**3GPP TSG-RAN WG4 Meeting # 98-e R4-210xxxx**

**Electronic Meeting, 25th January – 5th February, 2021**

**Agenda item:** 9.34

**Source:** Moderator (Qualcomm Incorporated)

**Title:** Email discussion summary for [98e][132] HPUE\_PC1\_5\_n77\_n78

**Document for:** Information

# Introduction

This document summarizes the email discussion on topics related to Power Class 1.5 in Bands n77 and n78 in Agenda 9.34. The discussion is divided into two topics:

Topic #1: UE RF assumptions

Topic #2: RF exposure regulatory aspects

# Topic #1: UE RF assumptions

In order to conduct the work, especially to derive MPR and A-MPR, it is beneficial to adopt assumptions.

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2100287**](http://ftp.3gpp.org/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100287.zip) | LG Electronics France | **Consideration for RF architecture for n77/n78 PC1.5 UE**  Observation 1: For PC1.5 UL-MIMO requirements, the architecture with 2PA (26dBm +26dBm) and 2 Tx antenna used as baseline in Rel-16.  Proposal 1: RAN4 should consider above basic simulations assumptions in for MPR/A-MPR requirements for PC 1.5 UE at n77/n78 in Rel-17.  Proposal 2: If Proposal 1 is reasonable to derive n77/n78 MPR/A-MPR requirements for smart phone type UE, then RAN4 can reuse MPR requirement in Table 6.2.2-4 for PC1.5 UE with dual Tx in TS38.101-1.  Proposal 3: RAN4 can derive A-MPR requirements based on the above simulations assumptions in section 3 for PC1.5 NR UE in n77/n78.   * 2 Tx antennas and 2 PA with 26dBm +26dBm * Antenna isolation of 10dB * Post PA loss of 4dB * Equal power per Antenna * Allow UL contiguous/non-contiguous resource allocation * NR DFT-s-OFDM/QPSK with 30kHz SCS * NR 60MHz CBW * Various allocation combinations with range of aggregate BWs, with focus on “worst case” combinations (assumed to be near-equal allocation BWs). * Determine back-off required to meet the regional regulations such as Additional SEM, Additional SE and specific ACLR limits * Goal is to take data from multiple sources and determine whether or not define new A-MPR curves accommodating different implementations. |
| [**R4-2100515**](http://ftp.3gpp.org/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100515.zip) | Apple Inc. | **Considerations for PC1.5 with n77 and n78**  Observation 1: PC1.5 is achieved via dual Tx chains as there is no 29dBm power amplifier deployed in UEs and requires higher power backoff compared to single Tx operation.  Observation 2: PC1.5 MPR was developed for single and dual layer UL-MIMO operation but not for TxD.  Proposal 1: PC1.5 should not be used for TxD as the discussion is not finished in RAN4. Support for TxD can be added later if required.  Proposal 2: If improvements for power backoff are considered for n77 and n78 then the relevant measurement assumptions (Antenna isolations of 10 dB, 4 dB post PA loss and 26dBm Tx chains) shall be reused to obtain reliable results. |
| [**R4-2102283**](http://ftp.3gpp.org/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102283.zip) | Huawei, HiSilicon | **Consideration on adding PC 1.5 for n77 and n78**  Proposal 1: Add Power Class 1.5 to band n77 and n78 in Table 6.2.1-1 and Table 6.2D.1-1 as shown above.  Proposal 2: Reuse the existing MPR requirements in Clause 6.2.2 for band n77 and n78 PC 1.5.  Proposal 3: No A-MPR is needed for band n77 or n78 PC 1.5.  Proposal 4: Reuse the existing power reduction mechanism in Clause 6.2.4 for band n77 and n78 PC 1.5 in order to fulfil the regulatory SAR requirements. |
| [**R4-2102417**](http://ftp.3gpp.org/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102417.zip) | Qualcomm Incorporated | **PC 1.5 for bands n77 and n78**  Observation: Two approaches are available to derive requirements for FWA and mobile UE. The minimum requirement is based on mobile UE with the expectation that FWA can easily meet this, or two sets of requirements are defined according to each device type.  Proposal 1: It is proposed to evaluate whether the assumptions to derive performance requirements for FWA should be modified from those previously used for mobile UE.  Proposal 2: General requirements such as Tx power tolerance, spurious emissions, and signal quality are already defined in the specifications. SAR mechanisms including the 25% default value for uplink duty cycle should be reconsidered for FWA and modified if needed.  Proposal 3: No new emission requirements are needed for PC1.5 in Bands n77 and n78 and no new A-MPR appears to be needed for coexistence. However, the need for NS and A-MPR are to be further studied for power backoff reduction on a band-specific per-deployment basis in n77 and n78. |
| [**R4-2102930**](http://ftp.3gpp.org/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2102930.zip) | Skyworks Solutions Inc. | **Discussion on band n77 PC1.5 operation**  Observations:   * For the smartphone UE case, n77/n78 PC1.5 operation should be able to reuse the Release 16 MPR as the antenna isolation assumptions should be similar. * Whether both Tx Diversity and UL MIMO is supported for Band n77 and n78 PC1.5 operation should be clarified |

