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

Electronic Meeting, Jan. 25-Feb. 5, 2021

**Agenda item:** 7.10.1

**Source:** Moderator (China Telecom)

**Title:** Email discussion summary for [98e][325] NR\_DL256QAM\_FR2\_Demod

**Document for:** Information

# Introduction

This email thread discusses the demodulation and CSI reporting requirements for FR2 DL 256QAM in agenda 7.10.1.

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

* 1st round: Invite companies to provide comments (if any) on open issues and CRs in section 1.3, 2.3 and 3.3.
* 2nd round: Focus on the revised CRs within following e-mail sub-threads:
* R4-2103834 CR on demodulation performance requirements for DL 256QAM for FR2 (led by ZTE)
* R4-2103835 CR on simplified TDL-D channel model for FR2 DL 256QAM demodulation requirements (led by Intel)
* R4-2103836 CR on SDR requirements for DL 256QAM for FR2 (led by Huawei)
* R4-2103837 CR on adding applicability, requirements and measurement channel for FR2 DL 256QAM CQI reporting test under fading condition (led by China Telecom)
* R4-2103838 CR on applicability rules and FRC for FR2 DL 256QAM CQI requirements (led by Intel)

# Topic #1: PDSCH normal demodulation requirements

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2100880](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100880.zip) | China Telecom | Offline e-mail discussion summary on the TDLD30 channel simplification |
| [R4-2100881](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100881.zip) | China Telecom | Simulation results. |
| R4-2101116 | ZTE corporation | CR on demodulation performance requirements for DL 256QAM for FR2 |
| [R4-2101250](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101250.zip) | Intel Corporation | Proposal 1: Use the following channel model for FR2 256QAM requirements:

|  |  |  |  |
| --- | --- | --- | --- |
| Tap # | Delay | Power | Fading distribution |
| 1 | 0 | -0.2 | LOS path |
| 0 | -12.4 | Rayleigh |
| 2 | 20 | -21 | Rayleigh |
| 3 | 40 | -16.7 | Rayleigh |
| 4 | 55 | -18.3 | Rayleigh |
| 5 | 80 | -21.9 | Rayleigh |
| 6 | 120 | -27.8 | Rayleigh |
| 7 | 240 | -23.6 | Rayleigh |
| 8 | 285 | -24.8 | Rayleigh |
| 9 | 290 | -30.0 | Rayleigh |
| 10 | 375 | -27.6 | Rayleigh |

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| R4-2101251 | Intel Corporation | Simulation result summary. |
| [R4-2101252](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101252.zip) | Intel Corporation | CR on simplified TDL-D channel model for FR2 DL 256QAM demodulation requirements |
| [R4-2101296](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101296.zip) | Huawei, HiSilicon | Simulation results |
| [R4-2101297](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101297.zip) | Huawei, HiSilicon | CR on applicability and FRC for PDSCH normal demodulation for DL 256QAM for FR2 |
| R4-2101369 | NTT DOCOMO, INC. | In this contribution, we present our views on 256QAM UE requirements for FR2. Our observation is summarized below. Observation 1Table 1. Summary of ideal simulation results

|  |  |
| --- | --- |
| Channel Model | SNR point (dB) @70%TP Using MCS index:20 |
| TDLD30-75 | 16.5 dB |

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| [R4-2101419](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101419.zip) | Ericsson | Simulation results |
| [R4-2101420](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101420.zip) | Ericsson | Proposal 1: Define DL 256QAM PDSCH demodulation requirements in FR2 with TDLD30-75. Proposal 2: Specify the following path delay profile for TDLD30 in TS38.101-4 B.2.1.2.

|  |  |  |  |
| --- | --- | --- | --- |
| Tap # | Delay [ns] | Power [dB] | Fading distribution |
| 1 | 0 | -0.2 | LOS path |
| 1 | 0 | -12.4 | Rayleigh |
| 2 | 20 | -21.0 | Rayleigh |
| 3 | 40 | -16.7 | Rayleigh |
| 4 | 55 | -18.3 | Rayleigh |
| 5 | 80 | -21.9 | Rayleigh |
| 6 | 120 | -27.8 | Rayleigh |
| 7 | 240 | -23.6 | Rayleigh |
| 8 | 285 | -24.8 | Rayleigh |
| 9 | 290 | -30.0 | Rayleigh |
| 10 | 375 | -27.6 | Rayleigh |
| Note 1: Tap #1 follows a Ricean distribution.Note 2: LOS path applies the channel matrix specified in B.1 according to the antenna configuration. |

Proposal 3: Add the following note in the delay profile simplification procedure in TS38.101-4 B.2.1:Note: The paths containing both LOS path and Rayleigh distribution are considered as single path. |
| R4- 2102373 | Qualcomm Incorporated | Simulation result. |

## Open issues summary

### PDSCH normal test parameters

**Issue 1-1: Simplification of TDLD30 channel model in TS 38.101-4**

* *Agreement in RAN4 #97e (R4-2017536, WF)*
	+ *Specification of TDLD30 channel model into TS38.101-4*
		- *Option 1: derived using only Steps 1-5 from methodology in Section B.2.1 of TS 38.101-4 for Rayleigh components*

|  |  |  |  |
| --- | --- | --- | --- |
| *Tap #* | *Delay* | *Power in [dB]* | *Fading distribution* |
| *1* | *0* | *-0.2* | *LOS path* |
| *0* | *-12.4* | *Rayleigh* |
| *2* | *20* | *-21* | *Rayleigh* |
| *3* | *40* | *-16.7* | *Rayleigh* |
| *4* | *55* | *-18.3* | *Rayleigh* |
| *5* | *80* | *-21.9* | *Rayleigh* |
| *6* | *120* | *-27.8* | *Rayleigh* |
| *7* | *240* | *-23.6* | *Rayleigh* |
| *8* | *285* | *-24.8* | *Rayleigh* |
| *9* | *290* | *-30.0* | *Rayleigh* |
| *10* | *375* | *-27.7* | *Rayleigh* |

