**3GPP TSG-RAN WG4 Meeting # 104-bis-e R4-22XXXXX**

**Electronic Meeting, 10– 19 October 2022**

**Agenda item:** 6.23.4

**Source:** Moderator (Nokia)

**Title:** Email discussion summary for [104-bis-e][142] NR\_cov\_enh2\_part2

**Document for:** Information

# Introduction

*Briefly introduce background, the scope of this email discussion (e.g. list of treated agenda items) and provide some guidelines for email discussion if necessary.*

*List of candidate target of email discussion for 1st round and 2nd round*

* 1st round: Collect views on proposals in each of the contribution and aim at making the scope of the study more concrete
	+ Since this is the 1st meeting for Rel-18 CE, see if there are any agreements to be made.
* 2nd round: Continue the discussion on the 1st round if necessary and make parameters for simulations more concreate based on the 1st round outcome so that further inquiries are provided to make the agreements more specific and detailed, e.g., if 700 MHz can be agreeable as frequency to be studied in FR1, then, Channel BW as well as SCS are discussed.

It is appreciated that the delegates for this topic put their contact information in the table below.

Contact information

|  |  |  |
| --- | --- | --- |
| **Company** | **Name** | **Email address** |
|  |  |  |

Note:

1. Please add your contact information in above table once you make comments on this email thread.
2. If multiple delegates from the same company make comments on single email thread, please add you name as suffix after company name when make comments i.e. Company A (XX, XX)

# Topic #1: Work responsibility and High level scope

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2216588**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216588.zip) | Huawei, HiSilicon | ***Proposal 2: The following agreement in Rel-17 pi/2-BPSK SI should be inherited for the evaluation in this Rel-18 WI:**** ***Both data and DMRS would be filtered.***

***Proposal 3: The Rel-18 FDSS mechanism should still be up to UE implementation and transparent to the network, in order to minimize the impact to both UE and BS implementation.*** ***Proposal 4: RAN4 evaluation should not be triggered until RAN1 can converge and provide enough inputs about the FDSS w/wo SE and TR for DFT-s-OFDM.***  |
| [**R4-2215514**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215514.zip) | Nokia, Nokia Shanghai Bell | ***Proposal 1***: *RAN WG4 should be the (key) responsible WG for the performance evaluations related to MPR/PAR objective.****Proposal 2*:** *Actual conclusion of the MPR/PAR reduction methods should be based on net coverage gain results combining transmitter and receiver performance.****Proposal 4:***  *Consider DFT-s-OFDM and do not consider CP-OFDM.* ***Proposal 5:***  *Consider UE Power Class 3 and scenario with a single transmitter & single component carrier and do not consider SU-MIMO or UL CA.****Proposal 6:***  *Consider both FR1 and FR2.****Proposal 7:***  *Consider PUSCH and the associated DMRS, and do not consider other channels and signals.****Proposal 8:***  *Consider QPSK modulation and do not consider other modulation schemes.* |
| [**R4-2215515**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215515.zip) | Nokia, Nokia Shanghai Bell | ***Observation 1:*** *Compared to CP-OFDM, DFT-s-OFDM waveform provides opportunities for smaller MPR/PAR and allows considerably smaller UE complexity for implementing tone reservation.****Proposal 1:*** *Determine Extension factor (a) as Excess band size / Total allocation size* ***Proposal 2:***  *Consider symmetric extension for FDSS with spectrum extension.****Proposal 3:***  *Support a = 0.25.* ***Proposal 4:*** *At least for QPSK modulation, deprioritize tone reservation for both DFT-s-OFDM and CP-OFDM****.*****Proposal 5:** *Update spectral flatness requirements in TS 38.101-x to cover FDSS with spectrum extension with QPSK modulation. Consider the following approaches:** *Two ranges defined for pi/2 BPSK are applied for the total allocation (Inband + Excess band)*
* *Two ranges defined for pi/2 BPSK are applied for the Inband signal. The third range with a new parameter X3 is introduced for Excess band.*

**Proposal 6:** *From IBE point of view, consider excess band as a part of the allocated UL transmission bandwidth.***Proposal 7:** *Update MPR tables (at least Table 6.2.2-1) in TS 38.101-1.* * *In order to minimize the specification complexity, it makes sense to consider definition of the current RB regions (Edge/Outer/Inner) as the starting point.*

