RAN-R18-WS-non-eMBB-SONY - Version 0.0.2
RAN

3GPP TSG RAN Rel-18 workshop **RWS-210596**

Electronic Meeting, June 28 - July 2, 2021

Agenda Item: **4.2**

Source: **Sony**

Title: **NWM discussion on Sony non-eMBB contributions**

Document for: **Discussion**

1 Introduction

This document is used for the email discussion for the Sony contributions on non-eMBB functionality for Release-18. Sony submitted the following contributions to the Release-18 workshop on non-eMBB functionality:

RWS-210302: IoT Features in Rel-18

RWS-210304: Rel-18 Broadband URLLC

This document is structured as follows:

Section 2: General comments on Sony documents for non-eMBB functionality.

Section 3: Questions, comments and answers on RWS-210302 (IoT Features for Rel-18).

Section 4: Questions, comments and answers on RWS-210304 (Rel-18 Broadband URLLC).

Section 5: Summary of the NWM discussion on Sony documents submitted under AI4.2.

2 General comments on Sony documents for non-eMBB functionality

This section is for general comments, questions and answers on the Sony documents for non-eMBB functionality (RWS-210302, RWS-210304).

2.1 Round 1: Questions and comments on Sony documents for non-eMBB functionality

Companies are invited to make general comments on the Sony documents for non-eMBB functionality (RWS-210302, RWS-210304) in the feedback form below.

Feedback Form 1: Round 1: General comments on Sony documents for non-eMBB functionality

2.2 Round 2: Further Questions and comments on Sony documents for non-eMBB functionality

There were no general comments on the Sony documents for non-eMBB functionality in Round 1. The feedback form below allows for general questions and comments in round 2.

Feedback Form 2: Round 2: General comments on Sony documents for non-eMBB functionality

3 RWS-210302 (IoT features in Rel-18)

This section is for comments, questions and answers on the Sony document RWS-210302 (IoT features in Rel-18).

RWS-210302 made the following proposals.

IoT-NTN:

Proposal 1: IoT-NTN is enhanced in Release-18 to support full functionality, striving to meet the 5G mMTC requirements. Enhancements should be considered in the areas of latency, coverage, battery life, connection density, mobility and the support of high value mMTC applications.

NB-IoT / eMTC:

Proposal 2: Terrestrial NB-IoT and eMTC do not require enhancement in Rel-18.

Redcap:

Proposal 3: Redcap is enhanced in Rel-18 to better support coexistence with URLLC devices and to support low power devices.

Energy harvesting:

Proposal 4: Rel-18 includes enhancements to support devices that obtain their power from energy harvesting.

3.1 Round 1: RWS-210302: questions and comments

Questions / comments are invited on the above proposals or on other aspects of the document RWS-210302.

Feedback Form 3: Round 1: Questions and comments on RWS-210302 (IoT features)

1 – Classon Consulting [for FUTUREWEI] We do not believe a replacement for LTE mMTC is needed in rel-18. Harvesting energy is interesting.
2 – Huawei Tech.(UK) Co.. Ltd In the paper, it is stated that enery harvesting for RedCap is different to passive IoT (backscattering and low power receivers). In that sense, what is the standard impact for energy harvesting for RedCap? Is it just an implementation choice behind proposal 4?

3.2 Round 1: answers for RWS-210302 comments

The table below provides answers from SONY to the questions provided in round 1.

Table 1: Answers to questions / comments on RWS-210302

question / comment	**answer**
Regarding mMTC in Rel-18	SONY agrees that neither eMTC nor NB-IoT should be replaced in Rel-18. Our understanding of RWS input documents is that this is a fairly common view among companies.
Energy harvesting (general)	Yes, energy harvesting is interesting. As well as being useful of itself, it is a bridge between battery-based communication and zero-power IoT. We have noted that several companies have shown interest in energy harvesting in their RWS input documents, including: Fraunhofer (RWS-210324), vivo / Spreadtrum (RWS-210168), Huawei/HiSi (RWS-210453), Everactive (RWS-210085), Ericsson (R1-210313), SONY (RWS-210302).

