3GPP TSG RAN WG1 #101 R1-200XXXX

**e-Meeting, May 25th – June 5th, 2020**

**Source: Moderator (Nokia)**

**Title: Thread#2 for AI 7.2.4.6 QoS management**

**Agenda item: 7.2.4.6**

**Document for: Discussion and Decision**

# Introduction

[101-e-NR-5G\_V2X\_NRSL-QoS-02] Email discussion/approval regarding the assumption on P\_("MAX" ,CBR) when maximumtransmitPower-SL is not provided, by 5/28, with potential TP by 6/3 – Torsten (Nokia)

This email thread includes the following issue:

* Procedures Issue 1.4: P\_{MAX,CBR}

TS 38.213 V16.1.0 currently defines the following behaviour for $P\_{MAX,CBR}$ in PSSCH power control:

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| $P\_{MAX,CBR}$ is determined by a value of *maximumtransmitPower-SL* based on a priority level of the PSSCH transmission and a CBR range that includes a CBR measured in slot $i-N$ [6, TS 38.214]; if *maximumtransmitPower-SL* is not provided, $P\_{MAX,CBR}=0$ |

Notes:

* Parameter *maximumtransmitPower-SL* corresponds to sl-MaxTxPower in current TS 38.331.
* Current text imposes a rather low upper bound on TX power (0 dBm) when *maximumtransmitPower-SL* is not provided. This is not based on any agreement and was probably not intended.

# Company views

**Q1: Should TS 38.213 state explicitly that CBR-based power control does not apply to a PSSCH transmission using resources allocated using mode 1?**

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| **Company** | **View** | **Comments** |
| Nokia, NSB | no | The consequence of not explicitly mentioning the mode in TS 38.213 is that, depending on RAN2 details, it may be possible to support CBR-based power control in mode 1:While the objective “Support for simultaneous configuration of Mode 1 and Mode 2 for a UE” was removed from the WID, as far as I can see nothing currently prevents the gNB from including both sl-ScheduledConfig and sl-UE-SelectedConfig (which indirectly provides sl-MaxTxPower=*maximumtransmitPower-SL*) in an RRCReconfiguration message and nothing states that the UE is not expected to handle such a configuration. If my understanding is correct, then the gNB can provide a UE in mode 1 with *maximumtransmitPower-SL.* Moreover, a future release may introduce “Support for simultaneous configuration of Mode 1 and Mode 2 for a UE”, in which case including both the sl-ScheduledConfig and the sl-UE-SelectedConfig IEs in RRCReconfiguration will naturally be supported. |
| Samsung | Yes | Our understanding is that CBR-based sidelink power control is not supported in mode 1 by 38.331 description (*maximumtransmitPower-SL* is conftgured only for Mode2 (*SL-UE-SelectedConfig-r16*)). If this is not a common understanding, we prefer to capture this in 38.213. Otherwise, if this is a common understanding, we do not need to capture this in 38.213 additionally.  |
| Apple | Yes | We know that by current RAN2 configuration TS 38.331, maximumtransmitPower-SL is not configured/provided for mode 1. This implies that CBR based power control is not applicable to mode 1. However, we slightly prefer to clarify in RAN1 specification (TS 38.213) that CBR-based power control does not apply to a PSSCH transmission for mode 1. This could avoid the ambiguity when in a future release, a UE is configured by both mode 1 and mode 2.  |
| OPPO | No | Based on RAN2 RRC spec (38.331), it is clear that *SL-PSSCH-TxConfigList* which contains the parameter *sl-MaxTxPower* is only provided in mode 2 / UE selected mode. And hance it would be redundant to “redescribe” in 38.213. Furthermore, if simultaneous configuration of Mode 1 and Mode 2 for a UE is supported in a later release, it would actually be more troublesome to change the description in 38.213. Therefore, it is preferred not to make any changes in 38.213 for this issue. |
| Intel | Yes | We prefer clarification in 38.213 rather than exploration of details of higher layer signaling to figure out that CBR-based power control does not apply to a PSSCH transmission for Mode 1.  |
| vivo | No | In the 38.331, the condition of CBR-based power control is clear:The field is OPTIONALly present, Need R, when *SL-PSSCH-TxConfigList* is in *SL-UE-SelectedConfig* in *SIB12* or *SL-PreconfigurationNR*; otherwise the field is not present, need R.We don’t have to duplicate the condition in RAN1, otherwise, we have to duplicate description of every field in 331 to RAN1, which is obviously not desirable.Besides, I don’t understand the argument on future release. It is even possible to extend CBR-based PC to mode-1 (not our preference), then adding any text in the release may equally imply spec changes in the future.  |
| Ericsson | No | In our view the CBR-based power control should also apply to Mode-1. One reason for that is in the case Mode-1 UEs and Mode-2 UEs coexist in a resource pool, there is no reason why Mode-1 UEs are allowed to bypass the power control rule that Mode-2 UEs must follow.  |
| Huawei/HiSilicon | No | Based on TS 38.331, it is clear that *sl-MaxTxPower* is available only in Mode2 (*SL-UE-SelectedConfig-r16*).We want to avoid duplications here. Otherwise, we may also need to have such duplications for other IEs of similar situation. |
| Futurewei | No | We do not see any ambiguity: sl-MaxTxPower, thus maximumtransmitPower-SL, is not provided for mode-1. No additional spec effort is needed in RAN1 |