* + - *Option 2:*

|  |  |  |  |
| --- | --- | --- | --- |
| *Tap #* | *Delay* | *Power in [dB]* | *Fading distribution* |
| *1* | *0* | *-0.2* | *LOS path* |
| *0* | *-13.5* | *Rayleigh* |
| *2* | *2* | *-18.8* | *Rayleigh* |
| *3* | *18* | *-21* | *Rayleigh* |
| *4* | *40* | *-22.8* | *Rayleigh* |
| *5* | *42* | *-17.9* | *Rayleigh* |
| *6* | *54* | *-18.3* | *Rayleigh* |
| *7* | *78* | *-21.9* | *Rayleigh* |
| *8* | *122* | *-27.8* | *Rayleigh* |
| *9* | *238* | *-23.6* | *Rayleigh* |
| *10* | *282* | *-24.8* | *Rayleigh* |
| *11* | *292* | *-30* | *Rayleigh* |
| *12* | *376* | *-27.7* | *Rayleigh* |

* + - *Companies are encouraged to check if the above option 1 is agreeable and provide feedback in RAN4 draft reflector during 16th - 27th Nov after the meeting.*
* *Consensus in offline e-mail discussion*
	+ *For the two components with 0 ns delay in TDLD (one with LOS path, the other with Rayleigh distribution), are they considered as two taps or one tap from the TE implementation perspective?*
		- *Proposed agreement: One tap*
	+ *Final proposal on the simplified TDLD channel*
		- *Proposed agreement: Use Intel’s proposal with adjusting the power of tap#10 to -27.6dB (Target DS is 30ns).*

|  |  |  |  |
| --- | --- | --- | --- |
| *Tap #* | *Delay* | *Power in [dB]* | *Fading distribution* |
| *1* | *0* | *-0.2* | *LOS path* |
| *0* | *-12.4* | *Rayleigh* |
| *2* | *20* | *-21* | *Rayleigh* |
| *3* | *40* | *-16.7* | *Rayleigh* |
| *4* | *55* | *-18.3* | *Rayleigh* |
| *5* | *80* | *-21.9* | *Rayleigh* |
| *6* | *120* | *-27.8* | *Rayleigh* |
| *7* | *240* | *-23.6* | *Rayleigh* |
| *8* | *285* | *-24.8* | *Rayleigh* |
| *9* | *290* | *-30.0* | *Rayleigh* |
| *10* | *375* | *-27.6* | *Rayleigh* |

* Proposals on the channel model for simulation:
	+ Option 1: Use following model and confirm negligible performance difference compared with the original TDLD30 channel model in TR 38.901 (Intel, E///, offline discussion proposal in [R4-2100880](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100880.zip))

|  |  |  |  |
| --- | --- | --- | --- |
| Tap # | Delay | Power in [dB] | Fading distribution |
| 1 | 0 | -0.2 | LOS path |
| 0 | -12.4 | Rayleigh |
| 2 | 20 | -21 | Rayleigh |
| 3 | 40 | -16.7 | Rayleigh |
| 4 | 55 | -18.3 | Rayleigh |
| 5 | 80 | -21.9 | Rayleigh |
| 6 | 120 | -27.8 | Rayleigh |
| 7 | 240 | -23.6 | Rayleigh |
| 8 | 285 | -24.8 | Rayleigh |
| 9 | 290 | -30.0 | Rayleigh |
| 10 | 375 | -27.6 | Rayleigh |

* Proposals on the additional notes for the 38.101-4 CR on the simplified TDLD30 channel model
	+ Option 1: (Intel)
		- 1 additional note in clause B.2.1: ‘Delay profile for TDLD30 is generated under assumption that Steps 1-8 are applied for taps with Rayleigh distribution.’
	+ Option 2: (E///)
		- 1 additional note in clause B.2.1: ‘The paths containing both LOS path and Rayleigh distribution are consider as single path.’
* E///: Avoid the confusion if RAN4 decide to define new PDP in the future.
	+ - 2 additional notes in Table B.2.1.2-4 as below:
* ‘Note 1: Tap #1 follows a Ricean distribution.’
* ‘Note 2: LOS path applies the channel matrix specified in B.1 according to the antenna configuration.’
* Recommendation for the first-round
	+ On the channel model for simulation
		- Use option1.
	+ On the additional note for the 38.101-4 CR on the simplified TDLD30 channel model
		- Encourage feedback from more companies.

**Issue 1-2: Propagation condition**

* *Agreement in RAN4 #97e (R4-2017536, WF)*
	+ *Propagation condition*
		- *Introduce test case with TDLD30-75 based on the assumption that we can complete the work for introducing TDL-D channel model into specification in RAN4#98e. If no conclusion for introducing TDL-D channel model in RAN4#98e, then RAN4 will adopt TDLA30-300 instead of TDLD30-75.*
* Proposals:
	+ Option 1: TDLD30-75 (E///)
* Recommendation for the first-round
	+ Use option1 if the proposed simplified TDLD30 channel model for simulation in issue 1-1 can be agreeable.

