**3GPP TSG-RAN WG4 Meeting # 98-e R4-21XXXXX**

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

**Agenda item:** 12.4

**Source:** Ericsson

**Title:** Email discussion summary for [98e][148] FS\_NR\_600MHz\_ext\_Spark

**Document for:** Information

# Introduction

This email discussion is divided into five topics

1. General (work plan and TR)
2. Regulatory aspects
3. Need for coexistence studies
4. Band plan and feasibility of implementation
5. Reply LS to AWG

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

* 1st round:
	+ agree the work plan and TR skeleton
	+ decide on which regulatory requirements that should be considered for the APT 600 MHz band
	+ include regulatory background in the TR (from contributions)
	+ narrow down options for the APT 600 band arrangement (if other than B1 and B2, based on proposals)
	+ reply to AWG from this meeting or not?
* 2nd round: TBA

# Topic #1: General (work plan and TR)

A work plan and a TR skeleton must be agreed.

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2100055 | Spark NZ | Title: Details of workplan for study of extended 600MHz NR band |
| R4-2100167 | Spark NZ | Title: Blank TR for extended 600MHz NR band |

## Open issues summary

### Sub-topic 1-1 Work plan

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

**Issue 1-1: approval of work plan**

* Proposals
	+ Option 1: Agree work plan as proposed in R4-2100055
	+ Option 2: Modify the work plan proposed R4-2100055 (specify how)
* Recommended WF
	+ Option 1

### Sub-topic 1-2 TR skeleton

*Sub-topic description*

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

**Issue 1-2: approval of TR skeleton**

* Proposals
	+ Option 1: Agree the TR skeleton as proposed in R4-2100167
	+ Option 2: Modify the work plan proposed R4-2100167 (specify how)
* Recommended WF
	+ Option 1 (the outline of the TR can always be modified)

## Companies views’ collection for 1st round

### Open issues

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| --- | --- |
| **Company** | **Comments** |
| Huawei | Sub topic 1-1: in general we are ok with the proposed workplan. However, there are some clarifications needed: - For the proposal on the Band Name (i.e. APT 600 MHz): we are ok with the proposed name. Do we need formal decision on this, or can it be basically capture in the TR? - For the B1/B2 decision: we are expecting that RAN4 will send out LS to AWG this meeting, as requested by AWG. However, it is not clear if RAN4 will be able to conclude on the final recommendation on B1/B2 options/B2 modifications, etc. It may happen that the LS will list various options, while further study will continue in RAN4. This aspect requires some clarification. Our recommendation would be to at least rule out some options before the next RAN4 meeting. - Regulatory study: we support capturing regulatory overview based on the contributions this meeting. However, the workplan (row 3) lists also operating bands, CHBW, duplexer architectures, etc. Some of those aspect are expected one more RAN4 meeting to conclude. - interim report to RAN: this is to understood as the Rapproteur’s contribution to RAN as Status Report (not for RAN4)Based on the above minor revision of the work plan may be needed. Sub topic 1-2: add section for the regulatory matters (based on ITU-R, plus potential country-specific inputs, depending on the future contributions). Refer to Huawei tdoc in R4-2102572. |
| Spark  | Sub topic 1-1: Spark supports option 1Sub topic 1-2: Spark supports option 1  |
| Ericsson | Sub topic 1-1: option 1Sub topic 1-2: Actually, there are some mistakes with subclauses numbering (e.g. twice 5.3.2, all sub-sections number to 7.2). I don’t think either we need the sub-clauses “minimum requirement” in 7.2, and any of sub-clauses in 6.6.3 (which should be actually 7.2.1). |
| Skyworks | Regarding B1/B2 decision we do not think that elements are on the table this meeting to decide and also there are other alternatives worth discussing. What can be done is to agree which options will be studied by RAN4. It is OK to send an LS mentioning all the agreed options. We also believe that we should discuss if the whole range is supported with a single band definition or whether n71+nXX is an option.For the regulatory aspects it depends if the scope is only APT or it includes n71 in the US also |

### 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** |
| TP (TR skeleton) based on R4-2100167 | Huawei: add section for the regulatory matters |
|  Ericsson: see above comments. |
|  |
| 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.*

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

*Recommendations on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 |  |  |

### 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)

## 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**  |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #2: Regulatory aspects

Several companies contribute with information on regulatory aspects. A regulatory background should be included in the TR, possibly in a joint TP.