## Open issues summary

### Sub-topic 1-1: Smartphone MPR

It was recognized by several companies that the prior work on PC1.5 in Band n41 was focused on mobile handset UE. During that work, a number of assumptions were agreed as listed below

* Antenna isolation of 10 dB
* Post PA loss of 4 dB
* Two 26 dBm Tx chains (NR)
* Equal Power on both transmit chains
* Various channel and allocation BWs, with focus on “worst case” allocations
* RB size, allocation position, waveform, and modulation should be the same between two transmitters
* Results for both CP-OFDM and DFT-S-OFDM are welcome, with the priority being CP-OFDM because it is expected to be worst case
* Determine back-off required to meet OOBE, ACLR and EVM specifications
* Goal is to take data from multiple sources and define A-MPR curves for PC1.5 UL MIMO and Transmit diversity accommodating different implementations

*For mobile handheld UE, i.e., smartphone, can the same assumptions be also applied for PC1.5 in bands n77 and n78?*

*If so, can the same MPR be used, maybe in square bracket to give companies an opportunity to check?*

### Sub-topic 1-2: MPR applicability to TxDiv

An observation was made in R4-2100515 that the MPR already included in the specification does not apply to TxDiv case, but only to single or dual layer UL MIMO. On the other hand, it is commented in R4-2102930 that PC 1.5 MPR specified in Rel-16 applies to both Tx Diversity and UL MIMO.

*Does the existing MPR specified for PC1.5 apply to both TxDiv and UL MIMO? Or does TxDiv MPR still need to be specified? If existing MPR does not apply to TxDiv, what are the differences between TxDiv and single layer UL MIMO that would cause an MPR difference?*

### Sub-topic 1-3: FWA MPR

An FWA device is quite different from a smartphone and has a different set of constraints from cost, size, power consumption perspective as well as different set of requirements in number of bands supported, mobility, etc. Therefore, it seems reasonable that the assumptions for deriving MPR for FWA may not be the same as for smartphone.

*Should assumptions be reconsidered for FWA, or should the same assumptions and requirements for smartphone also apply to FWA (not including the SAR/MPE which is treated separately as Topic #2)?*

*Are there any suggestions or proposals on which assumptions would change and their new value or range of values?*

### Sub-topic 1-4: Additional emission requirements for n77/n78

No new emission requirements for band n77 or band n78 have been identified in any of the submitted contributions.

*Do companies agree that no new emission requirements apply and there is no need for any new NS for the purpose of signaling additional spurious emission requirements?*

### Sub-topic 1-5: A-MPR

Pending agreement on sub-topic 1-4, there are no new emission requirements in Band n77 and n78 for PC1.5. On the other hand, a number of companies presented thoughts on A-MPR deriviation, assumptions, etc.