**Issue 1-3: Simulation results and SNR requirement for PDSCH normal demodulation**

* *Agreement in RAN4 #97e (R4-2017536, WF)*
	+ *Propagation condition*
		- *In RAN4#98e, companies provide simulation results (including 70%TP ideal and impairment SNR points and TP curves) in the template provided by Intel.*
* Recommendation for the first-round
	+ Companies to provide and align the simulation results in the summary template by 6pm UTC Jan 27th.
	+ Add the requirement value with [] in the CR in this meeting.

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | Comments collection for 1st round |
| Ericsson | **Issue 1-1: Simplification of TDLD30 channel model in TS 38.101-4**Channel mode: We support Option 1.Additional notes: We prefer to put all the descriptions, that is,In clause B.2.1: * ‘Delay profile for TDLD30 is generated under assumption that Steps 1-8 are applied for taps with Rayleigh distribution.’
* ‘The paths containing both LOS path and Rayleigh distribution are consider as single path.’

In in Table [B.2.1.2-4]* ‘Note 1: Tap #1 follows a Ricean distribution.’
* ‘Note 2: LOS path applies the channel matrix specified in B.1 according to the antenna configuration.’

**Issue 1-2: Propagation condition**Support the moderator’s recommendation. **Issue 1-3: Simulation results and SNR requirement for PDSCH normal demodulation**Support the moderator’s recommendation.**Others** |
| China Telecom | **Issue 1-1: Simplification of TDLD30 channel model in TS 38.101-4**For the channel model for simulation, ok with the recommendation for the first round.**Issue 1-2: Propagation condition**OK with the recommendation for the first round. |
| Huawei | **Issue 1-1: Simplification of TDLD30 channel model in TS 38.101-4**On the channel model for simulation, we agree with the recommended WF.On the additional note for the 38.101-4 CR on the simplified TDLD30 channel model, we agree with both Option 1 and Option 2 to make specification more clear.**Issue 1-2: Propagation condition**Agree with the recommended WF.**Issue 1-3: Simulation results and SNR requirement for PDSCH normal demodulation**Agree with the recommended WF. |
| Intel | **Issue 1-1: Simplification of TDLD30 channel model in TS 38.101-4**We are fine with notes for Clause B.2.1 from Ericsson proposal. As for notes for Table [B.2.1.2-4], Note 1 is fine for us and meaning/necessity of Note 2 is not clear for us and more clarifications are needed.  |
| Qualcomm | **Issue 1-1: Simplification of TDLD30 channel model in TS 38.101-4**We are ok with option 1 for channel model. For notes, we prefer Option 1. For option 2, we have below concerns:If we add that LOS and NLOS paths are treated as single tap in general, we may run into issues in future when number of taps may get larger than 12 if we don’t consider them as 1 tap and it restricts the TE implementation where they can also implement them as separate taps. Saying that Tap#1 follows Rician fading is confusing because Tap#1 also has NLOS path.We need more clarification on why Note 2 is needed.**Issue 1-2: Propagation condition**Prefer Option 1.**Issue 1-3: Simulation results and SNR requirement for PDSCH normal demodulation**Ok with recommended WF. |
| ZTE | **Issue 1-1: Simplification of TDLD30 channel model in TS 38.101-4**We agree with Option 1**Issue 1-2: Propagation condition**We agree with the Recommended WF. |
| docomo | **Issue 1-1: Simplification of TDLD30 channel model in TS 38.101-4**Channel mode: We support Option 1.**Issue 1-2: Propagation condition**OK with the recommended WF.**Issue 1-3: Simulation results and SNR requirement for PDSCH normal demodulation**OK with the recommended WF. |
| Rohde & Schwarz | **Issue 1-1: Simplification of TDLD30 channel model in TS 38.101-4**Regarding the Notes, we have similar comments as Qualcomm and Intel. Note 2 is not clear to us and we currently would prefer to leave it out to avoid confusion. |
| Ericsson2 | **Issue 1-1: Simplification of TDLD30 channel model in TS 38.101-4**To Intel, Qualcomm, and Rohde & Schwarz, firstly, we would like to confirm if our understanding is correct. TDLD consists of LOS path and NLOS path. For the NLOS paths, we apply the Rayleigh fading for each path. For the LOS path, we apply the static propagation condition, which means the following channel matrix specified in B.1 is applied, e.g., $H=\left[\begin{matrix}1&j\\1&-j\end{matrix}\right]$ for 2x2 scenario. Or do we apply $H=\left[\begin{matrix}1&1\\1&1\end{matrix}\right]$ to LOS path for 2x2 scenario?  |
| Intel3 | **Issue 1-1: Simplification of TDLD30 channel model in TS 38.101-4**For generation of LOS channel model, we use the modelling of the Rician fading which have the following equation:where Yc and Ys are NLOS components (Raleigh fading) and second term in each equation (after +) corresponds to LOS components (wd is the maximum radian Doppler frequency, θ0 and φ0 are the angle of arrival and the initial phase).We can double check the other companies assumptions for LOS channel generation. |