**Q2: Currently in TS 38.213,** $P\_{MAX,CBR}=0 dBm$ **when *maximumtransmitPower-SL* is not provided – should this behaviour be changed? If so, how?**

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| **Company** | **View** | **Comments** |
| Nokia, NSB | Yes$P\_{MAX,CBR}= Infinity$ | The point is that CBR-based power control does not apply if *maximumtransmitPower-SL* is not provided. This could be captured in several different ways, but setting the value to Infinity looks most straightforward and readable to me. |
| Samsung | Yes, if maximumtransmitPower-SL is provided, $P\_{PSSCH}(i)=min\left(P\_{CMAX},P\_{MAX,CBR},min\left(P\_{PSSCH,D}\left(i\right),P\_{PSSCH,SL}(i)\right)\right)$ else, $$P\_{PSSCH}(i)=min\left(P\_{CMAX},min\left(P\_{PSSCH,D}\left(i\right),P\_{PSSCH,SL}(i)\right)\right)$$ | We suggest to follow the LTE approach (Section 14.1.1.5 in 36.213) as shown in the left hand side, rather than to introduce an infinity value.  |
| Apple | Yes $P\_{MAX,CBR}= Infinity$ | If *maximumtransmitPower-SL* is not provided, the current TS 38.213 implies that the transmit power is likely 0 dBm, which is not proper (especially for Mode 1). If the CBR-based power control is not used (e.g., in Mode 1), then the upper bound $P\_{MAX,CBR}$ should not function in the transmit power formula. Hence, the default value of infinity works in this way.  |
| OPPO | We tend to agree with Samsung and thus infinity value is not needed. |  |
| Intel | Yes | We prefer the way it was done for LTE-V2X rather than infinity value |
| vivo | Yes | Simply remove the CBR component if not configured, which is aligned with the current spec style in 38.213. |
| Ericsson | Yes, $P\_{MAX,CBR}= Infinity$, | This basically means CBR-based power control does not apply in this case. |
| Huawei/HiSilicon | Support LTE-V’s approach | We support to reuse LTE-V’s approach (see Section 14.1.1.5 in TS 36.213), this can avoid introducing “infinity” value. |
| FUTUREWEI | Not necessarily: cf Samsung’s inputs | If my recollection is correct, we had this discussion in RAN1 for LTE-V, and the wording cited by Samsung was used to avoid setting a power value to infinity. This approach can be reused here |

**Q3: Anything else for this issue?**

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| **Company** | **Comments** |
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# Issues