Energy harvesting (standards impact)	The way that energy is harvested will not require standardization in our view. The standardization impact of energy harvesting is likely to relate to the implications of how 3GPP specifications support a device that has energy reserves that are low and not guaranteed. Some questions that 3GPP would need to address include the following. What is the transmit power of devices operating on harvested energy. How protocols deal with devices that are power depleted (cloudy day scenario), are running out of power or suddenly have an abundance of power.

3.3 Round 2: RWS-210302: further questions and comments

In the feedback form in this section, we invite responses to the answers that we provided to the round 1 comments. We also invite further new comments and questions on RWS-210302.

Feedback Form 4: Round 2: questions and comments on RWS-210302

1 – Huawei Tech.(UK) Co.. Ltd Thanks for the response. For the mini-slot structure, are there any concerns on extra overhead such as sidelink AGC and gap symbols?
2 – Huawei Tech.(UK) Co.. Ltd Sorry, the above Q was relevant to 316. For this paper: We agree that the way of energy harvesting does not require 3GPP standardization. To understand the efforts needed for supporting energy harvesting, the maximum power consumption for batteryless devices may need to be clarified. For example, if most energy harvesting technologies can only provide power less than 1mW considering limited size of the devices, a device with 10mW power for transceiving will not be able to work on harvested energy. We guess your question ”what is the transmit power of devices operating on harvested energy” refers to the similar issue.

3.4 Round 2: RWS-210302: answers from Sony on further questions / comments

This section provides answers and responses to questions and comments that were received in Round 2.

Huawei:

General: Thank you for your considered and interesting reply.

Point 1: **We agree that the way of energy harvesting does not require 3GPP standardization**. Thanks. It seems like some other companies might be envisaging standards impacts, for example if RF energy is proactively sent to the UE (wireless power transfer).

Point 2: **To understand the efforts needed for supporting energy harvesting, the maximum power consumption for batteryless devices may need to be clarified. For example, if most energy harvesting technologies can only provide power less than 1mW considering limited size of the devices, a device with 10mW power for transceiving will not be able to work on harvested energy**. We don't totally agree with your view. Our view on this 1mW / 10mW scenario would be that if energy harvesting can only provide 1mW of power, then the device needs to wait 10ms before transceiving with 10mWof power for 1ms. The UE harvests 10 microJoules of energy and then expends 10 microJoules. There will still be some limit on the amount of transmit power that is possible since the energy storage device (battery or capacitor) will only be able to source a limited amount of current.

It seems that there are several issues to study about devices operating on harvested energy. We would want the study to include (1) consideration of devices that sporadically have enough energy to communicate as well as (2) consideration of devices that can communicate continuously but with very low power consumption.

4 RWS-210304 (Rel-18 Broadband URLLC)

This section is for comments, questions and answers on the Sony document RWS-210304 (Rel-18 Broadband URLLC).

RWS-210304 made the following proposals.

Consider designs for broadband URLLC under a controlled environment where the UE has high SNIR coverage.

Consider UL heavy URLLC scenarios and methods to support them.

4.1 Round 1: RWS-210304: questions and comments

Questions / comments are invited on the above proposals or on other aspects of the document RWS-210304.

Feedback Form 5: Round 1: Questions and comments on RWS-210304 (broadband URLLC)

1 – Nokia Germany

Broadband URLLC: Is this something to be discussed as part of potential REl-18 URLLC/IIoT WI or more as part of the expected Rel-18 XR WI? What specific enhancements are envisioned here?

UL heavy URLLC scenarios: Rel-15 NR supports already UL heavy TDD configurations as well as flexible TDD (i.e. SFI) as well. Moreover, the topic of full duplex operation and UL CI seems to be addressed by several companies as part of AI 4.3.
What are the envisioned enhancements here? Would they need to be handled as part of some Rel-18 URLL-C/IIoT WI or depending on the enhancement in some other Rel-18 WI, such as cross-link interference related (CLI)?