See also 2.3.2 (comments on TP in R4-2102572)

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2100744 | Nokia, Nokia Shanghai Bell | Title: Regulatory study for APT 600 MHz***Proposal 1: It is assumed that there is no specific regulatory requirement (such as additional spurious emissions) to study in RAN4 other than ones that can be reused from band n71.*** |
| R4-2102162 | Ericsson | Title: Extended 600MHz band - Regulatory aspects |
| R4-2102572 | Huawei | Title: Regulatory aspects for the 600MHz range in APT regionBased on the discussion, it is proposed to agree in the following proposals: **Proposal 1**: approve the attached TP to TR on regulatory aspects.  |

## Open issues summary

### Sub-topic 2-1 Coexistence with other services

*Sub-topic description: what to include in the TR, adoption of Band n71 limit/requirements for B1/B2.*

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

**Issue 2-1: Coexistence with other services, regulatory background to be captured in the TR**

* Proposals
	+ Option 1: Agree the TP as proposed in R4-2102572
	+ Option 2: Merge information in R4-2100744 and R4-2102162 with R4-2102572 into a revised joint TP
	+ Option 3: other (specify what)
* Recommended WF
	+ Option 2

### Sub-topic 2-2 Requirements relevant for APT600

*Regulatory requirements*

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

**Issue 2-2-1: Regulatory requirements relevant for B1/B2 for BS and UE**

* Proposals
	+ Option 1: no specific regulatory requirement (such as additional spurious emissions) to study in RAN4 other than ones that can be reused from band n71 as proposed in R4-2100744.
	+ Option 2: Other (specify what)
* Recommended WF
	+ TBA

**Issue 2-2-2: BS/UE requirements for coexistence with other 3GPP bands for B1/B2**

* Proposals
	+ Option 1: for B1/B2 adopt the Band 71 requirements for coexistence with other 3GPP bands
	+ Option 2: other (specify what)
* Recommended WF
	+ TBA

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Huawei | Sub topic 2-1: Option 3: as per the proposed work plan, the co-ex study is to be concluded by the next meeting. Therefore we suggest splitting coex and regulatory background into two topics, e.g.- WF or TP for coex and identification of the other services – there was number of contributions submitted on those aspects, e.g. R4-2102162. Refer to topic #3.- for regulatory background: based on the regulatory inputs submitted, it is worth to revise and extend the regulatory aspects in TP in R4-2102572 ( as in Option 2). Sub topic 2-2-1: Option 2: wording of this proposal may require some clarifications. We would suggest to refine the text to say that there are no specific requirements defined “right now” for that region – in our understanding, the related regulatory discussions are to be continued. In case of specific regulation being refined, those have to be respected by RAN4 requirements of course, and can be considered by means of regional requirements. Sub topic 2-2-2: we would be fine to consider n71 requirements as the starting point for the discussion (WF?), but we need more time to study for the next RAN4 meeting. See also 2-1. |
| Spark | Sub topic 2-1: Agree Option 2Sub topic 2-2-1 : Agree Option 1, but duplex direction is reverse to ensure coexistence with Band28Sub topic 2-2-1 : Agree Option 1, but duplex direction is reverse to ensure coexistence with Band28….Others: |
| Qualcomm | Issue 2-1: Option 2, however, is it necessary to copy-and-paste text from ITU radio regulations? Wouldn’t it be sufficient to provide the reference? If it is preferable to copy the text, since the scope of this SI is Region3, what is the need to list the allocation in Region 1? Issue 2-2-1: Ok with Option 1Issue 2-2-2: Option 2. It doesn’t make sense to adopt Band n71 UE coexistence requirements since Band n71 is for US. This band is for Region 3 so we need to consider the coexistence with bands deployed in Region 3, not the US. |
| Xiaomi | Issue 2-1: support Option 2.Issue 2-2-1: support Option 1.Issue2-2-2: support Option 2, we agreed QC since this new band is for Region 3, the coexistence bands should be considered based on Region 3 not like Band n71 in US. |
|  | CATTSub topic 2-1: Fine with Option 2. Sub topic 2-2-1:Generally Ok with option 1, but share the Huawei comments that if specific regulation is refined in the future, it should be considered by means of regional requirements. Sub topic 2-2-2: Fine to use Option 1 as the starting point. Further check is not precluded. |
| Ericsson | Sub topic 2-1: option 2Sub topic 2-2:Issue 2-2-1: option 1 would be ok but we shall clarify the taken assumptions: - RAS coexistence will be managed via distance separation, based on each country regulation.- DTV protection: minimum expected guard band.Issue 2-2-2: option 1 as starting point.….Others: |
| Nokia | Sub topic 2-1: Option 2: It is better to include the information about band 71/n71 that coexists with the incumbent services, which is useful information for APT study.Sub topic 2-2-1: Option 1Sub topic 2-2-2: Option 2: The coexisting 3GPP bands should be based on Region 3 bands. Own band (DL protection) may need to be further checked, once the frequency arrangement is decided. |
| Telstra | Issue 2-1: OK with Option 2Issue 2-2-1: Option 1Issue 2-2-2: Ok with Option 1 as a starting point. |
| ZTE | Sub topic 2-1: Option 2, in addition, some APT related information should also be captured instead just from ITU perspective.Sub topic 2-2-1: Option 2: Currently, just without regional requirement proposed, however it doesn’t preclude regulator would have some regulatory requirements proposed within SID/WID phase, we prefer to be option 2.Sub topic 2-2-2: similar as Sub topic 2-2-1, we could start from band n71. |
| Skyworks | 2-1: Since option B1 and B2 claim reuse of the n71 ecosystem it means that there is a concern from proponent to reuse hardware between the region 3 spectrum and n71. If so we need to make sure that n71 US regulation can be met by UE implementing B1 or B2 or any other solution. As such capturing regulation for 71/n71 is useful2-2-1: option 12-2-2: option 1 |

