**3GPP TSG RAN WG1 Meeting #101-e                     R1-200330x**

**e-Meeting, May 25 – June 5, 2020**

**Agenda Item: 7.2.2.2.2**

**Source: Moderator (Charter Communications)**

**Title: Feature lead summary on for initial access procedures enhancements**

**Document for: Discussion and Decision**

# Introduction

A number of proposed corrections to Rel-16 specifications have been submitted to RAN1#101-e on initial access procedures for NR-U [1]-[13]. This first summary provides a list of the submitted corrections/clarifications and a proposal for multiple email discussions to resolve the corrections identified as higher priority.

The outcomes of 7.2.2.2.2 email discussions in RAN1#100b-e can be found in [14]-[16].

# Corrections for SS/PBCH Block

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| Issue # | Description | Tdoc | Email discussion |
| 2.1 | Replace the parameter “ssbPositionQCL-Relationship-r16” with “ssb-PositionQCL-r16” for signaling of Q in Clause 4.1 of TS 38.213 to align TS 38.331. | R1-2003451 | Y |
| 2.2 | UE performs rate-matching for all of SS/PBCH block candidate position indices (within configured DRS transmission window) QCLed with actually transmitted SS/PBCH block indices that are provided by *ssb-PositionsInBurst* in RMSI. | R1-2004014 | N |
| 2.3 | Modify the description in Clause 4.1 of TS 38.213 (If MSB , , of *ssb-PositionsInBurst* is set to 1, the UE assumes that one or more SS/PBCH blocks within the discovery burst transmission window with candidate SS/PBCH block indexes corresponding to SS/PBCH block index equal to may be transmitted) to clarify only one transmitted SS/PBCH blocks with a same SS/PBCH block index within a discovery burst transmission window. | R1-2003451 | Y |
| 2.4 | Missing instances of ‘candidate SS/PBCH block index’ terminology in: TS 38.214 Subclause 5.1.4 relating to PDSCH rate matching.TS 38.213 Subclause 8.1 relating to RO validation.TS 38.213 Subclause 11.1.1 relating to UL validation in SFI.TS 38.213 Subclause 5 relating to RLM. | ~~R1-2003973~~R1-2004001R1-2003861 | N (editorial) |
| 2.5 | Add “The maximum number of transmitted SS/PBCH blocks within a discovery burst transmission window is 8.” to TS 38.213 Clause 4.1.  | R1-2003657 | Y |
| 2.6 | The UE performs PDSCH rate-matching around the resources of candidate SS/PBCH blocks corresponding to a same SS/PBCH block index according to ssb-PositionsInBurst, until the UE has successfully detected one SS/PBCH block within a discovery burst transmission window (TP for TS 38.214). | R1-2003451R1-2004086R1-2003973 | Y |
| 2.7 | UE behavior in case GSCN offset refers to a GSCN which is not allowed in band n46. If the GSCN offset refers to a GSCN which is not allowed in [8-1, TS 38.101-1] for FR1, UE may ignore the information related to GSCN of SS/PBCH locations in performing cell search. | R1-2004086 | Y |
| 2.8 | Proposal: “For the CSI-RS outside DRS window, the associated SSB index should be the SSB index, for the CSI-RS inside DRS window, the associated SSB should be the candidate SSB index.” | R1-2004086 | N |
| 2.9 | Replace terminology “discovery burst transmission window” with “SS/PBCH block transmission window” in TS 38.213 | R1-2004001 | N (editorial) |
| 2.10 | Merge the determination process of QCL and SSB index in Clause 4.1 in TS 38.213 to clarify the relationship between SSBs with the same SSB index within a same DRS transmission window or across DRS transmission windows. | R1-2003451 | N (editorial) |
| 2.11 | The MIB interpretation ambiguity issue for overlapping frequency bands should be resolved. Different sync raster point are defined for licensed and unlicensed operation. | R1-2004086 | Covered in AI 7.2.2.1.1 (#2.4) |
| 2.12 | Reflect RAN4 agreement that UE is allowed to take any active SCell in the cell group as timing reference cell in TS 38.213 Subclause 4.1. | R1-2003451R1-2003844 (no RAN1 impact) | To be managed under 7.2.2 per R1-2004680 |
| 2.13 | Within a fixed frame period, only up to the first 8 candidate SSB positions are considered valid, and no PDSCH rate matching and no RLM/RRM measurement will be done for the remaining candidate SSB positions in the FFP. For FBE, the DRS window length is no longer than an FFP. | R1-2004444R1-2003513 | N (No consensus on related proposals in previous two meetings) |
| 2.14 | RAN1 clarifies one from the following alternatives:• Alt 1: Only support single SS/PBCH block burst transmission and single associated LBT procedure in a discovery burst transmission window.o Spec impact: UE can assume the difference between the first and last candidate SS/PBCH block index of the transmission burst is smaller than Q.• Alt 2: Support multiple SS/PBCH block bursts transmission in a discovery burst transmission window, wherein each SS/PBCH block burst is associated with a separate LBT procedure.o No spec impact. | R1-2003861 | N (This is more appropriate for AI 7.2.2.2.1, FL will make this suggestion) |
| 2.15 | Reply to RAN4 LS on NR-U SSB monitoring:Proposals: If defined, N1/N2 should be fixed in the RAN4 specifications and not be a UE capability.For RLM/BFD/CBD it is mandatory for the UE to monitor all candidate SS/PBCH block positions in the discovery burst transmission window corresponding to the same SS/PBCH block index, i.e. N1 = 10/20 for 15/30 kHz SCS respectively. Inform RAN4 of this decision.For intra and inter-frequency measurements (in IDLE and CONNECTED mode) it is mandatory for the UE to monitor at least N2 = 5/10 (for 15/30 kHz SCS respectively) candidate SS/PBCH block positions corresponding to the same SS/PBCH block index in the SMTC window. Inform RAN4 of this decision.The values of N1/N2 should be the same for LBE and FBE. Inform RAN4 of this decision. | R1-2003844R1-2003513R1-2004526 | To be handled separately under 7.2.11.2, as per R1-2004680 |
| 2.16 | Remove redundant references to both ¯L\_max and k\_SSB definitions in TS 38.212 Clause 7.1 | R1-2004526 | N (editorial change, plus better suited to AI 7.2.2.1.1) |

