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

**Electronic Meeting, 12th – 20th April, 2021**

**Agenda item:** 5.2.1.1 & 5.2.1.2

**Source:** Moderator (LG Electronics)

**Title:** Email discussion summary for [98bise][317] V2X\_Demod\_Part1

**Document for:** Information

# Introduction

This email discussion is for Rel-16 NR V2X demodulation performance for single link in Agenda 5.2.1.1 and 5.2.1.2. For the information, in this meeting, email discussion will focus on defining performance requirements and alignment of table format for draft CRs.

List of email discussion for 1st round is as follows:

* 1st round:
	+ Topic#1: Performance requirements
	+ Topic#2: Requirements structure and draft CRs
* 2nd round: TBA

# Topic #1: Performance requirements

This section will treat the performance requirements based on companies’ simulation results.

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2104573 | MediaTek inc. | Proposal 1: The required SNR targeted 10% BLER for PSSCH test case with TDLA30ns-180Hz is about 13.1dB.Proposal 2: The required SNR targeted 10% BLER for PSSCH test case with TDLA30ns-1400Hz is about 7.7dB.Proposal 3: The required SNR targeted 10% BLER for PSSCH test case with TDLA30ns-2700Hz is about 2.9dB. |
| R4-2104574 | MediaTek inc. | Proposal 1: The required SNR targeted 1% BLER for PSCCH test case is about 3.8dB. |
| R4-2104575 | MediaTek inc. | Proposal 1: The required SNR targeted 1% BLER for PSBCH test case is about -2.9dB. |
| R4-2104773 | CATT | The simulation results of single link test cases are provided |
| R4-2104992 | LG Electronics Inc. | We provide simulation results and impairment results for V2X demodulation single link test cases |
| R4-2106417 | Intel Corporation | We provided alignment and impairment results for V2X demodulation PSSCH single link requirements |
| R4-2106418 | Intel Corporation | We provided alignment and impairment results for V2X demodulation PSCCH single link requirements. |
| R4-2106420 | Intel Corporation | We provided alignment and impairment results for NR V2X Single link PSBCH requirements. |
| R4-2106421 | Intel Corporation | We provided alignment and impairment results for PSFCH single link requirements. |
| R4-2106797 | Huawei, HiSilicon | We provide our simulation results for PSSCH test. |
| R4-2106798 | Huawei, HiSilicon | We provide our simulation results on PSCCH test. |
| R4-2106799 | Huawei, HiSilicon | We provide our simulation results for PSBCH test. |
| R4-2106800 | Huawei, HiSilicon | We provide our simulation results for PSFCH performance test.  |
| R4-2107219 | Qualcomm, Inc. | Proposal: Use the following guidelines to align PSBCH alignment results:(1) Under the same propagation condition, code rate difference contributes to most of the performance difference between PSCCH and PSBCH.(2) Higher speed (Doppler spread) yields better performance for PSBCH. |

## Open issues summary

### Sub-topic 1-1

Following table is based on companies’ simulation results for single link test cases.

Table 1 Proposed requirements for single link test cases w/o impairment

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Test cases** | **LG** | **Intel** | **Huawei** | **QC(Note1)** | **CATT,GOHIGH** | **MTK** |
| PSSCH\_Test1 (QPSK\_TDLA30-2700) | 1.23 | 4.20 | 1.47 | 1.63 | 1.40 | 2.90 |
| PSSCH\_Test2 (16QAM\_TDLA30-1400) | 5.77 | 6.70 | 7.41 |  | 7.00 | 7.70 |
| PSSCH\_Test3(64QAM\_TDLA30-180) | 12.03 | 12.30 | 13.49 | 12.86 | 11.57 | 13.10 |
| PSCCH | 3.03 | 3.50 | 3.16 | 2.84 | 2.10 | 3.80 |
| PSBCH | -3.32 | 0.30 | -2.94 | -1.50 | -1.70 | -2.90 |
| PSFCH | 5.98 | 7.20 | 6.86 |  | 8.52 |  |
| Note1: The results were provided in RAN4#98. |

