

**3GPP TSG RAN Rel-18 workshop RWS-210519**

**Electronic Meeting, June 28 - July 2, 2021**

**Source:** Moderator (CMCC)

**Title:** Email discussion summary for [RAN-R18-WS-eMBB-CMCC]

**Agenda item:** 4.1

**Document for:** Information

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## 1 Introduction

This email thread covers the following contributions from CMCC.

RWS-210332 CMCC views on Rel-18 eMBB-driven Functional Evolution

RWS-210333 On Rel-18 NR MBS enhancement

RWS-210334 Motivation of study for frequency combination based elastic cell

RWS-210335 New study on frequency combination based elastic cell

RWS-210336 Further enhancement of SON and MDT for NR

RWS-210337 Motivation for new WI on air-to-ground network for NR

RWS-210338 New WID on air-to-ground network for NR

RWS-210339 NR smart repeaters

RWS-210340 Motivation for Home Base station for NR

RWS-210341 New WID on Home Base station for NR

This email discussion includes two big areas: New areas and Rel-17 enhancement topics. For each big area, three sub topics are included.

- New topic #1: Frequency combination based elastic cell
- New topic #2: Air-to-ground (ATG)
- New topic #3: Home Base Station (HBS)

- Rel-17 enhancement #1: MBS enhancement
- Rel-17 enhancement #2: SON&MDT further enhancement
- Rel-17 enhancement #3: NR smart repeaters

Companies are invited to share views and ask questions on these issues.

Timeline for the email discussion is:

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

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

## 2 [1st round] Comments to the Tdocs

### 2.1 General

#### Feedback Form 1: General comments/questions

##### 1 – Samsung Electronics Co.

We have question for RWS-210349 which cannot found below. We agree to continue the work of R17 leftovers. And for the proposal “For non-supported slice by the serving cell, the solutions to support UE to access to the intended slice by setting up DC or CA can be considered.” Could you please clarify more? What enhancement could be in R18? Our understanding is this is already supported by NW even in R15/16. and R17 will do.

### 2.2 Frequency combination based elastic cell

RWS-210334 Motivation of study for frequency combination based elastic cell

RWS-210335 New study on frequency combination based elastic cell

#### Feedback Form 2: Comments/Questions on frequency combination based elastic cell

##### 1 – China Unicom

[China Unicom] We have some questions for clarification.

Q1: The elastic cell with multiple carriers is treated as one cell with one physical cell ID or multiple physical cell IDs for each carrier?

Q2: If considering load balance among multiple carriers, how to define some principles for load balance mechanism? Or it’s up to network implementation?

## 2 – ZTE Corporation

For a cell consisting with multiple carriers from different spectrums, are these different carriers allowed to transmit (or receive) at the same time?

Could you elaborate a little bit on “BWP-like flexible carrier scheduling and aggregation”? Does it refer to a cell with multiple active BWPs from different spectrums?

## 3 – Intel Corporation (UK) Ltd

<Intel>

Q1. if inter-band carriers form a cell and if PRACH can be transmitted in both carriers, how to determine the pathloss reference?

## 4 – CATT

We support the motivation and we have similar proposal in RWS- 210402.

We would like to clarify the following questions.

Q1: On Page 3, it it said that for connected UEs, aggregated carriers can be SUL carriers. But the second last bullet on Page 4 does not include SUL. Can you clarify?

Q2: For BWP aggregation on P3, does it mean that UEs support multiple active BWPs?

## 5 – vivo Mobile Communication Co.

Thank you for the contribution. We are also interesting about idle/inactive aspects. We think this is also helpful about the non-colocation SUL case. However, it should be discussed if anchor BPW modeling or anchor Cell modeling further.

For connection mode, can you confirm that the current RAN4 UE RF requirement based on carriers are kept unchanged in general, and what would be the RAN4 impact do you have in mind?

## 6 – Nokia Corporation

Several small questions to understand the concept:

1) For IDLE, Is this only about allowing UE to select which UL resource to use? Or both UL and DL? How many such carriers would be indicated in SIB?

2) What is different in this from CA in CONNECTED mode?

## 7 – Spreadtrum Communications

Thanks for the contribution. We have some questions for clarification:

1. The justification part mentions that offloading is one main target for elastic cell. Could you elaborate how to achieve offloading for idle/inactive UE?

2. Does UE always camp one same DL frequency block and one same frequency block, for idle/inactive state and when initial access, considering UE complexity?

3. For the objective of RWS-210335, we notice that the second bullet states to study for idle/inactive state based elastic cell, while the third bullet states to study for connected for multiple carrier operation. Does it mean that UE supports one elastic cell with multiple non-continuous frequency block in idle/inactive state, and supports CA, i.e., each carrier corresponding one cell, in connected state.

4. Are the aggregated spectrum only FDD band, or only TDD band, or both?

**8 – TCL Communication Ltd.**

Would the maximum number of consecutive or non-consecutive spectrums supported be defined?

**9 – Lenovo Mobile Com. Technology**

Thanks for the proposals! we see this is an important scenario for operators to use fractional frequency efficiently. we have some questions for further understanding

1. for IDLE/INACTIVE UEs, we see this is more like a SUL extension for UEs, since legacy UE behavior can support UE to acquire SIB/paging and perform cell (re)selection on anchor carrier. On the other hand for initial access, UE can select one UL carrier from multiple carriers of frequency resources, instead of select from normal UL and SUL in legacy. Does our understanding is aligned with what in your mind?

2. for connected UE, we would like to understand more on *aggregate carriers can be SUL carrier* e.g. do you mean SUL can be formed by multiple frequency resource?

**10 – Qualcomm Incorporated**

Is it correct understanding that the target is to enable aggregating narrowband carrier(s) that cannot accommodate broadcast/SSB together with an anchor carrier that accommodates broadcast/SSB? If so, what bandwidth is such narrowband carrier(s) supposed to have?

**11 – Qualcomm Incorporated**

... continuation

Besides the previous question we asked on SSB, we'd like to know that whether the main motivation of the proposal is reducing the signaling overhead during initial access? Can you please clarify what does it mean by "Handover signaling due to offloading also brings a lot of system overhead" in RWS-210335. Another question is how to make sure UL Tx on contiguous (physical) RBs within this elastic virtual cell?

**12 – Apple GmbH**

Q1: We already support flexible BWP, so if a CC contains fragmented frequency resource, as long as each UE is contained within one fragment, it should already be largely supported. If a UE is operated with multiple fragments of frequency, we think the current flexible NR configuration can also support it such as CORESET configuration, RS configuration and FDRA in DCI. More specifically, which area we need enhancement?

Q2: What is the different between inter-band CA solution. Is it the correct understanding that inter-band CA can achieve the same functionality but the motivation for this new elastic virtual cell is to reduce overhead?

**13 – Beijing Xiaomi Mobile Software**

Thanks for the contribution, we are interested in the proposal.

Is this item focus on idle mode or connected mode or both?

## 2.3 Air-to-ground (RAN4 only)

ATG was proposed as a Rel-17 RAN4 WI from 2019. The WI scope is quite stable after at least 4 rounds of email discussions tasked by RAN. Due to the high work load in Rel-17 RAN4, this WI proposal was postponed. Considering the urgency of commercialization, we still prefer to start the work in Rel-17. If Rel-17 is not possible to complete the work, we propose to treat ATG as high priority topic in Rel-18 RAN4.

RWS-210337 Motivation for new WI on air-to-ground network for NR

RWS-210338 New WID on air-to-ground network for NR

**Feedback Form 3: Comments/Questions on Air-to-ground**

**1 – Beijing Xiaomi Mobile Software**

We think the scope is quite clear, but given the overloaded work in Rel-17 RAN4, we slight prefer to introduce it in Rel-18.

**2 – China Unicom**

[China Unicom] The scope for ATG is very clear. Considering current workload in RAN4, ATG should be complete in R18 to fulfill commercial demands.

**3 – Intel Corporation (UK) Ltd**

<Intel>

Q1. What are candidate RF bands for ATG operation?

Q2. What is the motivation to use new specifications and why existing specifications cannot be reused?

Q3. Does the proposal focus on co-channel or adjacent channel deployment with terrestrial networks?

Q4. What is the target UE power class (including antenna gain)?

**4 – Lenovo (Beijing) Ltd**

The scope of ATG is clear and the commercial demand is insistent. This WI should be completed no late than R18.

**5 – ZTE Corporation**

Thanks for your proposal. We are supportive on this topic as proposed in our contributions (RWS-210477). As one important scenario to boost the 5G application, the relevant discussion has been done in Rel-17 and the RAN4 part is pending due to the workload issue. Early treatment of this WI is preferred.

**6 – vivo Communication Technology**

This topic has been extensively discussed in RAN for several meetings, the scope is quite clear. We think this work should be high priority in Rel-18 RAN4 task.

**7 – CATT**

The scope of this WI is clear and stable. We support to treat this WI in R18 to address operator's demands.

