

## RAN-R18-WS-crossFunc-Vodafone - Version 0.0.2

### RAN

3GPP TSG RAN Rel-18 workshop

RWS-210648

e-Meeting, June 28th - July 2nd, 2021

**Source:** Vodafone

**Title:** Email discussion summary for [RAN-R18-WS-crossFunc-Vodafone]

**Agenda Item:** 4.3

**Document for:** Discussion

#### 1.0 Introduction

This document contains the discussion on Vodafone contributions [1-4] submitted to the agenda item 4.3.

Section 4 provides a summary of the discussion.

#### 1.1 References

[1] RWS-210459, Uplink Radio Capacity, Coverage & Speed Improvement, *Vodafone*

[2] RWS-210460, Improvements for lower frequency bands (2.1 GHz and lower), *Vodafone*

[3] RWS-210461, Higher Capability UE for bands in high FR1 (e.g. 6-7 GHz)low FR2, *Vodafone*

[4] RWS-210462, Energy Efficiency Improvements, *Vodafone*

#### 1.2 Timeline

The following is the timeline of the discussion:

##### Round 1 Q&A:

- Questions: June 14 08:00 UTC – June 17 8:00 UTC;

- Answers: June 17 8:00 UTC – June 18 23:59 UTC

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Round 2 Q&A:

- Questions: June 21 08:00 UTC – June 23 8:00 UTC;

- Answers: June 23 8:00 UTC – June 24 18:00 UTC

Before June 25 18:00 UTC, email discussion summary is to be uploaded.

## **2 General Comments**

Please provide any general comments and questions on the Vodafone contributions [1-4] in this section. Comments and questions on specific documents should go in the next section.

**Feedback Form 1: Please use this area for general comments and questions**

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## **3 Summary of Q&A and comments on contributions**

### **3.1 RWS-210459, Uplink Radio Capacity, Coverage & Speed Improvement, *Vodafone***

Please provide any general comments on this contribution [1] in this section. Its contents are copied below.

#### **Uplink speed, capacity & coverage has not kept pace with downlink improvements**

Underlying problem:

Operators use additional frequency spectrum to increase capacity and speed

“Energy per bit / noise power spectral density” remains a fundamental parameter

Base station transmits around 20 Watts per 10 MHz

- 100 MHz of downlink spectrum à 200W of power from the base station

But UE only transmits around 0.2 Watts (23 dBm)

- roughly factor 1000 imbalance between Base Station and UE Transmit Power!

This situation will get worse as operators deploy more spectrum!

### **Other drivers for Uplink Improvements**

More uplink oriented services:

- Uplink video for Augmented Reality
- Remote monitoring with video
- Machine/IoT traffic likely to be either “uplink oriented”, or “equal uplink and downlink”. This contrasts to “downlink oriented” eMBB traffic.
- Need for contiguous, wide area, uplink coverage to match downlink coverage of FR1 TDD bands above 2.1 GHz
- Nationally fixed, downlink oriented, uplink/downlink split of TDD bands

**Proposal: 3GPP should devote significant Rel 18 resources to uplink improvements**

### **Feedback Form 2: please use this area for comments and questions on RWS-210459**

#### **1 – ZTE Corporation**

We agree with the analysis that more UL-heavy applications have emerged and UL enhancements for better UL coverage and higher UL capacity are desirable in Rel-18. Not sure whether do you have any specific enhancements to propose? In our contribution RWS-210479 (NWM link: <https://nwm-trial.etsi.org/#/documents/4776>), we provide a list of specific enhancements including aspects related to CA, UL MIMO, high modulation order, UE coordination etc. Appreciated to hear your views on these enhancements.

#### **2 – Futurewei Technologies**

We also support working on UL coverage and capacity enhancements to keep up with the DL for various new uplink oriented services;

We suggest that other aspects for UL enhancements such as latency, spectrum efficient, connection density also need to be studied besides the coverage and capacity enhancement.

Please take a look at our contribution RWS-210036 ([https://www.3gpp.org/ftp/tsg\\_ran/TSG\\_RAN/TSGR\\_AHs/2021\\_06\\_1210036.zip](https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_AHs/2021_06_1210036.zip)) and feel free to comment at: <https://nwm-trial.etsi.org/#/documents/4580>

#### **3 – Huawei Tech.(UK) Co.. Ltd**

Uplink enhancements are very important for Rel-18, we agree this is an important direction.

#### **4 – Samsung Electronics Polska**

Thanks for the paper. In slide 2 and 3, what is Vodafone's view on TDD enhancement? Our view is that UL coverage is a bottleneck in TDD systems and increase UL coverage with enhancing duplex schemes (as XDD we pointed out). We want to ask your interest about duplex enhancements for UL improvement.

#### **5 – Samsung Electronics Polska**

##### **Round 2 comment:**

Thanks for reply and your interest on XDD. For your question, for deploying XDD, there can be some changes in RRH for handling self-interference.

