

Spark NZ's views on RAN Rel 19



Spark^{nz}

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Improving capacity

The Physical layer is reaching maturity. Space domain and frequency domain are orthogonal ways to improve capacity.

Getting more spectrum is challenging as all bands are now encumbered with existing users and the use of mobile comes at a price of onerous co existence conditions. Higher bands – Mm wave and above suffer from sparsity and low channel rank

Getting more from MIMO (space domain) is part of every release and will likely be the case for Rel 19 as well. Whilst the gains may be reaching diminishing returns but the areas for further study are:

- *Improve CSI acquisition via better reference signal designs*
- *Higher resolution MU MIMO precoding and beamforming*
- *Non linear precoding (this was studied some years ago but with improved CSI models it may be useful to revisit previous studies).*
- *Distributed massive MIMO and scaling issues (access points should be placed outside the spatial coherence distance- are we paying attention to this?)*

Improving UL coverage

Mobile coverage is limited by the UL. It is recognised that UL coverage is as one of the key elements for success of 5G NR, since the UL performance could be a bottleneck in real deployments . We are now considering CA over many bands and this includes the UL in order to provide high data rates in the UL . However this may not be possible in the UL as CA may involve power reductions .

To address this 3GPP should consider power enhancement methods when CA is deployed

We propose that UL transmission power may be enhanced, e.g., by increasing the UE transmission power limit for carrier aggregation and dual connectivity while in compliance with relevant regulations .

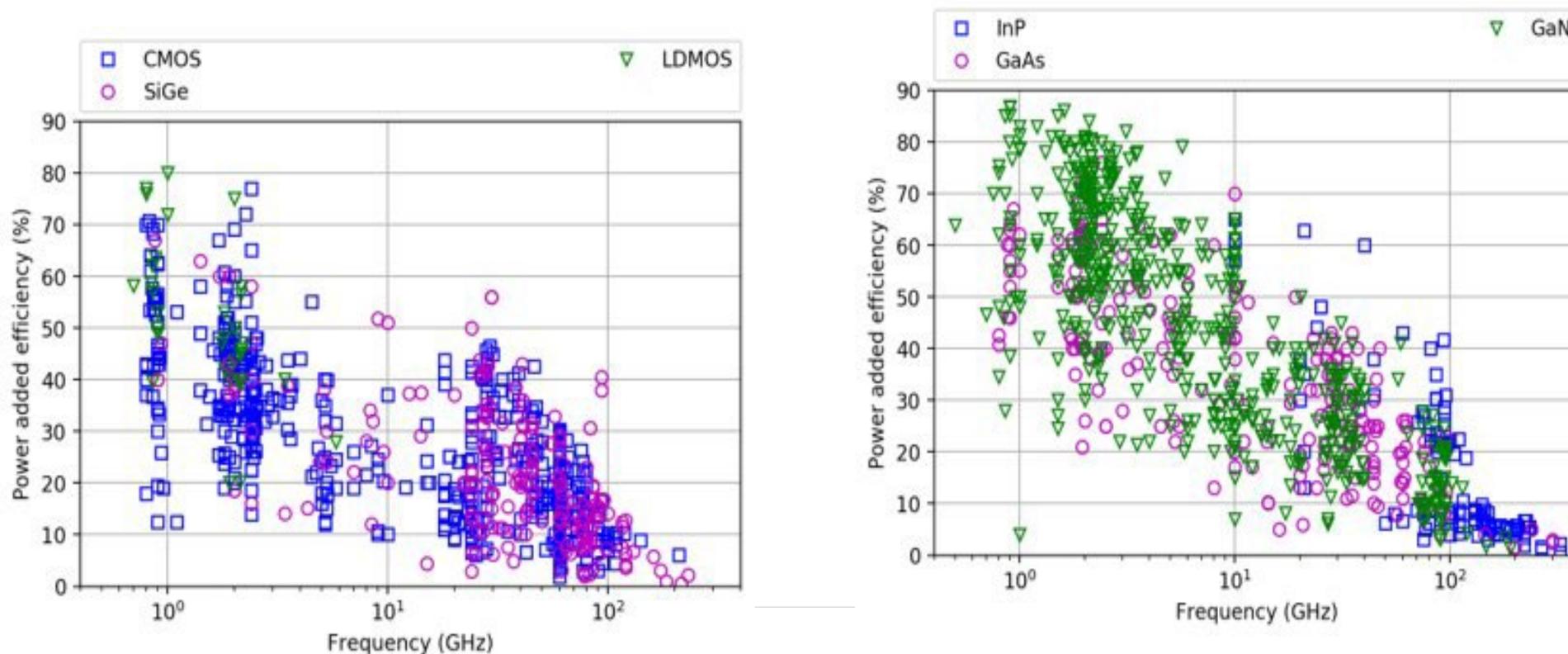
We also suggest to review the Rel 18 agreements on UL coverage enhancements to see if they can be further optimised.

