



3GPP TSG-RAN WG4 Meeting #82  
Athens, Greece, 13 - 17 Feb 2017  
Agenda Item: 12

R4-1700561

Motivation for a WI proposal:  
**CRS-IM Performance Requirements for  
Single RX Chain UEs**

**Intel Corporation**

# Work Item Justification

## Single RX Chain Devices

Many LTE IOT devices are expected to be equipped with single RX chain in order to achieve cost reduction, reduced power consumption and smaller device size

Single RX chain IOT devices can be used in a variety of different use cases:

- Low cost IOT (MTC, eMTC, NB IOT): low data rate, low power, low complexity/cost MTC use cases such as smart metering, building automation, smart city, etc
- Wearables (FeMTC, Cat 1 UE + 1RX): 1RX can be used for more high end use cases such as wearables, which still require reduced power consumption, but support higher data rate and have more flexibility in terms of the baseband complexity.

# Work Item Justification

## Advanced Receivers for Single RX Chain

In the LTE Rel.11-14, multiple enhancements of UE advanced receiver for the interference-limited environments were introduced

- Key enhancements include LMMSE-IRC, CRS-IM, SU-MIMO IS/IC, NAICS, and others.
- All previous enhancements were introduced for UEs with either 2 or 4 RX chains

### Single RX chain UEs

- All existing performance requirements for 1 RX chain UEs are defined for the noise limited scenarios and are based on MRC processing.
- Advanced IS/IC receivers can be used to improve the performance in the interference-limited conditions.
- Advanced receivers imply increased UE implementation complexity and not recommended for low cost MTC. Meantime, wearable devices are capable to support increased baseband complexity and can potentially support IS/IC features.

# Work Item Justification

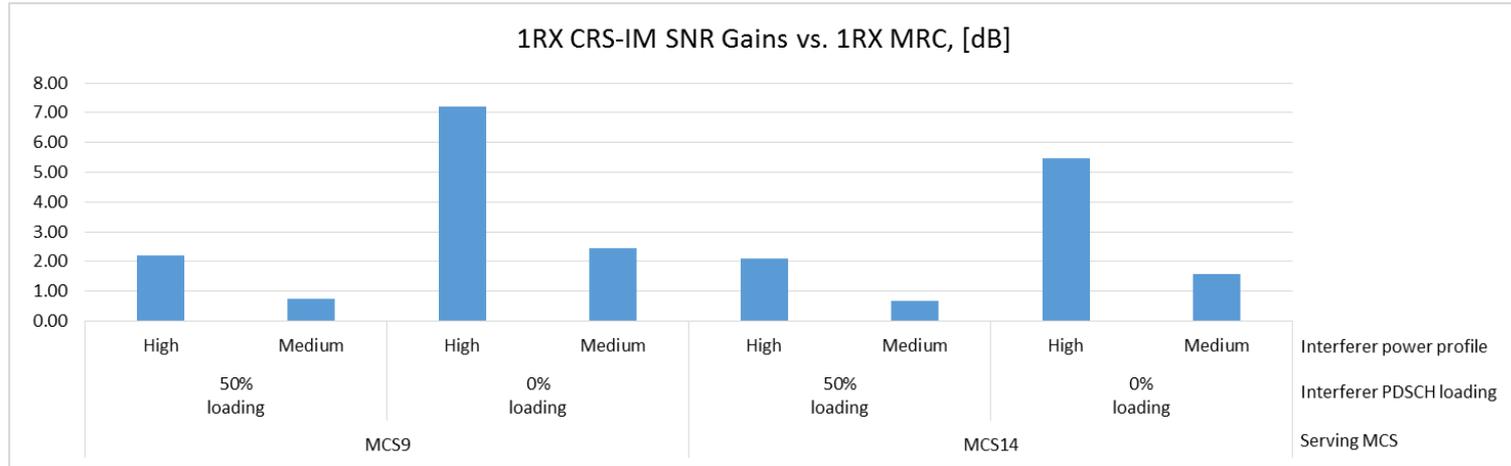
## CRS-IM for Single RX chain

CRS-IM techniques can be used for Single RX chain UEs to improve demodulation performance in the interference-limited scenarios

- Single RX chain UEs cannot apply the linear interference suppression (e.g. MMSE-IRC).
- Non-linear interference suppression and cancellation (IS/IC) techniques can be used to improve the performance in the interference-limited conditions.
- CRS-IM functionality is considered to be a viable candidate to improve the 1RX chain UEs performance in many interference-limited scenarios considered in the Rel-13 CRS-IM and Rel-14 Enhanced CRS-IM work items
- Comparing to other IC techniques, CRS-IM functionality has relatively limited complexity impacts and should not significantly affect the power consumption which are both important factors for the 1RX capable UEs.

# Work Item Justification

## CRS-IM for Single RX chain



*CRS-IM can provide substantial performance gains for the 1 RX chain UEs in the interference-limited scenarios with the dominant CRS interference*

# Work Item Justification

## Summary

### CONCLUSIONS

- Single RX capable UEs are emerging in the market
- UEs with Single RX chains are not expected to have interference mitigation capabilities
- Inter-cell interference is one of the key factor limiting the DL performance in the LTE networks
- CRS-IM receivers can provide substantial performance improvement for the 1RX capable UEs.

### PROPOSAL

- Organize Rel-15 RAN4-led WI to introduce CRS-IM performance requirements for the single RX chain UEs with the focus on the wearable use cases

# Work Item Objectives

## Investigate feasibility of CRS-IM receivers for the UEs equipped with 1 RX chain

- Identify target scenarios including deployment scenarios, interference models, and others.
  - Reuse Rel-13/14 CRS-IM assumptions as the starting point.
- Identify reference CRS-IM receiver structure assumptions including at least number of cancelled interference cell(s)
- Evaluate the CRS-IM performance benefits for the Single RX chain UEs

## Specify UE demodulation and CSI reporting performance requirements for the UEs equipped with 1 RX chain

### The work should be done under the following assumptions:

- Target device types
  - Rel-14 “Cat 1 UE + 1RX” capable devices
  - Rel-14 FeMTC capable devices
- Consider both 2 and 4 CRS APs scenarios
- Focus on the Non-colliding CRS scenarios