*What is the need for A-MPR for PC1.5 in Band n77 and n78?*

## Companies views’ collection for 1st round

### Open issues

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| **Company** | **Comments** |
| Qualcomm | Sub topic 1-1: For mobile handset UE it is reasonable to reuse the same assumptions for the UE front end parameters for Band n77/n78 as was used for Band n41 PC1.5. From a UE perspective, if the same assumptions are used, then it is also reasonable to expect that the same MPR would be the outcome, especially since MPR is independent of band. However, we would like to further check the MPR with additional measurements. We also need to consider the PC1.5 MPR from a system perspective. If MPR values are large, then there is little to no value in PC1.5 compared to PC2.  Sub topic 1-2: It is our understanding that the same MPR applies for TxDiv as for UL MIMO. However, we also acknowledge that TxDiv is an ongoing discussion, so we should not preclude the possibility for a change in understanding if warranted.  Sub topic 1-3: Assumptions for FWA should be evaluated on their own rather than copied from mobile handset UE as the devices are very different and the same assumptions are not likely to apply.  Sub topic 1-4: Agree  Sub topic 1-5: As it was expressed during discussion of the WID, many companies wanted to ensure that power backoff requirements were defined only for n77/n78 and not applied generally. Although it isn’t our preferred method, A-MPR is one possible way to enable band specific power backoff requirements.  ….  Others: |
| Verizon | Sub-topic 1-1: It is fine for RAN4 to consider two 26 dBm Tx chains and other RAN4 assumptions for the UE front end parameters and for both PC1.5 band 77 and 78. We are support companies to further check the PC1.5 MPR values from a system perspective. The larger MRP values would be not valuable for PC1.5 and possibly lead to next higher power classe.  Sub-topic 1-2: Yes, the MPR should be applicable to both Tx Diversity and UL MIMO if it is possbile. Sub-topic 1-3: The FWA device should be in different from a smartphone and have a different set of constraints of bands supported. Therefore, it is reasonable to have different power tolerance, emsissoin and SAR mechanisms for uplink in assumptions from smartphone. Sub-topic 1-4: Agree to have no additional emission requirements for n77/n78  Sub-topic 1-5: We support RAN4 to consider A-MPR improvement for band n77/n78 |
| LGE | Sub topic 1-1: Smartphone MPR  *For mobile handheld UE, i.e., smartphone, can the same assumptions be also applied for PC1.5 in bands n77 and n78? 🡪 LGE: Yes.*  *If so, can the same MPR be used, maybe in square bracket to give companies an opportunity to check? 🡪 LGE: same MPR can be used for PC1.5 UE in n77/n78*  Sub-topic 1-2: MPR both Tx Diversity and UL MIMO to TxDiv  *Does the existing MPR specified for PC1.5 apply to both TxDiv and UL MIMO? Or does TxDiv MPR still need to be specified? If existing MPR does not apply to TxDiv, what are the differences between TxDiv and single layer UL MIMO that would cause an MPR difference?*  *🡪 LGE: same MPR will be applied to both TxDiv and UL-MIMO UE*  Sub-topic 1-3: FWA MPR  *Do companies agree that no new emission requirements apply and there is no need for any new NS for the purpose of signaling additional spurious emission requirements? 🡪 LGE : No strong view whether apply same requirements or not. If RAN4 specify the different RF requirements between smartphone UE and FWA UE in n77/n78, then need to analyze the required new emission requirements.*  Sub-topic 1-4: Additional emission requirements for n77/n78  *Do companies agree that no new emission requirements apply and there is no need for any new NS for the purpose of signaling additional spurious emission requirements? 🡪 LGE: Need to study the global regulatory requirements in n77/n78 to support PC1.5 UE. Based on RAN4 can decide whether to define new NS to meet the additional spurious emission requirements.*  Sub-topic 1-5: A-MPR  *What is the need for A-MPR for PC1.5 in Band n77 and n78? 🡪 LGE: It is related the sub-topic 1-4. Based on the regulatory requirements, we can further discuss what is the different parameters from MPR parameters and additional requirements to specify the A-MPR requirements.* |