### CRs

|  |  |
| --- | --- |
| **CR/TP number** | **Comments** |
| R4-2101116: CR on demodulation performance requirements, ZTE | Moderator’s note: Resubmission of endorsed Draft CR R4-2017537 without additional update. This CR should be a category B CR. |
| Ericsson: Affect to RAN5 spec is missing in the coversheet. It should affect to TS38.521-4. PDCCH AL should be AL4 for test 1-4 because only 32PRB are available for CORESET.  |
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|  |
| [R4-2101252](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101252.zip): CR on simplified TDL-D channel model, Intel | Ericsson: Add notes according to the conclusion of Issue 1-1. |
|  |
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| [R4-2101297](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101297.zip), CR on applicability and FRC for PDSCH normal demodulation, Huawei | Moderator’s note: Resubmission of endorsed Draft CR R4-2015596 without additional update. |
| Huawei: Mirror CR (Rel-17) is missed to be reserved so a new Tdoc number is need to be allocated. |
| Intel: We don’t have Rel-17 TS 38.101-4 yet. Therefore, Mirror CR is not needed. |
| Huawei: Thanks for Intel’s carefully check, we confirm that no new Tdoc number for Rel-17 Mirror CR is need to be allocated. |

## 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**  |
|  | **Issue 1-1: Simplification of TDLD30 channel model in TS 38.101-4*** Channel model for simulation:
	+ Tentative agreement: Use following model and confirm negligible performance difference compared with the original TDLD30 channel model in TR 38.901 (Intel, E///, CTC, HW, QC, ZTE, DCM)

|  |  |  |  |
| --- | --- | --- | --- |
| Tap # | Delay | Power in [dB] | Fading distribution |
| 1 | 0 | -0.2 | LOS path |
| 0 | -12.4 | Rayleigh |
| 2 | 20 | -21 | Rayleigh |
| 3 | 40 | -16.7 | Rayleigh |
| 4 | 55 | -18.3 | Rayleigh |
| 5 | 80 | -21.9 | Rayleigh |
| 6 | 120 | -27.8 | Rayleigh |
| 7 | 240 | -23.6 | Rayleigh |
| 8 | 285 | -24.8 | Rayleigh |
| 9 | 290 | -30.0 | Rayleigh |
| 10 | 375 | -27.6 | Rayleigh |

* Additional notes for the 38.101-4 CR on the simplified TDLD30 channel model
	+ Tentative agreement: Add following note (Intel, E///, HW, QC)
		- 1 additional note in clause B.2.1: ‘Delay profile for TDLD30 is generated under assumption that Steps 1-8 are applied for taps with Rayleigh distribution.’
	+ FFS whether following notes should be added
		- 1 additional note in clause B.2.1: ‘The paths containing both LOS path and Rayleigh distribution are consider as single path.’ (E///, HW, Intel)
* QC’s concern: Restricts the TE implementation where they can also implement them as separate taps.
	+ - 2 additional notes in Table B.2.1.2-4 as below:
* ‘Note 1: Tap #1 follows a Ricean distribution.’ (E///, HW, Intel)
* ‘Note 2: LOS path applies the channel matrix specified in B.1 according to the antenna configuration.’ (E///, HW)
* QC: Saying that Tap#1 follows Rician fading is confusing because Tap#1 also has NLOS path. We need more clarification on why Note 2 is needed.
* Intel: Meaning/necessity of Note 2 is not clear for us and more clarifications are needed.
* R&S: We have similar comments as Qualcomm and Intel. Note 2 is not clear to us and we currently would prefer to leave it out to avoid confusion.
* E///: TDLD consists of LOS path and NLOS path. For the NLOS paths, we apply the Rayleigh fading for each path. For the LOS path, we apply the static propagation condition.
* *Recommendation for the second round:*
	+ In the second round, further discuss whether to add the additional notes which remain ‘FFS’ within the sub-thread on the CR on the simplified TDLD30 channel model.

**Issue 1-2: Propagation condition*** Tentative agreement: Use TDLD30-75 since the simplified TDLD30 channel model can be agreeable (E///, CTC, HW, QC, ZTE, DCM)

**Issue 1-3: Simulation results and SNR requirement for PDSCH normal demodulation*** Moderator’s observation:
	+ 6 companies provided alignment & impairment simulation results under TDLD with 2.2dB SPAN for the ideal results.
	+ Based on the summary spreadsheet, 20.2dB SNR requirement is derived based on companies’ impairment results.
* *Recommendation for the second round*
	+ Companies to check whether it is agreeable to implement [20.2] dB as the tentative SNR requirement in the CR.
 |

### CRs

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

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| R4-2101116 | *To be revised.* |
| [R4-2101252](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101252.zip) | *To be revised* |
| [R4-2101297](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101297.zip) | *Agreeable* |

## Discussion on 2nd round

**R4-2103834 CR on demodulation performance requirements for DL 256QAM for FR2**

 *Type: CR For: Agreement
 38.101-4 v16.3.0 CR-0138 Cat: F (Rel-16)

 Source: ZTE Corporation*

**Discussion:**

[report of discussion]

**Decision: Return to.**

**R4-2103835 CR on simplified TDL-D channel model for FR2 DL 256QAM demodulation requirements**

 *Type: CR For: Agreement
 38.101-4 v16.3.0 CR-0140 Cat: B (Rel-16)

 Source: Intel Corporation*

**Discussion:**

[report of discussion]