Table 2 Proposed requirements for single link test cases w/ impairment

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test cases** | **LG** | **Intel** | **Huawei** | **QC** | **CATT,GOHIGH** | **MTK** | **AVE** | **Margin** | **Requirement** |
| PSSCH\_Test1 (QPSK\_TDLA30-2700) | 2.73 | 5.70 | 2.97 |  |  |  |  | 0.5 |  |
| PSSCH\_Test2 (16QAM\_TDLA30-1400) | 7.27 | 8.70 | 8.90 |  |  |  |  | 0.5 |  |
| PSSCH\_Test3(64QAM\_TDLA30-180) | 14.03 | 14.80 | 15.00 |  |  |  |  | 0.8 |  |
| PSCCH | 4.53 | 5.00 | 4.66 |  |  |  |  | 0.5 |  |
| PSBCH | -1.82 | 1.80 | -1.00 |  |  |  |  | 0.5 |  |
| PSFCH | 7.48 | 9.70 | 8.36 |  |  |  |  | 0.5 |  |

**Issue 1-1-1: Requirements for single link test cases**

* Proposals from moderator to the progress
	+ To define performance requirements, add margin in Table 2 to the average value of the companies’ impairment results
	+ Capture the requirements with [ ] in draft CRs
* Recommended WF
	+ Please provide impairment results for test cases
	+ Need further discussion for the proposals

**Issue 1-1-2: PSBCH performance**

* Proposals
	+ Use the following guidelines to align PSBCH alignment results:

1) Under the same propagation condition, code rate difference contributes to most of the performance difference between PSCCH and PSBCH.

2) Higher speed (Doppler spread) yields better performance for PSBCH.

* Recommended WF
	+ Need further discussion for the proposals

## Companies views’ collection for 1st round

### Open issues

**Issue 1-1-1: Requirements for single link test cases**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| LG | Support the proposals to finalize the WI on time. |
| Intel | Recommended WF is fine for us |
| QC | We observe larger deviation PSFCH results from the current results from other companies. We propose to finalize PSFCH SNR requirement in next meeting. |
| Huawei, HiSilicon | Firstly we should agree an acceptable largest span, such as 2.0dB or 2.5dB, among companies’ submitted results to derive the performance requirements. |
| LG | To Huawei,Thanks for suggestion. What is typical span for Rel-15 NR demodulation? To all,Could companies provide view on the acceptable largest span? * E.g., 2.0dB or 2.5dB
 |

**Issue 1-1-2: PSBCH performance**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Intel | Clarification question for sub-bullet 2): Does this proposal suggest to change channel model for PSBCH test? |
| QC | No, the proposal doesn’t change the propagation condition. In case that larger deviation is still observed after companies update the simulation results, this proposal suggest a way to help doing the sanity check for alignment of the results: providing PSBCH results with the same propagation condition as PSCCH test, as a reference but not the alignment result submission for specification purpose. |
| Huawei, HiSilicon | Company is encouraged to double check their results, if still cannot well aligned finally, some rules for derivation of performance requirements can be used, such as the rules used by NR Rel-15 normal performance requirements.To QC: Generally we agree with you proposal. But it should be considered that first OFDM symbol will be punctured for PSBCH which means the corresponding LLRs will be set to zero. While in PSCCH test, first OFDM symbol is copied from second symbol which is not used for demodulation. Therefore, not only code rate but also puncturing of first OFDM symbol will contribute to the performance difference between the two channels. |
| LG | To Huawei,What is the rules used by NR Rel-15 normal performance requirements?  |

### 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: Requirements structure and draft CRs

This section will discuss table structures of NR V2X demodulation specification and draft CRs. For draft CRs, please add comments directly in sub-section 2.3.2.