# Corrections for RACH

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| Issue # | Description | Tdoc | Email discussion |
| 3.1 | To accommodate DL processing time at UE, a PRACH resource is considered invalid if it overlaps with the first X symbols at the front of each FFP when FBE operation is indicated, where X could be configured or fixed in spec.  | R1-2003371 | N, treated in last meeting without consensus |
| 3.2 | MsgA PRACH-PUSCH gap:For the minimum value N of the MsgA PRACH-PUSCH gap in NR-U, select one of the alternatives in RAN1 #101-e: * Alt 1: N=2 (same as licensed operation)
* Alt 2: N can be smaller than 2 for identified cases, and N=2 for the rest
	+ For example, N = [0 or 1] when MsgA PUSCH has the same SCS and bandwidth as MsgA PRACH
* Note: it can be further discussed whether existing CP extension scheme can be applicable for the identified cases
 | R1-2003657R1-2003451R1-2004014R1-2003861R1-2003844 | Y |
| 3.3 | How the UE should detect DL transmission in the case of an FFP for which no SSB/RMSI is transmitted by the network:When a UE is not provided with C-RNTI and is configured with ChannelAccessMode-r16 = semistatic: • a DCI payload size may be also provided to the UE via the semiStaticChannelAccessConfig-r16 field. • UE assumes that FFP is acquired by gNB if detects PDCCH of configured payload size scrambled with SI-RNTI in the lowest PDCCH candidate of TYPE0 CSS in the first slot of the FFP containing at least one valid RO.n FBE mode, COT detection for IDLE UEs should be based on PDCCH monitoring, where DCI payload is configured in SIB1. UE assumes that FFP is acquired by gNB if detects PDCCH of configured payload size scrambled with SI-RNTI in the lowest PDCCH candidate of TYPE0 CSS in the first slot of the FFP containing at least one valid RO. | R1-2004526 | Y |
| 3.4 | Clarify and correct capturing the validation of SFN LSBs in Section 8.2 and 8.2A of TS 38.213, respectively and consider some special cases, e.g., RAR window size of <=10ms and contention-free random access (CFRA). | R1-2003451R1-2004014R1-2004444R1-2003844R1-2003513R1-2004526 | Y |
| 3.5 | If a PRACH occasion is overlapped (fully or partially) with a slot which contains RMSI, the PRACH occasion should be treated as invalid PRACH occasion. | R1-2004086 | N (no consensus in last meeting to prioritize this issue) |
| 3.6 | Since 38.300 is Stage 2 spec, update TS 38.211 to restrict both the use of these new long ZC sequences to NR-U and the use of the long ZC sequence corresponding to L\_RA = 839 to NR according to [7], section 5.3.4. | R1-2004526 | N (suggest for next meeting) |