**8 – China Telecommunications**

We would like to echo the urgency and importance of ATG for operators' 5G development. From our side, we already have ATG trials for several domestic routes. Candidate RF band for us includes n78.

We really appreciate if ATG can be considered in Rel-18 at the latest.

## 2.4 Home Base Station (RAN4 only)

RWS-210340 Motivation for Home Base station for NR

RWS-210341 New WID on Home Base station for NR

### **Feedback Form 4: Comments/Questions on Home Base Station**

<p><b>1 – China Unicom</b></p> <p>[China Unicom]</p> <p>Q1. What is the difference between Home Base Station and CPE?</p> <p>Q2. Is there new SAR requirement for Home Base Station?</p>
<p><b>2 – Intel Corporation (UK) Ltd</b></p> <p>&lt;Intel&gt;</p> <p>Q1. What are the expected RF requirements for Home BS? Is it expected to reuse the LTE Home BS (femtocell) characteristics as baseline?</p> <p>Q2. Further clarifications on the use case are encouraged. In particular, is it expected that Home BS will operate with in Closed Access Group (CAG) mode?</p>
<p><b>3 – CATT</b></p> <p>It is anticipated to get some feedback on the following,</p> <ol style="list-style-type: none"><li>1. Will the Home Node B be deployed in dedicated spectrum or shared spectrum with other BS types or service?</li><li>2. Does the scope include both FDD and TDD?</li><li>3. It is anticipated that the home NB, if used, may have different UL/DL configurations than other type of BS. Is there any interference coordinating technique to be considered?</li><li>4. If interference coordination will be considered, whether other working groups will also be involved?</li></ol>
<p><b>4 – Spreadtrum Communications</b></p> <p>Q1. maybe F2 can also be considered, which may have less interference on outdoor users, considering wall isolation.</p> <p>Q2. SA1 will finish their work on residential 5G, what is the view on starting RAN (not only RAN4) work in R18?</p>
<p><b>5 – Samsung Electronics Co.</b></p> <p>If it is understood correctly this HBS proposal is for FR1 only? And since new BS type(s) mentioned in objective, could you clarify further what kind of new type beside existing 1-C 1-H 1-O and 2-O?</p>

## 2.5 MBS enhancement

RWS-210333 On Rel-18 NR MBS enhancement

## Feedback Form 5: Comments/Questions on MBS enhancement

### 1 – Classon Consulting

[for FUTUREWEI]

SFN is interesting. What is your intent for numerology/CP?

### 2 – Intel Corporation (UK) Ltd

<Intel>

Q1. For multicast reception in *RRCIDLE*, since SA2 only agrees the support of multicast in *CM-CONNECTED* and *RRCIDLE* corresponds to CM IDLE state, how to resolve the conflicts with SA2 conclusion?

2) Regarding “power saving signal/channel in triggering UE adaptation to the DRX operation for broadcast/multicast service”, is the intention to introduce DCP for unicast to MBS?

### 3 – ZTE Corporation

Thanks for the contribution. We have the same concern from Intel on Q1 that how to enable Multicast reception for UE in *RRC\_IDLE*.

Other than that, we have the following questions on different issues:

# on scenarios and market need

- Can the need for features like FTA/ROM, 100% resources for MBS be met by Rel-16 LTE based 5G Terrestrial Broadcast?

- Is the market needs clear on following scenarios, e.g., UEs with both Terrestrial Broadcast and NR, and deployment of both Terrestrial Broadcast and NR from operators?

- Is it possible for UE to receive FTA and unicast simultaneously?

# on MBSFN

- Do you see the need to support different numerology (e.g., different SCS or CP) for MBSFN and unicast? If yes, then how to support simultaneous reception of MBSFN and unicast if they are with different numerologies?

# on L1 feedback

- Could you elaborate a bit more on the CSI feedback enhancement?

Great thanks.

### 4 – Guangdong OPPO Mobile Telecom.

Thanks for the contribution. Some questions from our side

**Q1.** dynamic HARQ process management/sharing has been supported in R-17, what functionality is needed in addition in R-18?

**Q2.** CSI measurement/report is being discussed in R-17 and no enhancement is identified yet. What enhancement is expected for CSI measurement/report in R-18?

**Q3.** what “100% resource allocation” mean, given that in Rel-17 the CFR could be configured to be same as UE dedicated BWP?

One more comment is that whether enhancement for HARQ-ACK feedback is needed or not depends on the outcome of R-17.

#### 5 – HUAWEI TECHNOLOGIES Co. Ltd.

[Huawei, HiSilicon] Thank you for the paper. Q1: on multiple MCCHs, how to keep backward compatibility with Rel-17 UEs if some services are offloaded to new MCCHs□

#### 6 – CATT

We support NR MBS enhancement in Rel-18, for the similar reasons/motivations mentioned by this contribution. We are open to discuss with operators and other companies on the exact work scope, to achieve a good balance of market requirements and work load.

#### 7 – BBC

BBC supports the evolution of NR MBS under Rel-18.

In particular to the specific topics listed in your contribution, we think the following topics have higher priority:

-  
Rel-18 should address leftovers from Rel-17.

-  
Support of Free-to-Air/receive only mode;

Note that BBC has also proposed the topics above for Rel-18 in RWS-210133 and being discussed under [RAN-R18-WS-crossFunc-BBC] in NWM.

Questions:

We have the following questions comments from the following topics listed in your contribution:

-  
Standardised support of SFN over multiple cells above gNB-DU level [RAN1, RAN2, RAN3];

o  
Are you considering changes in sub-carrier spacing and/or CP?

■  
We have concerns that significant changes in UEs may hinder the deployment of the feature. As stated in our contribution [RWS-210133] and being discussed under [RAN-R18-WS-crossFunc-BBC] in NWM we believe widespread feature support in handsets is essential. Specially for UEs in RRC\_IDLE/INACTIVE that may not be able to signal back to the gNB the capability, enhancements that force significant changes in the UEs may limit the reach of Multicast and Broadcast.

■  
Considerations should be taken in whether simulcasting two signals (with different CPs) would be overall beneficial to the system spectral efficiency.

- Another aspect to consider is whether the reference signals frequency sampling (assuming are unchanged) can cope with the additional channel selectivity from deployments with larger ISDs and therefore extended CPs.

Support of up to 100% resource allocation to broadcast/multicast service [RAN1, RAN2].

- Are you considering dynamic or static resource allocation? why does Rel-17 NR MBS not fulfil this requirement?

- we think dynamic allocation provides more flexibility.

### **8 – vivo Communication Technology**

We are in general fine to study some leftover of the Rel-17 MBS, following are the comments to some objectives,

- (1) Rel-17 has not study any CSI measure/report enhancement for MBS, it is more appropriate to study from a study phase before know any schemes to improve.
- (2) It is not clear which aspects need to enhance for up to 100% resource allocation and further elaboration is appreciated.
- (3) For IDLE/INACTIVE, we are not sure whether MBS service can be monitored by DRX operation since the specification does not have any definition of MBS DRX in IDLE/INACTIVE.

For connected state, a '0' value for the Wake-up indication bit, when reported to higher layers, indicates to not start the *drx-onDurationTimer* for the next long DRX cycle. Hence for that case, monitoring of the PDCCH for MBS can also be controlled by connected state wake-up signal.

### **9 – Apple Computer Trading Co. Ltd**

Thanks for the nice contribution. one question for clarification on "Support of up to 100% resource allocation to broadcast/multicast service", this seems the scheduling issue whether unicast can be scheduled in CFR, or the intention is to define a MBS dedicated BWP?

### **10 – MediaTek Inc.**

SFN is interesting. We also think there is a need to have SFN based transmission across DUs. We assume this applies to mainly to normal base station, instead of high power high tower BS. Is this correct.

We also want to know the exact idea for power saving. Is the intention to introduce WUS alike signal for MBS reception?

### **11 – Qualcomm Incorporated**

We wonder how multicast can be supported in idle? According to R17 SA2 system design, "multicast" is supported in NAS CM\_CONNECTED however the UE in RRC\_IDLE is in NAS CM\_IDLE. Additionally, "broadcast" is already supported in all RRC states. We think multicast reception in RRC\_INACTIVE state can save UE power, but RRC\_IDLE should be excluded.

Rel-17 already supports intra-DU SFN. In our view, wide Area SFN increases complexity without necessarily improving efficiency in dense deployments.

ROM is the solution that has impacts in RAN, FTA is just a service requirement. So, we think "support of receive only mode" should be sufficient (no need to mention FTA).

#### **12 – Apple Portugal**

We don't think the support of multicast in IDLE is feasible since it is not aligned with SA2 concept of the active multicast MBS session. But we think it's ok to consider the multicast transmission in RRC INACTIVE state.

#### **13 – Lenovo (Beijing) Ltd**

Thanks for the contribution. One question from my side for clarification:

Since RAN1 has agreed it is up to network to assign HARQ processes for unicast or multicast, I wonder what's the motivation to study "dynamic HARQ process management/share between broadcast/multicast service and unicast service"?

