**3GPP TSG-RAN WG1 Meeting #106-eR1-210XXXX**

e-Meeting, August 16th – 27th, 2021

**Agenda item: 8.3**

**Source: Moderator (Nokia)**

**Title: [Post-106-e-Rel17-RRC-03] Enhanced IIoT and URLLC**

**Document for: Discussion and Decision**

# Introduction

As per chairman’s guidance, the email discussion

* [Post-106-e-Rel17-RRC-03] Enhanced IIoT and URLLC

is planned according to the following guidelines:

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| --- |
| *As announced during RAN1#106-e, there will be a number of email threads on Rel-17 RRC parameters. For each Rel-17 work item, the work item rapporteur will kick off the email thread. The email discussions on RRC parameters will start from September 1 until September 10 (of course excluding the weekend). The purpose of these email discussions is to initiate our preparations to send the first LS to RAN2 on Rel-17 RRC parameters in October (e.g. tabulate agreed RRC parameters so far and identify ones that RAN1 should discuss whether or not to define).**Please note that RAN1 will NOT be making any decision with regards to the Rel-17 RRC parameters during the email discussions. Intention is to have the work item rapporteurs provide their initial assessment and collect company views if there are any. I am hoping that this discussion will help companies better prepare for RAN1#106bis-e. For each email thread, the rapporteur is to provide a tdoc collecting company views along with a draft list of RRC parameter at the end of the email discussion.* |

This document is there to support the RAN1 email discussion on the RRC parameter list for the Rel-17 URLLC/IIoT WI. Companies are encouraged to provide their comments on the latest version of the RRC parameter sheet in the respective AI specific drafts folder and the changes to the RRC parameter sheet will only be done by the AI moderator based on the received comments in each round or iteration of email discussions on this issue.

**This document is structured as follows:**

* Section 2 contains the email discussion for HARQ-ACK enhancements (AI 8.3.1.1)
* Section 3 contains the email discussion for CSI enhancements (AI 8.3.1.2)
* Section 4 contains the email discussion for NR-U enhancements (AI 8.3.2)
* Section 5 contains the email discussion for Intra-UE periodization enhancements (AI 8.3.3)
* Section 6 contains the email discussion for Other / Propagation delay compensation (AI 8.3.4)

# HARQ-ACK enhancements (AI 8.3.1.1)

* 1. Dropping of SPS HARQ-ACK feedback in TDD operation / SPS deferral

### 1st Round

The following need for RRC parameters has been identified by the moderator:

1. Enable the feature per SPS configuration
2. Configure the maximum deferral per SPS configuration

On these and in case of having missed some aspect, please comment below as well:

|  |  |
| --- | --- |
| *Company* | *Comments* |
| Samsung | We think that enabling/disabling the feature should be considered together with the maximum deferral per SPS configuration. That is, there is no need to make two separate RRC parameters. Just one RRC parameter is enough. * Instead of {1..15}, {0..15} should be considered. Here, 0 means disable the feature.
* Furthermore, there has been no explicit agreement to support new RRC parameter for enabling/disabling the feature

Moderator: Thanks for the feedback. I can remove the separate RRC parameter on enabling with an update. Just to check: actually we would not need the value 0 either as if the parameter is not configured (as this would be an optional parameter anyhow), having the max. deferral value not configured could be understood as ‘not enabled’?  |
| DOCOMO | Agree. |
| Intel | We prefer the approach with the parameters not configured = the feature is disabled. This is the most common throughout NR specs.Regarding the maximum value 15, while we understand the rationale, probably a separate discussion and a formal agreement is needed for that. |
| vivo | We agree with Moderator and Intel that when the parameter is not configured, it means the feature is not enabled. We are also fine with the value range.  |
| Sony | We are fine whether to have a separate “Enable” parameter per SPS Config or lump it into max deferral. Also the “Enable the feature” should be per SPS Config (which was commented as per SPS Config in the spreadsheet but not in this document). Moderator: sorry about not being that precise in this word document above, the important thing clearly seems the spreadsheet |
| ZTE | We are fine with separate “enable” parameter. If parameters not configured = the feature is disabled, {1...15} is also fine, it seems no need to add {0}, as configuration absence means disable. |
| OPPO | We are fine to remove the separate RRC parameter on enabling. With respect to maximum deferral, we’d like to clarify whether the value of maximum deferral can be less than the value of k1 configured for the SPS configuration,If answer is no, we prefer to add restrictive sentence in description.Moderator: First, the applicable k1 value for SPS is not configured but determined by the activation or do you refer to the configured k1 sets? Please note, that we discussed further restrictions already (e.g. if the k1+k1\_def needs to correspond to a value in the k1 set(s)) but there was no agreement on further restrictions).Clearly, having a smaller value of max (k1+k1\_def) configured than the k1 indicated in the activation DCI seems to be not really working. But we cannot really put this in RRC to my understanding, as the k1 value for the SPS configuration is not given by the RRC configuration but through activation. If a sentence would be needed here, this would need to be handled by the specifications (e.g. in 38.213), something like ‘the UE does not expect …” or similar.  |
| LG | We prefer the mechanism of no configuring parameter to disable the feature. Especially when only one parameter is required for the feature, this is more the consistent approach considering current specification.Regarding maximum number, we think it is OK to leave for further discussion. In our point of view, {1 … maxDeferral} is fine for now.  |