### CRs/TPs comments collection

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| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2102572TP for TR | Company Spark: Adopt the conclusions of Issue 2.1  |
| Nokia: Revision would be requried. |
|  |

## 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.*

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

*Suggestion on WF/LS assignment*

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| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 |  |  |

### CRs/TPs

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

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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)

## 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”* |

# Topic #3: Need for coexistence studies

Which coexistence requirements should be considered for the APT 600 MHz band?

It is remarked that studies of coexistence with other radio services are not in the scope of 3GPP (RAN4).

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2100745 | Nokia, Nokia Shanghai Bell, CBN | Title: Coexistence for APT 600 MHz***Observation 1: Option B1 and B2 can coexist with the broadcast service below 610 and 605 MHz, respectively, assuming the minimum guard-band of 7 MHz.******Observation 2: Option B2 may require vacating one more TV channel depending on TV channel raster.******Proposal 1: No specific BS spurious emission requirement to protect the broadcast service is considered in this study item.*** ***Observation 3: The coexistence requirement with radio astronomy are out of scope of 3GPP.******Proposal 2: No specific BS spurious emission requirement to protect the radio astronomy service is considered in this study item.*** ***Proposal 3: There is no specific coexistence issue with band n28 for APT 600 MHz.*** |
| R4-2101957 | ZTE Corporation, CBN | Title: Coexistence study for extended 600MHz NR band**Observation 1: for Option B1, frequency separation between upper frequency edge of DTV37 and lower frequency edge of extended 600MHz is 6MHz which is less than minimum 7MHz frequency separation requested by FCC.** **Observation 2: for Option B2, frequency separation between upper frequency edge of DTV37 and lower frequency edge of extended 600MHz is 11MHz which is large than the minimum 7MHz frequency separation requested by FCC and existing frequency separation 9MHz between n71 and DTV CH 36.** |
| R4-2102573 | Huawei | Title: Initial considerations on the coexistence studies for 600MHz SI**Observation 1:** before (potential) analysis on co-existence scenarios starts, RAN4 shall first conclude on the preferred frequency arrangement (B1, B2 or other) for the extended 600MHz band in Region 3. **Observation 2:** TR 36.755 shall be used as the starting point for the (potential) co-existence studies in this SI, with consideration of Region 3 regulations on adjacent services.  |

## Open issues summary

### Sub-topic 3-1 Consideration of Region 3 specific requirements

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

**Issue 3-1-1: account of coexistence with broadcast services for BS (for B1/B2 or other proposed arrangement)**

* Proposals
	+ Option 1: for B1/B2, no specific BS spurious emission requirement to protect the broadcast service is considered as proposed in R4-2100745
	+ Option 2: other (specify what)
* Recommended WF
	+ TBA

**Issue 3-1-2: account of coexistence with RAS for BS (for B1/B2 or other proposed arrangement)**

* Proposals
	+ Option 1: for B1/B2, no specific spurious emission requirement to protect the radio astronomy service is considered as proposed in R4-2100745
	+ Option 2: other (specify what)
* Recommended WF
	+ TBA

**Issue 3-1-3 Requirements for coexistence with Band n28**

* Proposals
	+ Option 1: for B1/B2, there is no specific coexistence issue with band n28 for APT 600 as proposed in R4-2100745
	+ Option 2: other (specify what)
* Recommended WF
	+ TBA