| Skyworks | 1-1: we agree that current PC1.5 MPR is applicable to n77 PC1.5 smarphone smarphone use case. Since it is MPR that is already specified we don’t see that brackets can be used.  1-2: for PC1.5 the MPR is meant for both TxDiv and Ul MIMO but since there are discussion on how TxDiv should be evaluated in test we can wait for the discussion to conclude to confirm MPR applies to both.  1-3: how to handle FWA case is not clear yet, if we recognize there are less constraints for this and better performance might be achievable we need first to agree to a common set of assumptions and agree how to capture the specifics in the spec  1-4: no need for new NS as we are not aware of any specific regulation in n77/n78  1-5: as there is no new NS we do not see that A-MPR is needed and we think that A-MPR is not the right way to handle FWA case if it was the intention since this must rather be associated with a UE signaling or at least a specific test. |
| Huawei | Sub topic 1-1:  The same assumption should apply to band n77/78. So is the MPR.  Sub topic 1-2:  There’s no difference between TxD and single-layer MIMO from RF perspective. Hence the same MPR should apply to both. I believe this is already agreed in the last meeting.  Sub topic 1-3:  According to the WID (RP-202912), “The PC1.5 specifications are applicable to both mobile and FWA form factors”. Only one set of requirements are to be defined. Any discussion on MPR improvement is outside the scope of this WI.  Furthermore, even if FWA UEs may have less MPR due to larger form factor, the potential advantage could be realized via PHR report, etc. In other words, the actual power reduction is implementation dependent, which is the same as handheld UEs. For the network, the coverage would still be limited by handheld UEs. Therefore to define two sets of MPR requirements for the same power class is unnecessary.  Sub topic 1-4:  No new emission requirements are identified, hence no need for new NS.  Sub topic 1-5:  No A-MPR is needed so far. |
| ZTE | Sub topic 1-1: same assumption can be applied. And the MPR is expected the same since MPR is not defined band dependent.  Sub topic 1-2:  same MPR should apply to both TxDiv and UL-MIMO UE  Sub topic 1-4:  No new emission requirements are identified.  Sub topic 1-5:  No A-MPR requirement is needed due to no NS. |
| Samsung | Sub-topic 1-1: Yes. Same assumption and MPR as n41 PC1.5 can be applied to n77/n78.  Sub-topic 1-2: Yes, the MPR should be applicable to both Tx Diversity and UL MIMO. However, for TxD, we can wait until the conclusion. Sub-topic 1-3: Without having a common understanding of the method about how to implement the FWA UE in the spec, we think there is no other way than to reuse the value of smartphone’s. Sub-topic 1-4: We agree to have no additional emission requirements for n77/n78. |
| Apple | Sub topic 1-1: The mobile handheld UE should be able to use the assumptions from n41 for n77 and n78. With the same assumptions also MPR will be same and brackets are not required.  Sub topic 1-2: To clarify the statement made in R4-210051: It does not say that MPR is not applicable. While the MPR was developed for single and dual layer UL-MIMO, there was a certain agreement that TxD can use the same MPR. The motivation of the statement is that TxD support should not be discussed here before the main discussion has finished.  Sub topic 1-4: Current coexistence situation seems to not demand introduction of new NS and requirements.  Sub topic 1-5: As new NS does not seem to be required A-MPR is not needed. At least not for complying with coexistence requirements. We are open to discuss further considerations. |