*Round 1 response to ZTE, Futurewei, Huawei:*

Thanks for the feedback. As an operator, we don't have specific proposals but did wish to express the need for these improvements. We will try and study your proposals during 'round 2' and the subsequent discussions.

*Round 1 response to Samsung:*

We agree that Uplink coverage is a bottleneck. We are interested in understanding more about e.g. your XDD proposal. While this is implementation and not standards, I assume that changing a site from TDD to XDD would require the Remote Radio Head to be replaced?

*Round 2 response to Samsung*

Thanks for the extra information.

### **3.2 RWS-210460, Improvements for lower frequency bands (2.1 GHz and lower), Vodafone**

Please provide any general comments on this contribution [2] in this section. Its contents are copied below.

Spectrum auction results demonstrate the high value to operators of spectrum in the lower frequency bands (e.g. 2.1 GHz and lower)

- these bands tend to provide some operators' core contiguous coverage and capacity

Many of 3GPP's recent improvements have focussed on

- higher frequencies and antenna arrays. These arrays seem to be mechanically infeasible for lower frequencies on existing base station towers

- larger bandwidths that aren't available in the lower bands.

There have been few recent 3GPP improvements for the lower bands.

#### **Potential areas for improvements for bands below 2.1 GHz**

Interference Cancellation improvements for FDD capacity Overhead reduction for FDD MIMO Faster entry from RRC Idle/Inactive into Carrier Aggregation DSS improvements

The lifespan of GSM IoT devices shows us that LTE IoT devices will probably be around for decades! This will make it difficult to turn off LTE transmissions and hence DSS sites may be needed (on e.g. sub 1 GHz bands) for a very long time. Hence techniques to maximise NR/LTE “cell” sharing efficiency are important!

**Proposal: 3GPP should devote serious effort in Rel 18 to identify improvements for bands at 2.1 GHz and below.**

**Feedback Form 3: please use this area for comments and questions on RWS-210460**

**1 – Huawei Tech.(UK) Co.. Ltd**

We also think that capacity enhancements for frequencies below 2.1 GHz (or 2.3 GHz) are important and feasible. Aggregated FDD bands can offer a similar experience as one wide 5G cell.

Overhead reduction can be achieved by defining one serving cell over several FDD bands, removing the redundant overhead of control signaling in CA, and enabling mobility with multiple active carriers.

Improving capacity under inter-cell interference can be achieved by supporting coherent joint transmission with mTRP in Rel-18.

**2 – Nokia Corporation**

In general this is an area of interest. Wrt. the motivation for LTE IoT coexistence with NR in the long term, do you have more concrete requirements or solutions in mind over what is already possible with today’s NR specs? Would both NB-IoT and eMTC be of equal importance?

**3 – Nokia Corporation**

**Round 2 comment:** Thank you for your response, this clarifies perfectly. The LTE CRS overhead and LTE PDCCH overhead are the most significant issue in this context, and there some work is being done already, and some additional work is being proposed for Rel-18 in this WS, such as LTE CRS interference cancellation and NR PDCCH CRS rate matching/puncturing.

*Round 1 response to Huawei:*

Thanks for the support, we will try to study your proposals.

*Round 1 response to Nokia:*

Thanks for your interest. Our request is mostly driven with regard to LTE Cat 4, 3, 1 devices. Our experience of the 2G IoT market leads us to expect that many LTE cat 4/3/1 IoT devices will be installed in other equipment in the field, both now and for decades into the future. Turning off the last carrier(s) of LTE may well be very difficult and hence co-existence of NR and LTE is likely to be important for decades. These ‘last carriers’ for LTE-IoT are likely to be an operator’s band(s) with the best coverage and hence they will also be important for NR coverage - so capacity improvements for “dual/multi RAT frequency bands” in Rel 18 or 19 would seem to be valuable over the long term.

We did not specifically consider Cat M or NB\_IoT, but we anticipate that customers will also need their continued support. However (at least for NB-IoT) we could probably just give them a ‘dedicated carrier’ and not need its resources to be fully dynamically shared with NR.

*Round 2 response to Nokia*

Thanks for the extra information.

### **3.3 RWS-210461, Higher Capability UE for bands in high FR1 (e.g. 6-7 GHz) low FR2, Vodafone**

Please provide any general comments on this contribution [3] in this section. Its contents are copied below.

**Apology:** The title differs from the title in the tdoc list

*This is because the author incorrectly believed that FR1 denoted frequencies below 6 GHz and that FR2 denoted frequencies above 6 GHz: sorry !*

This document considers the frequencies around 6-7 GHz.

Antenna sizes for frequencies in this range are about half the size (and spacing) of those for bands such as n78 (3.5 GHz)

This opens up the opportunities for higher capability UEs using

- more transmit antenna
- more receive antenna

Improved UE processing power may allow other improvements e.g. downlink interference cancellation techniques.