#### **14 – Nokia France**

Could you elaborate on what you have in mind for the scenario "support of up to 100% resource allocation to MBS"? Specifically, do you have in mind standalone MBS carriers that are dedicated to MBS, or flexible mixed carriers that may dynamically increase MBS RA up to 100%?

#### **15 – Nokia France**

Power saving: what do you have in mind for a power saving signal/channel, and how would it "triggering UE adaptation to the DRX operation for broadcast/multicast service"?

## 2.6 SON&MDT further enhancement

RWS-210336 Further enhancement of SON and MDT for NR

### **Feedback Form 6: Comments/Questions on SON/MDT further enhancement**

#### **1 – China Unicom**

[China Unicom]SON/MDT enhancement in R18 is needed. What are the considerations on scope for R17 features, i.e. MR-DC(CPAC), SDT, Redcap and MBS?

#### **2 – ZTE Corporation**

We share the similar view as CMCC, at least MBS, NPN & R17 left issue can be captured in Rel-18.

#### **3 – Lenovo (Beijing) Ltd**

SON/MDT for Rel-18 is necessary. We also have the paper for Rel-18 SON (see RWS-210263). Do you have any plan for the case of Inter-RAT from NR to E-UTRA for voice fallback.

#### **4 – InterDigital Germany GmbH**

NTN was missing from your list of R17 left overs - was that just an oversight, or it is low priority, or do you think that it isn't necessary? Also what would your relative priority be between the R17 left overs you mentioned, if a reduced scope is necessary?

#### **5 – CATT**

Thanks for the contribution. We share the view that further SON/MDT enhancement with more aspects considered should be discussed in Rel-18. From our point of view, besides the cases list in the contribution, some other cases e.g. MR-DC enhancement could also be included.

#### **6 – Samsung Electronics Co.**

We also foresee further SON/MDT enhancement in Rel-18 is needed. Some questions:

1) Rel-17 leftovers indeed needs to be continued. In your expectation, which parts needs to be postponed to Rel-18 ?

2) For R16 and R17 features including IAB, NPN, V2X, CPAC, MBS..., which features CMCC has deployment plan ?

## 2.7 Smart repeaters

RWS-210339 NR smart repeaters

### **Feedback Form 7: Comments/Questions on smart repeaters**

#### **1 – Intel Corporation (UK) Ltd**

<Intel>

Q1. What is the use case for configurable repeater bandwidth? Is it related to multi-carrier or single carrier operation? Is it expected to tune the actual RF bandwidth or retune the center frequency?

#### **2 – Sony Corporation**

Thank you for your proposal on smart repeaters. Here is a questions from us:

1. Could you please expand further on how the proposed control information applied by the candidate side (i.e., ON/OFF information, slot and symbol UL/DL configuration, Tx/Rx beam information, bandwidth information, etc.) would be obtained? For example, are currently existing mechanisms in Rel-16/17 sufficient, or do you think enhancements are needed?

#### **3 – Lenovo (Beijing) Ltd**

It seems there are time/frequency/spatial domain coordination between two links associated with the repeater. Actually R17 IAB also discuss similar mechanisms for resource multiplexing, can you elaborate a bit more on the difference between the schemes for smart repeater and IAB?

#### 4 – KDDI Corporation

Thank you very much for your proposals. We are also interested in smart repeater, as mentioned in our contribution (RWS-210300). In order to understand your proposal more concretely, let us ask you a few questions below.

<Q1>

In your contribution, you mention "Transmitter and receiver spatial information, i.e., beam information" as one of the candidates for side control information. Is this information supposed to be UE-specific and dynamically notified, or is it supposed to be semi-statically configured?

<Q2>

Is there any particular use case that you would like to focus on in the smart repeater? (e.g. FR1 or FR2?, indoor or outdoor?, etc.)

#### 5 – Xiaomi Communications

Is the smart repeater L1 relay? Can you explain the protocol stack of the smart repeater?

#### 6 – Huawei Technologies France

Thanks for the contribution.

Could you clarify what is the meaning of "configurable repeater bandwidth" for smart repeater?

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### 3 [1st round] Answers by moderator

#### 3.1 General

<To Samsung>

**Q:** We have question for RWS-210349 which cannot found below. We agree to continue the work of R17 leftovers. And for the proposal "For non-supported slice by the serving cell, the solutions to support UE to access to the intended slice by setting up DC or CA can be considered." Could you please clarify more? What enhancement could be in R18? Our understanding is this is already supported by NW even in R15/16. and R17 will do.

**A:** RWS-210349 was submitted under agenda 4.2 non e-MBB. We observed that Samsung made same comments under email thread RAN-R18-WS-non-eMBB-CMCC. We already provide our feedback there. Thank you.

#### 3.2 Frequency combination based elastic cell

Thanks for companies' interests and questions on this topic. We give our answers to companies in this section.

<To China Unicom>

**Q1:** The elastic cell with multiple carriers is treated as one cell with one physical cell ID or multiple physical cell IDs for each carrier?

**Q2:** If considering load balance among multiple carriers, how to define some principles for load balance mechanism? Or it's up to network implementation?

**A1:** Both can be supported, depending on frequency separation, network planning, co-existence with legacy UEs, but the NCGI should be same.

**A2:** It can be controlled by network and indicated to UE, e.g. based on RSRP or based on service type.

**<To ZTE Corporation**

**Q:** For a cell consisting with multiple carriers from different spectrums, are these different carriers allowed to transmit (or receive) at the same time?

Could you elaborate a little bit on "BWP-like flexible carrier scheduling and aggregation"? Does it refer to a cell with multiple active BWPs from different spectrums?

**A:** For the first question, the answer is yes. Transmitting (or receiving) on multiple carriers simultaneously is allowed to improve throughput, as long as supported by UE capability.

BWP-like scheduling here means the scheduling can be dynamically switching between different carriers or different number of carriers, each carrier can have one active BWP

**<To Intel>**

**Q:** if inter-band carriers form a cell and if PRACH can be transmitted in both carriers, how to determine the pathloss reference?

**A:** For co-located multiple carriers that form one elastic cell, the pathloss differences between different carriers can be estimated in advance, if anchor downlink carrier is determined as the reference, the pathloss differences between other non-anchor carriers can be compensated by UE.

**<To CATT**

We support the motivation and we have similar proposal in RWS- 210402.

We would like to clarify the following questions.

**Q1:** On Page 3, it it said that for connected UEs, aggregated carriers can be SUL carriers. But the second last bullet on Page 4 does not include SUL. Can you clarify?

**Q2:** For BWP aggregation on P3, does it mean that UEs support multiple active BWPs?

**A1:** Sorry for the confusion, UL only and DL only on page4 is intended for SUL and SDL.

**A2:** For the second question, if UE capability supports multiple active BWPs, then multiple BWPs on

different carriers can be activated simultaneously.

<To vivo>

**Q:** Thank you for the contribution. We are also interesting about idle/inactive aspects. We think this is also helpful about the non-colocation SUL case. However, it should be discussed if anchor BPW modeling or anchor Cell modeling further.

For connection mode, can you confirm that the current RAN4 UE RF requirement based on carriers are kept unchanged in general, and what would be the RAN4 impact do you have in mind?

**A:** We think co-located case can be prioritized since it is simpler, and the non-co-located case can also be studied. For the second question, we do not intent to change the current RAN4 UE RF requirements. Probably the BWP switching requirements.

<To Nokia>

**Q1:** For IDLE, Is this only about allowing UE to select which UL resource to use? Or both UL and DL? How many such carriers would be indicated in SIB?

**Q2:** What is different in this from CA in CONNECTED mode?

**A1:** The multiple carriers in one elastic cell can be FDD, TDD or SUL carrier, so it is flexible for UE to select only UL or both DL and UL for initial access. For example, if UE chooses a non-anchor FDD carrier for access, and CORESET and CSSs are also configured for this FDD DL, then both DL and UL are chosen. For some narrow band non-anchor carrier, there may be no CORESET or CSSs configured for the downlink carrier, then the downlink carrier of anchor carrier can be shared during initial access. The maximum number of carriers can be defined by spec, and the actual number of carriers is indicated in SIB.

**A2:** We think CA scheduling mechanism can be maximally reused for connected mode. While for neighbor carriers, some enhancement can be further studied, for example, the activation delay can be largely reduced due to co-located and similar propagation characteristics, and dynamic carrier switching can be studied.

UE can choose one primary carrier for PDCCH monitoring, and the primary carrier can be dynamically changed for connected UEs.

Multiple carriers scheduling by single PDCCH can also be studied.

<To Spreadtrum>

**Q1:** The justification part mentions that offloading is one main target for elastic cell. Could you elaborate how to achieve offloading for idle/inactive UE?

**Q2:** Does UE always camp one same DL frequency block and one same frequency block, for idle/inactive state and when initial access, considering UE complexity?

**Q3:** For the objective of RWS-210335, we notice that the second bullet states to study for idle/inactive state based elastic cell, while the third bullet states to study for connected for multiple carrier operation. Does it

mean that UE supports one elastic cell with multiple non-continuous frequency block in idle/inactive state, and supports CA, i.e., each carrier corresponding one cell, in connected state.