* 1. PUCCH repetition enhancements

### 1st Round

1. The moderator could only identify the need for the RRC parameter of nrofSlots for PUCCH format0 (but there could be some overlap with defining this in Cov. Enh. WI).

2. For PUCCH format 2, this is already supported from signaling perspective through PUCCH format config, just the restriction to configure would need to be removed in Rel-17:

|  |
| --- |
|  |

3. The configuration for the dynamic PUCCH repetition indication could be re-used from Cov. Enh. WI. So no need for us to define the related RRC parameters.

On these and in case of having missed some aspect, please comment below as well.

Please provide your input to the table below:

|  |  |
| --- | --- |
| *Company* | *Comments* |
| Samsung | OK  |
| DOCOMO | Agree. |
| Intel | We agree with Moderator’s explanation.It is however questioned whether we need the parameter currently listed in Excel file ‘nrofSlotsFormat0’, since the same functionality would be achieved by removing the restriction, if we understand the intention correctly.Moderator: Please note, that for Format 0 there is no ‘PUCCH-format config’ (see the first copied RRC part, only available for PUCCH formats 1, 2, 3 and 4), therefore there is no way with the current RCC signaling framework to indicate the repetition number.  |
| vivo | We agree with Moderator’s views.  |
| Sony | Agree. |
| ZTE | Agree |
| OPPO | Agree |
| LG | Agree |

* 1. Type-1 HARQ-ACK Codebook enhancements

### 1st Round

The moderator did not find any needed RRC parameter for this feature, as the current RRC signaling supports this already.

|  |
| --- |
| HARQ-ACK-CodebookList-r16 ::= SEQUENCE (SIZE (1..2)) OF ENUMERATED {semiStatic, dynamic} |

We just need to remove the Rel-16 restriction to now allow the configuration of sub-slot based PUCCH config and Type 1 CB.

Please provide your input to the table below:

|  |  |
| --- | --- |
| *Company* | *Comments* |
| Samsung | Agree |
| DOCOMO | Agree |
| Intel | Agree |
| vivo | Agree. |
| Sony | Agree |
| ZTE | Agree |
| OPPO | Agree |
| LG | Agree |

* 1. Retransmissions of dropped HARQ-ACK

### Rel-16 Type-3 CB enhancements (DCI 1\_2 / PHY prioritization)

#### 1st Round

We agreed the PHY priority handling and the support for DCI format 1\_2 for the Rel-16 Type 3 CB.

The moderator identified the following needs:

1. Clearly we need an RRC parameter for the DCI 1\_2 operation
2. But it seems none for the PHY prioritization, as this is already supported by the signaling framework (just need to remove the restriction of not being able to configure PHY prioritization and Rel-16 Type 3 CB at the same time).