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Huawei | Sub topic 3-1-1: Option 2: even though there is no obvious co-ex scenario identified so far (option1), we would recommend capturing related background information in TR (next meeting, as per workplan), e.g. RAS services and the separation requirement, etc. Furthermore, even if certain cases (e.g. NR vs. RAS) are out of scope of 3GPP, it would be good to also capture such information in the TR, i.e. potential co-ex studies being under regional regulators’ responsibility.Sub topic 3-1-2: same as 3-1-1Sub topic 3-1-3: same as 3-1-1 |
| Spark | Sub topic 3-1.1: For band plan B1 an additional DTV need to be cleared to guard band requirements. For band plan B2 the same conditions as band N71 apply. For both band plans option 1 also applies.Sub topic 3-1.2: Support Option 1, but protection for RAS requires physical separation as given in R4-21012407Subtopic 3-1.3: Support option 1 provided the extended 600 MHz band plans are reverse duplex.Others: |
| Qualcomm | Issue 3-1-2: Option 1Issue 3-1-3: Option 2. The UL to DL coexistence into Band n28 needs to be studied. In R4-2100745, the basis for this proposal is an unsubstantiated claim “As uplink to downlink between band 28 and APT600 is sufficiently far, there is no specific coexistence issue in downlink, too”. While this may very well turn out to be the case, no evidence has been provided to justify this, especially considering that the DL is on the opposite side to n28 DL so the duplexer may not provide as much rejection.  |
| CATT | Sub topic 3-1-1: Use option 1 as the starting point. Sub topic 3-1-2:Use option 1 as the starting point. Sub topic 3-1-3:Use option 1 as the starting point. |
| Ericsson | Sub topic 3-1: Issue 3-1-1: option 1 with same comment than for issue 2-2-1.Issue 3-1-2: option 1 with same comment than for issue 2-2-1.Issue 3-1-3: option 1 |
| Nokia | Sub topic 3-1-1: option 1Sub topic 3-1-2: option 1Sub topic 3-1-3: option 1 |
| Telstra  | Issue 3-1-1: Option 1Issue 3-1-2: Option 1Issue 3-1-3: Option 1 (Telstra however would also like to see the justification for the proposal from R4-2100745 regarding coexistence with B28 as raised by Qualcomm) |
| ZTE | Sub topic 3-1-1: option 1, in addition, this also depends how to broadcast band planning in region.Sub topic 3-1-2: option 1Sub topic 3-1-3: option 1 |
| Skyworks | 3-1-3: Coexistence with band n28 is needed especially if large UL BW are defined and if the full band n28 is used in the same region than the proposed band. the study needs to account for both UL BW. also note that n28 has up to 30MHz UL BW and thus may create coexistence issue with the new band. finally the option B2 has a reduced gap thus the upper part of the DL may not meet the -50dBm/MHz own ban protection. This is why other otpions are worth looking at |

### 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.*

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

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 |  |  |

### 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)

## 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”* |

# Topic #4: Band plan and feasibility of implementation

Two band arrangements, B1 and B2, have been proposed by AWG. The SI is also open for studies of other possible band arrangements.

Views on feasibility of different duplexer/band arrangements are also collected under this topic.

See also 4.3.2 (comments on TP in R4-2102574)

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2100056 | Spark NZ | Title: Frequency band arrangements and duplexer options for extended 600MHz NR bandThe frequency band arrangements are presented in this contribution. |
| R4-2100501 | CATT, CBN | Title: Consideration on extended 600MHz NR band**Proposal 1: It is proposed to use Option B2 as the starting point for 600MHz frequency arrangement.****Proposal 2: It is proposed to investigate supporting larger carrier bandwidth (>25MHz) in the extended 600MHz NR band.** |
| R4-2100542 | Skyworks Solutions Inc. | Title: Extended 600MHz NR Duplexer Feasibility and Band Arrangement**Proposal:** * **Alternative solutions using band n71 as-is plus an additional NR band are studied**
* **Additional band may reuse existing or extended band for filter implementations**
* **These options except option 5 do not preclude the use of a 2x40MHz duplexer once feasible without compromising the performance of band n71 while option 5 enables direct reuse of existing UE transceivers**
* **This approach enables immediate reuse of band n71 without impacting its performance and enables additional 5MHz of spectrum at reasonable additional size and cost.**
 |
| R4-2100746 | Nokia, Nokia Shanghai Bell | Title: Frequency arrangements for APT 600 MHz***Observation 1: The ecosystem of band n71 should be maximally reused for APT.******Observation 2: The passband bandwidth extension is not practically feasible without significant degradation from band n71 due to its larger insertion loss.******Observation 3: Option B2 is more harmonized with band n71 in terms of UE implementation and duplexer performance.******Observation 4: Option B2 is a natural extension of n71 and is not harmful to n71 ecosystem.*** ***Proposal 1: Option B1 shall be discouraged for APT/AWG to proceed.******Observation 5: The upper duplexer passband bandwidth can be up to UE implementation as far as UE can support any channel bandwidth in any carrier frequency within the band and can meet the same requirement as band n71 for the entire frequency range.******Proposal 2: The set of the channel bandwidths shall be the same as band n71.******Proposal 3: UE RF requirement (such as MOP, REFSENS, etc) shall be the same as n71.******Proposal 4: Other duplexer implementation is not precluded but the frequency arrangement and RF requirement baseline should be based on Option B2 without relaxing any requirement from band n71.*** |
| R4-2101372 | Xiaomi | Title: Discussion on frequency arrangement for extended 600MHz NR Band**Proposal: Prefer to Option B1 for extended 600MHz NR band.** |
| R4-2101958 | ZTE Corporation, CBN | Title: Discussions on Option B1 and B2 for extended 600MHz**Observation 1: there should be no issues between extended 600MHz and n28;****Observation 2: both Option B1 and B2 should be feasible from BS perspective;** **Observation 3: it might be not easy to support 30MHz with single duplexer from UE perspective;** **Observation 4: to reuse asymmetric UL 20MHz/DL 35MHz bandwidth configuration in n71 UE side for extended 600MHz;** |
| R4-2102161 | Ericsson | Title: APT 600 MHz band – frequency arrangements**Proposal: Consider frequency arrangement option B2 for the new 600MHz band with a 2 x 30 MHz split-duplexer arrangement.**  |
| R4-2102407 | Qualcomm Incorporated | Title: 600 MHz band for Region 3Further study is recommended. |
| R4-2102574 | Huawei, CBN | Title: Feasibility analysis of the frequency arrangement in 600MHz range for APT**Proposal 1**: agree on the recommendation of option B2, with the channel bandwidth of 35 MHz, as follows: *Option B2 is recommended for the frequency arrangements in the band 470-703 MHz for APT Members that wish to implement both the APT700 and a 600 MHz frequency arrangements, considering the channel bandwidth of 35 MHz.***Proposal 2**: approve the attached TP to TR on the B1/B2 frequency arrangement feasibility aspects.  |
| R4-2102589 | Apple | Title: Band Plan for 600MHz SIObservation 1: In the 600MHz frequency range the maximum realizable bandwidth for a single duplexer solution using available technologies is 35 MHz, better performance is achieved with 30MHzObservation 2: A dual duplexer band is quite complicated to specify, as the band definition depends on the UE implementation of the duplexers used to specify the band.Observation 3: Specifying a new dual duplexer band is technically possible but has the disadvantage of not using the economy of scale of existing band 71/n71 phonesProposal 1: Option B1 should not be used as a 2x 40MHz duplexer doesn’t seem to be possible with reasonable performance, size and costProposal 2: RAN4 should not specify a new dual duplexer band as proposed in option B2, but a new single duplexer band covering the additional spectrum in APT as proposed in Option B2aProposal 3: Specify a new single duplexer FDD band covering 673-703MHz UL and 627-657MHz DL and mandate support of band 71/n71 to be supported together with this band |