**Proposal 8:** *Extend the duty cycle -based power boost defined for pi/2 BPSK also for QPKS modulation* **Proposal 9:** *Define ACLR requirement according to power class also with power boost.****Proposal 10:*** *Ensure fair comparison between different methods by keeping the total bandwidth and the spectral efficiency the same for all compared cases.* **Proposal 11:** *Actual conclusion of the methods should be based on net coverage gain results combining transmitter and receiver performance.* **Proposal 12:** *Consider only FDSS with spectrum extension for DFT-s-OFDM.* |
| [**R4-2215891**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215891.zip) | ZTE Corporation | ***Observation 1:*** *For FDSS without spectrum extension, the window length of the shaping filter in the frequency domain is equal to the number of REs allocated for PUSCH transmission.****Observation 2:*** *Some RAN4 specification impacts areexpected for QPSK supporting of FDSS.****Observation 3:*** *For FDSS with spectrum extension, the window length of the shaping filter in the frequency domain is equal to (1+α) times of the number of REs allocated for original PUSCH transmission, where α is ratio of the extended REs.* ***Observation 4:*** *For tone reservation, the window length of the shaping filter in the frequency domain is equal to (1+**) times of the number of REs allocated for original PUSCH transmission, where*$ β $*is ratio of the reserved REs.* ***Observation 5:*** *For both pi/2-BPSK and QPSK, tone reservation cannot provide clear PAPR/CM reduction gain compared to FDSS with or without spectrum extension.* ***Observation 6:*** *For pi/2-BPSK, FDSS without spectrum extension can achieve 3dB PAPR gain or 1dB CM gain, and on top of this, FDSS with spectrum extension provides no or minor additional PAPR/CM reduction gain.* ***Observation 7:*** *For QPSK, FDSS without spectrum extension can achieve 2.3dB PAPR gain while marginal CM gain, and on top of this, FDSS with spectrum extension can provide additional PAPR/CM reduction gain about 0.51 dB, 0.9 dB and 1.63 dB PAPR gain or 0.27 dB, 0.71 dB and 1.17dB CM gain for extension ratio of 12.5%, 25% and 50% respectively.* ***Observation 8:*** *For pi/2-BPSK, FDSS without spectrum extension would cause about 0.56~0.79 dB link-level performance loss. For QPSK, FDSS without spectrum extension would cause about 0.56~0.78 dB link-level* ***Proposal 1:*** *For both pi/2-BPSK and QPSK, tone reservation is not supported in Rel-18 CE WI.****Proposal 2:*** *For pi/2-BPSK, FDSS with spectrum extension can be further studied in Rel-18 CE WI.****Proposal 3:*** *For QPSK, FDSS with or without spectrum extension can be further studied in Rel-18 CE WI.* |
| [**R4-2216121**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216121.zip) | vivo | ***Observation 1: For the outer allocation (e.g., 60RB20), FDSS with spectrum extension (no copying data) can improve the EVM performance compared with FDSS without spectrum extension, but there is only 0.3-0.5dB power boost.******Observation 2: For the outer allocation (e.g., 60RB20), for FDSS with spectrum extension (copying data), the main limit factor changes from EVM to ACLR compared with FDSS without coping data.******Observation 3: Provided the FDSS with spectrum extension is specified, the impact on spec would be very large, including the detailed extension RB number for different allocated RBs and the detailed MPR value for different RB regions. In addition, the RB region division (i.e., inner, outer, edge) also needs to be reconsidered.******Proposal 1: FDSS enhancement (i.e., FDSS with spectrum extension) in Rel-18 should be carefully studied and should not be specified unless being justified by more obvious power boost gain.*** |
| [**R4-2216639**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216639.zip) | Ericsson | Observation 1 Transparent MPR reduction schemes allow immediate improvements in UE PA efficiency and/or network coverage, rather than waiting for the network to be upgraded to support a non-transparent scheme. Observation 2 Transparent MPR reduction schemes allow flexible UE implementation, where the UE can dynamically adapt to power requirements and/or channel conditions, without intervention by the network.Observation 3 Non-transparent schemes are being studied because the extra degrees of freedom in the design as compared to transparent schemes may allow for better MPR reduction.Observation 4 Link simulation would be needed to compare the network gain for MPR reduction with spectrum extensionProposal-1:Transparent MPR reduction schemes are baselines to which non-transparent schemes are compared.Proposal-2:Candidate transparent MPR reduction schemes to consider include clipping and filtering, companding, and digital predistortion.Proposal-3:The filter coefficient could be one simulation parameter to be discussed and agreed.Proposal-4:Percentage and/or number of RBs used for the spectrum extension to be discussed and agreed.Proposal-5:Compare schemes at the link level using a same amount of time-frequency resource and at a same spectral efficiency, and assuming Rel-17 resource allocation mechanisms.Proposal-6:Investigate if there are modulation scheme limitations for the MPR reduction scheme.Proposal-7:Discuss the simulation assumption parameters in Tables 1.Proposal-8:Remaining parameters not given by Tables 1-3 that are needed for the link level simulations can be taken from the Rel-17 NR coverage enhancement TR 38.830, appendices A.1 and A.2. |
| **[R4-2216788](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216788.zip)** | Qualcomm Incorporated | **Proposal 1: RAN4 to focus on transparent waveform enhancements separately from any future support work for RAN1 to evaluate new waveforms or techniques (non-transparent enhancements).****Proposal 2: RAN4 to focus on enhancing UL power for 0 MPR waveforms for FR1 for the MPR/PAR reduction objective of the WI.** |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 1-1: Work plan and responsibility