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2105002 | LG Electronics Inc. | Proposal 1: Reference measurement channels are defined for different physical channels like LTE V2XProposal 2: Add 2nd stage SCI configuration in PSSCH reference measurement channel table as Table 1Proposal 3: Add the information for bandwidth/SCS and propagation condition in the table of minimum performanceProposal 4: Define single common resource pool configuration as shown in Table 2. |
| R4-2106415 | Intel Corporation | Proposal 1: Make the following changes to PSCCH RMC table • Remove information about number of DMRS symbols and keep only information about number of DMRS REs• Add information about overhead for TBS determination• Add information about number of resource elements allocated for SCI1 transmission• Add information about number of resource elements allocated for SCI2 transmission or add SCI2 configuration which is required for calculation of number of resource elementsProposal 2: Define the resource pool configuration in the Annex using example from Table 1 or in the table with common test parameters using example from Table 2. |

## Open issues summary

### Sub-topic 2-1

Table structures and contents for test parameters, minimum performance, RMC, and resource pool configuration should be finalized in this meeting, and the conclusions of sub-topic 2-1 will be captured in corresponding draft CRs.

**Issue 2-1-1: Table of test parameters and minimum performance**

* Proposals
	+ Add the information for bandwidth/SCS and propagation condition in the table of minimum performance
	+ Remove the information for 2nd stage SCI configuration, bandwidth/SCS, and propagation condition in the table of test parameters
* Recommended WF
	+ Apply the proposal to the structure of test parameters and minimum performance table

**Issue 2-1-2: RMC table**

* Proposals:
	+ Make the following changes to PSCCH RMC table

1) Reference measurement channels are defined for different physical channels like LTE V2X

2) Remove information about number of DMRS symbols and keep only information about number of DMRS REs

3) Add information about overhead for TBS determination

4) Add information about number of resource elements allocated for SCI1 transmission

5) Add information about number of resource elements allocated for SCI2 transmission or add SCI2 configuration which is required for calculation of number of resource elements

* Recommended WF
	+ Need further discussion

**Issue 2-1-3: Resource pool configuration**

* Proposals
	+ Option 1:

|  |  |
| --- | --- |
| **Information Element** | **Value** |
| **20 MHz** | **40 MHz** |
| SL-ResourcePool-r16 | sl-PSCCH-Config-r16 | sl-TimeResourcePSCCH-r16 | n2 | n2 |
|  |  | sl-FreqResourcePSCCH-r16 | n10 | n10 |
|  | sl-SyncAllowed-r16 |  | gnss-Sync-r16 | gnss-Sync-r16 |
|  | sl-SubchannelSize-r16 |  | n10 | n10 |
|  | sl-TimeResource-r16 |  | ones(1, 160) | ones(1, 160) |
|  | sl-StartRB-Subchannel-r16 |  | 0 | 0 |
|  | sl-NumSubchannel-r16 |  | 5 | 10 |
|  | sl-RB-Number-r16 |  | 51 | 106 |

* + Option 2:

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Value |
| Resource pool configuration | PSCCH Time resource | Symbols | 2 |
|  | PSCCH Frequency resource | PRBs | 10 |
|  | Synchronization reference |  | GNSS |
|  | Subchannel size | PRBs | 10 |
|  | Number of sub-channels |  | 5 for 20 MHz and 10 for 40 MHz |
|  | Start PRB for first sub-channel |  | 0 |
|  | Time resource bitmap |  | ones(1, 160) |
|  | Number of PRBs |  | 51 for 20 MHz and 106 for 40 MHz |

* + Option 3:

|  |  |  |
| --- | --- | --- |
| Information Element | Value/Remark | Comment |
| SL-BWP-ConfigCommon-r16 ::= SEQUENCE { |  | 　 |
|   sl-BWP-Generic-r16 SEQUENCE { |  | 　 |
|     sl-LengthSymbols-r16 | sym14 | 　 |
|    sl-StartSymbol-r16 | sym0 | 　 |
|   } |  | 　 |
|  sl-BWP-PoolConfigCommon-r16 SEQUENCE { |  | 　 |
|     sl-RxPool-r16 SEQUENCE (SIZE (1..maxNrofRXPool-r16)) OF SEQUENCE | 1 entry | SL-ResourcePool-r16 |
|      sl-TxPoolSelectedNormal-r16 SEQUENCE { |  | 　 |
|        sl-PoolToReleaseList-r16 |  | 　 |
|        sl-PoolToAddModList-r16 SEQUENCE (SIZE (1..maxNrofTXPool-r16)) OF SEQUENCE { | 1 entry | SL-ResourcePoolConfig-r16 |
|          sl-ResourcePoolID-r16 |  | 　 |
|          sl-ResourcePool-r16 { |  | 　 |
|            sl-PSCCH-Config-r16 { |  | 　 |
|                   sl-TimeResourcePSCCH-r16 | n2 | 　 |
|                   sl-FreqResourcePSCCH-r16 | n10 | 　 |
|                 } |  | 　 |
|            sl-PSFCH-Config-r16 { |  | 　 |
|                   sl-NumMuxCS-Pair-r16  | n1 | 　 |
|                   sl-PSFCH-HopID-r16 | 0 | 　 |
|               sl-PSFCH-CandidateResourceType-r16 | startSubCh | 　 |
|                 } |  | 　 |
|            sl-SyncAllowed-r16 | gnss | ENUMERATED {gnss, gnbEnb, ue } |
|            sl-SubchannelSize-r16 | n10 | 　 |
|            sl-TimeResource | 11111111111111111111 | Indicates the time resource of resource pool within sl-Period. |
|            sl-StartRB-Subchannel-r16 | 0 | 　 |
|            sl-Additional-MCS-Table-r16 | Not presented | 　 |
|            sl-PTRS-Config-r16 | Not presented | 　 |
|            sl-X-Overhead-r16 | n0 | 　 |
|          } |  | 　 |
|        } |  | 　 |
|      } |  | 　 |
|      sl-TxPoolSelectedNormal-r16 |  | 　 |
|      sl-TxPoolExceptional-r16 |  | 　 |
|   } |  | 　 |
| } |  | 　 |
| SL-ThresPSSCH-RSRP | 66 | Threshold to allow PSSCH transmission for PSFCH reception is infinity dBm.  |

* Recommended WF
	+ Need further discussion

## Companies views’ collection for 1st round

### Open issues

**Issue 2-1-1: Table of test parameters and minimum performance**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| LG | Support the proposal |
| Intel | We support the proposals. In addition, we suggest to move information about number of DMRS symbols from RMC table to table with PSSCH test parameters and keep only information about number of DMRS REs in RMC table (i.e. similar approach is used for PDSCH). Also, depending on resource pool configuration, we can add information about indexes of allocated sub-channels for PSSCH. |
| Huawei, HiSilicon | The proposal is fine for us. @Intel: “add information about indexes of allocated sub-channel for PSSCH” to test parameters table or RMC? For TBS calculation, the number of RB of PSSCH is enough, if needed, it can be added in the test parameters table.  |
| LG | To Intel,We are fine with adding information of the number of DMRS symbols in test parameters table. If sub-channel size would be defined in resource pool configuration, no need to add index of allocated sub-channels in test parameter table. |

**Issue 2-1-2: RMC table**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| LG | 1) support the proposal2) we don’t have strong view, but the information for number of DMRS symbols is helpful to easily understand overall PSSCH configuration3) we are fine the proposal to align NR demodulation RMC table (e.g., Overhead for TBS determination = 0)4) we are not sure how to capture it in RMC table. We prefer to add Note if needed.5) support adding SCI2 configuration which is required for calculation of the number of resource elements |
| Intel | Reply to LG:2) Please check our comment for Issue 2-1-14) Based on our understanding we can just add failed “Number of SCI1 resource elements” in the RMC table. |
| QC | We propose to keep DMRS symbol configuration since it’s an important configuration to match with propagation conditions.For SCI 1, number of symbols implies number of REs already. |
| Huawei, HiSilicon | 1) , 3) Support.2) Agree with Intel’s proposal: keep the number of DM-RS symbol in the test parameters table, only keep information of DM-RS REs for TBS calculation derived as per Table 8.1.3.2-1 of TS 38.214 in the RMC.4) Agree with QC: number of SCI1 symbol implies number of REs as per the allocated RBs.5). The number of SCI2 RE cannot be directly used for TBS calculation as per core specification. We suggest to add the SCI2 configurations in the RMC table. SCI2 overhead is calculated by following for TBS calculation:Where For calculation of number of SCI2 REs,  is the number of vacant resource elements in the resource block to which the last coded symbol of the 2nd-stage SCI belongs.for SCI2 RE overhead calculation in TBS calculation is different from the actual SCI2 RE number calculation.  |