## Open issues summary

### Sub-topic 4-1 Duplex arrangement

*Sub-topic description: feasibility of different duplexer arrangements, recognizing that there are inter-dependencies*

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

**Issue 4-1-1: Passband width for a duplex arrangement with 11(6) MHz duplex gap for B1(B2)**

* Proposals (more than one can apply, per duplexer if split, dependence on BC protection can also be stated)
	+ Option 1: 40 MHz for B1
	+ Option 2: 35 MHz for B1
	+ Option 3: 40 MHz for B2
	+ Option 4: 35 MHz for B2
	+ Option 5: 30 MHz
	+ Option 6: other (specify which)
* Recommended WF
	+ TBA

**Issue 4-1-2: Split duplexer or single duplexer (performance, complexity and cost)**

* Proposals
	+ Option 1: single 2 x 40 MHz duplexer for B1 or possibly B2
	+ Option 2: single duplexer (of different passband width) and another band arrangement
	+ Option 3: split duplexer for B1/B2
	+ Option 4: other (specify which)
* Recommended WF
	+ TBA

**Issue 4-1-3: Feasibility of 6 MHz duplex gap with ‘standard’ FDD requirements**

* Proposals
	+ Option 1: feasible for single 2 x 40 MHz duplexer
	+ Option 2: feasible for split duplexer (state passband width)
	+ Option 3: other (specify which)
* Recommended WF
	+ TBA

### Sub-topic 4-2 Channel bandwidth

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

**Issue 4-2: maximum channel bandwidth for B1/B2**

* Proposals
	+ Option 1: 30 MHz
	+ Option 2: 20 MHz
	+ Option 3: other (state which)
* Recommended WF
	+ TBA

### Sub-topic 4-3 Band arrangement

*Sub-topic description: down-select band options, preference for B1 or B2, other arrangements for study if any*

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

**Issue 4-3-1: B1 or B2?**

* Proposals
	+ Option 1: B1
	+ Option 2: B2
	+ Option 3: other (next issue)
* Recommended WF
	+ TBA

**Issue 4-3-2: other band arrangements for study**

* Proposals (more than one possible)
	+ Option 1: consider only B1 or B2
	+ Option 2: specify a new single duplexer FDD band covering 673-703MHz UL and 627-657MHz DL and mandate support of band 71/n71 to be supported together with this band as proposed in R4-2102589
	+ Option 3: consider Band n71 + Band X using extended n28A UL + 5MHz SDL (Option 3 in R4-2100542)
	+ Option 4: consider Band n71 + Band X using band n85 UL + 5MHz SDL (Option 4 in R4-2100542)
	+ Option 5: consider band n71 + FDD band nX with 6MHz gap between bands based on 5MHz shifted n71B duplexer (Option 5 in R4-2100542)
	+ Option 6: consider band n71 + FDD band nX with 11MHz gap between bands (Option 6 in R4-2100542)
* Recommended WF
	+ TBA