**Q4:** Are the aggregated spectrum only FDD band, or only TDD band, or both?

**A1:** The offloading can be controlled by network and indicated to UE, e.g. based on RSRP or based on service type.

**A2:** It is expected that UE always camps on anchor frequency resource for idle/inactive state, while random access can be performed on either anchor or non-anchor frequency resources.

**A3:** For connected state, the multiple carriers also belong to one single cell. For the multiple carrier operation in connected state, some enhancement can be further studied. For example, fast carrier activation and switching, multi-carrier scheduling.

**A4:** Both FDD band and TDD band can be aggregated.

<To TCL>

**Q:** Would the maximum number of consecutive or non-consecutive spectrums supported be defined?

**A:** Yes, the maximum number of carriers can be defined by spec, and the actual number of carriers is indicated in SIB

<To Lenovo>

**Q1:** for IDLE/INACTIVE UEs, we see this is more like a SUL extension for UEs, since legacy UE behavior can support UE to acquire SIB/paging and perform cell (re)selection on anchor carrier. On the other hand for initial access, UE can select one UL carrier from multiple carriers of frequency resources, instead of select from normal UL and SUL in legacy. Does our understanding is aligned with what in your mind?

**Q2:** for connected UE, we would like to understand more on *aggregate carriers can be SUL carrier* e.g. do you mean SUL can be formed by multiple frequency resource?

**A1:** Yes, we are on the same page, this is an extension of SUL scheme as a universal solution for multi-carrier operation, where the carriers selected for initial access in a cell is no longer limited to the carrier on SUL bands, but also can be the carriers on existing TDD/FDD bands.

**A2:** Currently in CA the component carrier cannot be an SUL carrier. As UL heavy traffic becomes popular, the aggregated carriers in elastic cell can be SUL to improve UL throughput for UEs with good channel condition. It means the number of aggregated uplink carriers can be larger than downlink carriers, this is different from CA.

<To Qualcomm>

**Q:** Is it correct understanding that the target is to enable aggregating narrowband carrier(s) that cannot accommodate broadcast/SSB together with an anchor carrier that accommodates broadcast/SSB? If so, what bandwidth is such narrowband carrier(s) supposed to have?

**A:** This is one of the motivations. For some narrow band carriers, for example, smaller than 10MHz/5MHz, SSB/SIB information will consume large resources, which otherwise can be used for data transmission. And for carriers re-farmed from 2G 3G and 4G with limited spectrum resources (e.g. 5MHz, 10MHz), the overhead for broadcast/SSB can also be reduced with elastic cell.

**Q:** Besides the previous question we asked on SSB, we'd like to know that whether the main motivation of the proposal is reducing the signaling overhead during initial access? Can you please clarify what does it mean by "Handover signaling due to offloading also brings a lot of system overhead" in RWS-210335. Another question is how to make sure UL Tx on contiguous (physical) RBs within this elastic virtual cell?

**A:** The main motivation of the proposal is to reduce signaling overhead for broadcast system information and paging, to reduce cell management overhead and realize more flexible offloading from initial access. Currently, UEs will camp on and perform initial access on the high priority frequency. If the network wants to offload them to another frequency, handover should be used after they enter RRC connected state. When offloading can be realized during initial access for elastic cell, offloading can be realized earlier with less signaling overhead.

When UE is configured with DFT-S-OFDM, it is likely that UE is in cell edge, then large bandwidth transmission is not possible due to limited transmit power, and the allocated frequency resource can be limited into one carrier. For UEs with high channel quality, CP-OFDM can be configured and non-contiguous (physical) RBs can be allocated to UEs.

<To Apple>

**Q1:** We already support flexible BWP, so if a CC contains fragmented frequency resource, as long as each UE is contained within one fragment, it should already be largely supported. If a UE is operated with multiple fragments of frequency, we think the current flexible NR configuration can also support it such as CORESET configuration, RS configuration and FDRA in DCI. More specifically, which area we need enhancement?

**Q2:** What is the different between inter-band CA solution. Is it the correct understanding that inter-band CA can achieve the same functionality but the motivation for this new elastic virtual cell is to reduce overhead?

**A1:** Currently, the frequency resources for one CC need to be continuous, and the BWP is also configured by RIV with continuous PRB. There is also limitation for one CC operation, with a maximum transmission bandwidth configuration  $N_{RB}$  defined in spec. It doesn't support multiple active BWPs on multiple spectrums to be scheduled at the same time.

**A2:** Both intra-band and inter-band carriers can be aggregated into elastic cell. The difference between CA and elastic cell including the following,

idle/inactive UEs can benefit from multiple carriers for initial access.

The network can realize flexible offloading early from initial access, other than by handover.

System overhead such as broadcast system information, paging can be reduced.

Cell management overhead can be reduced, since multiple carriers belong to the same cell.

Multiple carriers scheduling can be studied.

<To Xiaomi>

**Q:** Is this item focus on idle mode or connected mode or both?

**A:** Both idle mode and connected mode can be studied, the details can refer to answer A2 of Apple's comment

### 3.3 Air-to-ground (RAN4 only)

Thanks for companies' interests and questions on ATG. Thanks Xiaomi, China Unicom, Lenovo, ZTE, vivo, CATT, China Telecom for your support on ATG. It seems many companies foresee ATG in Rel-18 is needed.

Answers to Intel's questions are as below:

<To Intel>

**Q1.** What are candidate RF bands for ATG operation?

**A:** We can identify the example band as n79 and n78 for RF1. It needs to be considered based on operator's request in WI phase.

**Q2.** What is the motivation to use new specifications and why existing specifications cannot be reused?

**A:** Considering the new ATG CPE/ATG BS type of ATG, we need to define new RF requirements and coexistence analysis. At least one internal TR is required for technical analysis. We would like to see suggestions from other companies on how to handle this new ATG system and whether it would be more appropriate to introduce a new specification as ATG and IMT systems are somewhat different.

**Q3.** Does the proposal focus on co-channel or adjacent channel deployment with terrestrial networks?

**A:** We can focus on adjacent-channel co-existence. RAN4 generally does not conduct co-existence analysis of co-channel, which we can consider by the way of implementation. Other solutions are not precluded.

**Q4.** What is the target UE power class (including antenna gain)?

**A:** The UE power class can be further discussed in RAN4 according to the results of co-existence simulations.

### 3.4 Home Base Station (RAN4 only)

Thanks for companies' interest on HBS, we give our answers in this section.

<To China Unicom>

**Q1:** What is the difference between Home Base Station and CPE?

**A1:** HBS (home base station) is a traditional base station type. In the LTE stage, RAN4 has defined the characteristics of the home base station (FDD and TDD) in Rel-9. Home Base Stations are characterized by requirements derived from Femto Cell scenarios. This is a base station and not a CPE type UE.

**Q2:** Is there new SAR requirement for Home Base Station?

**A2:** No SAR issues need to be introduced for home base stations. SAR requirements are only applicable to UEs, as our feedback in Q1, HBS is a traditional base station type. In addition, home base station may not need high power, referring to the maximum power output definition of LTE HBS ( $\leq +20$  dBm for one transmit antenna port), the maximum power output of the HBS may not exceed the maximum power output of the local Area BS ( $< +24$  dBm).

**<To Intel>**

**Q1:** What are the expected RF requirements for Home BS? Is it expected to reuse the LTE Home BS (femtocell) characteristics as baseline?

**A1:** As we stated in WID (RWS-210341), it is expected that the RF metrics of NR Home BS may be similar to that of LTE Home BS. We can consider reusing the LTE HBS characteristics as a starting point to discuss the NR HS RF requirements.

**Q2:** Further clarifications on the use case are encouraged. In particular, is it expected that Home BS will operate with in Closed Access Group (CAG) mode?

**A2:** From the perspective of CMCC, we need such a cost-effective solution of Home base station to enhance indoor coverage. CAG is one of the use case for Home base station, but the WI of HBS is not limited to CAG. The HBS WI only involves the RF requirements in the scope of RAN4.

**<To CATT>**

**Q1:** Will the Home Node B be deployed in dedicated spectrum or shared spectrum with other BS types or service?

**A1:** The deployment of home base station may be deployed in dedicated band and shared spectrum with other BS types. We need to define transmitter spurious emissions for protection of the BS receiver of own or different BS and co-location with other base stations.

**Q2:** Does the scope include both FDD and TDD?

**A2:** Yes, the HBS WI scope including the FDD and TDD bands for FR1.

**Q3:** It is anticipated that the home NB, if used, may have different UL/DL configurations than other type of BS. Is there any interference coordinating technique to be considered?

**A3:** As we stated in WID (RWS-210341), in order to avoid synchronization issues, we need to define synchronization requirements, and we can consider referring to the way in LTE stage are defined in synchronization requirements.

**Q4:** If interference coordination will be considered, whether other working groups will also be involved?

**A4:** We can consider referring to the way as LTE synchronization requirements for home NodeB are defined in Rel-9. No other working groups will be involved.

