether to merge the WIs will be further discussed among proponents.  |

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| **Company** | **Topic #7: supporting non-colocated scenarios for band 42 and n77/n78 (RP-210359)** |
| Company name | Comments… |
| ZTE | For MRTD, perhaps it should be treated in FeRRM WI, not in a Demod WI. |
| Apple | We have concern on the support of non-collocated scenarios for band 42 and n77/n78 as this would be considered as intra-band EN-DC where the time alignment between B42 and n77/n78 needs to be tightly controlled to avoid simultaneous Rx/Tx and the impact to UE AGC and APC performance. |
| KDDI | We support the proposal of Softbank and are agreeable with the relevant part of the revised WI for NR\_demod\_enh2-Perf. |
| Qualcomm | We have concerns on the implementation feasibility of this proposal. This is also proposed for baseband, we expressed the same view there. There will be a big performance degradation with larger MRTD because of shared LNA and characterization of performance degradation will be very difficult. |
| SoftBank | As a proponent of this contribution, we would emphasize again that this functionality is very important from the deployment point of view. As a capability has already been introduced in Rel-17, a subsequent work is anyway necessary in order to make this functionality complete. We agree the comment by ZTE. MRTD (if not finalized in Rel-16) should be covered in FeRRM.  |
| Intel | Support the proposal. Further discussion on how to structure the work is needed. We see two basic options:1. Split the work across different WIs (e.g. handle MRTD in feRRM and perf requirements in the Enhanced Demodulation WI)
2. Keep all RRM/Demod objectives within a single WI.

In terms of work organization, the second option is preferable. |
| Nokia | We understand the UE implementation concerns but from network deployment flexibility point of view this would be beneficial. |
| MTK | We have concern on this objective. Increasing the MRTD for intra-band CA would bring serious degradation to UE demodulation performance due to LNA operation limitationProcedure-wise, we think we should stop the discussion of this issue here and move all discussion to the corresponding RRM and Demod WIs. |
| Ericsson | We support the addition of this objective. But this should be aligned with discussion on FeRRM thread. |
| OPPO | We understand the demands from operators, but the impacts to UE is not trivial needs to be considered carefully. We would like to understand better on how big this kind of deployments are in the real network. |
| Huawei | * + - * 1. We support to extend WI scope to consider the non-colocated scenario.

For PDSCH demod part, it is proposed to be added in the WID “Further enhancement on NR demodulation performance”.For MRTD part, it is proposed to be added in the WID “Further RRM enhancement for NR and MR-DC”. See similar discussion also in [91E][34][FeRRM\_scope].No need to limit the applicable UE type. |
| **Intermediate summary** | Mainly two issues have been raised in the first round and need resolution:1. The impact on UE performance with large MRTD
2. How to structure the work
	1. To have a standalone WI including both RRM and Demod work
	2. To merge into existing WIs, i.e. RRM part to be added in FeRRM and Demod part to be added to NR\_demod\_enh2?
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| Company name | Comments… |
| Ericsson | On issue 1) RAN4 needs to study and develop requirements which are reasonable for both UE and network.On issue 2), we support option b). That’s RRM and demod aspects are included in FeRRM and demod enhancement WIs respectively |
| * + - * 1. Qualcomm
 | 1. This is very difficult to assess because it depends on many factors, including largest MRTD. We believe the interest in this will be gone because of the performance degradation. * + - * 1. 2. This work shouldn’t be started altogether as we already commented.
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| SoftBank | 1. Agree with Ericsson. If large MRTD is horrible from performance point of view, such a MRTD value is not necessary to be specified. The current MRTD value is too restrictive from our deployment point of view, and we expect RAN4 can find a reasonable value.
2. Either way is fine.
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| Apple | For intra-band combinations, a common LNA would be used in UE receiver. If the cells are not collocated, the power difference between the two carriers would be a challenge to set a proper LNA gain.  |
| ZTE | More discussions are needed to have a more clear picture on the impacts from large MRTD, and we don’t think it is ready at this stage to create a WI, or included in an existing WI. |
| MTK | We understand the deployment concern from operator, but the degradation to UE due to large MRTD is big. To make the system work properly, the same MRTD should be kept. In this case, we do not see the need to start a new work in either a new WI or 2 existing WIs. |
| Intel | For issue 1) we agree with Ericsson and Softbank that RAN4 can further study and identify the acceptable MRTD value.For issue 2) we are ok with either option. For Option a) – it can be handled in FR1 RF WI. |
| KDDI | Some companies raise significant performance impact generated by the Shared LNA, but we can probably have RAN4 to discuss the technical details of the issue. |
| Nokia | For RRM we prefer own WIFor The demod part of n77 power imbalance topic is currently being discussed in NR\_demod\_enh2. |
| Huawei | We need to consider the appropriate requirements to address the deployment scenario of operators.Regarding how to structure the work, we are fine to both options.  |

# Final proposals/recommendations