## Topic 1: Sidelink Congestion Control

### Issue 1.5: CBR-based sidelink power control in mode 1

#### Background

For the LTE V2X sidelink, CBR-based sidelink power control was only applied in resource allocation mode 3. The current specification in TS 38.213 on the other hand appears to apply CBR-based sidelink power control regardless of resource allocation mode:

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| $P\_{PSSCH}(i)=min\left(P\_{CMAX},P\_{MAX,CBR},min\left(P\_{PSSCH,D}\left(i\right),P\_{PSSCH,SL}(i)\right)\right)$ [dBm]where- $P\_{CMAX}$ is defined in [8-1, TS 38.101-1]- $P\_{MAX,CBR}$ is determined by a value of *maximumtransmitPower-SL* based on a priority level of the PSSCH transmission and a CBR range that includes a CBR measured in slot $i-N$ [6, TS 38.214]; if *maximumtransmitPower-SL* is not provided, $P\_{MAX,CBR}=0$  |

Above I wrote that this **appears** to apply CBR-based sidelink power control regardless of resource allocation mode: It is not immediately obvious if the intention is that

* CBR-based sidelink power control can actually be applied in mode 1; or
* for mode 1 the parameter *maximumtransmitPower-SL* cannot be provided, hence CBR-based sidelink power control in mode 1 is actually not supported.

#### Views expressed in contributions

[Nokia, NSB] propose to make an explicit agreement that CBR-based power control can be applied in both resource allocation modes.

[Apple] propose that $P\_{MAX,CBR} $be set to infinity for mode 1.

#### Feature lead view

It would be useful to check if there is a common understanding of the intention. If RAN1 does not address this then the decision is de facto up to RAN2 – if *maximumtransmitPower-SL* can be provided to a mode 1 UE then CBR-based sidelink power control is supported in mode 1.

### Procedures Issue 1.4: P\_{MAX,CBR}

The following issue was identified in agenda item 7.2.4.5 Physical layer procedures for sidelink [feature lead summary R1-2003569]:

* Issue 1-4: the assumption on $P\_{MAX,CBR}$ when maximumtransmitPower-SL is not provided
	+ $P\_{MAX,CBR}$ is not used for power control
		- Support: [vivo, [R1-2003383](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_101-e/Docs/R1-2003383.zip)] [OPPO, [R1-2004073](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_101-e/Docs/R1-2004073.zip)] [Apple, [R1-2004219](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_101-e/Docs/R1-2004219.zip)]

Vivo: text proposal for the case that *maximumtransmitPower-SL* is not provided.

OPPO: propose that “For mode 2, $P\_{MAX,CBR}$ is set to infinity.”

Apple: propose that “The value P\_{max\_CBR} in the PSSCH transmit power formula is set to infinite for mode 1 or if the higher layer parameter “maximumtransmitPower-SL” is not provided.”

Current specification in TS 38.213 V16.1.0:

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| $P\_{PSSCH}(i)=min\left(P\_{CMAX},P\_{MAX,CBR},min\left(P\_{PSSCH,D}\left(i\right),P\_{PSSCH,SL}(i)\right)\right)$ [dBm]where- $P\_{CMAX}$ is defined in [8-1, TS 38.101-1]- $P\_{MAX,CBR}$ is determined by a value of *maximumtransmitPower-SL* based on a priority level of the PSSCH transmission and a CBR range that includes a CBR measured in slot $i-N$ [6, TS 38.214]; if *maximumtransmitPower-SL* is not provided, $P\_{MAX,CBR}=0$  |

Alternatives proposed as value of $P\_{MAX,CBR}$ when *maximumtransmitPower-SL* is not provided:

* $min\left(P\_{CMAX},min\left(P\_{PSSCH,D}\left(i\right),P\_{PSSCH,SL}(i)\right)\right)$
* Infinity

# References

1. [RP-200129](http://www.3gpp.org/ftp//TSG_RAN/TSG_RAN/TSGR_87e/Docs/RP-200129.zip), “Revised WID: 5G V2X with NR sidelink”
2. TR 37.885, Study on evaluation methodology of new Vehicle-to-Everything V2X use cases for LTE and NR
3. TR 38.885, Study on NR Vehicle-to-Everything (V2X)