**<To Spreadtrum>**

**Q1:** maybe F2 can also be considered, which may have less interference on outdoor users, considering wall isolation.

**A1:** Due to the differences in RF metrics between FR1 and FR2, RAN4 usually defines WI topics distinguished as FR1 and FR2. We can start with the FR1 home base station WI, and we already have LTE home NodeB RF requirements as the starting point. We recommend carrying out HBS for FR1 first. If there is request from operators in FR2, we can also consider to add it.

**Q2:** SA1 will finish their work on residential 5G, what is the view on starting RAN (not only RAN4) work in R18?

**A2:** For the HBS WI, this is the definition of general base station type RF requirements, which does not involve other groups. We can specify the HBS RF requirements independently in Rel-18 and be led by RAN4.

<To Samsung>

**Q1:** If it is understood correctly this HBS proposal is for FR1 only? And since new BS type(s) mentioned in objective, could you clarify further what kind of new type beside existing 1-C 1-H 1-O and 2-O?

**A1:** Yes, this HBS proposal is for FR1 only. The intention of this HBS WI is to define RF requirements for NR Home BS. The RF metrics of NR Home BS may be similar to that of LTE Home BS. We can consider reusing the LTE HBS characteristics as a starting point to discuss the NR HBS RF requirements. Since only FR1 is included, the types would be 1-C, 1-H, 1-O. Whether all these types are needed for HBS can be further discussed in WI phase.

### 3.5 MBS enhancement

Thanks for companies' interests and questions on Rel-18 MBS enhancement topic, and the questions are common or similar on some objectives, therefore, we summarize the companies' questions under each objective and give our answers.

**Answer 1:**

**Objective 1: Specify group scheduling mechanism enhancement to further improve spectrum efficiency, e.g., beam management for multicast service, especially for FR2, carrier aggregation for multicast service, dynamic HARQ process management/share between broadcast/multicast service and unicast service [RAN1, RAN2];**

There are some comments about elaboration on dynamic HARQ process management/share between broadcast/multicast service and unicast service from [OPPO, Lenovo], which think we have supported it in Rel-17.

In previous RAN1 meeting, we had the conclusion that "How to allocate HARQ processes between unicast and multicast is up to gNB", one simple implementation way is gNB semi-statically allocating the HPN for unicast and multicast.

In last RAN1#105 e-meeting, we also had some discussion on whether/how to differentiate the HARQ process ID used for PTP (re)transmission for unicast and PTP retransmission for multicast but had no agreement. But considering limited remaining three meetings in RAN1, we have many higher priorities issue to be discussed, e.g., detailed DCI format fields, DCI size alignment procedure, detail CFR configuration, and may don't have enough time to discuss the HARQ process management issue.

The motivation we list HARQ process management/share in this objective is to encourage companies further discuss and specify on the HARQ process management issue if we don't have further agreements in Rel-17,

for example, whether NDI toggled or not is relative to the NDI in DCI with C-RNTI and G-RNTI or only relative to C-RNTI or G-RNTI, DCI to differentiate one C-RNTI PDSCH scheduling is used for unicast service re-transmission or PTM re-transmission through PTP. We are also fine to revise the wording according to the outcome of Rel-17.

#### **Answer 2:**

#### **Objective 2: Specify reliability improvement enhancement, e.g., HARQ-ACK feedback enhancement, CSI measurement/report enhancement for multicast service, support of ARQ in Layer 2 [RAN1, RAN2];**

There are some comments about elaboration on CSI feedback enhancement from [ZTE, OPPO], in addition, [vivo] also proposes a study phase is needed to identify concrete CSI feedback enhancement schemes.

In Rel-17, companies proposed some CSI feedback enhancement schemes in their contributions, e.g., group-common PDCCH triggering A-CSI feedback of group UEs, CSI report/resource configuration associated with CFR but not BWP. Up to previous RAN1#105 e-meeting, there was no agreement to exclude CSI enhancement for Rel-17 MBS, but due to limited remaining three meetings in RAN1, we are still working hard on HARQ-ACK feedback design and the CSI feedback is with low priority.

One motivation of CSI feedback enhancement in Rel-18 is that considering UEs' active BWPs are not totally the same and current CSI feedback is associated with UE-specific BWP, a group-common CSI feedback configuration/triggering can enable gNB get more accurate CSI on CFR-only and simultaneously from the group of UEs.

In addition, [OPPO] also proposes whether enhancement for HARQ-ACK feedback is needed or not depends on the outcome of Rel-17. From our observation, the remaining three RAN1 meetings may not accomplish all features proposed by companies, e.g., the sub-slot PUCCH, the relationship with M-TRP feature. In addition, we also think some other HARQ-ACK feedback enhancement in Rel-17 IIoT/URLLC WI can also be introduced in Rel-18 MBS, e.g., PUCCH format 0/1 repetition, intra-UE multiplexing with different priorities.

Anyway, we just list some potential reliability improvement schemes, companies can further discuss the detailed scopes and we are also fine to begin with a study phase on CSI feedback enhancement in Rel-18 and further discuss whether to keep or exclude the HARQ-ACK feedback enhancement in objective depends on RAN1 progress.

#### **Answer 3:**

#### **Objective 3: Support of multicast service for UEs in RRC\_IDLE/INACTIVE states [RAN2, RAN1, RAN3];**

There are several concerns from [Intel, ZTE, Qualcomm, Apple] about whether multicast service can be supported in RRC\_IDLE state and the confliction with SA2 agreement.

**@Intel, ZTE, Qualcomm, Apple**, In RAN2#113 e-meeting, we had the agreements to postpone discussing the multicast support in RRC\_INACTIVE/IDLE as the following, "Whether UEs that receive Multicast can be released to RRC Inactive / Idle and continue receiving Multicast is Postponed. Should limit to RRC inactive in future discussions". In addition, the agreement of support of multicast in CM-CONNECTED by SA2 is only about Rel-17.

From our perspective, there is no confliction issue with SA2 because we are discussing Rel-18 not Rel-17, whether to support both IDLE and INACTIVE or INACTIVE-only can be discussed in Rel-18 both in SA and RAN, and it is not needed to jump into a conclusion now.

**Answer 4:**

**Objective 4: Specify the multiple MCCHs for broadcast service per cell [RAN2, RAN1].**

There is a comment from [Huawei] about how to keep backward compatibility with Rel-17 UEs if some services are offloaded to new MCCHs.

**@Huawei**, Assuming there are N broadcast services in the network and both Rel-17 and Rel-18 UEs can receive. For Rel-17 UEs, one MCCH is used to configure N MTCH configurations associated with N broadcast services. But for Rel-18 UEs, N MCCHs are transmitted which each MCCH is used to configure only one MTCH associated with one broadcast service. From network perspective, both Rel-17 single MCCH and Rel-18 multiple MCCHs are used to convey the same MTCH configurations, but there is no backward compatibility issue.

**Answer 5:**

**Objective 5: Standardised support of SFN over multiple cells above gNB-DU level [RAN1, RAN2, RAN3];**

The first question is about the SFN deployment scenario, [Qualcomm] thinks Rel-17 intra-DU SFN is enough and wide area SFN increases complexity without necessarily improving efficiency in dense deployments. [MTK] wants to clarify whether SFN is used for normal base station or High Tower station.

**@Qualcomm**, our interested SFN use case is large-scale activity broadcast service in huge venue, e.g., sports competition in a stadium, international exhibition. In this scenario, multiple cells deployment is needed to meet the coverage requirement and multi-cell SFN can be used to further improve broadcast service performance.

**@ MTK**, it is correct, we only consider normal base station not HPHT scenario.

And there are also some questions about whether to introduce new numerology/CP for SFN [Futurewei, ZTE, BBC], as the reply to Qualcomm and MTK, our interested SFN scenario is small area multi cells SFN to serve some large-scale activity broadcast service but not very large area high tower station scenario, and these normal cells are also used for unicast service, therefore, we prefer not introducing new numerology/CP to avoid coexistence issue.

**Answer 6:**

**Objective 6: Support of Free-to-Air service and receive only mod [RAN2];**

One comment from [Qualcomm] that ROM is the solution that has impacts in RAN, FTA is just a service requirement and proposes no need to mention FTA in this objective.

**@Qualcomm**, we have used the wording “Free to air/receive only mode” in Rel-17 WID, we think it’s OK to keep FTA wording, we are also fine to listen more views from other companies.

[ZTE] proposes several questions about the scenario and market needs, the first question is whether the need for features like FTA/ROM, 100% resources for MBS be met by Rel-16 LTE based 5G Terrestrial Broadcast.

**@ZTE**, Of course FTA/ROM, 100% resources can be met by Rel-16 LTE based 5G Terrestrial Broadcast but the RAT is LTE. Considering LTE will quit the stage in the future, it is essential to specify FTA/ROM, 100% resources features in NR RAT. We think FTA/ROM is useful for some services such as public safety, critical mission, public video. In addition, the bandwidth of NR is larger than LTE, higher broadcast service data rate e.g., HD video as the service trend needs to be supported.

