# **[100b-e-NR-5G\_V2X\_NRSL-SL\_PHY\_Procedure-01] Handling TX and RX of multiple PSFCHs**

[100b-e-NR-5G\_V2X\_NRSL-PHY-Procedure-01] Email discussion/approval regarding handling TX and RX of multiple PSFCHs

* PSD of each PSFCH when transmitting multiple PSFCH TX
* Prioritization between TX and RX when the UE is required to TX/RX multiple PSFCH

till 4/23, with potential TPs by 4/28 (Hanbyul, LGE)

**1. PSD of each PSFCH when transmitting multiple PSFCH TX**

Assumption: The UE supports up to Nmax simultaneous PSFCH transmissions in a PSFCH TX occasion, and Nreq PSFCH transmissions are requested for the UE in a given PSFCH TX occasion. The UE selects N PSFCH transmissions for the actual PSFCH transmission.

Q1: How does the UE determine N for the following cases?

Q1-1: Nreq<=Nmax and TX power limit is not reached (i.e., the sum of Nreq PSFCH transmissions power before applying the upper limit does not exceed Pc,max)

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| Company | Answer |
| NTT DOCOMO | N = Nreq.In case that TX power limit is not reached, the UE should transmit PSFCHs as many as possible. |
| Apple | N=Nreq |
| ZTE, Sanechips | The message from RAN4 suggests that, even if Pcmax is not reached, there are some other reasons to require N<Nreq. Please also see our answer for Q1-2.  |
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Q1-2: Nreq<=Nmax and TX power limit is reached (i.e., the sum of Nreq PSFCH transmissions power before applying the upper limit exceeds Pc,max)

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| Company | Answer |
| NTT DOCOMO | N is up to UE implementation.If N = Nreq, power of each PSFCH transmission could be quite small. PSFCH transmission with higher priority is failed due to PSFCH transmission with lower priority. This means, a UE which supports larger Nmax has disadvantage from reliability perspective of PSFCH transmissions with higher priority. We believe that it is undesirable situation. |
| Apple | $N=\left⌊10^{\frac{P\_{CMAX}-P}{10}}\right⌋, $where P is the transmit power calculated with the existing formula in Section 16.2.3 of TS38.213, for a single PSFCH transmission.  |
| ZTE, Sanechips | We have a fundamental question upon the way these questions are asked. How to judge “Tx power limit is not reached”? The equation in Q2 for single PSFCH is capped by $P\_{CMAX}-10log\_{10}\left(N\right)$. The FL intention for the PSFCH Tx power allocation procedure seems to be framed as following: * Step-1: Tx power calculation for single PSFCH based on DL pathloss, i.e., apply equation in Q2 w/o the upper-bound of $P\_{CMAX}-10log\_{10}\left(Nreq\right)$.
* Step-2: derive number of actual PSFCH to be transmitted, N, based on {step-1 result, Nreq, Nmax}
* Step-3: With N determined, apply the equation in Q2 again, but this time with the upper-bound of $P\_{CMAX}-10log\_{10}\left(N\right)$

The three above steps construct an overall strange framework. With step-2, the capping of $P\_{CMAX}-10log\_{10}\left(N\right)$ in step-3 may not be necessary. In addition, neither RAN1 agreement nor current RAN1 spec relies on the logic that the same pathloss-based power adjustment should be applied twice. We also have a concern for using spec to mandate Nreq reduction (PSFCH dropping) just because DL pathloss based Tx power exceeds a threshold, given the DL pathloss calculation is generally not accurate enough and the parameters in the power control formula may also not be configured as optimized. Our preference is that: the determination of N from {Nreq, Nmax} is an UE implementation issue, which may take power limitation into consideration. But such consideration may or may not drop PSFCH every time when DL-pathloss drives the total PSFCH power beyond Pcmax. So **for Q1-1, Q1-2, Q1-3, Q1-4, we have the same unified answer:** **N PSFCH are selected based on priority, where N≤ min{Nreq, Namx} and exact value of N is by UE implementation.** |
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Q1-3: Nreq>Nmax and TX power limit is not reached (i.e., the sum of Nmax PSFCH transmissions power before applying the upper limit does not exceed Pc,max)

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| Company | Answer |
| NTT DOCOMO | N = Nmax.In case that TX power limit is not reached, the UE should transmit PSFCHs as many as possible. |
| Apple | N=Nmax |
| ZTE, Sanechips | The message from RAN4 suggests that, even if Pcmax is not reached, there are some other reasons to require N<min{Nreq,Nmax}. Please also see our answer for Q1-2. |
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Q1-4: Nreq>Nmax and TX power limit is reached (i.e., the sum of Nmax PSFCH transmissions power before applying the upper limit exceeds Pc,max)

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| Company | Answer |
| NTT DOCOMO | N is up to UE implementation.If N = Nmax, power of each PSFCH transmission could be quite small. PSFCH transmission with higher priority is failed due to PSFCH transmission with lower priority. This means, a UE which supports larger Nmax has disadvantage from reliability perspective of PSFCH transmissions with higher priority. We believe that it is undesirable situation. |
| Apple | $N=\left⌊10^{\frac{P\_{CMAX}-P}{10}}\right⌋, $where P is the transmit power calculated with the existing formula in Section 16.2.3 of TS38.213, for a single PSFCH transmission. |
| ZTE, Sanechips | Please see our response for Q1-2.  |
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Q2: Once N is determined by the answer to Q1, do you agree that the TX power of each PSFCH is given by the following modified equation (to replace the one in Section 16.2.3 of TS 38.213)?

$P\_{PSFCH,k}(i)=min\left(P\_{CMAX}-10log\_{10}\left(N\right),P\_{O,PSFCH}+10log\_{10}\left(2^{μ}\right)+α\_{PFSCH}⋅PL\right)$ [dBm]

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| Company | Answer |
| NTT DOCOMO | OK |
| Apple | We think each PSFCH transmit power is still given by the existing formula in Section 16.2.3 of TS38.213. No need to modify the equation. |
| ZTE, Sanechips | Ok. |
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**2. Prioritization between TX and RX when the UE is required to TX/RX multiple PSFCH**

Q3: Do you agree the following proposal to determine the priority of PSFCH TX and RX when the UE is required to transmit/receive multiple PSFCHs?

* Proposal:
	+ When the UE is required to transmit more than one PSFCH, the highest priority of the associated PSCCH/PSSCH is used for prioritization of the PSFCH transmission.
	+ When the UE is required to receive more than one PSFCH, the highest priority of the associated PSCCH/PSSCH is used for prioritization of the PSFCH reception.

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| Company | Answer |
| NTT DOCOMO | Direction is OK.One comment is, the proposal should be clarified that the assumed case is collision between PSFCH TX and PSFCH RX, where at least either TX or RX is more than one.Question is saying that, while proposal does not. We believe that other case does not use the above rule. |
| Apple | Agree |
| ZTE, Sanechips | Yes, agree. We also have the same feel as DoCoMo: the proposal should clarify the scope where the rule applies.  |
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