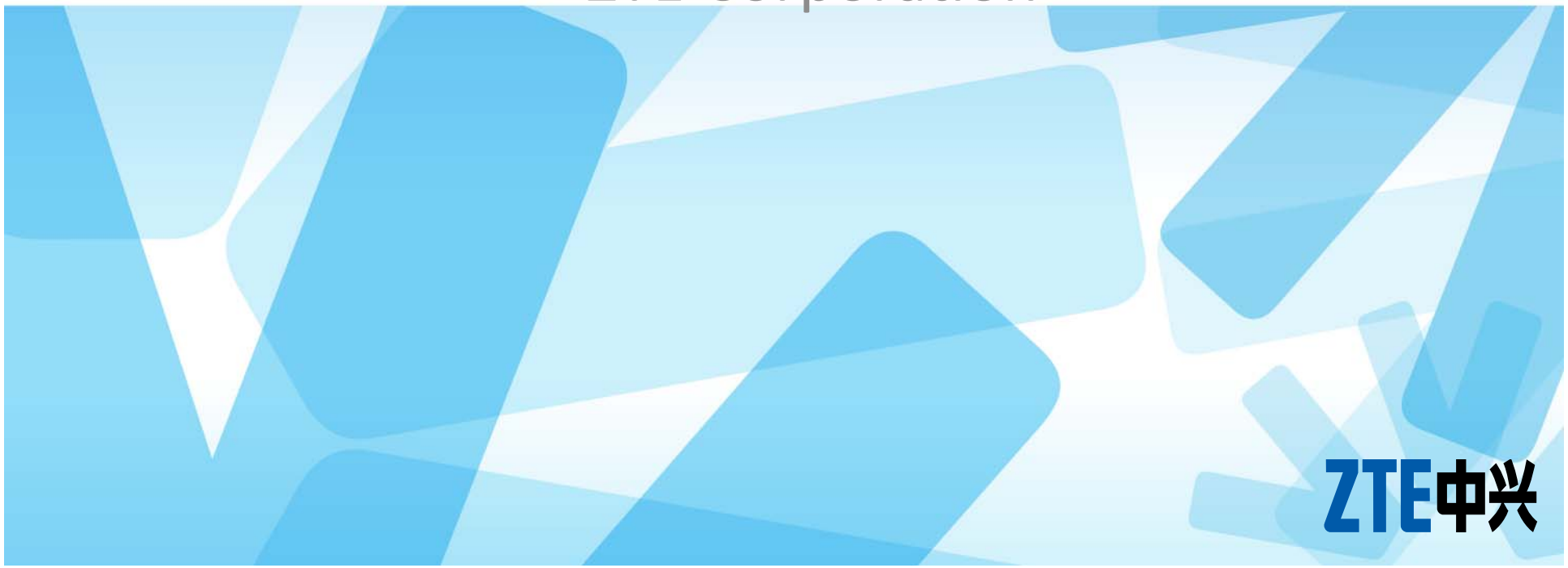
3GPP TSG RAN Meeting #65
Edinburgh, Scotland, 9 - 12 September 2014

RP-141191

Motivation for new WID proposal for the High Power BS 256QAM

ZTE Corporation



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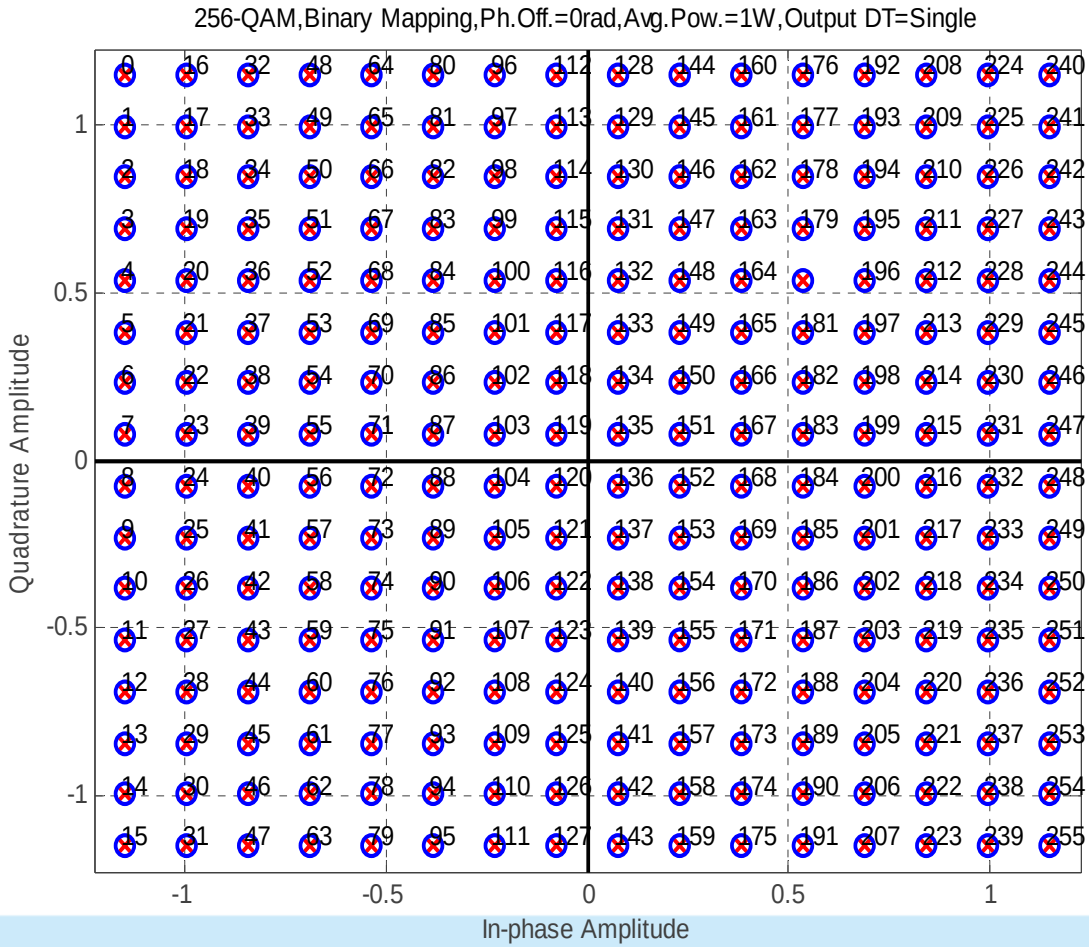
What is Higher Order Modulation?