### CRs/TPs comments collection

*Major close-to-finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

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| **CR/TP number** | **Comments collection** |
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| Company B |
|  |
|  | Company A |
| Company B |
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## Summary for 1st round

### Open issues

*Sub-topic 1-1: Smartphone MPR*

All companies expressed the view that the same assumptions previously used to derive MPR and therefore the MPR itself could be applied to Band n77/n78 for smartphone. Thus, from a UE capability perspective it seems reasonable that the same values can apply. However, one company requested an opportunity for further checking and two companies also suggested that a system perspective to the MPR values is also needed. The moderator recommends further discussion.

*Sub-topic 1-2: MPR applicability to TxDiv*

Most companies believe that the MPR applies for both UL MIMO and TxDiv, but a few companies acknowledged there is ongoing discussion in general on TxDiv. The moderator recommends to accept that MPR applies for both UL MIMO and TxDiv, but that this agreement can be revisited pending the outcome of the general TxDiv discussion.

*Sub-topic 1-3: FWA MPR*

Most companies recognize that FWA devices are different than mobile handheld devices and therefore the same assumptions may not apply. It was suggested that assumptions should be identified and agreed before analysis could take place. One company believes that the WID limits the scope of work to one set of requirements citing the objective “The PC1.5 specifications are applicable to both mobile and FWA form factors”. However, the moderator’s view is that the statement “The PC1.5 specifications” does not mean one and only one requirement but is taken collectively as the set of requirements to enable PC1.5. The moderator recommendation is that separate assumptions *can* be taken for FWA and encourages interested companies to provide proposals.

*Sub-topic 1-4: Additional emission requirements for n77/n78*

Most companies did not believe any new emission requirements were needed for PC1.5 in Band n77/n78. However, one company suggested checking worldwide regulations before making this conclusion. The moderator invites companies to submit findings on regulatory requirements in n77/n78 that would necessitate an NS.

*Sub-topic 1-5: A-MPR*

No specific need was identified for A-MPR, but several companies wanted to leave the option open for the time being.

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|  | **Status summary** |
| **Sub-topic#1-1**  **Smartphone MPR** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round: Further discussion* |
| **Sub-topic#1-2**  **MPR applicability to TxDiv** | *Tentative agreements: MPR applies to both UL MIMO and TxDiv*  *Candidate options:*  *Recommendations for 2nd round: No further discussion* |
| **Sub-topic#1-3**  **FWA MPR** | *Tentative agreements: There was no consensus on whether the same assumptions or different assumptions should be taken to derive requirements for FWA.*  *Candidate options:*  *Recommendations for 2nd round: No further discussion on whether separate assumptions can be taken. For the next meeting, companies are free to provide assumptions with justification for FWA. It is not precluded that those assumptions are the same or different from previous assumptions for mobile handset as long as they are provided with justification.* |
| **Sub-topic#1-4**  **Additional emission requirements** | *Tentative agreements: No additional emission requirements and no new NS for Band n77 and n78 for the purpose of additional emission requirements. This agreement can be revisited if a company discovers a regulatory requirement needing to be reflected.*  *Candidate options:*  *Recommendations for 2nd round: No further discussion* |
| **Sub-topic#1-5**  **A-MPR** | *Tentative agreements: For discussion in future meetings if a need is identified.*  *Candidate options:*  *Recommendations for 2nd round: No further discussion* |

*Recommendations on WF/LS assignment*

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| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| R4-2103227 | Way Forward on assumptions for PC 1.5 in Bands n77 and n78 | Qualcomm Incorporated |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

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| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

One of the aspects that came out of initial discussion is that the work item includes multiple UE types – namely, FWA and mobile handset. These types of devices *may* have different requirements associated with each and it *may* be advantageous to relay this information to the gNB or other entity. For the second round, in addition to the continuation of discussion on sub topic 1-1 on smartphone MPR, the moderator opens up a new discussion topic on if/how to treat different devices types in the RAN4 specifications. In the second round, a WF for UE RF assumptions is also being developed.