## Companies views’ collection for 1st round

### Open issues

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| --- | --- |
| **Company** | **Comments** |
| Huawei | General question for clarification/discussion: do we capture all the options with pros and cons in the TR during this SI, while replying to AWG on B1/B2 (as per AWG question) during this meeting?Sub topic 4-1-1: option 4Sub topic 4-1-2: B2 so dual duplexer (option 3), but dual duplexer architecture’s pros and cons analysis needed.Sub topic 4-1-3: Option 3: more study neededSub topic 4-2: we shall rather focus on the feasibilities during SI, and not to decide on concrete channel bandwidth. From the deployment point of view, the widest would be preferred to maximize flexibility and spectrum utilization, but it comes with the cost. Such relations shall be captured in the LS.Sub topic 4-3-1: Option 2Sub topic 4-3-2: Options beyond B1 and B2 require more study. We shall not imply certain band arrangements at this stage (or not in SI in general). Pros and cons of single new band vs n71 plus new band: this analysis require more time to study. |
| Spark | Sub topic 4-1-1: Duplex Arrangement: For B1 to have a bandwidth of 35 MHz this same as N71. But the requirement is to have a total bandwidth of 40 MHz, therefore two overlapping duplexers are required. For all options 1-5 passband bandwidth is a key parameter, and should consider what is possible via technological advances in filter design and materials. Sub topic 4-1-2: Split or Single Duplexer. We don’t agree with an band arrangement as discussed elsewhere, in choosing B2 if trying to achieve economies of scale with N71 as it almost leads to two duplexers. Sub topic 4-1-3: 6MHz duplex gap: This is subject to filter studies as shown in R4 2102407. It might require a relaxation in the UE to UE coexistence level.Sub topic 4-2: Channel Bandwidth: This is related to the passband bandwidth (issue 4-1-1), and cannot be answered in isolation. Sub topic 4-3-1 Spark’s preference is B2 in a single band, as it retains some economies of scale of N71. However, 3GPP needs to study both B1 and B2 to respond to AWG. The AWG may then choose an option on any advice on technical feasibilityB1 may experience some resistance from Administrations with RAS footnotes in the radio regulations, even though adequate protection of RAS services can be achieved via physical separation.Sub topic 4-3-2 Spark prefers option 1 to consider B1 or B2.Option 2 (doc r4-2102589) defines a new band that is equivalent to the second duplexer of B2. It may retain N71 as is, but many technical issues such as UE coexistence will continue to apply and in addition if an operator has spectrum in both bands, interband carrier aggregation may be required.This document mentions that Europe chose the lower duplexer of band 28 due to the technical difficulties of two duplexers. The correct reason is that the European digital dividend one B20 that overlaps the upper portion of Band 28. Likewise Japan uses the upper duplexer of band 28 for local reasons to protect broadcast TV. Both of these with single duplexer use from band 28 are not due to the technical difficulties of two duplexers. In Asia many countries have implemented the full band 28.As far as roaming advantages are mentioned, phones already support many bands that enable roaming. However ENDC band combinations in different regions do not necessarily match. Therefore it is not straight forward to say, mandating the adoption of N71 will somehow facilitate roaming.Option 3 (R4-21005420) This option would require the modification of all existing band 28 infrastructure to support the extended uplink. The additional 5MHz in band 28 UL may be fragmented from and existing users allocation. In addition, besides N71 hardware, supplementary DL hardware is needed. The additional components would add substantial cost. Option 4 B85 is not used in Region 3, so not suitable.Option 5 Note the words and diagram don’t match and have assumed the proposal is a 20 MHz channel with a 15 MHz overlap as shown by the diagram. If tis is the intent, then this is a sub option of B2. All the issues associated with two duplexers would apply here. However, in text it is implied that the 20 MHz channel is a new band and not associated with a second duplexer. All the issues described about two bands in R4-2102589 would also apply.Option 6 This is a hybrid of B1 and B2, however using a new band for the second duplexer. But as mentioned earlier in this document coexistence RAS is an issue, and the difficulties of two bands would apply.The document notes that all additional band options N71 + BnX can be used as a stepping stone as a consolidated band in the future. This will be difficult and impractical, as spectrum is allocated to operators who have already deployed their hardware, and can not take advantage of future consolidation without incurring large expenditures.In summary the concerns with the additional options are:* To modify band 28 is unlikely to be well received by operators as this would require substantial hardware replacement.
* The options 2 through 6 seem to have the intent to preserve N71 and do extensions via new bands or supplementary links. However, this is far more complex than the B1 or B2 proposals, as new bands will require additional radios and create carrier aggregation issues. Another way to look at this, by adopting B2 with overlapping duplexers, we are making the reach of N71 truly global.
* What may seem a small gain of 5MHz is not trivial when considering the cost of spectrum in this spectrum range is in the order of US$ 0.53 to US$ 1.42 per MHz/pop based on recent US and Canadian Auctions.
* In addition, it should be noted because of the enhanced propagation properties of the sub 1MHz band this spectrum is heavily utilized.