*Sub-topic description:*

R4-2215514 (Nokia) proposes that RAN4 should be the key WG for the performance evaluation while it seems that R4-2216588 (Huawei) considers that RAN1 is the key WG and RAN4 should wait for the evaluation until RAN1 can converge and provide enough inputs about the FDSS w/wo SE and TR for DFT-s-OFDM.

*Open issues and candidate options before e-meeting:*

**Issue 1-1: When should RAN4 start performance evaluation?**

* Proposal:
	+ Option 1: RAN4 is responsible for performance evaluation work and RAN4 can discuss it without being triggered by RAN1
	+ Option 2: RAN4 evaluation should not be triggered until RAN1 can converge and provide enough inputs about the FDSS w/wo SE and TR for DFT-s-OFDM
	+ Option 3: Others
* Recommended WF
	+ TBA

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| --- | --- |
| **Company** | **Comments** |
| XXX |  |

### Sub-topic 1-2: Handling of Non-Transparent schemes

*Sub-topic description:*

*R4-2216639 (Ericsson) proposes that “Transparent MPR reduction schemes are baselines to which non-transparent schemes are compared” as P1 and it seems that some other contributions follow this way. In addition, R4-2215515 (Nokia) takes one step further and proposes that “Consider only FDSS with spectrum extension for DFT-s-OFDM”. On the other hand, R4-2216788 (Qualcomm) proposes that “RAN4 to focus on enhancing UL power for 0 MPR waveforms for FR1 for the MPR/PAR reduction objective of the WI” as P2.*

*Open issues and candidate options before e-meeting:*

**Issue 1-2: Handling of transparent and Non-transparent schemes**

* Proposals
	+ Option 1: Non-transparent schemes should be considered, and transparent schemes can be used as baseline to evaluate the gain of Non-transparent schemes
	+ Option 2: RAN4 to focus on transparent waveform enhancements separately from any future support work for RAN1 to evaluate new waveforms or techniques (non-transparent enhancements)
		- Note: It means that RAN4 focus on transparent waveform enhancements and wait for convergence in RAN1 on Non-transparent enhancements before tackling in RAN4
	+ Option 3: No transparent scheme is used as baseline
	+ Others 4: Others
* Recommended WF
	+ TBA

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| **Company** | **Comments** |
| XXX |  |

### Sub-topic 1-3: Transparent MPR reduction schemes

*Sub-topic description:*

*Issue 1-3-1: R4-2216639 (Ericsson) proposes specific transparent MPR reduction schemes candidate schemes as P2 while WID of RP-221858 says that “including frequency domain spectrum shaping with and without spectrum extension for DFT-S-OFDM and tone reservation”. See if P2 in R4-2216639 is agreeable or not.*