**Decision: Return to.**

## Summary on 2nd round

*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 #2: SDR requirements

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2100885](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100885.zip) | China Telecom | ***Proposal 1:*** *Add following row in Table 7.1.1.3-1 of TS 38.101-4 (marked yellow), and no additional change is needed to the test requirement in clause 7.5A.1 in TS 38.101-4.*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **7.1.1.3 Applicability of requirements for optional UE features**The performance requirements in Table 7.1.1.3-1 shall apply for UEs which support optional UE features only.Table 7.1.1.3-1: Requirements applicability for optional UE features

|  |  |  |  |
| --- | --- | --- | --- |
| UE feature/capability [14] | Test type | Test list | Applicability notes |
| SU-MIMO Interference Mitigation advanced receiver | FR2 TDD | PDSCH | Clause 7.2.2.2.1 (Test 3-1) |  |
| Basic DL NR-NR CA operation (*supportedBandCombinationList*) | NR CA | SDR | Clause 7.5A.1 | 1) Up to 16 DL carriers2) Same numerology across carrier for data/control channel at a given time |
| PDSCH repetitions over multiple slots *(pdsch-RepetitionMultiSlots)* | FR2 TDD | PDSCH | Clause 7.2.2.2.2 |  |
| 256QAM for PDSCH(*pdsch-256QAM-FR2*) | FR2 TDD | SDR | Clause 7.5A.1 | For UE capable of PDSCH 256QAM for certain band(s), the MCS table is configured to ‘*64QAM*’ for SDR test, i.e., no additional SDR test for UE capable of PDSCH 256QAM feature. |

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| [R4-2101299](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101299.zip) | Huawei, HiSilicon | CR on SDR requirements for DL 256QAM for FR2 |

## Open issues summary

**Issue 2-1: Applicability of SDR requirements for UE capable of 256QAM in certain band(s)**

* Proposals:
	+ Option 1: Add following applicability in Table 7.1.1.3-1 and no additional change is needed to the test requirement in clause 7.5A.1 in TS 38.101-4 (CTC, [R4-2100885](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100885.zip))

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Table 7.1.1.3-1: Requirements applicability for optional UE features

|  |  |  |  |
| --- | --- | --- | --- |
| UE feature/capability [14] | Test type | Test list | Applicability notes |
| 256QAM for PDSCH(*pdsch-256QAM-FR2*) | FR2 TDD | SDR | Clause 7.5A.1 | For UE capable of PDSCH 256QAM for certain band(s), the MCS table is configured to ‘*64QAM*’ for SDR test, i.e., no additional SDR test for UE capable of PDSCH 256QAM feature. |

 |

* + Option 2: Add following notes in Table 7.5A.1-3 in the test requirement in clause 7.5A.1 in TS 38.101-4 (HW, [R4-2101299](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101299.zip))
		- Note 1: MCS Index is based on MCS index Table 1 defined in clause 5.1.3.1 of TS 38.214 [12].
		- Note 2: For the band(s) on which UE supporting “Maximum modulation format” of 8, the MCS index is derived from the rows with “Maximum modulation format” of 6.
* Recommendation for the first-round
	+ Encourage feedback from more companies.

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | Comments collection for 1st round |
| XXX | **Issue 2-1: Applicability of SDR requirements for UE capable of 256QAM in certain band(s)****Others** |
| China Telecom | **Issue 2-1: Applicability of SDR requirements for UE capable of 256QAM in certain band(s)**Since we have decided not to define SDR test for FR2 256QAM, on the bands where UE supports 256QAM for PDSCH, the existing SDR test will be directly applicable by only configuring MCS table1 in the test. As a result, we suggest to add applicability for this feature in Table 7.1.1.3-1 in TS38.101-4 rather than making revision to the test procedure. |
| Huawei | As per TS 38.101-4, MCS is calculated based on UE capabilities.

|  |
| --- |
| “*Use Table 7.5A.1-3 to determine the MCS (=MCS1) achieving the largest data rate [clause 4.1.2 of TS 38.306 [14]] based on UE capabilities.*” |

For UE supporting “*Maximum modulation format*” of 8, if we don’t add the note in Table 7.5A.1-3 and just configure MCS table to “64QAM”, we can’t derive the MCS1 since UE capabilities is independent by configurations. Therefore, we prefer Option 2. |
| Intel | Based on our understanding, we can define applicability in Table 7.1.1.3-1 based on Option 1 and add Note 2 in Table 7.5A.1-3 from Option 2. |
| Qualcomm | We are ok to use both Option 1 and Option 2. |

### CRs

|  |  |
| --- | --- |
| **CR/TP number** | **Comments** |
| [R4-2101299](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101299.zip), CR on SDR requirements, Huawei | Huawei: Mirror CR (Rel-17) is missed to be reserved so a new Tdoc number is need to be allocated. |
| Intel: We don’t have Rel-17 TS 38.101-4 yet. Therefore, Mirror CR is not needed. |
| Huawei: Thanks for Intel’s carefully check, we confirm that no new Tdoc number for Rel-17 Mirror CR is need to be allocated. |
|  |

## Summary for 1st round

### Open issues

|  |  |
| --- | --- |
|  | **Status summary**  |
|  | **Issue 2-1: Applicability of SDR requirements for UE capable of 256QAM in certain band(s)*** Candidate options:
	+ Option 1: Add following applicability in Table 7.1.1.3-1 and no additional change is needed to the test requirement in clause 7.5A.1 in TS 38.101-4 (CTC)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Table 7.1.1.3-1: Requirements applicability for optional UE features

|  |  |  |  |
| --- | --- | --- | --- |
| UE feature/capability [14] | Test type | Test list | Applicability notes |
| 256QAM for PDSCH(*pdsch-256QAM-FR2*) | FR2 TDD | SDR | Clause 7.5A.1 | For UE capable of PDSCH 256QAM for certain band(s), the MCS table is configured to ‘*64QAM*’ for SDR test, i.e., no additional SDR test for UE capable of PDSCH 256QAM feature. |
|  |  |  |  |  |

 |

* + Option 2: Add following notes in Table 7.5A.1-3 in the test requirement in clause 7.5A.1 in TS 38.101-4 (HW)
		- Note 1: MCS Index is based on MCS index Table 1 defined in clause 5.1.3.1 of TS 38.214 [12].
		- Note 2: For the band(s) on which UE supporting “Maximum modulation format” of 8, the MCS index is derived from the rows with “Maximum modulation format” of 6.
	+ Both option 1 and note 2 in option 2 (Intel)
	+ Both option 1 and option 2 (QC)
* *Agreements on the GTW session*
	+ Option 1 + note 2 in option 2, and FFS whether note 1 needed or not
	+ FFS further offline for CR drafting whether note 1 needed or not
 |