Please provide your input to the table below:

|  |  |
| --- | --- |
| *Company* | *Comments* |
| Samsung | OK. We understand that “RRC parameter for the DCI 1\_2 operation” means the configuration for the presence of the priority indicator.Moderator: I guess for DCI 1\_2, should be the presence of the ‘Type 3 triggering’!? |
| DOCOMO | We agree that no additional RRC parameter is needed to support PHY priority indication for DCI 1\_1 and 1\_2. However, regarding “just need to remove the restriction of not being able to configure PHY prioritization and Rel-16 Type 3 CB at the same time”, we don’t think such restriction exists in current specification.Moderator: Not fully sure, but clearly if there is no restriction currently then nothing would need to be removed.  |
| Intel | Agree |
| vivo | We agree with moderator that the RRC parameter for triggering the Rel-16 Type 3 codebook by DCI format 1\_2 is needed. In addition to that, we wondered whether additional RRC parameters such as “pdsch-HARQ-ACK-OneShotFeedbackCBGDCI-1-2” and “pdsch-HARQ-ACK-OneShotFeedbackNDIDCI-1-2” are needed or those parameters for DCI format 1\_2 reuse the ones configured for DCI format 1\_1?Moderator comment: Good comment & question. It was moderator’s implicit assumption as we don’t even distinguish between different priorities (where the payload size would have made a different), that we would not change the Type 3 CB structure for DCI format 1\_2 either. Please note, that the CBG and NDI does not have an impact on the DCI size, so the motivation for having this is slightly limited (different to having things separately configurable for DCI format 1\_2 to be able to configure the size of the DCI separately). Or does vivo think that this would have an impact on the DCI size? If so, we could continue discussing here.  |
| Sony | Agree |
| ZTE | Agree |
| OPPO | Agree with DOCOMO.In addition, Due to PHY prioritization is introduced, the collision handling between Type3 HARQ-ACK CB and other HARQ-ACK CB, i.e. Type1 or Type2 HARQ-ACK CB may be changed. To be specific, in R16, Type3 HARQ-ACK CB is always higher priority than other HARQ-ACK CBs, as described in TS38.213.“If a UE detects a DCI format that includes a One-shot HARQ-ACK request field with value 1, the UE determines a PUCCH or a PUSCH to multiplex a Type-3 HARQ-ACK codebook for transmission in a slot as described in Clauses 9.2.3 and 9.2.5. The UE multiplexes only the Type-3 HARQ-ACK codebook in the PUCCH or the PUSCH for transmission in the slot.”However, in R17, if Type3 HARQ-ACK CB is indicated as low priority, the existing collision handling seems not reasonable. At least, we need further discussion on collision handling. So we suggest to add RRC parameter related with PHY priority, e.g. *PriorityforType3* and highlighted by yellow.Moderator: First, the sentence above from the specifications describes the case that only a single HARQ-ACK codebook can be constructed per PUCCH slot (i.e. a single PHY priority, PHY priority and Type 3 CB cannot be configured for a UE in Rel-16). If having the ability and being configured with two PUCCH configs (i.e. UE can create more than one HARQ-ACK codebook for a slot), one can be of Type 3 and the other can be of any other type. So clearly some minor specs change will be needed there to clarify that the clause from above is to apply per priority. But then, wouldn’t the normal PHY prioritization procedure from 38.213 apply then there? Let’s not forget, this is under gNB control to indicate LP or HP in the Type 3 triggering DCI – so gNB should be aware of what is triggered and in the end, which of the HARQ CBs is to be dropped due to the Rel-16 PHY prioritization? If you think some further clarifications are needed, please bring some related input to the next RAN1 meeting. Without any additional agreements, the PHY prioritization procedure of Sec. 9 of 38.213 would automatically apply. Second on the need for RRC parameter – bit unclear why this is needed? If the UE is configured with both in Rel-17, this means that the PHY priority handling for Type 3 CB is to be applied. So there is no need for any additional RRC parameter there (as the combination of PHY priority & Type 3 CB not supported earlier – there can be no miss-understanding).  |
| LG | Agree with FL |

### Enhanced Type-3 CB of ‘smaller size’

#### 1st Round

There are still some pending decisions, but the intention here is to discuss also potential RRC parameters already (as per Mr. Chairman’s guidance).

The moderator identified at least the following needed parameters:

1. List of enhanced Type-3 HARQ-ACK codebooks of smaller size
2. For each enhanced Type 3 HARQ-ACK codebook of smaller size
	1. Enhanced Type 3 HARQ-ACK codebook set / structure (two options for configuration agreed, per CC – or per HARQ process & CC)
	2. CBG configuration for the enh. Type 3 HARQ-ACK CB
	3. NDI configuration for the enh. Type 3 HARQ-ACK CB
3. Enabling of DCI format 1\_2 operation for enh. Type 3 HARQ-ACK codebook.