- To achieve ultra-high capacity mobile networks and to improve the spectrum efficiency (bps/Hz), high order modulation (HOM) schemes, e.g. 64QAM and 256QAM has been employed
- HOM consists of:
  - Downlink 64QAM and 256QAM
  - Uplink 64QAM and also 256QAM if UE hardware permitted
- HOM is used in Adaptive Modulation and Coding scheme/algorithm for LTE and HSPA BSs
  - Leverage the SNR degradation due to frequency selective fading channels
  - Effective means for MIMO and beamforming transmissions
- HOM can improve user data rates
  - Proven to be effective in small cells deployment scenarios
  - Better user experience for users in HOM utilisation area
- Existing HSPA and LTE BS classes can support downlink HOM up to 64QAM
  - Evolution of RF hardware technology could enable support of 256QAM

256QAM Constellation Diagram

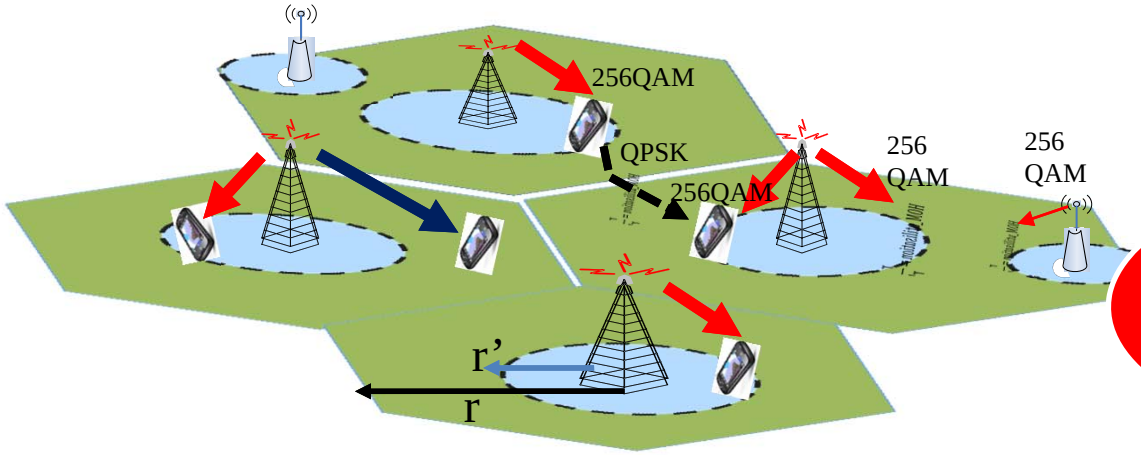
- Each constellation point carries 8-bit information