*Issue 1-3-2: R4-2216588 (Huawei) has a proposal on handling of FDSS mechanism as P3.*

*Open issues and candidate options before e-meeting:*

**Issue 1-3-1: Candidate transparent MPR reduction schemes**

* Proposals: Which of the option should be considered as baseline for MPR reduction schemes if it’s used as baseline to compare with Non-transparent schemes in Rel-18 CE?
	+ Option 1: RAN4 should follow WID objective, i.e., frequency domain spectrum shaping without spectrum extension for DFT-S-OFDM
	+ Option 2: In addition to Option 1, consider clipping and companding, and digital predistortion
	+ Option 3: Other transparent scheme

Note: Down scoping of tone reservation is proposed, and the final outcome of Issue 1-3 may change depending on the outcome of the Issue 1-4-1 even if Option 1 is selected.

Note: “companding” may not belong to transparent. Need clarification from Ericsson.

* Recommended WF
	+ TBA

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| **Company** | **Comments** |
| XXX |  |

**Issue 1-3-2: Rel-18 FDSS mechanism**

* Proposals: The Rel-18 FDSS mechanism should still be up to UE implementation and transparent to the network, in order to minimize the impact to both UE and BS implementation

Note: It’s encouraged for Huawei to clarify if this proposal applies to only FDSS functionality, i.e., it doesn’t include FDSS with spectrum extension and tone reservation as early as possible.

* + Option 1: Agree
	+ Option 2: Don’t agree
	+ Option 3: Others
* Recommended WF
	+ TBA

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| **Company** | **Comments** |
| XXX |  |

### Sub-topic 1-4: Modulation/Waveform(DFT-s-OFDM/CP-OFDM)

*Sub-topic description:*

*There are high level proposals on modulation as well as waveforms (DFT-s-OFDM/CP-OFDM) together with side conditions like specific non-transparent schemes.*

*Issue 1-4-1 are related to mainly tone reservation handling in P1 in R4-2215891 (ZTE) and P4 in R4-2215515 (Nokia).*

*Issue 1-4-2 are related to mainly modulation handling in P2 in R4-2215891 (ZTE), P8 in R4-2215514 (Nokia) and P6 in R4-2216639*

*Issue 1-4-3 is related to mainly waveforms* (*DFT-s-OFDM/CP-OFDM) handling in P4 in R4-2215514 (Nokia).*

*Open issues and candidate options before e-meeting:*

**Issue 1-4-1: For both pi/2-BPSK and QPSK, tone reservation is not supported in Rel-18 CE WI**

* Proposals
	+ Option 1: Yes
	+ Option 2: No
	+ Option 3: Others
* Recommended WF
	+ TBA

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| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 1-4-2: Should pi/2 BPSK FDSS with spectrum extension be further studied in Rel-18 CE WI or should RAN4 discuss only QPSK?**

* Proposals
	+ Option 1: Both pi/2 BPSK FDSS with spectrum extension and QPSK FDSS with or without spectrum extension can be discussed
	+ Option 2: Only QPSK with spectrum extension can be discussed
	+ Option 3: Others
* Recommended WF
	+ TBA

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| **Company** | **Comments** |
| XXX |  |

**Issue 1-4-3: Should DFT-s-OFDM be considered or both DFT-s-OFDM and CP-OFDM be considered?**

* Proposals
	+ Option 1: Only DFT-s-OFDM is considered
	+ Option 2: Both DFT-s-OFDM and CP-OFDM are considered
	+ Option 3: Others
* Recommended WF
	+ TBA

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| **Company** | **Comments** |
| XXX |  |

### Sub-topic 1-5: Threshold to specify the requirements for MPR FDSS with spectrum extension

*Sub-topic description:*

*R4-2216121 (vivo) has a proposal not to specify requirements for FDSS with spectrum extension in Rel-18 unless being justified by more obvious power boost gain. We collect views from companies. It’s noted that specifically observation 3 can be a good point to be discussed as one of the future issues. Since R4-2215514 (Nokia) has P7 where it says the existing MPR table side conditions like resource block regions should be a baseline to minimize spec impact, we would need to see how MPR table looks like if simulation results converge and gain can be seen.*