# Corrections for RRM/RLM

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| Issue # | Description | Tdoc | Email discussion |
| 4.1 | If SSB is configured as RLM-RS, UE will only use one SSB sample with the largest RSRP among the set of candidate SSBs indicated by ssb-Index. | R1-2003371 | N (Can be left to implementation) |
| 4.2 | If one CSI-RS resource is configured as RLM-RS, UE should skip invalid CSI-RS when performing IS and OOS evaluation. For one CSI-RS resource configured as RLM-RS, if there is no any valid CSI-RS sample in the latest indication period between current indication time and previous indication time, the CSI-RS resource will not be considered as the active resource and there will not be any IS and OOS reporting. | R1-2003371 | N (no consensus in WI phase and no consensus on CSI-RS validation in AI 7.2.1.2) |
| 4.3 | Respond to RAN4 that the UE can assume that the same transmit power is used across different occasions, for both CSI-RS and SSB-based RRM measurements. | R1-2003844 | Expected to be allocated a separate thread as per R1-2004680 |
| 4.4 | For the value ranges for measDuration-r16,* Alt 1: {sym1, sym14or28or56or48, sym28or56or112or96, sym42or84or168or144, sym70or140or280or240}
	+ “sym14or28or56or48” refers to 14 symbols for 15 kHz SCS, 28 symbols for 30 kHz SCS, 56 symbols for 60 kHz SCS with NCP, and 48 symbols for 60 kHz SCS with ECP, respectively, and so on
	+ Inform RAN2 of this decision (can be within updated RRC parameter spread sheet that we send to RAN2, not necessarily a separate LS)
* Alt 2: {sym1, sym14or12, sym28or24, sym42or36, sym70or60}
	+ “sym14or12” refers to 14 symbols for NCP and 12 symbols for ECP, respectively, and so on
	+ Inform RAN2 of this decision (can be within updated RRC parameter spread sheet that we send to RAN2, not necessarily a separate LS)

Note 1: If measured bandwidth of RSSI overlaps with the active DL BWP, UE performs RSSI measurement with the SCS of the active DL bandwidth part during the measurement duration derived from combination of measDuration-r16 and rmtc-ref-SCS-CP. Note 2: The UE expects an integer number of symbol(s) with respect to the SCS of the active DL BWP to be configured for RSSI measurement. | R1-2003451 (Alt. 2)R1-2003729 (Alt. 1)R1-2004014 (Alt. 2)R1-2003861(Alt. 2)R1-2003844(Alt. 2)R1-2003513(Alt. 1)R1-2004526(Alt. 1) | Y |
| 4.5 | NR-U shall support the following enhancement to CSI-RS as part of discovery burst: * UE assumes a CSI-RS resource has at least one transmission occasions in a discovery burst transmission window, wherein the slot index of the transmission occasion has the same value of ;
* The initial condition for generating the CSI-RS sequence in a discovery burst transmission window is the same in at least one transmission occasions and according to

. | R1-2003861 | Covered in AI 7.2.2.1.1 (issue #3.1) |

# Other submitted TPs/proposals not for email discussion in this agenda

Multiple editorial changes listed above can be addressed in the next meeting.