2 – Intel Corporation (UK) Ltd

Could you provide examples of further enhancements to support broadband URLLC and UL heavy sce-

narios?
3 – Apple Italia S.R.L. Do you have any specific enhancements in mind to better handle these use cases?
4 – ZTE Corporation We share similar view that UL heavy applications with URLLC requirements are emerging and potential solutions need to be studied in Rel-18. We are wondering whether do you have any specific enhancements in mind? In our contribution RWS-210479, 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.
5 – Samsung Electronics Co. You only listed up the use cases of broadband URLLC. What kinds of RAN enhancements are required for this?

4.2 Round 1: answers for RWS-210304 comments

The table below provides answers from SONY to the questions provided in round 1.

Table 2: Answers to questions / comments on RWS-210304

question / comment	answer
What are the enhancements in Rel-18 to support Broadband ULLC?	We assume Broadband URLLC would operate best in an environment with high SINR. That is, the environment can be designed to have high SINR (e.g. by deployment planning in a restricted area, such as a factory). Under such an environment we expect the following enhancements: - Advanced Modulation (ref: RWS-210305) - Extra-wide PRB allocation, e.g. TB occupying multiple CCs/BWPs - Extra-long allocation for high SCS, e.g. TB occupying multiple slots - High spectral efficiency control channels that operate in the high SINR - Protocol enhancements to allow for high throughput with low latency

What are the enhancements in Rel-18 to support Heavy UL?	For Rel-18 URLLC, some of the enhancements for Broadband URLLC can be used for Heavy UL. Enhancements specific to Heavy UL: For TDD operation, - we expect to maximise UL resources and would therefore consider operation with minimal DL symbols, e.g. multiple slots without DL symbols. Therefore we consider HARQ enhancements when there are infrequent opportunities for DL ACK/NACK - UE autonomous MCS adjustment for UL transmissions to improve spectral efficiency leading to higher capacity and also reliability, For FDD & TDD operation: - Flexible duplex where portion of a bandwidth can be UL and another can be DL at the same time. - Scheduling enhancements for TDD / HD-FDD (minimize the time that the UE has to monitor DL in order to free up more time for UL transmission) - Power efficiency enhancements (the UL transmission needs to be power efficient in order to reduce heating and operate within battery constraints) - Consider higher transmission power class UE
Nokia: Is Broadband URLLC for Rel-18 XR or Rel-18 URLLC?	We do not have a strong view on where Broadband URLLC is specified. Broadband URLLC use case is not limited to XR albeit applicable to XR. We think when scoping the WI, there may be shared proposals/features between these two WIs and RAN plenary can decide the WI that would be best to define some of these features.
Nokia: WI to specify Heavy UL.	We agree that Heavy UL is not unique to URLLC and Heavy UL features can be specified in different WIs, as you suggested. Rel-18 URLLC will focus only on Heavy UL features that require also moderate reliability and low latency.

4.3 Round 2: RWS-210304: further questions and comments

In the feedback form in this section, we invite responses to the answers that we provided to the round 1 comments. We also invite further new comments and questions on RWS-210304.

Feedback Form 6: Round 2: questions and comments on RWS-210304

1 – Fujitsu Limited

Thank you for the contribution.

We have interest in this broadband URLLC. Do you have any specific reason that broadband URLLC is limited to high SNIR coverage? Note that we think that it is better to develop universal specification regardless of coverage.

2 – Nokia Germany

Thanks to Sony for addressing our first round questions. A few follow-up questions and comments from our side:

Broadband URLLC:

1. Extra-wide PRB / FDRA and extra-long TDRA allocations – what are the gain mechanisms you envision there, as if having high SINR there will be anyhow several CBs within a single slot / CC already (in contrast to the discussions in Cov. Enh)? Moreover, with longer allocations would the RTT increase?

2. High spectral efficiency control channels: What do you envision there? Different control channel coding schemes or for PDCCH e.g. AL<1?