*Open issues and candidate options before e-meeting:*

**Issue 1-5: Threshold to introduce requirements for FDSS with spectrum extension in Rel-18 CE**

* FDSS enhancement (i.e., FDSS with spectrum extension) in Rel-18 should be carefully studied and should not be specified unless being justified by more obvious power boost gain
	+ Option 1: Agree
	+ Option 2: Don’t agree
	+ Option 3: Others
* Recommended WF
	+ TBA

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| **Company** | **Comments** |
| XXX |  |

### Sub-topic 1-6: Miscellaneous proposals on scope

*Sub-topic description:*

*Issue 1-6-1 – 1-6-3 are related to P5-7 R4-2215514.*

*Open issues and candidate options before e-meeting:*

**Issue 1-6-1: Power Class/CA/ MIMO**

* Consider UE Power Class 3 and scenario with a single transmitter & single component carrier and do not consider SU-MIMO or UL CA.
	+ Option 1: Yes
	+ Option 2: No
	+ Option 3: Others
* Recommended WF
	+ TBA

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| **Company** | **Comments** |
| XXX |  |

**Issue 1-6-2: Frequency ranges**

* Consider one of the following options
	+ Option 1: FR1 and FR2
	+ Option 2: FR1
	+ Option 3: FR2
	+ Option 4: Others
* Recommended WF
	+ TBA

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| **Company** | **Comments** |
| XXX |  |

**Issue 1-6-3: Physical channel**

* Consider PUSCH and the associated DMRS, and do not consider other channels and signals
	+ Option 1: Agree
	+ Option 2: Don’t agree
	+ Option 3: Others
* Recommended WF
	+ TBA

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| **Company** | **Comments** |
| XXX |  |

## Companies views’ collection for 1st round

### Open issues

*One of the two formats, i.e. either example 1 or 2 can be used by moderators.*

**Example 1**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 1-1: Sub topic 1-2:….Others: |

**Example 2**

Sub topic 1-1

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

Sub topic 1-2

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

### CRs/TPs/ comments collection

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

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

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic #1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

### CRs/TPs

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

*Note: The tdoc decisions shall be provided in Section 3 and this table is optional in case moderators would like to provide additional information.*

|  |  |
| --- | --- |
| **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)