On these, and in case you think there is something missing, please provide your input to the table below:

|  |  |
| --- | --- |
| *Company* | *Comments* |
| Samsung | CBG and NDI should be removed for now – can discuss in RAN1#106b-e whether to support when targeting a codebook with small size. Also, DCI 1\_2 does not support CBGs while the need/motivation for NDI may not exist in URLLC. Moderator: Please see the RAN1 chair comments and note that we do not agree any of these RRC parameters (there is no real endorsement) but just the starting point for discussions (with endorsement) during RAN1#106-e. The point was also to identify RRC parameters maybe still needed, and this is such case. We could keep them there and mark them in yellow (if Samsung prefers).  |
| DOCOMO | Share similar view as Samsung that we haven’t discussed CBG and/or NDI for enhanced type 3 HARQ-ACK CB so far. Better to remove “pdsch-HARQ-ACK-enhType3NDI” and “pdsch-HARQ-ACK-enhType3CBG”.Moderator: see my reply to Samsung |
| Intel | It seems we may need another pdsch-HARQ-ACK-enhType3DCI-1-1 but for DCI format 1\_1. Is current assumption that 1\_1 is automatically enabled with the whole list, while 1\_2 is enabled with the subset of CBs ?Moderator: The moderator assumption was that for DCI format 1\_1 this is then automatically enabled (following the logic of R16 Type 3 CB, where format 1\_1 is automatically the triggering DCI). Moderator assumption therefore was, that *pdsch-HARQ-ACK-enhType3ToAddModList*, *pdsch-HARQ-ACK-enhType3ToReleaseList* and *pdsch-HARQ-ACK-enhType3* would be the parameters automatically applicable to DCI format 1\_1 (so what you mean there would be those 3 parameters, why not adding DCI format 1\_1 there yet is that also in Rel-16 we don’t have this addition there). Now to DCI format 1\_2, currently there is only the ‘enable’ parameter. We may need to discuss, if there is a separate configurability of the ‘number of sets / list’ there, but it is the moderator’s understanding that this may be dependent on the way the indication is carried (where RAN1 does not have any decision yet). In case the number of subset’s that can be dynamically indicated is not increasing the DCI size (as proposed by some companies), then there would be at least no need for separate lists. In case the number of dynamically indicated subsets does have an effect on the DCI size, then some further RRC parameters would be needed (e.g. for DCI format 1\_2 using a subset of the list configured, or only the first in the list can be triggered).But the moderator’s assumption at least here was, that we could not configure different enh. Type 3 CBs for 1\_2 compared to 1\_1 (but only 1\_2 may not provide the full flexibility in the dynamic indication as discussed above).  |
| vivo | In excel sheet row 25, we wondered whether the Parent IE for pdsch-HARQ-ACK-enhType3DCI-1-2 should be the pdsch-config, similar as pdsch-HARQ-ACK-OneShotFeedbackDCI-1-2 shown in row 12.Moderator: Good point – should be consistent there (my mistake). But please also see my reply to Intel on the number of dynamically indiated enh. Type 3 CBs with DCI format 1\_2. Will be updated, change in green. On Intel’s question, our understanding is same as Intel’s assumption that when the whole list is configured, DCI format 1\_1 is automatically enabled, similar as Rel-16 features/configurations indicated by compact DCI format. Moderator: see reply to Intel above |
| Sony | Actually per CC and per HARQ/CC can be the same parameter. Or rather HARQ/CC would have cover per CC configuration since the network can configure “ALL” HARQ Process IDs for a particular CC.Moderator comment: Fully agree here. When start drafting the RRC parameter list I was actually thinking that if having only the ‘per HARQ/CC’ would be sufficient and would simplify the RRC parameter list as well as the implementation in the specs. But moderator followed just the RAN1 agreements here. Maybe we could discuss if we should not remove the ‘Alt. 1 per CC’ as this can be also indicated with the ‘per HARQ/CC’ signalling framework.  |
| ZTE | We support the explanation on DCI format 1\_1 from moderator. i.e., that pds*ch-HARQ-ACK-enhType3ToAddModList*, *pdsch-HARQ-ACK-enhType3ToReleaseList* and *pdsch-HARQ-ACK-enhType3* would be the parameters automatically applicable to DCI format 1\_1.A question to be clarified on the “**whole list**” in comments from Intel and vivo, this term means the list in Excel row 17/18, or the traditional whole 16 HARQ process?Moderator: Better for Intel to clarify. But in the reply to Intel the moderators assumption had been that the ‘whole list’ would be the lists in row 17/18.  |
| OPPO | Considering related bitfield sizes in DCI format 1\_2 and DCI format 1\_1 are usually separate, usually it requires further study on whether RRC parameters related with enhanced Type3 HARQ-ACK CB for DCI format 1\_2 is separate from that of DCI format 1\_1 too. So we need further agreements on RRC parameters related with enhanced Type3 HARQ-ACK CB for DCI format 1\_2.Moderator: See my reply to Intel above on DCI format 1\_2. This is only the initial list and may be dependent on further discussions on the DCI signalling as well.  |
| LG | We understand and prefer that the configuration is based on DCI format 1\_1, and DCI format 1\_2 only borrow parameters for DCI format 1\_1. But it is discussable that two separated parameter is necessary for legacy type-3 and enh. Type-3 of DCI format 1\_2. We think *pdsch-HARQ-ACK-OneShotFeedbackDCI-1-2* and *pdsch-HARQ-ACK-enhType3DCI-1-2* could be unified as single parameter. For parameter for CBG and NDI, we are fine with current version as starting point but it should be discussed whether to support those indication and how to support those indication for each type-3 codebook in the list.  |