….Others: |
| Qualcomm | Issue 4-1-1: This may benefit from further study before a decision is taken.Issue 4-1-2: A single duplexer is preferred, option 1Issue 4-1-3: The current 71/n71 filter does not support UE coexistence with 6 MHz duplex gap. A new filter would also be challenged with such a narrow gap. This topic probably needs more study and discussion.Issue 4-2: Due to the close Tx-Rx separation, larger channel bandwidths may suffer from Rx degradation. Since this is a SI on band plan, then it may not be necessary to finalize channel bandwidths at this point in time.Issue 4-3-1 and 4-3-2: We believe that further study is needed. I don’t believe we are yet in a position to definitively rule out any possibilities. |
| Xiaomi | A single duplexer is the best choice no matter from the definition of RF requirements or UE implementation. But considering the difficulty and cost of the duplexer, RAN4 just gives a baseline for how to define the RF requirements and leaves more implementation possibility to UE, like Band n28 and n71, RAN4 defined the RF requirements for these bands based on split duplexers. Actually the UE could also be implemented using a single duplexer if it can meet the requirements. Therefore for new extended 600MHz NR band, we can refer to the way of Band n28 and n71, define the RF requirements based on split duplexer, it will not limit the UE implementation. Considering the flexibility and scalability of channel bandwidth for this new band, i.e., some Operator wants to support 30MHz or 35MHz channel bandwidth in this new band in the future, RAN4 should consider the split duplexers as wider as possible.Issue 4-1-1: support Option 2: 35 MHz for B1 and Option 4: 35 MHz for B2Issue 4-1-2: support Option 3: split duplexer for B1/B2Issue 4-1-3: support Option 2: feasible for split duplexer (state passband width)Issue 4-2: Option 1: 30 MHz, this is AWG’s considering in their LS RP-202143, RAN4 should also consider it.Issue 4-3-1: Option 1: B1, more flexible implementation than B2Issue 4-3-2: prefer to define a new band not fragment this whole spectrum to cater to existing band, support Option 1: consider only B1 or B2. |
| CATT | Sub topic 4-1-1: Option 3 or Option 4 pending further study.Sub topic 4-1-2: Prefer Option 3.Sub topic 4-2: Prefer to study support of larger channel bandwidth, e.g. Option 1, but fine to leave the decision on max. CBW to WI phase.Sub topic 4-3-1: Prefer Option 2.Sub topic 4-3-2: Is the intention to study a different band arrangement in addition to B1/2? It seems not possible to conclude in this meeting. Then should we delay the LS back to AGW? |
| Ericsson | Sub topic 4-1: Issue 4-1-1: full-band duplexers for B71 are now becoming available, but option 5 appears more feasible in terms of performance and for meeting the standard FDD requirements for protection of the DL band with 6 MHz duplex gap by using a split-duplexer arrangement that can support B71 in addition.Issue 4-1-2: option 3 to get better performance.Issue 4-1-3: perhaps option 2 with a split duplexer (FFS)Sub topic 4-2:Issue 4-2: option 1 preferably (possibly with NR-ARFCN restrictions due to the duplexer arrangement), at least Option 2Sub topic 4-3:Issue 4-3-1: option 2Issue 4-3-2: Option 3 and 4 do not give sufficient channel bandwidth flexibility, Option 5 and 6 should be studied further….Others: |
| Nokia | Sub topic 4-1-1: Option 4: Pass band more than 35 MHz would not provide a good performance.Sub topic 4-1-2: Option 3: Sub topic 4-1-3: Option 2: max 35 MHz passband per duplexer should be considered.Sub topic 4-2: Option 3: For more than 20 MHz channel bandwidth, further study on A-MPR and MSD (or uplink configuration for REFSENS test) may be needed. We are ok to study how to support larger channel bandwidths.Sub topic 4-3-1: Support Option 2.Sub topic 4-3-2: Support Option 1.* Band Option 3/4/6 would require vacating a TV channel. RAS coexistence requirement for Region 3 is not clear as of today, so it might be risky to extend band downward.
* Band Option 6 is usually not possible from regulator point of view to mix different duplex distances. If nX=5MHz without overlap with n71, such a new independent band could be introduced like for PPDR.
 |
| ZTE | Sub topic 4-1-1: Option 4 for UE side, for BS side;Sub topic 4-1-2: Option 3 for UE side, however from BS side, single duplexer is more preferred if feasbility is verified to be okay.Sub topic 4-1-3: Option 2, it should be feasible to have 2x35 with dual duplexer based on the discussion on n71Sub topic 4-2: Option 3, similar views as Nokia mentioned on potential work and self -degradation due to larger channel bandwidth. In addition,it should be clarified for DL or UL, For DL, it might be easier to support relative larger channel bandwidth up to 35MHz.* Sub topic 4-3-1: Support Option 2 for UE side.

