[100b-e-NR-5G\_V2X\_NRSL-PHYstructure-04]

Email discussion/approval regarding SCI related

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   - A. Indication of MCS tables (if necessary) and MCS table determination

till 4/24, with potential TP till 4/29 – Jeongho (SS)

This document has the following question.

* A. How to indicate MCS table to be used for PSSCH?

# **A. How to indicate MCS table to be used for PSSCH?**

Based on the submitted contributions, there are the following alternatives and supporting companies.

* Alt A-1. Indication by 1st SCI, if more than one MCS tables are configured
  + [Huawei, HiSilicon], [MediaTek], [LGE], [CATT], [CMCC], [InterDigital]
* Alt A-2. Only 1 table is configured per resource pool
  + [ZTE, Sanechips]
* Alt A-3. Only 1 table is configured per resource pool. This can be overwritten by PC5-RRC.
  + [Intel], [Apple], [NTT DCM]
* Alt A-4. Indication by 2nd SCI, if more than one MCS tables are configured
  + [Futurewei], [Ericsson]

Based on the contributions, the following proposal can be made.

*Proposal 1. The MCS table is indicated by Indication by 1st SCI, if more than one MCS tables are configured (multiple MCS tables can be (pre-)configured per resource pool.*

Please share your views if Proposal 1 is agreeable or, if not, please share your views on the reason why it is not workable.

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| **Company** | **Views** |
| NTT DOCOMO | We are supportive of the proposal, if more than one MCS table are mandatory feature.  Otherwise, i.e. if only one MCS table is mandatory feature, the mandated table is used for broadcast/groupcast. The remaining MCS tables are used for unicast only, where PC5-RRC message is exchanged. Traffic type and channel condition at the link will not be changed dynamically; hence Alt A-3 is sufficient in this case. |
| Huawei, HiSilicon | Yes  Indication of MCS table by 1st-stage SCI allows MCS table changes for groupcast in addition to unicast (PC-5 RRC is applicable for unicast only). PT-RS is determined based on MCS, and indication of MCS table in 2nd-stage SCI does not seem to work, unless a further elaborate scheme to enable it is envisioned. |
| CMCC | We agree with the proposal.  In our view, allowing to (pre)-configure multiple MCS tables per resource pool is beneficial to support different services and to improve resource utilization, and the MCS table used by a Tx UE for a certain PSSCH transmission can be indicated in the SCI. Since the 5bit MCS index is carried in the 1st SCI, we think it is straightforward to also indicate the MCS table in the 1st SCI. |
| Intel | We disagree with the proposal.  We don’t see why it is necessary to have multiple MCS tables configured for the broadcast case. Especially, since some tables contain entries that are not mandatory to support by UE. |
| Apple | Not agree.  We think a single MCS table (i.e., legacy 64QAM MCS table) is (pre)configured per resource pool. Hence, no need to increase L1 signaling overhead.  The support of 256QAM MCS table or low spectrum efficiency MCS table depends on UE capability, and these two MCS tables may not be suitable for broadcast or many groupcast cases. Hence, PC5-RRC can be used to overwrite the configured MCS table if needed for unicast. |
| Sharp | It depends on how we conclude the FFS on whether support for 256QAM is mandatory or is a UE capability from RX UE perspective. If it is a UE capability, the 256QAM MCS table is not applicable to broadcast and groupcast (i.e. the legacy 64QAM MCS table is the only choice for broadcast and groupcast), and it is thus unnecessary to indicate the MCS table in SCI. If it is otherwise mandatory to support 256QAM from RX UE perspective, the proposal here should be supported. |
| LG | We are supportive of the proposal.  In case of A-3, it is necessary to consider what will be the UE behavior during the PC5-RRC (re)configuration period. To be specific, TX UE and RX UE would have different understanding on the MCS table for a certain duration of time. In this case, the TX UE cannot decode PSSCH properly. To avoid this situation, it would be necessary that the TX UE does not transmit any PSCCH/PSSCH for a certain duration of time. Note that NR Uu link can use fallback DCI during the RRC (re)configuration period for this purposes.  Alternatively, it can be considered that the TX UE indicate which MCS table is used via SCI to avoid this ambiguity problem. In this case, the TX UE will indicate normal 64 QAM table during the (re)configuration period. When the TX UE determines that TX UE and RX UE have the same understanding on the configuration of MCS tables, then the TX UE can indicate other MCS table via SCI. Meanwhile, the bit field size of the MCS table indicator needs to be (pre)configured or fixed, but not PC5-RRC configured. In this case, for simplicity, it can be considered that the supportive MCS tables are (pre)configured in a resource pool, and the TX UE can select MCS table considering UE capability. |
| CATT | We agree with this proposal. |
| vivo | We disagree this proposal. Alt A-2 or Alt A-3 is fine to us (slightly prefer Alt A-3).  The FL proposal (i.e. Alt A-1) will introduce other issues, such as CQI association. Each MCS table has an associated CQI table for CSI derivation. If more than one MCS tables are configured (thus more than one CQI tables), a UE receiving a 4-bit CQI cannot not be aware of which CQI table the CQI associated with. The MCS indication in SCI does not help.  On the other hand, if only one MCS table is configured, there is no CQI ambiguity issue. |
| OPPO | Agree with the proposal, but it should be clarified that 256QAM MCS table should not be configured alone for a resource pool, as 256QAM transmission is up to UE capability. Additionally, at most 2 MCS tables should be configured per resource pool, otherwise more bits in SCI-1 are needed. |
| Ericsson | We are fine with the proposal. |
| Bosch | Alt-3 is the preferable alternative to us, as far as one MCS table per resource pool remains a baseline to guarantee no ambiguity.  We also agree that a 256-QAM table may not be needed for broadcast and groupcast communication for majority of the services. Hence, if a UE needs such a table (for unicast session), the UE may request this via PC5-RRC. However, for groupcast, the UE may still be able to select a resource pool that configures a 256-QAM table, i.e., if possible. |
| Futurewei | Agree with the proposal |
| InterDigital | Support the proposal. Supporting multiple MCS tables have been agreed already to support various traffic types with different QoS levels. Indication in 1st SCI is the only way to support dynamic change of the MCS table according to the QoS level of the packet transmission. |
| Samsung | We disagree with the proposal.  We do not see any benefit of increasing SCI signaling overhead to indicate MCS table. Alt 3 seems enough to use of multiple MCS tables. |
| ZTE,Sanechips | We disagree. Still we support A-2. To allow flexibility of updating the MCS table, A-3 is .also acceptable Additional L-1 signalling is not preferred |
| Spreadtrum | We agree with the proposal. |
| TCL | We agree with the proposal. |
| Qualcomm | We view unicast as the primary use case for the 256-QAM since transmitting with such high SE without a CQI report will have reliability issues (in addition to the differences in channel quality between different UEs). Therefore, it’s likely to have both the 256-QAM and 64-QAM MCS tables be in use in the same pool.  The low spectral efficiency 64-QAM MCS table is optional and it’s not yet decided whether 256-QAM reception is optional or mandatory but overriding via PC5-RRC could be possible for both tables.  The advantage of both Alt A-3 and Alt A-4 is to save bits in SCI-1, which is desirable. They need to assume a default table, as proposed by Intel, to use for SCI-2 decoding (including PT-RS resource determination) and would still need a bit in SCI-2 to resolve ambiguity during connection reestablishment after link failure (signal a fallback table). Alt A-4 would need complete decoupling of beta and MCS/TBS as in Ericsson’s contribution and a method to address PTRS or the default table proposal.  We think 1 bit is needed, this bit can be in SCI-1 or SCI-2. So, Alt A-1, Alt A-3 (with SCI indication), and Alt A-4 (with SCI-2/PTRS handling) can all be ok. |
| MediaTek | Agree with the proposal. Supporting multiple MCS tables in a resource pool can avoid resource partition due to different MCS tables. Accordingly, the indication in SCI can provide the specific MCS table assumption for each transmission (per link) with sufficient flexibility. |
| Nokia, NSB | Fine with proposal. While the potential increase in the size of 1st stage SCI is unfortunate, the benefit is that it is simple and flexible. |

**FL summary from the first round of discussion**

* The proposal based on Alt A-1 is supported by NTT DCM, Huawei, HiSilicon, CMCC, LG, CATT, OPPO, Ericsson, Futurewei, InterDigital, Spreadtrum, TCL, [Qualcomm](with 1 bit) , MediaTek, Nokia, NSB
* Intel, Apple, vivo, Bosch, Samsung, ZTE, Sanechips think no need to configure multiple MCS tables.
* Sharp thinks there is dependency with UE capability on 256QAM.

The clear majority view is to use SCI indication. The follow-up discussion is recommended to focus on whether there is a critical issue on the proposal.

*Proposal 1 (almost consensus)*

* The MCS table is indicated by Indication by 1st SCI, if more than one MCS tables are configured (multiple MCS tables can be (pre-)configured per resource pool.