### CRs

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

|  |  |
| --- | --- |
| **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”* |
| [R4-2101299](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101299.zip) | *To be revised.* |

## Discussion on 2nd round

**R4-2103836 CR on SDR requirements for DL 256QAM for FR2**

 *Type: CR For: Agreement
 38.101-4 v16.3.0 CR-0145 Cat: B (Rel-16)

 Source: Huawei, HiSilicon*

**Discussion:**

[report of discussion]

**Decision: Return to.**

## Summary on 2nd round

# Topic #3: CQI reporting requirements

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2100882](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100882.zip) | China Telecom | This paper provided simulation results and discussed the open issues on the CQI reporting requirements for FR2 DL 256QAM.The following observations and proposal were given for CQI reporting requirements:Observation 1: 256QAM corresponding CQI index (CQI > 11) can be reported with around 50% possibility when the SNR point is 17/18 dB, in which case 256QAM can be considered covered without testability issue.Observation 2: For UEs supporting DL 256QAM in FR2, the capability of reporting CQI indexes corresponding 256QAM under proper scenario should be verified. Otherwise, it will remain uncertainty that whether 256QAM will be correctly scheduled.Proposal 1: Configure the higher SNR point as 17/18dB for CQI reporting requirements under fading condition. |
| R4-2100883 | China Telecom | Summary of simulation results. |
| [R4-2100884](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2100884.zip) | China Telecom | CR on adding applicability, requirements and measurement channel for FR2 DL 256QAM CQI reporting test under fading condition |
| [R4-2101114](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101114.zip) | ZTE Corporation | In this contribution, we provide our simulation result on CQI reporting requirements for FR2 DL 256QAM. In summary, we make the following proposal:Proposal: Support the SNR point 18 dB for CQI reporting requirements if the SNR point in the testable SNR range. |
| [R4-2101253](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101253.zip) | Intel Corporation | CR on applicability rules and FRC for FR2 DL 256QAM CQI requirements |
| R4-2101298 | Huawei, HiSilicon | Not available. |
| [R4-2101421](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101421.zip) | Ericsson | Simulation result. |
| [R4-2101422](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101422.zip) | Ericsson | Observation 1: SNR testing points for 256QAM in CQI table 2 should be 19dB or more if the purpose of this test is to make sure UE report CQI index corresponding to 256QAM, regardless of TDLA30-35 or TDLD30-75.Observation 2: Percentage of reported CQI not in {medCQI-1, medCQI, medCQI+1} is more than 20% in SNR rage between 0dB to 22dB for TDLA30-35, but almost 0% for TDLD30-75.Observation 3: BLER of PDSCH with the followed CQI is more than 5% in SNR range from 1dB to 22dB for both TDLA30-35 and TDLD30-75.Observation 4: TP ratio with following CQI and fixed median CQI is more than 1.1 in SNR ranges from 0dB to 12dB, and 16dB to 23dB for TDLA30-35, but TP ratio becomes below 1.0 with some test points for TDLD30-75. Proposal 1: RAN4 specify the FR2 CQI reporting requirements with CQI table 2 in FR2 with TDLA30-35.Proposal 2: RAN4 set the SNR test points and requirements for FR2 CQI reporting test under fading condition as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| SNR test points (dB) | α: Minimum percentage (%) of reported CQI not in {median CQI – 1, median CQI, median CQI + 1} | γ: Minimum TP ratio of followed CQI and fixed median CQI | Minimum PDSCH BLER with followed CQI |
| 6 and 7 | 20% | 1.1 | 0.02 |
| 17 and 18 | 20% | 1.1 | 0.02 |

 |
| R4-2101848 | Huawei, HiSilicon | Withdrawn. |
| R4- 2102406 | Qualcomm Incorporated | Proposal 1: Define FR2 256QAM CQI reporting test for at least 21dB SNR to see the impact of 256QAM CQI table. |