The second question “Is the market needs clear on following scenarios, e.g., UEs with both Terrestrial Broadcast and NR, and deployment of both Terrestrial Broadcast and NR from operators?”

**@ZTE**, We want you to clarify the meaning of “Terrestrial Broadcast”, does it mean Rel-16 LTE based Terrestrial Broadcast or NR based Terrestrial Broadcast? As the reply in questions about SFN, we only consider normal base station not HPHT scenario and don’t want to introduce NR based Terrestrial Broadcast in Rel-18 MBS WI.

The third question is the possibility for UE to receive FTA and unicast simultaneously.

**@ZTE**, From our understanding, FTA mainly means “no subscription of MBS service” which is independent of unicast service. As the example in the reply about FTA/ROM use case, we think UE can receive public safety service through FTA and normal unicast service simultaneously.

#### **Answer 7:**

#### **Objective 7: Support of up to 100% resource allocation to broadcast/multicast service [RAN1, RAN2]□**

There are some comments about the elaboration of “100% resource allocation” meaning [OPPO, vivo, Apple, Nokia]. Some companies also think that Rel-17 can already realize it [OPPO, Apple], e.g., the CFR can be configured as UE active BWP [OPPO], it seems the scheduling issue whether unicast can be scheduled in CFR [Apple]. [BBC] wants to clarify whether it is dynamic or static resource allocation. [Nokia] proposes two interpretation of “100% resource allocation”, which one is standalone MBS carriers that are dedicated to MBS and another is flexible mixed carriers that may dynamically increase MBS RA up to 100%. [Apple] also wants to clarify whether the intention is to define a MBS dedicated BWP.

The main motivation to list this objective is that the Rel-17 WID says Rel-17 should not prevent introducing resource allocation up to 100% to Broadcast/Multicast service in future Releases.

**@OPPO, vivo, Apple, Nokia**, As the two interpretation of “100% resource allocation”, our interested deployment scenario is mixed mode which both unicast service and MBS service are served in one cell, that is we don’t want to define standalone MBS carrier or MBS dedicated BWP for MBS service only. In this deployment scenario, we acknowledge some companies’ view that Rel-17 CFR based framework can realize “100% resource allocation”, e.g., the CFR is configured the same as UE active BWP, and there is only MBS CSS configuration in CFR but no USS configuration in UE active BWP.

**@BBC**, From this perspective, the ratio of resource allocation is dynamically configured by gNB, e.g., it is up to gNB’s scheduling/configuration of unicast service, if no unicast service configuration/scheduling, the 100%

resource allocation for MBS can be met.

If companies have common understanding on the meaning of “100% resource allocation” which it is only about 100% resource allocation of MBS in mixed carriers but not defining dedicated MBS carrier/BWP/bandwidth and Rel-17 CFR based framework can meet the 100% resource allocation, we can delete this objective.

#### **Answer 8:**

#### **Objective 8: Specify the power saving techniques with power saving signal/channel in triggering UE adaptation to the DRX operation for broadcast/multicast service [RAN1, RAN2].**

There are some comments from [Intel, vivo, MTK, Nokia] to elaborate this objective, and [vivo] thinks Rel-16 DCP can also control connected state MBS service.

The original intention of this objective is introducing DCP for MBS DRX cycle. First let me clarify two questions from vivo,

**@vivo**, we had the agreements to reuse LTE SC-PTM DRX scheme as baseline for NR MBS delivery mode 2 in RAN2, that is MBS DRX has been introduced to RRC\_IDLE/INACTIVE states. As whether Rel-16 DCP can control connected mode MBS service, we only have “unicast” DRX cycle in Rel-15/16, which only controls the PDCCH monitoring behaviour of C-RNTI, MCS-C-RNTI, but not includes G-RNTI. From this perspective, we don’t think Rel-16 DCP can control Rel-17 MBS DRX cycle.

**@intel**, your comment extends another question about the association between DCP and unicast DRX and/or MBS DRX(s). One way is that in Rel-18, the Rel-16 based DCP can be used to control both unicast DRX cycle and MBS DRX cycle(s), and another way is to design new separate DCP for MBS DRX cycle(s) which is different from Rel-16 DCP. We can leave this detailed discussion in Rel-18 WI phase.

**@Nokia**, the meaning of “triggering UE adaptation to the DRX operation for broadcast/multicast service” is similar to what Rel-16 DCP work, i.e., the wake up indicator to indicate UE whether to start on-duration timer or not.

### **3.6 SON&MDT further enhancement**

Thanks for your interests and questions on this topic, it seems many companies foresee SON/MDT enhancement in Rel-18 is needed. Some general answers to all companies, the use cases list in our paper are not exhausted and we have no intention to preclude anything, the detailed use cases can be discussed in a later stage.

Please find the answers to the specific questions below.

**<To China Unicom>**

**Q:** SON/MDT enhancement in R18 is needed. What is the considerations on scope for R17 features, i.e. MR-DC(CPAC), SDT, Redcap and MBS?

**A:** For the Rel-17 new features, e.g., MR-DC(CPAC), SDT, Redcap and MBS, since many parameters or policy are configured by gNB, some information reported from UE may be needed to help the network

perform self-optimization. For MR-DC, in rel-17, we are only considering CHO optimization via SON/MDT, optimization of CPAC was not considered, so this can be discussed in Rel-18. For SDT and redcap, some logged information specific to SDT and redcap are expected, details needs further discussion. MBS service can be received at UE, network may not know the receiving status of the broadcast service, some reports from UE may be needed.

<To ZTE>

**Q:** We share the similar view as CMCC, at least MBS, NPN & R17 left issue can be captured in Rel-18.

**A:** Yes, MBS, NPN and Rel-17 left issues can be considered as Rel-18 scope

<To Lenovo>

**Q:** SON/MDT for Rel-18 is necessary. We also have the paper for Rel-18 SON (see RWS-210263). Do you have any plan for the case of Inter-RAT from NR to E-UTRA for voice fallback.

**A:** EPS fallback is an important feature. We are fine to discuss it in Rel-18 if the benefits and the potential impacts are acknowledged by companies.

<To Interdigital>

**Q:** NTN was missing from your list of R17 left overs - was that just an oversight, or it is low priority, or do you think that it isn't necessary? Also what would your relative priority be between the R17 leftovers you mentioned, if a reduced scope is necessary?

**A:** The use cases list in our paper is not exhausted and we have no intention to preclude anything. We are also interested in optimization of NTN and think this can be included in the Rel-18 scope. Normally, the leftovers can be treated with high priority, but this priority issue in our view may be a question in the very late stage and can even be discussed in the WGs.

<To CATT>

**Q:** Thanks for the contribution. We share the view that further SON/MDT enhancement with more aspects considered should be discussed in Rel-18. From our point of view, besides the cases list in the contribution, some other cases e.g. MR-DC enhancement could also be included.

**A:** Yes, we agree

<To Samsung>

**Q:** We also foreseen further SON/MDT enhancement in Rel-18 is needed. Some questions:

1) Rel-17 leftovers indeed needs to be continued. In your expectation, which parts needs to be postponed to Rel-18?

2) For R16 and R17 features including IAB, NPN, V2X, CPAC, MBS..., which features CMCC has deployment plan?

**A:** It is still too early to say what will be the Rel-17 leftovers, but some has been agreed in RAN3, e.g., postpone enhancements for RACH Report retrieval to Rel.18, and others may depend on what we could achieve on in the Rel-17 time frame, there may be some leftovers, e.g., optimization for CHO and DAPS.

We have plans to deploy at least NPN (PNI-NPN), IAB, V2X.

### 3.7 Smart repeaters

Thanks for companies' interests and questions on smart repeaters, we give our answers in this section.

**<To Intel>**

**Q:** What is the use case for configurable repeater bandwidth? Is it related to multi-carrier or single carrier operation? Is it expected to tune the actual RF bandwidth or retune the center frequency?

**A:** The repeater bandwidth may be changed due to the spectrum refarming or spectrum sharing among operators. For example, one operator holds 20MHz at the beginning, and due to the refarming, the spectrum changed from 20MHz to 50MHz. Then the repeater pass-band bandwidth needs to be reconfigured. Bandwidth configuration signalling could be helpful to change repeater pass-band bandwidth without incurring a large cost by manually re-configuring pass-band bandwidth. This is not related to multi-carrier or single carrier operation. And repeater is expected to tune its RF bandwidth in the above cases. But there may be also other use cases for the configurable bandwidth, and they may require additional changes.

**<To Sony>**

**Q:** Could you please expand further on how the proposed control information applied by the candidate side (i.e., ON/OFF information, slot and symbol UL/DL configuration, Tx/Rx beam information, bandwidth information, etc.) would be obtained? For example, are currently existing mechanisms in Rel-16/17 sufficient, or do you think enhancements are needed?

**A:** In our view, some enhancements are needed. In Rel-17, repeater is only to amplify signals, it cannot support dynamic TDD (without slot and symbol UL/DL information) and adaptive beamforming (without Tx/Rx beam information). That is why we propose to specify the smart repeater functions in Rel-18.

