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.  |
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**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 |
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**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.*