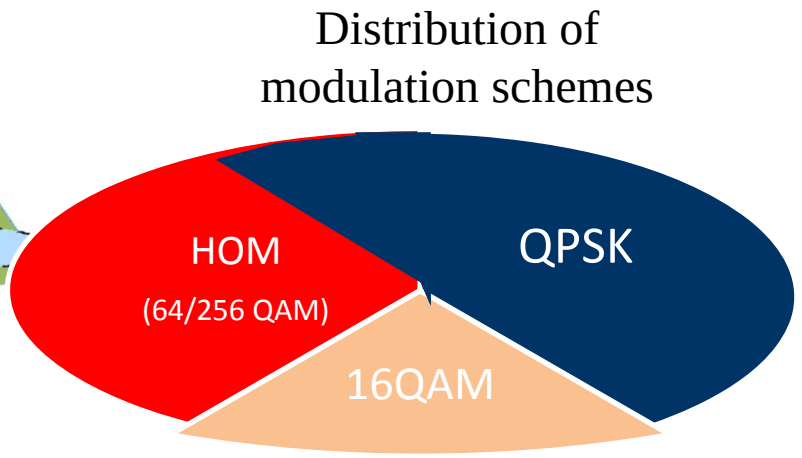


Constellation of 256QAM using rectangular-type QAM modulator

HOM Utilisation Area

- HOM utilisation increases with favourable channel condition, i.e. when UE close to BS
  - HOM utilisation factor can be defined as the ratio of HOM coverage with respect to the total cell coverage
  - HOM utilisation can be estimated from distribution of modulation schemes, obtained via e.g. field measurements
- Allowing macro/micro BSs to operate HOM can increase the HOM utilisation under HetNet deployment scenarios





Standardisation background

- HOM (256QAM) is part of feature under Small Cell Enhancements (SCE) work item (WI)
  - HOM feature implemented in small cell base stations: Home BS (20 dBm), Local Area BS (24 dBm)
  - Other small cell BS classes do not support 256QAM
- HOM (256QAM) has been implemented in IEEE 802.11 WiFi systems
- UE can support downlink 256QAM accordingly
  - 64QAM is supported via UE category
  - 256QAM implementation in UE is based on UE categories
- Uplink 256QAM is not supported
  - New WI proposal to support uplink 64QAM (RP-140152)
  - No plan to support uplink 256QAM
- ZTE submitted HiPow BS 256QAM SID (RP-140220)
  - Some companies' views:
    - NSN: we would not like to add extra work to RAN4 and consider this for next REL
    - ALU: agrees with NSN; how can we derive requirements based on local area BS?
    - ALU: is related to LS from RAN4 RP-140024, can be considered as REL independent
    - RAN chair: if REL-independent then there is no urgency
    - RAN chair: we will see LSin RP-140024 later and see whether anything needs to be added to existing WI LTE_SC_enh_L1-Core
    - ZTE: We believe separate SID can ensure systematic support of 256QAM in a release independent manner.
- RAN#63 decisions: RP-140510
  - The requirements studies and work for 256QAM for medium range BS will start once the requirements for Local Area BS and Home BS have been finalized.

Contents

New WI: Support of 256QAM for High Power BS Class

- Justifications:
  - Improved network capacity and spectral efficiency
  - Hardware technology advancement
- Scope of WI:
  - UTRA and E-UTRA BS, Tx output power level of larger than 24dBm
- Aspects of study:
  - BS and/or UE RF performance evaluation and analysis
  - Identify specification impacts

Detailed Objectives

- Feasible and suitable solution(s) towards High power 256QAM RF requirements, especially for EVM requirement. The solution(s) will focus on:
  - Tx output power level of larger than 24dBm. Some typical values such as 33 dBm, 37 dBm, 38dBm and 43dBm can be considered.
  - Include both UTRA and E-UTRA BS as the hardware capability is similar for both systems.
  - Identify the impact to UE RF, if any.

- To obtain the achievable performance requirement levels, taking into consideration of several factors or impairments in the hardware of BS transmitter.

256QAM Impacts on RAN1 Specs

- Modification to MCS table has been completed under SCE work
- No impact expected for high power BS support of 256QAM

256QAM Impacts on RAN2 Specs

- Existing RRC signalling and MAC protocol can support 256QAM
  - Due to the SCE work
- No impact expected for high power BS support of 256QAM

256QAM Impacts on RAN3 Specs

- No impact

256QAM Impacts on RAN4 Specs

- Use SCE WI work as guidance
- UE RF
  - Core requirements: maximum input level, inband emission (I/Q image rejection)
- BS RF
  - Core requirements: EVM, power control dynamic range
  - Conformance test requirements: test models, test procedure
- Performance
  - Some demod performance work
- Specification impacts:
  - UE specifications - TS xx.101
  - BS specifications – TS xx.104
  - BS conformance specifications – TS xx.141
  - RRM core requirements – TS xx.133

    where xx – 25, 36

New FRC → If Tx EVM is different from SCE WI, otherwise re-use existing FRCs.

Recommendations

- Observations:
  - SCE WI only focus on <24 dBm BS class → need to start a new WI for 256QAM
  - Release Independence → Legacy releases support via shadow CRs
    - RAN chair: considers this as a REL-13 topic, any urgency for it? no spec impact before REL-13
    - ALU: is related to LS from RAN4 RP-140024, can be considered as REL independent
- Early RAN#65 approval as Rel-13 WI
  - Early approval is beneficial to allow further technical preparations
  - Divide the work into 2-phase:
    - Phase 1: Study the BS classes with Tx output power >24 - 38 dBm, 43 dBm could be considered also.
    - Phase 2: Specify the RAN4 requirements for BS classes with Tx output power 38 – 43 dBm.

Bringing you Closer

Thanks!