### Sub-topic 1-1: Smartphone MPR

### Sub-topic 1-6: Treatment of different device types

### Sub-topic 1-7: Way Forward on assumptions for PC 1.5 in Bands n77 and n78

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| **Company** | **Comments** |
| Qualcomm | Sub topic 1-1: The reason for defining PC1.5 as a power class is to improve the uplink budget by approximately 3 dB compared to PC2. However, the MPR in the spec today for PC1.5 is often times itself 3 dB higher than the MPR for PC2. This means that there is *no benefit to PC1.5* compared to PC2 for devices that just meet the maximum output power and MPR requirements. This is true for edge and outer waveforms for all modulation types. The only waveforms for which there is benefit are inner waveforms. For these there is only 1.5 dB of benefit. We understand how these MPR were derived and we are sensitive to the challenges and performance impact associated with reverse IMD, but we are also concerned whether the justification of the work item can be met with such values.  Sub topic 1-6: In FR2, different device types are distinguished by a different power class because the FR2 definition of power class includes additional aspects (EIRP, TRP) beyond just conducted maximum output power. Another example found in FR1 are device types V2X and NR-U. The specification devotes a new suffix for each of these devices types. For NR-U the distinction is made through different band numbering; i.e., Band n46 and n96 are only for NR-U in 38.101. For V2X the distinction is also by band numbering with n47 and n38. It is indicated that where n38 is used for V2X, it is exclusively used for V2X. For FWA, a new band number seems excessive so a simpler indicator might be preferred.  Sub topic 1-7: |
| Huawei | 1-1: As discussed in the 1st round, the majority view is to reuse the existing PC1.5 requirements at least for handheld UEs. The MPR improvement issue has been debated intensively in the last RANP. There’s no need to repeat it here.  1-6: As described in Qualcomm’s comments above, the V2X and NR-U UEs operate in dedicated RF bands as well as use special physical-layer waveform formats. On the other hand, FWA UEs are no different from normal NR UEs except the form factor. We don’t see the reason or benefit to give FWA special treatment.  1-7: Our revisions to the WF can be found in the draft folder. Firstly, the majority view is to reuse the existing requirements for handheld UEs. Secondly, for FWA several companies propose to reuse the same MPR or hold a neutral view. And at least two companies have expressed concerns on the impact to the specs if new requirements are to be captured. These are the basis of our revisions. |
| LGE | Support to reuse the existing MPR requirements from PC1.5 UL-MIMO for n41 UE.  Also support MPR applies to both UL MIMO and TxDiv. |
| Skyworks | 1-1: since outer allocations are emission limited, the 3dB higher MPR for PC1.5 vs PC2 is justified. For inner if the PC1.5 benefit is only 1.5dB it is because EVM and IBE are limiting and the full 3dB improvement cannot be achieved when accounting for RIMD. Also this number is a compromise to cover TxDiv and UL MIMO which in fact correspond to different level of correlation of the two antenna signals which influences the RIMD level. It this point we do not see that there is much hope to improve MPR other than having separate numbers for the different TxDiv and UL MIMO cases. Since MPR is an allowance this can still be improved for some UEs especially as it depends on the type of PA architecture. At this point we support reusing the MPR as specified today as minimum requirement.  1-6: We believe it is essential that if requirements can only be achieved for a specific from factor it is clearly stated in the specification, especially it is to achieve better than minimum requirement. A note that the requirement only applies to FWA devices might be sufficient as it is used for 4x4 DL MIMO in n71 or mandatory 4x4 not applying to V2X…  1-7: For the WF: as discussed in 1-1 the current MPR for PC1.5 should be reused unless someone can justify how it can be improved significantly for a UE and still cover all TxDiv/UL MIMO cases and all implementations. Better implementations or lower back-off is not precluded as this is an allowance only. For FWA, the only option for improved performance (beyond SAR/MPE/thermal aspects) is antenna isolation, so we may want to discuss some numbers in this meeting. |
| Verizon | Sub topic 1-1: We share the comment from Qualcomm and agree the 3dB higher MPR than PC2 would have not any benefits to PC1.5 uplink budget compared to PC2. We encourage companies to provide assumptions for FWA with justification.  Sub topic 1-6: The FWA should be in different from a smartphone. Mainly, it would allow less constraint. In consequence, it should have better performance. For agreement, we encourage companies to provide common set of assumptions or FWA with justification.  Sub topic 1-7: Same comments as above, we encourage companies to provide common set of assumptions or FWA with justification. |
| Qualcomm | Sub topic 1-1: To Skyworks, we understand and appreciate the UE impairments that resulted in the MPR definition currently in the spec. However, we also observe from a system perspective that the MPR values do not lead to an overall PC1.5 solution the provides significant value over PC2. Not to take away anything from the previous work, but we believe this merits further investigation.  Sub topic 1-6: To Skyworks: we also agree that distinction is needed if requirements will be different. However, a note in the spec will not inform the basestation of any such differences so either the basestation will need to indirectly infer (possibly unreliable, slow, more complex) or will not be able to adjust its scheduling behavior accordingly.  Sub topic 1-7: I have removed the bullet on smartphone MPR from the draft WF as it is clear that there is not yet agreement on this topic. I have retained Huawei’s suggestion for an additional bullet on FWA MPR. |