Improving energy efficiency of the RAN

5G base stations have higher power consumption relative to 4G. We are expected to meet sustainability targets and reduce our Contribution to CO2 emissions.

We look forward to Rel 19 with innovative ways of exploring the improving of energy efficiency of the 5G RAN besides, NW based energy efficiency improvements

A large part of the energy consumption is the RF devices that do not have a good power efficiency (3GPP TR 38 808)- can this be improved? A lot of the energy is wasted as heat!. Noting that this is a semiconductor issue.



New applications- XR

5G usage today is dominated by eMBB and FWA but XR is emerging as a leading new application. XR rates consume a large bandwidth:

Our calculations show that rates with a 300:1 compression ratio for a single user are:

Pre VR : 11.2 Mbps

Entry level VR : 53.1 Mbps

Advanced VR : 353 Mbps

Whilst XR is a topic in Rel 18, but

These rates represent a huge load on the RAN and techniques on how to efficiently utilise the radio capacity under these large loads are needed .

Combined XR traffic may consist of different modes each with their own KPIs. The impact of these multiple modes on the RAN needs to be studied.

AI/ML applications

The AI/ML work in Rel 18 is expected to provide a foundation for AI/ML in 6G. RAN is a complex network element in a cellular systems as it is expected to maintain high performance during sever fading.

We believe that the following use cases (agreed in rel 18) may be used to deepen the understanding of AI/ML gains through performance comparisons with non AI/ML based implementations.

- CSI feedback (reduce CSI overhead, improve feedback to and clever channel predictions in the time and frequency domain, this may involve AI/ML based CSI encoders and decoders)
- Beam Management (reduce beam management overhead and improve beam selection accuracy, using AI/ML to infer the best beam amongst a set of beams)
- Positioning (improve positioning accuracy for different scenarios)

We believe that a comprehensive understanding of the benefits of AI/ML in the air interface will not only contribute to normative work in 5G Advanced but also in future generations

New Spectrum n 104

The upper 6Ghz band – n104 is at present restricted via a note to RCC countries only. Yet the mid band spectrum is essential for the wide area deployment of services such as XR that need wide band carriers and consume significant capacity per user.

The coverage of n 104 is similar to the C band (relative to mm wave bands) , these two bands could therefore be considered as companion bands for wide area deployment

In Region 3, the band is already allocated to Mobile and in some countries IMT identification (the subject of WRC 23 AI 1.2) is not required as per local regulations. This is the case in NZ. If the local regulations allow the use of this band for terrestrial mobile then this can happen without an IMT identification.

For this to happen we need to have confidence in the maturity of the complete eco system- base stations and devices and the relevant band combinations.

Channel Models

There is a need to revise TR 38 901 as new application/deployment scenarios are emerging. There are no standardised models. Examples are:

- Terrestrial to UAVs (there is a separate 3GPP model- maturity can be improved)
- UAV to UAVs (there is a separate 3GPP model- maturity can be improved)
- IoT deployments
- Sensing (there are some model proposals but we must settle on use cases and then have use case specific key models- representative of the physical situation)
- Vehicle to vehicle
- Improved clutter models (applies to all of the above categories)

There is also a need to check if the frequency dependence of models as given is valid over such a wide range as is the case in 38 901.

The modelling framework (a fixed number of clusters and rays per cluster etc) in 38 901 is based on TR 25 996 that was at the time written to evaluate MIMO capacity gains. But now we have many more bands and more measurements are available. There is a need to review/reconfirm if the original framework needs enhancements.

Sparsity and Spatial continuity are not correctly captured in the current model.

Antenna Models

There is no 3GPP TR on antenna models. Yet the information exists in many existing TRs but not in one place.

Antenna models are essential for co existence calculations that are undertaken by the ITU-R.

Current model/parameters do not reflect how an AAS BS is implemented. It would be good to consolidated TR models and relevant parameters in a common TR that can be used within 3GPP but also external as reference to other groups.

The present ITU R report M 2101 that forms the basis of almost all co existence studies was prepared a while ago and has a number of shortcomings and using this report co existence calculations have resulted in onerous sharing agreements that must be complied with especially if the later are endorsed by WRC resolutions.

New bands for IMT 2030 are being sought in the 7- 24 GHz range and almost all of these bands are heavily congested and occupied with incumbents. An updated antenna model in a 3GPP report will be very valuable for co existence calculations. This is release independent