## Open issues summary

### CQI test parameters

**Issue 3-1: SNR testing point for FR2 CQI Table 2 test**

* *Agreement in RAN4 #97e (R4-2017536, WF)*
	+ *Fading CQI test cases under rank1 transmission with CQI table 2:*
		- *SNR: FFS for higher test points*
		- *Options for further consideration:*
* *Option 1: 17/18 dB*
* *Other options are not precluded.*
* Proposal
	+ Option 1: 17/18 dB (CTC, [ZTE], E///)
		- CTC: 256QAM corresponding CQI index (CQI > 11) can be reported with around 50% possibility when the SNR point is 17/18 dB, in which case 256QAM can be considered covered without testability issue.
		- ZTE: Considering the simulation result and the information, we could support the SNR point 18dB for CQI reporting requirements if the SNR point in the testable SNR range.
		- E///: Propose to set SNR to 17/18dB in the CQI table 2 reporting tests in FR2, because testability is more important.
	+ Option 2: At least 19dB without impairments (21dB with adding 2dB for impairment) (QC)
		- QC: Following CQI throughput with 256QAM CQI table has significant gain compared to following 64QAM CQI table starting at 19dB SNR. Adding 2dB for impairments, RAN4 should define the 256QAM CQI reporting requirements at least for 21dB SNR.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **SNR (dB)** | **Median CQI (256QAM)** | **Percentage not in Median CQI+/-1** | **Percentage 256QAM CQI > 11** | **Following 256QAM CQI BLER** | **Following 256QAM CQI Thpt** | **Following 64QAM CQI Thpt** |
| 17 | 10 | 33.62 | 22.17 | 0.08 | 58.7 | 57.2 |
| 18 | 10 | 36.91 | 29.84 | 0.08 | 61.5 | 58.7 |
| 19 | 11 | 34.59 | 39.22 | 0.07 | 65.3 | 60.2 |
| 20 | 11 | 34.84 | 49.94 | 0.07 | 68.1 | 61.3 |

* Recommendation for the first round
	+ Among all companies’ simulation results under SNR 17/18 dB without impairments, since 22%~47% of the reported CQI indexes have covered 256QAM, can we go with option 1 based on majority’s view?

**Issue 3-2: Propagation condition for FR2 CQI Table 2 test**

* *Agreement in RAN4 #97e (R4-2017536, WF)*
	+ *If it is agreed to define FR2 CQI reporting test for CQI table 2,*
		- *Use channel bandwidth of 50MHz and reuse the other parameters in Rel-15 FR2 CQI tests, i.e., parameters in Table 8.2.2.2.2.1-1 in TS38.101-4.*
* Proposal
	+ Option 1: TDLA30-35 (E///, Last meeting’s agreement in the WF)
* Recommendation for the first round
	+ Confirm to use TDLA30-35 for FR2 CQI Table2 test.

**Issue 3-3: Test metric for FR2 CQI Table 2 test**

* Proposal:

|  |
| --- |
| **Test metric under SNR 6/7/17/18 dB** |
|  | Option 1 (E///) | Option 2 (Existing test requirements in Rel-15 FR2 CQI table 1 Test with 100MHz CBW) |
| α: Minimum percentage (%) of reported CQI not in {median CQI – 1, median CQI, median CQI + 1} | 20% | 2% |
| γ: Minimum TP ratio of followed CQI and fixed median CQI | 1.1 | 1.05 |
| Minimum PDSCH BLER with followed CQI | 0.02 | 0.01 |

* Recommendation for the first round
	+ Encourage more companies’ feedback during the first-round discussion.

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | Comments collection for 1st round |
| Ericsson | **Issue 3-1: SNR testing point for FR2 CQI Table 2 test**Option 1 (17/18dB)**Issue 3-2: Propagation condition for FR2 CQI Table 2 test**Support moderator’s recommendation (TDLA30-35).**Issue 3-3: Test requirement for FR2 CQI Table 2 test**We are fine with option 2. We found our proposal is a copy from FR1, but it is the test for FR2, so Option 2 is fine with us. **Others** |
| China Telecom | **Issue 3-1: SNR testing point for FR2 CQI Table 2 test**We support the recommendation for the first round, i.e., 17/18dB, since 22%~47% of the reported CQI indexes have covered 256QAM under 17dB SNR.**Issue 3-2: Propagation condition for FR2 CQI Table 2 test**Support the recommendation for the first round.**Issue 3-3: Test requirement for FR2 CQI Table 2 test**The requirements in option 1 look reasonable based on all companies’ simulation results. Furthermore, it can be observed during our simulation that, the percentage of the reported CQI not in Median CQI+/-1 (alpha value) under the current agreed test parameter (50MHz CBW), is larger than that under the existing test parameters in Rel-15 FR2 CQI table 1 Test (100MHz CBW). As a result, we slightly prefer defining larger alpha values for FR2 CQI Table2 test, e.g., 20%. For the other requirements (Min TP ratio and min BLER), the proposed values in option 1 are also acceptable for us based on companies’ simulation results.But if the majority prefer option 2, then option 2 is also ok for us. |
| Huawei | **Issue 3-1: SNR testing point for FR2 CQI Table 2 test**In our view, 3dB impairment margin should be added. Therefore, it is proposed to use 20/21 dB.**Issue 3-2: Propagation condition for FR2 CQI Table 2 test**Agree with the recommended WF.**Issue 3-3: Test metric for FR2 CQI Table 2 test**Prefer Option 2 that is same as the existing FR2 CQI reporting cases defined in Rel-15. |
| Qualcomm | **Issue 3-1: SNR testing point for FR2 CQI Table 2 test**We prefer to define the requirements for 18/19dB +impairment margin of 3dB because that’s where we will start seeing the gain with 256QAM CQI. Otherwise, there is no benefit of defining this test.Also, for lower SNRs, we prefer to define the requirements for 7/8 dB instead of 6/7dB. Based on our simulation results, CQIs are very close to each other from 5-7dB which may result in not very good throughput ratio.**Issue 3-2: Propagation condition for FR2 CQI Table 2 test**Ok with recommended WF.**Issue 3-3: Test metric for FR2 CQI Table 2 test**It should be decided based on simulation results when SNR points are finalized. |
| ZTE | **Issue 3-1: SNR testing point for FR2 CQI Table 2 test**We support option 1.**Issue 3-2: Propagation condition for FR2 CQI Table 2 test**We agree with the Recommended WF.**Issue 3-3: Test metric for FR2 CQI Table 2 test**We agree with option 2 which reuse the defining in Rel-15. |