Background

WI Objectives

At RAN#83, a new work item “5G V2X with NR sidelink” (5G\_V2X\_NRSL) was approved ‎[1]. Two of the objectives are relevant for the present agenda item:

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| 1. NR sidelink: Specify NR sidelink solutions necessary to support sidelink unicast, sidelink groupcast, and sidelink broadcast for V2X services, considering in-network coverage, out-of-network coverage, and partial network coverage.* …
* Congestion control [RAN1, RAN2]

4. Specify support for QoS management [RAN2, RAN3, RAN1] |

Earlier Agreements

The following relevant agreements have been reached in previous meetings:

QoS

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| Agreements:From RAN1 perspective, at least the following QoS-related parameters relevant to physical layer studies are considered: * Priority
* latency
* reliability
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| Agreements:RAN1 studies further how to use * priority,
* latency,
* reliability,
* minimum required communication range (as defined by higher layers) if agreed to use

in the physical layer aspects of at least * resource allocation and
* congestion control and
* resolution of in-device coexistence issues and
* power control
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In the Sidelink resource allocation mode 2 agenda item, the following working assumption was reached:

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| Working assumption:* An indication of a priority of a sidelink transmission is carried by SCI payload
	+ This indication is used for sensing and resource (re)selection procedures
	+ This priority is not necessarily the higher layer priority
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| Agreements:* For the priority indication in 1st stage SCI:
	+ Up to RAN2 on how to define the mapping between the priority indication and the corresponding QoS
	+ Size is 3 bits (as a working assumption)
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Sidelink Congestion Control

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| Agreements:* Introduce at least one congestion metric for NR sidelink
	+ FFS details – to be done in WI phase (if included)
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| Agreements:* Congestion control is supported at least for sidelink mode 2
	+ Note: details of congestion control can be covered in the work item phase, not in this SI.
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| **Conclusion**:* It is deemed beneficial to report Sidelink Congestion Metrics(s) to a gNB
	+ Consequently, it is recommended to specify the corresponding details in the WI phase
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| Agreements:Support at least NR CBR as congestion metric for NR sidelink congestion control. * LTE CBR is the baseline for defining NR CBR.
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| Agreements:* LTE V2X sidelink congestion control is the starting point for defining NR sidelink congestion control.
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| Agreements:* Higher-layer reporting of CBR to the gNB is supported for RRC\_CONNECTED UEs.
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| Agreements:* For PSCCH/PSSCH multiplexing option 3, one CBR measurement over a resource pool is defined.
	+ PSFCH resources, if (pre)configured, are excluded from this CBR measurement.
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| Agreements:Define NR sidelink Channel Occupancy Ratio (CR) measurement.* LTE CR is the baselines
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| Agreements:* Congestion control can restrict the values of at least the following PSSCH/PSCCH TX parameters per resource pool:
	+ Range of MCS for a given MCS table supported within the resource pool
	+ Range of number of sub-channels
	+ Upper bound of number of (re)transmissions – already agreed in mode 2 AI
	+ Upper bound of TX power (including zero TX power)
* Congestion control can set an upper bound on channel occupancy ratio (CR), CRlimit.
* Ranges/bounds of the transmission parameters and CRlimit are functions of QoS and CBR.
* In addition to congestion control (in use or not in use), the above parameters can be restricted by reusing the same mechanism as in LTE
	+ For speed, further discussion on absolute vs. relative speed
	+ FFS other parameter(s) that can be restricted
	+ FFS whether or not to tie the speed with a UE capability
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| Agreements:Lookup table links CBR range with values of the transmission parameters and CRlimit for each value of the indication of a priority of a sidelink transmission carried by SCI payload (as per WA from RAN1#98), Lookup table is (pre)configured. Details up to RAN2. * Up to 16 (as a working assumption) CBR ranges are supported
	+ The working assumption will be automatically confirmed in RAN1#99 if no further input
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| Agreements:* Sidelink RSSI (SL-RSSI) measurement is used for CBR estimation
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| Agreements:A sidelink resource is busy for the purpose of CBR measurement if Sidelink RSSI measured by the UE in that resource exceeds a (pre-)configured threshold. |