# Topic #2: Simulations

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
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| [**R4-2215891**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215891.zip) | ZTE Corporation | ***Observation 1:*** *For FDSS without spectrum extension, the window length of the shaping filter in the frequency domain is equal to the number of REs allocated for PUSCH transmission.****Observation 2:*** *Some RAN4 specification impacts areexpected for QPSK supporting of FDSS.****Observation 3:*** *For FDSS with spectrum extension, the window length of the shaping filter in the frequency domain is equal to (1+α) times of the number of REs allocated for original PUSCH transmission, where α is ratio of the extended REs.* ***Observation 4:*** *For tone reservation, the window length of the shaping filter in the frequency domain is equal to (1+**) times of the number of REs allocated for original PUSCH transmission, where*$ β $*is ratio of the reserved REs.* ***Observation 5:*** *For both pi/2-BPSK and QPSK, tone reservation cannot provide clear PAPR/CM reduction gain compared to FDSS with or without spectrum extension.* ***Observation 6:*** *For pi/2-BPSK, FDSS without spectrum extension can achieve 3dB PAPR gain or 1dB CM gain, and on top of this, FDSS with spectrum extension provides no or minor additional PAPR/CM reduction gain.* ***Observation 7:*** *For QPSK, FDSS without spectrum extension can achieve 2.3dB PAPR gain while marginal CM gain, and on top of this, FDSS with spectrum extension can provide additional PAPR/CM reduction gain about 0.51 dB, 0.9 dB and 1.63 dB PAPR gain or 0.27 dB, 0.71 dB and 1.17dB CM gain for extension ratio of 12.5%, 25% and 50% respectively.* ***Observation 8:*** *For pi/2-BPSK, FDSS without spectrum extension would cause about 0.56~0.79 dB link-level performance loss. For QPSK, FDSS without spectrum extension would cause about 0.56~0.78 dB link-level* ***Proposal 1:*** *For both pi/2-BPSK and QPSK, tone reservation is not supported in Rel-18 CE WI.****Proposal 2:*** *For pi/2-BPSK, FDSS with spectrum extension can be further studied in Rel-18 CE WI.****Proposal 3:*** *For QPSK, FDSS with or without spectrum extension can be further studied in Rel-18 CE WI.* |
| [**R4-2216121**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216121.zip) | vivo | ***Observation 1: For the outer allocation (e.g., 60RB20), FDSS with spectrum extension (no copying data) can improve the EVM performance compared with FDSS without spectrum extension, but there is only 0.3-0.5dB power boost.******Observation 2: For the outer allocation (e.g., 60RB20), for FDSS with spectrum extension (copying data), the main limit factor changes from EVM to ACLR compared with FDSS without coping data.******Observation 3: Provided the FDSS with spectrum extension is specified, the impact on spec would be very large, including the detailed extension RB number for different allocated RBs and the detailed MPR value for different RB regions. In addition, the RB region division (i.e., inner, outer, edge) also needs to be reconsidered.******Proposal 1: FDSS enhancement (i.e., FDSS with spectrum extension) in Rel-18 should be carefully studied and should not be specified unless being justified by more obvious power boost gain.*** |
| [**R4-2216639**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216639.zip) | Ericsson | Observation 1 Transparent MPR reduction schemes allow immediate improvements in UE PA efficiency and/or network coverage, rather than waiting for the network to be upgraded to support a non-transparent scheme. Observation 2 Transparent MPR reduction schemes allow flexible UE implementation, where the UE can dynamically adapt to power requirements and/or channel conditions, without intervention by the network.Observation 3 Non-transparent schemes are being studied because the extra degrees of freedom in the design as compared to transparent schemes may allow for better MPR reduction.Observation 4 Link simulation would be needed to compare the network gain for MPR reduction with spectrum extensionProposal-1:Transparent MPR reduction schemes are baselines to which non-transparent schemes are compared.Proposal-2:Candidate transparent MPR reduction schemes to consider include clipping and filtering, companding, and digital predistortion.Proposal-3:The filter coefficient could be one simulation parameter to be discussed and agreed.Proposal-4:Percentage and/or number of RBs used for the spectrum extension to be discussed and agreed.Proposal-5:Compare schemes at the link level using a same amount of time-frequency resource and at a same spectral efficiency, and assuming Rel-17 resource allocation mechanisms.Proposal-6:Investigate if there are modulation scheme limitations for the MPR reduction scheme.Proposal-7:Discuss the simulation assumption parameters in Tables 1.Proposal-8:Remaining parameters not given by Tables 1-3 that are needed for the link level simulations can be taken from the Rel-17 NR coverage enhancement TR 38.830, appendices A.1 and A.2. |
| [**R4-2216788**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216788.zip) | Qualcomm Incorporated | **Proposal 1: RAN4 to focus on transparent waveform enhancements separately from any future support work for RAN1 to evaluate new waveforms or techniques (non-transparent enhancements).****Proposal 2: RAN4 to focus on enhancing UL power for 0 MPR waveforms for FR1 for the MPR/PAR reduction objective of the WI.** |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 2-1: Common

*Sub-topic description:*

*There are proposals on essential precondition(s) to draw a conclusion and on how to draw a conclusion like P2 in R4-2216588 (Huawei), P2 in R4-2215514 (Nokia), P1, P2, P10 and P11 in R4-2215515 (Nokia), and Ob4, P3-P5 and P7 in R4-2216639 (Ericsson). Here we collect views on each of the proposals to see if there is possibility to converge and agree something specific.*

*Open issues and candidate options before e-meeting:*

**Issue 2-1-1: A way to draw a conclusion**

* Actual conclusion of the MPR/PAR reduction methods should be based on net coverage gain results combining transmitter and receiver performance.
	+ Option 1: Yes
	+ Option 2: No
	+ Option 3: Others
* Recommended WF
	+ TBA

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 2-1-2: Handling of an agreement in Rel-17 pi/2-BPSK SI**

