3GPP TSG RAN WG1#46 **R1-061996**
Tallinn, Estonia
Aug. 28 – Sep. 1, 2006

Source: **Motorola**
Title: **Observations on 64QAM in SFN Mode for E-MBMS**
Document for: **Discussion**

1. Introduction

The use of 64QAM is, of course, a working assumption for the LTE downlink, and 64QAM has been included in establishing reference E-MBMS performance levels in several contributions [1][2]. In this contribution we very briefly investigate the utility of 64QAM for E-MBMS through system simulations. We focus on the behaviour of dual-port receiver operation for LTE Cases 3 and 4 (modified for 5MHz bandwidth) noting that single-port receiver operation would obviously be further degraded. An extreme UE velocity (350km/h) is considered simply to explore the bounds of performance, noting (as stated below) that while the majority of applicable impairments are included, channel estimation error is not yet addressed in the absence of a fully finalised reference symbol configuration for E-MBMS.

2. Simulations

The performance criterion used is coverage (%) vs. spectral efficiency (bps/Hz) where a user is defined as in outage if the simulated FER is greater than 1%. Link impairments considered include receiver thermal noise, Doppler induced inter-carrier interference (ICI), the effect of delay spread in excess of the CP length, and implementation losses at the eNB transmitter and UE receiver. Due to the lack of formally agreed reference pilot structures, channel estimation error is not considered at this time, but is seen as an important determinant of performance. A description of the simulated impairments and the modulation/coding schemes used in determining FER can be found in [3].

Figure 1 shows simulation results for both modified LTE Case 3 and LTE Case 4. For LTE Case 4, 64 QAM allows increased spectral efficiency at 100% coverage level. The same is not true in LTE Case 3. Even at speeds of 3kmph, less than 65% coverage is achieved using 64 QAM. Indeed, the more robust 16 QAM also proves insufficient providing a maximum of 92% coverage, short of the 95% and 99% acceptable target levels.

3. Conclusion

Initial simulation results indicate 64 QAM does enable increased spectral efficiency at acceptable coverage levels for LTE Case 4 but does not provide realistic enhancement for LTE Case 3.

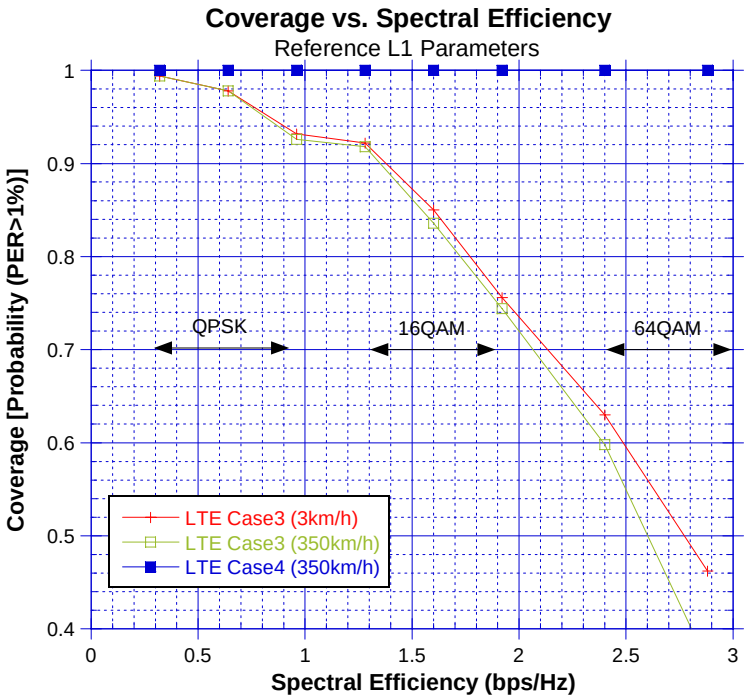

Figure 1 – Coverage versus spectral efficiency for LTE Case 3 and Case 4.

4. References

[1] R1-061847, Nortel, "Supporting TV broadcast services in LTE (LTE-B)", Cannes, France, June 27-30 2006

[2] R1-061445, Texas Instruments, "E-MBMS performance: Data Rates and Coverage", Shanghai, China, May 8-12 2006

[3] R1-061998, Motorola, "Observations on Alternative L1 Parameters for E-MBMS", Tallinn, Estonia, Aug 28 – Oct 1.