### One-shot triggering (by a DL assignment) of HARQ-ACK re-transmission on a PUCCH resource

#### 1st Round

There are still some pending decisions, but the intention here is to discuss also potential RRC parameters already (as per Mr. Chairman’s guidance).

The moderator identified at least the following needed parameters:

1. Enabling of the new ‘one-shot triggering’
2. Enabling of DCI format 1\_2 triggering
3. Configure the ‘offset’ for the dynamic indication of the PUCCH occasions / CB to be re-transmitted

On these, and in case you think there is something missing, please provide your input to the table below:

|  |  |
| --- | --- |
| *Company* | *Comments* |
| Samsung | It is not clear why RRC configuration for the “offset” of the PUCCH occasion is needed – may be discussed in RAN1#106b-e.Moderator: same comment as above, it was also about identifying potentially needed RRC parameters. Will mark in yellow in an update (but not to remove..) |
| DOCOMO | We agree with the 1st and 2nd point for enabling. Regarding the third point, it’s better to be discussed after we have agreements on mechanisms to indicate the retransmitted HARQ-ACK CB.Moderator: Same comment as to Samsung |
| Intel | Agree |
| vivo | We agree with moderator’s explanation.  |
| Sony | Agree.Do we need separate “1-shot” field for e-Type 3 and 1-shot ReTx. Can a single 1-shot indicator be used to trigger both.Moderator: This could be still discussed in RAN1, but e.g. in Rel-16 for enh. Type 2 CB and Type 3 CB also there separate fields had been used (for simplicity). But as we don’t know yet the details of the DCI signaling for e-Type 3 and 1-shot ReTX, bit hard to say for now. But based on the moderator’s understanding, this should not really have an effect on the RRC parameters (but more on the DCI field definition in 38.212 and the HARQ procedures in 38.213 Sec. 9.X) |
| ZTE | Agree. For Sony’s question, my primitive thought is e-Type 3 or 1-shot ReTx is enabled by gNB, and only one of alternatives can be enabled. It seems a single indicator can be used to trigger either of them. But I am open to either single indicator or two separate indicators to trigger because the detail of DCI structure is not determined. Anyway, it will not affect RRC parameters. |
| OPPO | Agree |
| LG | We slightly prefer to rename the first parameter to pdsch-HARQ-ACK-retxDCI-1-1, unless DCI format 1-0 supports one-shot triggering. For the offset, it can be discussed whether to make the range of indication configurable. We prefer to remove the parameter for now.  |

* 1. PUCCH carrier switching

### 1st Round

There are still some pending decisions, but the intention here is to discuss also potential RRC parameters already (as per Mr. Chairman’s guidance).