# Proposed email discussions for phase 1 of RAN1#101-e

The following email discussions and sub-topics are proposed for further discussion in AI 7.2.2.2.2 during the RAN1#101-e preparation phase until 5/22:

* [101-e-NR-unlic-NRU-InitAccessProc-01]
	+ (#2.1, #2.3, #2.5) Remaining corrections for cell search in TS 38.213.
	+ (#2.6) PDSCH rate-matching around a given SSB index until the UE has successfully detected one SS/PBCH block.
	+ (#2.7) UE behavior in case GSCN offset refers to a GSCN which is not allowed in band n46.
* [101-e-NR-unlic-NRU-InitAccessProc-02]
	+ (#3.2) For the minimum value N of the MsgA PRACH-PUSCH gap in NR-U, select one of the alternatives in RAN1 #101-e:
		- Alt 1: N=2 (same as licensed operation)
		- Alt 2: N can be smaller than 2 for identified cases, and N=2 for the rest
		- For example, N = [0 or 1] when MsgA PUSCH has the same SCS and bandwith as MsgA PRACH
		- Note: it can be further discussed whether existing CP extension scheme can be applicable for the identified cases
	+ (#3.3) How the UE should detect DL transmission in the case of an FFP for which no SSB/RMSI is transmitted by the network.
* [101-e-NR-unlic-NRU-InitAccessProc-03]
	+ (#4.4) Choose between following alternatives for RSSI measurement duration in RAN1#101-e:
* Alt 1: {sym1, sym14or28or56or48, sym28or56or112or96, sym42or84or168or144, sym70or140or280or240}
	+ “sym14or28or56or48” refers to 14 symbols for 15 kHz SCS, 28 symbols for 30 kHz SCS, 56 symbols for 60 kHz SCS with NCP, and 48 symbols for 60 kHz SCS with ECP, respectively, and so on
	+ Inform RAN2 of this decision (can be within updated RRC parameter spread sheet that we send to RAN2, not necessarily a separate LS)
* Alt 2: {sym1, sym14or12, sym28or24, sym42or36, sym70or60}
	+ “sym14or12” refers to 14 symbols for NCP and 12 symbols for ECP, respectively, and so on
	+ Inform RAN2 of this decision (can be within updated RRC parameter spread sheet that we send to RAN2, not necessarily a separate LS)

Note 1: If measured bandwidth of RSSI overlaps with the active DL BWP, UE performs RSSI measurement with the SCS of the active DL bandwidth part during the measurement duration derived from combination of measDuration-r16 and rmtc-ref-SCS-CP.

Note 2: The UE expects an integer number of symbol(s) with respect to the SCS of the active DL BWP to be configured for RSSI measurement.

* [101-e-NR-unlic-NRU-InitAccessProc-04]
	+ (#3.4) Clarify and correct capturing the validation of SFN LSBs in Section 8.2 and 8.2A of TS 38.213, respectively and consider some special cases, e.g., RAR window size of <=10ms and contention-free random access (CFRA).

Note: this is a continuation of email discussion [100b-e-NR-unlic-NRU-InitAccessProc-05] Email approval of the corresponding TP to address LS from RAN2 in R1-2001506 by 4/23 - Jing (Qualcomm)

* The LS-related topics (#2.12, #2.15, #4.3) are expected to be handled in separate email discussions allocated by the Chairman.

For issues not included above, it does not mean that corrections are not needed; rather, these issues can be discussed at the next meeting.