**Issue 2-1-3: Resource pool configuration**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| LG | We think that the information according to CBW might not be needed in the resource pool configuration. So we prefer option 3. |
| Intel | Based on our understanding Option 3 is rather detailed and complicated for definition in specification with performance tests. Such definition is mainly applicable for specification with conformance tests and can be handled by RAN5. Same time, this option contains BWP configuration which is already defined in the common test parameters in General section. If we are going to define the dedicated resource pool configuration then, based on our understanding, it should contain only parameters related to resource pool configuration. Therefore, we suggest to go with Option 1 or 2. Option 2 is more preferable because all common test parameters (BWP, Resource pool etc) will be captured in one place. |
| QC | Since PSSCH transmission is needed for PSFCH demod test, Tx pool configuration is needed, which is missing in option 1 and 2. |
| Huawei, HiSilicon | Only define the common resource pool configurations for all test cases, Option 2 is preferred that only define those needed parameters from RAN4 point of view.  |
| LG | we still think that there is no need CBW information since this information is captured in common test parameters in general section provided by Intel. Can we consider below table for the resource pool configuration for all test cases?

|  |  |
| --- | --- |
| Information Element | Value/Remark |
| sl-RxPool-r16  | 　 | 　 | 　 | 1 entry |
| sl-TxPoolSelectedNormal-r16 | 　 | 　 | 　 | 1 entry |
| 　 | sl-ResourcePool-r16 | sl-PSCCH-Config-r16 | sl-TimeResourcePSCCH-r16 | n2 |
| 　 | 　 | 　 | sl-FreqResourcePSCCH-r16 | n10 |
| 　 | 　 | sl-PSFCH-Config-r16 | sl-NumMuxCS-Pair-r16  | n1 |
| 　 | 　 | 　 | sl-PSFCH-HopID-r16 | 0 |
| 　 | 　 | 　 | sl-PSFCH-CandidateResourceType-r16 | startSubCh |
| 　 | 　 | sl-SyncAllowed-r16 | 　 | gnss |
| 　 | 　 | sl-SubchannelSize-r16 | 　 | n10 |
| 　 | 　 | sl-TimeResource | 　 | 11111111111111111111 |
|
|
| 　 | 　 | sl-Additional-MCS-Table-r16 |  | Not presented |
| 　 | 　 | sl-X-Overhead-r16 | 　 | n0 |
| 　 | 　 | sl-UE-SelectedConfigRP-r16 | SL-ThresPSSCH-RSRP | 66 |

 |

### 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** |
| R4-2104576 (PSFCH) | LG: According to Big CR approach in RAN4, draft CR should be based on endorsed Big draft CR in the previous meeting. So, it is better to submit the draft CR with track change based on the endorsed Big draft CR.Generally we are fine, but the requirement and resource pool configuration need to be revised based on conclusion for Issue 1-1-1 and Issue 2-1-3. |
| Huawei, HiSilicon: Share the same views as LG. Besides, we propose to set the test parameters table to sub-clause 11.1.5.1.1 rather than 11.1.5.1.1-1 since this table are used for both requirements. |
|  |
| R4-2104995 (PSSCH) | LG: overall contents will revise based on conclusion for Issue 1-1-1 and sub-topic 2-1. |
| Company B |
|  |
| R4-2106416 (General) | LG: The information of Table 11.1.1.2-1 (Common test parameters) could be overlapped with resource pool configuration.  |
| Intel: Reply to LG: Please check our comment for Issue 2-1-3. |
|  |
| R4-2106419 (PSCCH) | LG: Generally we are fine, but the requirement needs to be revised based on conclusion for Issue 1-1-1 |
| Intel: We will update CR based on outcome of discussion. |
|  |

## 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**

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

**Existing tdocs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-210xxxx | 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** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-210xxxx | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-210xxxx | 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