The moderator identified at least the following needed parameters **common to semi-static and dynamic indication of PUCCH carrier switching**:

1. Configuration of list of candidate cells (used by both, semi-static & dynamic switching)
2. RRC parameter(s) for independent TPC for the PUCCH cells for DCI format 2\_2

The moderator identified at least the following needed parameters **for PUCCH carrier switching based on dynamic indication**:

1. Enable the feature of PUCCH carrier switching based on dynamic indication
2. Enable the PUCCH carrier switching based on dynamic indication using DCI format 1\_2 (in case we decide to have a dedicated DCI field for the carrier indication).

The moderator identified at least the following needed parameters **for semi-static PUCCH carrier switching**:

1. Pattern periodicity (in case we agree to support this)
2. Pattern definition (using list of candidate carriers)

On these, and in case you think there is something missing, please provide your input to the table below:

|  |  |
| --- | --- |
| *Company* | *Comments* |
| Samsung | For “parameters **common to semi-static and dynamic indication”**1. There is no need to have a list of candidate carriers – one SCell/SUL is enough. Support of PUCCH carrier switching is also conditioned on minimum spec impact.

Moderator: In the comments of that row, it is already captured that there may not be a need for list if having X=1. For “parameters **for PUCCH carrier switching based on dynamic indication”**1. OK - it is however unclear why DCI 1\_2 is explicitly mentioned but DCI 1\_1 is not.

Moderator: Moderator assumption is, that at least DCI format 1\_1 will support the dynamic indication (no need to separately configure). But for DCI format 1\_2, in the spirit of DCI format 1\_2 being independently configurable, enables to configure it separately for DCI format 1\_2. For “parameters **for semi-static PUCCH carrier switching”**1. Having RRC configuration for the pattern periodicity needs justification – there is no apparent need or benefit. Support of PUCCH carrier switching is also conditioned on minimum spec impact.

Moderator: Marked now in yellow. As for other RRC parameters not based on agreements, the intention is also to identify the related possibly needed RRC parameters based on Mr. chairman’s guidance. 1. The pattern definition is needed but there is no need to have a list of candidate carriers – one SCell/SUL is enough.

Moderator: The value of X is there still in red (cannot use yellow marking within a table field). If only one cell is supported (X=1), then this becomes effectively a bitmap anyhow.  |
| DOCOMO | 1. parameters **common to semi-static and dynamic indication of PUCCH carrier switching**:[Comment] One clarification question: Is the intention that “the index x” indicated by DCI or pucchCellPattern is commonly applied to both lists, and the PUCCH cell/carrier is determined by combination of the two lists with the index, is it correct understanding? Maybe single parameter “pucch-SCell-And-Carrier-List” is enough? For example, we can configured the list as “cell#1, cell#2, cell#3-UL, cell#3-SUL”.Moderator: A single parameter may not be sufficient, as for the last two cases we need a cellID for cell’3 and UL & DL separately??For the example above, based on the current list the gNB would configure: pucch-SCellList = {cellID#1, cellID#2, cellID#3, cellID#3) pucch-CarrierList={‘UL’,’UL’,’UL’,’SUL).. so there is a limit overall on the number of PUCCH carriers / cells given by X. But for each PUCCH carrier we would need to indicate the cell ID plus the corresponding information on if this is a normal UL or SUL carrier.2. parameters **for PUCCH carrier switching based on dynamic indication**:[Comment] Agree. 3. parameters **for semi-static PUCCH carrier switching**:[Comment] Agree. |
| Intel | Agree as an initial list |
| vivo | We share the view as Samsung that dynamic switching between two CCs including PCell is sufficient for Rel-17 for minimum spec efforts. So, there is no need to have a list of candidate carriers. We are OK to keep it for now given moderator’s explanation. |
| ZTE | The number of candidate CCs is still pending to be discussed. We can keep the parameter (list of candidate carriers) here to be determined later. |
| LG | We are fine with the most of parameters. For RRC structure of patterns, We would like to suggest to have list of {slot length, cell index} for carrier switching pattern. In practical, consecutive slots may have same target cell index and adding slot length could be more scalable signaling design.  |

# CSI enhancements (AI 8.3.1.2)

VOID

1. NR-U Enhancements (AI 8.3.2)

VOID

1. Intra-UE multiplexing & priorization enh. (AI 8.3.3)

VOID

1. Propagation delay compensation (AI 8.3.4)

VOID