**<To Lenovo>**

**Q:** It seems there are time/frequency/spatial domain coordination between two links associated with the repeater. Actually R17 IAB also discuss similar mechanisms for resource multiplexing, can you elaborate a bit more on the difference between the schemes for smart repeater and IAB?

**A:** IAB has functions of both UE and BS, and has the full protocol. Repeater is much simpler node, it only contains PHY and RF. By adding these information, the motivation is to make repeater smarter and better support dynamic TDD, ON/OFF, beamforming, etc.

**<To KDDI>**

**Q1:** In your contribution, you mention "Transmitter and receiver spatial information, i.e., beam information" as one of the candidates for side control information. Is this information supposed to be UE-specific and dynamically notified, or is it supposed to be semi-statically configured?

**A:** In our view, it would be better to have UE-specific and dynamically notified. But this also depends on how many users under the repeater, semi-static configuration is also possible. We also would like to know your view on this point. Thank you.

**Q2:** Is there any particular use case that you would like to focus on in the smart repeater? (e.g. FR1 or FR2?, indoor or outdoor?, etc.)

**A:** Both FR1 and FR2, indoor and outdoor are under our consideration. For some use cases, e.g. dynamic TDD or beam forming, these are more FR2 focused. For some use cases, e.g. configurable bandwidth, ON/OFF information, these are common for FR1 and FR2. We would also like to hear your views on the use case you are interested in. Thank you.

<To Xiaomi>

**Q:** Is the smart repeater L1 relay? Can you explain the protocol stack of the smart repeater?

**A:** In our view, the smart repeater has PHY and RF, which I guess is what you said L1 relay.

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## 4 [2nd round] Comments to the Tdocs

### 4.1 General Comments

#### Feedback Form 8: General comments/questions

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### 4.2 Frequency combination based elastic cell

RWS-210334 Motivation of study for frequency combination based elastic cell

RWS-210335 New study on frequency combination based elastic cell

#### Feedback Form 9: Comments/Questions on frequency combination based elastic cell

##### 1 – ZTE Corporation

Q1: Thanks for the response. If transmitting (or receiving) on multiple carriers simultaneously is allowed to improve throughput in elastic cell, then it seems more like a CA-based solution. We also proposed a flexible association of DL and UL carriers solution in our tdoc RWS-210479 (<https://nwm-trial.etsi.org/#/documents/4776>), which can serve the same purpose. Do you agree that both your scheme proposed in your tdoc and CA based scheme in our contribution can achieve the same goal?

Q2: Thanks for the proposal and answers to the round 1 questions.

We understand both of us intend to realize efficient load offloading from initial access and we also propose a solution (i.e. inter-cell fast access) in our paper RWS-210485 Further enhancement for IDLE/INACTIVE in Rel-18.

For inter-cell fast access, The UE will acquire the initial access configuration for other cells through the SIB of camped cell, and can switch to the target cell and initiate the access procedure immediately, which enables the phantom cells without SIB to avoid network power consumption for SIB transmission as well as access from the camped cell to another cell supporting the intended service without HO/redirection/reselection.

Could you please confirm our understanding and let us know if our inter-cell fast access also helps with efficient load offloading from initial access?

## 2 – QUALCOMM JAPAN LLC.

On the carrier(s)/band(s) with sufficient bandwidth for broadcast/SSB (e.g., 5MHz, 10MHz), if the broadcast/SSB is not transmitted, the carrier(s)/band(s) becomes inaccessible by legacy UEs (and by UEs not supporting this elastic cell feature). While the overhead reduction of broadcast/SSB could be a potential gain, we are wondering if this would rather cause unbalanced load across carrier(s)/band(s).

One further essential question is: whether the proposal is to enable initial/random access on a UL carrier based on SSB/SIB/paging reception on a DL carrier that is not paired/linked with the UL carrier in the band definition. For any possible linkage, REFSSENS, MSD and other requirements still need to be derived and specified per pairing. Once it is done, how is the pairing really different from simply defining it as an FDD band? Also, in such pairings, the possible DL BW and UL BW combinations and frequency offsets would still need to be defined, which again would make it not much different from simply defining it as an FDD band.

## 4.3 Air-to-ground (RAN4 only)

During 1st round discussion, companies show great interests and support on this topic. Further comments or questions are welcome for 2nd round.

RWS-210337 Motivation for new WI on air-to-ground network for NR

RWS-210338 New WID on air-to-ground network for NR

### Feedback Form 10: Comments/questions on ATG

## 4.4 Home Base Station (RAN only)

RWS-210340 Motivation for Home Base station for NR

RWS-210341 New WID on Home Base station for NR

## Feedback Form 11: Comments/questions on Home Base Station

### 1 – Intel Corporation (UK) Ltd

Thank you for the 1st round responses! We have an additional question:

Q1: With respect to CAG/non-CAG use cases (or CSG in LTE), LTE specification include dedicated requirements Home for co-channel E-UTRA protection. The purpose of requirements is to minimize the co-channel DL interference to non-CSG macro UEs operating in close proximity, while optimizing the CSG Home BS coverage. Are similar requirements considered for NR Home BS?

## 4.5 MBS enhancement

RWS-210333 On Rel-18 NR MBS enhancement

## Feedback Form 12: Comments/questions on MBS enhancement

### 1 – BBC

Thank you very much for your replies.

Regarding your Answer 5 to Objective 5 (*Standardised support of SFN over multiple cells above gNB-DU level [RAN1, RAN2, RAN3]*), we agree with the use case of multicast/broadcast possibly multiplexed with unicast for small area multi cells SFN operation and we also agree that the starting point for the study can be reusing existing numerologies.

Regarding your Answer 6 to Objective 6 (*Support of Free-to-Air service and receive only mod [RAN2]*) we also agree that the target for Rel-18 should be mobile networks, i.e. integrated with unicast capability.

Regarding your Answer 7 to Objective 6 (*Support of up to 100% resource allocation to broadcast/multicast service [RAN1, RAN2]*), thanks for the clarification and we agree with the discussion under MBS mixed carrier.

### 2 – ZTE Corporation

Thanks for the reply and clarifications. We have below further questions/clarifications:

- Even if legacy SCS is reused for MBSFN, MBSFN and unicast may still use different SCS, e.g., 15KHz for MBSFN and 30KHz for unicast. In this case, how to guarantee simultaneous reception of FD Med MBSFN and unicast, or only TD Med reception of MBSFN and unicast is allowed?

- Based on the 1st round of Q&A, it seems CMCC is also interested in IDLE/INACTIVE enhancement for MBS. Without any enhancement, network has to use conservative MCS to schedule MBS, which may end up with low system efficiency. Do you see any potential necessity to increase the throughput/spectrum efficiency for MBS transmission in IDLE/INACTIVE?

- for objective 3 (Support of multicast service for UEs in RRCIDLE states), in general we think this is not necessary, as to allow reception of Multicast in RRCIDLE makes Multicast no different from Broadcast from both AS layer and 3GPP network capability exposure's perspective, which is a bit against the decision

that 3GPP differentiated Multicast from Broadcast in the beginning. That being said, we are open to hear more opinions from companies and other WGs.

- as for FTA/ROM/100% resources for MBS, we tend to think FTA will be implemented/initiated in SA/CT WGs, and ROM/100% resources for MBS can be easily supported in Rel-17 based on the flexible NR framework. We can check whether any further enhancement is needed as we approach the end of Rel-17.

### **3 – HUAWEI TECHNOLOGIES Co. Ltd.**

[Huawei, HiSilicon] Thank you for your replies. On Objective 7: "100% resource allocation of MBS": we think the network can utilize nearly 100% resources for MBS with Rel-17 spec. However, if the network intends to use 100% resources for MBS, it would be better to prevent some UEs from camping on this cell especially for the UEs not interested in MBS. We think this would require some discussion in Rel-18

### **4 – CATT**

Thanks for the response in round 1.

A few follow up from our side.

- 1) Regarding SFN aspects we are open to further discuss the main scenario, gains and potential complexity/impact.
- 2) For aspects like HARQ/CSI, etc, we are open to discuss, based on R17 output.
- 3) For FTA we tend to agree this is one important aspect for R18 NR MBS enh.

## **4.6 SON&MDT further enhancement**

RWS-210336 Further enhancement of SON and MDT for NR

### **Feedback Form 13: Comments/questions on SONMDT further enhancement**

## **4.7 Smart repeaters**

RWS-210339 NR smart repeaters

### **Feedback Form 14: Comments/questions on smart repeaters**

#### **1 – Xiaomi Communications**

Thanks for the contribution and good responses. Does it need a new interface between gNB and smart repeater? Is the smart repeater transparent to UE? From UE perspective, can the smart repeater be treated as a TRP? Thanks!

#### **2 – Sony Corporation**

Thank you very much for your answers and comments during the first Q&A round. Here is a further question. In your view, are smart repeaters transparent to UEs?

### 3 – KDDI Corporation

Thank you very much for your response.

