

Source: Ericsson, Alcatel-Lucent, CATT, Freescale Semiconductor, Huawei, Icera Semiconductor, Interdigital, IPWireless, LGE, Mitsubishi, Motorola, Nextwave, Nokia, Nokia Siemens Networks, Nortel, NTT DoCoMo, Panasonic, Philips, Qualcomm Europe, Samsung, Sharp, Texas Instruments, ZTE
Title: Way forward for CQI reporting
Agenda Item: 7.2.4
Document for: Discussion and Decision

1. Introduction

RAN1#49 agreed to the following way forward for the CQI reporting needs:

- The time and frequency resources that can be used by the UE to report CQI are controlled by the eNB
- Baseline is periodic CQI reporting. The possibility of linking the configuration of a periodic reporting cycle to a persistent scheduling cycle should be considered. Trigger-based CQI reporting, in addition to periodic CQI reporting, is FFS.
- Types of CQI reporting:
 - Wideband CQI report: up to 5 bits (assuming SIMO)
 - Multi-band CQI report: equivalent resolution up to 5 bits per sub-band (assuming SIMO)
 - Sub-band is defined as the band to which a CQI value is related
 - CQI reports for applicable MIMO schemes
 - Combination of the above types of CQI reporting is FFS
 - Overhead is added, e.g. from compression schemes or due to combination of different CQI reports
- Total number of CQI bits (including overhead) in a PUCCH subframe per UE shall not exceed approximately 10 bits (independently from the system bandwidth) assuming QPSK and an approximate code rate of up to 1/2, actual modulation and coding FFS

RAN1#50 agreed to have TDM (before DFT precoding) between CQI and transport block data on PUSCH

2. Proposed way forward

Proposed way forward for CQI reporting:

- CQI, PMI and rank can be transmitted on PUCCH and PUSCH
 - PUSCH is used when and only when UE is scheduled in uplink.
 - CQI, PMI and rank can be transmitted on PUSCH even without simultaneous data transmission.
 - Multiple message sizes will be defined
 - No blind decoding for Node B.
 - PUCCH is used when and only when UE is not scheduled in uplink.
- Reporting can be periodic or aperiodic.
 - Periodic reporting
 - Periodic reports are transmitted on PUSCH when UE is scheduled in uplink and on PUCCH when UE is not scheduled in uplink.
 - The eNB configures a set of sizes and formats of the report
 - Size and format of the report may be dependent on whether it is transmitted over PUCCH or PUSCH
 - The possibility of linking the configuration of a periodic reporting cycle to a persistent scheduling cycle should be considered.
 - The possibility of masking the periodic report with DTX/DRX patterns should be considered
 - Aperiodic reporting is FFS
 - Aperiodic reports are scheduled by eNB in downlink (details of signaling FFS) and transmitted by the UE on PUSCH (or PUCCH is FFS)
 - Aperiodic report size and message format can be flexible in terms of size and contents but format needs to be configured by the eNB and reported to UE (e.g. via RRC).
 - In case both periodic and aperiodic reporting would occur in the same subframe, only the aperiodic report is transmitted in that subframe.

- The following types of multi-band CQI reports are under consideration (where sub-band sizes (number of PRBs) are configured by the network):
 - “eNB-selected sub-bands reported in one PUSCH subframe”
 - Includes the possibility to select all sub-bands.
 - One value per codeword (or average over two codewords) is reported for each selected sub-band.
 - Differential representation
 - “eNB-selected sub-bands reported using one or multiple PUCCH subframes”
 - Includes the possibility to select all sub-bands.
 - One value per codeword (or average over two codewords) is reported for each selected sub-band.
 - Differential representation
 - “UE-selected sub-bands over PUCCH or PUSCH”
 - UE reports which sub-bands it has selected
 - Differential representation is not precluded
 - For selected sub-bands the following alternatives are considered for the report:
 - One value per codeword (or average over two codewords) per selected sub-band
 - Average over all selected sub-bands
 - Some additional information should also be possible to be reported.
 - Wideband CQI information, or
 - Information for the other (not selected) bands (e.g. an average value).
- CQI reporting metric is TBD
 - RAN4 has proposed a CQI definition that relates directly to link adaptation parameters like TBS or MCS [1].

3. References

- [1] R1-072650 (R4-070802), “LS on CQI reporting requirements for E-UTRA UE”, RAN4