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| **Company** | **Views** |
| Samsung | For 2.6, we don’t think the restriction should be added. A gNB cannot expect whether and when a UE can detect a SSB, so the gNB cannot rely on this information to change its rate matching behavior. For example, if a SSB can only be received by UE A, but cannot be received by UE B, then the rate matching behavior will be different for UE A and UE B, which contradict with the intention of cell-specific indication of the SSB transmission. For 2.7, in Rel-15, there is no restriction that the indicated GSCN has to be a valid sync raster point, so when the same scheme is used for NR-U, there is no issue at all. Current specification can work perfectly, so no change is needed. For 2.4, we believe this clarification is essential, and we already confirmed in the previous meeting that a case-by-case identification of the wording issue should be performed. Moreover, the clarification of TS 38.213 Subclause 5 relating to RLM is different from the other clarifications in this item, since that SSB is indicated by ssb-Index (not ssb-PositionsInBurst). So far, 38.213 has a clarification of ssb-PositionsInBurst, but there is no spec yet clarifies the use of ssb-Index. To summarize, we suggest to remove 2.6 and 2.7 in email thread 1, and add 2.4 into email discussion. Other email threads are good to us.  |
| OPPO | @FL, we have a proposal about PDSCH rate-match around SSB in our contribution R1-2004086 section 2.5 proposal 5 and TP3.3. But this contribution was not captured in the summary. We propose to discuss about proposal together under [email thread-01]#2.6.  |
| Spreadtrum | For #2.6, there could be mis-alignment b/w gNB and UE. PDSCH rate matching occurs at most in a slot. If gNB sends two SSBs in a slot, but UE detects the first SSB, then UE will only perform PDSCH rate matching around the first SSB, but gNB will perform PDSCH rate matching around the two SSBs.Regarding PDSCH rate matching around SSB, #2.13 can be supported for both FBE and LBE, if “Only support single SS/PBCH block burst transmission and single associated LBT procedure in a discovery burst transmission window” is agreed in #2.14. In our view, #2.13 provide a more efficient way for PDSCH rate matching than the current mechanism that solely relies on *SSB-PositionsInBurst*. Therefore, **#2.6, #2.13 and #2.14 can be discussed together**. |
| ETRI | @FL, we also have a contribution on the PDSCH rate-matching around SSB which is closely related with issue #2.6 not editorial. So we moved our contribution under the issue #2.6. Regarding the issue, we have similar view with Samsung. The SSB indication for rate-matching should be cell-specific manner. |
| LG Electronics | For email thread #01, we agree with Samsung in that issues 2.6 and 2.7 are not preferable to discuss, but issue 2.4 is an essential issue. If we adopt issue 2.4 as essential, issue 2.2 should be handled together since those two issues focus on the same topic.For email thread #02, we disagree to discuss issue 3.3 as commented in previous meetings, since it seems optimization and requires quite a big change to idle mode UE behavior.For email threads #03 and #04, we are OK for FL’s suggestion. |
| Qualcomm | For issue 2.6, share the same view that detection of SSB based rate matching is not robust.For issue 3.3, we believe it is important to discuss, especially the SI-RNTI based alternative, or the many ROs will be unnecessarily wasted. |
| ZTE | For Issue 2.5, we believe the agreement has already been captured in spec implicitly, since we have “The UE assumes that within a discovery burst transmission window, a number of transmitted SS/PBCH blocks on a serving cell is not larger than and a number of transmitted SS/PBCH blocks with a same SS/PBCH block index is not larger than one.” We can derive that the number of transmitted SSBs is not larger than Q, and Q is not larger than 8, so we have “The maximum number of transmitted SS/PBCH blocks within a discovery burst transmission window is 8”. Therefore, we don’t need to discuss it anymore.For Issue 2.6, we want to clarify that the purpose is to echo the agreement we made in last meeting that “The UE assumes ... a number of transmitted SS/PBCH blocks with a same SS/PBCH block index is not larger than one”. When UE detects one SSB, it won’t monitor the remaining candidate SSB positions and won’t perform rate matching around these candidate SSBs, we think it’s a very natural and reasonable result. In addition, it’s not to restrict gNB’s behavior, only from UE’s perspective.For Issue 2.12, the issue is valid that RAN4’s agreement that UE is allowed to take any active SCell in the cell group as timing reference cell does have impact on 38.213, since the current statement is “For a serving cell without transmission of SS/PBCH blocks, a UE acquires time and frequency synchronization with the serving cell based on receptions of SS/PBCH blocks on the PCell, or on the PSCell, of the cell group for the serving cell”. We understand FL’s comment to handle this in separate LS email thread, but this LS is not asking reply and it seems the initial assessment doesn’t put it into a separate email thread, so we suggest that we could put 2.12 in email thread #1 if chairman finally decide not to approve this separate LS email thread.For Issue 3.3, we believe this is an optimization issue and has impact in RAN2 as well, we are not sure if it’s appropriate to discuss this in the last stage of Rel-16. It’s better to focus on the remaining discussion from last meeting and try to reach consensus. For editorial issues, maybe we could simply vote in preparation phase that if we could agree directly and transfer to editor, or make a decision in TP discussing week, because we are afraid that we may not have chance to handle these in next meeting.  |
| vivo | For email thread #01, agree with Samsung and LG that issue 2.2 and 2.4 are essential issue while issue 2.6 and 2.7 should be removed. It is clear that PDSCH rate matching around SSB should be in cell specific manner.For email thread #02, issue 3.3 is an essential issue which should be discussed. For idle UE, there will be no chance for the UE to transmit PRACH if there is no SSB/Type 0 PDCCH. I agree that introducing a new PDCCH for this purpose is a good proposal. To alleviate the concern with big change for idle UEs, maybe invalidation of these ROs could be another simple solution. This problem is clear and needs to be solved by either way.For email thread #04, I don’t agree that issue 4.1 is an implementation issue. According to current RLM mechanism, UE needs to make IS/OOS evaluation for all the configured samples in the corresponding evaluation period. Here the purpose of the proposal is to select one sample used for IS/OOS evaluation. This is also related with the LS from RAN4 and we suggest it could be handled together with the LS reply discussion. For issue 4.2, we agree that CSI-RS validation rule is not agreed yet and are OK with waiting for the conclusion in DL AI. If any validation rule for CSI-RS is specified, issue 4.2 should be discussed to handle the invalid CSI-RS in RLM. |
| Huawei, HiSilicon | For email thread#1, 2.2 and 2.6 are two alternative solutions for the same issue. If discussed, they should be together. 2.7 is not a problem considering R15 already have such situationFor email thread#2, 3.3 can be clarified but the introduction of SFI-RNTI for idle UE is not the only choice. Idle UE can wait for the FFP with SSB/RMSI anyway.  |
| Nokia, NSB | - Related to 2.6 and 2.7, we support Samsung, LGE & Vivo statements (plus Huawei’s for 2.7) and therefore would suggest not to discuss these topics. We are fine with discussing 2.4 instead.- Related to 2.5, we support Mediatek statement, as the RAN1 agreement they pointed out also impacts gNB implementation – i.e. the gNB should transmit 8 SSBs at the most within a discovery burst Tx window. Hence this is not only a UE matter.- We believe that 2.13 should be discussed, as for FBE mode our understanding is that if the gNB is granted access to the spectrum for a given FFP there no point to transmit more than Q SSBs at the first Q positions of the FFP - “beam-cycling” being useful for LBE mode only.- We are fine with not discussing 2.16 in this meeting – this is indeed an editorial topic – but we see no reason why it should not be further discussed in 72222 AI.- Related to 3.3, we support Qualcomm, Vivo and Huawei statements that it should be discussed, otherwise the issue of managing ROs for FFPs in which not SSB/RMSI is transmitted remains open and as pointed out by Qualcomm, may lead to a waste of ROs resources.- Related to LSs, we would like to remind that R1-2004680 is still under discussion, then the final decision may be for some of them to allocate the related discussion to 72222 threads.In particular we believe that 2.15 should be mandatorily discussed in 72222 AI, as it is highly linked with Initial Access Procedures. BTW and in our understanding all Companies providing feedback in R1-2004680 for this LS have shared this view, including Nokia/NSB.It is also our understanding that 4.3 should be discussed in 72211 AI anyway. |
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# References