### CR

|  |  |
| --- | --- |
| **CR/TP number** | **Comments** |
| R4-2100884: CR on applicability, requirements and measurement channel, CTC | Moderator’s note: According to the updated WP agreed in the last meeting (R4-2014674), the CR on applicability and FRC is scheduled to be provided by Intel. |
| China Telecom: Following the agreed WP, we will delete the applicability and FRC table in our CR. |
| Qualcomm: Requirements should be decided based on simulation results rather than copying the same requirements from 64QAM table. |
|  |
|  |
| [R4-2101253](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101253.zip): CR on applicability rules and FRC, Intel | Ericsson: It looks the information bit payload is derived based on 2 MIMO layers, but it should be based on 1 MIMO layer.  |
| China Telecom: 1) Suggest to double check the TBS size and available RE number in the FRC table, because different results are derived in our CR in R4-2100884. 2) The new created FRC table ‘Mapping of CQI Index to Information Bit payload (CQI table 2)’ already exists in TS 38.101-4 in Table A.4-2, so adding a new row in Table A.4-2 named ‘TBS.2-7’ seems more reasonable. |
| Huawei: Payload size that we calculate is aligned with CTC for all CQI indices except CQI index 1 (552 bits). |
| Intel: We’ve made mistake in TBS and calculated TBS size based on 66 PRBs allocation (not for 32 PRBs). We will revise CR with correct TBS values. @China Telecom: As for comment 2, we think that adding of new TBS in Table A.4-2 will overload this table. In this meeting, we have CR R4-2101945 for R15 maintenance with new table with additional TBSs for CQI Table 2. In case this CR will be acceptable, we can add TBS for FR2 CQI requirements in new table from CR R4-2101945. Otherwise, we prefer to introduce new table for this TBS.----- Update 27-01-21 -----@China Telecom: Based on current discussion of CR R4-2101945 in [98e][314] Demod\_R15\_Maintenance, probably adding of new FRC in Table A.4-2 with name ‘TBS.2-7’ will be considered in the revised version. |
|  |

## 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**  |
|  | **Issue 3-1: SNR testing point for FR2 CQI Table 2 test*** Higher SNR point without impairment margin
	+ Option1: 17/18 dB (CTC, ZTE, E///, HW)
	+ Option2: 18/19 dB (QC)
		- QC: Following CQI throughput with 256QAM CQI table has significant gain compared to following 64QAM CQI table starting at 19dB SNR.
* Lower SNR point without impairment margin
	+ Option 1: 6/7 dB (Agreed parameter in the last meeting in R4-2017536)
	+ Option 2: 7/8 dB (QC)
		- QC: Based on our simulation results, CQIs are very close to each other from 5-7dB which may result in not very good throughput ratio.

**Issue 3-4 (new issue): Whether to consider extra margin for the SNR point in 38.101-4*** Candidate options:
	+ Option 1: Extra margin of 3dB should be added (QC, HW)
	+ Option 2: Not to consider extra margin. (Aligned with the Rel-15 FR2 CQI table 1 SNR configuration)
* *Agreements on the GTW session*
	+ For the higher SNR:
		- [20/21] dB
		- Note: Above SNR test points agreed with the consideration of impairment margin due to high SNR points with 256QAM reporting configuration
	+ For the lower SNR:
		- [7/8] dB

**Issue 3-2: Propagation condition for FR2 CQI Table 2 test*** Tentative agreement: TDLA30-35 (CTC, E///, HW, QC, ZTE)

**Issue 3-3: Test requirement for FR2 CQI Table 2 test*** Candidate options:

|  |
| --- |
| **Test metric** |
|  | Option 1 (slightly preferred by CTC) | Option 2 (Existing test requirements in Rel-15 FR2 CQI table 1 Test with 100MHz CBW, E///, CTC, HW, ZTE) |
| α: Minimum percentage (%) of reported CQI not in {median CQI – 1, median CQI, median CQI + 1} | 20% | 2% |
| γ: Minimum TP ratio of followed CQI and fixed median CQI | 1.1 | 1.05 |
| Minimum PDSCH BLER with followed CQI | 0.02 | 0.01 |

* + QC: It should be decided based on simulation results when SNR points are finalized.
* *Agreements on the GTW session*
	+ Option 2 with values in [ ].
 |

### CRs

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

|  |  |
| --- | --- |
| **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”* |
| R4-2100884 | *To be revised* |
| [R4-2101253](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_98_e/Docs/R4-2101253.zip) | *To be revised* |

##  Discussion on 2nd round

**R4-2103838 CR on applicability rules and FRC for FR2 DL 256QAM CQI requirements**

 *Type: CR For: Agreement
 38.101-4 v16.3.0 CR-0141 Cat: B (Rel-16)

 Source: Intel Corporation*

**Discussion:**

[report of discussion]

**Decision: Return to.**

**R4-2103837 CR on adding applicability, requirements and measurement channel for FR2 DL 256QAM CQI reporting test under fading condition**

 *Type: CR For: Agreement
 38.101-4 v16.3.0 CR-0133 Cat: B (Rel-16)

 Source: China Telecom*

**Discussion:**

[report of discussion]

**Decision: Return to.**

## Summary on 2nd round

*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”* |
|  |  |