UL Heavy URLLC:

1. The need for HARQ enhancements is a bit unclear to us. If there are several slots without DL symbols meaning there would be sufficient HARQ-ACK feedback opportunities with UL heavy TDD operation already?

2. Based on which information would the UE adjust the MCS (as it is not aware of the UL situation at the gNB location)? Would the gNB need to detect the MCS blindly or would there be data associated UL control signalling used to indicate the UE selected MCS?

4.4 Round 2: RWS-210304: answers from Sony on further questions / comments

We would like to thank Fujitsu and Nokia for their Round 2 questions. The following table contains our answers.

Table 3:

Questions	**Answers**
Fujitsu: Why limit to high SNR scenario	We think that it is very challenging to provide broadband URLLC at cell edge with poor SNR and hence difficult to guarantee the support of URLLC in such scenario. Furthermore, the applications requiring broadband URLLC would likely be in places such as hospital, a conference room, a high-tech factory, where it is easier to manage the deployment and to ensure high SNR coverage. The features developed for broadband URLLC can be applied to all scenarios but we would prefer that the design of broadband URLLC not be pulled back due to the need to consider operation in poor coverage.

Nokia: Extra wide & extra long TB gain over existing using single CC and/or single slot TB.	Multi-TB scheduling in LTE, where a single DCI schedules multiple TBs, has gain over traditional TB scheduling due to reduction in DCI overhead, which for URLLC also has reduction in latency. We expect extra wide & extra long TB to have a gain over multi-TB since a large packet does not need to be segmented over multiple TBs. On extra-wide TB, where the TB spans a few CCs or BWP, we expect this to be used if the CC/BWP is narrow or not configured to be wide enough to transmit the entire packet within a short time. The TB spanning different CC will also benefit from CC diversity. For extra-long TB, we are targeting high SCS operation where the duration of the TB spans several slots but still remains within the URLLC latency requirement (e.g. 1ms to 5ms).
Nokia: Heavy URLLC	On HARQ-ACK enhancement, the DL symbols may be too short and infrequent to provide fast feedback or retransmission for multiple contiguous PUSCH transmissions over several UL slots. We agree that we should see if there is a need for enhancement considering whether the infrequent DL symbols/slot would be sufficient to meet URLLC latency targets. On MCS adjustment. This is for TDD operation where the UE can make use of channel reciprocity to fine tune the MCS. The UE would need to provide the adjustment MCS, in a UCI in the PUSCH, i.e. similar to CG-UCI in NR-U.

5 Summary of email discussion

This document captures the email discussion on Sony inputs to AI4.2 of the RAN plenary Release-18 workshop. The email discussion was held via NWM using the NWM tag of "RAN-R18-WS-non-eMBB-SONY".

The email discussion was based on the following Sony input documents:

RWS-210302: IoT Features in Rel-18

RWS-210304: Rel-18 Broadband URLLC

Our summary of the email discussions of these documents is as follows:

RWS-210302. IoT Features in Rel-18. We received comments from two companies. The issue of the 3GPP roadmap for LPWA was brought up. Both responding companies were interested in energy harvesting. For energy harvesting, the issue revolves around that the standards impact would be. Low transmission power was

suggested as a potential standards impact. We responded that the sporadic availability of energy could also impact standards.

RWS-210304: Rel-18 Broadband URLLC. We received comments from 6 companies. Most companies asked about the features and enhancements we would like to consider in Rel-18 to support Broadband URLLC and Heavy UL. Some of the companies also shared interest in Broadband URLLC and/or Heavy UL. The WI where Broadband URLLC and Heavy UL should be specified was also discussed. We listed the features and enhancements, e.g. advanced modulation, extra large TB, high spectral efficiency control channel, HARQ enhancements & MCS adjustment. We received further questions on the limitation to high SNR condition, the expected gains on using extra large TB and clarification questions on HARQ enhancements & MCS adjustment. We clarified that Broadband URLLC is not restricted to only high SNR environment but it is challenging to guarantee the service at poor SNR. We also provided clarifications on HARQ enhancements and MCS adjustments.