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| Agreements:The CBR measurement time window size is 100 ms and 100 slots by (pre-)configuration.CR window size is { 1000 ms, 1000 slots } by (pre)-configuration |

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| Agreement:* The future segment of the CR evaluation window reuses the same behaviour as in the LTE V2X sidelink.
	+ FFS whether additional constraints on UE’s choice of values for a and b are needed
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| Agreement: For the constraints on past/future window in CR evaluation:1. n+b shall not exceed the last transmission opportunity of the grant for the current transmission
2. b >= 0
3. b < (a+b+1)/2

 Notes:* in the first bullet point above, LTE’s “should” has been replaced by “shall”
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| Agreement:* UE evaluates CR and applies CR\_limit for every (re)transmission.
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| Agreement: * The CBR processing time is given by UE capability according to the following table

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| **µ**  | Congestion process time 1 (slots) | Congestion processing time 2 (slots) |
| 0 | 2 | 2 |
| 1 | 2 | 4 |
| 2 | 4 | 8 |
| 3 | 8 | 16 |

* A UE shall only apply a single CBR/CR processing time capability in SL.
* CR processing time is the same as CBR processing time.
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| Agreement:* The slot index in the definition of CBR is the physical slot index.

Agreement:* The slot index in the definition of CR is the physical slot index.
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TX Parameter Restrictions

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| Agreements:* Only TX parameter restriction based on absolute speed can be (pre)configured in Rel-16.
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| Agreement:* In addition to congestion control (in use or not in use), the following PSSCH/PSCCH TX parameters per resource pool can be restricted by reusing the same mechanism as in LTE:
	+ Range of MCS for a given MCS table supported within the resource pool
	+ Range of number of sub-channels
	+ Upper bound of number of (re)transmissions

Note: This reverts the agreement made in RAN1#98b, which included “Upper bound of TX power” in the set of TX parameters that can be restricted using this mechanism. |

Appendix: Contributions used as basis for the summary

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| [R1-2003314](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_101-e/Docs/R1-2003314.zip) | Remaining details of QoS management for sidelink | Nokia, Nokia Shanghai Bell |
| [R1-2003384](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_101-e/Docs/R1-2003384.zip) | Remaining issues on QoS management for sidelink | vivo |
| [R1-2003499](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_101-e/Docs/R1-2003499.zip) | Remaining details of QoS management for NR sidelink | Huawei, HiSilicon |
| [R1-2003553](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_101-e/Docs/R1-2003553.zip) | Remaining issues on QoS | ZTE, Sanechips |
| [R1-2003567](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_101-e/Docs/R1-2003567.zip) | Discussion on QoS management for NR sidelink | LG Electronics |
| [R1-2003619](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_101-e/Docs/R1-2003619.zip) | Remaining issues on QoS management in NR V2X | CATT |
| [R1-2003878](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_101-e/Docs/R1-2003878.zip) | On QoS Management for NR Sidelink | Samsung |
| [R1-2004077](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_101-e/Docs/R1-2004077.zip) | Remaining open issues on QoS | OPPO |
| [R1-2004220](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_101-e/Docs/R1-2004220.zip) | Remaining Issues of Sidelink QoS Management | Apple |
| [R1-2004297](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_101-e/Docs/R1-2004297.zip) | Remaining Issues on Congestion control and QoS Management for NR-V2X | InterDigital, Inc. |
| [R1-2004549](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_101-e/Docs/R1-2004549.zip) | QoS management for NR sidelink | Ericsson |
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[R1-2004220](http://www.3gpp.org/ftp//TSG_RAN/WG1_RL1/TSGR1_101-e/Docs/R1-2004220.zip) Apple

***Proposal 2:*** *The value* $P\_{max\\_CBR}$ *in the PSSCH transmit power formula is set to infinite for mode 1.*