We are still studying the use cases of smart repeater internally, but at the moment, our main focuses are to expand the outdoor area of FR2 and to improve the O2I penetration. As for FR1, We believe that there is a problem of increased interference due to the introduction of repeater, and we are interested in how much the problem of increased interference can be suppressed by ON/OFF control. We would appreciate it if we could continue discussion with you. Thank you.

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## 5 [2nd round] Answers by moderator

### 5.1 General

### 5.2 Frequency combination based elastic cell

<To ZTE>

**Q1:** Thanks for the response. If transmitting (or receiving) on multiple carriers simultaneously is allowed to improve throughput in elastic cell, then it seems more like a CA-based solution. We also proposed a flexible association of DL and UL carriers solution in our tdoc RWS-210479

(<https://nwm-trial.etsi.org/#/documents/4776>), which can serve the same purpose. Do you agree that both your scheme proposed in your tdoc and CA based scheme in our contribution can achieve the same goal?

**A1:** For connected mode, CA scheduling mechanism can be maximally reused, with some enhancement such as dynamic carriers switching, multiple carrier scheduling.

And for idle/inactive state, you also proposed UL CA in idle/inactive state, where SS, MIB, SIB and paging are transmitted in Pcell, and multiple SIB configured Scells can also be selected by UE for PRACH/Msg3 transmission, this is similar to our proposed frequency combination based elastic cell. The difference is that for elastic cell, multiple carriers share the same physical cell ID or the same NCGI, cell management effort can be reduced.

**Q2:** Thanks for the proposal and answers to the round 1 questions.

We understand both of us intend to realize efficient load offloading from initial access and we also propose a solution (i.e. inter-cell fast access) in our paper RWS-210485 Further enhancement for IDLE/INACTIVE in Rel-18.

For inter-cell fast access, The UE will acquire the initial access configuration for other cells through the SIB of camped cell, and can switch to the target cell and initiate the access procedure immediately, which enables the phantom cells without SIB to avoid network power consumption for SIB transmission as well as access from the camped cell to another cell supporting the intended service without HO/redirection/reselection.

Could you please confirm our understanding and let us know if our inter-cell fast access also helps with efficient load offloading from initial access?

**A2:** if your proposed inter-cell fast access allows no SIB transmission on phantom cells, and the initial access configuration for them are broadcast in SIB, they are similar. The difference is whether they are treated as same cell or different cells and the cell management effort can be different.

<To QUALCOMM>

**Q:** On the carrier(s)/band(s) with sufficient bandwidth for broadcast/SSB (e.g., 5MHz, 10MHz), if the broadcast/SSB is not transmitted, the carrier(s)/band(s) becomes inaccessible by legacy UEs (and by UEs not supporting this elastic cell feature). While the overhead reduction of broadcast/SSB could be a potential gain, we are wondering if this would rather cause unbalanced load across carrier(s)/band(s).

One further essential question is: whether the proposal is to enable initial/random access on a UL carrier based on SSB/SIB/paging reception on a DL carrier that is not paired/linked with the UL carrier in the band definition. For any possible linkage, REFSSENS, MSD and other requirements still need to be derived and specified per pairing. Once it is done, how is the pairing really different from simply defining it as an FDD band? Also, in such pairings, the possible DL BW and UL BW combinations and frequency offsets would still need to be defined, which again would make it not much different from simply defining it as an FDD band.

**A:** For carrier(s)/band(s) that have legacy UEs to serve, the broadcast/SSB can be transmitted. For carrier(s)/band(s) that re-farmed from LTE, there will be no legacy UEs, and the broadcast/SSB overhead can be reduced. The load balancing can be controlled by gNB considering both the load of legacy UEs and new UEs on each carrier.

For elastic cell, the non-anchor carriers can be FDD, TDD, SUL, SDL. When UE selects the uplink carrier of one FDD band for initial access, the DL carrier of the same FDD band can also be used for Msg2/4 transmission, by this way, the current band definition is maximally reused, this can be the starting point and high priority. If flexible linkage of DL and UL carrier is enabled, for example, UE heavy traffic requires more uplink resources than downlink, then the downlink carrier can be shared by multiple uplink carriers. Some RAN4 requirements may be needed, but compared to defining new bands, this is more flexible for spectrum usage.

### 5.3 Air-to-ground (RAN4 only)

### 5.4 Home Base Station (RAN4 only)

<To Intel>

**Q:** With respect to CAG/non-CAG use cases (or CSG in LTE), LTE specification include dedicated requirements Home for co-channel E-UTRA protection. The purpose of requirements is to minimize the co-channel DL interference to non-CSG macro UEs operating in close proximity, while optimizing the CSG Home BS coverage. Are similar requirements considered for NR Home BS?

**A:** Thanks for the question. As we replied in the 1<sup>st</sup> round, CAG is one of the use case for NR Home base station. So we believe similar requirements of co-channel protection are needed for NR if we consider the protection of non-CAG UE. The details of requirements can be discussed during the WI phase (if approved).

### 5.5 MBS enhancement

<To BBC>

Thanks for the alignment on these objectives.

<To ZTE>

**Q1:** MBSFN and unicast may still use different SCS, how to guarantee simultaneous reception of FDMed MBSFN and unicast, or only TDMed reception of MBSFN and unicast is allowed?

**A1:** We need discuss whether to support different numerologies between MBSFN and unicast in the same BWP/CFR firstly and then discuss the simultaneous issue or coexistence issue if it is supported. We can discuss these aspects in Rel-18 WI phase and don't need to go to technical details at the present stage.

**Q2:** Do you see any potential necessity to increase the throughput/spectrum efficiency for MBS transmission in IDLE/INACTIVE?

**A2:** In Rel-17, delivery mode 2 is used to transmit low QoS requirement MBS service which the throughput/spectrum efficiency performance is not much stringent. But considering to support multicast service in RRC\_IDLE/INACTIVE states in Rel-18, we are open to enhance the throughput/spectrum efficiency for RRC\_IDLE/INACTIVE UEs.

**Q3:** Support of multicast service for UEs in RRCIDLE states

**A3:** We also support to hear more views from companies and other WGs

**Q4:** ROM/100% resources for MBS can be easily supported in Rel-17, whether any further enhancement is needed

**A4:** Regarding 100% resources for MBS, as the reply, we think Rel-17 framework can met the requirement.

Regarding ROM, the definition of "ROM" is as the following in 23.757,

**"Receive Only Mode:** A UE configuration option that allows a UE to receive only broadcast service without the need to access and register with the PLMN offering the MBS service. Use of Receive Only Mode does not require USIM for the UE."

The non-access/register procedure are not supported in Rel-17, which needs the standard enhancement in Rel-18.

<To Huawei>

**Q1:** If the network intends to use 100% resources for MBS, it would be better to prevent some UEs from camping on this cell especially for the UEs not interested in MBS.

**A1:** As the reply in 1<sup>st</sup> round, we prefer the 100% resource allocation is under mixed MBS carrier scenario, that is whether 100% resource can be allocated to MBS service is up to whether UE(s) have unicast service or not and also related to gNB's implementation. If some UE(s) only have unicast service, there are two options for gNB, which the first one is gNB responding to serve these UEs and not 100% resource be allocated to MBS service. The second option is gNB preventing these UEs from camping on it to guarantee 100% resource. It is an implementation issue for option 1 without spec enhancement, but standard work is needed for option 2. We are open to discuss whether the barring function is needed.

<To CATT>

Thanks for the support on these objectives.

## 5.6 SON&MDT further enhancement

## 5.7 Smart repeaters

<To Xiaomi>

**Q:** Thanks for the contribution and good responses. Does it need a new interface between gNB and smart repeater? Is the smart repeater transparent to UE? From UE perspective, can the smart repeater be treated as a TRP? Thanks!

**A:** In our view, Uu interface can be used between smart repeater and gNB, and smart repeater is transparent to UE. UE will not aware of the repeater.

<To Sony>

**Q:** Thank you very much for your answers and comments during the first Q&A round. Here is a further question. In your view, are smart repeaters transparent to UEs?

**A:** In our view, smart repeaters are transparent to UEs.

<To KDDI>

**Q:** We are still studying the use cases of smart repeater internally, but at the moment, our main focuses are to expand the outdoor area of FR2 and to improve the O2I penetration. As for FR1, We believe that there is a problem of increased interference due to the introduction of repeater, and we are interested in how much the problem of increased interference can be suppressed by ON/OFF control. We would appreciate it if we could continue discussion with you. Thank you.

**A:** Thanks for your feedback. Regarding the concern of increased interference caused by repeaters, it depends on repeater output power and practical deployment scenario.

If repeater output power does not exceeds maximum UE power class, the interference is negligible. if repeater exceeds UE power class, repeater will serve a wider access area and is deployed relatively distant from donor gNB. For example, repeater is deployed in rural area to provide coverage instead of gNB because of repeater'low cost, in which cases the pathloss between aggressor repeater and victim gNB is also large and after the planned deployment and antenna beam adjustment, the interference could be acceptable.