* Should the agreement of “Both data and DMRS would be filtered” in Rel-17 pi/2 BPSK SI be inherited to Rel-18 CE WI?
	+ Option 1: Yes
	+ Option 2: No
	+ Option 3: Others
* Recommended WF
	+ TBA

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 2-1-3: Principle to comparison between different methods**

* Ensure fair comparison between different methods by keeping the total bandwidth, the spectral efficiency and resource in time domain the same for all compared cases
	+ Option 1: Agree
	+ Option 2: Don’t agree
	+ Option 3: Others

Note: P10 in R4-2215515 (Nokia) and P5 in R4-2216639 (Ericsson) are merged

* Recommended WF
	+ TBA

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| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 2-1-4: Definition of extension/reservation factor for spectrum extension and tone reservation**

* Define extension/reservation factor (*a*) as Excess band size / Total allocation, where
	+ Inband size: Occupied REs after DFT-block
	+ Excess/reserved band size: The amount of spectrum extension.
	+ Total allocation size (Inband size + Excess/reserved band size): Occupied REs after spectrum extension
	+ Option 1: Agree
	+ Option 2: Don’t agree
	+ Option 3: Others

Note: “reservation” may be deleted if the proposal in Issue 1-4-1 is agreed. There is P4 to discuss Percentage and/or number of RB in R4-2216639 (Ericsson). It will be handled in the 2nd round after definition is agreed.

* Recommended WF
	+ TBA

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| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 2-1-5: Handling of asymmetric extension**

* Consider symmetric extension for FDSS with spectrum extension
	+ Option 1: Agree
	+ Option 2: Don’t agree
	+ Option 3: Others
* Recommended WF
	+ TBA

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| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 2-1-6: Frequency bands**

* Consider one of the following options
	+ Option 1: 700 MHz, 4 GHz and 28 GHz (From R4-2216639(Ericsson))
	+ Option 2: 4 GHz and 28 GHz (From R4-2215515(Nokia))
	+ Option 3: 4 GHz (From R4-2215891(ZTE) and R4-2216121(vivo))
	+ Option 4: Others

Note: vivo clarified that their simulation result uses 4 GHz in offline.

* Recommended WF
	+ TBA

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 2-1-7: Channel bandwidth(s) and SCS(s) for 4 GHz**

* Consider one of the following options
	+ Option 1: 20 MHz and 100 MHz with SCS of 30 kHz (From R4-2215515(Nokia))
	+ Option 2: 50 MHz and/or 100 MHz with SCS of 30 kHz (From R4-2216639(Ericsson)
	+ Option 3: 100 MHz with SCS of 30 or 60 kHz (From R4-2215891(ZTE))
	+ Option 4: 20MHz with SCS of 15 kHz (From R4-2216121(vivo))
	+ Option 5: Others

Note: CBW and SCS for 700 MHz and 28 GHz are discussed after seeing the result of Issue 2-1-6

Note: It’s not possible to obtain exact proposal on CBW from R4-2216639 and an assumption of SCS from R4-2215891

Note: vivo clarified their simulation result uses 20 MHz with SCS of 15 kHz for 4 GHz.

* Recommended WF
	+ TBA

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 2-1-8: FDSS and filter coefficient**

* Consider one of the following options
	+ Option 1: 3-tap, Pulse shaping filter (0.335 1 0.335) and Truncated RRC (0.5, 0.1667) (R4-2215515(Nokia))
	+ Option 2: 3-tap, Pulse shaping filter (0.28 1 0.28) (R4-2215891(ZTE) and R4-2216121(vivo))
	+ Option 3: Others
* Recommended WF
	+ TBA

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| --- | --- |
| **Company** | **Comments** |
| XXX |  |

### Sub-topic 2-2: MPR evaluation parameters

*Sub-topic description:*

*Open issues and candidate options before e-meeting:*

**Issue 2-2-1: Reference of power enhancement**

* UL power for 0 MPR waveforms should be used as the reference for the power enhancement (From R4-2216788(Qualcomm))
	+ Option 1: Agree
	+ Option 2: Don’t agree
	+ Option 3: Others
* Recommended WF
	+ TBA