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

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| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| R4-2103227 | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #2: RF exposure regulatory aspects

An important part of the evaluation is the consideration of regulatory aspects. In particular, requirements of SAR and MPE shall be considered.

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2100912**](http://ftp.3gpp.org/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100912.zip) | Samsung | **Regulatory information on RF exposure for FWA devices**  Observation 1: Most of the countries are currently enacting the exposure regulations for mobile devices in compliance with the ICNIRP 1998 Guidelines and/or FCC regulations.  Observation 2: SAR value is specifically specified for the EMF compliance as criteria by human body and frequency range.  Observation 3: For handheld UEs for FR1, the device can be determined as used in close proximity to the body, and the SAR criteria are applied as the evaluation parameters.  Observation 4: For UEs for FWA operations, the device can be determined as maintained 20 cm separation distance to the body at least, and the MPE criteria are applied as the evaluation parameters.  Observation 5: High-power UEs for FWA operations should have a different mechanism with the current PC1.5 requirements of the SAR handling.  Observation 6: It is recommended to carry out the study on the quantitative impact, and derive new requirements to handle the RF exposure regulation for the FWA UE. |

## Open issues summary

### Sub-topic 2-1: Smartphone SAR

A mechanism to facilitate SAR compliance by reporting *maxUplinkDutyCycle-PC2-FR1* has been agreed for PC1.5 when the work was done with Band n41. The default duty cycle limit is 25% if nothing is reported; otherwise, it is half the reported value since the same IE is used for PC2 reporting as well.

*Can the existing SAR mechanism and 25% default value be reused for PC1.5 smartphone in Band n77/n78?*

### Sub-topic 2-1: FWA SAR or MPE

An FWA device is significantly different from a smartphone UE that is held next to the user’s head. It has been proposed in R4-2100912 that a different mechanism is defined for PC1.5 FWA devices rather than to reuse the SAR mechanism for handheld UE’s. It is also proposed that MPE should be used as the evaluation criterion rather than SAR.

*Do companies agree that a different mechanism should be defined for FWA to comply with RF exposure requirements? What are the elements of this new mechanism?*