**Proposal: 3GPP should consider Rel 18 enhancements using higher capability UEs for bands around 6-7 GHz.**

#### **Feedback Form 4: please use this area for comments and questions on RWS-210461**

##### **1 – Huawei Technologies France**

we support to consider Rel 18 enhancements using higher capability UEs for bands around 6-7 GHz.  
Does more Tx/Rx antenna include analog beamforming

*Round 2 response to Huawei*

Ideally each antenna would have its own RF chain and digital processing for optimal beamforming performance and flexibility, but this may require many changes to the specifications. With that in mind, keeping with 4 receive chains but having multiple antennas per chain ought still to be able to provide some gains (possibly incorporating some form of analogue/hybrid beamforming) that could partially compensate for other losses caused by the use of higher frequencies.

### **3.4 RWS-210462, Energy Efficiency improvements, Vodafone**

Please provide any general comments on this contribution [4] in this section. Its contents are copied below.

Improved Energy Efficiency is important for at least:

- Reduction in greenhouse gas emissions
- Reduction in energy costs

Our current studies show that the majority of energy is consumed at the base station site

Within the base station site, the majority of power is consumed by the “remote radio head” transmission path

This situation is likely to get worse as more frequency bands are added to existing sites.

Current techniques for energy saving include dynamically powering down under utilised frequency bands on multi-band sites

- Fairly effective but crude -> optimisations and alternatives are likely to exist!

Maintenance of coverage for LTE and 2G will remain important for IoT devices

**Proposal: in Rel18, 3GPP should study techniques for base station energy efficiency improvements, including those that permit maintenance of LTE coverage while delivering NR (e.g. using DSS)**

**Feedback Form 5: please use this area for comments and questions on RWS-210462**

**1 – MediaTek Inc.**

Thanks for the quality contribution on system energy efficiency improvements. The real-world practice by site-wise power down is quite primitive, and there looks certain space for further enhancements. Below please find our comments/questions:

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It is understood the target of network energy saving is to reduce operator OPEX. On the other hand, **user experience should not be compromised in order to avoid impact to user subscription.** In this regard, it will be important ensure minimum impact to legacy UEs (R15/R16/R17) in the aspects of coverage, mobility, packet throughput/latency and UE power consumptions.

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Answer to the above question can base on system-level evaluation with UE metrics included. Since system-level evaluation assumptions for UE power consumption has been developed in TR38.840, it is possible to leverage and extend the methodology to further include network power models and operations so as to optimize overall system energy efficiency.

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Enabling dynamic gNB/TRP power saving will be a key enhancement for better system energy efficiency. Since, for gNB/TRP power saving, potential UE UL activity will also prevent gNB/TRP to enter deeper sleep, it is suggested to take into both gNB/TRP and UE into account for developing the most effective solutions.

## **2 – BBC**

### **Sustainability**

The BBC supports measures to improve the sustainability of the 5G RAN.

In particular we're keen to see a realistic and standardised methodology for the measurement and modelling of power consumption in networks to help operators to reduce their impact. In addition, as a content provider, the BBC would like the ability to better understand the impact of our content being consumed over these networks to also drive down our impact.

## **3 – CATT**

Thanks for the contribution in driving green network. One question on the network energy saving is the potential impact to the UE services and coverage. Do you have any design targets and requirements for the network energy saving?

### *Round 1 response to Mediatek and CATT*

Thanks for the questions/comments. Our expectation is that coverage is maintained, and service to existing devices is maintained (in at least one band) while saving energy: typically the capacity of the site is reduced as the load reduces. One simplistic mechanism would be to power down the 2.1 GHz and 1800 MHz carriers while keeping the 800 MHz carrier active. However, this mechanism is likely to lag the variation in load, so, more sophisticated mechanisms that can respond more rapidly to load changes could be interesting.

Our goals are not just opex but also CO2 emission (etc) related. The design targets would just be "as much as possible", but the gains need to be significant enough to justify their deployment.

### *Round 1 response to BBC*

Thanks for the support. With regard to a measurement methodology for gNB energy consumption, I believe (but I could be completely wrong) that there are some ETSI specifications in this area. Gathering statistics on the energy used in delivering specific content (to a set of users) is an interesting (new) requirement.

*No additional questions during round 2.*

## **4 Summary**

### **4.1 RWS-210459, Uplink Radio Capacity, Coverage & Speed Improvement**

There seems to be widespread support for Uplink Improvements in these and also other areas.

### **4.2 RWS-210460, Improvements for lower frequency bands (2.1 GHz and lower)**

2 companies expressed support as well as raising questions. The importance of continued NR co-existence with LTE in at least some bands (e.g. DSS) was recognised.

### **4.3 RWS-210461, Higher Capability UE for bands in high FR1 (e.g. 6-7 GHz) low FR2**

Only one company expressed support for this work. The lack of other support is probably because the author had used an erroneous title when requesting a tdoc number.

### **4.4 RWS-210462, Energy Efficiency improvements**

There seems to be widespread support for work on energy efficiency. The importance of continued NR co-existence with LTE in at least some bands (e.g. DSS) is probably a key additional requirement compared to inputs submitted by other companies.