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| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 2-2-2: Power Class and ACLR for FR1**

* Power Class and associated ACLR to be considered for MPR evaluation
	+ Option 1: PC3 and 30 dB
	+ Option 2: PC2 and 31 dB
	+ Option 3: Both Option 1 and 2
	+ Option 4: Others
* Recommended WF
	+ TBA

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

## Companies views’ collection for 1st round

### Open issues

**Example 1**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 1-1: Sub topic 1-2:….Others: |

**Example 2**

Sub topic 1-1

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

Sub topic 1-2

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

### 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** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic#1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

### 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)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

# Topic #3: UE RF requirements

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2215515**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215515.zip) | Nokia, Nokia Shanghai Bell | **Proposal 5:** *Update spectral flatness requirements in TS 38.101-x to cover FDSS with spectrum extension with QPSK modulation. Consider the following approaches:** *Two ranges defined for pi/2 BPSK are applied for the total allocation (Inband + Excess band)*
* *Two ranges defined for pi/2 BPSK are applied for the Inband signal. The third range with a new parameter X3 is introduced for Excess band.*

**Proposal 6:** *From IBE point of view, consider excess band as a part of the allocated UL transmission bandwidth.***Proposal 7:** *Update MPR tables (at least Table 6.2.2-1) in TS 38.101-1.* * *In order to minimize the specification complexity, it makes sense to consider definition of the current RB regions (Edge/Outer/Inner) as the starting point.*

**Proposal 8:** *Extend the duty cycle -based power boost defined for pi/2 BPSK also for QPKS modulation* |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 3-1: UE RF requirements impact

*Sub-topic description: Though there are proposals on UE RF requirements, it wouldn’t be urgent to agree with something at this stage. Hence, here the purpose is to check if there are any possibility to agree and to collect views on each proposal in R4-2215515.*

*It’s noted that the below inquiries are conducted under the assumption that if requirements for FDDSS with spectrum extension are introduced. Hence, the agreement(s) if any doesn’t mean the introduction of the requirements is ensured.*

*Open issues and candidate options before e-meeting:*

**Issue 3-1: RAN4 spec impacts in case requirements for FDSS with spectrum extension are introduced**

* Can we agree with the following proposals or at least are they the requirements to be impacted?
	+ P1: Update spectral flatness requirements in TS 38.101-x to cover FDSS with spectrum extension with QPSK modulation. Consider the following approaches:
		- Two ranges defined for pi/2 BPSK are applied for the total allocation (Inband + Excess band)
		- Two ranges defined for pi/2 BPSK are applied for the Inband signal. The third range with a new parameter X3 is introduced for Excess band.
	+ P2: For IBE, consider excess band as a part of the allocated UL transmission bandwidth.
	+ P3: Update MPR tables (at least Table 6.2.2-1) in TS 38.101-1.
		- In order to minimize the specification complexity, it makes sense to consider definition of the current RB regions (Edge/Outer/Inner) as the starting point.
	+ P3: Extend the duty cycle -based power boost defined for pi/2 BPSK also for QPKS modulation
* Recommended WF
	+ TBA

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| **Company** | **Comments** |
| XXX |  |

## Companies views’ collection for 1st round

### Open issues

**Example 1**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 1-1: Sub topic 1-2:….Others: |

**Example 2**

Sub topic 1-1

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

Sub topic 1-2

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

### 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** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic#1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

### 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)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Comments** |
|  | WF on … | YYY |  |
|  | LS on … | ZZZ | To: RAN\_X; Cc: RAN\_Y |
|  |  |  |  |

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-22xxxxx |  | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics incl. existing and new tdocs.
2. For the Recommendation column please include one of the following:
	1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
	2. Other documents: Agreeable, Revised, Noted
3. For new LS documents, please include information on To/Cc WGs in the comments column
4. Do not include hyper-links in the documents

## 2nd round

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-22xxxxx |  | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-22xxxxx |  | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-22xxxxx |  | LS on … | ZZZ | Agreeable, Revised, Noted |  |
|  |  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics.
2. For the Recommendation column please include one of the following:
	1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
	2. Other documents: Agreeable, Revised, Noted
3. Do not include hyper-links in the documents