## Companies views’ collection for 1st round

### Open issues

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| **Company** | **Comments** |
| Qualcomm | Sub topic 2-1: Yes  Sub topic 2-2: Yes. We expect that duty cycle will also play a key role in containing RF exposure, but the transmit power level may also be considered.  ….  Others: |
| LGE | Sub-topic 2-1: Smartphone SAR  *Can the existing SAR mechanism and 25% default value be reused for PC1.5 smartphone in Band n77/n78? 🡪 LGE: Yes, RAN4 can consider same SAR mechanism*  Sub-topic 2-2: FWA SAR or MPE  *Do companies agree that a different mechanism should be defined for FWA to comply with RF exposure requirements? What are the elements of this new mechanism? 🡪 LGE: basically, FWA is not come close to the user. So RAN4 can have different mechanism will be defined for FWA UE.* |
| Skyworks | 2-1: same duty cycle restrictions and handling that current PC1.5 should apply  2-2: for FWA MPE should apply thus duty cycle may be different but does this needs a specific UE type, power class, declaration?? May be the FWA UE can signal its max duty cycle anyhow as this is allowed |
| Huawei | Sub topic 2-1:  The existing SAR mechanism can be reused.  Sub topic 2-2:  As per FCC rules, the MPE requirements seem more suitable for FWA UEs. On the other hand, the regulations in other regions where FCC rules do not apply should also be checked. We’re open for further discussions. |
| OPPO | Sub-topic 2-1: Smartphone SAR  Yes.  Sub-topic 2-2: FWA SAR or MPE  Yes, from form factor and use case point of view it is true that FWA is different from FWA UE. However, from paper R4-2100912, it seems the FCC MPE requirements for below 6GHz is not for FWA use case? If SAR is still be used for FWA UE, then potentially similar solution could be used.  *NOTE 2: Designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons.* |
| ZTE | Sub topic 2-1: Yes  Sub topic 2-2: Different with smart phone, FWA will not close to the human body, so the different mechanism may be defined for FWA to comply with RF exposure requirements |
| Samsung | Sub-topic 2-1: Yes, as noted in the WID already.  Sub-topic 2-1: Based on the information in our paper, we do believe that we don’t need to limit the UL performance of FWA scenario without further evaluation to meet the different regulation with handheld UE’s. So, we would suggest to carry out the study on the quantitative impact as the different mechanism, and to derive new requirements based on the existing test reports of FR1 CPE devices in future meetings. For example, we can find out what the max duty is for the device. @OPPO, the NOTE 2 is about the mobile device (CPE) which is different with portable device in FCC terminology. |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
|  | Company A |
| Company B |
|  |
|  | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

*2.2.1 Sub-topic 2-1: Smartphone SAR*

Companies agreed that the same SAR mechanism and the same default value of 25% can be reused for smartphone.

*2.2.2 Sub-topic 2-2: FWA SAR or MPE*

Most companies agreed that FWA devices and requirements are different from smartphone so that a different mitigation mechanism could be evaluated. Some companies also pointed out that there may be requirements other than MPE in some countries or that MPE may not be applicable. The moderator suggests further discussion in future meetings, but that a WF is drafted to guide the future discussion.

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|  | **Status summary** |
| **Sub-topic#2-1**  **Smartphone SAR** | *Tentative agreements: The same SAR mechanism and default value of 25% can be reused for smartphone.*  *Candidate options:*  *Recommendations for 2nd round: No further discussion.* |
| **Sub-topic#2-2**  **FWA SAR/MPE** | *Tentative agreements: A different mitigation mechanism can be evaluated for FWA compared to smartphone. Details including requirements (MPE or other) can be discussed in future meetings.*  *Candidate options:*  *Recommendations for 2nd round: A way forward is drafted to help guide the future discussion.* |

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| R4-2103228 | Way Forward on FWA MPE handling for n77/n78 | Samsung |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

In the second round, a WF for MPR handling is being developed.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Huawei | On the draft WF R4-2103228:  During the 1st round discussions, most companies recognized that SAR might not be a suitable requirement for FWA due to its relatively large distance to users. However, there’s no consensus yet that instead of SAR MPE is the only regulatory requirement. We believe companies would like to further study all possible RF exposure regulations that are applicable to FWA. Based on this, we think the texts in the current WF are too strong, too specific. As this is the 1st meeting discussing this matter, we prefer that the WF only captures the most general consensuses. |
| LGE | Support MPE rather than SAR based on the regulatory information on RF exposure for FWA devices in R4-2100912. RAN4 further discuss how to define the FWA requirements among 3 options in next RAN4 meeting. |
| Skyworks | Support using MPE, ok to check other regulations but don’t know of any and some might be regional. How to handle is FFS but MPE should be covered. Since the UE signals its power class we are not sure that the declared duty cycle has to be halved since the BS should know the UE power class, the UE should be able to declare directly its duty cycle. |
| Verizon | We support companies to further check regulation requirements for FWA. |

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |