

Source: Motorola
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1. Introduction

RAN1#48 (St. Louis) agreed [1] that at least reference symbol received power (RSRP) and E-UTRA carrier received signal strength indication (RSSI) were appropriate physical layer measurements in support of unicast mobility. The use of reference symbols (RS) as the basis for physical layer measurements¹ or channel quality indication (CQI) reports in support of link adaptation for unicast operation in both single- and multi-stream configurations has also been the subject of many contributions. The further decision in RAN1#48 that MCH transport channels mapped onto a single subframe originate from a single multicast broadcast single frequency network (MBSFN) area (i.e. SFA) – and are therefore subject to a cell-common set of reference symbols (RS) according to the MCH subframe format of TS36.211 (Fig. 9) – permits further progress to be made in the area of CQI reporting to support slow rate and coverage adaptation for the adopted multi-cell MCH MBSFN mode.²

2. Principles Governing Channel Quality Indication (CQI) for MCH

The discussion to date (e.g. [2][3][4][5]) permits some key principles to be adopted in the area of MCH CQI reporting and coverage adaptation:

- 1) *MCH CQI reports are generated from observations of the common RS's associated with MCH subframes allocated to an SFA.* The precise formulation of the RS-related metric is for further study.
- 2) *An MCH CQI report is associated with a single SFA.* This is a natural consequence of the working assumption that MCH transport channels mapped onto a single subframe originate from a single multicast broadcast single frequency network. As a consequence, MCH CQI reports are applicable to all MCH's transported by the SFA. Although RAN1 has not yet concluded on the number of MCH's that may be multiplexed into a single subframe, the report would then be applicable to all MCH's supported by the SFA.
- 3) *MCH CQI reports terminate at the eNB, but would be further transferred (possibly after modification or consolidation) to the Multi-cell/Multicast Coordination Entity (MCE).* This principle arises from the role [6] of the MCE to allocate radio resources used by all eNB's in the SFA, including allocation of time-frequency resources and determination of the applicable modulation and coding scheme. Note that this is consistent with the slow transport block

¹ The terms “physical layer measurements” and “CQI” are used synonymously here in relation to MBSFN operation. The term CQI is used for convenience since the measurements are not mobility related, but relate to MBSFN rate and coverage adaptation. Nevertheless, given the low rate of reporting compared to unicast link adaptation, the report described here may be best defined as a measurement report.

² MBMS CQI reporting applicable to any single-cell modes adopted for MBMS is for further study.

adaptation physical channel model for the MCH (TS 36.300) and proposed methods of synchronizing MBSFN content via the introduction of a synchronization sub-layer terminating in the MBMS UPE [7][8].

3. Metrics for MBSFN CQI Reporting

Further, given the decisions of RAN1#48, the following principles for MCH CQI reporting may be established concerning metrics for the MCH CQI report:

- 1) *All of the common RS's in an MCH subframe allocated to a specific SFA may be used for MCH CQI generation.* Clearly, all OFDM symbols bearing RS's in the subframe – i.e. the SFA-common RS's in OFDM symbol 2 in the first slot of Figure 9 of TS 36.211 plus OFDM symbols 0 and 5 of the second slot in the same figure – are eligible for MCH CQI metric generation.
- 2) *The MCH CQI measurement bandwidth is equal to the SFA bandwidth.* Since RAN1 has determined that all RS's in an MCH-allocated subframe are sourced from a single SFA, and since – given the MCH physical model – frequency selective scheduling is clearly not applicable to the MCH, the measurement bandwidth is the entire downlink carrier bandwidth of the SFA. Further, since any UE accessing an SFA (in RRC_ACTIVE or RRC_IDLE mode) is by definition aware of the bandwidth of the SFA, it is not necessary to signal a measurement bandwidth for MCH CQI reporting.

4. Conclusions

While the transmission configurations applicable to LTE MBMS are not yet completely specified, the working assumptions to date on MCH design and mapping onto SFA's now permit further definition of MBSFN physical layer measurement reporting to be progressed. It is proposed that RAN1 communicate the principles above to RAN2 and RAN4 via an appropriate LS [9].

5. References

- [1] R1-071156, Motorola, NTT DoCoMo, Panasonic, Siemens, “LS on LTE Measurement Supporting Mobility”
- [2] R1-070063, Motorola, “E-MBMS with Feedback”, Sorrento, Italy, January 15-19, 2007
- [3] R2-070726, Motorola, “Uplink Feedback for E-MBMS”, St. Louis, USA, 12-16 Feb. 2007
- [4] R2-061985, Motorola, “MBMS Modulation and Coding State Selection”, Cannes, France, June 27-30, 2006
- [5] R2-070537, Panasonic, “Uplink Feedback for eMBMS SFN Operations”, St. Louis, USA, 12-16 Feb. 2007
- [6] R3-062015, LS RAN3 to RAN1, RAN2 and SA2 “LTE-MBMS Discussions in RAN3”, Riga, Latvia, 6-10 Nov. 2006
- [7] R2-070242, Nokia, “Radio Link Layer and Content Synchronization for MBMS”, St. Louis, USA, 12-16 Feb. 2007
- [8] R2-070573, Ericsson, “L2 MBMS Content Synchronization”, St. Louis, USA, 12-16 Feb. 2007
- [9] R1-071435, Motorola, “Draft LS on Physical Layer Measurements for MBSFN”, St. Julians, Malta, 26-30 March 2007