Sub topic 4-3-2: further study needed. |
| Skyworks | Sub topic 4-1-1: It is useless to pick options if the criterias are not known. Any of the proposaed solution has an issue or some are not applicable:* + Option 1: 40 MHz for B1 => results in degraded performance for n71
	+ Option 2: 35 MHz for B1 => it is n71!
	+ Option 3: 40 MHz for B2 => not applicable
	+ Option 4: 35 MHz for B2 => true B2 with one duplexer = n71 but two challenging duplexer =>more than 2x the cost => band protection challenging for upper 5MHz of DL
	+ Option 5: 30 MHz => single or dualor…?

Our view is that it is useful to study a dual duplexer solution (lets call it B2bis) with n71 duplexer + a simpler second duplexer 25-30MHzMHz duplexer and decide based on cost/performance/spectrum usage. It is to be note that band n71 has 35MHz DL but UL limited to 20MHz and wider DL/UL only result in bad lin performance due to MSD and potential AMPR for band n28 protection.Sub topic 4-1-12: See above, Split duplexer is the best approach to enable partial reuse of n71 without impacting band n71 performance. Second duplexer could be smaller BW as proposed aboveSub topic 4-1-1: not possible to determine without a duplexer feasibility study but: 6MHz gap not enough to guareanty -50dBm/MHz for the entire DL. B1 with 11MHz gap will have to trade off IL and band n71 performance to achieve RX/TX isolationSub topic 4-2: for n71 frequency range reuse n71 current agreements: 35MHz DL and 20MHz UL, for the additional duplexer or 5MHz extension look into 25-30MHz DL and 20MHz ULSub topic 4-3-1: we believe there are benefit in split band approach as legacy UE supporting n71 are immediately available and roaming is feasible. Band arrangement needs to be decided based on RFFE feasibility, both B1 and B2 have issues/compromises that need to be studiedSub topic 4-3-2: on top of B1/B@ that we are requested to study anyhow we think is useful to study another dual duplexer approach based on n71 full band duplexer with a second 25-30MHz duplexer covering the additional 5MHz (similar to band 28/71 split duplexer which is lower cost/size)  |

### CRs/TPs comments collection

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| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2102574TP to TR | Huawei: for sake of progress, it is suggested to aim for revision and check how we can progress on agreements. |
| Nokia: WF is better than discussing the TP to TR. |
|  |

## 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:* |

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 |  |  |

### CRs/TPs

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

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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)

## 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**  |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #3: Reply LS to AWG

A reply to the LS from AWG in RP-202934 is proposed.

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2102575 | Huawei, CBN | Title: [DRAFT] Reply LS on technical feasibilities for frequency arrangements for IMT in 470 – 703 MHz band, cover**Proposal 1**: approve the attached TP to TR on the B1/B2 frequency arrangement feasibility aspects. [Moderator: approval of draft reply LS assumed.] |

## Open issues summary

### Sub-topic 5-1 Reply LS to AWG

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

**Issue 5-1: Reply LS to AWG from RAN4#98-e**

* Proposals
	+ Option 1: Agree Reply LS as proposed in R4-2102575
	+ Option 2: Modify the proposed Reply LS in R4-2102575 (specify how)
	+ Option 3: reply to AWG at a later RAN4 meeting
* Recommended WF
	+ TBA

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Huawei | Sub topic 5-1: Option 2, reflecting topic #4 conclusions this meeting. AWG requested feedback before their March meeting so RAN4 shall provide reply this meeting. This does not preclude future LS’ based on further studies.  |
| Spark | Sub topic 5-1: A Liaison statement to the AWG was also approved by the TSG RAN (RP-202934). This has already been sent, and says the work shall be completed by September 2021.Do we need another Liaison statement, if so we should refer to what has already been sent?Perhaps a better option could be to write a progress report to RAN plenary and suggest it be sent to AWG ….Others: |
| Qualcomm | Issue 5-1: Option 3. Depending on the discussions and agreements this week, it may be possible to send details in an LS, also dependent on AWG’s meeting calendar and when they need such information. However, it may not be possible to reach agreement during this meeting on such technical details in which case, there doesn’t seem to be much value in sending this LS during this meeting. |
| CATT | Option 2 is preferred if finally we decided to send the LS in this meeting. |
| Ericsson | Sub topic 5-1: option 3, no need to send any LS after this 1st meeting |
| Nokia | Issue 5-1: We support Spark’s view. |
| Telstra | Issue 5-1: Option 3: RAN has already responded to AWG that work has been approved and provided the SID timeframe. Time would be better spent in RAN4 to produce an LS to AWG when suitable technical details have been agreed. |
| ZTE | Sub topic 5-1: option 3, if agreement could be achieved and speed up the APT discussion. |
| Skyworks | Option 3: we believe it is premature to give a response and if any it would only be a pro/con discussion on multiple options. |

### 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** |
| R4-2102575 | Huawei: to be revised to correct the content, as commented over email. New tdoc number to be requested for the LS itself. |
| Nokia: Revision is not needed for now. |
|  |
| 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:* |

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 |  |  |

### CRs/TPs

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

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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)

## 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”* |