1. R1-2003371 Remaining issues on initial access procedure for NR-U vivo
2. R1-2003451 Remaining issues on the initial access procedure for NR-U ZTE, Sanechips
3. R1-2003513 Maintenance on the initial access procedures Huawei, HiSilicon
4. R1-2003657 Remaining issues on initial access procedure for NR-U operation MediaTek Inc.
5. R1-2003729 Enhancements to initial access and mobility for NR-unlicensed Intel Corporation
6. R1-2003844 Enhancements to initial access procedures Ericsson
7. R1-2003861 Initial access procedures for NR-U Samsung
8. R1-2003973 Remaining issues on initial access procedure for NR-U ETRI
9. R1-2004001 Remaining issues on initial access procedure Spreadtrum Communications
10. R1-2004014 Remaining issues of initial access and mobility for NR-U LG Electronics
11. R1-2004086 Discussion on the remaining issues of enhancements to initial access procedure OPPO
12. R1-2004444 TP for Initial access and mobility procedures for NR-U Qualcomm Incorporated
13. R1-2004526 On Enhancements to Initial Access Procedure for NR-U Nokia, Nokia Shanghai Bell
14. R1-2002849 Outcome of email thread [100b-e-NR-unlic-NRU-InitAccessProc-01] Charter Communications
15. R1-2002850 Outcome of email thread [100b-e-NR-unlic-NRU-InitAccessProc-02] Charter Communications
16. R1-2002851 Outcome of email thread [100b-e-NR-unlic-NRU-InitAccessProc-03] Charter Communications